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# **World Geomorphological Landscapes**

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Catherine Kuzucuođlu  
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Editors

# Landscapes and Landforms of Turkey

 Springer

*Editors*

Catherine Kuzucuođlu  
Laboratory of Physical Geography (LGP,  
UMR 8591)  
CNRS, Universities of Paris 1 Panthéon-Sorbonne  
and Paris 12 U-Pec  
Meudon, France

Nizamettin Kazancı  
Ankara University  
Ankara, Turkey

Attila Çiner  
Istanbul Technical University  
Istanbul, Turkey

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# The Physical Geography of Turkey: An Outline

# 2

Catherine Kuzucuoğlu

## Abstract

The following outline of the physical geography of Turkey is a broad introduction about the four main factors that produce the present characteristics of the Turkish landscapes, i.e. relief, climate, vegetation and hydrography. The nationwide contrasts and spatial variability between the geomorphological regions of Turkey and their present landscapes are indeed rooted in the processes and evolution which have constructed them on the long timescale, within the Anatolian peninsula context. The chapter also discusses two important characteristics of these landscapes on the peninsula scale: the treeless landscapes of many areas from central to eastern Anatolia, and the exceptional richness of Anatolia in endemic flora and fauna species, which makes Turkey a hotspot of biodiversity within the Europe, Middle East and Turano-Iranian areas.

## Keywords

Turkey • Relief • Climate • Vegetation  
Hydrography

## 2.1 Introduction to Physical Geography of Turkey

Geographically, Turkey forms a bridge between Europe and Asia, with the division between the two running from the Black Sea (*Karadeniz*) to the north down along the Bosphorus Strait (*İstanbul Boğazı*) through the Sea of Marmara (*Marmara Denizi*) and the Dardanelles Strait (*Çanakkale Boğazı*) to the Aegean Sea (*Ege Denizi*) and the Mediterranean Sea (*Akdeniz*) to the south (Fig. 2.1). Anatolian peninsula or

C. Kuzucuoğlu (✉)  
Laboratory of Physical Geography (LGP, UMR 8591), CNRS,  
Universities of Paris 1 Panthéon-Sorbonne and Paris 12 U-Pec,  
Meudon, France  
e-mail: [catherine.kuzucuoğlu@lgp.cnrs.fr](mailto:catherine.kuzucuoğlu@lgp.cnrs.fr)

Anatolia (*Anadolu*) consists of a high central plateau (ca. 1000–1200 m a.s.l.) fringed by narrow coastal plains, surrounded by mountain ranges in the north (the Black Sea Mountains—*Karadeniz Dağları*—from the Kaçkar highlands to the Rhodope massif) and in the south (the Taurus Mountains—*Toros Dağları*—to the south and south-east). As a result of altitudes rising steadily eastwards, the eastern part of the peninsula presents high mountainous landscapes, home to the sources of rivers such as the Euphrates (*Fırat*), the Tigris (*Dicle*) and the Araks (*Aras*), as well as it is home to remarkable landscapes as Lake Van (*Van Gölü*) and Mount Ararat (*Ağrı Dağı*), Turkey's highest peak at 5137 m.

### 2.1.1 Relief

Most of the Turkish relief is formed by high plateaus and mountain ranges, which rise sharply above surrounding seas (Mediterranean, Aegean, Marmara, Black Sea) (Fig. 2.2). Inland, the summit altitudes of the plateaus increase towards the eastern Anatolian highlands, which connect to the Caucasus and Zagros ranges. On the seashores, low coastal zones are narrow, mostly restricted to deltas or large rivers and to wide valleys whose sediments progress seawards. As a result of this distribution, the mean altitude of the country is quite high (1132 m) (Fig. 2.3).

### 2.1.2 Climate

The topographic barriers formed by the mountains running parallel to the coasts, together with the general topographic rise eastwards, cause a high climatic variability in Turkey (Figs. 2.4 and 2.5). The coastal and mountainous land stripe forming the Aegean and Mediterranean regions face the NAO influenced atmospheric circulation (Mediterranean cyclonic tracks). The northern Black Sea region faces the humidity tracks from the Black Sea in addition to influences of the Siberian High System (Türkeş and Erlat 2003; Şahin

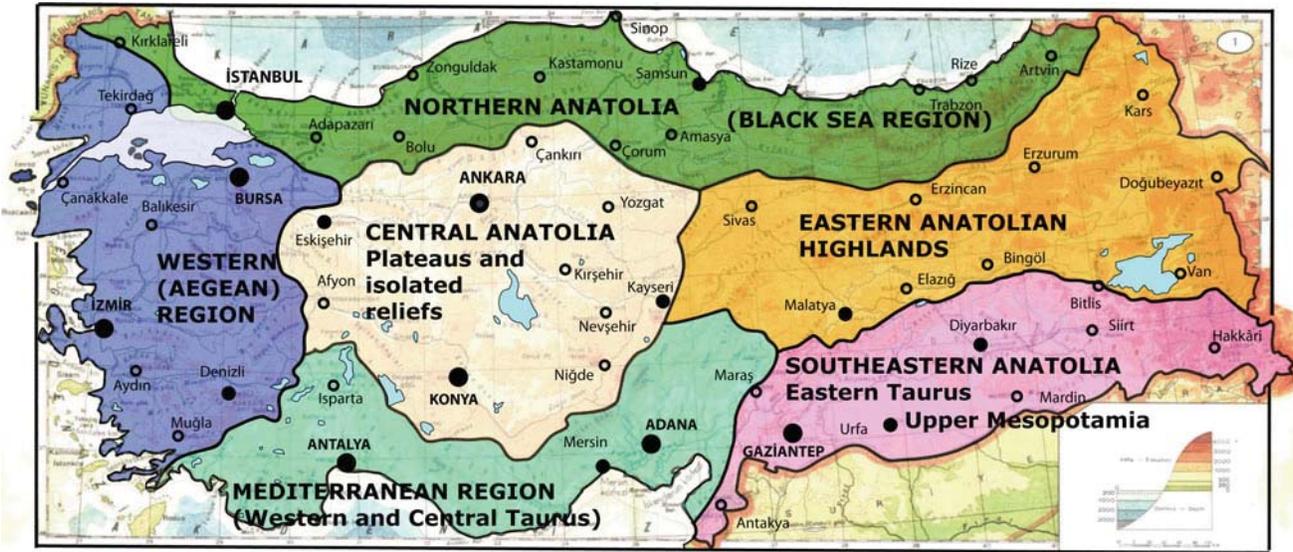


Fig. 2.1 Limits of the geomorphological regions of Turkey presented in the book

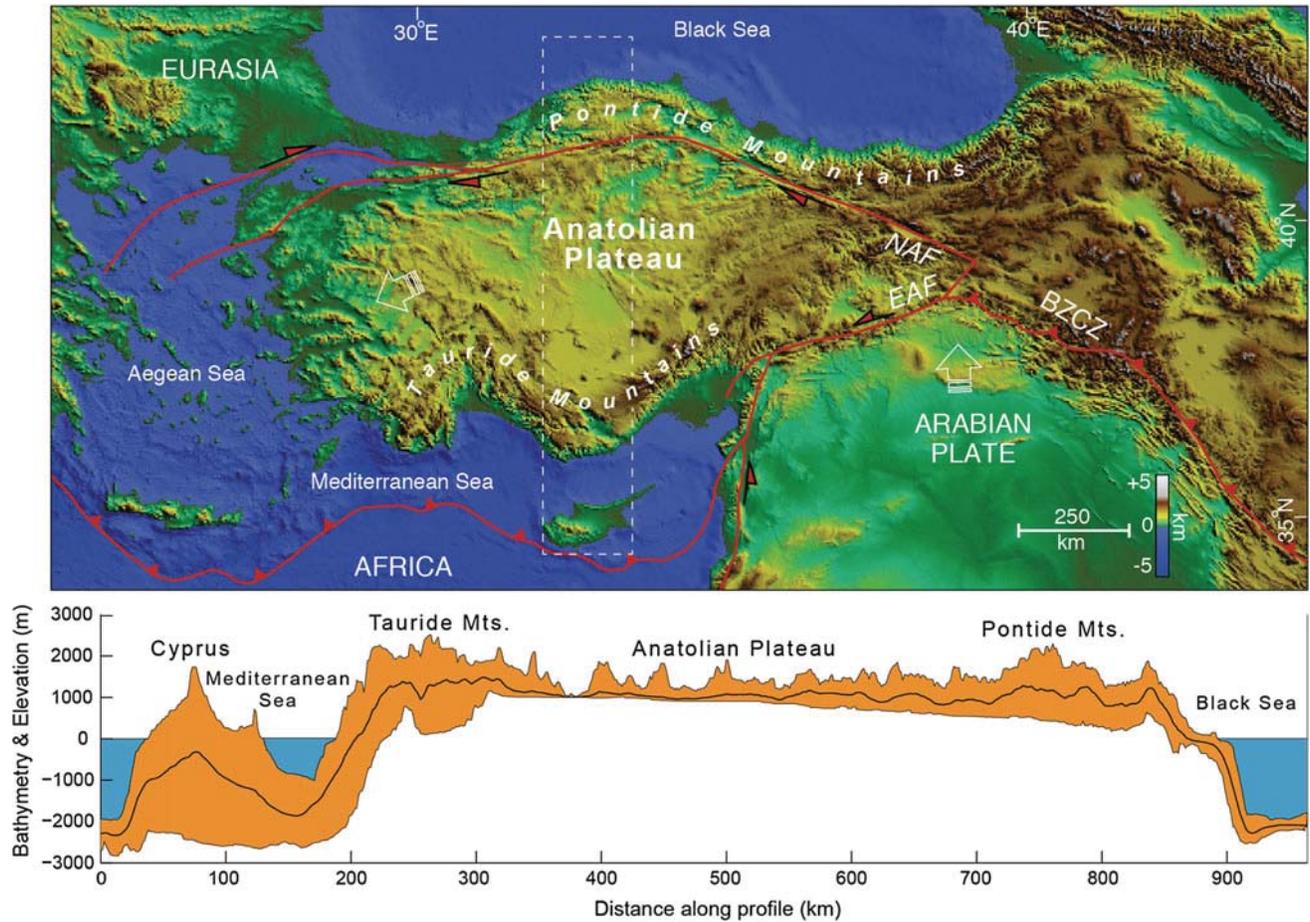
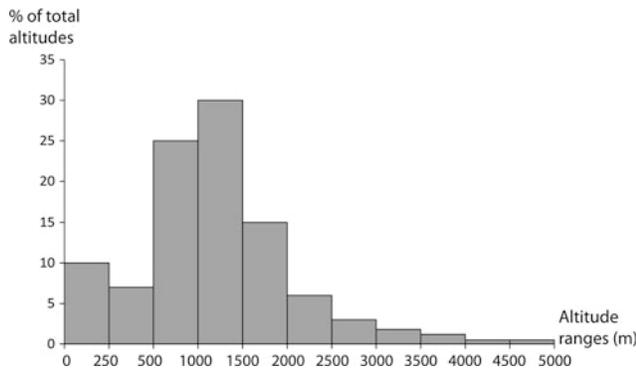


Fig. 2.2 N-S topographic cross section through Anatolia. Dashed box shows region sampled for topographic swath profile (below) indicating minimum, mean, and maximum elevations across the swath width for the Anatolian plateau. NAF: North Anatolian Fault, EAF: East Anatolian Fault, BZCZ: Bitlis–Zagros Collision Zone. Arrows indicate plate motions (Section by Cengiz Yıldırım)



**Fig. 2.3** Distribution of altitude groups in Turkey

and Çiğizoğlu 2012). In central Anatolia, the rain shadow of the surrounding highlands generates humidity depletion, while temperatures decline with increasing elevation. Temperature range, an indication of climatic continentality, is large in central Anatolia. As a result, climatic regions are defined by high contrasts, which draw a picture mixing both the impacts of rapidly changing topographies and variable sources of humidity (Fig. 2.6). These climatic regions respond to the effects of (i) the rain shadow of the highlands encircling the central plateaus, (ii) the origin of the precipitations: Atlantic and Mediterranean in the W and SW, Pontic and Siberian in the N and NE, Mesopotamian in the SE, and (iii) the eastward rising continentality.

### 2.1.3 Hydrography

The river network and general drainage, on the peninsula scale, are organized in relation to the three surrounding seas (Fig. 2.7a). Proper Turkey's longest rivers are the Kızılırmak, the Yeşilırmak and the Sakarya, all flowing north into the Black Sea. There are two other basins of the peninsula, which are proper to Turkey: the Aegean and the Mediterranean basins. In addition, the country comprises three exogenous basins flowing (i) eastward to the Caspian Sea (the Aras River upper basin) and southward to the Persian Gulf (the Euphrates and Tigris upper basins). After drawing the limits of these outflowing basins, a large area inside the peninsula has no outlet to any sea (Fig. 2.7b). Corresponding to the southern parts of the central plateaus, it is composed of the Lake District, the Konya plain, the Tuz Gölü plain and a wide part of Cappadocia.

### 2.1.4 Phytogeography

The spatial distribution of the vegetation in Turkey resembles that of the relief, with steppe in the inner parts of the country, and forests covering the surrounding mountain

slopes as soon as rainfall increase with altitudes allows them to grow (Davis et al. 1965–1988) (Fig. 2.8). Within these wooded land, Turkish pine (*Pinus brutia*) forests cover ca. 5.4 million hectares in Turkey. Forests cover 27% of the country, while arable, permanent cropland covers another 35%. Above the forest limit in the highlands, Alpine pastures (called “yaylas” in Turkish<sup>1</sup>) are associated with seasonal human migrations from lower areas (Fig. 2.9). These migrations occur both in the coastal areas vs. central plateaus (Aegean and Taurus Mountains), in the long range between remote places (e.g. northern Syria) vs. highlands (e.g. eastern Anatolia), but also within the central plateaus in the steppe areas.

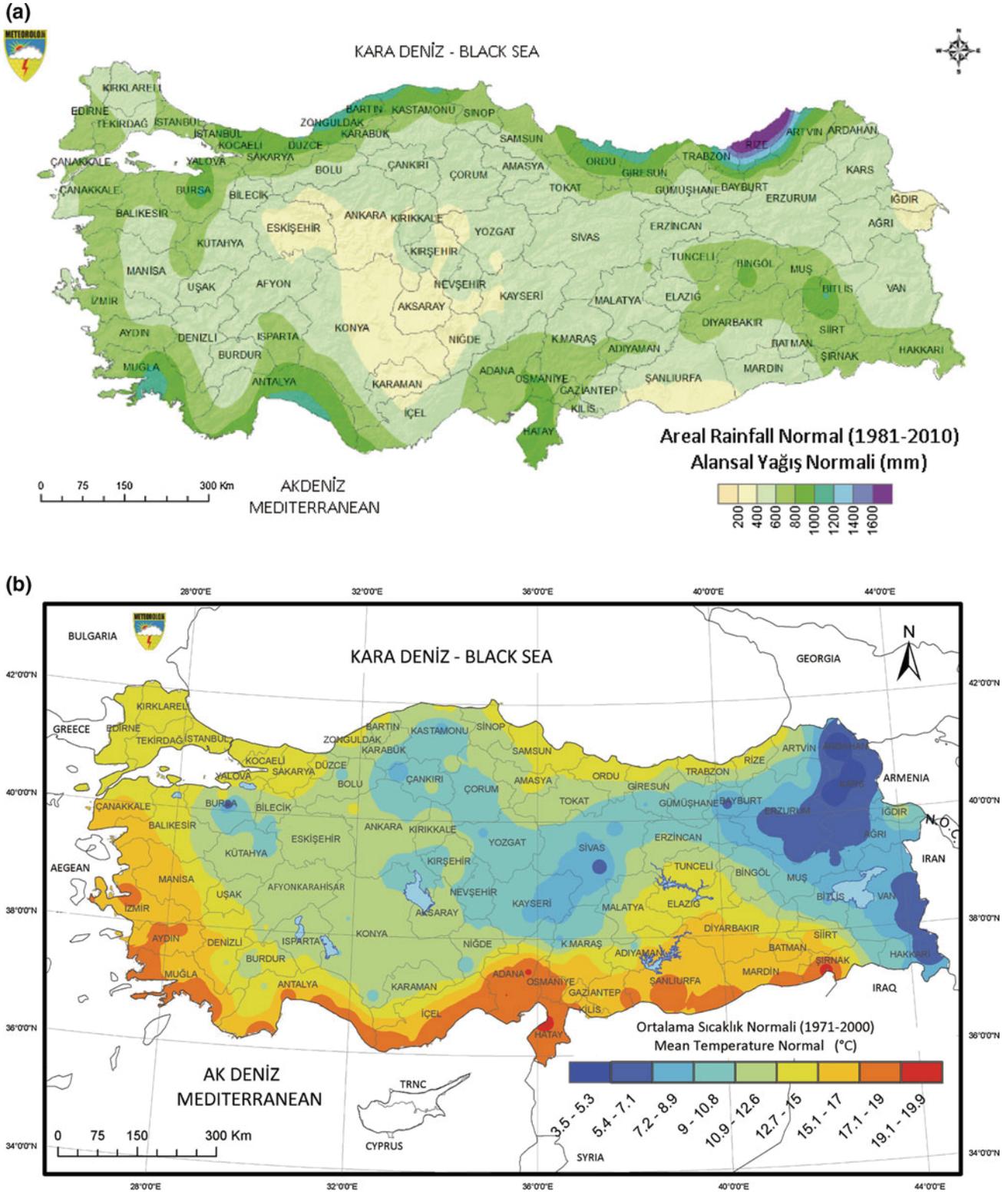
#### 2.1.4.1 The Treeless Landscape of Anatolia: What Role for Human Deforestation?

Since when and how much man's pressures on the wood resources contributed to the treeless Anatolian landscape, which characterizes especially the rolling hills between Ankara, Kayseri and Konya? The subject is debated (Roberts 2002). Man's impact on the Anatolian landscapes started indeed very soon within the Neolithic period (Woldring and Bottema 2001/2002), as in the near East in general (Assouti and Kabukçu 2014). Deforestation accentuated with the development of complex agriculture since the Bronze Ages (Bottema and Woldring 1984; Eastwood et al. 1999), continuing during the Classic Ages unto the Byzance period (Haldon 2007; England et al. 2008). During the Seldjuk and Ottoman Empires (thirteenth to nineteenth centuries), the increasing importance given to sheep husbandry in the interior lands, allowed some renewal of the forests on the highest areas, while steppe was exploited for pasturing on the lower parts (including camels in the Konya plain). On the coastal areas, however, ever since the Roman period, the forests declined because of tree cutting for civil and military needs such as housing, boats. With the growth of rural population and of socio-economic demand during the twentieth century, the forest remains in the central plateaus which were destroyed again, mainly for fuelwood and soils. The situation worsened after the 1990s with the development of irrigation and the development of touristic resorts in first in the coastal areas, and recently in high-altitude summer resorts.

#### 2.1.4.2 A High Botanic Diversity and Amount of Endemic Species

Anatolia is the transition point between the European and Irano-Turanian vegetation groups. As such, it is part of the

<sup>1</sup>The “yayla” word means seasonal habitats and pasturing grounds related to animal herding during spring to summer displacements, whatever is the region concerned.



**Fig. 2.4** a 1981–2010 mean annual precipitation values over Turkey (mm/yr) (Şensoy 2016). b 1981–2010 mean annual temperature values over Turkey (°C/yr) (Şensoy 2016)

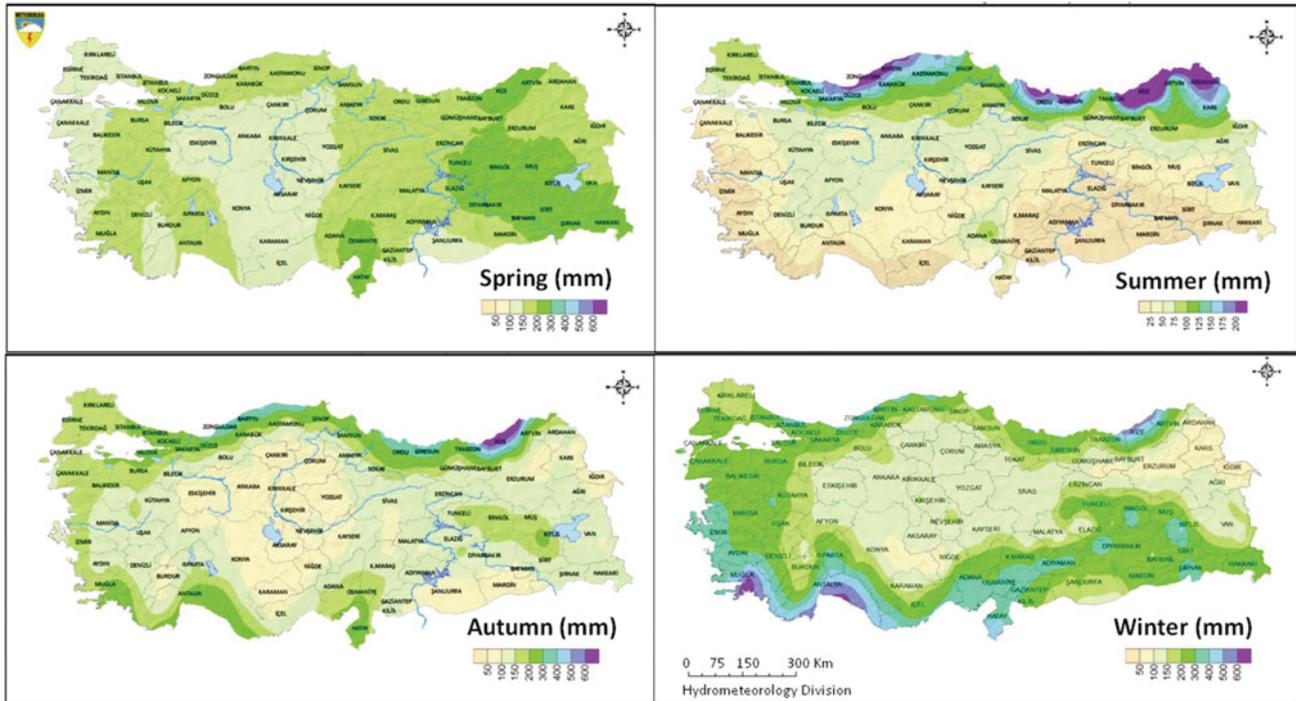


Fig. 2.5 1981–2010 mean seasonal precipitation values over Turkey (Şensoy 2016)

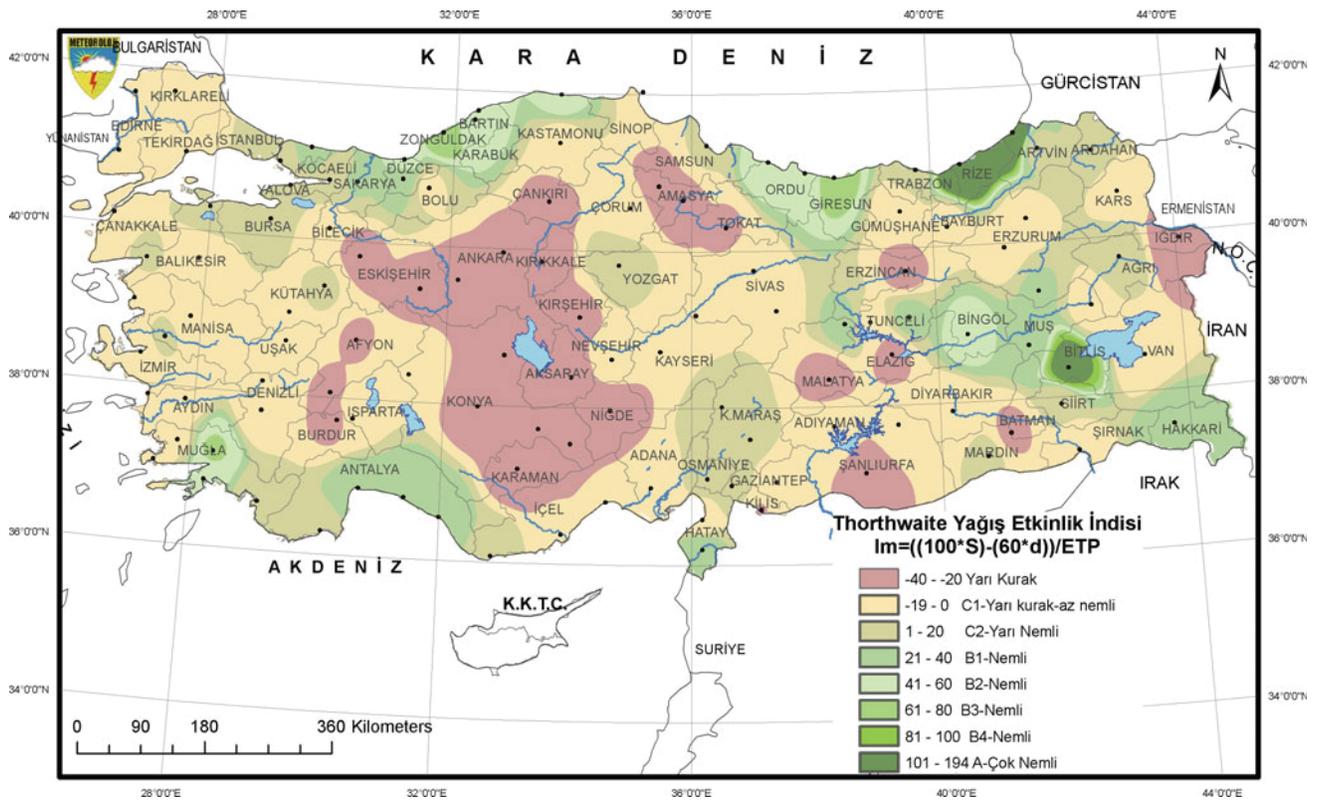
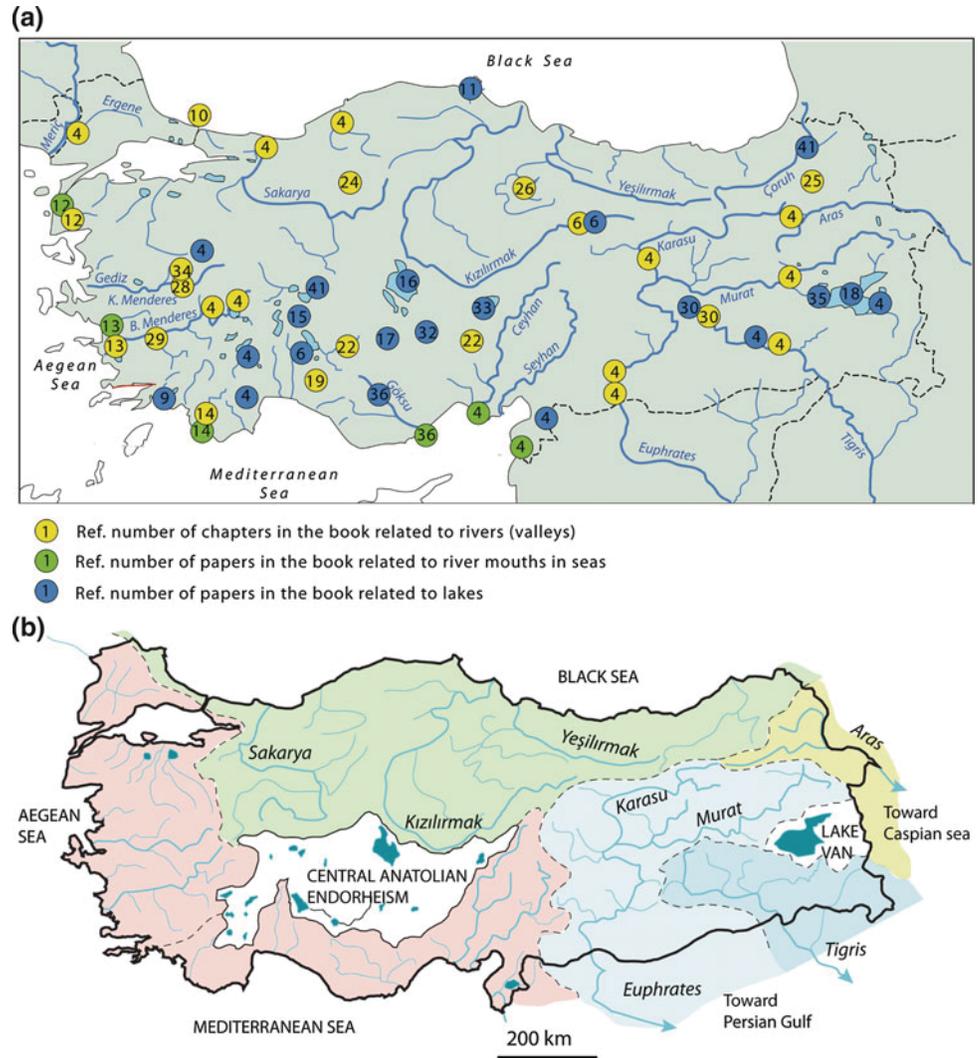


Fig. 2.6 Climatic regions of Turkey (based on Thornthwaite’s Humidity/Aridity Index) (Şensoy 2016)

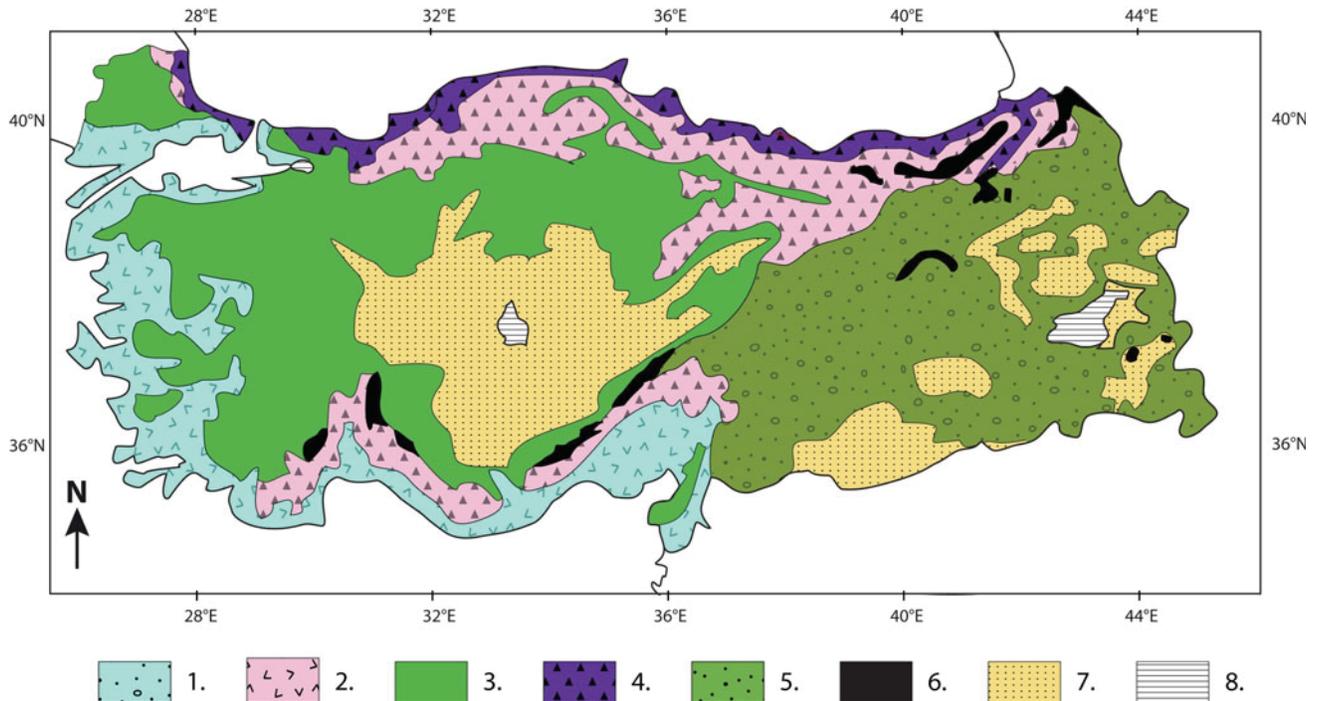
**Fig. 2.7 a** Main rivers of Turkey and positions of chapters related to rivers and lakes.

**b** Hydrography map of Turkey: river drainage basins. Legend of colours: green: Black Sea Basin; pink: Marmara, Aegean and Mediterranean seas Basins; blue: Arab Gulf Basin (Chott-el-Arab); light blue: Euphrates River Basin; dark blue: Tigris River Basin; brownish: Caspian Sea Basin; white: No access to the sea (endorheic basins)



Irano-Anatolian region, which is a significant biodiversity hotspot (Kareiva and Marvier 2003). In 1988, Davis et al. calculated that nearly one third (30.6%) of Turkish plant species is endemic to Turkey and the nearby Aegean Islands. This high endemism ratio contributes to the high level of plant biodiversity of the Turkish territory (9300 species of vascular plants (Pils 2013)), which is also explained by (i) a high degree of climatic and edaphic variability on local

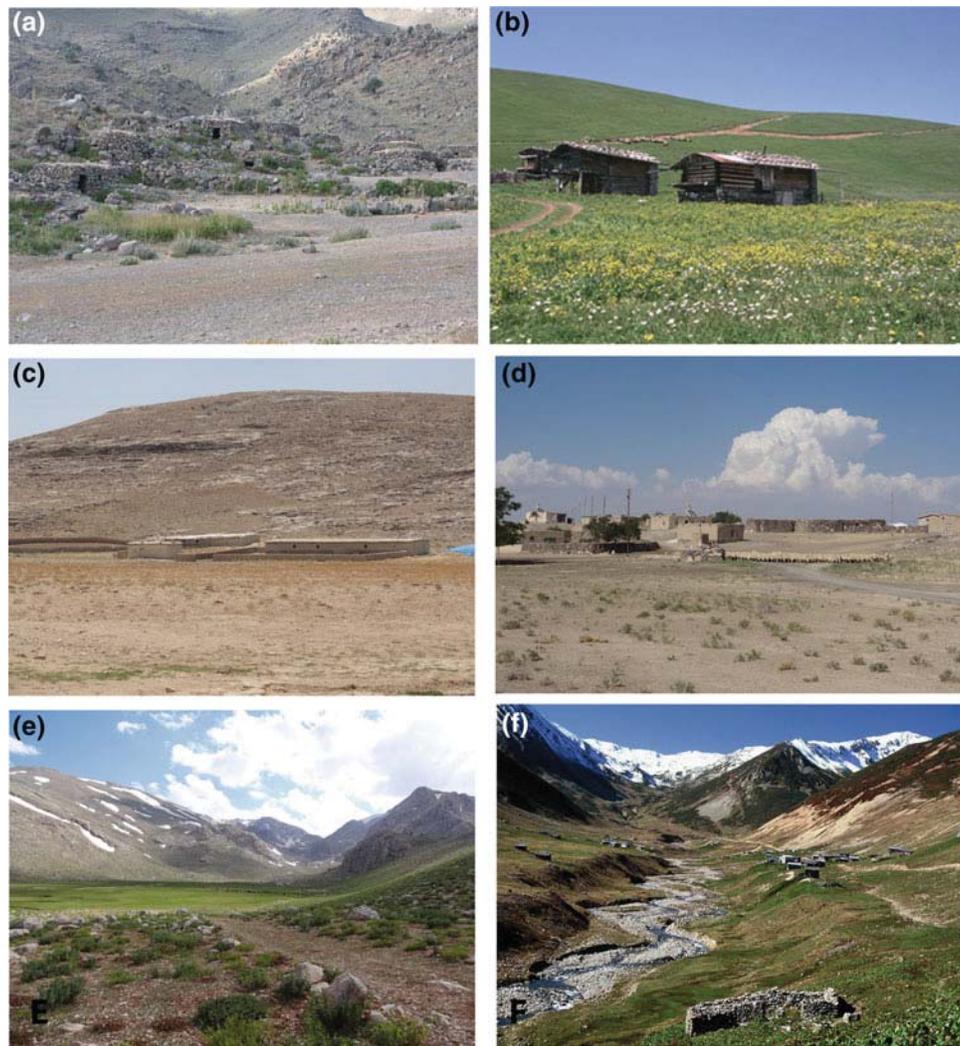
scales, (ii) isolated and fragmented contexts such as deep river valleys between high mountains, closed depressions, and (iii) the fact that during the Last Glacial period, the ranges surrounding the Anatolian peninsula as well as the southern lowlands now most partly immersed by the sea, constituted important refuges where plants survived the glacial period (e.g. several species of cereals and fruit trees).



**Fig. 2.8** Phytogeographic regions of Turkey: (1) Eu Mediterranean vegetation; (2) Montane forests; (3) Mixed broad-leaved and needle-leaved woodland resistant to cold; (4) Open tree and shrub vegetation; (5) Cold-deciduous forests; (6) Subalpine and alpine vegetation; (7) Dwarf shrubland (steppe); (8) Lakes. Modified from (i) van Zeist and Bottema (1991) and (ii) the 1:1.000.000 Map of Phytogeographic Regions of Turkey, Forestry Ministry of Turkey

In addition, a dividing line known as the “Anatolian diagonal” runs across central and eastern Turkey from the north-eastern corner of the Mediterranean Sea to the south-eastern corner of the Black Sea. Many species of plants existing west of the diagonal are not present to the

east and vice versa (Davis et al. 1965–1988). In 1989, Ekim and Güner confirmed this distribution, with 135 out of 550 species they analysed found to be “eastern” and 228 “western”. In addition, 400 plant species are endemic to the diagonal itself (Öztürk et al. 2015).



**Fig. 2.9** Some “Yayla” examples (seasonal settlements associated with summer pastures). **a** Yayla in the high-altitude landscapes of the Hasandağ volcano in central Anatolia (Altunhisar, Bor); **b** Ardanuş-Kutul Yayla in the Kaçkar range (Artvin); **c** Yayla at the southern edge of the Konya plain (Ayrancı, Ereğli); **d** Yayla (equipped in electricity)

in the high central plateaus south of Aksaray; **e** Subaşı Yayla in the Akdağ Mountain (western Taurus); **f** Şafşat-Mereta Yayla (Kaçkar, Artvin). Photographs by C. Kuzucuoğlu (a, c, d, e) and O. Kurdoğlu (b, f). Photographs by C. Kuzucuoğlu (a, c, d, e) and O. Kurdoğlu (b, f)

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