

FIGURE 2-11 Vegetation and soils, Eastern Arabia. These *adher* and *rimth* bushes grow on compact, sandy soils southwest of Dhahran. Animal tracks indicate grazing of the vegetation by desert animals.

Russians and based primarily on climate factors was widely used—but also widely debated—for several decades before the 1970s. Of several national systems that have emerged, the “Seventh Approximation,” published by the U.S. Department of Agriculture in 1975, has been the most influential. Based on inherent soil characteristics, the classification is highly scientific and precise. However, since its precision introduces technical detail that is confusing to the nonspecialist, the following discussion utilizes a simpler and more familiar taxonomy based on the traditional ecological-genetic concept.

Barren Sands and Rock and Other Non-Soils. Generally speaking, the area of barren land and desert soils in the Middle East lies south of the 35th parallel—that is, southward from the 10-in./250-mm rainfall line (compare Map 2-5). Approximately half of the area extending from western Egypt across

the Arabian Peninsula and the Syrian Desert to eastern Iran is so barren that it lacks either true soil or appreciable vegetation cover on its virtually bare rock or its gravel, loose sand, and dune sand (see Figs. 1-1 and 2-11). Prominent sand areas include western Egypt and, on the Arabian Peninsula, the Great Nafud in the north and the enormous Rub al-Khali in the south, with the arc of Dahna sands connecting the two. Huge gravel plains lacking true soils extend across the north of the Arabian Peninsula and appear in extensive tracts in the eastern third of the peninsula.

Large areas of Lithosols (rock soils) extend along the east side of the Levant Rift System—Red Sea rift on the basaltic lava outpourings. A particularly common type of landscape in this area is the *hamadah*, typically an extensive plain with barren rock or a surface cover of stones (Fig. 2-3). Actual soil development is limited, and vegetal



FIGURE 2-12 Sabkhat Matti, a typical *sabkha* (tidal salt flat). With a white crust of silty salt, such flats are inviting to vehicles and aircraft, but using them can be risky, especially after a rain. The soil on the *sabkha* is a Solonchak, as the salt crust suggests.

cover is generally lacking. Even larger areas of Lithosols extend over the limestones of eastern Syria and Jordan, of Iraq west of the Euphrates, and along the axis of the north-south escarpments in central Arabia shown in Figure 14-2. Soils of the Lithosol group are also intermixed with varied Mountain soils in all the mountainous areas and are grouped with Undifferentiated Mountain soils on Map 2-7.

True Soils of the Desert. The other half of the desert areas referred to above contains true soils with developed profiles and vegetation cover: Desert soils, Red Desert soils, Sierozem soils, and Solonchak (salty) soils. All except Solonchaks are grouped as Undifferentiated Desert soils on Map 2-7. Some profiles are weakly developed, and some of the vegetation is thin and scattered, but the landscape is less barren than the desert areas of Egypt, the Nafud, and the Rub al-Khali.

Desert soils are light gray or light brownish-gray, low in organic matter, and closely

overlie calcareous (calcium-containing) material, typically limestone. They normally support scattered shrubby desert plants but can be quite productive when irrigated. Much the same may be said of the Red Desert soils, although they are reddish, in the upper part of the profile, as the name suggests, and tend to develop in the hotter parts of the deserts. Sierozems are more widely scattered but are found in two large areas: on the floor of the great central basin of Turkey around Tuz Gölü, and in much of northern Syria, where they support scattered short grass and brush as well as desert shrubs.

Solonchak soils are especially found in large interior undrained basins and low-lying areas: the Dasht-e Lut and the even saltier Dasht-e Kavir (Salt Desert) on the Iranian Plateau; the Qattara Depression in northwestern Egypt; southern Mesopotamia back from the river floodplains; in the tidal flats (*sabkhas*) along low coastlines on both sides of the Arabian Peninsula; and over the inland coastal plain of the Gulf (Fig. 2-12

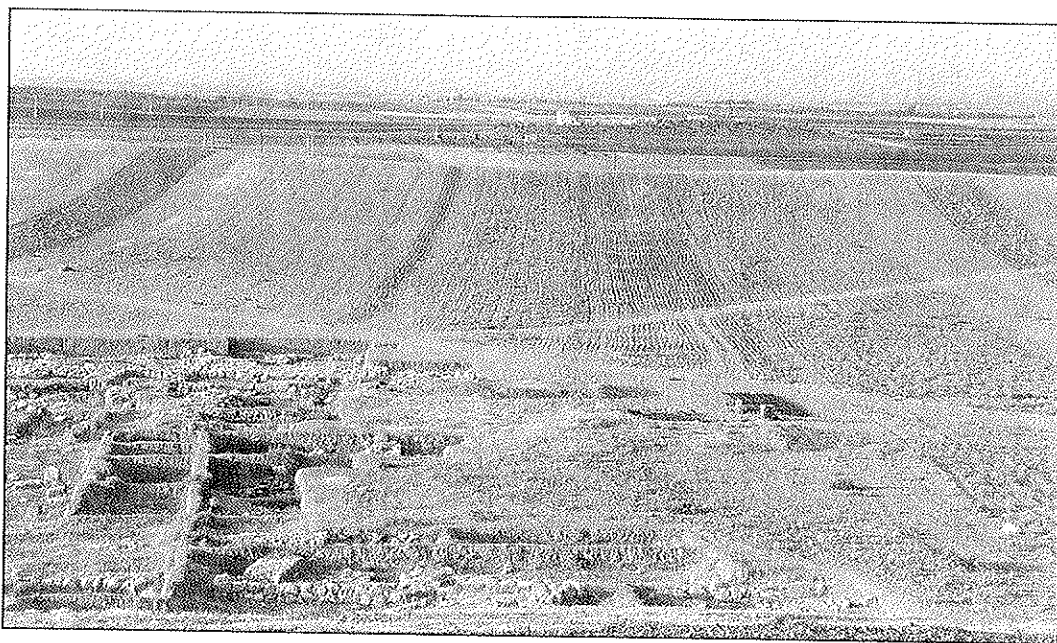


FIGURE 2-13 Cultivated Reddish-Chestnut steppe soils in the western Fertile Crescent south of Aleppo, Syria. This is productive wheat country. Archaeological excavations in the foreground are of ancient Ebla.

and Map 2-7). Either because of interior drainage or periodic tides, all these areas have high saltwater tables that supply salty water to the surface; evaporation of this water forms the typical salt crust of Solonchaks. Most Solonchaks are useless for agriculture, but some can be made reasonably productive by artificially flushing the salt with fresh water and then applying proper fertilization. One area of special interest suffering seriously from salt accumulation in otherwise irrigable and cultivable soils is southern Iraq.

Alluvial Soils. Alluvial soils—or, more properly, soils on alluvium as a parent material—are among the most intensively cultivated and productive in the world, certainly in the Middle East. Although limited in area, they include the rich soils of the Nile Valley and Delta, floodplains of the Tigris and Euphrates rivers, valleys of west-central Iran, and small scattered oases and larger wadi bottoms of the Arabian Penin-

sula. They possess young profiles, are usually of good texture and tillability, and display most of the other characteristics of an ideal agricultural soil. Moreover, water for irrigating the soils is typically nearby.

Soils of the Humid Areas. Except for the irrigated alluvial soils, most of the cultivated and agriculturally productive soils of the Middle East are those of Asia Minor, the Fertile Crescent proper, and western Iran. On the inner, less humid side of the curve of the Fertile Crescent, there is an irregular belt of grassland soils that have developed in a zone receiving 6–10 in./150–250 mm of annual precipitation. They belong, in groups of decreasing aridity, to the traditional Reddish-Brown, Chestnut, and Reddish-Chestnut groups (grouped as Steppe soils on Map 2-7; see Fig. 2-13). Such soils vary from well developed and deep to poorly developed and thin on hillsides. Most are calcareous, especially since many overlie the widespread limestones of Jordan, Syria,

southeastern Turkey, and Iraq, where they receive sufficient precipitation to permit grain farming without irrigation.

In a major portion of the Mediterranean climate areas, a particular group of soils develops because of the regime of cool, wet winters and hot, dry summers. Usually called Mediterranean soils (as on Map 2-7), they are of a reddish-brown color, because of their iron content, and are referred to as *terra rossa* (red earth). Especially in early spring, this soil contrasts dramatically with the white limestone hills that surround pockets of the soil in southern Turkey and the Levant. Although badly eroded on limestone slopes in many areas, *terra rossa* has been productive for thousands of years throughout the Mediterranean Basin and is thus more important than is suggested by its limited occurrences.

Rendzina soil is also derived from limestones, usually the softer types, such as marls, and is often associated with *terra rossa*. Usually gray or black, in contrast to the rust of the *terra rossa*, it is calcareous, clayey, and productive. It alternates with *terra rossa* in the uplands inland from the Levant coast from northwestern Syria south to Beer Sheva in Israel (its occurrences are too limited to show on Map 2-7).

Most of the remaining soil pattern is a complex one, forming a mosaic of Noncalcareous Brown soils, Brown Forest soils, and Lithosols and other Mountain soils of Anatolia, northwestern Iran, and the mountains behind the eastern Mediterranean coast. These soil associations produce a great variety of foods, fodder, and industrial crops, including timber forests and tree crops of nuts and fruits, on moderate slopes in the better climate areas.

Vegetation

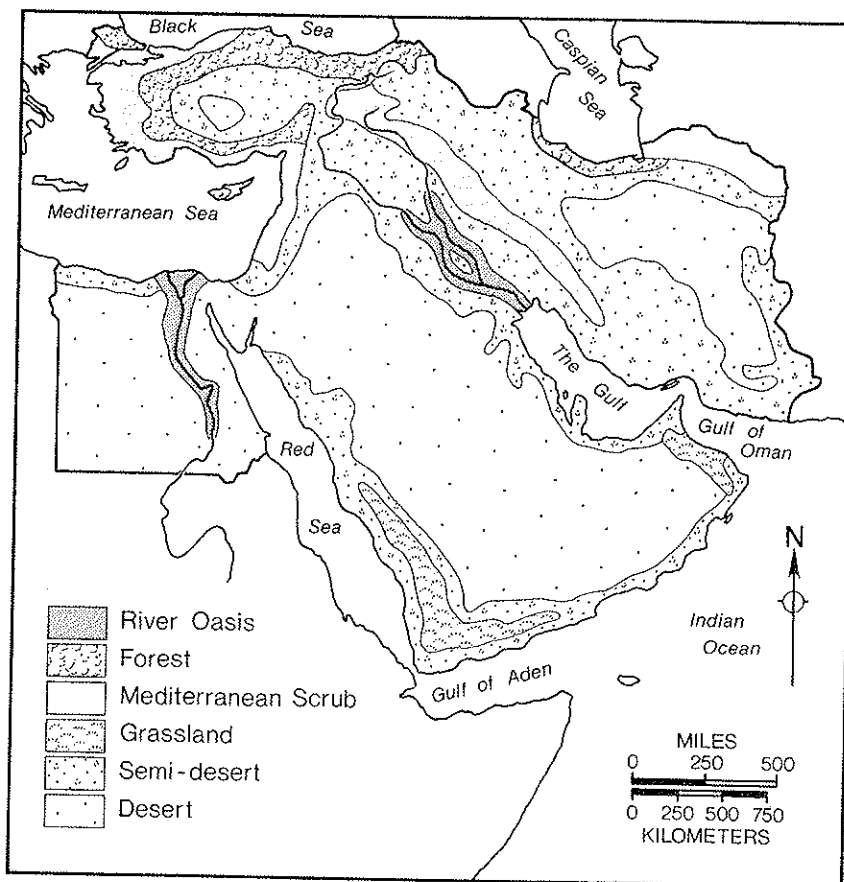
As a product of interacting influences on landscape, the natural vegetation of an area is often an effective indicator of the general

character of the local ecosystem. Like the region's topography and soils, Middle East vegetation has undergone natural changes during recent geological times. Certain plants are survivals from earlier periods; other plants from those periods have completely disappeared, from either natural or human causes, and their former presence is indicated only by seeds, spores, fruits, or leaves in old lake beds or in archaeological mounds (tells).

Human activities, including agricultural exploitation, have especially altered vegetation as well as other aspects of the environment in the millennia since the Agricultural Revolution. Unfortunately, the human impact on natural vegetation in the Middle East has been one of destruction as well as change. People have cleared forests not only to gain land for agricultural purposes but also to obtain timber and fuel. Cedars of Lebanon and other trees of the Levant supplied timbers for Egyptian and Phoenician ships, as did trees from Anatolia for ships of the Greeks, Romans, Byzantines, and Ottomans. Wood has also been used in the Middle East for making charcoal, long used in heating and cooking and in lime and pottery kilns. Not only trees but also grasses, shrubs, and other low vegetation have been degraded or destroyed because of human activity and because of overgrazing by sheep and goats.

Middle East Vegetation Patterns

Varied vegetation types extend from the dense high forests inland from the Black Sea and Caspian coasts to the scattered desert shrub of the Arabian Peninsula and the barren, salty *kavirs* of the interior Iranian Plateau (Map 2-8). Notwithstanding extensive forests in several northern mountain areas, the vegetal formations occupying the greatest expanses of the region are annual grasses and broadleaf annuals and shrubs of the steppes and deserts. Rather specialized



MAP 2-8 Middle East natural vegetation. Both "Grassland" and "Semi-desert" may be roughly equivalent to steppe.

scrub forms known as *maquis* and *garigue*, originally French terms but now more widely used, are typical of the Mediterranean areas with their cool, wet winters and hot, rainless summers (Fig. 2-14).

The phytogeographical (phyto = plant) patterns examined in this section are primarily the plant associations, inferred from existing vegetation in noncultivated areas, that would exist without human interference.¹¹

Desert Shrub. The true desert is the product of aridity, and its xerophytic (dry plant) vegetation gives the desert its true expression. The desert environment supplies plants with favorable warmth and light but then imposes unfavorable mois-

ture conditions. Some desert plants tolerate drought, some resist it, and some avoid it. When water occasionally does become available, plants respond immediately and profusely.

Areas that are barren of vegetation are generally coextensive with the areas of barren sands, rock, and salt surfaces on the soil map (Map 2-7), as well as with the areas that receive less than 1 in./25 mm of annual rainfall—even so, the Rub al-Khali has areas that have a surprisingly well-developed vegetation. Deserts that are truly barren of vegetation are less common than is often supposed, and the typical desert exhibits at least a scattering of especially equipped dry bush or shrub (see Fig. 2-11).

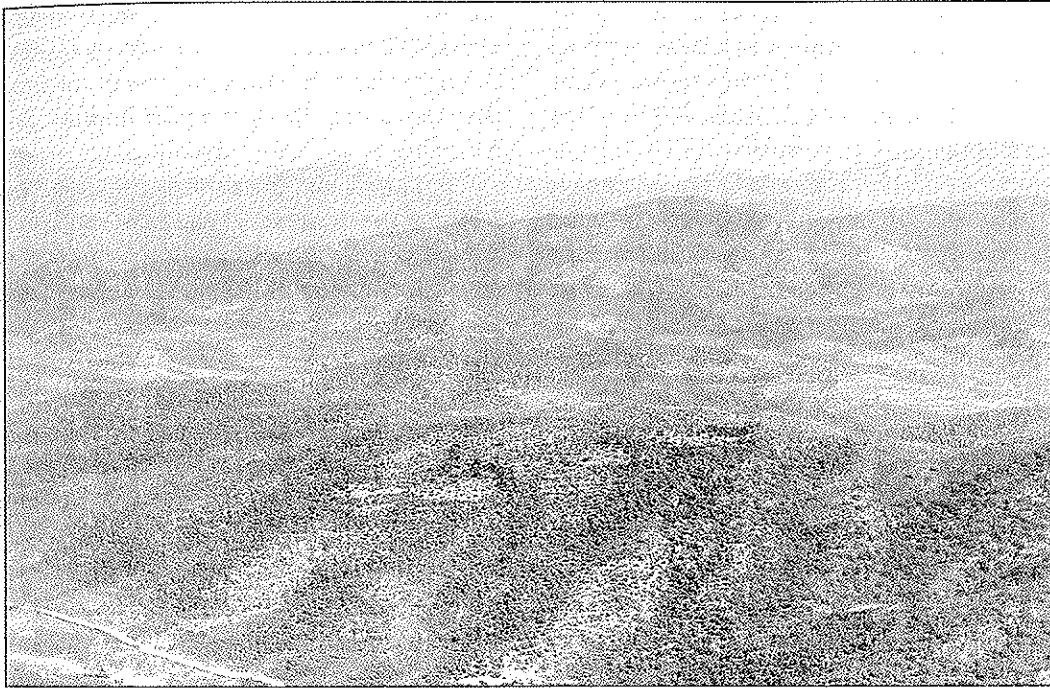


FIGURE 2-14 Typical Mediterranean flora on south-facing slopes of the Taurus Mountains of southern Turkey. Growing in limestone-derived soil in this summer-dry climate, the taller vegetative association is maquis, the lower is garigue. The road at lower left fringes the Mediterranean shore.

Beginning with its small size—3–5 ft./1–1.5 m—and the wide spacing among individual plants to accommodate the limited supply of moisture, xerophytic vegetation has an impressive array of survival devices. With low shoot-to-root ratios, some shrubs have root systems that extend to depths of 30–50 ft./9–15 m. Their leaves are small, are often coated against excess transpiration (moisture loss), and in some species curl or even drop during unusually dry periods. Tough stems resist drought, and the shrubs often have thorns for protection against grazing animals. Some of the lower bushes, 6–18 in./15–46 cm high, have woody or wiry stems and tiny leaves but a deep root system. By contrast, other desert plants, such as *Euphorbia*, store water in expandable succulent parts.

Scattered among the perennial and often long-lived shrubby plants are other low veg-

etal forms (4–12 in./10–30 cm) that sometimes constitute more than two-thirds of the typical desert plant community, including some species of grasses and many herbaceous forms. Some of these small plants are perennial, some are annual, and a few are both, depending upon their ecology. Most of the herbaceous annuals have an ephemeral life cycle of six to ten weeks, after which they lie dormant as seeds that burst into sprouts with the next rain, sometimes several years later. Along with a few of the xeromorphic perennial shrubs, they “avoid” the dry season instead of trying to endure it.

Shrubs in extensive fields of eolian (wind-blown) sand may be passive sand dwellers or sand binders; the latter hold the sand around extensive root systems and thus build prominent phytogenic (plant-created) mounds or hillocks. The resulting landscape, usually called *dikakah*

or *marbakh* in Arabia, makes cross-country travel difficult. Some salty soils support halophytic (salt plant) vegetation. Over much of the eastern Arabian Peninsula, a common saltbush, popularly called *rimth*—useful for fodder and dietary salt for camels and other animals—is usually associated with at least slightly salty groundwater in poorly drained areas. However, on the true *sabkhahs* along the eastern Arabian Peninsula coast and on the *kavirs* of interior Iran, with their salt crust and briny subsurface, not even the most salt-tolerant plants can survive (see Fig. 2-12).¹²

The acacia, one of the largest desert shrubs, grades into a modest tree—up to 20 ft./6 m—in moister soils. With its characteristic umbrella crown, it is a prominent and readily identifiable vegetative form in the silts, sands, and gravels in drainage channels or sheets from the central to the southern Arabian Peninsula. Often where no other shade is available from the broiling sun, the acacia offers welcome relief to animals and people.

Grasslands (Steppes). Like most other boundaries in nature, the change from desert to grassland is actually a zone of transition, and the division between the two is difficult to delineate. As moisture increases away from the desert, the more xerophytic species increasingly yield to plants adapted to the greater precipitation and better developed soils. More important, plant population density increases until the grasses form a virtually continuous vegetal cover.

The steppes constitute a discontinuous belt extending from the Sinai Peninsula northward through western Jordan and Syria, across southeastern Turkey and northern Syria, in an arc around northern Iraq, and along the Zagros piedmont. Some of the region's most extensive steppes are in central Anatolia and smaller areas in scattered locations in west-central Iran. (Steppe

and semidesert are much the same in many areas.) With their short-grass vegetation, the steppelands are thus the core of the Fertile Crescent, with all that fact implies historically and agriculturally.

Mediterranean Zone. Whereas desert and steppe plants are especially equipped to survive a drought that lasts even many years, Mediterranean floras survive the characteristic summer drought of two to six months and then take advantage of the winter rain. The typical denser flora appears as a low evergreen forest with scattered small trees and more closely spaced bushes and scrub. The height of the plants and the density of their growth increase from the dry side (approximately along the 15-in./380-mm isohyet) to the more humid part of the habitat, where the summer drought is also shorter (Fig. 2-14). On the dry side, the Mediterranean vegetation zone is similar to the wooded steppe. On the humid side, the zone grades into the full forest of the highlands across the northern sector of the Middle East.

In between is the typical Mediterranean flora, which may be divided into two main groups: garigue, the lower and more degraded of the flora, and maquis, the taller and better developed association. Some plant geographers also distinguish a third category of Mediterranean vegetation, *batha*, a kind of subgarigue. Both maquis and garigue are found in Mediterranean climate areas across southern Europe and elsewhere. In southern California, for example, similar vegetation is called "chaparral."

Garigue includes primarily a sclerophyllous (hard-leaved) scrub about 3 ft./1 m in height and also smaller shrubs, grass, and in spring, many colorful flowers—anemone, ranunculus, crocus, iris, and others. Commonly found on steeper, uncultivated hillsides in the Levant and in western and southern Asia Minor, garigue is a last safe-

guard against soil erosion. Maquis, which is typical of more favorable habitats than is garigue, forms a woodland dominated by low sclerophyllous evergreen trees and shrubs up to about 12 ft./3.7 m in height. In better stands of maquis, one finds trees—oaks, pistachios, and pines, especially the widespread Aleppo pine. Culinary herbs, such as thyme, marjoram, and laurel; and flowering bushes, such as oleanders, are associated with both garigue and maquis.

Forests. Few areas in the Middle East now have woodlands as well developed as those in Europe and North America, but historical evidence indicates that 2,500–3,000 years ago, forests clothed slopes that are now almost bare or are ragged—forests such as the Cedars of Lebanon or the forests of Asia Minor. Current reforestation and afforestation programs in several Middle East states are demonstrating that many previously treeless habitats can, given proper care, produce impressive forests of selected species. The United Arab Emirates, especially Abu Dhabi, is even growing small forests in the desert.

The region's most extensive high forests extend along the Pontic Mountains from Istanbul eastward to the Iranian border and include impressive stands of beech, mixed with areas of spruce (especially *Picea orientalis*) in the east. On the southern, inner slopes of the Pontic Mountains, and especially in the western highlands, there are extensive areas of oak and pine (*Pinus nigra* and *P. silvestris* in the north and *P. brutia* in the west). *P. nigra* and *P. brutia* dominate the forests of the Taurus Mountains across southern Anatolia, and oaks predominate in the southeastern mountains west and south of Lake Van.

The great Euxinian Forest of northern Anatolia extends, with some discontinuity, into northern Iran to link up with the Hyrcanian or Caspian Forest in the Elburz

Mountains. This humid forest facing the Caspian Sea is almost tropical in its luxuriance, with a rich variety of undergrowth as well as tall trees: linden, ash, oak, beech, elm, hornbeam, walnut, maple, and evergreens. Beech, dominant on the lower open slopes, is gradually replaced higher up, so that at 6,000–8,000 ft./1,830–2,440 m one finds the most magnificent trees in the Middle East—primarily oaks (*Quercus macranthera* and others) but also elm, ash, hornbeam, and maple.

In the higher elevations of the Zagros chains there is a somewhat dry, deciduous forest in which oaks dominate. With smaller and more widely spaced trees, and with a limited number of species, this Zagrosian Forest differs appreciably from the humid Euxinian and Hyrcanian forests.

In the west, scattered woodlands survive in areas of former extensive forests in the Levant highlands—in Israel, Jordan, Lebanon, Syria—and on the island of Cyprus (Fig. 2–15). Most of these forests are either small remnants of great expanses of trees in the past, the Cedars of Lebanon, for example, or woodlands planted in recent decades through government programs of reforestation or afforestation. Israel has pursued an especially vigorous program of forestry, including encouraging tourists to purchase and plant seedlings.

The endemic Aleppo pine, *Pinus halepensis*, is the tree most frequently planted in the regional forestry programs. Sometimes called the “umbrella pine,” it has come to be identified with the Levant highlands. Efforts to regenerate forests of Cedars of Lebanon (*Cedrus libani*) have encountered many problems, especially slow growth. The broad-leaved tree most often used in plantation programs is a rapidly growing oak, *Quercus ithaburensis*. In drier areas, the pistachio serves well in planted woodlands; in still more arid areas, the tamarisk is utilized. *Tamarix aphylla* is used

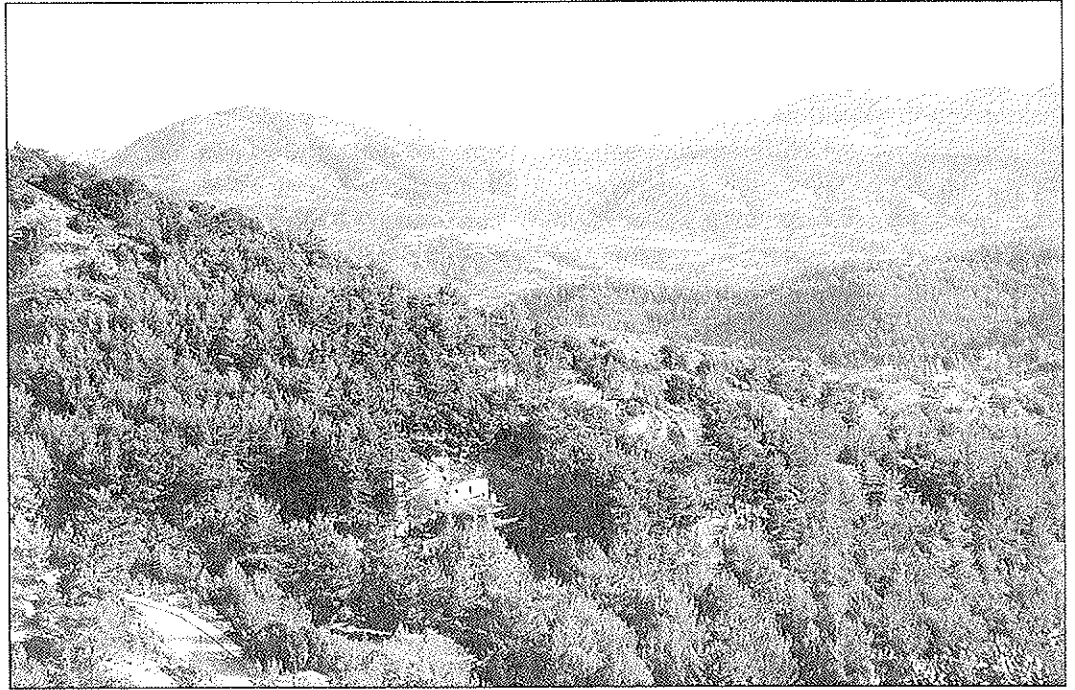


FIGURE 2-15 Mediterranean forests in the Troodos Mountains of Cyprus: Wild pine (*Pinus brutia*) and Troodos pine (*P. nigra*) clothe the upper slopes (foreground), with mixed maquis and garigue scrub forest on the slopes in the distance. Summer homes are scattered in the fragrant pine forests.

in group plantings, and *T. gallica* as wind-breaks.

Animal Life

Historical Changes. The varied Middle East environments support a rich variety of fauna. Iran alone has approximately the same number of species of mammals as all of Europe west of the pre-1991 Soviet border. Unfortunately, to judge by biblical and other early writings, many larger species have become extinct in the Middle East. Still others have been reduced to a fraction of their former count, are nearing extinction, or now occupy only a remnant of their original range.

Appreciably different environmental conditions in the Middle East during the Tertiary period and the Pleistocene epoch supported animal groups unlike those of modern times. For example, although the ancestor of *Bos taurus*, wild and domesti-

cated cattle, came from the Taurus Mountains of southern Anatolia, there is fossil evidence of *Bos* in the Rub al-Khali during pre-Pleistocene times. Some gazelle were numerous in the steppes and more vegetated deserts, and several species of deer grazed the wooded steppe and open forests. Wild sheep and goats kept to the heights. Lions, tigers, leopards, cheetahs, and other felines were formerly common in parts of the Fertile Crescent and Iran, and other carnivores, such as the wolf, fox, jackal, and hyena, roamed much of the same area.

All of these larger mammals have been decimated by nature and people, and the lion and tiger have virtually disappeared from the region. The crocodile disappeared about 1900, the ostrich in the early 1930s. The ruggedness of the north and the aridity of the south have given refuge to individual survivors and to small groups of gazelle, deer, mountain sheep and goats (including