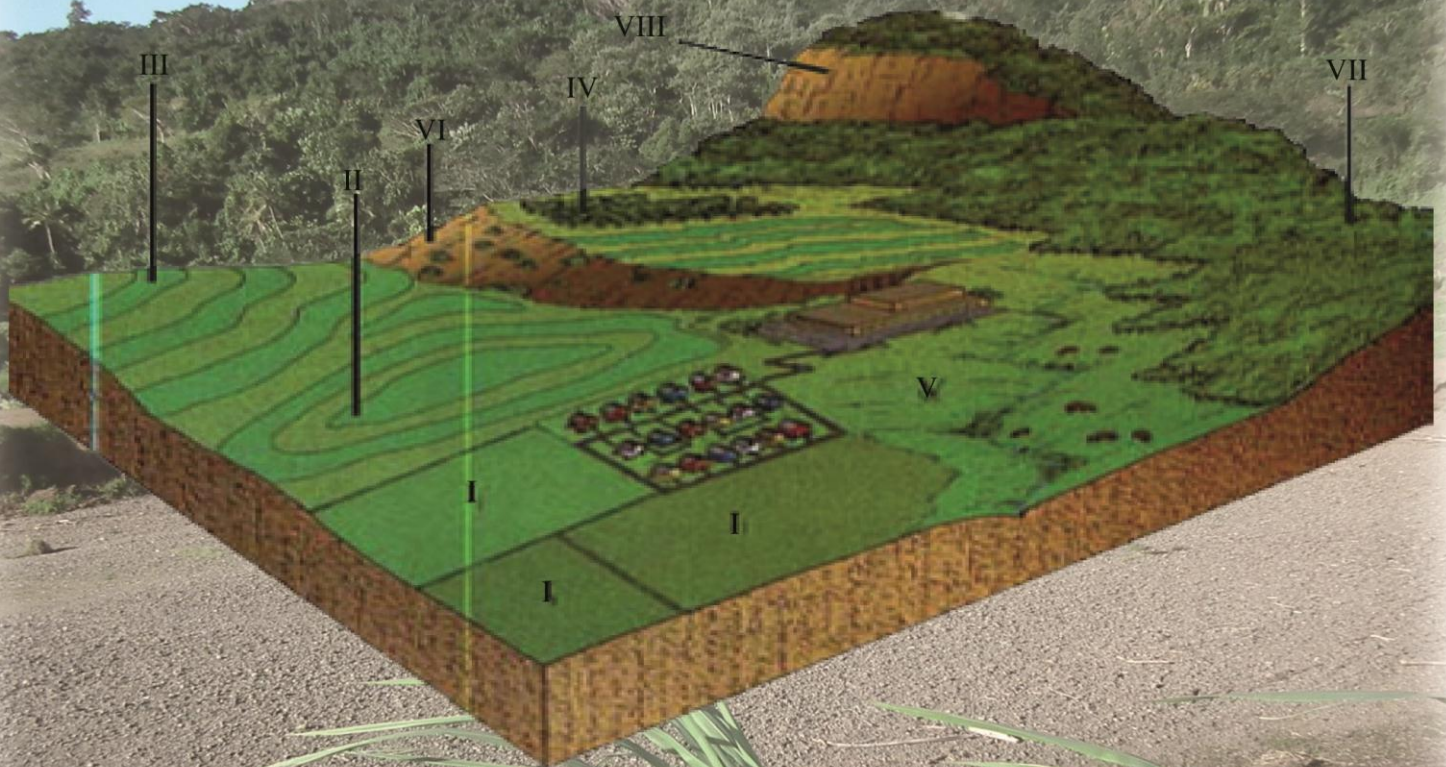


LAND USE CAPABILITY CLASSIFICATION SYSTEM

A FIJI GUIDELINE FOR THE
CLASSIFICATION OF LAND FOR
AGRICULTURE



LAND USE CAPABILITY CLASSIFICATION SYTEM

A Fiji Guideline for the classification of land for agriculture

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FOREWORD



This guideline introduces the reader to the Land Use Capability (LUC) classification system. The Fiji LUC system was adopted from the New Zealand Land Use Capability system which was modified in 1977 to suit Fiji's conditions.

The LUC system has two components. Firstly, the Land Resource Inventory is compiled as an assessment of physical factors important for land use and management. Secondly, the inventory is used for LUC classification, whereby land is categorized into eight classes according to its capability to sustain production.

In order to promote attention to the need for a land use planning and sustainable agricultural developments, land use capability classification is needed to assist land users in making informed decision on farm planning. It should recommend land use and conservation measures based on land used capability classes.

Land Use Capability Classification is a systematic arrangement of different kinds of land according to properties that determine its capacity for sustained production. This classification is to assess, classify and map land according to its capability to support a range of crops on a sustainable basis. The evaluation is based on the degree of limitation imposed on the land by a variety of physical factors which include erosion, soils, wetness and climate. Land is evaluated on the basis of the range of potential crops, productivity, and ease of management and risk of degradation.

Land capability assessment provides a ranking of the ability of an area to support a range of agricultural activities on a sustainable basis. As a basis for this assessment, an inventory is made on the facts about land, to assess the capacity of the land for permanent sustained production. The classification provides for three categories of grouping of the land inventory units, all of which are decided objectively, but which are based on physical qualities of a soil and its particular site.

The Fiji classification system comprises eight classes ranked in order of increasing degree of limitation in relation to agricultural use, and decreasing order of agricultural versatility. Class 1 is considered the best land for agriculture because of little or no limitation whereas Class 8 is not considered for agricultural use because of severe limitations the land have.

In its present form the Fiji LUC classification is soundly based and well placed to meet Fiji's current and future needs for land development planning, land evaluation, soil conservation and promoting sustainable land use practices.

It is our responsibility to see that this guideline is used as a basis for development in order to minimize land degradation. The challenge remains to ensure it is used consistently throughout Fiji as the basis for planning and advancing sustainable land use.

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INTRODUCTION

Arising out of preliminary trials of classification in Fiji and from a study of land use capability classification, surveying and mapping in New Zealand, as well as advice from visiting scientists, the Ministry of Agriculture and Fisheries finally decided to adopt, with modifications to suit local conditions, the New Zealand Land Use Capability System as described in the “Land Use Capability Survey Handbook” – 1974 edition.

The N. Z. classification system is itself a modified version of the American system on which many other international classification systems in the use to-day are based.

In modifying the New Zealand system to suit Fiji conditions, changes were made to areas affected by differences in climatic conditions, in the types of crops grown and their land requirements, in the kind and level of management systems applied, and in cultivation methods used.

This new classification replaces the 7 class system introduced by the Land Use Section in 1972. In its present form the classification is considered to be soundly based and adequate, and should therefore more than satisfactorily meet the country’s present and future needs in the fields of land development planning, land valuation, soil conservation, as well as in the promotion of recommended land use practices for safe-guarding expanding and sustained production from the land.

During the course of the national land inventory programme, it is expected that further changes to the system will become necessary as and when more accurate and up to date information become available.

1. LAND INVENTORY MAPPING SYSTEM

The N. Z. land inventory mapping system as described in the Land Use Capability Survey Handbook, is being adopted here with slight modifications. The land resource inventory provides an objective field measurement and record of those field characteristics of the land that existed at a particular site. As a basis for land use capability assessment an inventory is made of the facts about the land. The following basic information is required in order to compile a “Land Inventory Map”:-

1. Geology
2. Soils
3. Relief
4. Erosion
5. Vegetation
6. Land Use
7. Climate

1.1 Geology

This is important and needs recording only where the rock type is a major contributing factor to the erosion pattern in an area or region. However, little is known about this erosion/rocktype relationship, and this aspect therefore needs to be studied further to identify the more important rock types, before deciding on a more appropriate grouping and allocation of symbols.

Until such time as a meaningful and workable system could be devised geology may be omitted from the land inventory formula.

1.2 Soils

The initial classification of the soils of Fiji was fully described by I.T. Twyford and A.C.S Wright 2 miles to 1 inch reconnaissance soil map published in 1964; but they require adaptation in the field to the scale of the land inventory map (1:50,000 or 63 chains to 1 inch). The main soils are described in the Soil Taxonomic Unit Description sheets where 227 soil series were identified and mapped from Fiji. These are available from the Land Use section of the Department of Agriculture. There are also other more detailed soil maps of certain areas, and where applicable these should be used (e.g. Navua flats by Hunting Technical Service Ltd – 1969; Rewa Basin by FAO – 1972; Sigatoka Valley by S. Chandra – 1971, etc.).

The basic soil unit is the Soil type or the Soil Phase, and this should be the unit for the inventory formula. The unit symbol adopted in the soil survey concerned will be followed e.g. 27f = Sote clay: 27fH = Sote clay hilly phase, and so on. Also the soil survey from which the soil name (symbol) is obtained should be quoted in the land inventory map legend.

In areas where no soil exists e.g. bare rock surfaces or extremely bouldery areas, if mappable, the symbol B. R. (for Bare Rock) is used in the place of the soil unit, similarly, if not mappable but significant, B. R. or R. O. (for rock outcrop) is placed either before or after the soil type symbol depending on which of the two is more dominant.

1.3 Relief

This is expressed as slope in degrees and is measured with an abney level or a slope meter. Slope will be recorded in accordance with the slope grouping given under the “Limitation standards for LUC classes”.

The “C” slope group is subdivided into C- and C+ so as to suit the LUC classification. However, the minus and plus signs may also be used in other groups for the purpose of indicating which end of the group the slope is. A slope which is on the borderline between two groups can be shown as B/C or D/E, etc., placing the more dominant group first. Similarly compound slopes can be expressed as B + F or D + E etc., where B or D slopes are more dominant than F or E slopes. Double symbols should be used only where the less dominant slope group is almost equal in significance to the dominant group.

1.4 Erosion

Only accelerated erosion or erosion which has been initiated or intensified by the action of man, either by his management of the land, or the effect of the animals he has introduced is to be recorded in the land inventory formula, and this will be done in accordance with the “Present Erosion” classification given under Limitation standards for LUC Classes.

Degree of erosion can be represented by (a) percentage of bare ground exposed to erosion, or (b), severity or seriousness of types such as gully and a stream bank erosion, or mass movements.

Bare ground, in this case is that portion devoid of vegetation as a direct result of erosion; it does not however apply to areas made through clearing and/or burning for the purpose of cultivation, or ploughed land, or to fallow land. This is land that became bare largely as a result of sheet or wind erosion, and is recorded as a percentage of an inventory unit on a 1-5 scale of intensity.

Severity or seriousness applied to such erosion types as slip, slump, flow, gully, tunnel gully, rill, streambank, and deposition. The severity is measured on the basis of standard selected sites influenced by parent material, personal judgement, physical loss of land and cost of repair.

Additional data may be shown according to local requirements of the surveyor, e.g. it may be necessary to record the percentage of soil loss, especially in sheet and wind eroded areas.

1.5 Vegetation

This is recorded under five main groups – cropland, grassland or pasture, weedland, scrubland, and forest land. For vegetation grouping and selected symbols see under limitation standards for LUC Classes.

Capital letters are used where the type of vegetation comprises more than 40% of the cover; small letters where it is less than 40% (e.g. P or p.). Any combination of the above symbols may be used in descending order of dominance (e.g. C1 + C2b + o2c = about 50% of cane, 45% rainfed rice and 5% dryland rice).

Small letters are used to indicate species or association e.g. P1a = “P” for pasture or grassland, “1” for established pasture and “a” for paragrass.

In the case of a complex vegetation pattern, its recording should be limited to the 3 more dominant types or association only.

1.6 Land Use

This is recorded in terms of crops grown, in the same manner as vegetation types are recorded. Depending on local requirements, additional notes may be made on the history of land use, past and present management systems, water supply, fencing, stock carrying capacity, access, etc.

1.7 Climate

The two important factors, rainfall and temperature, should be accurately recorded in accordance with the classification given under limitation standards for LUC classes. Additional notes may be made on humidity, sunshine, rainfall intensity, etc. in as far as they affect land use and flooding.

The rainfall map by L. S. Matthews of the Fiji Meteorological Services should be used as a general guide in determining the rainfall groups of an area. This is a 5 region rainfall grouping based on the average annual rainfall over the past 20 years. Current trends and other detailed information can be obtained from local Met. Stations.

1.8 Land Inventory Formula

The formula which follows shows in a single form how distinct land inventory units are delineated on the land inventory map. Each inventory unit has a group of symbols which gives information about the geology and/or soil, the landslope, existing erosion, and the present vegetation cover or crops.

The standard formula layout is as follows:-

	GEOLOGY-	SOIL	-	SLOPE
	EXISTING EROSION		-	VEGETATION/LAND USE
Example:	BA	-	20a	- D + E
	25h, 1G		-	P1b, S2, W2.

1.8.1 Interpretation

The dominant rock type is calcareous basaltic agglomerate; the soil type is Tavua bouldery clay of the Nigrescent group; topography is rolling to steep with slopes 16 - 25° dominant; the area is affected by sheet and gully erosion classified as moderate and slight; the vegetation is a combination of blue grass & reeds with lantana found in some places.

An alternative form of layout which is recommended for narrow or irregular shape inventory units is:-

BA - 20a - D + E - 25h, 1G - P1b, S2, W2.

In addition to the information presented in formula form, other information associated with the soil type e.g. drainage, depth or shallowness, stoniness, natural fertility, salinity, moisture holding capacity or liability to drought, structural stability or susceptibility to erosion, together with information necessary for assessment of the use capability of the land e.g. altitude, liability to flooding, and climate, should also be accurately recorded in the “Land Inventory Record Book”, in accordance with their respective grouping provided under the “Limitation standards for land use capability classes”, prepared by the Land Use Section.

2. GUIDELINES FOR LAND INVENTORY SYSTEMS AND MAPPING

2.1 Slope

Group Symbol	Slope Range (degrees)	Description
A	0-3	Flat to gently undulating
B	4-7	Undulating
C ⁻	8-11	Gently rolling
C ⁺	12-15	Rolling
D	16-20	Moderately steep
E	21-25	Steep
F	26-35	Very steep
G	>35	Extremely steep

Slope is undoubtedly the most important factor to be considered in a capability classification. The intensity and convenience of tillage depends largely on the degree of the slope

2.2 Present erosion

Symbol	Description
0	No erosion – no evidence
1	Slight erosion – some evidence
2	Moderate erosion – more evidence
3	Severe erosion – getting serious
4	Very severe erosion – very serious
5	Extremely severe erosion

Erosion removes fertile topsoil and also reduces soil depth. Many large gullies on the land may interfere with normal cultivation

2.3 Susceptibility to erosion

Symbol	Description
0	Not susceptible - stable
1	Slightly susceptible
2	Moderately susceptible
3	Severely susceptible - unstable
4	Very severe susceptibility –very unstable
5	Extremely susceptible - unstable

2.4 Erosion types

Symbol	Description	
Sh	Sheet erosion	} Recorded on areal basis
W	Wind erosion	
Sc	Scree creep	
Sl	Slip erosion	} Recorded on the basis of seriousness
Su	Slump erosion	
F	Flow erosion	
R	Rill erosion	
T	Tunnel Gully	
Sb	Streambank erosion	
G	Gully erosion	
D	Deposition by water	
Dw	Deposition by wind	

2.5 Drainage (wetness)

Symbol	Description	Example
A	Well drained	Rewa series
B	Slight wetness	Rewa mottled series
C	Moderate wetness	Navua series
D	Severe wetness	Tokotoko series
E	Very severe wetness	Nausori series

2.6 Damaging flooding (wetness)

Symbol	Description
A	Very occasional – once in 8 years
B	Occasional – once in 5 - 8 years
C	Regular – once in 3- 4 years
D	Frequent – once in 2 years
E	Very frequent – once or more annually

2.7 Depth (shallowness)

Symbol	Description
A	Deep (>90cm of A and B horizons)
B	Slightly shallow (60-90cm)
C	Moderately shallow (30-60cm)
D	Shallow (15-30cm)
E	Very shallow (<15cm of A and B horizons)

Soil depth is probably one of the most important factors in classifying land capability. The texture of the soil cannot be easily modified. However, certain crops can be grown on very light soil or heavy soil.

2.8 Fertility

Symbol	Description	Example
A	Fertility	Most alluvial soils
B	Slightly infertile	Some Latosolic, Nigrescent and Colluvial soils
C	Moderately infertile	Latosolic, Nigrescent, some Humic Latosol and Gley soils
D	Infertile	Humic Latosol, Gley soil, Coastal sand and some Podsolcic soils
E	Very infertile	Podsolcic soils and some Ferruginous Latosol
F	Extremely infertile	Ferruginous Latosol soils

2.9 Stoniness

Symbol	Description
A	No stones or very slightly stony
B	Slightly stony - mainly gravels - suitable for use of machinery
C	Moderately stony - gravels and stones – suitable for use of machinery after the stones are collected
D	Stony – stones and boulders – unsuitable for use of machinery
E	Very stony – unsuitable for cropping but suitable for pasture
F	Very boulder – only marginal for pasture or for productive vegetation
G	Extremely boulder or rocky – unsuitable for productive vegetation
<i>Definition of stones:</i>	
<i>Gravel = <2.5cm diameter</i>	
<i>Stone = 2.5-20cm diameter</i>	
<i>Boulder = >20cm diameter</i>	

Stoniness, wetness, internal drainage, the height of the water table and overflow. Soil moisture holding capacity and salinity are not important because moisture is frequently replenished and the presence of toxic salts may not be common under the kind of climate and topography

2.10 Moisture holding capacity

Symbol	Description
A	Very high – deep to moderately shallow, heavy texture (heavy clay)
B	High – deep to moderately shallow, slightly heavy texture (clayey soils)
C	Medium – deep to moderately shallow, medium texture; or shallow, heavy texture
D	Low - deep to moderately shallow, light texture; or shallow, slightly heavy to medium texture
E	Very low – shallow, light texture; or very shallow, heavy to medium texture
F	Extremely low – very shallow, light texture

Definition of texture:

Heavy texture	=	Heavy clay soils
Slightly heavy texture	=	Clayey soils not lighter than sandy clay loam
Medium texture	=	Loam and loamy soils
Light texture	=	Sand

2.11 Salinity

Symbol	Description	Example
A	Non saline to very slightly saline	Rewa soils
B	Slightly salinity	Nakelo soils
C	Moderate to severe salinity	Soso soils
E	Extremely saline	Dogo soils

2.12 Mangrove swamp

Symbol	Description
A	Not difficult to reclaim for cropping
B	Difficult but can be reclaimed for cropping
C	Too difficult to reclaim for cropping but possible to develop for marginal pasture
D	Not feasible to develop for productive vegetation

2.13 Peat swamp

Symbol	Description
A	Not difficult to develop for cropping
B	Difficult but can be developed for cropping
C	Too difficult to develop for cropping but can be developed marginal for pasture
D	Not feasible to develop for productive vegetation

2.14 Rainfall (climate)

Symbol	Description
A	Very high (>4000mm)
B	High (3000 – 4000mm)
C	Moderate (2000 – 3000mm)
D	Low (1500 – 2000mm)
E	Very Low (<1500mm)

Climatic limitations, such as drought and low temperature for cropping, heavy rainfall, excessive runoff and floods may be common.

2.15 Temperature (climate)

Symbol	Description
A	Low – Winter temperature sometimes falling below 20°C; 70°F
B	High – Winter temperature never fell below 20°C; 70°F

2.16 Altitude (climate)

Symbol	Description
A	Low (<300m above sea level)
B	Medium (300 – 600m)
C	High (600 – 1000m)
D	Very high (>1000m)

2.17 Vegetation/Land Use

Symbol	Description	Symbol	Description	Symbol	Description
C	Cropland	P1	Established pasture	S	Scrub land
C1	Sugar cane	P1a	Para grass	S1	Braeken fern
C2	Rice	P1b	Blue grass	S2	Reeds
C2a	Irrigated rice	P1c	Grass-Legume combination	S3	Guava
C2b	Rainfed rice	P1d	Other species	S4	Vaivai
C2c	Dryland rice	P2	Mission grass	S5	Mangrove
C3	Cereals (maize, sorghum, broomcorn)	P3	Native grass land	S6	Mixed native scrub association
C4	Market vegetables (commercial gardens)	P4	Unspecified grass association	F	Forest land
C5	Coconuts	W	Weeds	F1	Native forest
C6	Bananas	W1	Navua sedge	F1a	Hard wood
C7	Cocoa	W2	Lantana	F1b	Soft wood
C8	Citrus	W3	Solanum	F1c	Other species
C9	Pineapples	W4	Noogoorabur	F2	Exotic forest
C10	Ginger	W5	Mint weed	F2a	Pine
C11	Subsistence cultivation	W6	Hibiscus burr	F2b	Mahogany
C12	All others	W7	Swamp vegetation (not including mangrove)	F2c	Other species
P	Pasture-Grassland	W8	All others	F3	Unspecified forest association

3. THE CLASSIFICATION SYSTEM

Land use capability classification is a systematic arrangement of different kinds of land according to those properties that determine its capacity for permanent sustained production. The word “capability” is used in the sense of “suitability for productive use” after taking into account the physical limitations the land may have.

This capacity depends largely on the physical qualities of the soil and the environment; these are frequently far from ideal, and the difference between the ideal and the actual is regarded as limitations imposed by these soil qualities and by the environment.

These limitations affect the productivity of the land, the number and complexity of corrective practices needed and the type and intensity of land use. The degree of limitations can be assessed from:

- a) susceptibility to erosion,
- (b) steepness of slope,
- (c) liability to flooding, wetness, or to drought,
- (d) salinity,
- (e) depth of soil,
- (f) soil texture, structure, and fertility,
- (g) stoniness, and
- (h) climate.

As a basis for this assessment an inventory is made on the facts about the land, and the information is recorded on the “Land Inventory Map” on which distinct “inventory units” are shown. The information on this map is combined with other information on geology, climate, land use, results of research, and farming experiences to assess the capacity of the land for permanent sustained production.

4. CATEGORIES OF THE CLASSIFICATION

The classification provides for three categories of grouping of the land inventory units all of which are decided objectively, but which are based on the physical qualities of a soil and its particular site. The three categories are; (a) major class, (b) subclass, and (c) capability unit.

4.1 Description of the major class

The first grouping is into eight major classes. Class 1 – 1V comprise land suitable for arable cultivation; land in classes V – VII is not suitable for arable cultivation but suitable for pastoral or forestry use; and class VIII is land suitable only for protective purposes.

The four arable and four non-arable classes are arranged in the order of increasing degree of limitation or hazard to use, from class 1 to class VIII. Correspondingly the range of uses to which the land may be put decreases from class 1 to class VII, with class VIII having land least suitable for productive use.

The major class gives information about the general limitations of the land only (i.e. total degree of limitation); it shows only the location, amount and general suitability of the land for agricultural, pastoral or forestry use.

Each major class may include many different kinds of land units or soils, and many of the units within a class may require different management treatments. Thus it is difficult to make valid generalisations at the major class level about suitable kinds of crops or other management needs.

4.2 Description of the subclass

The second category, the subclass, provides for a grouping of units within the major class that have the same kind of limitation or hazard. The four general kinds of limitation recognised are:

- E** - **Erodibility**
- W** - **Wetness**
- S** - **Soil limitation within the rooting zone.**
- C** - **Climate**

These are the subclasses and they may be used in two ways – either as broad divisions of the major classes at a more general level of classification for land use, or as groupings of the units for detailed classifications.

Subclass E: Erodibility, where erosion susceptibility, past erosion damage, or steepness of slope are the main limitations to use. This subclass is present in all major classes except class 1 which is of flat land with soils of good structural stability.

Subclass W: Wetness, where the main limitations to use are due to soils of poor drainage or a high water table, or to damaging flooding from rivers or coastal waters, or to areas of deep peat, or larger mangrove swamps.

The subclass apply in all major classes except class V. Wetness due to poor drainage or high water table apply only in classes 1-IV; on damaging flooding the wetness limitations occur in classes 1-IV and in VI; and on peat and mangrove, the limitations are found only in classes VI and VIII.

Subclass S: Soil limitations within the rooting zone of plants. These are limitations on shallowness, stoniness, low fertility which is difficult to correct, salinity, toxicity, low moisture holding capacity, unfavourable soil texture and structure, and peaty soils or shallow peat. This subclass is the only one that occurs in all the major classes.

Subclass C: Climatic limitations, where the climate (rainfall, temperature, wind, humidity and sunshine) is the major hazard in the use of the land. The subclass is used only where a less than ideal climate is the only limitation to the use of the land, or where a climatic factor (e.g. too much or too little rain, or extreme temperature) is the dominant limitation to land use. This subclass is present only in major classes 1-VI. It does not occur in VII and VIII.

4.3 Explanatory notes

Certain conventions are observed in determining the correct subclass. The dominant kind of limitation determines which of the four subclasses to be used. In practice there are frequently several limitations affecting the one land unit at the same time, and it may be very difficult to decide which should be the dominant subclass, especially where soil (S) limitations and either erosion risk (E) or wetness (W) are very closely related. Where two kinds of limitations are essentially equal, the subclasses are given the following priority – E, W, S, C: that is E is given precedence over W, S & C, and W is given precedence over S & C, and so on. Only in rare cases is more than one subclass used, and in such a case the priority order also applies – e.g. IV E. W. However, the use of multiple symbols in general negates the objects of classification, one of which is simplicity, and this should be avoided as much as possible.

4.4 Description of the capability unit

At the most detailed or lowest level of classification, the capability unit is used as a grouping of those inventory units which respond similarly to the same management, are adapted to the same kinds of crops, pasture or forest species, have about the same potential yield, and require the application of the same conservation measures.

Thus the capability unit comprises land within a subclass, with similar soil characteristics, slope, erodibility, potential productivity, and management requirements. The capability unit groups together similar inventory units and helps to simplify what may be a very complex inventory pattern. When shown together with the major class and subclass, the capability unit provides the additional information about management practices necessary for best use of the land.

The symbol used for the capability unit is a small Arabic numeral placed after the subclass symbol (e.g. III E. 1; III E. 2, etc). At this stage, it is not possible to say how many capability units there will be in each subclass of the eight major classes. This is because it is not practicable now to standardise definitions of units on national level. However, the ultimate objective is to work towards standardisation of the capability unit, first on catchment basis, then on a national basis. Both correlation and standardisation are best tackled when enough is known about this towards the end of the national survey.

5. THE CLASSIFICATION

5.1 Capability division

The eight major classes can be divided into four “Use capability divisions” as follows:-

		Capability Division	Major Class	Slope
1. ARABLE	(a)	Suitable for ploughing and for intensive cropping	1 – III	0 - 11 ⁰
	(b)	Unsuitable for ploughing but suitable for less intensive cropping under traditional cultivation methods.	IV	12 - 15 ⁰
2. NONARABLE	(a)	Unsuitable for arable cropping but suitable for pastoral or forestry use.	V – VII	16 - 35 ⁰
	(b)	Unsuitable for productive vegetation; suitable only for protective purposes.	VIII	35 ⁰ +

5.2 Description of individual classes

5.2.1 Major Class 1 (map colour – dark green)

This is very good multiple use land. It is flat (0 - 3°), has deep, easily worked, fertile soils; no risk of erosion, well drained but not seriously affected by drought, and the climate is favourable for the growth of a wide range of crops, and for pasture and forestry.

Class 1 land is confined almost entirely to well drained, recent alluvial areas above frequent flood level.

Subclasses which may occur in major class 1 are:-

- 1. W.
 - 1. Very slight initial wetness (soil condition or high water table).
 - 2. Very slight risk of damaging overflows from rivers and streams (very occasional flooding).

- 1. S.
 - 1. Very slight stoniness (presence of river gravels)
 - 2. Very slight salinity (easily removable by permanent work).

- 1. C.
 - 1. Where everything else is alright except climate (areas in rainfall zone B & C altitude class A, and temperate Class A).

Subclass C should be the best of all subclasses in major class 1.



Arable cropping on Class I land

5.2.2 Major Class II (map colour – light green)

This is good arable land with slight limitations which make it more difficult to manage than class 1. Management and conservation practices to overcome those limitations are easy to apply.

The land may be flat to gently undulating (0 - 7°), well drained to moderately drained, deep to slightly shallow, and fertile to moderately fertile.

Class II land is confined mainly to alluvial areas which are either slightly poorly drained or subject to regular flooding, and to flattish areas of better nigrescent and latosolic soils. The land can be used for arable cultivation, pasture or forestry.

Subclasses which may occur in major class II are:-

- I.I.E.
 1. “B” slopes (4-7°)
 2. Slight susceptibility to erosion.

- I.I.W.
 1. Slight to moderate wetness after drainage.
 2. Slight to moderate risk of damaging flooding.

- I.I.S.
 1. Slight stoniness (fine gravels).
 2. Slight infertility easy to correct.
 3. Unfavourable texture and structure – difficult in working.
 4. Slight salinity.
 5. Slight shallowness (soils of moderate depth).

- I.I.C.
 1. Class 1 land in “A” rainfall zone (>4000 mm)
Too much rain; and in “E” rainfall zone (<1500mm).
 2. Class 1 land on medium and high altitude areas (600-1000m) above sea level) – Cloudiness, less sunshine.
 3. Class 1 land in areas of low winter temperature



Vegetable farming on Class IIs land, Nadi



Pineapple farms on Class Iie land in Ba

Intensive arable cropping on Class II lands

5.2.3 Major Class III (map colour – light blue)

This is fair arable land with moderate limitations which restrict the choice of plants grown, or make special conservation practices necessary, or limit land use in both of these ways. The land may be flat or gently sloping (0 - 11°), slightly unstable, of moderate severe wetness, subject to frequent damaging flooding, of shallow, moderately stony, and/or infertile soils.

Class III land occurs mainly in areas of gley soils, lower river terraces, sandy coastal flats, nigrescent areas of moderate slopes, and in areas of better Humic Latosol and podsolic soils.

The land may be used for arable cultivation, pasture or forestry. Subclasses which may occur in major class III are:-

- III.E.
 - 1. Moderate slopes – “C” (8 - 11°).
 - 2. Moderate susceptibility to erosion.
 - 3. Severe effects of past erosion.

- III.W.
 - 1. Moderate to severe wetness.
 - 2. Frequent damaging flooding.

- III. S.
 - 1. Moderately stony (gravels and stones – can be collected to enable ploughing)
 - 2. Low fertility not easy to correct.
 - 3. Low moisture holding capacity.
 - 4. Moderate salinity.
 - 5. Shallow soils (depth class “C”).
 - 6. Areas of shallow peat-easy to develop for cropping.

- III.C.
 - 1. Classes 1 & II land in “A & D” rainfall zone (1500 – 2000 mm) – Too little rain.
 - 2. Classes 1 & II land in high altitude areas (610 – 914m above sea level).
 - 3. Class II land in areas of low winter temperatures.



Cane farming on Class IIIw land



Rice farming on Class IIIw land

5.2.4 Major Class IV (map colour – light brown)

This is marginal arable land with severe limitations which restrict the choice of crops grown, or necessitate intensive conservation treatment and very careful management, or which may affect land use in both of these ways.

Class IV land may be flat to rolling (0 - 15°) land may comprise one or more of the following – poor to very poorly drained; stony or bouldery or both; very shallow soils; infertile soils; coarse textured soils very low in moisture holding capacity; or mangrove or peat swamps which are not too difficult to reclaim for cropping.

Common soil types of class IV land are: strongly gleyed soils, some Humic latosols, some podsolic soils; or colluvium derived from Ferruginous latosol.

Because of these limitations, and in the case of rolling land the difficulty of installing and maintaining conservation work, this land class is used mainly for pasture, coconut plantations, or subsistence cultivation under traditional cultivation methods.

The upper slope limit for this land class is C⁺ (12 - 15°); this is too steep for ploughing either by machinery or by draught animals. Accordingly cropping in the E subclass will be restricted to subsistence cultivation using traditional methods including shifting.

Subclasses which may occur in major class IV are:-

- IV. E -
 1. Rolling slopes – C⁺ (12 - 15°).
 2. High susceptibility to erosion. Very unstable under arable cropping.
 3. Very severe effects of past erosion.
- IV. W -
 1. Very severe wetness (very poorly drained areas (mineral soils).
 2. High risk of damaging flooding (very frequent flooding).
- IV. S -
 1. Severe stoniness – cannot be ploughed but suitable for traditional cultivation methods.
 2. Infertile soils (e.g. Humic latosol and podsollic soils) – difficult to correct with the use of fertilisers.
 3. Coarse textured soils very low in moisture holding capacity, liable to severe drought.
 4. High salinity – areas of mangrove swamps not too difficult to reclaim for cropping.
 5. Very shallow soils (depth class “D”).
 6. Areas of moderately shallow peat which can be developed for cropping.
- IV. C -
 1. Classes 1-II land in the “E” rainfall zone and class III land in A.D and E rainfall zones.
 2. Some class III land in C & D altitude groups.
 3. Class III land in areas of low winter temperatures.



Sugar cane on LUC class IV land (IVe) in Nadi



Cultivated class IV land (IVe) in, Sakoca, Savutalele

5.2.5 Major Class V (map colour – light yellow)

This land class is unsuitable for arable cropping but suitable for pastoral or forestry use.

Steepness (D slopes – 16 - 20°) or stoniness (Class E) are the main limitations which render it non arable and restricting it to pastoral use or productive forestry.

The erosion risk on D slopes under pastoral or forestry use is only very slight, but on such a slope this hazard would be too great if put under arable cultivation. Where the slope is less than 15°, the land may be too stony or bouldery for the use of machinery in arable cultivation.

Thus Class V, in effect, now becomes the best non arable class, conforming to the progression from 1 to VIII.

Subclasses which may be found in major class V are:-

- V. E. 1. Strongly rolling slopes (D-16 to 20°).
- 2. Slight susceptibility to erosion (Class 3).

- V.S. - 1. Stoniness (class E); unsuitable for cropping.

- V.C. 1. Some class IV land in A and D rainfall zones.
- 2. Class IV and in areas of low winter temperature.
- 3. Class III & IV land in C & D altitude groups.



Grazing on class Ve land

This is marginal pastoral land with moderate to severe limitations. It comprises land that is rather too steep for pastoral use (E slopes – 21 to 25°); or that has evidence of severe effects of past erosion (class 3); or that is highly susceptible to erosion (class 4). Class VI may also comprise one or more of the following land types: lower river terraces subject to very frequent flooding (Class E); peat and mangrove swamps which would be too difficult to develop for cropping (Class C in each case); areas which are very stony to very bouldery (Classes E & F), or shallow to very shallow soils (classes D & E); soils which are very low to extremely low in moisture holding capacity (classes E & F), or low to very low in fertility (D & E), or very saline to extremely saline (D & E).

Production or commercial forestry may be the best form of land use where erosion or low fertility are the dominant limitations. On all other land types in this class, pasture should be suitable but its management will require special attention.

Subclasses which may occur in major class VI are:

- VI. E -
 1. Steep slopes (E-21 to 25°).
 2. Severe effects of past erosion (class 3).
 3. Moderate to severe susceptibility to erosion (class 4).

- VI. W -
 1. Very frequent damaging flooding (class E).
 - 3 Peat land (class C).
 - 4 Mangrove swamp (class C). This can also be a soil limitation.

- VI. S -
 1. Very shallow soils (class D/E).
 2. Very stony to very bouldery (class E/F).
 3. Infertile to very infertile soils (class D/E).
 2. Very low to extremely low in moisture holding capacity (class E/F).
 3. Very saline to extremely saline soils (class D/E). This can also be a wetness limitation.

- VI. C - 1. Classes IV and V land in E rainfall zone and class IV land in A & D zones, (very low rainfall).

This may not exist.

2. Class IV land in D altitude group (very high altitude).



*Pine plantations on LUC class VI's land
(degraded talasiga land)*



Marginal grazing on class VI's land

5.2.7 Major Class VII (map colour-pink)

Land in class VII is generally unsuitable for pastoral use, but its suitability for forestry may be fair to marginal. The class comprises land that is either very steep (slope group F – 26 - 35°); or that is very highly susceptible to erosion (class 4), or showing very severe damages from past or present erosion (class 4); or land that is very shallow (class E), very bouldery (class F), or very low in fertility (class E/F).

In areas where the major (dominant) hazard is erosion or low fertility, commercial forestry may be the best form of land use. Where steepness, shallowness or stoniness are the dominant hazards, protection forestry may be practised, or otherwise the land is best left untouched in its natural state. Subclasses which may occur in this major class are:-

- VII. E -
1. Very steep slopes (F group).
 2. Severe damages from present erosion (class 4)
 3. High susceptibility to erosion (class 4)
- VII. S -
1. Extreme shallowness (class E)

2. Very stony and bouldery (class F).
3. Very infertile to extremely infertile (class E/F).

Major class VII has no subclass on either wetness or climatic limitations.



LUC class VIIs with boulder and shallow



LUC class VII on steep slopes

5.2.8 Major Class VIII (map colour-red)

Land in major class VIII is generally unsuitable for productive use in both agriculture and forestry. This is predominantly very steep mountain land mostly above an altitude of 762 metres.

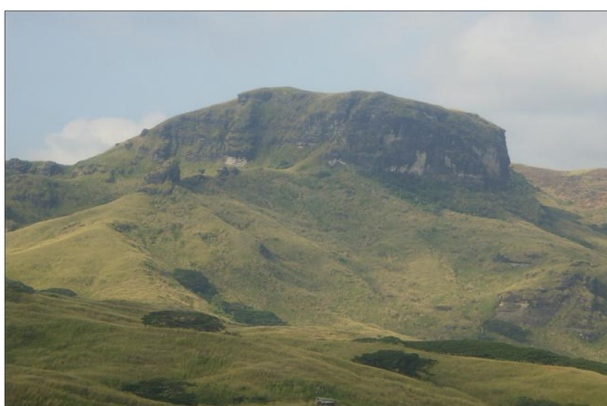
This also includes low land areas in unfavourable situations such as extreme erosion or susceptibility to erosion (e.g. areas highly susceptible to slumping or earth flow), or extreme stoniness, shallowness, or infertility; and also extremely steep slopes in high to very high rainfall areas (slope G in A and B rainfall zones).

Also included in major class VIII are peat and mangrove swamps whose development is not likely to be economically feasible.

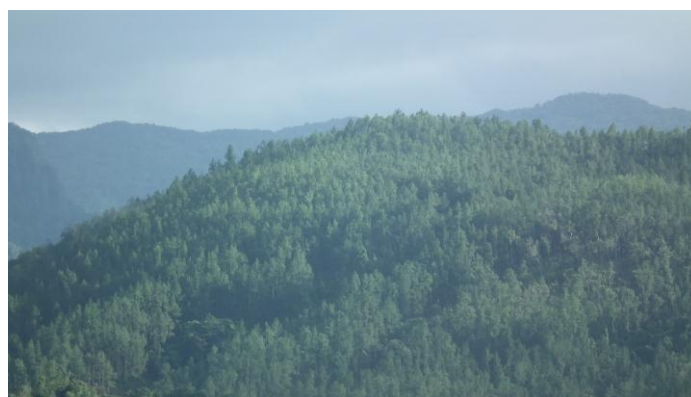
Class VIII land is therefore best protected and/or reserved for watershed and wild life protection purposes, or left in its natural state untouched.

Subclasses which may occur in this major class are:-

- VIII. E -
 1. Extreme steepness (G slopes)
 2. Extreme damage from erosion, or instability (class 5 in both cases).
- VIII. W -
 1. Peat swamp not feasible to develop
 2. Mangrove swamp not feasible to develop.
- VIII. S -
 1. Extreme shallowness
 2. Extreme stoniness
 3. Extreme infertility; (not likely to be common.)



Bouldery, shallow class VIIIs lands



Extremely steep with class VIIIe land

Unsuitable for production used in Agriculture and Forestry

6. LIMITATION CLASSIFICATION AND STANDARD FOR LAND USE CAPABILITY CLASSES

Factors, both physical and environmental, which affect or limit the use capability or productivity of the land are classified into groups in a manner that suits the capability classification best. For example, slope is classified (according to its steepness) into 8 groups, one for each capability class, from slope group A for major Class 1 to group G for major class VIII.

These standards are for use as a general guide in assessing the capability class for each land type; but the final classification will depend on various other factors including the number and type of limitations affecting the same land type, the number and complexity of corrective practices needed and whether or not the implementation of such practices is economically feasible, the type and intensity of land use that can be applied, etc.

For ease of recording and mapping, each limitation group (e.g. slope A,B,C etc.) and type (e.g. rill, gully, etc. in erosion) is given a standard symbol. Limitation groups are defined both quantitatively and qualitatively and they should therefore be easy to measure.

In some cases examples are given e.g. soil types in wetness and fertility limitations.

6.1 Slope

Group symbol	Slope Range °	Description	LUC Class
A	0-3	Flat to gently undulating	I
B	4-7	Undulating	II
C-	8-11	Gently rolling	III
C+	12-15	Rolling	IV
D	16-20	Moderately steep	V
E	21-25	Steep	VI
F	26-35	Very steep	VII
G	35+	Extremely steep	VIII

Note: Slope is measured with an abney level. Slopes in LUC Class 1 – V should be the upper limit for each of those classes. For Class VI, F slopes on stable but not too shallow or too stony land may be included, and similarly class VII may include G slopes.

6.2 Present erosion

Group symbol	Degree of erosion	Percentage of bare ground	LUC Class
0	None	None	I, II, V
1	Slight	1-10	
2	Moderate	11-20	III, V
3	Severe	21-40	IV, VI
4	Very severe	41-60	VII
5	Extreme	60+	VIII

Note: In LUC Classes 1 and II, erosion can be stopped and damages easily repaired. In classes III and V the severity can be reduced from moderate to slight by permanent works. In classes IV and VI it will be difficult to repair the damages which may remain as a permanent limitation; and in classes VII and VIII, it will not be economical to try and repair the damages so as to bring such land into productive use.

6.3 Susceptibility to erosion

Group symbol	Degree of susceptibility	LUC Class
0	Not susceptible (stable)	I
1	Slight susceptibility	II
2	Moderate susceptibility	III
3	Severe susceptibility	IV-V
4	Very susceptible	VI-VII
5	Extremely susceptible	VIII

Note: Susceptibility to erosion is determined from slope, rock type and/or soil type, and rainfall intensity. However, the relationship between these factors and land stability is not fully understood, and this aspect therefore requires further study.

6.4 Erosion type

Symbol	Description	
Sh	Sheet erosion	} Recorded on areal basis
W	Wind erosion	
Sc	Scree erosion	
Sl	Slip erosion	} Recorded on the basis of seriousness
Su	Slump erosion	
F	Flow erosion	
R	Rill erosion	
G	Gully erosion	
T	Tunnel gully erosion	
D	Deposition by water	} Recorded on the basis of seriousness
DW	Deposition by wind	

6.5 Drainage (wetness)

Group symbol	Description	Example	LUC Class
A	Well drained	Rewa series	I
B	Slight wetness	Rewa mottled series	II
C	Moderate wetness	Navua series	} III
D	Severe wetness	Tokotoko series	
E	Very severe wetness	Nausori series	IV

Note: Grading and Examples used here do not indicate the possibility or feasibility of draining a particular land. This will have to be considered when assessing capability.

6.6 Damaging flooding (wetness)

Group symbol	Description	Example	LUC Class
A	Very occasional (once in more than 8 years)	Higher terraces, river levees	I
B	Occasional (once in 5-8 years)	Middle terraces, river levees	
C	Regular (once in 3-4 years)	Middle terraces, Back swamp	II
D	Frequent (once in 2 years)	Lower terraces, Back swamp	III, IV
E	Very Frequent (once or more annually)	Lowest terraces, gravel banks, and islands in a river	VI

Note: This is not easy to assess. Knowledge of local residents must be sought and records of flooding in the past 20 years consulted. The grading above is based on frequency of flooding; other factors such as type and amount of material brought down by flood waters, duration of the flood, etc. must be considered when assessing its severity.

6.7 Depth (shallowness)

Group symbol	Description	LUC Class
A	Deep (over 90cm A and B horizons)	I
B	Slightly shallow (60-90cm)	
C	Moderately shallow (30-60cm)	II
D	Shallow (15-30cm)	III-V
E	Very shallow (less than 15cm)	VI-VIII

Note: This should be used only as a rough guide. Softness and depth of the “C” horizon must be considered in the case of classes VI – VIII. For example 10– 13cm of A & B horizons overlying more than 30cm of soft “C” is best upgraded to group D. Also where shallowness is associated with stoniness then down grading should be considered.

6.8 Stoniness

Group symbol	Description	LUC Class
A	No stones or very slightly stony	I
B	Slightly stony-gravels; suitable for the use of machinery	II
C	Moderately stony-gravels and stones; suitable for machinery after stones are collected	III
D	Stony-stones and boulders; unsuitable for machinery but suitable for traditional cultivation methods	IV
E	Very stony-boulders; unsuitable for cropping but suitable for pasture	V
F	Very boulder-marginal for productive vegetation	VI-VII
G	Extremely stony-unsuitable for productive vegetation	VIII

Definition:

Gravel = less than 2.5cm diameter
 Stone = 2.5 – 20cm diameter
 Boulder = more than 20cm diameter

Note: Degree of stoniness is assessed on the basis of the suitability of the land for (a) ploughing, (b) use of other machinery e.g. harvester, (c) traditional cultivation methods (d) pasture, (e) tree planting.

6.9 Soil fertility

Group symbol	Description	Example	LUC Class
A	Fertile	Most alluvial soils	I
B	Slight infertility	Some Latosolic, Nigrescent and Colluvial soils	II
C	Moderate infertility	Latosolic, Nigrescent, some Humic Latosol and Gley soils	III
D	Infertile	Humic Latosol, Gley, Coastal sand and some Podsollic soils	IV
E	Very infertile	Podsollic soils and some Ferruginous Latosol (Talasiga)	VI, VII
F	Extremely infertile	Ferruginous Latosol	VIII

Note: Also see under “Capability classes of soil types” for a more precise assessment of fertility level of soils.

6.10 Moisture holding capacity

Group symbol	Description	LUC Class
A	Very high-deep to moderately shallow, heavy texture (clay) soils	II, III
B	High-deep to moderately shallow, slightly heavy texture (clayey soils)	I
C	Medium-deep to moderately shallow, medium texture; or shallow, heavy texture	II, III
D	Low-deep to moderately shallow, light texture; or shallow. Slightly heavy to medium texture.	III, VI
E	Very low-shallow, light texture; or very shallow, heavy to medium texture	VI-VII
F	Extremely low-very shallow, light texture	VII-VIII

Definition:

Heavy Texture	=	Heavy clay
Slightly heavy	=	Clayey soils not lighter than sandy clay loam.
Medium	=	Loam and loamy soils
Light	=	Sand

Note: This should be used only as a general guide. The grades are based on depth and texture of the soil. Of equal importance in assessing the capability class for each group is rainfall – frequency, intensity, and distribution throughout the year. This may raise or lower the capability in each group. Also the content of gravels and stones in the soil is just as important as this can reduce the capacity of the soil to hold moisture.

6.11 Salinity

Group symbol	Description	Example	LUC Class
A	Non saline to very slightly saline	Rewa soils	1-II
B	Slight salinity	Nakelo soils	III
C	Moderate severe salinity	Soso soils	IV, VI
D	Extremely saline	Togo soils	VIII

Note: Further research is required to establish salinity classes on the basis of total soluble salts, and to correlate this with the use capability of the soil. Research is also required to establish the length of time in which the salt content could be lowered through leaching to reach an acceptable level.

Saline soils are found mostly in mangrove swamps which may be reclaimed for development. However, such land is best classified as non-arable and unsuitable for productive use (classes VII and VIII unless there is a positive plan to reclaim the area, in which case, the capability can be upgraded to a lower arable or a grazing class in the first place, then reassessed in later years as soil conditions improved.

Also see under “Mangrove swamp” for further detail.

6.12 Mangrove swamp (salinity/wetness)

Group symbol	Description	LUC Class
A	Easy to reclaim for cropping	III
B	Difficult but can be reclaimed for cropping	IV
C	Too difficult to reclaim for cropping but can be reclaimed for marginal pasture	VI
D	Not feasible to develop for productive use	VIII

Note: Unless there is a definite plan for reclaiming mangrove swamps, all should be put under classes VI and VIII in subclass W for wetness. The above grading will apply only where there is a plan for the development of an area.

6.13 Peat swamp (soil/wetness)

Group symbol	Description	LUC Class
A	Easy to develop for cropping	III
B	Difficult but can be development for cropping	IV
C	Too difficult to reclaim for cropping but can be developed for marginal pasture	VI
D	Not feasible to develop for productive use.	VIII

Note: Unlike mangrove swamps, peat land does not require the construction of such expensive structures as sea walls, etc. Accordingly its capability is assessed in the normal way regardless of

whether or not a development plan is at hand. Groups A and B have “S” limitations (peat), While C and D have “W” limitations (wetness).

6.14 Rainfall (climate)

Zone symbol	Description	LUC Class
A	Very high-over 400mm (over 400 cm)	II-VIII
B	High-3000 - 4000mm (300-400 cm)	I-VIII
C	Moderate-2000-3000mm (200-300 cm)	I-VIII
D	Low-1500-2000mm (150-200 cm)	II-VIII
E	Very low-Less than 1500mm (less than 150 cm)	IV, VI-VIII

Note: Rainfall affects the productivity of the land in several ways. The land may be too wet from too much rain, or droughty because of too little rain; this affects the time of planting and harvesting of crops, increases crop diseases, causes damage to the soil from the use of machinery, restricts the choice of crops, etc. Group “C” is considered the ideal range in Fiji.

For determining the rainfall, the annual average for the past 20 years should be the basis. The rainfall map by L. S. Mathews can be used as a general guide, but where available, local data must always be consulted.

6.15 Temperature (climate)

Group symbol	Description	LUC Class
A	High-Winter Temperature Rarely falls below 20°C (70°F)	I-VIII
B	Low-Normal winter Temperature is below 20°C	II-VIII

Note: Group B may occur only in areas like Nadarivatu and Nausori Highlands on altitudes above 2500 feet. Although cool winter temperature is considered ideal for certain crops (e.g. English vegetables) it is unsuitable for many tropical crops, therefore restricting the choice of crops. Temperature is very closely related to altitude and the two should be assessed together.

6.16 Altitude (climate)

Group symbol	Description	LUC Class
A	Low - Less than 300 m A.S.L	I-VIII
B	Medium - 300-600 m	II-VIII
C	High - 600-1000 m	II-VIII
D	Very high - more than 914 m	IV-VIII

Note: The main effect of altitude is increasing cloudiness and consequently a reduction of sunshine, thus limiting the choice of crops grown. The measurement of altitude should be based on D.O.S. 1:50,000 topographical map.

DOWNGRADING OF MAJOR CLASSES OWING TO CLIMATIC LIMITATIONS (RAINFALL TEMPERATURE AND ALTITUDE).

6.17 Rainfall

Zone	MAJOR CLASSES							
	I	II	III	IV	V	VI	VII	VIII
A	II	III	IV	V + VI	V	VI	VII	VIII
B	I	II	III	IV	V	VI	VII	VIII
C	I	II	III	IV	V	VI	VII	VIII
D	II	III	IV	V + VI	V	VI	VII	VIII
E	IV	IV	IV	VI	V	VI	VII	VIII

Class I land - Land in A and D zones, is downgraded to class II, and in E zone to class IV.

Class II land - Land in A and D zones is downgraded to class III, and in E zone to class IV.

Class III land - Land in A,D and E zones is downgraded to class IV.

Class IV land - Land in A,D and E zones is downgraded to class V and VI.

Class V land - Only land in E zone is downgraded to class VI.

Classes VI - VIII - No down grading

6.18 Altitude

	MAJOR CLASSES							
Group	I	II	III	IV	V	VI	VII	VIII
A	I	II	III	IV	V	VI	VII	VIII
B	II	II	III	IV	V	VI	VII	VIII
C	II	III	IV + V	IV + V	V	VI	VII	VIII
D	III	III	IV + V	V + VI	V	VI	VII	VIII

Class I land - in groups B and C the land is downgraded to class II, and in group D it is downgraded to class III.

Class II land - This is downgraded to class III in groups C and D.

Class III land - downgraded to classes IV and V in groups C and D.

Class IV land - In group C some land is downgraded to classes IV and V, in group D it is downgraded to classes V and VI.

Class V - VIII - No down grading.

6.19 Temperature

Classes I – VIII all went down by one class when they occur in group B, Classes IV – VIII are not downgraded.