# 3. VEGETATION OF HONAZ MOUNTAIN AND ITS SURROUNDINGS

The vegetation of Honaz Mountain and its surroundings generally consists of dry forests dominated by red pines at lower elevations and black pines at higher elevations. The northern slopes of the Honaz massif are influenced by the Mediterranean climate that penetrates along the Büyük Menderes valley, while the interior areas and southern slopes are under the influence of a continental climate. As a result, the vegetation on the northern and southern slopes of the massif differs. On the more humid northern slopes, a richer and more diverse maquis formation has developed, whereas on the southern slopes, a garigue formation consisting of only the most drought-resistant maquis species is prevalent.

Additionally, the valley interiors on the northern slopes differ from the southern areas, containing many humid-loving plant species typically associated with the Black Sea climate (*Tilia rubra subsp. caucasica, Castanea sativa, Populus tremula, Corylus avellana, Cornus mas, C. sanguinea, Mespilus germanica, Sorbus torminalis, Fraxinus angustifolia, Acer hyrcanum subsp. keckianum*).

Among the plant communities of Honaz Mountain (the extensive dry forests, maquis and garigue formations, and Alpine plants above the tree line), the most remarkable are the humid-loving Black Sea-origin species found in the valley interiors on the northern slopes, alongside maquis elements. These species are likely relicts of humid vegetation that extended southward to the Honaz massif under the wetter climatic conditions of the Pleistocene glacial period.

### **Honaz Mountain and Surroundings Vegetation Overview**

**Introduction** The study area is located in the Aegean Region, encompassing Honaz Mountain and its surroundings, which rise abruptly on the southern edge of the Çürüksu Basin, a part of the Büyük Menderes Depression. To the south, the Kızılhisar Plain borders the area, while the western boundary is defined by hilly terrain separated from the Honaz massif by the Kocadere valley (including Yayla Tepe and Etkayası Tepe). The eastern boundary connects to the mountainous mass characterized by peaks such as Taşyolak Tepe, Geyikli Tepe, Bozkaya Tepesi, and Oyak Tepe. Honaz Mountain, the highest point in Western Anatolia at 2528 meters, has a massive structure and stretches roughly in a NE-SW direction.

From a vegetation perspective, Honaz Mountain and its surroundings fall within Walter's classification of the "Mediterranean-Aegean Zone." Walter notes that this area represents the primary distribution range of *Pinus brutia* (Turkish pine) in Western Anatolia, with lower elevations dominated by maquis vegetation, including *Quercus coccifera*, *Arbutus*, *Olea*, *Laurus*, *Pistacia terebinthus*, *Erica arborea*, *Myrtus*, and *Cistus*. At higher altitudes, *Pinus brutia* is replaced by *Pinus nigra* (black pine), a pattern also observed on Honaz Mountain, except for some specific maquis species.

Davis identifies Western Anatolia, including the study area, as a transitional zone between the Mediterranean, Euro-Siberian, and Irano-Turanian floristic regions. Research on the nearby Bozdağ Mountains revealed the following floristic distribution: 26% Mediterranean, 9.4% Irano-Turanian, and 4.25% Euro-Siberian elements. Although similar data are unavailable for Honaz Mountain, it is likely that its species distribution mirrors that of the Bozdağ Mountains, with comparable proportions of these floristic elements.

Honaz Mountain, however, stands out for hosting several Euro-Siberian species (*Tilia rubra subsp. caucasica, Acer hyrcanum subsp. keckianum, Mespilus germanica, Quercus frainetto, Cornus mas, C. sanguinea, Populus tremula, Castanea sativa*), which were absent from Bozdağ. These findings suggest that Honaz Mountain harbors a richer diversity of Euro-Siberian species compared to Bozdağ.

Honaz Mountain, like other mountainous areas in the Aegean Region, is rich in endemic species, with endemic rates of 13.7% compared to Bozdağ’s 18.5%. Earlier studies by Rikli and others also emphasized the Mediterranean characteristics of Honaz Mountain, highlighting its black pine forests at higher elevations and a mixture of red pine and garigue vegetation at lower elevations. However, Rikli's claim that the northern and southern foothills of Honaz Mountain are covered in natural steppes is not supported by this study.

**Ecological Conditions for Vegetation**

**Temperature** Plants require specific temperature ranges to sustain their vital functions. Together with precipitation, temperature influences the distribution of vegetation and determines vegetation formations. By considering that plants grow within certain temperature thresholds, temperature is a critical factor determining the length of the growing season.

Using daily average temperatures above 8°C as the threshold, the growing season is calculated to last 280 days in Denizli (March 2 to December 11) and 230 days in Acıpayam (March 24 to November 8). The shorter growing season in Acıpayam is due to its higher altitude. On Honaz Mountain, the growing season shortens further with increasing altitude, estimated to last 190 days at 1000 meters, 160 days at 1500 meters, and 140 days at 2000 meters.

Temperature variations also impact the distribution of vegetation. The annual average temperature is 15.8°C in Denizli and 12.5°C in Acıpayam. During winter, the coldest areas are those above 1500 meters on Honaz Mountain, with temperatures ranging between -1°C and -4°C. In contrast, areas between 1000 and 1500 meters experience milder winters with temperatures between -1°C and -2°C.

**Precipitation** Precipitation plays a critical role in the distribution of vegetation, particularly in regions like the Mediterranean, where water scarcity, rather than temperature, limits plant life. Rainfall on Honaz Mountain varies by altitude and orientation. Precipitation levels range from 900-1200 mm annually at elevations of 1000-1500 meters, with northern slopes receiving more rainfall than southern slopes. For example, northern slopes at 1000-1500 meters receive between 600 and 900 mm of rainfall, while southern slopes receive less than 600 mm.

Annual rainfall fluctuations are significant in the region, with Denizli receiving between 338 mm and 868 mm and Acıpayam between 247 mm and 738 mm.

**Wind Conditions** Winds from the northern sector dominate the region throughout the year. In Denizli, 38.6% of the winds blow from the northwest, while in Acıpayam, 44.1% originate from the north-northwest. Seasonal variations in wind patterns also influence vegetation, particularly the presence of humid Black Sea species on the northern slopes of Honaz Mountain.

### **Climate Type**

Based on the data from Denizli and Acıpayam, the climate of the study area, according to Thornthwaite’s classification, is described as follows:

* For Denizli: **C1B3s2’b3’** (semi-arid, slightly humid, third-degree mesothermal, with water surplus in winter, open to maritime influence).
* For Acıpayam: **C1B2s2’b3’** (semi-arid, slightly humid, second-degree mesothermal, with water surplus in winter, open to maritime influence).

### **Soil**

As is well known, soil plays a significant role in the distribution of plant communities, in conjunction with other ecological factors.

The dominant soil type in the study area is **red-brown Mediterranean soil.** Other types, in order of importance, include colluvial soils, brown forest soils, chestnut-colored soils, red-chestnut soils, non-calcareous brown forest soils, rendzinas, alluvial soils, and regosols.

#### **Red-Brown Mediterranean Soils**

These soils form a wide belt extending along the northern slopes of Honaz Mountain, from Denizli to the Kocaçay Valley, covering the eastern half of the mountain. Although similar to terra-rossa soils, red-brown Mediterranean soils are prevalent in the moist but cool interior areas of the Mediterranean climate, away from maritime influence.

Characteristics:

* A developed **A horizon** rich in humus.
* A **B horizon** with sandy, clayey texture.
* Thin soil layers on steep slopes, with bedrock often exposed.
* Thick soils in valley floors and plains.
* Slightly acidic to neutral or basic reaction.
* Rich in organic matter with high water retention capacity.

Vegetation:

* Red pine (*Pinus brutia*) at lower altitudes.
* Black pine (*Pinus nigra*) at higher elevations.
* Shrub communities dominated by kermes oak (*Quercus coccifera*) on southern slopes.

#### **Colluvial Soils**

The second most widespread soil type, these are mainly found on the southeastern slopes of Honaz Mountain, particularly in the Kireniş River basin. They are located at lower altitudes compared to red-brown Mediterranean soils.

Characteristics:

* High porosity and permeability.
* Poor water retention.
* Rich in inorganic materials, containing lime.
* Deficient in organic and nutrient content.

Vegetation:

* Red pine at lower elevations.
* Black pine at higher elevations.
* Alpine formations on the summit areas of Honaz Mountain.

#### **Brown Forest Soils**

Third in prevalence, these soils are mainly found in the upper reaches of the Okçular Valley and the western slopes of Honaz Mountain.

Characteristics:

* Formed on calcareous parent material with A, B, and C horizons.
* A distinct humus layer on the surface.
* Well-drained, neutral to basic pH.
* Rich in humus and calcium.

Vegetation:

* Red pine at lower levels.
* Black pine and juniper forests at higher elevations.

### **Relief**

Honaz Mountain rises abruptly on the southern edge of the Çürüksu Basin, part of the Büyük Menderes Depression. It is bordered by the deep Kocaçay Valley to the east and Gökpınar Stream (Bağırsak Stream) to the west.

Honaz Mountain is the highest point in Western Anatolia, reaching 2528 meters at its peak, Kılıç Tepe. Other prominent peaks include Baba Tepe (2514 m), Beşiktarı Tepe (2331 m), Deliktaş Tepe (2119 m), Ayıpınarıüstü Tepe (2081 m), and Ebegümeci Tepe (2080 m). The massif is steeper on the northern slopes, which receive more rainfall than the southern slopes. Streams originating from the summits have deeply incised the northern face.

The mountain rises above plateaus at elevations of 1200-1300 meters. These plateaus dominate its SW, S, and SE sections. At the base of Honaz Mountain lie the Honaz Plain to the north, the Kızılhisar Plain to the south, and the Tavas Plain to the west.

The geological structure includes Mesozoic and Tertiary formations, with Paleozoic layers occupying smaller areas. The foundation consists largely of limestone and metamorphic schists. Fault lines, particularly one south of Honaz town, have influenced the distribution of water sources, benefiting moisture-loving plant species in the valleys of the northern slopes.

**Impact of Geomorphology on Vegetation** The effects of elevation, slope, and aspect are significant:

* Elevations range from 300 meters at the plain level to 2528 meters at the summit.
* Despite the elevation difference, rainfall is insufficient to create distinct vegetation zones.
* Red pine dominates at lower elevations, black pine at higher elevations, and alpine formations cover areas above 2000 meters.

Northern slopes host a diverse array of moisture-loving species (e.g., linden, ash, cornelian cherry, medlar, chestnut, and rowan) due to higher rainfall and abundant water sources. Southern slopes, influenced by aridity, exhibit reduced species diversity.

### **II. Distribution of Vegetation**

Vegetation in Honaz Mountain and its surroundings falls into three main groups: **dry forests, shrub formations, and alpine formations.** Notably, the semi-humid plant communities in the northern valleys, consisting largely of Black Sea floristic elements, are unique to Honaz and the Inner Aegean Region.

#### **Dry Forests**

Dominating much of the area, dry forests are characterized by their sparse structure, limited species diversity, and poor understory.

Key species:

* **Red pine (*Pinus brutia*)** at lower elevations.
* **Black pine (*Pinus nigra*)** at higher elevations, along with junipers (*Juniperus excelsa, J. foetidissima*) and oaks (*Quercus infectoria, Q. pubescens, Q. cerris, Q. frainetto*).

#### **Shrub Formations**

These include:

* **Maquis formations**: Predominantly on the northern slopes, dominated by kermes oak (*Quercus coccifera*) and other typical Mediterranean shrubs such as *Pistacia terebinthus* and *Juniperus oxycedrus*.
* **Garrigue formations**: Found on the southern slopes, these are less dense and consist of drought-resistant species.

#### **Alpine Formations**

Above 2000 meters, alpine formations dominate, with species adapted to harsh conditions.

Honaz Mountain’s vegetation reflects the influence of elevation, aspect, and human activity. While the lower slopes have been heavily deforested for agriculture and settlement, higher elevations and steep slopes remain largely intact.

### Alpine Formation

In the study area, regions above 2000 meters, beyond the forest boundary, are covered by alpine formations, extending up to the summit of Honaz Mountain at 2528 meters. However, the lower boundary of this formation is not natural, as it has descended to 1700 meters, especially on the southern slopes, due to forest destruction. In these areas, where winter temperatures drop below -4°C, spiny and cushion-like plants dominate. The main species include Acantholimon (*shepherd's cushion*), Daphne oleides (*olive-leaved daphne*), Rhamnus thymifolius (*buckthorn*), Astragalus (*milk-vetch*), and Asperula nitida.

### Semi-Moist Plant Communities

This plant community is unique to the northern valleys of Honaz Mountain, where it occurs only in these areas. At lower elevations, it mostly appears in shrub form, resembling pseudomaquis with intertwined Mediterranean and Black Sea elements. However, it differs from pseudomaquis due to its sparse distribution. In undisturbed areas, this community forms under Pinus brutia (*red pine*), Pinus nigra (*black pine*), Castanea sativa (*chestnut*), Fraxinus (*ash*), and Populus tremula (*aspen*) forests. Key Mediterranean elements include Pistacia terebinthus, Phillyrea latifolia, Cistus salviifolius, Quercus coccifera, Cercis siliquastrum, Juniperus oxycedrus, and Arbutus andrachne, intermixed with Black Sea elements such as Mespilus germanica (*medlar*), Cornus mas (*cornelian cherry*), Corylus avellana (*hazelnut*), and Sorbus torminalis (*wild service tree*).

Other shrubs in this community include Ulmus minor (*elm*), Crataegus monogyna (*hawthorn*), Rhus coriaria (*sumac*), Colutea (*bladder senna*), Paliurus spina-christi (*Christ's thorn*), Cotoneaster, Anagyris foetida (*bean trefoil*), Jasminium fruticans (*wild jasmine*), Rosa (*wild rose*), Tamarix (*salt cedar*), Salix fragilis (*crack willow*), and Vitex agnus-castus (*chaste tree*). Scattered oak species such as Quercus infectoria, Q. pubescens, and Q. infectoria subsp. boisseri add to the diversity.

Noteworthy moisture-loving species, such as Tilia rubra subsp. caucasica (*Caucasian lime*), occur in clusters above 800 meters, reflecting the humid conditions in the northern valleys. Acer hyrcanum subsp. keckianum (*Iranian maple*), first identified in this area, is another unique species.

The presence of these Black Sea moisture-loving species in the area is linked to water sources along the fault line near Honaz town at lower elevations and to increased spring rainfall at higher elevations due to dominant northern winds.

### Vegetation Transects in Honaz Mountain

#### A. Honaz–Honaz Mountain (2528 m)–Yüreğil Transect

South of Honaz town, vegetation begins with Pinus brutia forests, continuing up to 1000 meters on the northern slopes. These forests include Quercus infectoria as a secondary tree and scattered Juniperus excelsa and J. foetidissima. The forest understory consists of shrubs such as Pistacia terebinthus, Juniperus oxycedrus, Cistus salviifolius, Cercis siliquastrum, and Phillyrea latifolia, along with species like Crataegus monogyna, Colutea, Cotoneaster, and Rhus coriaria.

The Gökdere Valley, originating from the Honaz Mountain summits, features semi-moist species, including Fraxinus ornus, Tilia rubra, Acer hyrcanum, Ulmus minor, Prunus mahaleb, Castanea sativa, and others, alongside Mediterranean shrubs like Quercus coccifera and Phillyrea latifolia.

Above 1200 meters, Pinus nigra forests dominate, extending to the alpine zone at 2000 meters. These forests feature understory species such as Quercus coccifera, Cistus laurofolius, Rhamnus nitida, and others.

The alpine zone begins at 2000 meters on the northern slopes and 1700 meters on the southern slopes, featuring plants like Acantholimon, Daphne oleides, Astragalus, Rhamnus tymifolius, and Asperula nitida.

#### B. Dereçiftleri–Tepeliceyayla Tepe (1757 m)–Karahöyükafşarı Transect

South of Dereçiftleri, vegetation starts with Pinus brutia forests up to 1200 meters, transitioning to Pinus nigra forests further up. The Kocadere Valley features diverse vegetation, including Quercus cerris, Ulmus glabra, and riparian species like Salix elburensis and Tamarix. The alpine zone hosts sparse vegetation dominated by Acantholimon, Berberis vulgaris, and other hardy species.

### Conclusion

Honaz Mountain’s plant distribution reflects the contrasting effects of Mediterranean and continental climates. While Pinus brutia and Pinus nigra forests dominate, northern slopes host semi-humid vegetation with Mediterranean maquis and Black Sea floristic elements. In contrast, southern slopes feature more arid-adapted species.

The presence of moisture-loving Black Sea species, such as Tilia rubra and Castanea sativa, is attributed to water sources along fault lines and favorable spring rain patterns. These species are likely relicts from a wetter climate during the Pleistocene.

The combination of Mediterranean, Black Sea, and some Iranian-Turan species makes Honaz Mountain an ecologically diverse region and a significant area for vegetation studies.