Land Capability Classification
Land use- Land Cover…

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Land Vrs. Soil

Land: an area of ground, the solid surface of earth that is not permanently covered by water… includes.

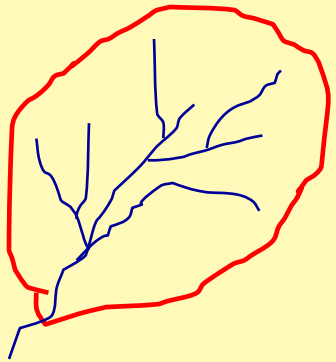
climate, relief, **soil,** hydrology, vegetation, minerals, landscapes, **proximity**, above and below ground entities.. to the extant that these influences the potential for land use

(Soil +…)

Soil: material on upper earth crust, primarily used for growing plants, made by weathering of **rocks and minerals** over **the years** by **climate** and **vegetation** conditioned by **topography**.

- Non-renewable (though formation takes place-too slow for human life span)
- Living entity-(most of the services governed)
- Can be sampled out (unlike to land)
- Polyphasic, 3-Dimensional

Watershed: A geographical area (land) draining to a common point (outlet)



Land cover is the physical material at the surface of the earth. - grass, asphalt, trees, bare ground, water, etc.

Land use is a description of how people *utilize* the land and of socio-economic activity.

- A map that shows the types and intensities of different land uses - LU map.
- Urban and agricultural land uses are two of the most commonly known land use classes.

Land Use	Land cover
Water storage	Water spread, dried up area
Agriculture	Cropped land, barren areas
Urban	Buildings, road, Park, barren patch
Recreation	Vegetation, grassland, water cover
Forest	Trees, barren, Shrubs

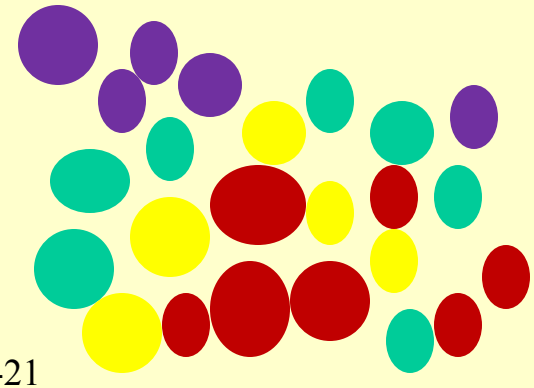
"To use the land according to its capability and treat the land according to its need"

LAND CAPABILITY CLASSIFICATION (L.C.C)

Concept

Land capability is the suitability of land for a specified use for maximum sustained production or returns.

It is a **systematic arrangement** of different type of lands according to those properties which determine the ability of land to produce on virtually permanent basis, without causing damage to it due to erosion or other hazards.



Class	Col	Area	Position	No.
1	G			
2	Y			
3	R			
4	B			

Purposes of land capability classification

- Land capability map makes available the technical data / information contained in a soil survey map, **in a simple and practical language** for application to the land use.
- It indicates the hazards of soil erosion and difficulties to be encountered in using the land.
- It indicates the most intensive, profitable and safe use of any piece of land
- It enables the land managers/ farmers to make the best use of research and experience in agriculture since the scientific and technical data are interpreted for each piece of land.

Parameter and permanent characteristics for LCC

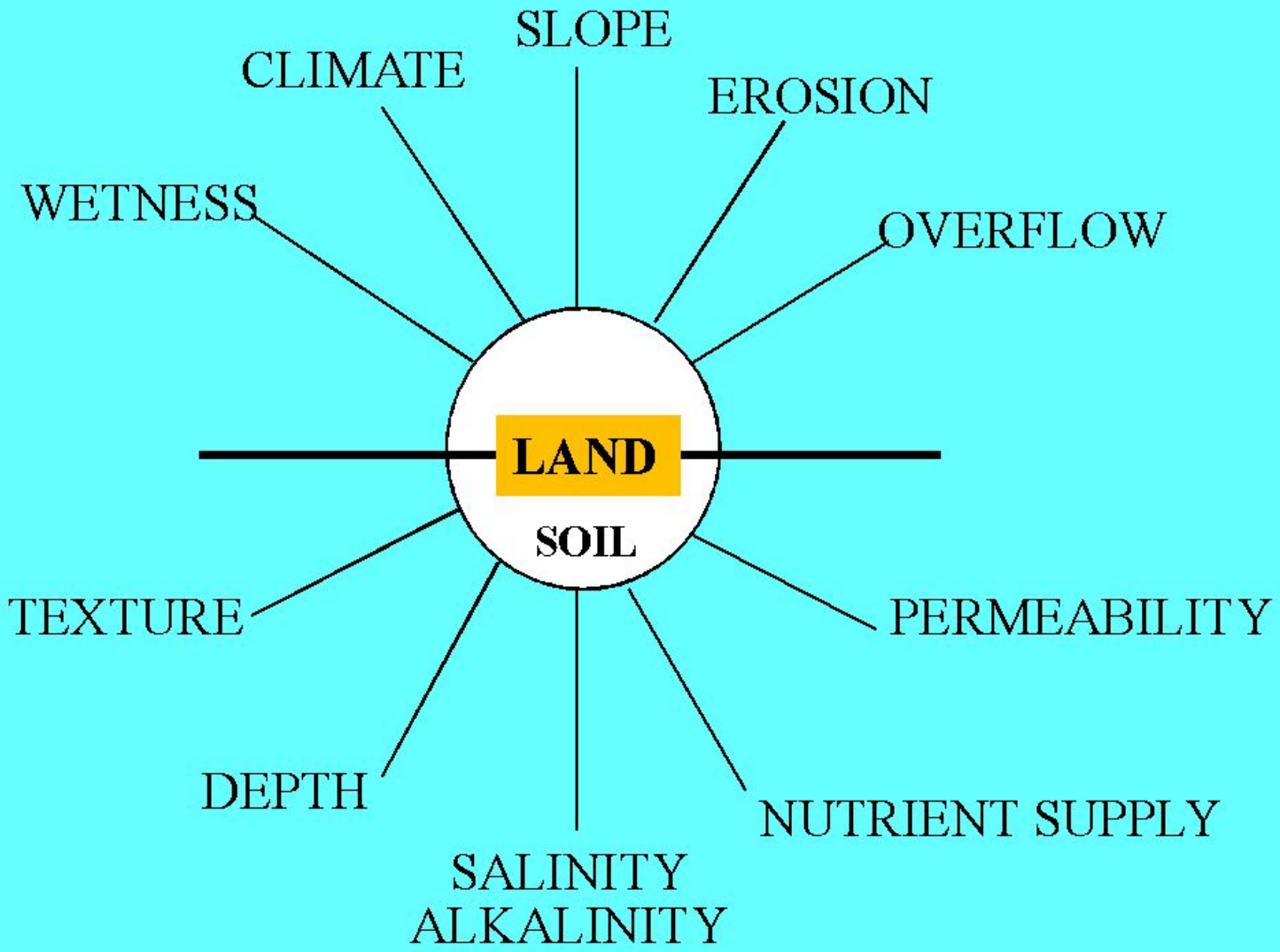
Soil parameters for soil functions: pH, EC, Texture, aggregation, water sable aggregates, BD, porosity, moisture holding capacity, permeability, erosion vulnerability.....

- **Slope, soil texture, soil depth, effects of past erosion, permeability, water-holding capacity, type of clay minerals are considered permanent soil qualities and characteristics.**

- **Shrubs, trees, or stumps are not considered permanent characteristics**

FACTORS DETERMINING LAND CAPABILITY

1. External features of land
   - i. Slope
   - ii. Erosion features
   - iii. Water logging / wetness / marshy land etc
2. Internal / Inherent soil characteristics
   - iv. Surface soil texture
   - v. Effective soil depth
   - vi. Permeability and internal drainage
   - vii. Soil salinity and alkalinity, fertility, etc.
3. Environmental factors
   - viii. Rainfall
   - ix. Temperature
   - x. Wind velocity,
   - xi. Evapotranspiration


SLOPE
CLIMATE
EROSION
WETNESS
OVERFLOW
LAND
SOIL
TEXTURE
PERMEABILITY
DEPTH
NUTRIENT SUPPLY
SALINITY
ALKALINITY

CLASSIFICATION

LAND SUITABILITY GROUP

A. Land suitable for cultivation
B. Land not suitable for cultivation

LAND CAPABILITY CLASSES

I II III IV V VI VII VIII

Increasing intensity of hazard and limitations of land use

Suitable for cultivation Not suitable for cultivation

SUB-CLASSES: Kind of limitation / problem

	Limitation/hazards	Symbol
i.	Erosion and runoff	e
ii.	Excess water/wetness	w
iii.	Root zone limitation	s
iv.	Climatic limitations	c

LAND CAPABILITY UNITS

Land capability unit - final step in the land capability classification.

Within each sub-class the land that is suited for essentially the same kind of management and the same kind of conservation treatment is designated as a land capability unit.

The soils in a capability unit are sufficiently uniform to:

- Produce similar kinds of cultivated crops and pasture with similar management practices.
- Require similar conservation treatment and management under the same kind and condition of vegetation cover.
- Have comparable potential productivity (within 25% variation-10/20 years average).

Land capability units are designated by ordinary numerals placed as subscript to the sub-class letters in the capability notation. For example, Class IIIs would show land with severe soil limitations. Soil limitations may arise because of one of the following reasons.

- Limitations of effective soil depth.
- Very heavy or light texture of soil.
- Nature of material restricting root zone.
- Salinity or alkalinity of soil.

- **Limitations of effective soil depth.**
- **Very heavy or light texture of soil.**
- **Nature of material restricting root zone.**
- **Salinity or alkalinity of soil.**

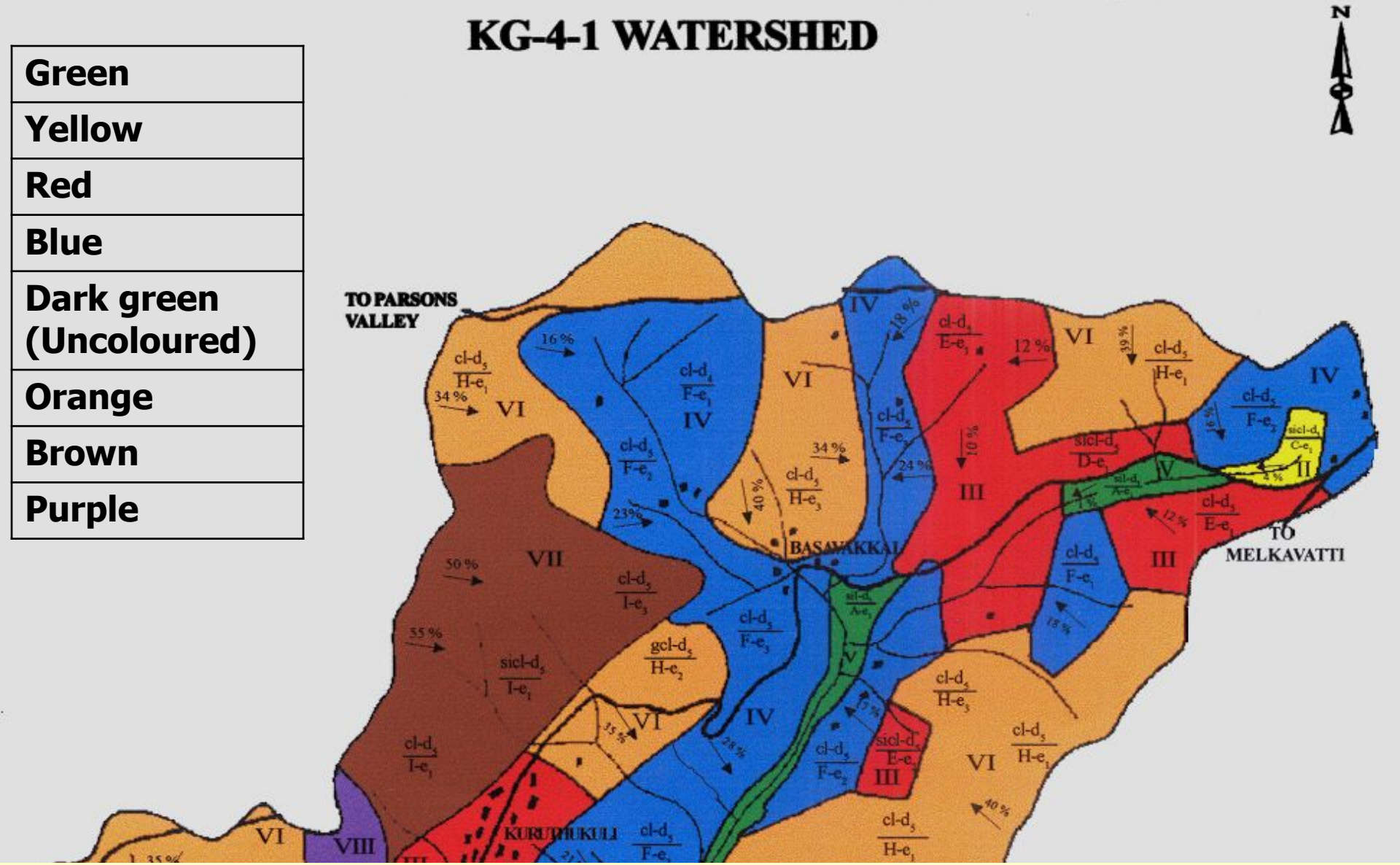
The above four soil limitations - need different management practices.

These capability units will be indicated as:

IIs_1 $IIIs_2$ $IIIs_3$ $IIIs_4$

MAP 1. LAND CAPABILITY CLASSIFICATION
KG-4-1 WATERSHED

Green
Yellow
Red
Blue
Dark green (Uncoloured)
Orange
Brown
Purple



UPGRADATION AND DOWNGRADATION IN LAND CAPABILITY CLASS

Optimum and well distributed rainfall throughout the year is required for classifying land under Class I, if there are no other limitations.

Assured supply of irrigation: –no moisture deficit and drought conditions -upgrade the land by one class.

Class upgradation is also considered when the suitable measures are taken for already existing problems or limitations of land.

New problem: Water logging in terms of either surface water stagnation, seasonal overflow, or high water table
and limited soil moisture or aridity –

downgrade the land capability.

SUITABILITY OF LAND CAPABILITY CLASSES FOR DIFFERENT LAND USES

LC CLASS	Wild life	Fore-stry	Lim. graz.	Mod graz.	Intens. graz.	Lim. cult.	Mod cult.	Intens. cult	Very int. cul.
I	□	□	□	□	□	□	□	□	□
II	□	□	□	□	□	□	□	□	
III	□	□	□	□	□	□	□		
IV	□	□	□	□	□	□			
V	□	□	□	□	□				
VI	□	□	□	□					
VII	□	□	□						
VIII	□								

LAND CAPABILITY CLASSIFICATION : METHOD

There are two ways to obtain information for land capability classes and sub-classes.

Detailed soil survey maps - provide all information for land capability classification such as

- soil series, soil texture, effective soil depth, land slope and degree of erosion.
- Information - wetness, water logging, salinity, alkalinity, stoniness, rockiness, climate, etc. can be used for the land capability classification.

In the absence of standard or detailed soil survey map, actual field survey has to be done to obtain information

To begin- cadestral maps (village maps) or large scale toposheets can be used to serve as base maps.

- Google earth- for land cover, slope, erosion hazards

Steps in Land Capability Classification and Mapping of a Watershed Area

- Get familiar with the base map of the area
- A quick reconnaissance survey to ascertain ridge line, to have judgement about the physiography of the land.

- Survey work is started at one end of the watershed from a place of easily identifiable permanent features

- Take observation on texture of top soil, effective soil depth, land slope, erosion evidence
  - any other relevant features or details
  - at 3-4 locations in an area, more or less uniform with respect to physio-graphy
  - record the observations in a tabular format.

Table for data collection

Survey/unit No	Soil texture	Soil depth (cm)	Slope (%)	Erosion class	Land use		Land Management	
					Major cate.	Status	Measure	Status
1	sl	>90	17	e_1	Ag	C_2	Terrace	T_2
2	cl	>90	25	e_2	Tea	P_1	Trenching	Good
3	cl	60	35	e_1	Forest	F_2	Nil	-

- Rating chart to be used to determine land capability classes and sub-classes
- Confirm boundary of the mapping units and demarcate the boundary on the map.
- Minimum mapable area will depend upon the scale of the map.
- Area of each land capability class is determined by using Planimeter.

MAPPING UNITS OR SYMBOLS

The collected information for classification is recorded as mapping unit in the following ways:

Soil series - Texture of top soil - Effective soil depth

Land Slope - Erosion hazard

Simply it also can be written as,

Texture - depth

Slope - erosion

The different information to be collected is as follows

Texture of top soil	**-**	**By Feel method**
Effective soil depth	**-**	**By Screw Auger/road cuts**
Land slope	**-**	**By Abney's level/Hand level**
Erosion hazard	**-**	**By visual (eye) judgment.**

Parameters	Proposed LC Class	Mapping unit	LC Class with sub-class
Texture- loam (l) soil depth- (45-90 cm)-d_4 Slope- 0-1% (A) Erosion-Absent/very slight(e_1)	I II I I	$\underline{l\text{-}d_4}$ A-e_1	IIs
Texture-clay loam(cl) Depth->90 cm (d_5) Slope-5-10% (D) Erosion-Severe (e_3)	I or II I III VI	$\underline{cl\text{-}d_5}$ D – e_3	VIe
Texture-silty clay (sil) Depth->90 cm (d_5) Slope- 5-10% (D) Erosion-moderate (e_2)	I or II I III III	$\underline{sil – d_5}$ D – e_2	IIIe

RATING TABLE FOR LAND CAPABILITY CLASSIFICATION

Class	Soil Texture	Soil depth (cm)	Slope (%)					Erosion status		Other attributes			Mapping colour
			Allu vial soils	Black soils	Red soils	Deep red soils of EG & WG	Hima - layas	Effect of past erosion	Succeptibili ty to erosion Eg.,distanc e from active gully heads	Permiabilit y (cm/hr)	Con duct ivity (dS/ m)	Climate	
I	sicl, cl, l, sl, sil, scl	>90 (d_5)	0-1	0-1	0-1	0-1	0-1	e_1 Upto ¼ top soil lost-Sheet	Very far away	Moderate (2-5)	0-2	Humid with well distributed rainfall throughout the year	Green
II	sicl, cl, sl, sil, scl	45-90 (d_4)	1-3	1-3	1-3	1-3	1-3	e_1 Upto ¼ top soil lost-Sheet	Minimum 60 m	Mod.slow (0.5-2) Mod.rapid (5-12.5)	2-4	Humid with occasional dry spell; sub-humid; crop yield frequently reduced by drought	Yellow
III	sc, sic, c, ls	22.5-45 (d_3)	3-5 5-10	3-5	5-10	5-10 10-15	3-5	e_2 ¼ to ¾ top soil lost-rill	Between 6-60 m for 0-3% slope	Slow (0.125-0.5) Rapid (12.5-25)	4-8	Sub-humid; crop yield frequently reduced by drought; semi-arid	Red
IV	s, c	7.5-22.5 (d_2)	10-15	5-10	5-10	15-25 25-33	10-15 15-25	e_3 ¾ top soil and ¼ sub soil -SG	-----	Very slow (<0.125) very rapid (>25)	8-16	Semi arid and arid	Blue
V	Same characteristics as class I land except for one or more limitation of wetness or stoniness or rockiness or adverse climatic conditions. It has no hazard of erosion like class I land.							Gullied land or sand dunes (e_4)	Marginal land (6m wide strip near gully land)	--	>16	---	Dark green (Uncolou red)
VI		<7.5 (d_1)	15-25	10-15	25-33	33-50	25-33 33-50	Gullied land or sand dunes (e_4)	Gully sides and beds				Orange
VII		<7.5 (d_1)	25-33	15-25	33-50	50-100	50-100	Gullied land or sand dunes (e_4)	Gully sides and beds				Brown
VIII		Rock	>33	>25	>50	>100	>100	Bad lands	Gully sides and beds				Purple

DETERMINATION OF SOIL TEXTURE BY FEEL METHOD

Sl.No.	Soil Texture	Feel by fingers	Ball formation	Stickiness	Ribbon formation
1.	Sand	Very gritty	Does not form ball	Does not stain fingers	No
2.	Loamy sand	Very gritty	Forms very easily broken ball	Very little-stains fingers slightly	No
3.	Sandy loam	Moderately gritty	Forms very firm ball but easily broken.	Definitely stain fingers	No
4.	Loam	Neither very gritty nor very smooth	Forms firm ball	Definitely stain fingers	No
5.	Silt loam	Smooth or slick buttery feel	Forms firm ball	Definitely stain fingers	Slight tendency to ribbon with flaky surface
6.	Clay loam	Slightly gritty	Moderately hard ball when dry	Definitely stain fingers	Ribbons out on squeezing but the ribbons breaks easily
7.	Silty clay loam	Very smooth	Moderately hard ball when dry	Definitely stain fingers	Shows some flaking on ribbon surface similar to silt loam
8.	Clay	Very smooth	Forms hard ball when dry, cannot be crushed by fingers	Definitely stain fingers	Squeezes out at right moisture into long (1″-3″)

LCC under different textural classes

Texture class		Symbol	Proposed LC class
Sand	.....	s	IV
Loamy sand	.....	ls	III
Sandy loam	.....	sl	I, II
Loam	....	l	I
Clay loam	.....	cl	I, II
Sandy clay loam	.....	scl	I, II
Silt	.....	si	I
Silty loam	.....	sil	I,II
Silty clay	.....	sic	II, III
Silty clay loam	.....	sicl	I,II
Sandy clay	....	sc	III
Clay	.....	c	III, IV

SOIL DEPTH CLASSES

Depth range	Symbol	Description	Proposed LC class
Above 90 cm	d_5	Very deep	I
45 - 90 cm	d_4	Deep	II
22.5 - 45 cm	d_3	Mod. Deep	III
7.5 - 22.5 cm	d_2	Shallow	IV
7.5 cm or less	d_1	Very shallow	VI, VII

SLOPE CLASSES

Class of slope	Range of slope(%)	Proposed LC class
A	0 - 1	I
B	1 - 3	II
C	3 - 5	II
D	5 – 10	III
E	10 – 15	III
F	15 – 25	IV
G	25 – 33	IV
H	33 – 50	VI
I	50 – 100	VII
J	>100	VIII

EROSION CLASSES

Erosion class symbol and description		Proposed LC class
e_1	No erosion or slight erosion	I,II
e_2	Moderate erosion – sheet and rill	III
e_3	Severe erosion – incipient of gullies.	IV
e_4	Very severe erosion - shallow and deep gullies	VI,VI

Climate	
Humid with well distributed rainfall throughout the year	I
Humid with occasional dry spell; sub-humid; crop yield frequently reduced by drought	II
Sub-humid; crop yield frequently reduced by drought; semi-arid	III
Semi arid and arid	IV

Salinity and Alkalinity:

- Free,
- Slight,
- Moderate,
- Strong

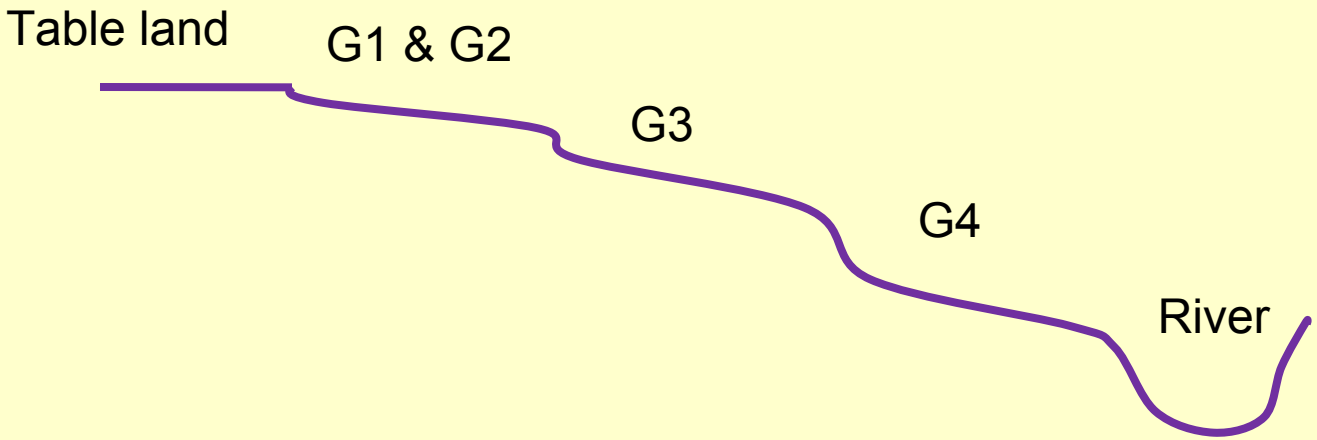
Drainage:

- Good,
- Wetness which can be corrected by drainage,
- Wetness which continue after drainage,
- Excessive wetness

Land capability classification in ravine lands (Tejwani 1975).

Land form	Slope (%)	Distance from gully rim (m)	Land capability class
Table land	0-1	>60	I
Table land	1-3	>60	II
Table lands and wide humps in between wide gullies	0-3	6-60	III(a)
Table lands	3-5	>6	III (b)
Table lands	5-10	>6	III ©
Table lands	10-15	>6	IV
Marginal land between the gully rim and the table land	0-15	<6	VI (a)
Table lands	15-20	--	VI (b)
Bed of very small, small and medium gully sides and beds (G1, G2 and G3)	--	--	VI ©
Table land	25	--	VII(a)
Deep and narrow gully channels	--	--	VII (b)

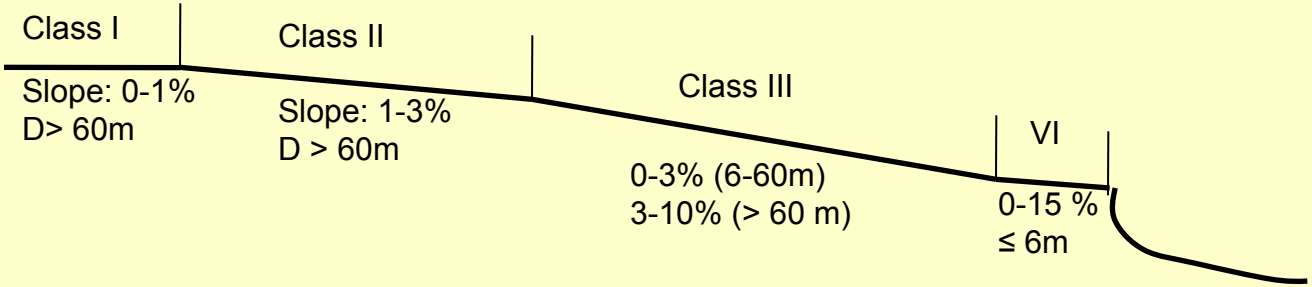
LCC for Gully and ravines



Classification of Gullies

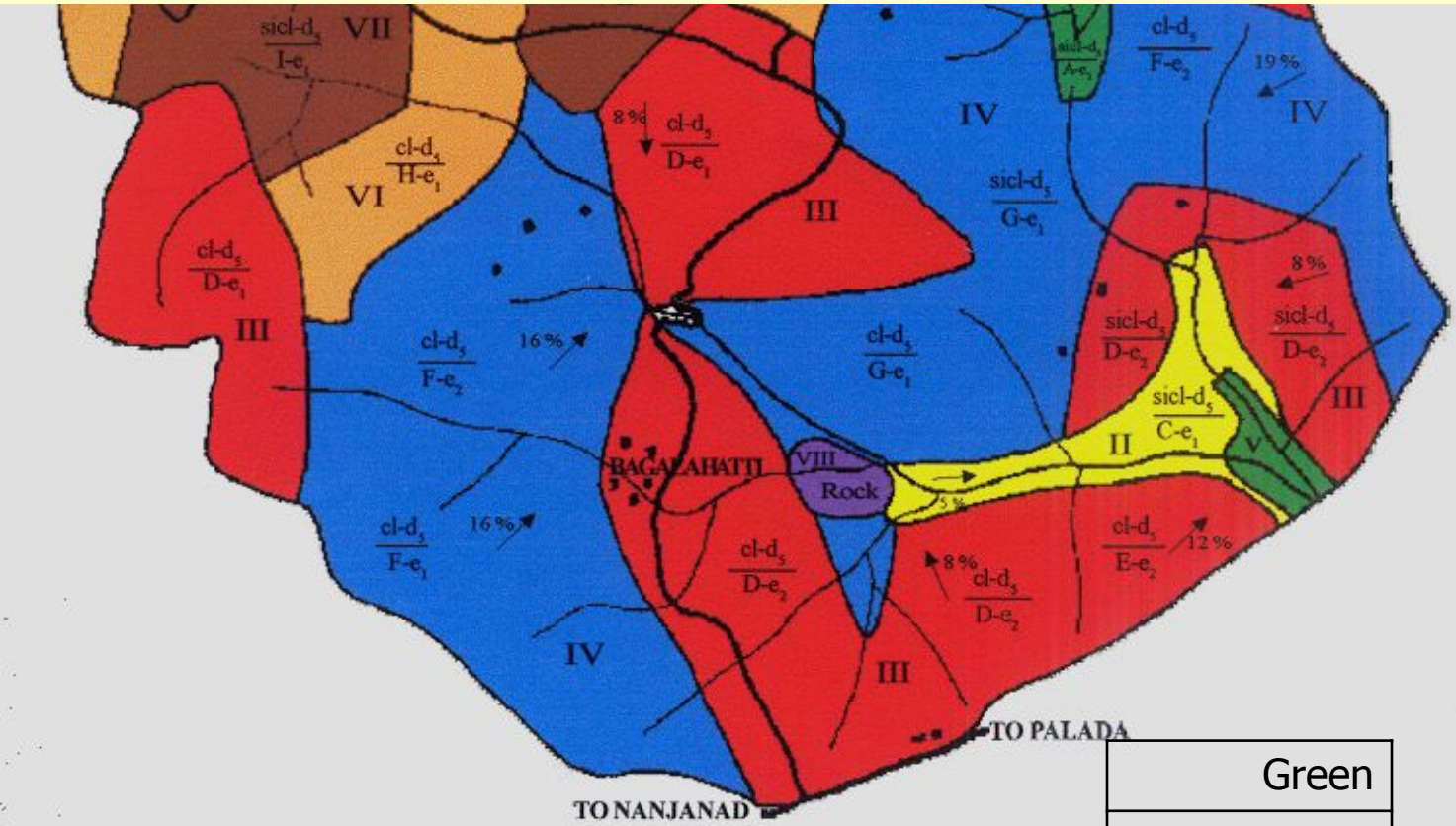
Very small	small	medium	Deep and narrow	Deep and narrow
G1	G2	G3	G4 (A)	G4 (B)
W < 18m	W ≥18m	W ≥ 18m	W < 18m	W < 18m
D ≤ 3m	D ≤ 3m	D: 3-9m	D: 3-9 m	D: > 9 m
SS vary	SS vary	SS :8-15%	SS: vary	SS: vary most steep

LCC for ravines



Area occupied by each mapping unit will have the following details:-

- Boundary of the area by black line.
- Mapping unit with Symbol.
- Land capability class and sub-class symbol.
- Slope direction shown by arrows with exact degree of slope in per cent.
- Standard colour of land capability class.



Green
Yellow
Red
Blue
Dark green (Uncoloured)
Orange
Brown
Purple

LEGEND

- HABITATION
- ROAD
- STREAM
- LCC-II
- LCC-III
- LCC-IV
- LCC-V
- LCC-VI
- LCC-VII
- LCC-VIII


भारतीय मृदा एवं जल संरक्षण संस्थान
IISWC
माता भूमिः पुत्रो अहं पृथिव्याः। पर्जन्यः पिता स उ नः पिपर्तु।।

Thank You