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Partnership on Sustainable Agriculture and Mitigation to Climate Change

Report on the Agricultural Biodiversity of Erdemli/ Turkiye

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1. BIODIVERSITY

From the deepest point of the oceans to the highest point of the mountains, from the coldest polar regions to the driest deserts, from bacteria to large mammals, life is everywhere on earth. This diversity of life is the result of 4.5 billion years of evolution, including the process of speciation and response to major extinctions. The diversity of life forms, their adaptive abilities, and the measures taken in response to geological and environmental factors create an unlimited spectrum of life. Therefore, addressing all aspects of this diversity with a precise definition is a difficult and evolving process (Boenigk vd., 2015).

"Why are there so many varieties?", "What is the relationship of a species to its individual representatives?", "Why is there order in nature?", "Are these species arranged in a systematic way?". These are questions posed by Greek philosophers and are still relevant. Plato was the first to argue that "life tends to manifest itself in the greatest variety" as an expression of the "principle of abundance". Although Plato was not centrally focused on nature, Aristotle made the living world the object of his study. Aristotle is generally considered the founder of the biological sciences because he developed biological definitions and classifications.

"There is something wonderful in everything natural." (Borghini ve Casetta, 2009) He emphasized that every living organism (from the scariest to the most magnificent) should be evaluated in the same way. Swedish botanist Carl Linnaeus initiated a systematic classification of living organisms in the 1700s, and this classification included hierarchical levels ranging from the most inclusive "species level" to the most exclusive "kingdom level." Wilcox (1985) defines biodiversity as "the diversity of life forms, the ecological roles they perform, and the genetic diversity they contain."

The term "biodiversity" began to be recognized in the European Union during the Rio 1992 Earth Summit (United Nations Conference on Environment and Development (UNCED)), when 150 states signed the Convention on Biological Diversity (United Nations Convention on Biological Diversity, CBD). This definition from the CBD (Anonymous, 1992) is still the most accepted: "Biodiversity refers to the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part."

Global Biodiversity Strategy (1992) developed by the World Resources Institute (WRI), the International Union for Conservation of Nature (IUCN), the United Nations Environment Program (UNEP), the Food and Agriculture Organization (FAO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) (WRI/IUCN/UNEP, 1992) adopted these three aspects of diversity levels as follows;

1. Genetic or alpha diversity refers to the diversity of genes within species.
2. While species diversity or beta diversity refers to the diversity of species in a region, species diversity can be measured in many ways; The number of species or species richness in an area is often used. Species diversity is also considered in terms of taxonomic diversity, which considers the relationship of one species to another.
3. Ecosystems or gamma diversity refers to the number of species in a particular location, the ecological functions of species, the way species composition changes within a region, the association of species in certain areas, and the process. Within and between ecosystems. Ecosystem diversity extends to the landscape and biome level.

1.1. Genetic Diversity

Genetic diversity indicates that there are genetic differences between individuals in a community of living things of the same species. People who belong to the same species but have different eye and hair colours, heights and resistance to diseases can be examples of this situation. In addition, genetic diversity is expressed as an important phenomenon that ensures the continuity of biodiversity. Reasons for genetic diversity to occur;

a. Geographic regions play an important role in genetic change. Species spread over large regional areas have twice as much genetic diversity as endemic species. The most typical example of this is that foxes living in very distant regions (polar, desert and temperate regions) have significant genetic differences in terms of morphology. Foxes living in the polar region have a fat and fatty structure that provides a lot of energy in order to withstand extreme cold, and have non-pointy ears and chins to prevent body heat from being lost easily. In the desert fox, this morphological structure is completely opposite.

b. Life span also affects genetic diversity. For example; perennial plants show higher genetic diversity than short-lived annual plants.

c. Migrations between societies also increase genetic diversity. The main reason for this is that different gene flow occurs in this way.

d. It is emphasized that obtaining the resources necessary for life (food, water, light, temperature) creates genetic diversity (Uzun, 2013).

1.2. Species Diversity

According to the biological species concept, species; It is a taxonomic unit that includes individuals that can mate with each other under natural conditions and have the potential to raise offspring with reproductive abilities. Species diversity refers to the number and density of plant and animal species and subspecies in a region. However, taxonomic diversity should also be taken into account when considering species diversity. The two regions we have prioritized may both contain the same number of species. However, one of these regions may contain only a single taxon at the genus level, while the other may have two or more taxa at the genus level. In this example, although the number of species is the same, it is stated that species diversity is greater in the second case (Uzun, 2013).

1.3. Ecosystem Diversity

The whole formed by living things living in a certain area and constantly interacting with each other and their non-living environment is called an ecosystem. Ecosystems, regardless of size, consist of living (producers, consumers and decomposers) and non-living elements (inorganic substances, organic substances and physical conditions). The more diverse the resources of the ecological conditions that ensure the survival of living things and constantly influence them, that is, the ecosystems, the more secure the survival of rich species communities is. The ecological feature that provides this assurance is expressed as ecosystem diversity. For example; If we consider ecosystems such as agriculture, pasture, forest, lake and river, and steppe and reed beds, it is easily understood how many different plant and animal species can live without harming each other. Thus, ecosystems with different characteristics in terms of structure and function will also have diverse living communities. In other words, the more ecosystems have different characteristics in terms of structure and function, the more they will have the characteristics of various living environments in terms of the living creatures they host. (Uzun, 2013).

Noss and Cooperrider (1994) expanded the definition as follows: “Biodiversity is the diversity of life and its processes. It includes the diversity of living organisms, the genetic differences among them, the communities and ecosystems in which they exist, and the ecological and evolutionary processes that sustain their functioning but are constantly changing and adapting.” With this definition, ecological and evolutionary processes also come to the fore.

Human civilization was developed by altering nature, encroaching on wilder areas, and depleting natural resources. Vitousek et al. (1997) stated that 30-50% of the land surface has been modified by humans. However, for more than two centuries, this occupation has pushed its limits and gained great momentum, and this period is now called 'Anthropocene' (Mauser, 2006). This new definition points to human intervention in nature, which is influenced by human beings, whose metabolism is dominant. The Millennium Ecosystem Assessment (MEA, 2005) named the “big five” global challenges that threaten biodiversity. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report (2019) classifies these impacts by magnitude as (1) changes in land and sea use; (2) direct exploitation of organisms; (3) climate change; (4) pollution and (5) invasive alien species.

Due to the decline in biodiversity and ecosystems, the ecological processes on which humanity's survival depends through products and services are disappearing globally (Walpole et al., 2009; Tittensor et al., 2014). Direct loss of biodiversity at local, regional and global levels and the simplification of diverse habitats into less diverse habitats with more dominant species is occurring in many places globally (Pereira et al., 2012). However, the rate, intensity and selectivity of biodiversity loss varies spatially and temporally (Edie, 2018)

The extraordinary loss of biodiversity over the last few centuries has been highlighted as the “sixth mass extinction” (Ceballos et al., 2015). Mass extinction events resulted in the loss of almost 75% of species in a geologically short period. Considering the previous five extinctions in Earth's five-billion-year history, mass extinctions triggered new emergence or dominance, from anaerobic bacteria to oxygen-producing algae. This innovation in life forms made recovery possible, and some sudden changes, such as asteroid impacts, spurred the evolution of various organisms.

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But today the loss rate is higher than ever. Examples are Ceballos et al. (2015) (using IUCN vertebrate data since 1500); 338 species are listed as extinct (EX) and 279 species are listed as extinct in the wild (EW). It has been shown that biodiversity loss is linked to global change such as the 'Anthropocene' we mentioned before. Globalization, modernization and economic development are important socio-economic factors that cause land cover changes, expansion of urban and agricultural areas, deforestation, over-harvesting, pollution and alteration of ecosystems causing invasion.

Biodiversity is vital to human survival. Agriculture, fisheries, medicine and pharmacy are examples of ecosystem products, and these directly collected products are components of biodiversity. In addition, various ecosystem mechanisms and processes at different scales regulate the situation and ensure the stability of the service and therefore human well-being (Mace et al., 2012; Cardinale et al., 2012). Conservation of water resources, carbon sequestration and waste assimilation are key examples of ecosystem services that humans benefit from nature (MEA, 2005). In addition to these examples, intangible benefits such as cultural values are also provided by nature.

2. BIODIVERSITY OF TURKIYE

Türkiye is a special country with diverse ecological regions, geographically and climatically suitable and vital resources for food security. Since Türkiye is a bridge between continents, climate and geographical features change over short distances. As a result, Türkiye hosts significant species diversity and has a high level of biological diversity with its forest, mountain, steppe, wetland, coastal and marine ecosystems and habitat diversity (Figure 1). Altitude ranges starting from sea level and exceeding 5000 meters allowed speciation and intraspecific diversity during the last glacial maximum (Médail and Diadema 2009). The Mediterranean basin, the Caucasus and the Iran-Anatolia hotspots meet in Türkiye (Çağlayan, 2020), and Türkiye is the only country where almost its entire area is covered by three hotspots (Şekercioğlu et al., 2011).

Our country's biodiversity is hidden in its unique geography;

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1. Our country has a horizontal rectangular shape, that is, parallel to the equator. The sun's journey between east and west takes 76 minutes. The entire country's territory receives sufficient daylight. The fact that the Anatolian Peninsula is a rectangle extending on the East-West axis rather than the North-South axis keeps the latitude difference to a minimum. The difference in latitude affects the duration and rhythm of day and night, as well as the duration of clear sunshine. In this respect, the advantage in the Anatolian Peninsula turns into a disadvantage in, for example, the Scandinavian Peninsula.

2. This rectangular piece of land has rugged terrain that starts from sea level in the west and can reach over 5,000 meters with the summit of Mount Ararat in the east, and mostly spreads between 1,000-2,000 meters. The endemic plants of the Lakes Region are distributed at different altitudes in different proportions (Özçelik et al., 2012). Accordingly, 0-1000 m. 129 taxa (11%) between 1000-2000 m. 150 taxa (16%) between and 2000 m. 39 taxa (4%) were identified above, and 645 taxa (69%) were spread over various altitudes. In other words, these endemic species are not negatively affected by the elevation difference in these lands. These figures will be updated as studies on our other regions are carried out, so that comments can be made on the number of taxa according to elevation across the country.

3. The mountains are parallel to the coast in the north and south, and perpendicular to the coast in the west. This structural feature of the mountains allows the moist air coming from the Aegean Sea to enter further in the west, while creating a barrier between the Black Sea in the north and the Mediterranean in the south, creating different microclimates. In addition, in such a mountain range, the southern slope of the mountain receives more sun and heat than the northern slope. This situation, which we call difference in aspect, contributes to biodiversity as different plants or different species of the same plant between the northern and southern slopes at the same elevation.

4. The existence of a sea, such as the Marmara Sea, connected to two large water basins by two natural straits, increases the amount of humidity in the Marmara Region, which has a low average elevation. In addition, the Marmara Sea also increases the length of our country's coastline.

5. While our country is surrounded by the sea on three sides, its east and southeast are adjacent to the land and its southeast is open to desert influence. Again, in this region, the arcs drawn by the mountains prevent the dry desert air from reaching the interior.

6. Most importantly, our country is at the intersection of the world's three largest phytogeographic belts, from north to south: Euro-Siberian, Irano-Turanian and Mediterranean (Mediterranean) (FAO, 2018). In our country, all three vegetation types belonging to these phytogeographic zones are seen in different regions. This situation saves the flora elements from monotony.

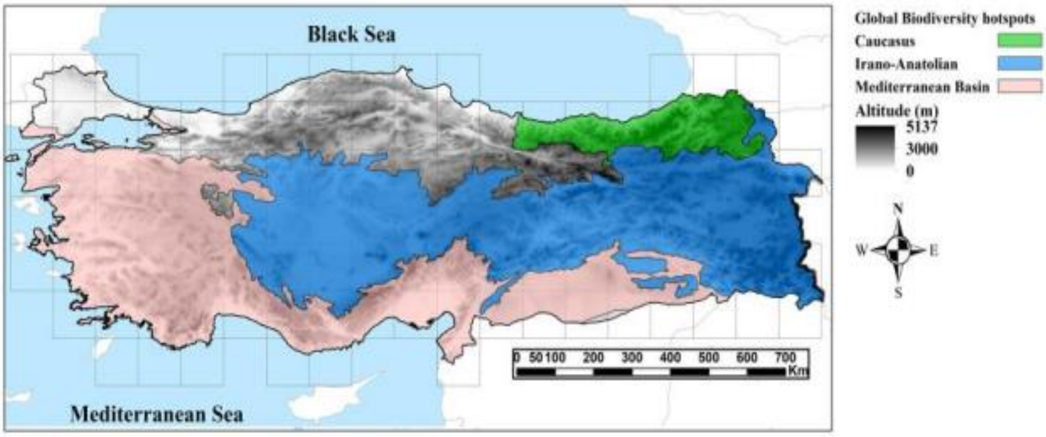

Figure 1. Türkiye's biodiversity hotspots (Noroozi vd., 2019)

In Türkiye, there are 168 mammals (Şekercioğlu et al. 2011), 502 birds (Kiziroğlu, 2008), 236 fish (Kuru, 2004), 11 turtles, 63 lizards, 55 snakes (129 reptiles) and 28 amphibians (Baran et al., 2004). There are. Numbers are updated with ongoing efforts. Updated taxon numbers are presented in Table 1 (Zeydanlı et al., 2020).

Table 1. Taxon numbers (Zeydanlı vd., 2020)

Species Group	***Approximate number***
Vascular plants	11.840
Birds	551
Freshwater fish	389
Mammals	176
Reptiles	149
Amphibians	35
Butterflies	377

The plant richness and abundance of endemic plants has been an interesting topic when considering Türkiye's biodiversity. New plants are being discovered at a rate of approximately one species per week (Özhatay and Byfield, 2003). The distribution of plants included in the IUCN Red List is presented in Table 2.

Table 2.. Distribution of plants according to IUCN red list categories (Ekim ve Gür, 2017)

	EX	CR	EN	VU	LC- NT	DD	NE	Total
Red List of Plants	10	422	774	705	1541	223	3	3678
Updated version	3	1328	675	624	1264	130	28	4052

Türkiye, mohair (Linum), onion and garlic (Allium), barley (Hordeum), wheat (Triticum), oats (Avena), chickpeas (Cicer), lentils (Lens), peas (Pisum), grapes (Vitis), almonds It is located at the intersection of two major Vavilovian gene centers (Mediterranean and Near Eastern gene centers), which played a key role in the emergence of cereal and horticultural crops from genera such as (Amygdalus), plum (Prunus) and sugar beet (Beta). There are five micro gene centres, with a wide diversity of more than 100 species, which are the origin or center of many important crops and other economically important plant species such as medicinal plants and fruit tree species. These micro gene centers provide crucial genetic resources for the future sustainability of many plant species grown worldwide. These centers are (1) Thrace and the Aegean Region, (2) Southern and Southeastern Anatolia, (3) Samsun, Tokat and Amasya provinces, (4) Kayseri Province and its surroundings, (5) Ağrı Province and its surroundings (FAO, 2018). In addition to species richness, ecosystem richness is also a great value in terms of diversity.

Wild areas and old-growth forests contribute to Türkiye's functional and compositional diversity (Zeydanlı et al., 2020). Forests, steppes, arable lands, wetlands, inland waters and mountain, coastal and marine ecosystems diversify Türkiye. The land cover map shown in Figure 2 reflects the diversity of various land cover types in Türkiye.

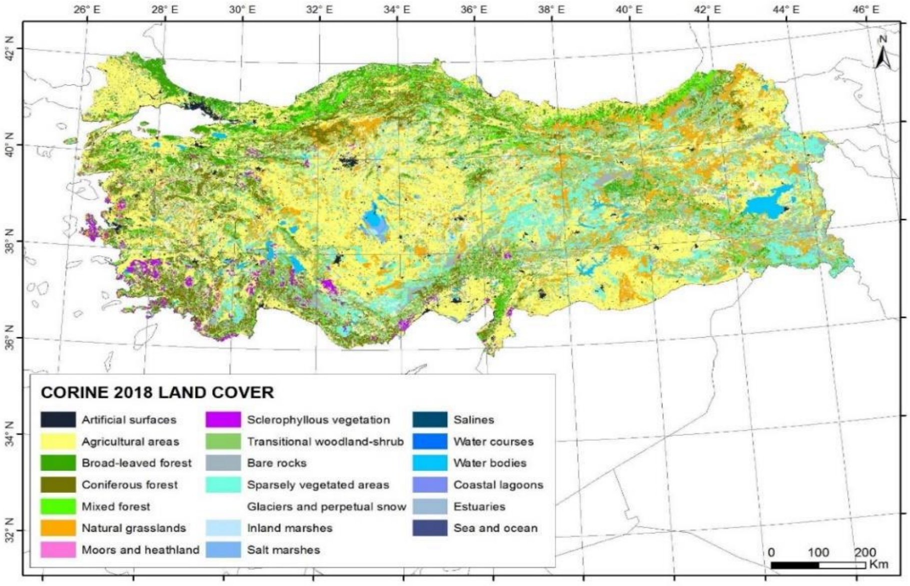

Figure 2.Land cover map of Türkiye

Another schematization of ecosystem diversity is presented in Figure 3. This map produced by Olson et al. (2001) reflects Türkiye's terrestrial ecological regions.

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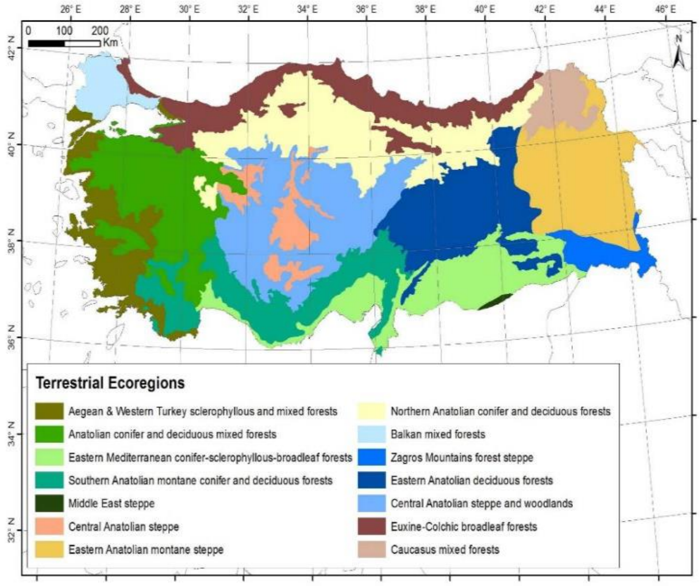

Figure 3. Terrestrial Ecoregions of Türkiye(Olson vd., 2001)

However, this amazing diversity is threatened by many factors, causing the negative effects on biodiversity to increase day by day. Population growth, obsession with development, and interest in rapid growth of the economy are depleting Türkiye's natural capital. Energy consumption and demand for hydroelectric power plants, together with irrigation projects, cause great destruction in freshwater ecosystems and wetlands. Overgrazing and erosion deteriorate steppes and pastures. Due to the construction of summer houses and tourism facilities, habitat loss is experienced in maquis and furigana bushes in coastal areas (Çağatay, 2020; Şekercioğlu et al., 2011).

Kahraman et al. (2012), the main activities that threaten Türkiye's gene pool are overgrazing of meadows and pastures, erosion, stubble burning, mechanized farming practices, irregular and excessive use of pesticides in agriculture, domestic and industrial waste, global warming, excessive hunting and gathering, and climate change. Drying of wetlands, dams, urbanization and industrialization.

The increasing population in the world and in our country requires more agricultural production and causes the needs to diversify and change. Achieving production that can meet changing needs depends on the development and production of new productive, high-quality, durable plant varieties. Genetic resources form the basis of a variety of development studies. It is not possible to know in advance what

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factors will arise that will hinder agricultural production in the future. In the event of unexpected negative factors emerging, the solution will again be sought in genetic resources. If Türkiye's rich biological diversity and agricultural genetic resources are used appropriately and integrated into the economy, key solutions will be provided for many agricultural problems.

In, the second half of the twentieth century, especially in the 1970s, discussions began that the irresponsible and wasteful use of plants and animals would endanger the future of humankind in the future (Faith, 2021). When the idea of natural conservation of species came to the fore, some authors advocated the preservation of only living species that are beneficial to humans. Some authors have proposed the protection of all ecosystems because we do not know which living creatures may be beneficial to humans in the future (Ehrenfeld, 1988). Finally, in the 1980s, the word biodiversity began to be used, and with increasing momentum, attention was drawn to extinct species and vanishing ecosystems.

3. AGRICULTURAL BIODIVERSITY

The fact that biological diversity is one of the most important elements in maintaining ecological balance, as well as one of the basic requirements of agricultural production and food security, is increasingly accepted all over the world (Thrupp, 1988). Agricultural biodiversity includes all components of food and agriculture-related biodiversity. These are the genetic, species, and ecosystem levels that play a key role in the agroecosystem with the diversity, structure, and functions of plants, animals, and microorganisms.

Agricultural biodiversity is important with the following functions;

• Sustainable food production and other agricultural products,
• Biological support through soil biota, pollinators, and predators,
• Providing a wide ecological environment thanks to agroecosystems (such as landscape protection, soil protection and health, water cycle and quality, air quality).

Components of agricultural biodiversity;

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• Cultivated plants and products, products of wild plants and their form of food, farm trees, meadow-pasture species,
• Cultured animals, animals caught for food, wild and farmed fish,
• Insects (pollinators: bees and butterflies), pests (wasps, beetles), termites in the soil cycle,
• Other microorganisms (worms),
• Microorganisms (rhizobia, fungi, disease-causing pathogens) (CIP-UPWARD 2003).

Around the world, agricultural biodiversity is a key element of farm systems and generates many dimensions of diversity at the genetic, species and ecosystem levels. Over the centuries, farmers have learned different agricultural practices to use when necessary, propagated and preserved different seeds, crops, trees, livestock, and included agricultural ecosystems in traditional farm systems. These practices include the use of beneficial insects against diseases and pests and the use of woody plants in the agroforestry system. Although humans consume roughly 7000 plant species, only 150 species are economically important, and approximately 90% of the world's crops are derived from 103 species. Just three crops (paddy, wheat and corn) provide 60% of the calories and 56% of the protein from plants. Reducing diversity in farm systems makes continuity in food production and supply uncertain, while increasing risks for farmers and often increasing vulnerability to climate change (Thrupp, 1988). When the characteristics of agricultural biodiversity are compared with other biodiversity elements, the result is as follows;

• Agricultural biodiversity is actively used by farmers.
• Many agricultural biodiversity components cannot exist without some human intervention. Local knowledge and culture are an integral part of the agricultural biodiversity method.

The Convention on Biological Diversity (BDS) obliges the countries that have signed the agreement to implement the necessary actions and reforms to protect agricultural biological diversity. International concern about the control of plant genetic resources has led to the creation of legal regulations on intellectual property that affect the access of farmers, as well as public institutions and private firms, to genetic resources. For example, the General Trade and Customs Agreement (GATT) regulates the control, sale, and access of genetic resources and property rights related to agricultural biodiversity (Thrupp, 1988). Although there are various ideas about the number of higher plants on Earth, it is stated that there are around 270,000. The distribution of these species is not equal on Earth, and it also varies in geographical regions within the same belt. Tropical regions are the richest places in terms of species diversity, and the number of species decreases as you move toward the poles. The richest places in terms of species are the northern parts of South America and the Indonesian archipelago. The number of endemic species, as well as the number of species they contain, is of great importance in terms of the biological diversity of countries (Arslan, 2004). The richest country in the world in terms of number of species is Brazil, and the countries rich in endemic species are Australia and South Africa. Although the surface areas of Ecuador and Malaysia are similar to Germany and England, the number of species is very high. Although the number of natural species is low, England preserves 25,000 plant species from different countries of the world in its botanical gardens and arboretums. The plant species found in our country constitute approximately 3.6% of the world's plant species. Türkiye's surface area is only 0.53% of the world's land area. These rates are another indicator of our species' richness. Approximately 70,000 of the 270,000 plants on earth are used. Of the 70,000 plants, approximately 3000 are used as food sources, 25,000 for treatment purposes, 5,000 for industrial purposes, and 15,000 as ornamental plants, and the remaining are used in other areas. Although there are more unused plants, it is estimated that initially, about 25,000 of them can be used for medicinal purposes and 10,000 of them can be used as a food source. It is stated that approximately 13% of the plants in the world are in danger of extinction, the majority of which are endemic plants, and this rate may increase further with further research (Arslan, 2004).

4. THE IMPACT OF CLIMATE CHANGE, AGRICULTURAL PRODUCTION, AND LAND USE ON BIODIVERSITY IN TÜRKİYE

The Mediterranean Basin, which includes Türkiye, is among the regions that will be significantly affected by global climate change due to its geographical location. Within the framework of climate change, the most significant impacts throughout the basin are expected to be drought and drought. It has been observed that rainfall throughout the Mediterranean Basin has decreased by 20 percent in the last 25 years. In the future, it is estimated that agricultural product yields will decrease due to drought and thirst due to the continuous decrease in precipitation, there will be a loss of sectoral income, especially in

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agriculture and tourism, and natural disasters such as forest fires will increase and biodiversity will disappear (Özhatay et al., 2003). With the changes in the climate in Türkiye, the water availability required for the growing of crops is currently insufficient. Due to future changes, it is estimated that the negative conditions in water availability will deepen due to the decrease in precipitation and the increase in average temperature, especially in the Central Anatolia, Aegean, and Mediterranean Regions. Insufficient water required for production directly affects product yield. In the Eastern Black Sea Region, extreme precipitation events are expected to increase due to the change in the precipitation regime (Kadıoğlu et al., 2017). It is stated that due to the 50 percent decrease in surface water in the Gediz and Büyük Menderes Basins in the Aegean Region by the end of the century, there will be a great deal of water stress in agricultural production, residential areas and industrial activities (Anonim, 2012).

In the European Environment Agency's report "Adaptation to Climate Change in the Agricultural Sector in Europe"; It is stated that in the Mediterranean Region, due to climate change, there are effects such as an increase in extreme temperatures, a decrease in precipitation, an increase in the risk of drought and, accordingly, loss of biodiversity, an increase in water demand in agriculture, a decrease in product yield and a risk in livestock activities. In the areas stated as mountain regions in Türkiye, which mostly cover the Central Anatolia, Southeastern Anatolia and Eastern Anatolia Regions; There is a risk of hail, risk of frost, increased risk due to rockfalls and landslides, higher temperature increases compared to the European average, and shifting effects on plant and animal species. Turkish agriculture has been affected by international developments and policies implemented at the national level from past to present. Until today, certain breaking points have been experienced in the global economic structure. It is possible to divide the ruptures experienced with political processes into four periods. The decisions taken at these points regarding the global economic structure and markets also played a role in shaping the agricultural policies in Türkiye and, accordingly, in changing the structure in the rural area. With the various ecological destructions experienced in the process, Turkish agriculture has become an activity that affects both climate change and is negatively affected by climate change due to approaches focused on increasing production.

Among the multiple drivers of changes in biodiversity, the largest negative impact of land use change over the next century is expected to be on terrestrial ecosystems (Sala et al., 2000). Changes in land cover and land use affect biodiversity by altering habitat, ecological processes, biotic interactions, and human disturbances (Marzluff, 2001). These mechanisms act on the population dynamics of each species through changes in birth, death, and movement rates. Perhaps the most obvious reflections of land use change are species losses (extinction) and fragmentation and degradation of habitats (Işık, 2011). Conversion of natural habitats to agriculture or other intensive human land uses causes these areas to become uninhabitable for many native species. This transformation also reduces natural habitats. Established theories and empirical evidence in island biogeography have shown that community diversity decreases as habitat area decreases as a function of well-established species-area relationships. Smaller habitats can support fewer individuals within a population, so extinction rates increase with habitat loss. The spatial structure of the habitat also affects biodiversity potential. Within forest stands, simplifying the number of canopy layers and other measures of forest structure reduces the microhabitats available for organisms, again resulting in reduced biodiversity (Aksoy ve Sivri, 2023).

Globally, land use is causing widespread changes in fire and flood regimes, with strong consequences for biodiversity. Impacts on ecological processes resulting from land use are not only terrestrial. Freshwater systems are perhaps the most endangered systems globally. Land use changes resulting in sediment loading and nitrogen fertilization pose one of the major threats to the health of these ecosystems. Watersheds transmit these harmful effects to the coastal zone, where enhanced fertilization can lead to harmful algal blooms and pollution of coral reefs from sedimentation. Some consequences of land use change are much less visible because they affect not only habitats but also the organisms within habitats.

Human activities often cause changes in the number and distribution of native species, as well as the introduction of alien species and pathogens. As a result, biotic interactions between species change, which changes ecosystem properties. Biotic interactions affected include competition, predation, disease, and parasitism (Marzluff, 2001). Diseases; It can spread between people, pets, and wildlife. The introduction and spread of exotic species is perhaps the most common type of biotic change resulting from land use. Human activities have enabled many species to cross geographic boundaries and spread to new locations, sometimes with devastating effects on native species and ecological processes. Humans also interact directly with native species through exploitation and unintentional harm. In many parts of the world, legal hunting or illegal poaching greatly reduces certain wildlife species (Işık, 2011). Outdoor recreation, such as irregular and unconscious nature walks and off-road vehicle use, is becoming increasingly popular around natural habitats. Such human activities can affect the reproduction, survival, and population dynamics of wildlife in relevant areas and their immediate surroundings by disrupting or occupying their habitats. In summary, numerous studies show that land use change is a major driver of negative changes in biodiversity in many parts of the world.

Natural habitats have been converted to more intensive human land uses, with dramatic impacts on native species and communities. Human activities around natural habitats can change the ecological processes in nature and genetic resources conservation areas and the number and species composition of the living community. These findings suggest that the future ability of protected areas to sustain current species richness depends on aligning resource management with regional land use activities. (Aksoy ve Sivri, 2023).

Due to its complex climate structure, Türkiye is one of the countries that will be most affected by climate change, especially due to global warming. One of the most important reasons for this is that there is a desert zone just south of Türkiye and this zone is moving towards the north with warming. It is predicted that a large part of our country will be affected by a dry and hot climate, and many areas such as water resources, ecological and economic processes, ecosystem and biodiversity, and agriculture will be significantly affected (Demir, 2009). In Türkiye, the average temperature increase has already exceeded 1.5°C since the industrial age. This temperature increase and global climate change increase the risk of drought and desertification in Türkiye day by day. As a result of significant warming, the number of human deaths resulting from extreme heat is expected to triple by the end of the century. High temperatures are also predicted to increase the rate of hospitalizations resulting from respiratory problems. It is stated that the majority of these cases will occur in the regions of Europe, including Türkiye (Türkeş, 2020). It is predicted that the increase in water temperatures will affect marine biodiversity and this will have an impact on the fishing industry in Türkiye.

Even if emissions remain low, there is a risk of losing approximately 10% of Mediterranean fish species. By 2060, more than 20% of the marine species with high economic value in the Eastern Mediterranean are in danger of extinction (Turan vd., 2016). In the Black Sea, high temperatures will reduce the oxygen level of the sea in many regions, thus changing the distribution of fish species (Anonymous, 2019). In the Mediterranean region, there is a decrease in annual precipitation and an increase in extreme precipitation events due to climate change. It is stated that climate change will also reduce the quality of agricultural soils. It is predicted that soil erosion will increase due to the predicted change in Türkiye's rainfall regime and increasing air temperature. This situation threatens approximately 30% of agricultural lands, especially in the Mediterranean Region. In Türkiye, with climate change, a decrease in productivity, an increase in the demand for irrigation water, changes in planting and harvesting time, a decrease in the suitability of the soil, show that more disease and pest threats have emerged and these threats are gradually increasing. It is predicted that the frequency and intensity of droughts will increase due to climate change, and approximately 54% of the population in the Mediterranean Region will experience water scarcity at different scales (Byers vd., 2018).

Climate change causes a decrease in water resources and a decrease in water quality in Türkiye. If emissions are high, it is predicted that Lake Beyşehir may dry up completely by 2070 (Bucak vd., 2017).

Aydın vd. (2020), examined the changes that occurred on the surface of Tuz Lake in the last 32 years and investigated the relationship of this change with climatic and anthropogenic factors. Until the early 2000s, it was determined that drought had a limited effect on the change in water and salt-covered areas in the lake, due to the higher groundwater level in the basin. However, after the 2000s, multi-year rainfall deficits and the decrease in groundwater level led to the expansion of salt-covered areas. In addition, it has been observed that wells drilled for irrigation purposes cause the groundwater level in the basin to decrease. As a result of these two effects, it has been determined that the salt-covered areas of the lake tend to expand. With the impact of climate change, Türkiye is getting closer to becoming a water-poor country every year. It is stated that the continuation of emissions and the cumulative effect of temperature increase will cause significant damage to the Turkish economy. In addition to being harmed by the effects of climate change within its own borders, Türkiye will also be deeply affected by the effects of global warming occurring in other countries. For example, the negative effects of climate change on international supply chains, markets, the financial sector, and trade will restrict access to products in Türkiye, prices will increase and damage Türkiye's export market (Karagöl, 2022)

It is estimated that the main causes of disasters such as the drying of trees and pest invasions, which have become very common in Türkiye's forests due to climate change in recent years, are drought, air pollution, and acid rain. In addition, as a result of forest fires that have increased in recent years due to both human-induced and climate change, millions of decares of forest land and thousands of plants, insects, and microorganisms, including rare and endemic species living on them, have disappeared and continue to do so (Yaşar vd., 2021).

Türkiye is a very rich country in terms of climate, soil diversity, and endemic species. When effects such as drought and desertification, deforestation, and melting of mountain glaciers resulting from land use and global climate change are evaluated together, it is obvious that they will affect our country's rich biodiversity, and terrestrial and aquatic ecosystems more than other countries.

5. INTERNATIONAL POLICIES AND ORGANIZATIONS

Türkiye is a party to thirty international agreements and conventions on the environment. Table 4 shows international conventions and protocols that require direct or indirect monitoring of biodiversity. The Convention on Biological Diversity has been mentioned in previous sections due to its particular focus on biological diversity. However, other conventions, such as the UNFCCC (United Nations Framework Convention on Climate Change) and UNCCD (United Nations Convention to Combat Desertification), mandate environmental monitoring and recommend standardized monitoring terminology at the ecosystem level for monitoring greenhouse gases or desertification mitigation. Among these agreements, monitoring biodiversity has an important place both politically and scientifically. Table 3 lists the international agreements ratified by Türkiye.

Table 3. International agreements ratified by Türkiye

Annotation	*Name*	*Year*	*Place*	*Year of ratification*
Ramsar •	Convention on Wetlands	1971	Ramsar	1994
CITES •*	Convention on International Trade in Endangered Species of Wild Fauna and Flora	1973	Washington	1996
Bern •*	Convention on the Conservation of European Wildlife and Natural Habitats	1976	Bern	1984
UNFCCC °	United Nations Framework Convention on Climate Change	1992	Rio de Janeiro	2004
Kyoto °	The Kyoto Protocol on the United Nations Framework Convention on Climate Change	1997	Kyoto	2009
CBD *	Convention on Biological Diversity	1992	Rio de Janeiro	1996
Cartagena •	The Cartagena Protocol on Biosafety to the Convention on Biological Diversity	2000	Cartagena	2004
UNCCD °	United Nations Convention to Combat Desertification	1994	Paris	1998
Barcelona •*	Mediterranean Action Plan-Barcelona Convention	1995	Barcelona	2002
ELC	The European Landscape Convention	2000	Florence	2003
UNESCO	Convention concerning the Protection of World Cultural and Natural Heritage	1972	Stockholm	1983
• Monitoring of biodiversity is required/proposed ° Monitoring of land cover/ land use is required/proposed * Monitoring targets have been set in particular lists (species, ecosystems, etc.)				

The Convention on Biological Diversity is the most important political instrument for the protection of biological diversity at the global level. Since its development at the Rio Earth Summit in 1992, various targets have been imposed on countries to prevent biodiversity loss. The United Nations Environment Program (UNEP) set the goal in 2002 as follows: "To achieve a significant reduction in the current rate of biodiversity loss at global, regional and national levels by 2010, to contribute to the reduction of poverty and the benefit of all life on Earth." Similarly, in 2011, twenty targets were determined to be achieved by 2020 under five strategic targets. These goals are;

• Strategic Objective A: Addressing the underlying causes of biodiversity loss by promoting biodiversity across government and society,

• Strategic Objective B: Reducing direct pressures on biodiversity and promoting sustainable use,

• Strategic Objective C: To improve the status of biological diversity by protecting ecosystems, species and genetic diversity,

• Strategic Objective D: To increase everyone's benefit from biodiversity and ecosystem services,

• Strategic Objective E: Improving implementation through participatory planning, knowledge management, and capacity building,

Unfortunately, these ambitious goals were not achieved as planned. Many studies have highlighted various reasons behind this failure. Voluntary reporting of selected indicators creates confusion in comparison and harmonization. Establishing a list of biodiversity indicators diverts the monitoring focus away from providing biodiversity data for specific aspects and minimum standards and may result in unclear messages to decision-makers (Scholes et al., 2008; Pereira et al., 2013). Most developing countries choose their reporting indicators based on available key data. Reporting is often based on data collected for other purposes and usually covers short periods. The extent of protected areas and forest extent and forest type indicators are the most commonly reported indicators (Walpole et al., 2009; Collen and Nicholson 2014).

Tittensor et al. (2014) emphasized that only a few indicators can reflect accurate trend information. Many are difficult to interpret and can therefore sometimes mislead policies due to their temporal and spatial scope, especially on a global scale. The establishment of national biodiversity strategies and action plans shapes biodiversity strategies and policies in many countries and enables them to monitor measures and implement ecological, evaluative, and performance-based measures. pushes indicators to be reported. Governments are in the process of developing a post-2020 global biodiversity framework that will guide action in the coming decades (Anonymous, 1992).

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6. REGIONAL POLICIES AND ORGANIZATIONS

6.1. European Union Legislation

The European Union has developed strong legal instruments to protect biodiversity on the continent. The Birds Directive aims to protect wild birds in Europe. The directive prohibits activities that directly threaten birds. It also states that approximately 200 bird species are particularly threatened and requires Member States to establish Special Protection Areas to ensure the protection of areas most suitable for the protection of these bird species living in the EU and migratory birds. These Special Protected Areas are part of the Natura 2000 ecological network created under the Habitats Directive. Similar to the Birds Directive, the Habitats Directive Supplement highlights around 1200 specific species and habitat types, mostly endangered or vulnerable. The most important result of the directives is Natura 2000 areas. The Natura 2000 network consists of outstanding natural areas where Europe's typical and most threatened habitats and species are protected and restored. Monitoring and reporting of the status of the fields is carried out regionally at six-year intervals. Although Türkiye is not a member country yet, creating a network of protected areas using the Natura 2000 concept is the focus of the General Directorate of Nature Conservation and National Parks. In recent years, the "Technical Assistance for Strengthening the National Nature Protection System for the Implementation of Natura 2000 Requirements" project, in which the Central Anatolia Region was examined, was carried out (Anonim, 2020).

The 2030 Biodiversity Strategy defines key commitments in the following elements (Anonymous, 2020);

• Building on existing Natura 2000 sites, creating a wider EU-wide network of protected areas on land and at sea, providing stringent protection for areas of very high biodiversity and climate value.

• An EU Nature Restoration Plan – a set of concrete commitments and actions to restore degraded ecosystems across the EU by 2030 and manage them sustainably by addressing the key drivers of biodiversity loss.

• A set of measures to enable the necessary transformative change: mobilizing a new, strengthened governance framework to better practice and track progress, improve knowledge, finance and investment, and demonstrate greater respect for nature in public and business decision-making.

• Measures to tackle the global biodiversity challenge, demonstrating that the EU is ready to lead by example towards the successful adoption of an ambitious global biodiversity framework under the Convention on Biological Diversity.

6.2. European Green Deal

The European Green Deal is an action plan developed sequentially with the "EU Biodiversity Strategy 2030", "EU strategies for energy system integration and hydrogen" and the "EU Climate Law". It focuses on "increasing the efficient use of resources by shifting to a clean, circular economy" and "revitalizing biodiversity and reducing pollution." This agreement set out the ambitious goal of making Europe climate-neutral by 2050.

6.3. Barcelona Convention

In 1995, the Action Plan for the Protection of the Marine Environment of the Mediterranean and the Sustainable Development of Coastal Areas was adopted by the Contracting Parties, replacing the 1975 Mediterranean Action Plan. Türkiye ratified the convention in 2002. Focusing on the maritime field, this project has a special impact on the development of Türkiye's protected areas network by introducing a new category, "Special Environmental Protection Areas". Today, these areas constitute 35% of the total protected area coverage.

7. THE NATIONAL BIOLOGICAL DIVERSITY STRATEGY AND ACTION PLANS (NBDSAP)

The General Directorate of Nature Conservation and National Parks (GDNCNP) first prepared the national biodiversity strategy and action plan in 1998 and updated the strategy in 2007 and 2018. These strategies have been forwarded to the Biological Diversity Secretariat (BDS) to fulfill the responsibility in Article Six.

The main objectives identified in each action plan presented below are explained.

1998 action plan

• Conservation and Sustainable Use

• Ecological Management

• Education and Awareness

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• Incentives and Legislation
• International Cupertino
• APPLICATION

2007 action plan;

• GOAL 1: Identifying, protecting and monitoring biodiversity components that are important for Türkiye

• GOAL 2: To use biodiversity components sustainably, taking into account the needs of future generations and applying methods appropriate to their renewal capacity.

• GOAL 3: Identifying, protecting, and benefiting from genetic diversity components that are important for Türkiye, including traditional knowledge.

• GOAL 4: Identifying, protecting, and monitoring biodiversity components that are important for agricultural biodiversity; protecting genetic resources with real and potential value for food and agriculture and ensuring the sustainable use of these resources; To ensure fair and equitable sharing of benefits arising from the use of genetic resources

• GOAL 5: To protect the steppe biological diversity, to ensure the sustainable use of its components, and to ensure the fair and equitable sharing of the benefits obtained from the use of genetic resources; combating the loss of steppe biodiversity and its socio-economic consequences

• GOAL 6: Establishing an effective monitoring, management, and coordination system for the protection of forest biological diversity and the sustainable use of its components

• GOAL 7: To establish an effective monitoring, management, and coordination system for the protection and sustainable use of mountain biological diversity with its different ecosystems with a holistic approach

• GOAL 8: To develop and implement effective methods for the protection of inland water biological diversity, the maintenance of the ecological functions of inland water ecosystems, and the sustainable use of these ecosystems.

• GOAL 9: To develop and implement effective methods for the protection of coastal and marine biodiversity, the maintenance of the ecological functions provided by coastal and marine ecosystems, and the sustainable use of these ecosystems.

• GOAL 10: Implementation of the Biological Diversity Strategy and Action Plan and creating a mechanism for monitoring implementation and reporting

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2018 action plan;

• NATIONAL GOAL 1: Pressures and threats on biodiversity and ecosystems will be identified and reduced to the lowest possible level or eliminated.

• NATIONAL GOAL 2: Biological diversity components (ecosystem, species, and genetic diversity) will be identified and monitored, and species-specific and ecosystem-based (traditional and modern) conservation approaches will be developed by determining the current status of biological diversity.

• NATIONAL GOAL 3: The protection and sustainable management of biological diversity of areas exposed to agriculture, forestry, and fishing activities in the country will be ensured.

• NATIONAL GOAL 4: The awareness of the public and managers about ecosystem services will be increased, the benefit from ecosystem services will be increased and sustainable biodiversity management will be ensured.

• NATIONAL GOAL 5: Rehabilitation and restoration of ecosystems damaged for different reasons will be ensured, measures to prevent damage to healthy ecosystems will be developed and legislative gaps will be filled.

• NATIONAL GOAL 6: Coordination mechanisms will be established between universities, and the public and private sectors, and long-term plans and programs will be prepared to develop high value-added products based on knowledge and technology regarding the protection and sustainable use of biological resources.

• NATIONAL GOAL 7: National legislation will be prepared and the necessary technical infrastructure will be created, taking into account international agreements regarding the fair and equitable sharing of benefits arising from access and use of genetic resources.

Each action plan differs in content. In 1998 and 2007, the focus was mostly on defining biodiversity values and highlighting the threats among them.

8. NATIONAL BIODIVERSITY INVENTORY AND MONITORING PROJECT (UBENIS)

The National Biodiversity Inventory and Monitoring project (UBENİS) was launched in 2013 with the cash support of the Ministry of Development and is carried out by the General Directorate of Nature Conservation and National Parks of the Ministry of Agriculture and Forestry. Biological data collected within the scope of the UBENIS project and Species Action Plans, especially species records, are stored in the Noah's Ark National Biodiversity Database. Although the database was created in 2007, data entry increased after the launch of the UBENIS project in 2013. The figures shown in the graphs below are presented on the official website of the Noah's Ark National Biodiversity Database, only summary statistics are available, no further interest is shared even with data contributors. In Figures 4 and 5, graphs of the number of taxa according to live and economic value in Türkiye taken from the Noah's Ark database are shown (Anonymous, 2024).

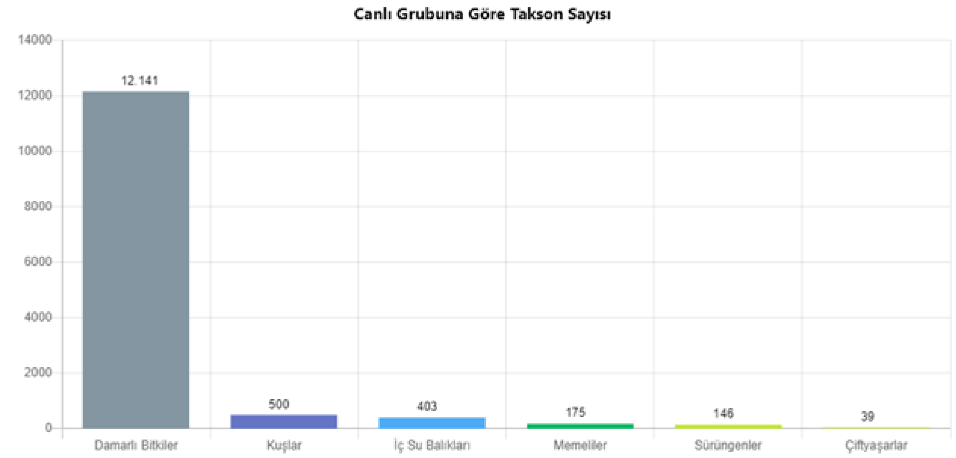

Figure 4. Number of taxa according to living group (Source: Anonymous, 2024)

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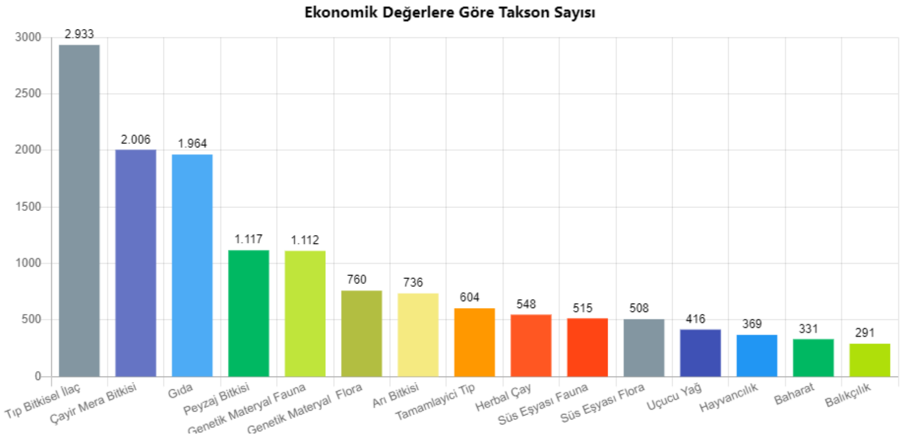

Figure 5. Number of taxa according to economic value (Anonymous, 2024)

9. MERSIN PROVINCE BIODIVERSITY

9.1. Mersin Province

Mersin is in the South Central region of the Anatolian peninsula, where three continents meet. It is surrounded by the provinces of Karaman and Konya in the north, Adana in the east, and Antalya in the west. In the south, the Mediterranean coast extends from east to west. Mersin's emergence on the stage of history dates back to the mid-19th century. Cotton production, which developed in Çukurova to alleviate the cotton shortage in the world, especially during the American Civil War, and the connection of the region to the railway network in 1866, changed the fate of Mersin. During this period, Mersin rapidly became a port and trade center where Çukurova's agricultural products were exported. Mersin, where Türkiye's tallest skyscraper is located, is the fourth city after the three major cities where the State Opera and Ballet is located. Our city, known as İçel for many years, has been named after its central district, Mersin, in recent years. Districts of Mersin province; Akdeniz, Mezitli, Toroslar, Yenişehir, Anamur, Aydıncık, Bozyazı, Çamlıyayla, Erdemli, Gülnar, Mut, Silifke and Tarsus. The typical Mediterranean warm and temperate climate prevails in Mersin and its surroundings. Summer months are hot and extremely humid, and winter months are warm and rainy. 87% of the province's surface area is mountainous. Berdan Stream (268 km) and Göksu (90 km) are important rivers. Mersin province is located between 36-37° northern latitudes and 33-35° eastern longitudes. The land border of the province is 608 km, the sea border is 321 km, and its surface area is 15,853 km². A large part of Mersin province consists of the very high, rugged, and rocky Western and Central Taurus Mountains. Plains and gently sloping areas are developed in areas such as the city center, Tarsus, and Silifke, where these mountains extend towards the sea. Apart from this, the remaining flat or slightly sloping areas are seen among the mountains or in the higher parts of the north.

A large part of the plains in Mersin and its surroundings were formed by sediments carried by streams and depending on the slope on the southern foothills of the Taurus Mountains. These areas, which are very suitable for agriculture, extend as a strip, parallel to the mountains, from the Mersin-Adana border to Silifke. The two largest rivers of Mersin province are the Göksu River and Tarsus (Berdan) Stream. Apart from this, there are many large and small streams and streams flowing into the Mediterranean. Some of those; In Mersin: Mezitli Stream, Tece Stream, Mufti (Efrenk) Stream, Deliçay Stream; In Anamur: Anamur Stream, Sultan Stream, Melleç Stream; In Aydıncık: Menekşe, Gözsüzce Stream; In Bozyazı: Siniçay Stream, Aksaz Stream; In Erdemli: Alata Stream is Lamas Stream. Natural lakes in Mersin province; In Silifke: Akgöl, Keklik Lake, Paradeniz Lake; In Gülnar: Aygır Lake, Kamışlı Lake, Uzun Lake. In addition to these, there are Gezende and Berdan Dam lakes and many ponds built for irrigation purposes in the region. Forestry: Mersin province is very rich in forests. 55% of the land is covered with forests and shrubs. The coastal zone from Anamur to Tarsus is covered with shrubs (maquis). Among the maquis, there are wild olive and stone pines called "Delice". Dense forests are found from the Maquis belt up to an altitude of 2200 m, and stunted and sparse forests are found at higher elevations. Oak, gum, rosary, myrtle, and sandalwood trees are found in forests up to 600 m altitude. Various types of pine, fir and cedar trees are abundant at higher elevations. The area covered by forests is 785 thousand hectares, and the shrubland area is 100 thousand hectares. Every year, 3500 tons of resin and 250 thousand m^3 of industrial wood are obtained from forests (Anonymous, 2011).

9.2. Mersin Province Topography

Mersin province is located between 36-37° northern latitudes and 33-35° eastern longitudes. The land border of the province is 608 km, the sea border is 321 km, and its surface area is 15,853 km^2. A large part of Mersin province consists of the very high, rugged, and rocky Western and Central Taurus Mountains. Plains and gently sloping areas are developed in areas such as the city center, Tarsus, and Silifke, where these mountains extend towards the sea. Apart from this, the remaining flat or slightly sloping areas are seen among the mountains or in the higher parts of the north. Mountains: The Central Taurus Mountains separate Mersin province from the Central Anatolia Region. The highest point within the borders of Mersin province is Medetsiz Hill (3585 m) in the Bolkar Mountains. The heights decrease from the northeast to the northwest and south. From the Bolkar Mountains to the west, Kümpet Mountain (2473 m), Elmadağı (2160 m), Alamusa Mountain (2013 m), Büyük Eğri Mountain (2025 m), Kızıldağ (2260 m), Naldöken Mountain (1754 m), Kabaklı Mountain (1675 m) are important elevations. In addition, Karaziyaret Mountain, Tol Mountain, Sunturas Mountain, Balkalesi, Ayvagedigini, Makam Hill, and Kaşkaya Hill are other important heights extending towards the south. Gülek Strait (1050 m) from the northeast and Sertavul Pass (1610 m) from the northwest connect Mersin to Central Anatolia. Plateaus: Various plains have been formed in the upper parts of the Taurus Mountains under the influence of rivers, streams, atmospheric conditions, and faults in the region.

The height of these plains is 700-1500 m. It varies between. A large part of the plains in Mersin and its surroundings were formed by sediments carried by streams and depending on the slope on the southern foothills of the Taurus Mountains. These areas, which are very suitable for agriculture, extend as a strip, parallel to the mountains, from the Mersin-Adana border to Silifke. Depending on the residential areas, these are; They are called Yenice, Tarsus Mersin, Erdemli, and Silifke Plains.

9.3. Mersin Province Vegetation

We can examine myrtle vegetation in two ways. The first is general vegetation and the second is agricultural vegetation. In the general vegetation, maquis group vegetation is dominant. Maquis grows on wavy plains and can be seen up to 700 meters. After the maquis, the forest area begins. These are red pine, larch, cedar, fir, oak, juniper, oath, beech, hornbeam, and ash; are the main tree species of our forests. At altitudes exceeding 2000 meters, forests begin to become sparse and stunted. After 2500 meters, bushes and large grasslands are encountered. Additionally, according to botanical research, 115 endemic species grow in Mersin. Blue snowdrops, straillatrus orchid, sand lily, fenugreek, almond, and blueberry are examples of endemic plants (Anonymous, 2011).

9.4.Flora, Fauna, and Regionally Specific Agricultural Varieties

Mersin; Taşeli plateau, Mut line, and Bolkar Mountains show approximately 376 endemic plants and endemism rates around 20%. In this area, Amgdalus zielinskii, Quercus petrea subsp. In addition to endemic trees such as pinnatiloba and Pyrus syriaca, genera with many main endemic species such as Astragalus, Verbascum, Centaurea, Galium, Alyssum and Stachys live here. The order of endemic species collected from some plateaus in Gülnar, Bozyazı, Mut, Erdemli, Çamlıyayla, and Tarsus districts in danger categories is approximately as follows: LR (nt) 64 species, LR (cd) 27 species, LR (lc) 148 species, VU 46 species, EN 22 types, DD 11 types and CR 5 types. In addition, although not endemic, five of the rare species in the same areas fall into the DD category, six into the VU category, and one into the EN category. Apart from their scientific names, the uses of endemic plants among the public vary. Some of these plants are locally used: Myrtle Almond, Caper, Rock Grove, Cress, Asparagus, Thyme, and Sage. The animal world that develops and concentrates in a region, from single-celled animals, and zooplankton to mammals, constitutes the fauna of that region. Göksu Delta offers living, breeding, feeding, and accommodation opportunities for rare and endangered bird species. Protected sea turtles (Caretta-caretta) live on the beaches of Kazanlı, Göksu Delta, and Anamur, and the Mediterranean Monk Seal lives among Tasucu Anamur.

Flora: The forest formations formed under the influence of soil-climate and elevation in Mersin province are as follows:

Maquis Areas: There is maquis formation on 0-300 m and poor soils (less decomposed limestone). These plant communities, which are resistant to drought and many of which preserve their leaves at all times, include olive, carob, myrtle, holm oak, kermes oak, wild pistachio, sandalwood, thorn, etc. It consists of tree species. Maquis is a plant community unique to the Mediterranean.

Red Pine Forests: It is a drought-resistant tree species. These forests, mixed with oak and juniper at high altitudes, constitute 47.1% of the forests of our province.

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Juniper Forests: There are juniper forests at altitudes of 900-1500 m. Juniper forests form mixed forests with fir, cedar, and larch, as well as pure stands in large areas.

Fir Forests: At altitudes of 1000-1500 m, in humid and northern aspects, they generally form pure stands mixed with juniper, cedar and larch, and very few (Namrun-Çamlıyayla, Gözne).

Oak Forests: It is seen in places with better soil conditions and better humidity at altitudes of 1000-1400 m. Existing oak forests in our city have generally been destroyed for grazing purposes.

Cedar Forests: Cedar forests, which are an endemic species found only in the Taurus Mountains in our country, are a tree species with high economic value.

Black Pine Forests: It forms stands, generally pure and sometimes mixed with juniper, fir, and cedar, in Mut, Erdemli, Mersin, and Tarsus regions, localized in good moisture areas on good soil between 1000-1500 m altitude. There are cypress forests individually or in small groups along the Silifke Göksu Valley and Gülnar-Babadıl Stream, and yew trees in the Çamlıyayla-kadıncık Valley. In our province, there is a relict and endemic shrub species, Flueggea Anatolia Gemici, which was detected around the Kadıncık I Dam in Tarsus District in the 1990s. It is approximately 20 km from Çamlıyayla to the north. There is a main juniper (monumental tree) at the foot of the Bolkar Mountains and in the north of the Kadıncık valley. Today, it is a tree that is 1107 years old, 22 meters tall, and 3.5 meters in diameter.

Koca Katran (Big Sedir): Natural Monument is located in the Atuşluğu location in the Cocakderesi Valley, within the borders of Sebil Town of Çamlıyayla District of our city. Its area is 2500 m2. The tar tree, which gave its name to the Natural Monument, is a tree that was 620 years old in the year it was registered, has a height of 40 m, a diameter of 2.34 m, and a circumference of 2.34 m (Anonymous, 2011).

The Kadincik shrub (Flueggea Anatolia Gemini): is a relict and endemic shrub species that was recently discovered in our country. The only known distribution area of the species to date is around the Kadıncık I Dam in the Tarsus district of Mersin province.

Flowering ash tree (Fraxinus ornus): is a 5-10 m tall tree that blooms with white flowers between May and June. Yerköprü Waterfall Natural Monument has an extremely rich vegetation consisting of red pine trees as well as oak, boxwood, walnut, terebinth, fig, oleander, plane tree, chasteberry, hawthorn, mountain ash, pomegranate, judas tree and herbaceous species of gallows, tamarisk, caper and partridge has. In Cukurova, which is bordered by the Mediterranean and covers the Tarsus, Berdan, Silifke Plains of Mersin, and most of Adana, there is a vegetation cover, mostly dune, saline and aquatic, at altitudes of 5-10 m. Additionally, in areas overlooking the plain, it is approximately 100-200 m. as well as wall plants at a height of 200-300 m. It is possible to find a different plant spread consisting of *Tamarix smyrnensis, Salix alba, Populus nigra, P. tremula*, local *P. euphratica,* and *Cupressus sempervirens* in the Mut bridge, as in the Mersin Göksu coast. The vegetation layers in the Mediterranean Region can be called warm Mediterranean, main Mediterranean, upper Mediterranean, and Mediterranean mountain vegetation. The mountainous structure of the Mediterranean region has prepared the ground for the shelter of endemics that require very unique conditions to live. It has been determined that 213 of the 1053 species living on the Taşeli plateau are endemic. For example, Verbascum microcephalum (Anamur: Akpınar Plateau, 1900 m.) and *Astragalus thalassaus* (Anamur: Güneybahsis village, 1840 m.) are on the endangered list.

Marine flora: In general, the soft-ground infralittoral zone (between ~0 - ~-30 m.) in the entire Mediterranean is covered with Mediterranean endemic seagrass meadows (*Posidonia oceanica*), while it is covered with dense *Cymodosea nodosa* meadow in the east of Turgutlar Bay, which forms the eastern border of the species. The effects of these creatures, which have newly joined the regional ecosystem and found a place for themselves, on the natural balance are not yet known. However, it is possible that plants classified as invasive species, such as *Caulerpa racemosa* and especially *Caulerpa scalpeliformis*, which are observed to be rapidly expanding although they have just begun to be observed in the area, and species such as *Fistularia commersonii*, which are thought to have an impact on juvenile fish, will cause significant pressure on the ecosystem shortly. On the other hand, it is also known that the migratory mussel (Brachidontes variabilis), which is also a Lessepsian migrant, forms habitats with native algae species, especially Corallina mediterranea and Jania rubens, causing the enrichment of the mediolittoral (tidal zone) and upper infralittoral zone. Aydıncık coast is one of the rare areas with different features in the

Levant Sea. In addition to its structural similarities to the Levant coastal ecosystem (mediolittoral/tidal zone habitats formed by migratory mussels - *Brachidontes variabilis* and red algae - Corallina mediterranea and Jania rubens), it also has healthy Posidonia seagrass meadows, making the area very interesting in terms of marine biology. Triton (Charonia tritonis), Pina (Pinna nobilis), and Lagoon (Tonna galea) can be seen on Sancak Cape, at the exit of Gemikonagi and Kurtini bays and on Yılanlı Island. Just at the end of the face, It is possible to encounter sponges of the genus Axinella, which are endangered and threatened, in the soft ground following the shell sediment that begins (Anonymous, 2011).

Göksu Delta Flora: The natural vegetation of the Göksu Delta Special Environmental Protection Area, which is located at an average altitude of 2 meters above the sea, consists of dense dune plants and salt steppes together with the Mediterranean maquis formation. In addition to natural vegetation, there are also cultivated plants in the region. It has been determined that natural vegetation is concentrated especially in the form of beach dune vegetation. In addition to the rich flora in the sand structure, there are large amounts of fertile grasses, and large areas around Akgöl and Paradeniz in the south of the delta are covered with low and horizontal halophyte vegetation. There are a total of 442 plant species in the delta. 8 of these are endemic and 32 are rare and sensitive species. Göksu Delta is an area rich in biodiversity.

Fauna: The red-spotted trout, which is in danger of extinction, is a local species living in the Cennetdere and Kadıncık Valley Streams of Çamlıyayla district, where the population of the "red-spotted trout", also known as Dağalası, has started to increase. Turach birds, which are the common name for birds of the Francolinus species of the Phasianiadae family of the Galliformes group and resemble partridges, are around 25-40 cm long. The males of these birds have large beaks, strong legs mostly brown feathers, and spurs on their legs. Females are paler in color than males. They live in Asia and Africa. These species, which are increasingly becoming extinct in Türkiye, are specially protected and produced in the Tarsus Eucalyptus Forest Turaç Protection and Production Area in the Mediterranean and at the Tarsus Production Station in Tarsus Karabucak. 222 223 Biological Diversity Symposium - 2012 Proceedings The Taurus frog (Rana Holtz) is an endemic frog species from the Ranidae family, with an average length of 6 cm to 7.5 cm. Additionally, the only frog species in the world that does not sing is the Taurus frog.

While it is thought to live only in Çiniligöl (2600 m.) and Karagol (2500 m.) in the Bolkar Mountains in the Central Taurus Mountains, research conducted in 2007 found that this mountain is approximately 3000 m. It has been determined for the first time that it lives in Eğrigöl location at altitude. The habitat of Taurus frogs is very narrow, so their extinction is vulnerable to endangerment. The Red Hawk, which is frequently seen in the Taurus Mountains in our province, is a medium-sized and wide-winged predator. It is easily recognized by the black frame and red color on its wing feathers. Its mottled, light colors can be easily distinguished when flying or perching. It is the bird species with the best maneuverability among birds of prey, reaching an excellent speed of 320 km/h when diving. In the Kargıcak Gorge, crowded griffon vulture (*Gyps fulvus*) groups are observed during the periods when nomads engaged in animal husbandry come to the area (the maximum number of individuals counted at the same time is 24). At the end of summer, small flocks of falcon (*Falco eleonorae*) can be seen on the cliffs of the Ovacık peninsula, and small flocks of falcon (*Tadorna ferruginea*) can be seen in the Tisan Marshes during the breeding season (about to disappear) and on the shores of Dana Island. One of the summer visitors, the Little Vulture (*Neophron percnopterus*), shelters between Boğsak and Aydıncık. Distribution and Ecological Characteristics The Wild Goat, a species distributed in the Mediterranean and Black Sea Mountains, is the wildest and most timid of the hunting animals. Sensations that no other animal has been concentrated in the wild goat. Among the wildlife protection areas in the province, only the Çamlıyayla / Cocak-Cehennem Creek Mountain Goat protection area has been opened to hunting tourism.

Marine fauna: Kazanlı Beach in the center of Mersin in our province, Alata Beach in Erdemli District, Göksu Delta in Silifke District, and Anamur beach are important breeding beaches for both types of sea turtles (Caretta caretta and Chelonia mydas), mainly loggerhead sea turtles. Mersin Province, Anamur District. A very significant part of the Mediterranean monk seal (*Monachus monachus*) colony, which is the most populous and continuously breeding known on the Turkish coast, called the Kiliya colony, is located in this area. There is a bottlenose dolphin (Tursiops truncatus) family of 5-6 individuals that can be observed throughout the year on both sides of Kızılliman Cape and around Aksan Island. Among the marine creatures seen in Anamur and Kızıliman Capes are Risso's dolphin (Grampus griseus), Cuvier's dolphin (*Ziphius cavirostris*); Also, long whales (Balenoptera physalus) are seen in flocks. Long spined sea urchin (*Centrostephanus longispinus*) and Triton (*Charonia tritonis*), which are among the endangered and threatened species, can be commonly seen around Dana Island and Beşparmak Island and in the infralittoral zone, which is an extension of cliffs. It is possible to come across Pina (*Pinna nobilis*), Abalone (*Tonna galea*), and Seahorse *(Hippocampus ramulosus*) in the infralittoral zone with soft ground and especially in the Cymodosea nodosa meadows. *Axinella cannabina* and *Axinella polypoides* can be seen from the branch sponges, starting from the deep border (~33m) of the infralittoral zone, where the sea lilies end. Among the birds, Gray Shearwater (*Calonectris diomedea*) can be seen in the open sea, and Crested Cormorant (Phalacrocorax aristotelis) can be seen on rocky shores and especially on Dana Island and Beşparmak Island. Sea urchin (*Paracentrotus lividus*), Blackfish (*Scyllarides latus*), Grouper (*Epinephelus marginatus*) and Eskina (*Umbrina cirrosa*), which are sensitive species in the rocky infralittoral, are frequently seen. Since the region is located on the eastern border of the tuna breeding area in the Eastern Mediterranean, it is possible to encounter crowded schools, especially between May and July. Gilindire islands, known as Aydıncık islands, are one of the few breeding areas of the Island Gull (*Larus audouinii*) in the Eastern Mediterranean. In areas where the surface is shallow, the infralittoral region is covered with healthy and lush seagrass meadows (*Posidonia oceanica*). Seahorses (*Hippocampus ramulosus*) and Green Sea turtles, which use the area for wintering purposes, are encountered in the meadow, at 20-30 meters towards the lower border of the infralittoral. Sea urchin (*Paracentrotus lividus*), Blackfish (*Scyllarides latus*), Grouper (*Epinephelus marginatus*) and Eskina (*Umbrina cirrosa*), which are sensitive species in the rocky infralittoral, are frequently seen. Since the region is located on the eastern border of the tuna breeding area in the Eastern Mediterranean, it is possible to encounter crowded schools, especially between May and July. Eel (*Anguilla anguilla*), gray mullet *(Mugil cephalus*), blackfish (*Glarias lasera*) and carp (*Cypinus carpino*) are caught in Akgöl. From the Paradeniz, sea bream (Sparus aurata), sea bass (*Dicentrachus labrax*), sinagrit (*Dentex dentex*), sharpsea (*Cantharus lineatus*), bream (Diplodus vulgaris), melenuria (*Oblada meleruda*), yelloweye (*Diplodus sargus*), striped coral (*Lithognatus mormyrus*), coral (*Pagrus pagrus)* are hunted. Taşucu Bay hosts the Mediterranean Monk Seal (*Monachus monacus*) community, which is the easternmost part of the Turkish coast. Dolphin species can also be seen on the coast, especially in winter. 633 vertebrate and invertebrate species have been identified in the Göksu Delta. The delta is considered one of the most important wetlands in the Mediterranean and Europe in terms of ornithological importance. 328 of Türkiye's birds, consisting of 450 species, can be seen in the Göksu Delta. Sazhorozu (Porphyrio porphyrio) has become the symbol of Göksu Delta and is a species constantly watched by bird watchers. Göksu Delta and the hills surrounding it host a very diverse and dense reptile population. In addition, Göksu Delta is one of the 17 designated sea turtle breeding areas along the Turkish coast.

Insects have a very important place in the food chain of the Göksu Delta due to their very different diets. 215 identified species belonging to 99 families belonging to 10 orders were found in the delta. In Göksu Delta; Four species of frogs have been identified: Night Frog (Bufo viridis), Plain Frog (*Rona ridibunda*), Earth Frog (*Pelobates syriacus*) and Tree Frog (*Hyla savignii*) (Anonymous, 2011).

10. Current Agricultural Situation of Mersin Province

Located in the Mediterranean Region, Mersin constitutes 2% of Türkiye's total surface area with a total surface area of 1,585,300 hectares. 53% of the total surface area is forest land, 21% is agricultural land, 22% is non-agricultural land, and 4% is meadows and pastures. The land suitable for agriculture in Mersin is 406,000 hectares, of which 267,643 hectares (66%) are dry agriculture and fallow areas, and 138,357 hectares (34%) are irrigated agricultural areas (Figure 6) (Anonymous, 2022).

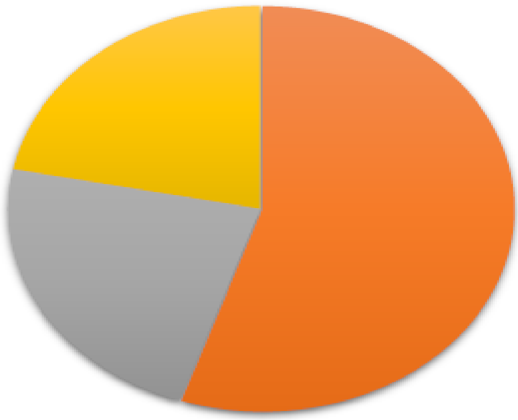

Figure 6. Land assets in Mersin province (Anonymous, 2022).

Non-agricultural land includes urban settlements and areas that are not suitable for agriculture. These lands may show some minor changes over the years, albeit partially. While the development of urban settlements may increase this rate, new areas opened for agriculture may cause the rate to decrease.

Table 4. Distribution of agricultural areas in Mersin province according to types (hectares) (Anonim, 2022).

	2021	2022	Change (%)	Share in Türkiye (%)
Fruits, Beverage, and Spice Plants Area	154.248	157.715	2	4
Fallow Field	28.208	30.017	6	1
Vegetable Field	31.063	29.046	-6	4
Ornamental Plants Area	105	127	21	2
Cereals and Other Plant Products Area	117.903	112.408	-5	1

When the distribution of agricultural areas in Mersin province according to their types is examined (Table 4), our city has a significant size throughout Türkiye with its fruit and vegetable areas. In 2022, all agricultural areas in our province, except the "area of cereals and other plant products" and "vegetable area", have expanded. The decrease in the area of grains and other plant products within agricultural areas in 2021 continued at the same pace in 2022 (Anonymous, 2022).

Table 5. Distribution of Mersin Province Agricultural Areas by Districts in 2022 (Hectares) (Anonim, 2022).

Districts	Fruits, Beverage, and Spice Plants Area	Fallow field	Vegetable field	Orn. Plants Area	Cereals and Other Plant Products Area	Change according to 2021 year(%)	Share(%)
Akdeniz	8.012	0	3.467	20	242	-7	4
Anamur	9.970	2.600	50	0	8.813	4	7
Aydıncık	528	3.047	478	1	1.872	6	2
Bozyazı	1.880	1.500	646	0	2.825	-2	2
Erdemli	**14.998**	**2.500**	**6.089**	**5**	**2.573**	**-2**	**8**
Gülnar	9.041	82	84	0	9.912	2	6
Mezitli	4.409	71	562	2	92	-7	2
Mut	44.035	3.724	1.789	0	21.537	-3	22
Silifke	14.808	15.076	3.178	0	17.447	3	15
Tarsus	41.672	930	12.542	93	46.126	1	31
Toroslar	5.623	450	52	7	245	-22	2
Yenişehir	2.180	3	83	0	489	0	1
Çamlıyayla	560	35	26	0	236	-11	0
Toplam	**157.715**	**30.017**	**29.046**	**127**	**112.408**	**-1**	**100**

On a district basis, the district with the largest share in agricultural area is Tarsus with 31%, Mut with 22%, and Silifke with 15%. Looking at the annual change in agricultural areas by districts, a contraction in agricultural areas was observed in seven districts compared to the previous year (Table 5). This situation was mainly affected by the decrease in fruit areas in Mut and Toroslar districts. The planted area of grains and other plant products is concentrated in Tarsus, Mut, and Silifke, the vegetable area is concentrated in Tarsus and Erdemli, the area of fruits, beverage, and spice plants is concentrated in Mut and Tarsus, and ornamental plants are concentrated in Tarsus districts (Anonymous, 2022).

11. ERDEMLI PROVINCE

11.1. History

After the declaration of the Republic of Türkiye, it was a small settlement in Silifke District, but it became a district on June 1, 1954. It has significant development potential in terms of tourism, historical riches, and natural beauty. Erdemli is a district located 37 km west of Mersin and on the Mediterranean coast. The abundance of historical and touristic places within the district borders and the fact that a large part of the citrus production is grown in this district reveals the important position of the district within the province. Although it is not known exactly where the name Erdemli comes from, it is stated that it comes from the name of a Turkmen tribe called "Erdemoğulları" (tribal lord named Erdem Bey), which is thought to have come from Central Anatolia in the 15th century. Virtuous; It lived through the times of the Hittites, Seleucids, Romans, Byzantines, Egyptians, Karamanids and Ottomans. Erdemli, which was a village until 1953, was a small settlement in Silifke District, but it was established as a district on June 1, 1954, by merging Silifke's Yağda District and Mersin's Elvanlı District. Erdemli is surrounded by Mersin to the east, Silifke to the west, Karaman and Konya to the north, and the Mediterranean to the south. Its surface area is 2,078 km2. 62% of this area is forest, 17% is agricultural land, 21% is pasture, stony and rocky.

The plain part of the district is under the influence of a warm and temperate subtropical climate. Summers are hot and extremely humid, and winters are quite warm and rainy. The high mountainous region is cool and rainy in summer, and snowy and cold in winter. The hottest months of the district are July and August (average around 28°C), and the coldest months are January and February (average 15.5°C). The average annual temperature oscillates around 20.23°C. Precipitation occurs mostly in winter and spring. The average annual precipitation is 1,480 mm. The amount of precipitation between the driest and rainiest months of the year: is 126 mm. The average temperature varies around 16,8 °C throughout the year.

11.2. Erdemli District Agricultural Potential

Of the district's 2 million 78 thousand decare surface area, 877 thousand 644 decares are arable land. According to the data received from the District Directorate of Agriculture, the agricultural map of the district can be seen in the tables below.

Figure 7. Mersin Province agricultural product pattern map

Erdemli, an important district of Mersin in terms of agricultural production, is among the largest sources of income in the district with the agricultural activities carried out. Erdemli has a very important potential, especially with citrus production (Figure 7). Erdemli, which has a significant portion of the citrus production in Mersin, has a large capacity, especially in lemon production. With lemon production, Erdemli not only generates income in terms of exports but also creates income by providing job opportunities for people. Considering the districts of Mersin, Erdemli ranks in an important place in terms of total cultivated agricultural areas. The current agricultural areas of Erdemli district are given in Table 6. It is very important that among the 13 districts of Mersin, Erdemli ranks fifth in terms of total cultivated agricultural area and perennial plant area. Erdemli district is also in a very important position compared to other districts in our country. Erdemli ranks 19th among 872 districts in our country, proving that it has a large share in production (Ege ve Caba, 2018).

Table 6. Erdemli district agricultural areas (2022) (Tuik.gov.tr)

Product	Area (Decare)
Fruits, Beverage, and Spice Plants Area	149.982
Fallow field	25.000
Vegetable field	60.886
Ornamental Plants Area	48
Cereals and Other Plant Products Area	25.732
Erdemli irrigated agricultural area	**203.006**
Total dry area	**674.639**

In the dry farming areas of the district, especially in the plateau villages, grain and chickpea cultivation and partly greenhouse vegetable cultivation are carried out. Citrus cultivation is carried out in the area starting from the Çeşmeli neighborhood, which forms the coastline of the district and extends to the Kızkalesi neighborhood, and lemon cultivation comes first. The lemon harvest in 2018 was around 450,000 tons and is the locomotive of the region's economy. Field crops, vegetable, and fruit production amounts of Erdemli district are given in Table 7, Table 8, and Table 9.

Table 7. Erdemli district field crops production amounts (2022) (Tuik.gov.tr)

Species	Produce amount (Ton)
Wheat, Except Durum Wheat	3.590
Barley	174
Cheakpeace	14
Vetch	42
Clover	138
Sainfoin	675
Sweetcorne	957

Table 8. Erdemli district vegetable crops production amounts (2022) (Tuik.gov.tr)

Species	Produce amount (Ton)
Tomatoes	**589.457**
Cucumber	**27.715**
Green beans	20.900
Lettuce	11.455
Pepper	10.153
Cauliflower	10.125
Broccoli	5.875
Courgette	1.406
Kidney bean	840
Onion	54
Broad beans	15
Garlic	9
TOTAL	678.004

Table 9. Erdemli district fruit crops production amounts (2022) (Tuik.gov.tr)

Species	Produce amount (Ton)
Lemon	**324.277**
Apple	48.985
Peach	18.408
Banana	12.488
Olive	6.519
Orange	5.869
Grape	5.219
Cherry	4.622
Mandarin	3.005
Plum	2.985
Kiwi	2.579
Maltese plum	1.595
Pomegranate	1.117
Walnut	1.100
Nectarine	1.095
Avocado	983
Apricot	592
Carob	556
Pear	459
Almond	289
Quince	177
Fig	161
TOTAL	**443.797**

11.3.Virtuous Animal Husbandry Potential

Dairy farming and beef cattle farming are generally carried out in the district. Dairy farming is done as a family business. As a result of artificial insemination studies carried out for a long time, 95% of the cattle in the district have been converted into cultural hybrids. Tosun fattening is done in closed barns in enterprises with 10 to 100 heads. The district is also a winter accommodation center for migratory beekeepers due to its rich flora and climate. In Table 10, information about the animal species and numbers in Erdemli district is given.

Table 10.Virtuous animal existence of Erdemli

Animal species	**Number (Arch-Colony)**
Cattle	9,975
Sheep	106,975
Goat	144,781
Beehive	52,362
Equid (Horse, donkey, mule)	40

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