Soils

8

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Abstract

The different types of soils are related to the diverse pedogenetic conditions and factors. The geographical distribution of soils is distinguished for its vertical stratification, mainly conditioned by the hilly-mountainous relief. Human activity also affects the soil features.

The classification of soils based on the genetic-agronomic system distinguishes zonal soils (mountain meadows soils, dark mountain forest soils, Cinnamon mountain soils, Cinnamon meadow soils, gray cinnamon soils), intrazonal soils (hydromorphic soils, saline soil), and azonal soils (alluvial soils).

Albania has limited land potential for agricultural production: Only about 25% of the land is suitable for agriculture, and part of it has rather limited fertility; about 10% of the land is in cold regions above the altitude of 1600 meters; about 55% of the lands are located on steep slopes with intense erosion activity, etc. Increasing the agricultural land area, if not impossible, is extremely limited. In some areas, soils have been severely damaged by erosion and pollution.

Keywords

Soils · Pedogenetic conditions · The genetic-agronomic system · Zonal soils · Intrazonal soils · Azonal soils

8.1 General Features

The pedogenetic conditions and factors of the country are distinguished for their diversity: The chemical and mineralogical composition of the parent formations vary; the morphological features of the relief also vary – climatic conditions and hydrographic and especially biotic factors (tall plants, microorganisms, and soil fauna). These changes are observed in the horizontal variability and particularly in the vertical variability. This brings about unequal action and features of the soil-forming factors. Consequently, different land types have been formed, whereas their geographical distribution is distinguished especially for their vertical stratification, mainly conditioned by the hilly-mountainous relief. Besides the natural soil-forming factors, the soil characteristics and their respective changes are also influenced by human activity, especially in the cultivated soils.

The genetic-agronomic system has been used for soil classification, considering soil formation conditions and morphological features of the soil profile, differentiated by pedogenesis and agronomic features that soils acquire during their agricultural use. According to this classification, soils are divided into zonal, intrazonal, and azonal soils (Gjoka and Cara 2003).

8.2 Zonal Soils

They stretch in the form of belts from sea level to the mountain heights. They are like or the same with the lands of Mediterranean mountainous countries. There are five types: mountain meadow soils, dark mountain forest soils, Cinnamon mountain soils, Cinnamon meadow soils, and gray cinnamon soils, which have respectively developed under the four main plant belts: alpine pastures, beech, conifers, oak, and the Mediterranean shrubs. There is a decrease in the height of these belts from the south to the north and from the west to the east, which is related to the differing climate conditions and vegetation in these areas (Figs. 8.1 and 8.2).

– *Mountain meadow soils* (cambisol and leptosol) extend over altitudes of 1600 m and make up about 270,000 hectares or 9.4% of the territory. The most common ones are

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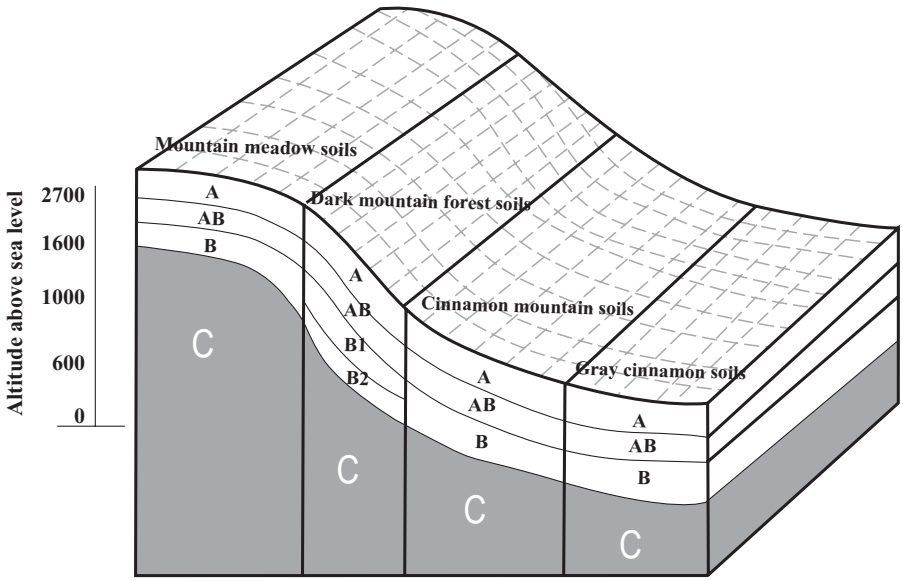

Fig. 8.1 Vertical zonation of soils. (Gjoka and Cara 2003, p. 26)

found in the north and east. These are mainly formed on limestone, sandstone, and metamorphic and magmatic parent rock, in very heterogeneous relief and with great fragmentation and slope. This type develops in areas with the harshest climatic conditions in the country, with cold winter, heavy rainfall, and little evaporation and snowfall predominance, while the summers are cool, with considerable rainfall. The herbaceous vegetation of alpine pastures, with great development during the short vegetation period, from late spring to autumn, when the temperature drops, and the snow begins, a large mass of humus is formed under these conditions (17–25% on the surface) (Gjoka and Brahushi 2007).

The humus composition in the mountain meadow soils of Southern Albania is lower (up to 17%), which is explained due to the scarcer vegetation cover and the longer and drier summers, which translates into greater mineralization. As summers grow longer and drier from the mountain heights toward the plains, the mineralization process is greater, which in turn reduces the humus. Besides the frequent reduction of decomposing organic matter, the reduction in the humus content in brown forest soils, and particularly brown and gray-brown soils, is also due to this mineralization process.

These soils have a profile about one-meter thick, with a well-defined, thick, and elongated humus horizon. Humus content decreases with depth, from about 20% to 1–1.5% on horizon B. On the surface, there is a thin layer (of 3–15 cm) permeable to the roots (barren horizon), which forms a porous mass. The humus horizon (A), up to 40 cm, dark brown to black, is brittle and airy, with well-balanced granular structure. Horizon AB reaches up to 70 cm and B up to 100 cm. This horizon is denser, with a brownish-yellow color, without structure, and dusty.

They have medium-sized mechanical clay composition in all their profile (clay composition is 30–50% of soil) and acid reaction (pH 4–5.6), while on limestones, they are neutral or slightly acidic. This reaction is related to the high content of organic matter and the low activity of the perspiration process, conditioned by the cool climate. Depending on the conditions of their formation, and their morphological and chemical features, mountainous meadow soils are divided into four subtypes: typical, black, dry, and meadows of barren forests. The dense vegetation cover that grows on mountain meadows is used as pastures during the summer. During the communist period, some of them were used for the cultivation of potatoes, rye, and barley.

– *Dark mountain forest soils (of beech and pine forests) or cambisol, leptsol, and phaeozem* lie at altitudes between 1000 and 1600 m above the sea level. In the north and southeast of the country, they descend up to 900 m or even lower (the Albanian Alps, etc.). They occupy 14.8% of the country's area. They are more widespread in the north and east and less so in the south. They develop on terrigenous rocks, limestone, magmatic and metamorphic rocks, in rugged relief, in the humid and cold Mediterranean premountainous and mountainous Mediterranean climate, under the beech and coniferous forests with sensational development, and herbaceous vegetation that requires little light (Gjoka and Brahushi 2007).

The profile of these soils, 80–140 cm thick, begins with a layer up to 5 cm thick (Ao) made of undecomposed debris and then continues with the humus horizon, up to 30 cm thick, dark brown or brown in color, medium granular struc-

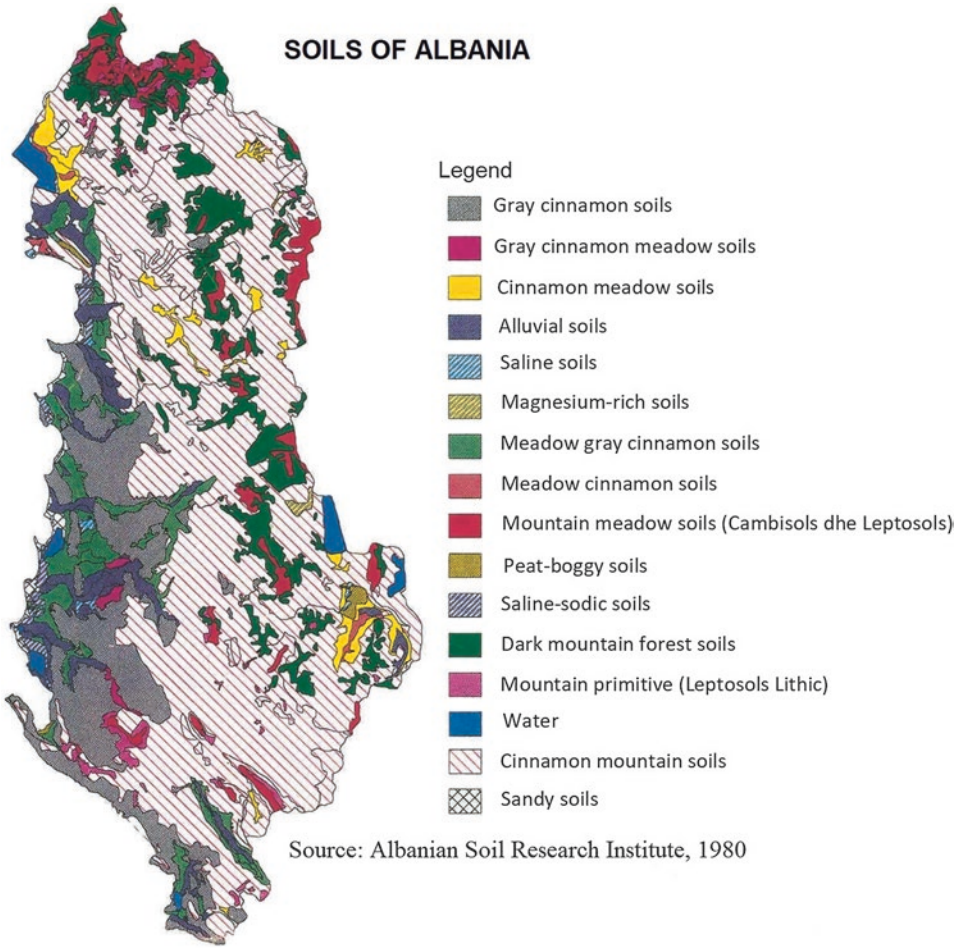

Fig. 8.2 Soils map of Albania. (Gjoka and Cara 2003, p 121)

ture, and sub-clay composition, and then with horizon B having yellowish brown color and granular structure, up to pleats.

Beech and conifer forests develop in the soils of this belt. However, rye, wheat, potatoes, apples, cherries, plums, chestnuts, etc., can also be cultivated in these lands. Many of these soils have been abandoned, running the risk of degradation and desertification by erosion.

Depending on the conditions of their formation and their morphological and chemical features, these soils are divided into seven subtypes: typical forest brown soils or *humic cambisol*, reddish forest brown soils or *humic nitosols*, black brown forest soils, rinsed brown forest soils, carbonate-humus soils or *rendzinc*, brown forest meadow soils or *humic cambisol,* and shtoi soils, brought to the Shtoit plain of Upper Shkodra (20–26 m above sea level) by waters from the slopes of the Albanian Alps.

– *Cinnamon mountain soils and Cinnamon meadow soils* (cambisol, luvisol, leptosol, vertisol) have a greater extent (42.1% of the territory), and they are located at an altitude of 600–1000 m above sea level, while in the north of the country, they descend up to about 200 m in altitude and formed on sedimentary and magmatic rocks, under the rare xerophilous oak forests in relief with significant slope with intense erosion, in climates with annual rainfall between 600 and 1600 mm, with not too harsh winters and generally hot summers. In winter, soil leaching occurs, while in summer, salt accumulation occurs due to high evaporation. Consequently, on the middle horizons of the earth, pseudomycelia and new spots of carbonate formations appear which condition the reaction around the neutral value. They have a granular structure, a deep profile up to 1.20–1.5 m, and humus surface composition of 4–9%, while the depth is not more than 1% (Gjoka and Brahushi 2007).

Depending on the conditions of their formation and their morphological and chemical features, these soils are divided into five subtypes: typical soils or *eutric cambisol*, brown limestone or *calcium luvisol*, reddish brown or *rhodic nitosol*, black soils or *eutric vertisol*, and brown meadow soils or *luvic phaeozems*.

Cereals, industrial plants, vines, fruit trees, etc., are cultivated in brown soils.

– *Gray cinnamon soils* are a characteristic of the Mediterranean shores. In Albania, they lie up to altitudes between 200 and 600 meters. They amount to 48.5% of the country's arable land. They are mainly formed on sedimentary rocks, mostly in plain relief in the typical Mediterranean climate, with summer droughts lasting up to about 3 months, accompanied by strong physical and chemical alteration, leading to the formation of secondary minerals, inhibiting the development of vegetation, consisting of Mediterranean shrubs and herbaceous vegetation, resulting in the large mineralization of organic matter and, consequently, in the small humus content (2–4% humus). They have a slight basic reaction, which is more related to the perspiration process, elongated humus horizon, mechanical sub-clay composition, and granular structure. Horizon B is saturated with bases, especially carbonates in the form of pseudomycelia and white spots. Depending on the conditions of their formation and their physical and chemical characteristics, gray cinnamon soils are divided into four subtypes: typical brown gray soils, loamy soils or *calcic luvisol*, red soils (*terra rosa*) or *rhodic nitosol,* and gray brown meadow soils or *eutric cambisol* in flat fields (Gjoka and Brahushi 2007).

Gray cinnamon soils are used for the cultivation of subtropical crops, cereals, industrial crops, vegetables, fodder, vines, fruit trees, etc. (Veshi 1986).

8.3 Intrazonal Soils

These soils are found in several vertical belts, and they are mainly related to the action of the main local factor in their formation, such as a water phreatic layer near the surface, which creates conditions for the formation of swampy soils (hydromorphic), and salty waters which form saline soils.

– *Hydromorphic soils* (*vertisol, cambisol, castanozem, gelisol*) are found in many areas of the country, but they are more common in the western plains and on the shores of lagoons, where they are often connected with saline soils. Until the 1950s, these soils took up about 38.000 hectares. The drying of swamps and the massive land reclamation in the following years turned most of these soils into fertile lands (the swamps and marshes of Maliqi, Tërbufi, Vurgu, Roskoveci, etc.), turning them into suitable land areas where they are located. Currently, they amount to 9970 hectares (Gjoka and Brahushi 2007).

The swamping process occurs when there is excess moisture in the soil, which leads to a decrease in oxygen in the soil, an increase in acidity, and a decrease in microbiological activity. Therefore, the decomposition of organic and mineral matter has to take place under the conditions of lack of oxygen, which creates little mineral bonding. As a result of incomplete decomposition of abundant organic matter resulting from rich hygrophilous vegetation, a thick layer of peat is formed in these soils. In Tërbufi, this layer reaches a thickness of 1.2 m; in Maliqi, it is 8 m, etc. They are divided into three types: swamp meadow soils, which are formed on alluvial and lake deposits in the vicinity of swamps; peatlands, which are found in former swampy territories (Maliqi, Tërbufi, Kakariqi, Roskoveci, Thumana, etc.); peatlands located mainly in Maliqi, Tërbufi, Kakariqi, Roskoveci, etc.

Due to recent preservation and drainage, these soils have been improved. They now have high yields in some agricultural crops, such as fodder, industrial plants, etc.

– *Saline soils (solonetz)* contain over 1300 mg/liter of salts. Their general area is constantly shrinking, because of artificial reclamation and desalination, after which they evolve into gray-brown soils. In 1960, there were about 35000 hectares, while in 1985, they amounted to about 16000 hectares. These soils lie in the coastal belt of the Western Lowlands and in the Vrina plain. They are formed under the conditions of high perspiration regime, because of which salts accumulate in the upper layers of the soil. During wet winters, the opposite process occurs. These soils are found in flat areas and in some cases in areas below sea level and have poor halophyte vegetation: glasswort (*Salicornia herbacea*), marina, etc (Veshi and Leka 1997).

Soil salinization is associated with the deposition of salts in geological formations which rise to the surface. It relates to the sea salt infiltration into the light soils of the coastal belt, with phreatic waters with a high degree of mineralization near the surface and with excessive irrigation, which results in the mixing of the irrigation water with the salty groundwater. It is also associated with artificially or naturally dried salty swamps or marshes. There are cases when they are related to salty springs. Most salts are made up of sodium chloride. According to their salt content, these soils are divided into poorly saline soils (0.2–0.5% salts), moderately saline soils (0.5–1% salts), and highly saline soils (more than 1% salts) (Qendra e Studimeve Gjeografke 1990; Veshi and Leka 1997).

To make these soils suitable for cultivation, they must be desalinated, their water regime adjusted, their physical and chemical qualities improved, etc.

8.4 Azonal Soils (Alluvial or Fluvisol, Cambisol, Regosol, Arenosol, Gelisol)

These are soils that form on river deposits. They can be carbonate or acid, sand, silt, or clay. They are usually formed in flat areas, and they are young. The most typical types are found in the major river valleys. They are also formed on marine, lake, swamp deposits, which are usually clay and sand, etc. Due to repeated alluvial deposits, they are composed of layers, which replace their genetic horizons, while the scarce vegetation is usually herbaceous, and in rare cases, it is forest with poplar, willow, etc.

They generally have sub-clay and clay compositions in river estuaries or in the lower and sub-sandy and sandy streams in the direction of their middle and upper course. They are unstructured soils, with basic reaction, poor in organic matter (up to 2% humus). They occupy about 160,000 hectares. About 95,000 hectares are cultivated land. According to the conditions of their formation and the degree of their development, we distinguished alluvial meadow soils, located near the bed of the lower river flows; gravel soils, which form in gravels and sands in which the pedogenetic process has just begun; undeveloped sandy soils, in beach sands; and sandy soils of old little developed dunes (Qendra e Studimeve Gjeografke 1990).

Alluvial soils are suitable for all agricultural plants, but they must be carefully treated to maintain their moisture and biological health.

8.5 Land Resources, Condition, and Damage

The total land potential for agricultural production in Albania is limited. Only about 25% of the land area is suitable for agriculture, while a part of it has limited fertility. About 10% of the land is in cold regions above 1600 m in altitude, about 55% of the lands are located on steep slopes with intense erosion, etc. Expansion of the agricultural area, if not impossible, is extremely limited. In some areas, the soils have been severely damaged by erosion and pollution.

Soil erosion is very intense due to the natural factors and exacerbated by centuries-old human activity on their vegetation cover. As a result, soils were impoverished, depleted, degraded, even desertified in many areas, and abandoned altogether.

Soils are polluted by industrial waste (mining industry of chromium, copper, iron-nickel, coal, extraction, processing of oil, etc.), urban waste, and agricultural chemicals (pesticides and chemical fertilizers exceeding standard norms, etc.).

Soil preservation and protection from degradation and pollution requires studies and effective measures (reforestation of baren areas, terraces, improvement of irrigation, tilling and cultivation technology, processing of polluting waste, and so on).

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