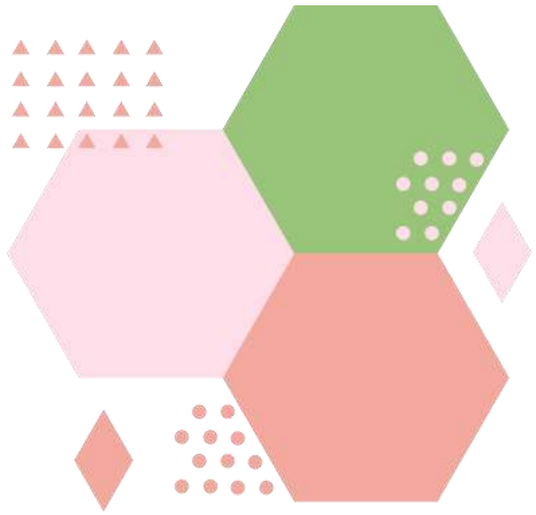
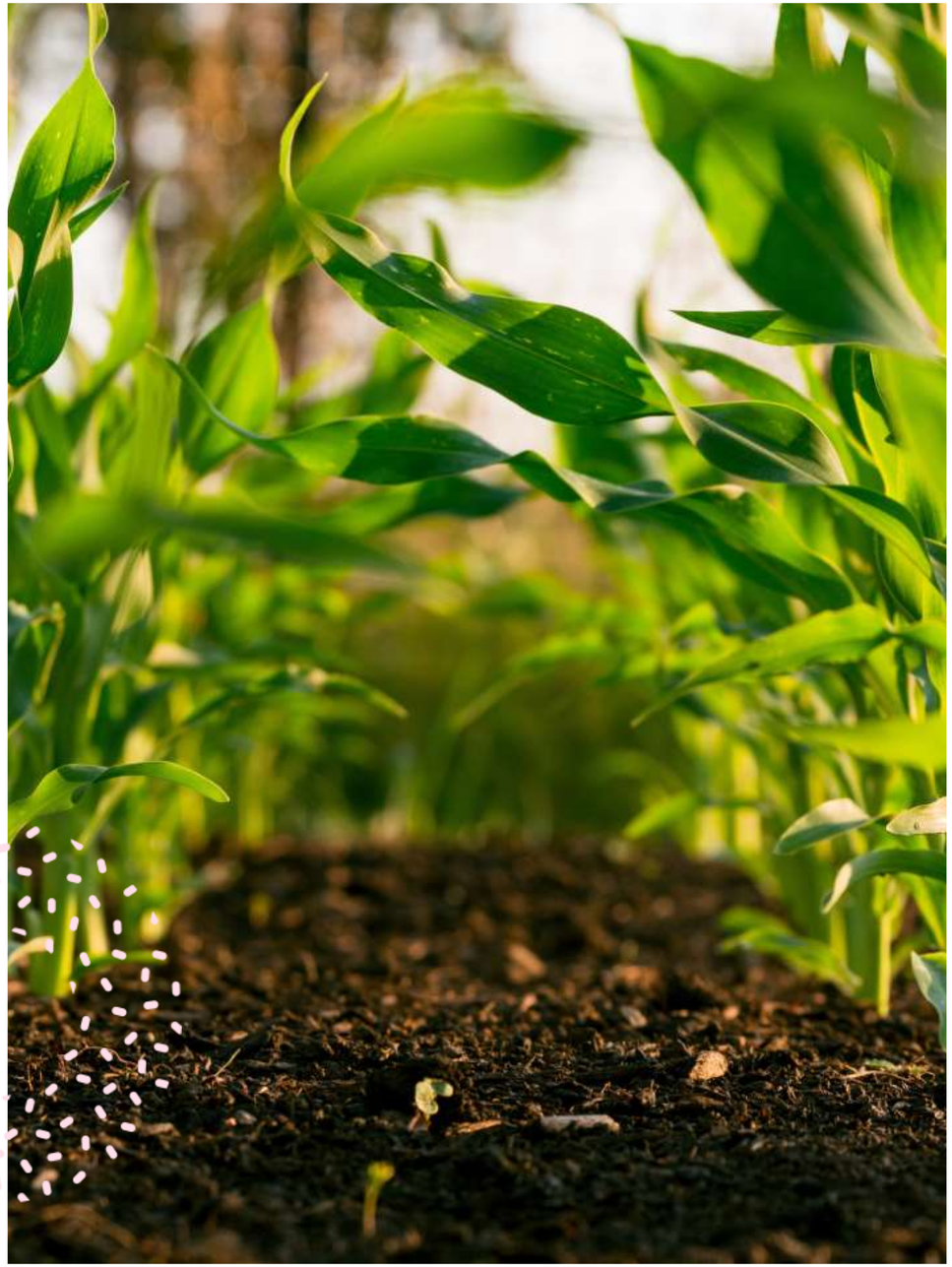
AGRICULTURAL GEOGRAPHY

UNIT - 2

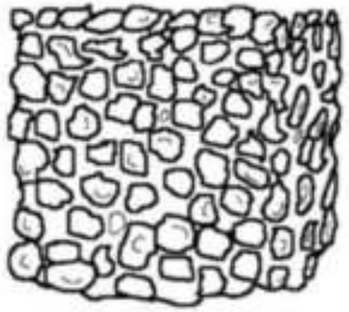
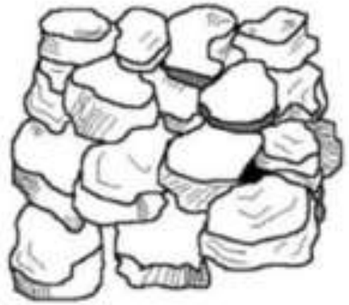
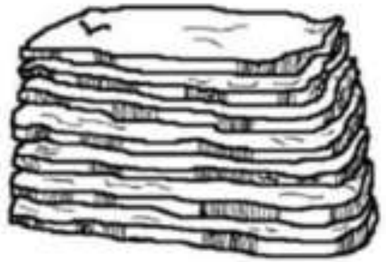
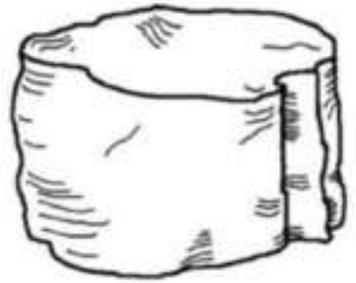


SOIL

- Soil is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life of plants and soil organisms.
- Soil structure describes the arrangement of the solid parts of the soil and of the pore spaces located between them



SOIL STRUCTURE

SINGLE GRAIN	GRANULAR	BLOCKY
		
Composed of largely non-reactive sand size particles of roughly uniform size distribution.	Predominantly the result of biological forces including: earthworms, insects, fungal hyphae, and fine roots.	Developed through cycles of shrink-swell. Size defined by boundaries in homogeneous matrix (i.e. root patterning). Most common to soils with rapid drying.
PRISMATIC	**PLATY**	**MASSIVE**
		
Uniform shrinkage after extended periods of saturation. Most common in uniformly textured soils, enriched with sodium, that slowly dry.	Generally occur through unidirectional compressional forces. Most commonly produced in surface soils compressed by heavy equipment.	Common in fine textured sediments that are slowly sorted and cemented (argillinc), manufactuired (clay barriers), or compressed (fragipan).

Images courtesy of the U.S. Department of Agriculture

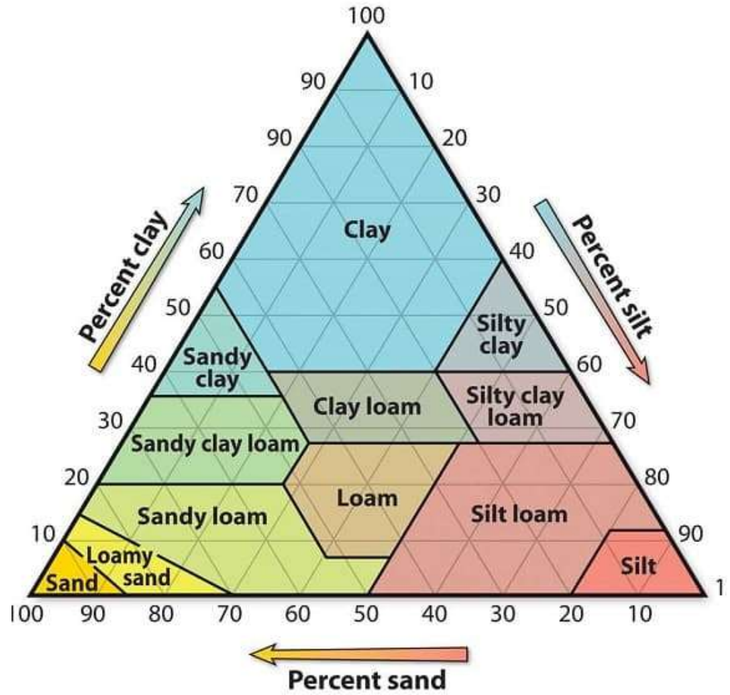
CLASSIFICATION

1. MASSACHUSETTS INSTITUTE OF TECHNOLOGY SYSTEM (MIT)

MIT Classification

Material		Size (mm)
Boulder		> 60
Gravel	Fine	2 – 6
	Medium	6 – 20
	Coarse	20 – 60
Sand	Fine	0.06 – 0.2
	Medium	0.2 – 0.6
	Coarse	0.6 – 2
Silt	Fine	0.002 – 0.006
	Medium	0.006 – 0.02
	Coarse	0.02 – 0.06
Clay		< 0.002

2. TEXTURAL CLASSIFICATION OF SOIL



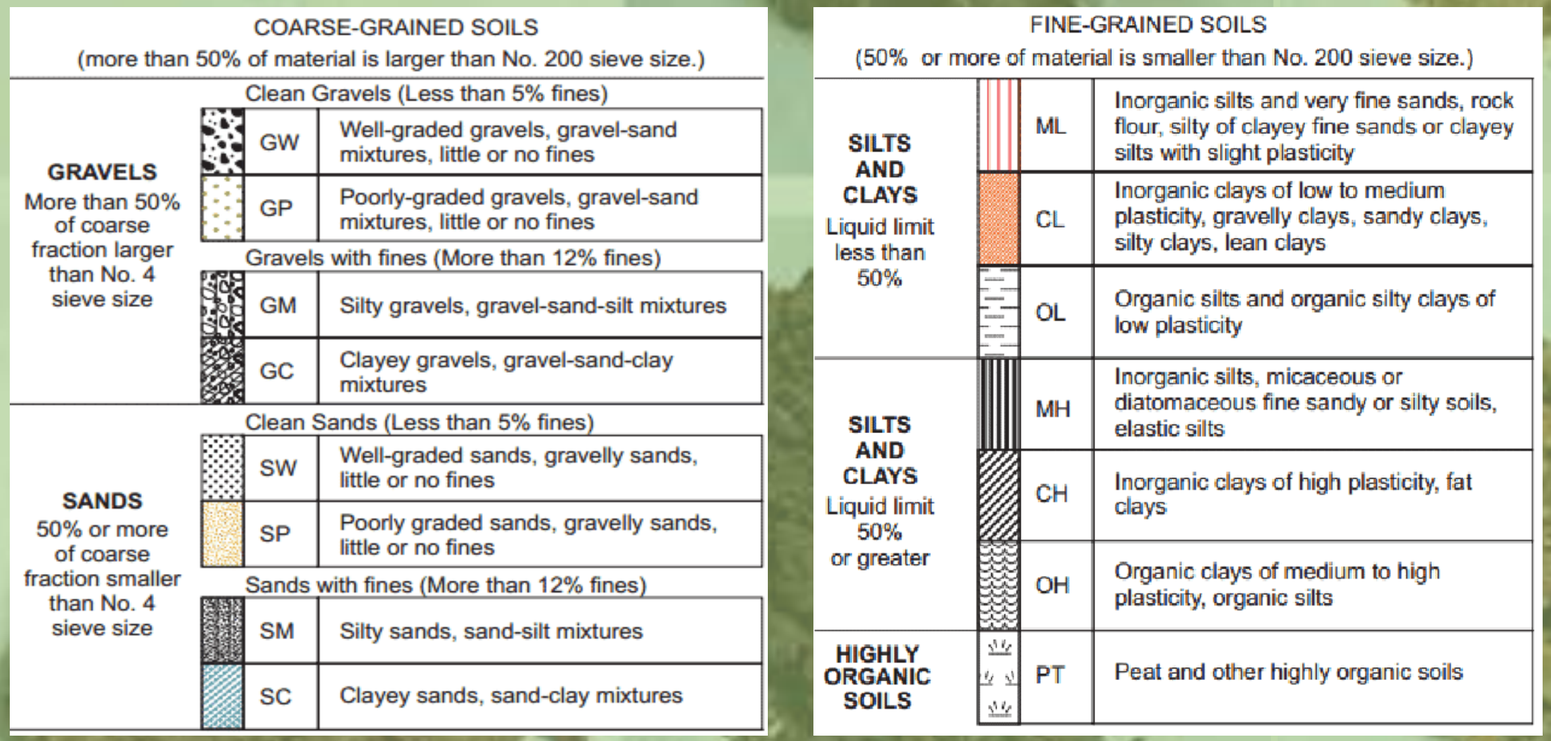
3.AASHTO CLASSIFICATION SYSTEM OF SOIL

Table 4.1 AASHTO Soil Classification System

General classification	*Granular materials (35% or less passing US No. 200 sieve)*			*Silt-clay materials (More than 35% passing US No. 200 sieve)*							
Group classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1a	A-1b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve analysis Percent passing US No. 10 (2 mm)	50 max										
US No. 40 (420 μ)	30 max	50 max	51 max								
US No. 200 (75 μ)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing US No. 40 (420 μ) Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		Non-plastic	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Group index	0		0	0		4 max		8 max	12 max	16 max	20 max
Usual types of significant constituent materials	Stone fragments gravel and sand		Fine Sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General rating as subgrade	Excellent to good							Fair to poor			

Note: A-8 is identified by visual classification, and is not shown in the Table.
Classification procedure: Proceeding from left to right in the chart, the correct group will be found by the process of elimination. The first group from the left consistent with the test data is the correct classification. A-7 group is subdivided into A-7-5 or A-7-6 depending on the plastic limit. For $w_p < 30$, the classification is A-7-6; for $w_p \geq 30$, it is A-7-5.

4. UNIFIED SOIL CLASSIFICATION SYSTEM



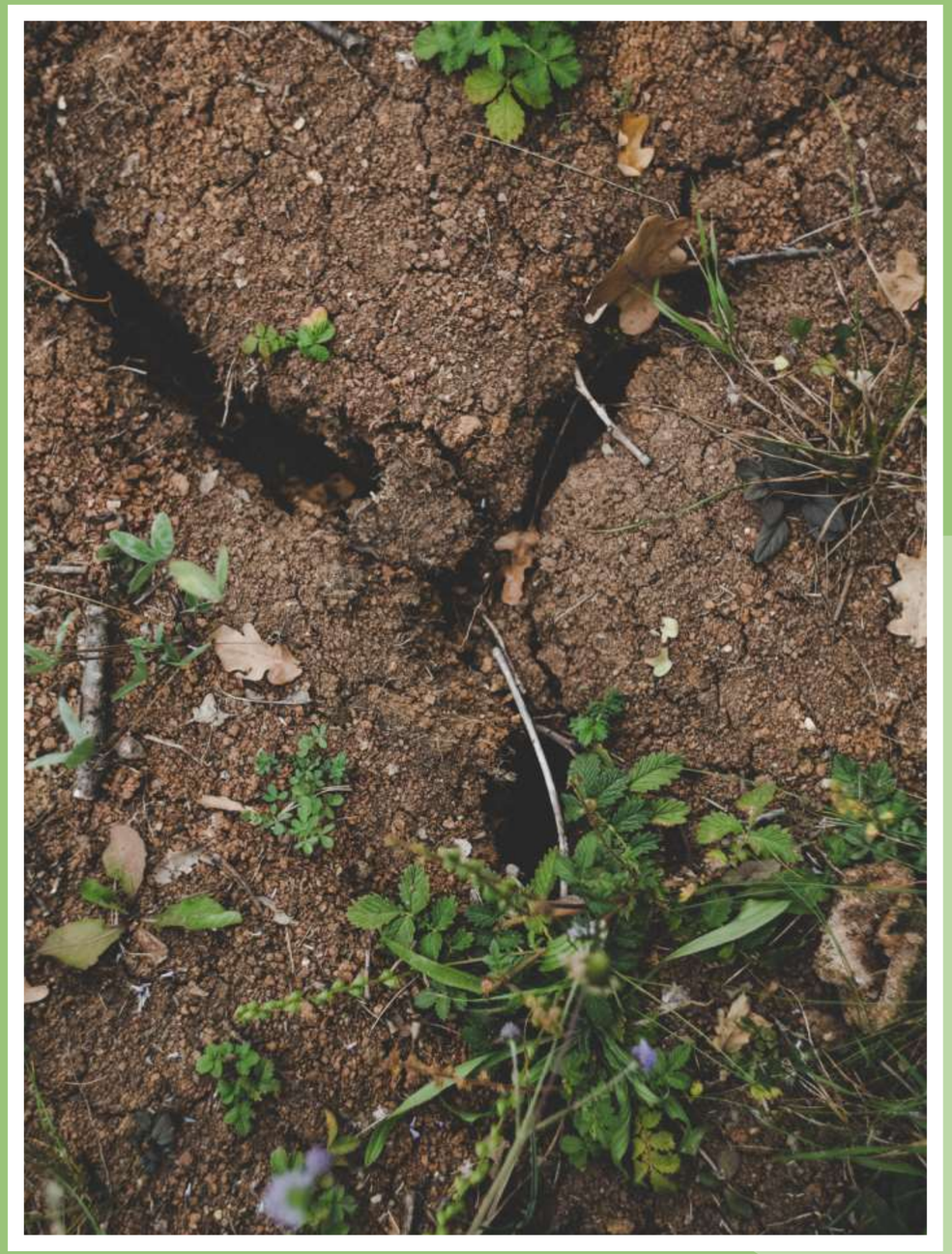
COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

5. INDIAN STANDARD SYSTEM OF SOIL CLASSIFICATION

Indian Standard Soil Classification System (ISSCS)

Boulder size		**> 300 mm**
Cobble size		**80 - 300 mm**
Gravel size (G)	***Coarse***	**20 - 80 mm**
	Fine	**4.75 - 20 mm**
Sand size (S)	***Coarse***	**2 - 4.75 mm**
	Medium	**0.425 - 2 mm**
	Fine	**0.075 - 0.425 mm**
Silt size (M)		**0.002 - 0.075 mm**
Clay size (C)		**< 0.002 mm**



SOIL EROSION

- Soil erosion is the natural process in which the topsoil of a field is carried away by physical sources such as wind and water.
- The most common soil problems are
- Humus reduction
- A disturbed mineral balance
- Rapid fictional of minerals
- Insufficient soul life, disturbed soil-life balance
- Soil disease, poor bacteria gain the upper land.

REMEDIES

Ways to prevent soil Erosion:

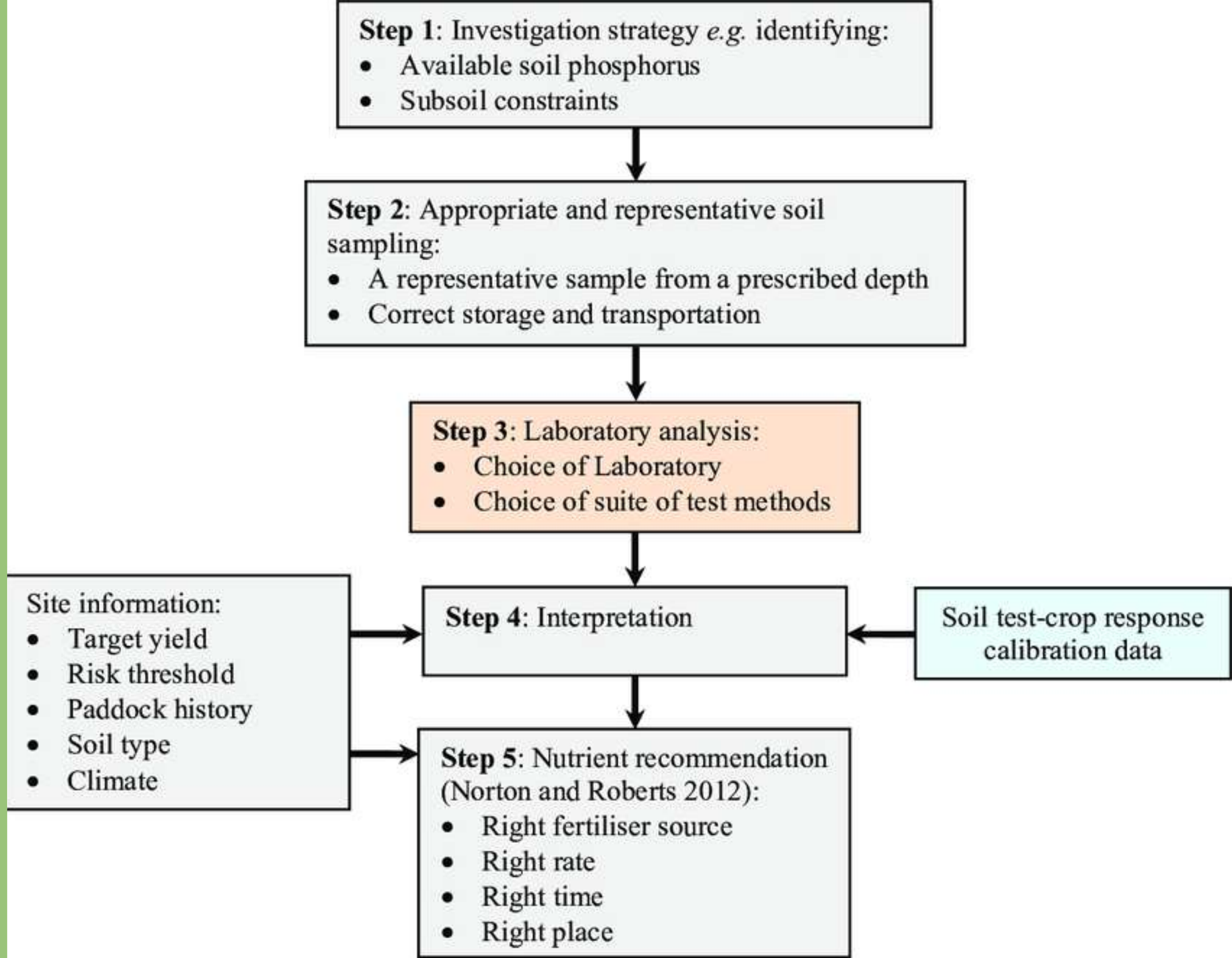
- **Contour farming,**
- **Strip farming,**
- **Terrace farming.**

- **Contour Farming:**
- **Planting in row patterns that run level around a hill instead of up and down the slope has been shown to reduce runoff and decrease the risk of water erosion**
- **Strip Farming:**
- **In areas where a slope is particularly steep or there is no alternative method of preventing erosion, planting fields in long strips alternated in a crop rotation system (strip farming) has proven effective.**
- **Terrace Farming:**
- **Many farmers have successfully combated erosion by planting in flat areas created on hillsides in a step-like formation. (terrace farming)**

SOIL TESTING

- The analysis type depends on the explored components or properties of the field ground that may beneficially or adversely impact crop development. The most frequently-used types analyze and measure:
- mineral content,
- pH level,
- soil moisture,
- salinity,
- pesticides and chemical contamination,
- structure and texture, etc.

STEPS


Step 1: Investigation strategy e.g. identifying:
• Available soil phosphorus
• Subsoil constraints
Step 2: Appropriate and representative soil sampling:
• A representative sample from a prescribed depth
• Correct storage and transportation
Step 3: Laboratory analysis:
• Choice of Laboratory
• Choice of suite of test methods
Site information:
• Target yield
• Risk threshold
• Paddock history
• Soil type
• Climate
Step 4: Interpretation
Soil test-crop response calibration data
Step 5: Nutrient recommendation (Norton and Roberts 2012):
• Right fertiliser source
• Right rate
• Right time
• Right place

LAND USE CLASSIFICATION

USGS (United States Geological Survey)

- The United States Geological Survey is a scientific agency of the United States government. The scientists of the USGS study the landscape of the United States, its natural resources, and the natural hazards that threaten it.
- Its Headquarters is located in Reston, Virginia.
- Land cover data documents how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types.
- Land use define how people are using the land.

USGS
science for a changing world

CLASSIFICATION OF LAND USE IN AMERICA

1) Code 100 land use UBL (urban and built up land):

Urban or Built-up Land is comprised of areas of intensive use with much of the land covered by structures. It Included cities, towns, villages, strip developments along highways, transportation, power, and communications facilities.

2) Code 211 land use DCP (dryland cropped and pasture)

Dryland farmed crops may include winter wheat, maize, beans, sunflowers or even watermelon.

3) Code 212 land use ICP (Irrigated cropland and pasture):

Irrigated cropland means any land that is customarily supplied with water by artificial means for growing plants.

4) Code 213 land use MC (mixed dryland, irrigated cropland and pasture)

- When more than one-third intermixture of either herbaceous or shrub and
- brush dryland species occurs in a specific area, it is classified as Mixed
- dryland

- Irrigated cropland means any land that is customarily supplied with water by
- artificial means for growing plants.

- Pasture is a land covered with grass or herbage and grazed by or suitable
- for grazing by livestock.

5) Code 280 land use CGM (cropland and grassland)

- Cropland can be understood as land with regularly or recently cultivated
- agricultural, horticultural and domestic habitats.

- Grassland ecosystems are areas covered by grass-dominated vegetation
- with little or no tree cover and include meadows, steppes and grasslands
- grazed with a variable intensity.

6) Code 290 land use CWM (cropland and woodland)

A woodland is a habitat where trees are the dominant plant form.

NINE FOLD CLASSIFICATION

1. FOREST

Any area within the forest, whether it is a grazing land or cropping area raised with in the forest or an open grazing area comes under this classification

2. AREA UNDER NON-AGRICULTURAL USES

Includes any land occupied by buildings, road and railways, or underwater like canals, rivers and etc.

3. BARREN OR UNCULTURABLE LAND

Lands which are not suitable for cultivation expect at an exorbitant cost , like mountains and deserts, comes under this classification, whether such land is in isolated blocks with in cultivated holdings.

4. PERMANENT PASTURES AND OTHER GRAZING LANDS

All the grazing lands whether they are permanent pastures and meadows or not. Village common grazing land is included under this class.

5. CULTURABLE WASTE LANDS

Lands which are cultivable but not cultivating at present or not taken up for cultivation for any reasons.

NINE FOLD CLASSIFICATION

6. CURRENT FALLOWS

Cropped areas, but kept fallow at the current year.

7. FALLOW LANDS OTHER THAN CURRENNT FALLOWS

Any land which were cultivated but temporarily kept fallow for a period not less than one yea and not more than five years.

8. NET SOWN AREA

Total areas sown with any crops or orchards. Area sown more than once in a year counted only once

9. LAND UNDER MISCELLANEOUS TREE CROPS, ETC.

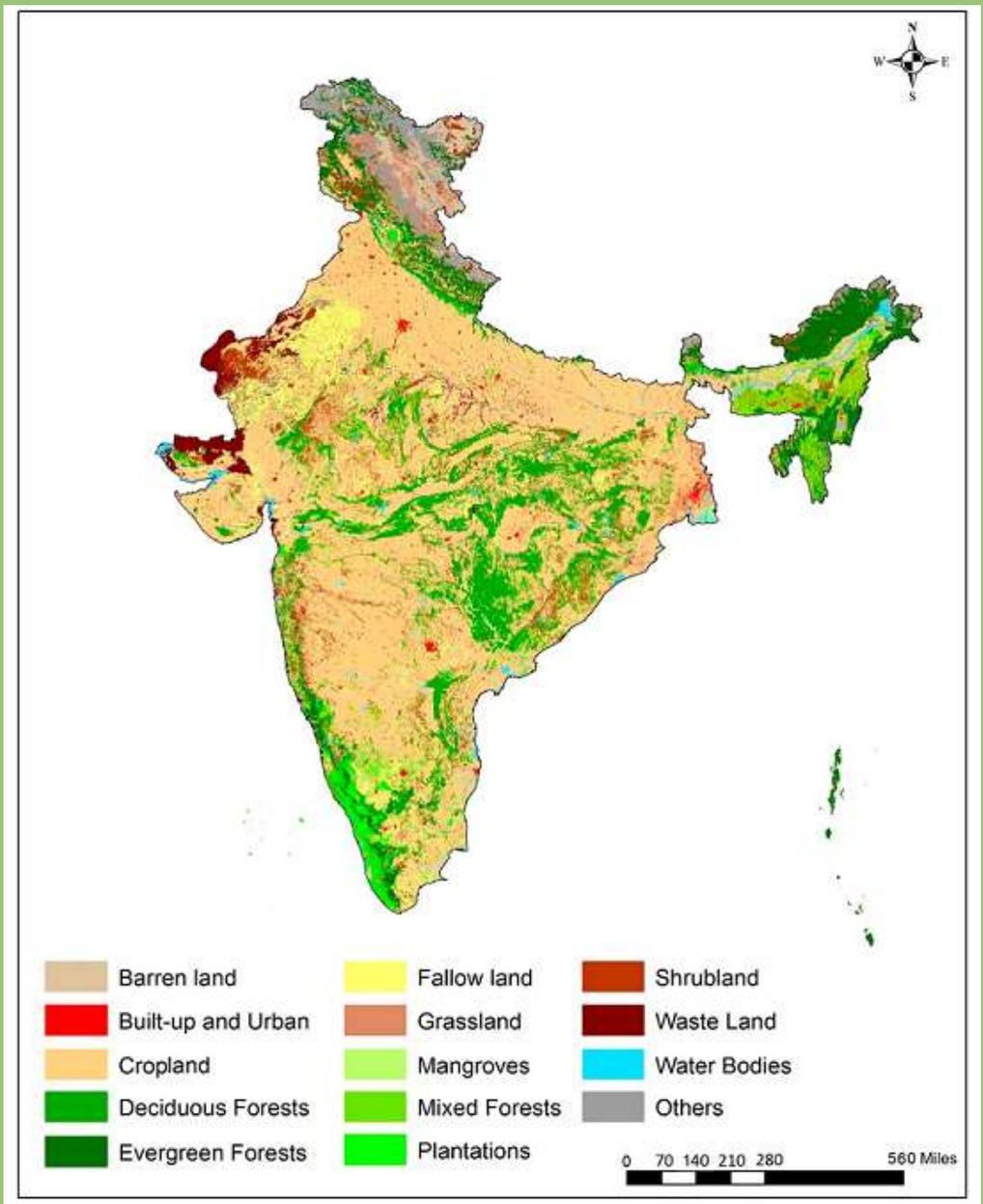
All cultivable lands which are not included in
“net sown area” but is put to some agricultural uses. Lands covered with Casurina trees, thatching grasses, bamboo bushes, and other groves for fuels which are not
included under orchards comes under this classification.

NRSC CLASSIFICATION

National Remote Sensing Centre (NRSC) in May 2006 devised a LULC classification system for use with remote sensing data in India (NRSC Manual 2006).

The Major Classes are as follows:

- Built Up
- Agricultural Land
- Forest
- Grassland
- Wastelands
- Water bodies
- Snow cover



CLASSIFICATION

Level I	*Level II*
Urban built up land	Built up: residential, commercial and service, industrial, transportation, communication and utilities, industrial and commercial complexes, mixed urban and built up
Agricultural land	Cropland and pasture, orchards, groves, vineyards, nurseries and ornamental horticulture areas. Other agricultural areas
Rangeland	Shrub and bush rangeland and mixed rangeland
Forest land	Deciduous forest land, Evergreen forest mixed forest
Water	Streams, lakes, reservoirs, Bays and estuaries
Wetland	Forested wetland and non-forest wetland
Barren land	Dry-salt flats, beaches, sandy areas other than beaches, bare exposed rocks, strip mines, quarries and gravel bits mixed barren and transitional areas.
Tundra	Shrub and bush tundra, bare ground tundra and mixed tundra.