

10. LAND RESOURCES AND MANAGEMENT

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LEARNING OBJECTIVES

After reading this chapter, a student should be able to:

1. Locate the major soil zones of Pakistan on a map, and describe their main characteristics.

2. Specify the criteria on which the land capability classification scheme is based and describe the four major classes of land.

3. Discuss the main types of problem soils found in Pakistan.

4. Given a situation involving a specific problem soil, recommend appropriate techniques to manage the soil.

1 Climatic zones of Pakistan

Pakistan lies approximately between latitudes 24 and 37°N, and longitudes 67 and 76°E. To its northeast are situated the world's biggest mountain ranges: the Hindukush, Karakoram, and Himalayas. For the most part, its northern border with Afghanistan and Iran too is uneven, mountainous country that steadily loses height southward. The northern part of this border is crossed by a number of passes. All these physical features have a great effect not only on the temperature and rainfall pattern of Pakistan, but also on the general circulation of the atmosphere over southern Asia.

The climate of Pakistan falls into the following five climatic types.

Tropical semiarid climate with mild winter. This includes Karachi, Hyderabad, and southern Khairpur Divisions. The mean annual temperature is above 18°C.

Subtropical semiarid climate with average annual temperature about 18°C and a distinct, short winter. This includes southern Kalat and the whole of the Indus plain from Lahore, Rawalpindi, and D.I. Khan Divisions to the northern half of Khairpur Division.

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3. Semiarid climate with rather dry summer. This includes the hilly regions of southern NWFP, the southern part of Azad Kashmir, Zhob and Quetta Divisions, and the northern half of Kalat Division.
4. Moist temperate climate with the average temperature of the coldest month below -10°C , warm summer with mean temperature of the warmest month between 10 and 22°C . It includes the central mountainous areas of NWFP and Kashmir, and northern hilly areas of Punjab.
5. Alpine climate with average temperature of the warmest month between 10 and 0°C . It includes Baltistan, Gilgit, northern Chitral, and the eastern and northern parts of Kashmir including Ladakh.

10.2 Soil zones of Pakistan

Geographically, Pakistan has a highly diversified landscape and environment. Lofty, snow-covered mountains, vast sandy deserts, and extensive river and piedmont plains combine to give rise to wide variations in soil-forming factors. This is clearly reflected in the variety of soil characteristics found in Pakistan. The different kinds of soil found in Pakistan fall into the following nine broad ecological zones (See Fig. 10.1, foldout page).

1. Northern mountainous region
2. Western mountainous region
3. Pothwar upland
4. Sandy deserts
5. Piedmont plains
6. Old river terraces
7. Sub-recent river plains
8. Recent river plains
9. Indus delta

10.2.1 Northern mountainous region

This region includes the mountainous country of the Himalayas, the Karakoram, and the Hindukush. Several types of climate are found within this region. A wide variety of sedimentary, igneous, and metamorphic rocks are exposed in this area. The soils characteristically have a high content of organic matter and abundant moisture at lower depths. Absence of soil salinity or sodicity is a universal characteristic of this region. The soil reaction varies from moderately alkaline to medium acid (pH 8.0-5.6). The soil materials are of alluvial origin and quite deep. Natural vegetation over the area is coniferous trees.

10.2.2 West

This region contains various geological materials and various soil types surrounding the western parts of the

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10.2.2 Western mountainous region

This region covers most of Balochistan, the Suleiman Ranges, Waziristan Agency, and the Kirthar Plateau. There is considerable variation in soil materials inherited from the parent rocks, and the soil parent material contains varying proportions of calcite. Except for some semiarid pockets surrounding Bannu, Zhob, Loralai, and Quetta, the region is arid. Harsh winters and relatively mild summers characterize the central and the northern parts of the area.

The native vegetation is a mixture of trees, shrubs, and grasses. The soil materials become progressively finer with distance from the mountains; the flat areas are occupied by deep silty deposits while the central, concave depressions of internally drained valleys contain fine, silty to clayey sediments. The organic matter content of the soils is quite low, averaging about 0.5% in the surface horizons. The processes of salinization are especially active in the enclosed depressions of the valleys, creating playas. The soils are invariably calcareous.

10.2.3 Pothwar upland

The Pothwar plateau has a semiarid to subhumid, subtropical continental climate. The natural vegetation is tall thorny shrubs, scattered trees, and an under-cover of a variety of grasses. The native vegetation has long since been cleared to bring the land under cultivation, and at present the area is extensively used for dry-farmed arable cropping. The cropping pattern and intensity depend upon the availability of moisture.

10.2.4 Sandy deserts

A large area of eolian sand deposits occurring in Thal, Thar-Cholistan, and the Chagai-Kharan desert is included in this category. The major portion of this zone has an arid, subtropical, continental climate. Salient features of the climate are low rainfall and atmospheric humidity, large seasonal and day and night variations in temperature, and a few frosty days. The area generally supports a desert scrub type of vegetation, mainly shrubs and bunch grasses. There is a surface layer of perennial grasses. The natural plant cover is used for large-scale grazing and livestock production, and as a consequence has been greatly modified. In drier areas, the protective plant cover has totally disappeared, resulting in severe wind erosion and sand dunes.

10.2.5 Piedmont plains

The region consists of the vast, gently sloping plains between the Suleiman Ranges and the Indus River, the Kachhi plain, and the plains areas of Bannu basin. All this area is made up of alluvial sediments brought down

from the nearby mountains to the low-lying areas by rainwater. The sediments are derived from a variety of rocks, but the major contribution is from calcareous rocks. This region has mostly an arid, subtropical, continental climate characterized by hot summers, mild winters, low humidity, and late summer rains, and a few frosty days. The soils may be slightly saline condition which is easily eliminated by a few irrigations.

10.2.6 Old river terraces

The region consists of the middle parts of the land between major river (doabs), of the Punjab. In general, the sediments are loamy in the northern reaches and become silty southward. They are characteristically calcareous and of mixed mineral content.

The region has a subtropical, continental climate, gradually changing from subhumid in the north to arid in the southern extremity. Native vegetation of the region is thorn forest, which has now disappeared as a result of colonization. A wide variety of irrigated cropping is practised in the area.

10.2.7 Sub-recent river plains

These areas lie between the old river terraces and the present river flood plains. The nature of sediments, their depositional pattern, and their arrangements are similar to the bar areas. The soils are formed to moderate depths only.

10.2.8 Recent river plains

The flood plains of the major rivers, occurring as narrow belts along the river streams, make up this region. This land is subject to periodic flooding. Sedimentation is still going on in some parts, especially those overlooking the river. The area is generally free of salinity/sodicity. The processes of burial of soil underneath fresh deposits and erosion are concurrently active in this landform.

10.2.9 Indus delta

This zone includes the deposits of the Indus River extending from a little south of Hyderabad to the sea. A major part of the area consists of estuary deposits. A narrow coastal margin forms its border with the sea. The surface gradient of the estuary plain is very small, and the salinity found here is of a different degree and kind (gypsiferous). The coastal area consists of strongly saline, clayey tidal flats with some narrow tidal ridges. The salinization takes place due to poor drainage conditions. The dominant soils of the area are severely saline silt loams with weak structural development. The soils are very difficult to cultivate because of a very rapid resalinization.

Delta: A
Diverging
Alluvial Ca

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2. AGRO-ECOLOGICAL ZONES OF PAKISTAN

Pakistan is a land of diverse ecologies. In the north there are high mountains interspersed with valleys. Southwards there is the Pothwar Plateau followed by fertile Indus Plain, which is 1287 km long and 322 km wide, with a 1.0 percent gradient from north to south. The western part mainly comprises Baluchistan Plateau, bordered by high to low mountains on the north-east. There are two sandy deserts in the Indus Basin; the Thal desert in the upper part and the Thar desert in the south-east. Marshy areas occur in the Rann of Kutch, along the southern most border of the country.

2.1. AGRO-ECOLOGICAL ZONES BASED ON PHYSIOGRAPHIC CHARACTERISTICS

PARC (1980) and Muhammad (1986) have delineated the country into ten agro-ecological zones/regions of Pakistan mainly on the basis of physiographic and on climate, soil type and agricultural land use.

→ The main agro-ecological zones of Pakistan are the following;

1. Indus Delta
2. Southern Irrigated Plain
3. Sandy Desert
4. Northern irrigated Plain
5. Barani (rainfall)
6. Wet Mountains
7. Northern dry mountains
8. Western Dry Mountains
9. Dry western Plateau
10. Sulaiman Piedmont

These agro-ecological zones of Pakistan are depicted in map no. 1.

Delta: A nearly flat plain of alluvial deposit between diverging branches of a river.
Alluvial land enclosed between^s two or more mouths of a river.

→ During 2015-16 the availability of water during Kharif season stood at 65.5 Million Acre Feet (MAF) showing a decrease of 5.5% over Kharif 2014.

During Rabi season 2015-16 the availability of water remained at 32.9 MAF which is 0.6% less than Rabi season 2014-15.

Main problems of Land Resources

→ About 40% or 6.3 mha of our cultivated irrigated land is flawed. About 4.9 million ha or nearly one third has clayey soils, need special tillage implements.

→ About 10% or 0.6 mha of land has very sandy soils.

→ of total salt affected soils of about 6.3 mha in Indus plain only one half has practical significance and its main problem is sodicity covering about 1.7 mha. It has been reported that over soil water pumped annually by tubewells causes sodicity in soils. Besides this about 1.3 mha of cultivated and

0.9 mha of uncultivated saline land & have drainage problem. In about 2.1 mha the water table is within 1.5 m depth in

April, which increases to 5.2 million ha in October and this water logged area varies from year to year.

→ About 70% of cultivated barani land has good soils but has a compact soil layer of 5-8 cm thick that has formed below 7-10 cm the plough layer of 7-10 cm