This project is co-funded by the European Union and the Republic of Turkey

Practicability of the EU Natura2000 Concept in the Forested Areas of Turkey

Civil Society Dialogue
EU Nature Conservation in Turkey Forests Project

Practicability of EU Natura 2000 Concept in the Forested Areas of Turkey

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The project "Practicability of EU Natura 2000 concept in the forested areas of Turkey"is carried out within the framework of the Civil Society Dialogue Program, which is co-financed by the European Union. The program, Turkey and the European Union member country from civil society organizations come together around a common theme, communities of mutual recognition, mutual exchange of information and was developed as a platform to establish permanent dialogue. The Ministry of the European Union is responsible for the technical implementation of the program and the Central Finance and Contracts Unit is the Contracting Authority of the Program.

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Practicability of the EU Natura2000 Concept in the Forested Areas of Turkey

PREFACE

This book has been prepared to present the scientific research activities under the project titled "Practicability of the EU Natura2000 Concept in the Forested Areas of Turkey" which has been completed between 15/02/2016 and 14/08/2017 with the support of the agreement no. TR2011/0135.15-01-2016 in the scope of the "Civil Society Dialogue between EU and Turkey Grant Scheme (CSD-IV/ENV)" of the European Union (EU). Turkish Association of Foresters was the beneficiary, Karabük University and NABU Germany were the co-beneficiaries in this project. The Eğriova and Kavaklı forests in Karabük and Yenice were selected as sampling forest sites where the project objectives were overseen, and all scientific activity took place in these sites.

Turkey is the leading country among EU member states in terms of the number of vascular plants and vertebrate-invertebrate animals per country. One of the major reasons for this rich diversity of species is the natural habitats with various climatic and geographical characteristics. Natura 2000 sites have a close relationship with the forest areas in EU member states. As of 2015, the ratio of total forest areas of member countries in Natura 2000 is 49%. It can be easily seen that this is a very high ratio in other land covers. The tree species in forests of Turkey and their habitat types have not been defined in the EU habitat directives. The protection of the diversity of habitats which is based on woody species that proliferate in various biogeographical regions in forests of Turkey entails significant opportunities as well as challenges for the EU in terms of Turkey and the Natura 2000 concept. Turkey became a party to the EU Natura 2000 concept in 1998. It is still a current issue since 2008 as a subject of approximation that has to be improved in the EU accession process. This project aims to identify the capacity of Turkey for selection of Natura 2000 sites in forest areas and to reinforce civil dialogue on the basis of EU policies on nature protection in forest areas of Turkey. In this framework, like in other European countries, assessments have been performed on the scientific, technical and administrative capacity to identify Natura 2000 sites and on improving participating approach of the civil society about the issue.

In chapter one, Stefan KREFT and Cumhur GÜNGÖROĞLU present some overall conceptual and legal information for Natura 2000, and more detailed information on selection of Natura 2000 sites. This chapter also presents the relationship between forestry and Natura 2000 sites. Chapter two presents vegetation units and characteristics of vegetation studies in the project application sites conducted by Sevda TÜRKİŞ. Chapter three presents a classification of habitat types of tree species in Karabük and Yenice forests, under Natura 2000 habitat directives by Cumhur GÜNGÖROĞLU, Sevda TÜRKİŞ and Erwin BERGMEIER. This study also presents the way of identification and classification of Natura 2000 habitats which will cover the western Black Sea region. Chapter four presents the results of the studies on mammal and bird fauna in the project sites conducted by Şafak BULUT and Murat DOĞAN. According to this study, there are bird and mammal species that will form a basis for creation of Natura 2000 sites in the project sites. Chapter five presents the results of the activities undertaken by Cumhur GÜNGÖROĞLU and Ufuk COŞGUN to evaluate the Natura 2000 practices with the local stakeholders in the project site. The last chapter presents Turkish forest habitat types of the EU Habitats Directive by Erwin BERGMEIER and Helge WALENTOWSKI and Cumhur GÜNGÖROĞLU which will offer a basis for the classification and identification of Natura 2000 forest habitat types in Turkey. It contains an annotated catalogue and suggestions for an upgrade of Turkish forest habitat types. This study has been included in this book to contribute to forestry in Turkey, in the scope of EU habitat classification.

I would like to thank Serkan AYKUT, who offered the most important basis for this book and who undertook the administrative and budget expenses in the abovementioned project and prepared the financial report; to A. Ozan ÇEKİÇ, Industrial Engineer of Forests and the chairman of the executive board of the association who seamlessly facilitated communication with the Undersecretary of Treasury, Central Financing and Procurement Unit and EU Ministry, Civil Society Dialogue; To Nihat ÖZ, Senior Forest Engineer and the second chairman of the Turkish Association of Foresters who coordinated the project on behalf of the executives of the association; to Prof. Dr. M. Bahattin ÇELİK, the dean of the Faculty of Forestry at Karabük University, who facilitated communication with the rector's office for project issues and made efforts to invite participants to meetings and workshops; to Asst. Prof. Ufuk COŞGUN, Lecturer at Department of Forest Engineering who moderated the interviews with village headmen in project sites; to Asst. Prof. Murat ALAN, for the opinion and recommendation of the visit to Germany; to Dominik SOPART who helped organize the training activities held in Berlin by NABU Germany; to Nils HORSTMEIER, the NABU expert who contributed to the exhausting administrative and technical tasks of the project partnership on behalf of NABU and who made a presentation at the workshop in Karabük; to Charlotte von MÖLLENDORFF, the NABU expert who made presentations at the workshop in Karabük and at the closing meeting in Ankara; and to all authors of chapters who contributed to this book, to Serkan ŞAHİN facilitating the translations, for their assistance and efforts.

I hope this book will be beneficial for relevant non-governmental organizations, practitioners at public and private organizations, to academics and to students...

Cumhur GÜNGÖROĞLU
Editor / Project Manager

CONTENTS

NATURA 2000 – AN OVERVIEW

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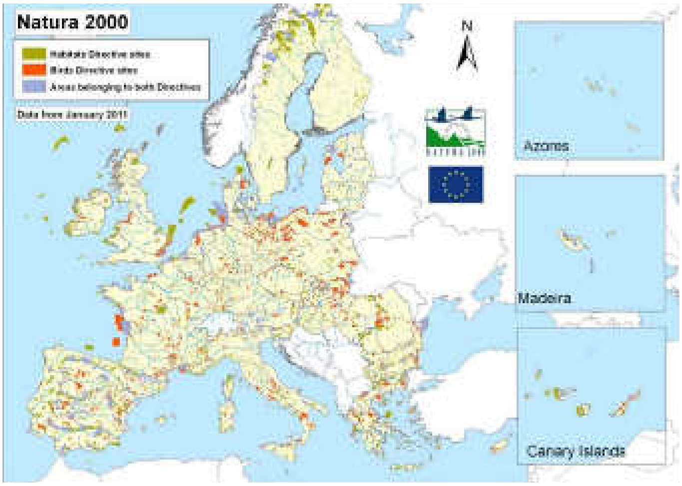
Abstract

Since 1992, Natura 2000 sites form the European Union-wide network of protected areas. Natura 2000 is aimed to conserve ecosystems (‘habitats’) and species of outstanding conservation importance by applying appropriate measures for their protection and restoration. The underlying legal framework is composed by the Habitats Directive (of 1992) and the Birds Directive (of 1979), regulating the designation of Special Areas of Conservation (SAC) and Special Protection Areas (SPA), respectively. The conservation objects are listed in annexes to these directives, namely 233 habitat types, 194 bird species and subspecies and approx. 900 species of taxonomic groups of plants, fungi and other animals. The total number of Natura 2000 sites to date is 27,522, covering 18.15% of land area of the EU. Selection of Natura 2000 sites follows criteria such as the size of a habitat type within a prospective Natura 2000 in relation to its total area size in the country, and the local conservation status. In birds, criteria address endangerment, vulnerability, rarity and given special conservation requirements of a population or species. Considerable differences between Member States regarding Natura 2000 exist. For example, percentages of Natura 2000 coverage vary from 10% to over 35%, and some countries have chosen to include relatively wide buffers in Natura 2000 site design, while others have not. Administrations of Member States are obliged to prevent the conservation status of any conservation objects in Natura 2000 site from deteriorating, and shall strive for their favourable conservation status. The other important goal established in the Habitats Directive is the coherence (ecological connectivity) of Natura 2000. Among ecosystems in the EU, forests cover 49% of the total Natura 2000 area. Of all forests in the EU, 21% are protected in Natura 2000. As long as the conservation obligations are met, economic and social functions of forests may be considered, for example, forestry for commercial purposes. Every Natura 2000 site has to have a management plan. Management success and compliance with the goals of the directives are monitored for species and habitat types at each site and reported to the EU Commission every six years. Examples for important achievements of Natura 2000 are a substantial increase of protected area coverage, the slowing down or even reversal of negative trends of a number of Annex habitat types and species locally or even across most of the EU, and a better collaboration between conservation actors across Member States. Remaining room for improvement for conservation of EU biodiversity concerns, for example, continued deterioration of some Annex habitat types and species, or a lack of equitable societal participation in site designation and site management.

1. INTRODUCTION

Natura 2000 sites compose the European Union-wide network of protected areas. Natura 2000 has been established since year 1992 pursuant to the Habitats Directive of the same year (Council 1992) and the 1979 Birds Directive (Council, 2009) (European Commission, 2002), commonly subsumed as the EU Nature Directives. According to these laws, management of Natura 2000 sites follows the guiding principle that conservation of biodiversity has priority in managing natural resources (European Commission, 2003). The regulations of the Nature Directives have to be translated into the national legislative framework of the EU Member States (Verschuuren, 2002). Natura 2000, in effect, constitutes a key conservation policy instrument of the EU. More specifically, Natura 2000 is aimed to conserve ecosystems ('habitats'[1]) and species of outstanding conservation importance throughout the EU by applying appropriate measures for their protection and restoration. As of February 2017, the total number of terrestrial and marine Natura 2000 sites taken together is 27,522 (Fig. 1, Sundseth, 2017). The proportion of terrestrial Natura 2000 sites designated under the Habitats Directive is approx. 80%, compared to 20% of sites being designated under the Birds Directive. In sum, Natura 2000 covers 18.15% of land area of the EU (European Commission, 2017), with considerable spatial overlap between both categories (Fig. 2).

Figure 1. Nature 2000 sites of the European Union (Sundseth, 2012)



1. 'Habitat' in the Habitats Directive actually means ecosystem. This old usage of 'habitat', albeit misleading, is maintained here to keep consistency with the legal texts.

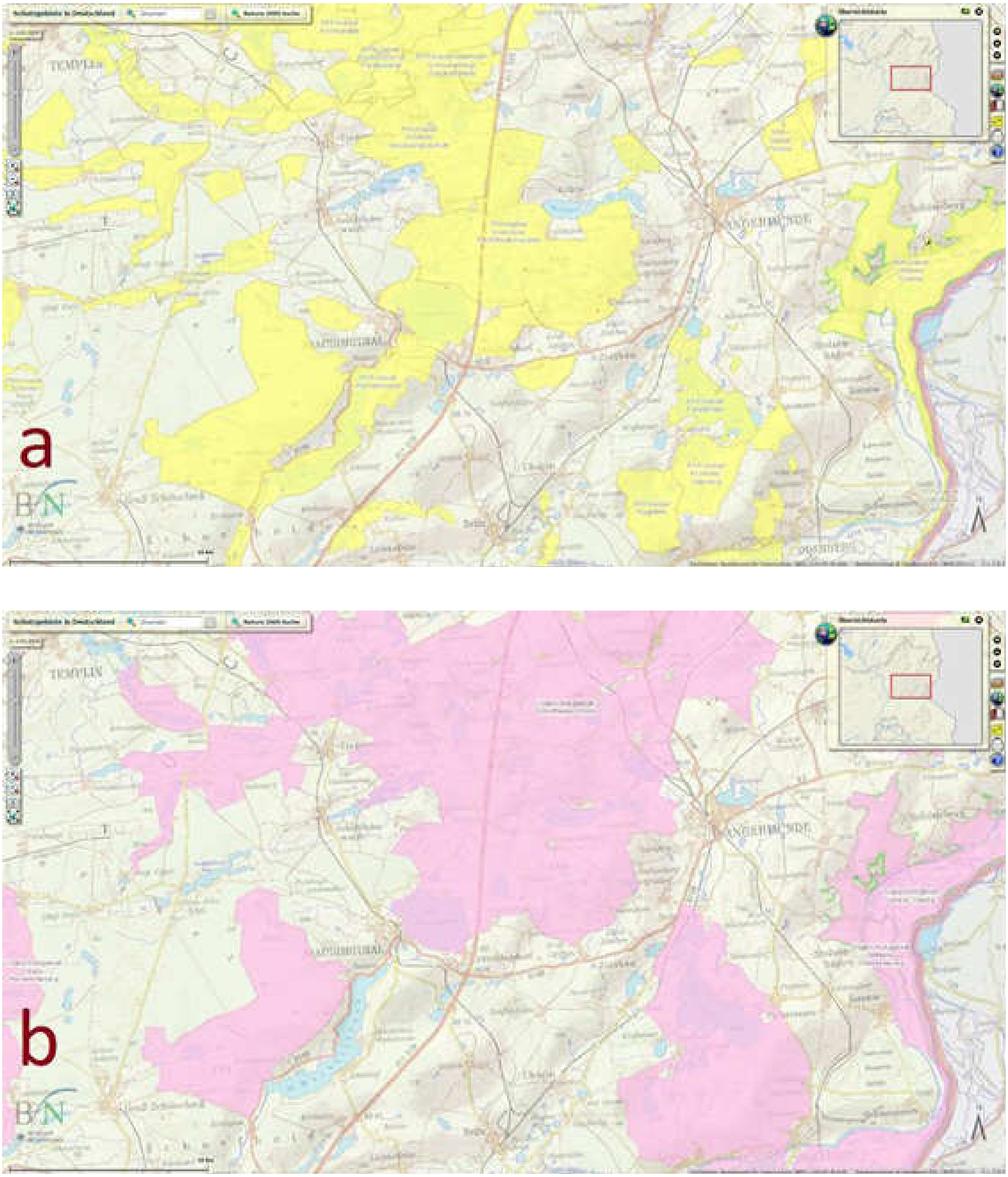


Figure 2. Example from Brandenburg, northeastern Germany, for spatial overlap of SACs (a) and SPAs (b) (BfN, 2017)

2. SELECTION AND DESIGNATION OF NATURA 2000 SITES

According to Article 3 of the Habitats Directive, Natura 2000 is a coherent European ecological network of Special Areas of Conservation (SAC) and Special Protection Areas for birds (SPA). SACs are sites to protect plants, animals (other than birds) and ecosystems (or parts thereof) of EU importance as designated by the Habitats Directive. SPAs are sites of conservation value for rare and threatened European bird species designated under the Birds Directive (Trochet and Schmeller, 2013). While the designation of SPAs is based on the presence of bird species listed in the annexes of the Birds Directive including a validation stage of the EU, SAC designation under the Habitats Directive is more complex and involves several stages (Figure 3; Trochet and Schmeller, 2013; Tworek et al., 2014).

The procedure for site selection involves two separate stages: In stage one, the EU member states identify proposed Sites of Community Importance (pSCIs) for inclusion in the Natura 2000 network and submit them to the European Commission together with the supplementary data and maps. In stage two, the sites are assessed at EU level for their EU-wide importance. The European Commission, in conjunction with the member states, adopts a list of SCIs for each biogeographical region, which then becomes part of the network (Article 4-2 of the Habitats Directive). Assessment of the pSCIs in both stages is conducted in accordance with the criteria set out in Annex III of the Habitats Directive (Tworek et al., 2014). Once the lists are completed, the member states are required to comply with the provisions of national legislation to place their respective sites under protection as Special Areas of Conservation (SACs) within a period of six years.

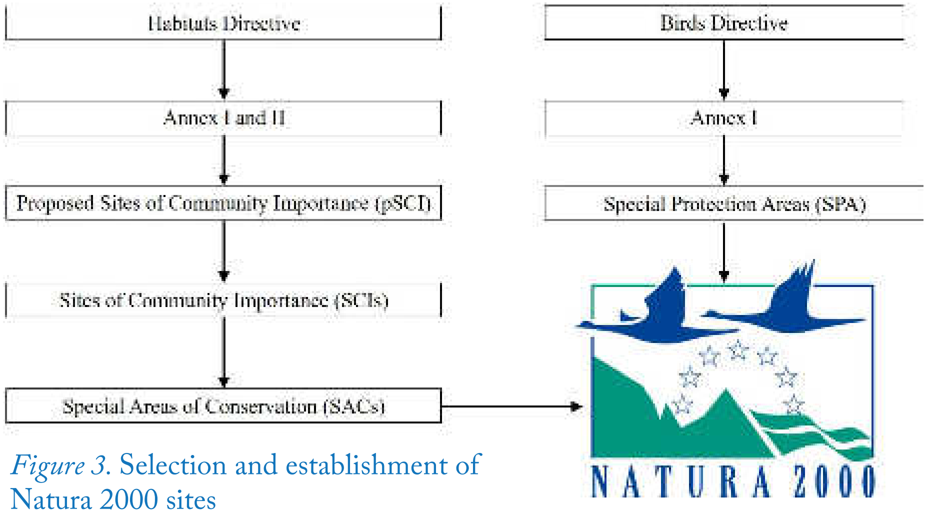


Figure 3. Selection and establishment of Natura 2000 sites

There are major criteria set out by the EU Nature Directives to be used while selecting EU Natura 2000 sites (Figure 4). The criteria to be considered for habitat types and species in the selection of pSCI, SCIs and SACs within the scope of the Habitats Directive necessitate fairly systematic scientific research. Most importantly, both the total area size of habitat types in a country, and their size within a (prospective) Natura 2000 site, their local conservation status and the destruction levels are to be documented. In terms of species, there should be sufficient information about the population sizes and distributional ranges of species as well as their conservation status. These assessments, together with basic information about a specific Natura 2000 site, such as location, delineation, area size, are documented in a so-called "Standard Data Form" (EC, 2011).

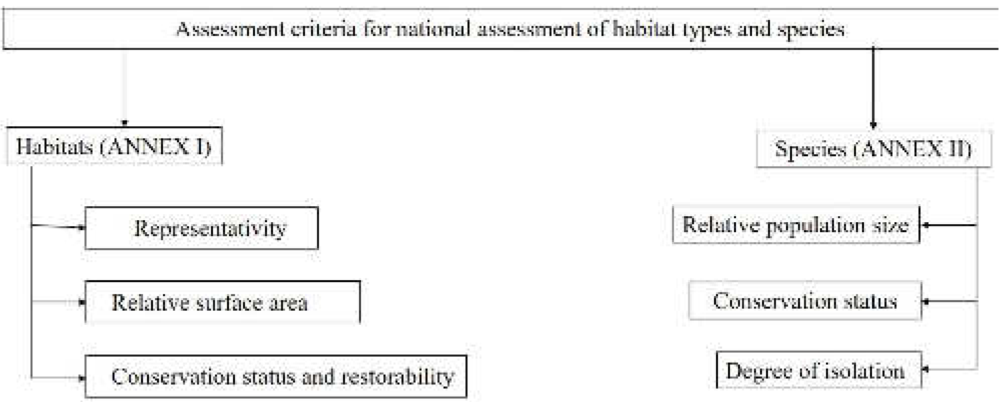


Figure 4. The assessment criteria set out by the Habitats Directive for selection of Natura 2000 sites. All three criteria are integrated into a global assessment of the habitat type or species concerned

2.1 ASSESSMENT CRITERIA FOR NATIONAL ASSESSMENT OF ANNEX I HABITAT TYPES (HABITATS DIRECTIVE)

1. *Representativity.* Degree of representativity of the occurrence of the listed habitat type in the pSCI, in relation to the overall occurrence of that habitat type in the physiographic province or biogeographical region.

2. *Relative surface area.* Area of the pSCI covered by the habitat type concerned in relation to the total area covered by that habitat type in a country.

3. *Conservation status and restorability.* Degree of conservation and restoration possibilities of the habitat type concerned in the pSCI. The 'conservation status' of individual sites in relation to habitat types can only be assessed with detailed local knowledge.

2.2 ASSESSMENT CRITERIA FOR NATIONAL ASSESSMENT OF ANNEX II SPECIES (HABITATS DIRECTIVE):

1. *Relative population size.* Population size of the species present on the proposed SCI in relation to the populations present within the national territory of a country. The relative population sizes of the individual species are also determined by the EU Member States.

2. *Conservation status.* Degree of conservation of the features of the habitat type which are important for the species concerned and restoration possibilities on the proposed SCI. The 'conservation status' of individual sites in terms of their importance for species can only be assessed with detailed local knowledge.

3. *Degree of isolation.* Degree of isolation (chorological situation) of the population present in the pSCI, in relation to the natural range of the species.

2.3 ASSESSMENT CRITERIA FOR ANNEX I (BIRDS DIRECTIVE)

The assessment criteria, as established in Article 4(1), for bird species and subspecies (see below: Biodiversity targeted under Natura 2000) listed in Annex I of the Birds Directive, read as follows:

1. *In danger of extinction;*

2. *Vulnerable to specific changes in their habitat;*

3. *Considered rare because of small populations or restricted local distribution;*

4. *Requiring particular attention for reasons of the specific nature of habitat.*

3. NATIONAL DIFFERENCES

The EU Nature Directives incorporate two contrasting principles to be balanced. On the one hand, the Nature Directives provide rather strict rules (Verschuuren, 2002). One example are exact timelines to be kept by Member States in the process of site selection and designation (see above) as well as reporting (see below: Forests in the Natura 2000 network). Another example consists in that all Member States have to convert EU conservation regulations into their national law. A third example is the required indisputability of Natura 2000 site delineation. Strictness of these rules ultimately allows the EU Commission to sue a Member State in cases of infringements (Verschuuren, 2002). On the other hand, the 'subsidiarity' principle concedes to the EU Member States the right to design a suitable national policy for implementation. Factors that influence national policies for Natura 2000 implementation, among others, may consist in the ecological conditions present in a country, in its land use history, current socioeconomic structures, or in the existent legal framework.

Considerable differences between Member States in the manifestation of Natura 2000 result from these national particularities (Evans 2012). Regarding proportion of Natura 2000 of the territory of a Member State, numbers range from under 10% (Denmark, United Kingdom) to over 35% (Croatia, Slovenia; Evans 2012, Sundseth 2017). Variation of mean Natura 2000 area sizes between Member States is similarly broad. While average sizes of Natura 2000 sites in several countries exceed 10,000 ha (more than 35,000 ha in Portugal), mean sizes of sites in other countries stay under 1,000 ha. In this context, it should be noted that some countries have chosen to include relatively wide buffers in Natura 2000 site design. In contrast, site delineation in other Member States is rather 'minimalistic' (European Commission, 2017).

4. GOALS OF BIODIVERSITY CONSERVATION IN THE NATURA 2000 NETWORK

4.1 CONSERVATION GOALS

Member States are obliged to prevent the conservation status of any Annex habitat types and species at any Natura 2000 site from deteriorating. Member States shall also strive for a favourable conservation status of all Annex habitat types and species. It should be stressed here that these obligations lie with the state administrations, not with the land users. Public administrations thus have to seek an appropriate management of Natura 2000 sites that secures achievement of the above-mentioned goals. The other important goal established in the Habitats Directive is the coherence of Natura 2000, i.e. development towards ecological connectivity. In order to achieve these goals, Member States are obliged to assess the potential impacts of prospective projects on a corresponding Natura 2000 site (Verschuuren, 2002).

4.2 BIODIVERSITY TARGETED UNDER NATURA 2000

Annex I of the Habitats Directive lists 233 habitat types. These fall into nine broader habitat classes, such as "Coastal and halophytic habitats", "Natural and semi-natural grassland formations", and "Forests" (Council, 1992). Habitats Directive Annex II contains approx. 900 species of different taxonomic groups of plants, fungi and animals (excluding birds). The Birds Directive, in its Annex I, lists 194 bird species and subspecies that shall receive adequate protection in Natura 2000 sites (Council, 2009). There is a number of so-called "priority" habitat types and birds, which means the directives consider them as especially vulnerable or endangered (Verschuuren, 2002). In addition, according to the Birds Directive, sizeable occurrences of migratory bird species shall also be protected within Natura 2000. In accordance with Article 4 (1) of the Directive, "the most convenient zones in terms of number and size" should be declared as SPAs (Council, 2009). New Member States can propose additional habitat types and species to be included in the annexes of both directives (Evans, 2012).

5. FORESTS IN THE NATURA 2000 NETWORK

5.1 REPRESENTATION OF FORESTS IN NATURA 2000

Forests cover approximately 42% of terrestrial EU (European Environment Agency, 2006). With 49% coverage, forests are even more predominant in Natura 2000 (European Commission, 2015). Of all forests in the EU, 21% are protected in Natura 2000 (Sundseth, 2015). Taking Germany as an example, 48% (26,550 km^2) of the total terrestrial Natura 2000 site complex (55,142 km^2) is forest. Of the total forest area in Germany, 24% are found in Natura 2000.

Natural forest is virtually absent in the EU, and 87% is currently being more or less intensively managed (European Commission, 2015). For centuries, these forests have been influenced by human intervention due to their multiple functions providing economic, cultural and environmental benefits. Today, they still continue to play an important role in supplying renewable raw materials and economic development, employment and prosperity, especially in rural areas. In spite of existing human pressures, these forests have still biodiversity value and high restoration potential for biodiversity (European Commission, 2015).

5.2 FOREST MANAGEMENT UNDER NATURA 2000

Natura 2000 aims to ensure survival of ecosystems and species of EU-wide importance on the long term by protecting them in sufficient extent or number, respectively, and managing them appropriately. The Natura 2000 sites are not conceived as strict nature reserve areas where economic activities are suppressed (European Commission, 2002). Instead, management of natural resources follows the general principle that the conservation of Annex I habitat types and Annex II species has priority. As long as the initial conservation status is maintained, or a favourable status can be restored, economic and social functions of forests can be considered, for example, forestry for commercial purposes (European Commission, 2003). This can be attributed to the fact that the creators of the Habitats Directive annexes had semi-natural forests in mind, not necessarily wilderness (European Environment Agency, 2006). Implementation of land use in the Natura 2000 sites is regulated in the Habitats Directive. The Court of Justice of the European Union has established that each Natura 2000 site has to have a management plan. Natura 2000 management plans can be designed specifically for a site or be integrated into other development plans such as forest management plans (European Commission, 2015). Several EU Member States have published handbooks, guidelines or other recommendations for the elaboration of management plans. Management success and compliance with the goals of the Nature Directives are regularly monitored for both species and habitat types at each site. Members States have to submit reports every six years, which are then assessed by the EU Commission (European Commission, 2013).

The case of Germany exemplifies that Natura 2000 management plans are still rather static and have a narrow conceptual focus on interventions on site such as late mowing of grasslands in favour of breeding birds, increasing water levels in drained peatlands etc. Other than in other protected area categories such as biosphere reserves or national parks, Natura 2000 management planners have hardly started to acknowledge the necessity of broader management approaches, e.g. equitable participation of local actors, or consideration of future risks (climate change and others) for effective conservation (Geyer et al. 2017).

6. CONCLUSIONS

After 25 five years of working towards a functional EU-wide protected area network, many important achievements of Natura 2000 and the underlying EU Nature Directives stand against shortcomings that await being resolved.

The following examples stand for the outstanding successes in EU nature conservation related to Natura 2000 and the EU Nature Directives:

- The establishment of the Natura 2000 complex has substantially increased area coverage under relatively strict protection in all EU Member States, in many cases three- or four-fold, or even more (Evans, 2012).
- This has allowed slowing down negative trends or even their reversal towards a good conservation status of a number of Annex habitat types and species on the local level (European Environment Agency & European Commission, no year).
- For some Annex habitat types and species, negative trends could be even decelerated or reverted across most of the EU (European Environment Agency & European Commission, no year; Evans 2012; for birds, see Donald et al., 2007).
- Decisions of the Court of Justice of the European Union and national courts, e.g. against destructive infrastructure projects, have contributed considerably to consolidation of Natura 2000 as a whole (Verschuuren, 2002). Progress in settling vague legal concepts by court decisions, and indisputable site delineation, has provided land use planning with higher legal certainty.
- Funding for EU biodiversity conservation, albeit still scarce in view of the staggering task, in total has increased with the creation of Natura 2000.
- Conservation policy standards set by the Habitats Directive for designation of Natura 2000 have facilitated collaboration between conservation actors across Member States, including administrations and civil society groups, in previously unseen dimensions.
- Not least, joint work towards Natura 2000 has led to much broader and more systematic knowledge of biodiversity present in the EU (Evans, 2012).

Notwithstanding, room for improvement for conservation of EU biodiversity remains:

· Some Annex habitat types and species keep deteriorating in certain regions or even on EU scale (European Environment Agency & European Commission, no year).

· Conservation goals defined by the EU Nature Directives are static in the sense that they collide with adaptive management in view of dynamic environmental conditions, such as climate change (Evans, 2012; Geyer et al., 2017).

· Societal participation of societies in site designation and site management has at best remained shallow in most Member States (for Germany, see Geyer et al., 2017).

· The foregoing two challenges represent examples of observable inertia of EU conservation legislation and management to incorporate the best available knowledge from science and policy. In particular, adaptive management and participatory processes are elements of the Ecosystem Approach, the conservation management approach adopted by the CBD (Fee et al., 2009). The Ecosystem Approach still awaits incorporation into management of Natura 2000 sites (e.g. Fee et al., 2009).

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VEGETATION CHARACTERISTICS of EĞRİOVA and KAVAKLI FORESTS: YENİCE HOTSPOT

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Abstract

Yenice Forests are one of the 100 forest areas in Turkey that need urgent protection. These areas, defined as "Hot Spots of European Forests", are among the most valuable areas in terms of biodiversity. The vegetation layers formed by the vascular plant species in the Kavaklı Nature Conservation Area and Eğriova forest ecosystems and the character types and general ecological characteristics of these formations have been determined. Within the scope of the Natura 2000 project studies, the Montane *Abies* forests of the Black Sea Region and the eastern beech Euxine *Fagus orientalis* forests, which were formed by Uludağ fir (*Abies nordmanniana* subsp. *bornmulleriana*), are quite extensive. There are also rich epiphytic plant groups that allow the nymph to remain under forests. In addition, the natural and semi-natural meadow formations of the *Globulario cordifoliae- Dianthenion leucophaei* community and the *Sempervivum-Astragalus* association where alpine ecosystem features are observed in the Keltepe region are composed of shallow soils consisting of limestone, dolomitic and calcareous volcanic rocks (basaltic, andesite etc.) of habitat type. Within the scope of this study, the simultaneous execution of plant sociology and plant ecology studies in the classification of habitat types where the plant cover is dominant will reveal more realistic habitat characteristics.

1. INTRODUCTION

As natural forests are destroyed and reduced, intact forests are needed to be used as indicators in order to understand ecological problems and develop solutions. Therefore, the importance of natural old forests is being realized more. Understanding these areas provides us with very important information for ecological based management of forests, to develop solutions and to avoid unnecessary actions. These forests are seen as conservation goals in biodiversity conservation in many countries. In addition, species composition, forest type, altitude, zone/phytogeography, abundance and habitat characteristics are important considerations to answer the question "how much of these areas should be protected" (Ülgen ve Zeydanlı, 2008).

One of the key roles in biodiversity conservation is structural heterogeneity and ecological continuum that is provided by dead trees (Chiristensen and Emborg, 1996). Nurse logs provides suitable habitats to a wide range of terrestrial and aquatic animals, plant and fungi (Gurnell et al., 2005). When these trees are cleared, species diversity of the system is reduced. Almost all natural old forest species need nurse log materials. Most of these are decomposed by very tiny insects that are hardly visible and fungi that exist in their arcane worlds. Many endangered wood insects live on overturned trees that lie on soils softened by fungal activities. Such pathogens are necessary for continuity of ecosystem functioning in natural forests and provides continuity of successive change, gene, species and age diversity by helping decomposition and exposing elements inside the trunk (Haila et al., 1994). From this point of view, old forests are systems that can form suitable environment within themselves for continuity of ecosystem processes (Figure 1).

Black Sea Region (BSR) covers the largest soil of the country (Kaya and Raynal, 2001). Among productive deciduous trees, oriental beech (Fagus orientalis, L.) covers only 7% (1.414.000 ha) of the total forests of the country.

Figure 1. General view from Yenice Forests.

2. MATERIAL AND METHODS

Kavaklı Nature Protection Area covers 334 hectares with a mean altitude of 1350 meters. Some main rivers in the area are: Filyos Brook, Şimşirli Creek, Abaza Creek, Bağlık Creek and İnönü Creek. These creeks and brooks generally emerge from forests in south and runs to the north. Field work was carried out monthly during a vegetation period and plant species in permanent sampling plots were photographed and collected for identification and processed as herbarium samples. For each species, percentage cover within permanent sampling plot is recorded. Plant species collected from the field were identified according to "Flora of Turkey" (Davis, 1968-1988). Most of the areas belong to forest communities and therefore minimum area was determined to be 400 $m^{2.}$ Vegetation information was determined by comparing with other studies in literature.

3. RESULTS

Soil that formed from sandstone flysch as main rock type is washed relatively easy and enable formation of pale brown forest soil or slightly pseudogley podzol-like brown forest soil type profiles. Flysch structure made of sandstone-claystone thin layers is slightly inclined. This situation and flysch main rock, depending on the climatic conditions, can easily dissolve and let the roots reach very deep in many places (Günay and Küçük, 2007).

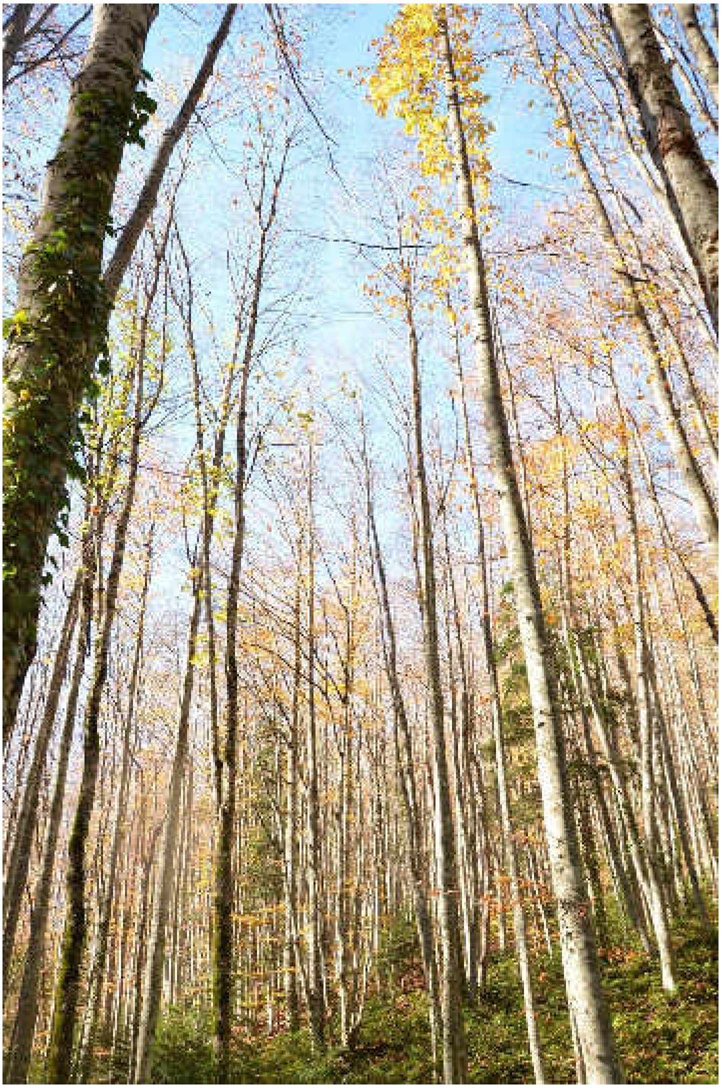
3.1. KAVAKLI FORMATIONS

Euxine *Fagus orientalis* Forests; This broad leaved humid forests, extend along northern slopes of North Anatolia and Istranca Mountains and reach up until 1000 m elevations from sea level. In this arch, mean annual temperature varies between 8 ˚ C and 12 ˚ C, and mean precipitation is higher than 800 mm. Beech (*Fagus orientalis*- Figure 2), oak (*Quercus dschorochensis, Q. frainetto, Q. cerris*) forests are dominant in northern slopes of Istranca Mountains and these forests reach up until 500-600 m. Shrub layer of these forests consist of *Rhododendron ponticum*, *Ilex aquifolium. Quercus dschorochensis* and *Carpinus betulus* (hornbeam) forests are seen as small clones in the northwestern sides of these mountains, shrub layers of these forests include Cornelian cherry (*Cornus mas*), nut (*Corylus avellana*), medlar, (*Mespilus germanica*), maple, (*Acer campestre*), *Sorbus torminalis, Prunus spinosa,* etc. (Atalay, 1986).

Temperate climate zone of Turkey has two specific phytogeographical regions. First one is Anatolian steppe in eastern and central Anatolia and it extends in Irano-Turanian Anatolia phytogeographical region. The second one is sub-pontic vegetation in Euro-Siberian phytogeographical region and most dominant species are *Fagus, Castanea, Ulmus, Celtis, Tillia, Alnus, Fraxinus, Acer, Platanus, Carpinus, Populus* and *Quercus* species (CECEC, 1987).

Taxus baccata, Ilex colchica, Ligustrum vulgare, Rhododendron ponticum, Crataegus orientalis and *Pyrus, Prunus, Vaccinium* and *Rubus* species increase in density with increasing elevation and shade. Alluvial forest galleries are mainly characterized with *Alnus glutinosa, Fraxinus excelsior, Salix alba, Populus alba and Pinus nigra.* A region that consists of mixed broad leaved/coniferous forests come after broad leaved forests in higher elevations in northern Anatolia highlands. *Abies bornmulleriana* and *Fagus orientalis* mixed forests starts from 1100 m altitudes in western parts of north Anatolia (in lower elevations it is mixed with oak) (CECEC, 1987). These forests represent areas with humidity and abundant nutrients (Çoban, 2016). In addition, density of *Rubus* sp. provide mild winters in these forests. Cold climate adaptations of *Rubus* sp. is effective in survival of some cryopreserved tissues (Reed, 1988; 1990). Development of cold tolerance is probably due to several factors. During cold acclimatization many changes occur in cytoplasmic components such as glucose and proteins that increase freezing tolerance of plants (Guy, 1990). It is reported that *Rubus* species withstand cold for two to ten weeks (Chang and Reed, 2000).

Figure 2. The eastern beech with shed their leaves in the autumn (*Fagus orientalis*) forest.



Ilex and *Taxus* Beech Forests; there are rich epiphyte plant groups in these forests. Especially *Pteridium aquilinium* in these forests are among species that keeps humidity under the forest (Figure 3). Other characteristic species in this area are; *Rhododendron ponticum*, *Trachystemon orientalis*, *Rubus hirtus*, *Melica uniflora*.

Linden and Acer Forests on Mountain Slopes and on strait ridges; especially *Tilia cordata* that is abundant in the area can grow in calcareous soil, podzol and brown soils, if mean precipitation is higher than 850 mm, *T. cordata* can be distributed along lime rich soil, however it is very resistant to drought. It is not influenced by spring and fall frost because reddening is regulated relatively late and budding is early. Moreover, characteristic maple of these forests is *Acer campestre* L. known as hedge maple. It has a very wide ecological range however it is more abundant in broadleaved oak forests until 1600 m from sea level (Nagy and Ducci, 2004; Hulten and Fries, 1986). It usually prefers warm climates, however it can tolerate rough winters and extremely hot weather, although late frosts at the beginning of a vegetative season potentially has an effect on species distribution (Savill, 2013). Characteristic species that coexist; *Ulmus glabra*, *Ostrya carpinifolia*, *Populus tremula*, *Alnus glutinosa*, *Lysimachia verticillaris* species. Important ecotone regions between stream

Figure 3. Beech forest with *Taxus*, where *Pteridium aquilinum* is intense (Türkiş and Elmas, 2016).

and rivers surrounded with terrestrial habitats are called “riparian” (Naiman and Decamps, 1997). They conserve high biodiversity by providing shelter for both aquatic and terrestrial species. Especially *Alnus glutinosa* in linden and maple forest on banks of creeks that feed Filyos stream in Kavaklı Nature Protection Area, has important functions in these ecosystems (Figure 4). It grows best in humid areas and it is frequently seen on river banks, lakeshores and marshy regions. It can fix nitrogen in symbiotic root nodules to improve soil. In addition it is compatible with a wide temperature range and relatively resistant to frost (McVean, 1953). In continental climates it can grow well however it needs abundant water to develop. Atmospheric humidity should stay high in every stage of reproduction cycle and root adapt well to grow in very wet soil: they survive better in flood compared to other forest tree species (McVean, 1953). Interestingly, among European tree species, it can fix nitrogen in root nodules through *Frankia alni* bacteria. Moreover, it keeps relatively high leaf nitrogen over the year until leaf fall in autumn and provide litter rich in nitrogen (Funk, 1990).

Figure 4. Alnus glutinosa trees on the border of linden and maple forests in riparian areas.

Asperulo Fagetum beech forests; Especially underbrush *Asperula taurina* subsp. *taurina* is dense in these communities that consist of unmixed beech forests (Figure 5). In the areas with these groups, beech trees are frequently found on hill edges and bottoms of clay basins. Optimum growth conditions are humid, calcareous and volcanic soil. In addition, they can't grow in flooded, slack water areas, they need good drainage, they do not prefer water logged, tight soil (Granier et al., 2007). At the same time, beech is not sensitive to soil type and tolerates a very large pH interval (3.5- 8.5). Nevertheless, it is not resistant to highly acidic environment, it prefers fertile, calcified, mild acidic soil. It is sensitive to late frosts (San-Miguel-Ayanz et al., 2016). Characteristic species of the area; *Galium odoratum, Cardamine impatiens, Carex sylvatica, Epipactis pontica, Crataegus microphylla, Melica uniflora, Sanicula europaea, Neottia nidus –avis* species.

Figure 5. a- Asperula Fagetum Forests in moist optimal growing environments. *b- Asperula taurina* subsp. *taurina* (Türkiş and Elmas, 2016).

Cardamino impatiendis- Fagetum orientalis communities are distributed mostly on granite main rock and sometimes on rhyolite and limestone (Akman et al., 1988). Characteristic species of this community are *Rhododendron ponticum, Lauracerasus officinalis, Hedera helix, Circaea lutediana, Cardamine bulbifera, Ruscus hypoglossum, Calamintha grandiflora, Ajuga reptans, Sanicula europaea.* Among these characteristic species, especially *Rhododendron luteum* L. is found especially in under tree flora on forest edges (Figure 6). *Rhododendron ponticum* invaded the sub layers of oriental beech forests along Black Sea Region in Turkey (Eşen et al., 2004). This arborescent shrub is seen humid, mountainous regions 2000 m high from sea level. *Rhododendron* supports acidic soil and humid conditions and usually it is invasive, it is spread via seeds and vegetative growth. This arborescent shrub reduces tree regeneration, seedling growth and local plant diversity significantly and causes habitat and production loss in forestry. At the same time, rhododendron with thick and widespread roots on forest edges, stabilize the soil on steep slopes; to remove these shrubs from steep slopes can cause soil erosion and sediment. Therefore, these slopes shouldn't be classified as forest production areas (Yıldız and Eşen).

Figure 6. Rhododendron ponticum L. on the left and *Lauracerasus officinalis* on the right are intensively located at the beech forests and in the lower layer communities (Türkiş and Elmas, 2016).

Fagus orientalis -Taxus baccata communities are found on 900 m - 1350 m altitudes where main rock is limestone (Çoban, 2016). Characteristic species are *Melica uniflora, Daphne pontica, Rhododendron ponticum, Lathyrus laxiflorus* subsp. *laxiflorus, Buxus sempervirens, Ruscus aculeatus, Cardamine bulbifera, Asperula taurina* subsp. *taurina, Galium odoratum, Galium rotundifolium, Staphylea pinnata, Viola odorata, Cyclamen coum* var. *coum, Mercurialis perennis, Actaea spicata, Circae lutetiana, Corydalis caucasica* subsp. *Abanthensis* (Figure 7).

Figure 7. From the forestous species in the *Fagus orientalis-Taxus baccata* communities, the species *Melica uniflora* on the left and the image on the right are *Corydalis caucasica* subsp. *abanthensis* (Türkiş and Elmas, 2016).

Fagus-Trachystemon orientalis- Hedera helix groups especially in Kavaklı Nature Protection Area includes mostly *Hedera helix* under *Fagus orientalis* on 650 m - 1050 m altitudes (Figure 8). It is known that where *Hedera helix* forms the understorey, humidity is high and nutrients are abundant and summers are warm and winters are mild. In addition, it is proposed that *Hedera helix* serves as temperature buffer where water and humidity resources are irregular (Ackerfield and Wen, 2003). Characteristic species of this community are; *Rubus idaeus, Pteridium aquilinium, Galium odoratum, Sanicula europaea, Dryopteris filix-mas, Petasitas albus, Carex pendula, Ranunculus ficaria subsp. ficariformis, Scilla bithynica, Sanicula europaea, Festuca heterophylla.*

Figure 8. Intensive *Hedera helix* communities located in the Kavaklı Tabiatı Koruma Alanı.

Montane Abies forests of the Black Sea region- Mixed *Abies - Picea - Fagus* woodland characteristic species; *Hedera helix, Moneses uniflora, Pyrola chlorantha, Circaea lutediana, Calamintha grandiflora, Sanicula europaea* (Özalp, 1993- Figure 9).

Figure 9. The black fir forests of the Black Sea are located in the lower flora, *Pyrola chlorantha*, and *Circaea lutetiana* species on the right (Türkiş and Elmas, 2016).

3.2 EĞRİOVA FORMATIONS

Temperate European Forests- Mixed Broad Leaved Forests with *Juniperus oxycedrus* or *Taxus baccata*; They are formations that coexist with *Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus* and *Cupressaceae* or *Taxaceae* species, that have mesozoic and eutrophic characters, that don't have major *Pinus* components and where there are no rivers (Hill *et al.*, 2004b). In particular, *Taxus baccata* and *Euonymus latifolius* subsp. *latifolius* species are two important plants in the Karabük Yenice Forests in terms of survival and diets of herbivorous animals *(Çil and Türkiş, 2017).* Species that belong to this group are *Juniperus communis, Ilex colchica, Veronica serpyllifolia, Galium odoratum, Ranunculus ficaria* subsp. *ficariformis, Ranunculus gracilis, Fritallaria pontica, Festuca drymeja, Calamintha grandiflora, Helleborus orientalis, Euphorbia amygdaloides, Polygonatum multiflorum, Acer platinoides, Epipactis pontica, Epipactis helleborine, Corydalis integra, Chaerophyllum aromaticum, Sanicula europaea.*

Temperate mountainous coniferous forests - *Pinus nigra* Forests (*Pinus nigra* subsp. *pallasiana*); Black pine is found at altitudes from 350 m in Italy to 2000 m in Taurus Mountains (Praciak *et al.*, 2013). Optimum elevation is between 800 and 1500 m. It can grow in various types of soil from podzolic areas to lime stone, in general depending on the region and climate, it is observed in areas with limestone (Farjon, 2013).

Black pine can tolerate temperature fluctuations well in extremely dry and humid habitats. It needs abundant daylight however in Scotland groups it can show more shade tolerance.

Plants: Consist of *Fritillaria pinardii, Helleborus orientalis, Ranunculus constantinapolis, Doronicum orientale, Platanthera bifolia, Festuca drymeja, Ornithogalum wiedemannii* var. *wiedemannii, Juniperus communis* (Figure 10). In the past, there have been no attempt to ecologically compare old forest plant species and other species at Europe scale. This kind of general overview can inform discussion on forest biodiversity indicators and help identifying the conditions for long term existence of these plants in Europe. In addition, *Melica uniflora* as characteristic species in these old forests is among the species that are found mostly in old forests with rare old species (Bastin and Thomas, 1999).

Figure 10. Fritillaria pinardii, a geophyte species, which is found in areas with limited field density in the alpine zona transition region from subalpine area.

Temperate mountainous coniferous forests- *Pinus nigra- Abies bornmülleriana* Forests; *Pinus nigra* and *Abies bornmülleriana* communities that are identified within Eğriova formations under the scope of Natura 2000 in Yenice forests don't have much commercial value except for silver fir and Caucasus fir (*Abies nordmanniana*). In Turkey they are still exploited for timber, and other firs for ornamental use in the gardens. Especially in limited areas, their protection is highly important by formation of protected reserves. Wild fires, animal husbandry and genetic drift represent the major threats (San-Miguel-Ayanz et al., 2016). Temperature needs are medium or less than medium, humidity needs are high for fir species, although their light needs are low and therefore they are tolerant to shade. Drought can harm these species besides they are sensitive to autumn and winter frosts. In addition, mature trees can tolerate long dry periods but they can't withstand spring frosts. They thrive in high water reserves and in deep acidic soil. They can easily rejuvenate. However water loss by transpiration and frost damage limit their distribution. In general, they exist as homogeneous communities. At some places they form mixed forests together with other tree species (*Fagus sp.*, *Quercus sp.*, *Pinus, Cedrus sp.* and *Juniperus sp.*) (San-Miguel-Ayanz et al., 2016). In our study area soil was identified to be mild acidic and close to neutral pH. Soil that formed from sandstone flysch as main rock type is washed relatively easy and enable formation of pale brown forest soil or slightly pseudogley podzol-like brown forest soil type profiles. Flysch structure made of sandstone-claystone thin layers is slightly inclined. This situation and flysch main rock, depending on the climatic conditions, can easily dissolve and let the roots reach very deep in many places (Günay and Küçük, 2007).

Characteristic species of these areas are; *Cerasus avium, Doronicum orientale, Astragalus anthylloides*, *Astragalus micropterus Asphodeline damascena*, *Scorzonera pygmae* subsp. *nutans, Pyrola clorantha, Melampyrum arvense* var. *arvense Cephalanthera rubra, Tragopogon coloratus, Vicia cassubica, Vicia crocea, Asarum europeaum, Lonicera caucasica* subsp. *caucasica, Juniperus oxycedrus Chamaecytisus hirsutus.*

Under the scope of Natura 2000, within the borders of Eğriova Forest Management land; In Montane Abies forests of Black Sea Region there are scots pine, fir and beech trees between 1000 m - 1600 m elevations on rocky, flysch, clay, sandstone, limestone areas (Çoban, 2016- Figure 11). Characteristic species; *Cerasus avium, Acer trautvetteri, Acer campestre* subsp. *campestre, Doronicum orientale, Briza media, Salvia tomentosa, Vicia cassubica, Vicia crocea, Lonicera caucasica* subsp. *caucasica, Chamaecytisus hirsutus.*


Figure 11. Eğriova Pond - Yenice Forests.

Melampyrum arvense-Quercus petraea formations *a*re found mostly at 800 m - 1300 m elevations on marble (Figure 12), clay and sandstone main rock areas (Çoban, 2016). Dominant species in the area; *Cerasus avium, Sorbus torminalis, Malus sylvestris* ssp. *orientalis, Briza media, Rosa canina, Ferulago thirkeana, Psorelea bituminosa, Dorycnium graecum, Trifolium medium L.* var. *medium, Trifolium nigrescens, Dactylis glomerata* species.

Figure 12. Melampyrum arvense (Türkiş ve Elmas, 2016).

3.3. KELTEPE FORMATIONS

Natural and Semi Natural Grass formations; *Rupicolous calcareous* grasslands of the *Sileno-Astragalion densifolii*. *Globulario cordifoliae- Dianthenion leucophaei* communities are found at Keltepe at 2000 m elevation, on limestone, dolomitic and calcareous volcanic rock (basaltic, andesite etc.) with shallow soil as alpine grassland ecosystems (Figure 13, 14). Characteristic species are *Sempervivum armenum* subsp. *armenum*, *Sempervivum gillianiea*, *Valeriana alliarifolia*, *Festuca valesiaca*, *Geranium tuberosum*, *Scorzonera pygmae* subsp. *nutans*, *Onosma bornmuelleri*, *Astragalus hirsutus* (Akman et al., 1988).

Figure 13. Globulario cordifoliae - Dianthenion leucophaei, which is located in the alpine area of the Keltepe, belongs to *Dianthus leucophaeus* on the left and *Globularia cordifolia* on the right.

Figure 14. Keltepe Summit- 2000m.

Rupicolous calcareous grasslands of the *Sileno-Astragalion densifolii*,- Dominant species within *Sempervivum-Astragalus*; *Astragalus vulnerariae, Gypsophila brachypetala, Dianthus leucophaeus, Cyanus reuterianus* var. *phrygia, Minuartia anatolica* subsp. *anatolica, Sempervivum gillianii, Geranium tuberosum, Festuca sp.* *Rhinanthus minor, Onosma bornmuelleri, Linum bienne, Daphne oleoides* subsp. *Oleoides* (Figure 15).

Figure 15. The view from the *Sempervivum-Astragalus* at the summit of the Keltepe.

4. DISCUSSION

Ancient forest species lists are important for nature conservation since they combine both qualitative (forest quality) and quantitative (biodiversity) protection criteria (Hermy et al., 1999). While new forests colonize rapidly (e.g. *Geum urbanum, Urtica dioica*), for other forest types it takes centuries to colonize (Peterken, 1981; Peterken and Game, 1984). These slow colonizing species are called ancient forest species because their existence indicates a long history of that habitat fragment and they can be indicators of more original forest conditions in the forest (Hermy et al., 1999). In some forests some species are identified as old forest indicators while not in others. In Denmark *Anemone nemorosa, Convallaria majalis, Melica uniflora, Mercurialis perennis, Primula elatior* and*Sanicula europaea* are not ancient forest species but they can be in other forests (Lawesson *et al.*, 1998). Therefore, existence of *Melica uniflora, Primula vulgaris, Sanicula europeae, Mercurialis perennis* in the understorey where there are monumental trees in different forest formations in study area are accepted as ancient forest indicators in Eğriova Forest Sub-District Directorate land and Kavaklı Nature Protection Areas. In addition, identification of geophyte species, especially orchid species, in old forests is also important. Because these species serves as an early alarm system for the health of their ecosystems and they are the first to disappear from the areas (Türkiş and Ertürk, 2015). One of the key roles in biodiversity conservation is structural heterogeneity and ecological continuum that is provided by dead trees (Christensen and Emborg, 1996). Nurse logs provides suitable habitats to a wide range of terrestrial and aquatic animals, plant and fungi (Gurnell et al., 2005). When these trees are cleared, species diversity of the system is reduced. Almost all natural old forest species need nurse log materials. Most of these are decomposed by very tiny insects that are hard to notice and fungi that exist in their arcane worlds. Many endangered wood insects live on overturned trees that lie on soils softened by fungal activities. Such pathogens are necessary for continuity of ecosystem functioning in natural forests and provides continuity of successive change, gene, species and age diversity by helping decomposition and exposing elements inside the trunk (Haila et al., 1994). From this point of view, old forests are systems that can form suitable environment within themselves for continuity of ecosystem processes.

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IMPLEMENTATION OF THE NATURA 2000 HABITAT CLASSIFICATION FOR TURKISH FORESTS

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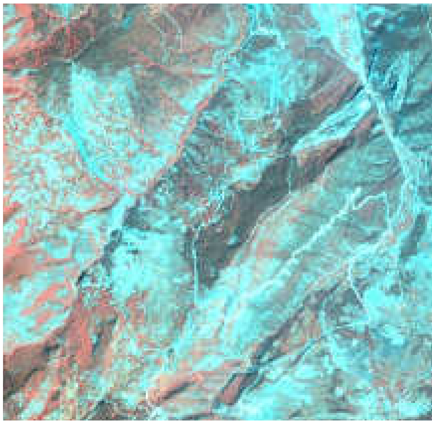

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Abstract

Natura 2000 is an ecological network of protected areas of the European Union and it is legally binding based on the Birds and Habitats Directives adopted by the EU Member States in 1979 and 1992, respectively. The purpose of this network is to ensure that the long-term survival of European biodiversity and especially of Europe's most valuable and endangered species and their habitats is secured. Forests have a relatively large area among the Natura 2000 areas implemented in the EU countries. Natura 2000 sites also cover large areas in countries having high forestry assets. Turkey comprises biogeographical regions with climatic and geographical properties varying over short distances. This privileges Turkey in harbouring high numbers of plants and animal species and having high endemism rates. The purpose of this study is to determine the variation and characteristics of Turkish forest habitats along the scope of the Natura 2000 framework. To this end, two forested areas, Kavaklı and Eğriova, located in the western Black Sea region of Turkey and different in their woody species composition, have been selected. Firstly, the boundaries of forest types have been reviewed. Twenty-four vegetation types have been determined by carrying out previously unavailable studies on vegetation. The map of forest habitat types has been obtained by superposing the forest management types with the vegetation types. As a result, eleven habitat types have been determined, of which only seven were previously attributed to Turkey. Montane *Abies* forests of the Black Sea region, generated by Uludağ fir (*Abies nordmanniana* subsp. *bornmuelleriana*) and Euxine oriental beech forests (*Fagus orientalis*) are the most widely distributed forest types. They are followed by oak broadleaved mixed forests of euxine and subeuxine character. The Black Sea climate study sites are generally rich in plants of euxine and subeuxine distribution. As studies on Turkish forest habitats to be included in the Habitat Directives are very limited, our approach required expertise during the assignment process of vegetation types to habitat types. Moreover, the assessment was hampered for lack of a common nomenclatural basis in vegetation classification for Turkish forest habitats in the respective biogeographical zones.

1. INTRODUCTION

There is a high correlation between the Natura 2000 areas and the forest areas of EU countries. The ratio of forest lands of the Member States to the total of the terrestrial Natura 2000 areas is 49%. Other vegetation formations and land use systems are less represented. The average distribution of Natura 2000 forest areas in the EU countries to the countries' forest areas is 21% (EC, 2015). For example, Germany has a total area of terrestrial Natura 2000 sites of 55,142 km^2; of these, 26,550 km^2, constituting 48% of the overall area, comprise forest areas. The total area of forests in Germany is 110,760 km^2 and the ratio of Natura 2000 forest areas corresponds to 24%. With a surface area of 783,562 km^2, Turkey is among Europe's largest countries. It shares in three biogeographical regions including the Anatolian (Irano-Turanian), the Mediterranean and the Black Sea (Euxinian) regions and transitional zones in between them (Kaya and Raynal, 2001). The number of plant taxa (species, subspecies and varietal level) in the Turkish flora is approximately 12,000 (Erik and Tarıkahya, 2004; Kahraman et al., 2012), including about 3,000 endemic plant species. The climatic and geographical spatial features of the biogeographical regions vary much and over short distances, both vertically and horizontally. Accordingly, the floristic turnover along the climatic and geographical gradients also varies considerably, especially in woodlands of species-rich forest tree genera such as oak (Uğurlu et al., 2012; Uğurlu and Oldeland, 2012; Uslu and Bakış, 2012). When also the use of Turkish forests by different ethnic groups in various periods of time is taken into consideration (Mayer and Aksoy, 1986), the variation in present-day forest diversity and structure becomes the more apparent.

Almost all of the Turkish forests are state-owned and the vast majority is managed by the General Directorate of Forestry. The private-owned forest land is less than 1/1000 of the total forest area (approximately 18,000 hectares). The forestry assets of Turkey comprise 27.6% of the country (Figure 1) (OGM, 2014).

The total forestry assets of Turkey have increased in the last 40 years. This increase also involves a major shift towards denser forests (density >10% tree canopy cover) and a reduction of scrub forests (< 10%) (Table 1). It has been suggested that the most important reason behind this variation has been the decline of the economically active village population and the increase of the urban population. There is also a continuous decrease of grazing pressure in the forests which, consequently and increasingly, become dense forests.

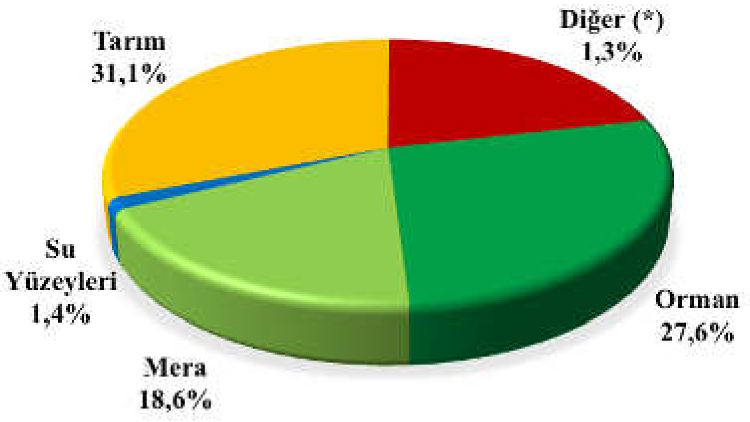


Figure 1. Distribution of land covers in Turkey (OGM, 2014*[1])

Moreover, it is a typical process observed in the countryside that the agricultural areas that are not utilized anymore for agricultural purposes are converted into woodlands by lateral seeding and subsequent scrub encroachment (Figure 2). These changes have important consequences in terms of species turnover, and formation of new species and habitats.

1. Other land uses include areas such as non-woody forest soil, plateaus, steppe, rocky-stony lands, sand, swamp, settlement, graveyard, mine, permitted facilities, etc.

Figure 2. Encroachment of agricultural lands not used for a long time

Table 1. Variation of forest areas in Turkey in the period of 1973-2012 Turkey (OGM, 2014).

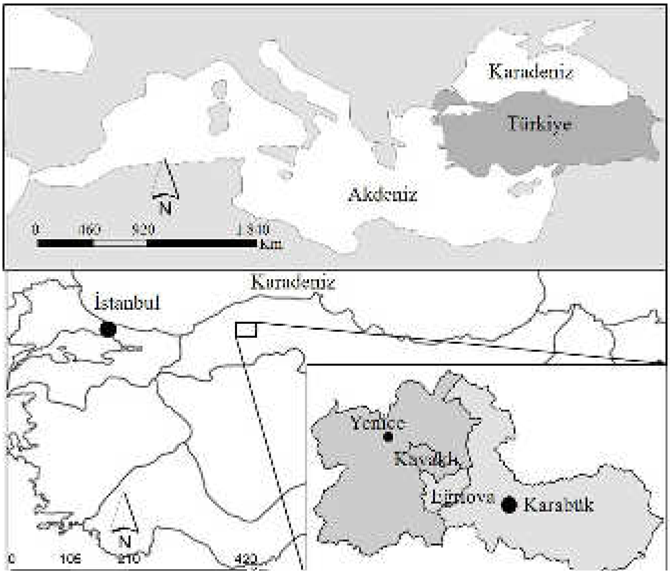
	1973		2004		2012	
	ha	%	**ha**	**%**	**ha**	**%**
[1]**Dense Forest**	8,856,457	43.85	10,621,221	50.13	11,558,668	53.32
[2]**Scrub**	11,342,839	56.15	10,567,526	49.87	10,119,466	46.68
Total	20,199,296	100	21,188,747	100	21,678,134	100

2. MATERIAL AND METHODS

2.1 STUDY SITE

The study areas in the project are Yenice Forestry Operation Directorate (FOD) and Kavaklı Forest Sub-District Directorate (FSD) affiliated to Zonguldak Regional Directorate of Forestry, and Eğriova FSD affiliated to Karabük FOD, both located in the western Black Sea region of Turkey (Figure 3). The total area of Kavaklı FSD is 4644.1 hectares and 95.8% of this area is wooded. There are two villages and Kavaklı Nature Reserve Area (Turkish abbreviation TKN) with a size of 334 ha in the district of Kavaklı. Eğriova FSD has a total area of 7243.9 ha and 82.8% of that area is covered with forests. The lowest point of the project sites is at 140 m, and the highest point is at the summit of Keltepe Mountain with an elevation of 1995 m.

Figure 3. Geographical location of research sites



2.2 METHODS

Forest stand types and vegetation types have been used to characterize the habitat types (Figure 4). The vegetation associations have been named by comparing the vegetation information obtained from field studies with the literature. The stand maps included in the forest management plans have been revised by means of field studies. In particular, it was figured out that there were accuracy problems with the delimitation of areas of some mixed stands. The use of remote sensing methods was necessary to resolve this. The auto-rectified panchromatic and multi-spectral band Pléiades images, having a terrestrial resolution of 70 cm, and taken in August 2015, was preferred for the visual classification and unsupervised classifications. Rapideye images with pixel size of 5 m, taken in July 2016, were used for Normalized Difference Vegetation Index (NDVI). The stand types were visually reviewed by means of band variations in images all over the site. Stand types with delimitation problems, screened for field studies visual scanning, were also subjected to unsupervised classification. The databases of stand types available in .shp format have been reviewed by means of Geographic Information System (GIS) and some of them were removed while others were added. The polygons whose accuracy was approved by remote sensing methods were reshaped. Depending on characteristics of vegetation types, the stand types were firstly classified by tree species composition. Other vegetation characteristics were used to distinguish different vegetation subtypes in the same tree species.

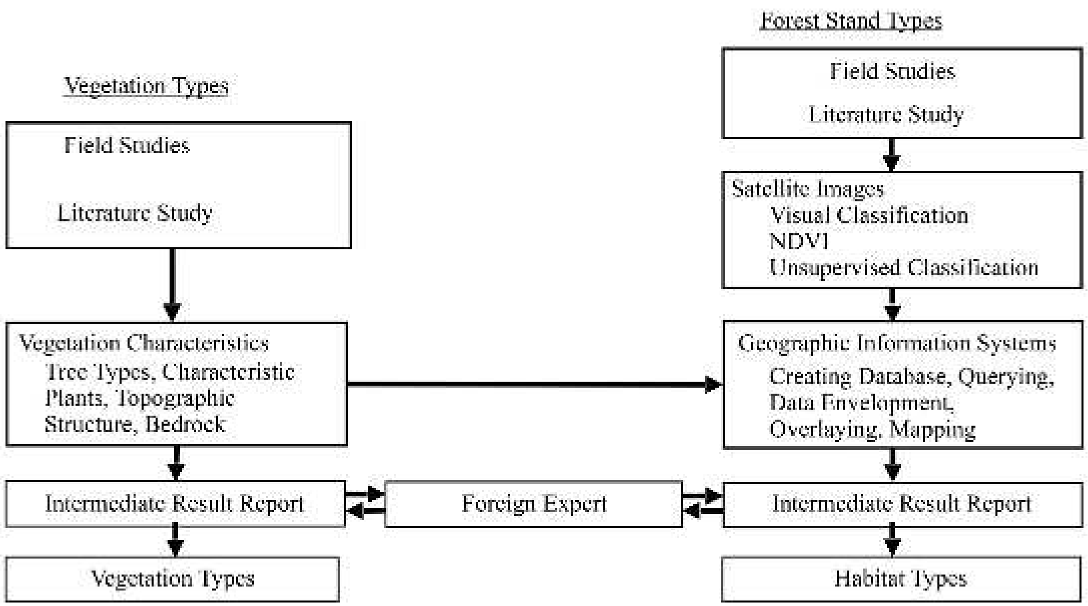


Figure 4. Methods Applied in Determination of Habitat Types

The explanatory notes of the “Interpretation Manual of European Union Habitats” (European Commission, 2003, 2013) given in the standard data form have been used to group and distinguish habitats. Erwin Bergmeier was consulted as foreign expert to confirm the Natura 2000 habitat types using the nomenclature adopted by Bergmeier et al. (2018).

3. RESULTS

3.1 VEGETATION

Özhatay et al. (2005) stated that "Yenice Forests", being one of the 122 "Important Plant Areas" of Turkey, has natural appearance as it contains largely intact humid forest communities, monument trees and deep wooded valleys. The study area is very rich in forest tree species. A total of 176 plant taxa at species and subspecies level, of which 30 are tree species, have been identified in the sample areas in the Nature Reserve located in Kavaklı Forest Sub-District Directorate. A total of 150 plant species including 27 tree species have been identified in forest areas belonging to Eğriova Forest Sub-District Directorate. In the habitat classified as Euxine Oriental Beech Forests according to the EUNIS habitat classification definitions, *Fagus orientalis* generates pure or almost pure stands, sometimes mixed with other broadleaved species. The climate type is rainy and humid (Arslan et al., 2012). The soil properties in Kavaklı Nature Reserve were found to be slightly acidic to near neutral. The dominant vegetation is fir-beech communities (*Abies nordmanniana – Fagus orientalis*) and characteristic species include *Actaea spicata*, *Asperula taurina* subsp. *taurina*, *Buxus sempervirens*, *Calamintha grandiflora*, *Circaea lutetiana*, *Crataegus microphylla*, *Dryopteris filix-mas*, *Galium odoratum*, *Hedera helix*, *Lauracerasus officinalis*, *Polygonatum orientale*, *Ranunculus brutius*, *Rubus hirtus* and *Sanicula europaea*.

In pure beech (*Fagus orientalis*) forest, among others the following species occur: *Asperula involucrata*, *Calamintha grandiflora*, *Cardamine bulbifera*, *Cephalanthera longifolia*, *Cephalanthera rubra*, *Chaerophyllum aromaticum*, *Corydalis caucasica* subsp. *abantensis*, *Corydalis integra*, *Cyclamen coum* var. *coum*, *Daphne pontica*, *Galium odoratum*, *Galium rotundifolium*, *Hedera helix*, *Lathyrus laxiflorus* subsp. *laxiflorus*, *Melica uniflora*, *Mercurialis perennis*, *Polygonatum multiflorum*, *Rubus hirtus*, *Rubus idaeus*, *Sorbus torminalis*, *Viola odorata*. Characteristic species in beech-hornbeam (*Carpinus betulus - Fagus orientalis*) mixed deciduous forests include *Acer platanoides*, *Aristolochia pontica*, *Calamintha grandiflora*, *Cardamine bulbifera*, *Chaerophyllum aromaticum*, *Corydalis integra*, *Crataegus monogyna*, *Epipactis helleborine*, *Epipactis pontica*, *Euphorbia amygdaloides*, *Festuca drymeja*, *Ficaria verna* subsp. *ficariiformis*, *Fritillaria pontica*, *Galium odoratum*, *Hedera helix*, *Helleborus orientalis*, *Ilex colchica*, *Lauracerasus officinalis*, *Polygonatum multiflorum*, *Sanicula europaea*. The vegetation dominating the area of the Eğriova Forests within the scope of this study is temperate montane coniferous forest. It occurs on limestone and siliceous bedrocks and constitutes a mix of Oriental beech, Uludağ fir, and Anatolian black pine (*Pinus nigra* subsp. *pallasiana*) (Figure 5a). Especially black pine and fir (*Pinus nigra - Abies nordmanniana*) form mixed stands. Characteristic species of these coniferous forests include *Asphodeline damascena*, *Astragalus anthylloides*, *Astragalus micropterus*, *Cephalanthera rubra*, *Cerasus avium*, *Doronicum orientale*, *Melampyrum arvense*, *Pyrola chlorantha*, and *Scorzonera pygmaea* subsp. *nutans*.

Figure 5. Forests formed by Uludağ fir and Anatolian black pine, belonging to the area of Eğriova Forest Sub-District Directorate (left). A view of the mixed beech-hornbeam forest area located in Kavaklı Nature Reserve Area (right).

3.2 FOREST STAND TYPES

3.2.1 Current situation of the forests

Kavaklı FSD has an area size of 4643.25 ha, of which 4484.14 ha are covered with forests. This corresponds to 96.6% of the total area. Eğriova FSD has an area size of 7248.26 ha with 6557.62 ha covered with forests, corresponding to 90.5%. The most important differences in forest cover between these two sites is the tree species composition.

The broadleaved mixed forests in Kavaklı area rank first with 39%, while pure beech (*Fagus orientalis*) forests have a share of 17%, followed by pure hop-hornbeam (*Ostrya carpinifolia*) forests with 4% (Figure 6). Other broadleaved species are common ash (*Fraxinus excelsior*), hornbeam (*Carpinus betulus*), and linden (*Tilia rubra* subsp. *caucasica*, *Tilia argentea*).

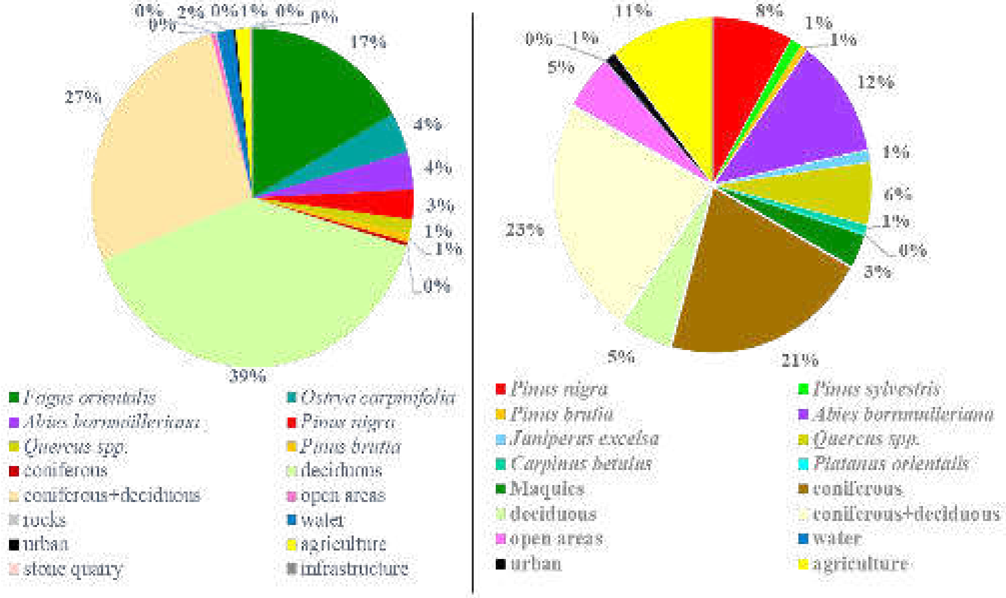


Figure 6. Distribution of land cover types in the project sites

The broadleaved-coniferous mixed forests rank as the second in total area with 27% (Figure 7). Fir (*Abies nordmanniana* subsp. *bornmuelleriana*) forests rank as the first among the pure coniferous forest with 4%, followed by black pine (*Pinus nigra* subsp. *pallasiana*) forests with 3%. Other coniferous forests consist of Scots pine (*Pinus silvestris*) and Turkish pine (*Pinus brutia*). There are 40 tree species and 14 tall shrub species in the area according to the data of the forest management plan (OGM 2010). Of these, 8 tree species establish pure or co-dominate in mixed stands. Five species of oak have been reported, but it has not been specified which of them establish forest stands.

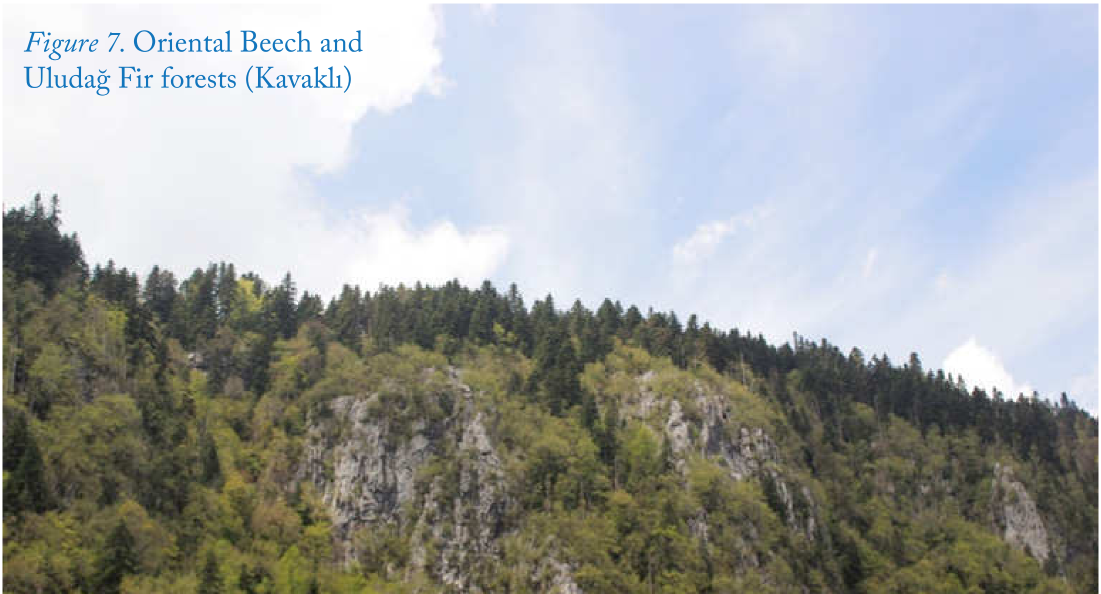


Figure 7. Oriental Beech and Uludağ Fir forests (Kavaklı)

Quercus petraea subsp. *iberica*, *Q. hartwissiana*, *Q. robur* and *Q. macranthera* subsp. *syspirensis* have been observed during project works to co-occur in different stands in varying densities. Some other species such as common yew (*Taxus baccata*), hedge maple (*Acer campestre*) and wild service-tree (*Sorbus torminalis*) occasionally join stands in different numbers.

In Eğriova site, the coniferous-broadleaved mixed forests occupy 23% and consist mainly of beech and fir (Figure 8). The mixed coniferous forests come second with 21%, and the mixed beech-pine forests of *Fagus orientalis* with *Pinus sylvestris* and *Fagus* with *Pinus nigra* come thereafter. Broadleaved mixed forests are represented with around 5%, with hornbeam-oak forests being most prominent among them. Fir forests rank with a proportion of 12% as the first among the pure coniferous forest types, followed by pure black pine forests with 8%. Other pure coniferous forests consist of *Pinus sylvestris*, *Pinus brutia* and arborescent juniper (*Juniperus excelsa*). Pure oak forests have a share of 6%, followed by hornbeam and riparian forests. There are 27 tree species and 15 tall shrub species in the Eğriova site according to the data of the forest management plan (OGM 2010), of which 6 tree species establish pure or co-dominate in mixed stand. Five species of oak have been reported but again it was unspecified which of them establish forest stands. *Quercus petrea* subsp. *iberica*, *Q. cerris*, *Q. coccifera* and *Q. pubescens* have been observed during the project works to co-occur in different stands in various densities.

Figure 8. Mixed fir-beech-hornbeam forests of Eğriova

There are other types of mixed broadleaved forests consisting of phillyrea (*Phillyrea latifolia*), oriental strawberry tree (*Arbutus andrachne*), western strawberry tree (*Arbutus unedo*), prickly juniper (*Juniperus oxycedrus*), dogwood (*Cornus mas*), prickly oak (*Quercus coccifera*) and downy oak (*Q. pubescens*) which cover an area of 3% of the Eğriova site.

A major part of the forests where fir and beech exist as pure or in mixed stands is exploited as selection forest. The villages in the area have been established on the lower slopes of the mountains. The most important pressure observed in forest areas is grazing, mostly around residential and agricultural areas (Figure 9). There are six villages in both sites and the income obtained from forestry works is relatively important for the household income. Logging, ground skidding and transportation works are fulfilled by cooperatives belonging to each village (Figure 10).

Figure 9. Overexploited forests in the intersection of forest and agricultural lands

Figure 10. Employment of local people in forestry

3.2.2 Use of satellite imagery

Since the forests located in the project sites have a mosaic pattern with relatively high numbers of tree species, they are to be classified with care. Firstly, the boundaries of the existing forest stand types were reviewed. The areas identified as having a delimitation problem were easily adapted for classification into the EU Natura 2000 habitat types system by transferring their processed raster images into GIS. Similar approaches in identifying Natura 2000 habitat types using satellite imagery are available in the literature (Corbane et al., 2015; Vanden Borre et al., 2011).

3.2.2.1 Visual classification

The existence of forest stands types and the field studies are giving priority to visual interpretation. On the other hand, the use of orthorectified panchromatic and high-resolution MS band Pléiades images also make visual interpretation easier. It turned out in visual scanning that the boundaries of types such as those located in intersections of high mountainous areas and of the agriculture-forest-settlement ecotone had to be revised by means of remote sensing technique (Figure 11 and 12).

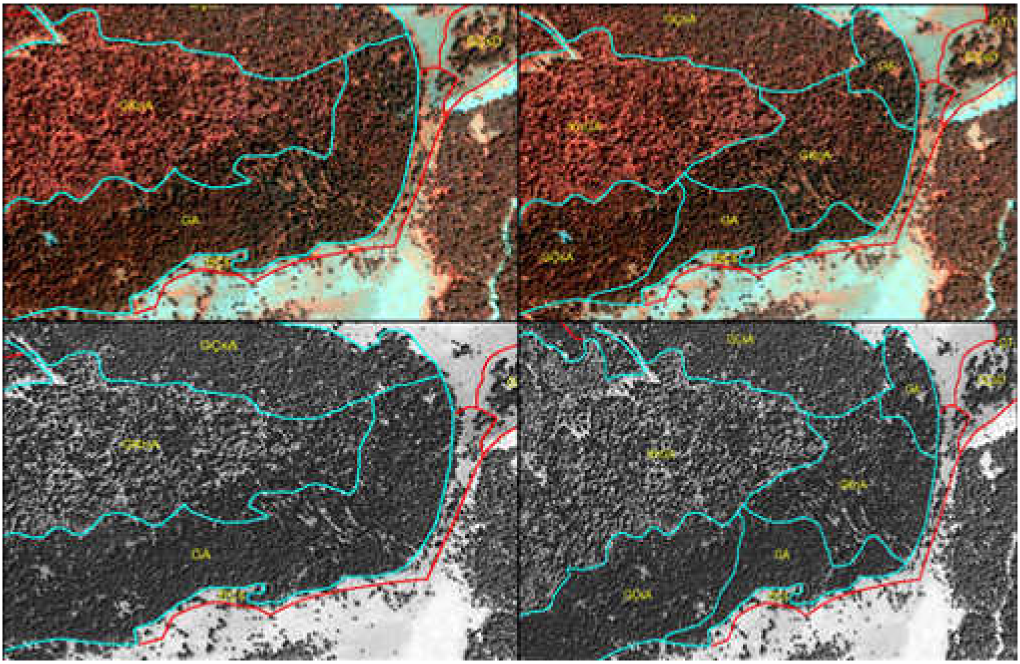


Figure 11. Conversion of Pléiades MS (upper left - light red) and panchromatic band (lower left - light grey) image of beech-fir forest into fir-beech forest (MS upper right, panchromatic bottom right)

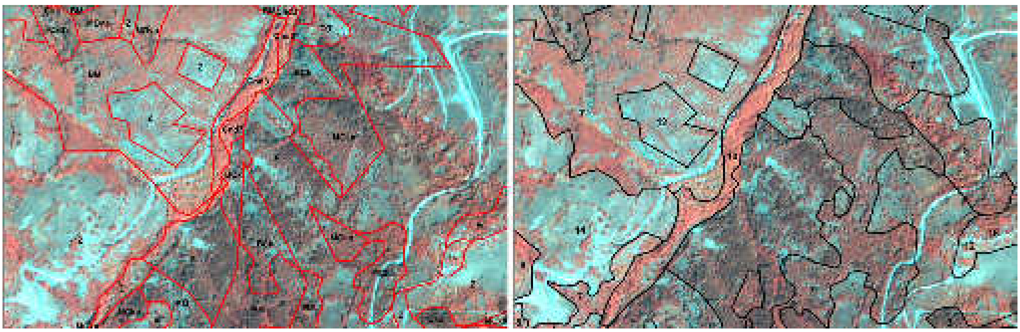


Figure 12. Visual classification of the black pine and oak forests having degraded qualification in the intersection of agriculture-forest

3.2.2.2 *Unsupervised classification*

It has been found that the unsupervised classification was quite useful in distinguishing broadleaved and coniferous forests. In fact it was not only useful for identifying forest types depending on dominant tree species in coniferous or broadleaved forests, but it was also a satisfactory tool in distinguishing agricultural areas without rock outcrops or low vegetation and water bodies (Figure 13). On the other hand, it turned out that it was less successful in distinguishing broadleaved forests from non-degraded areas hosting oak species specified as buschwald. At this point, it was considered that the density of leaf biomass has increased subpixels.

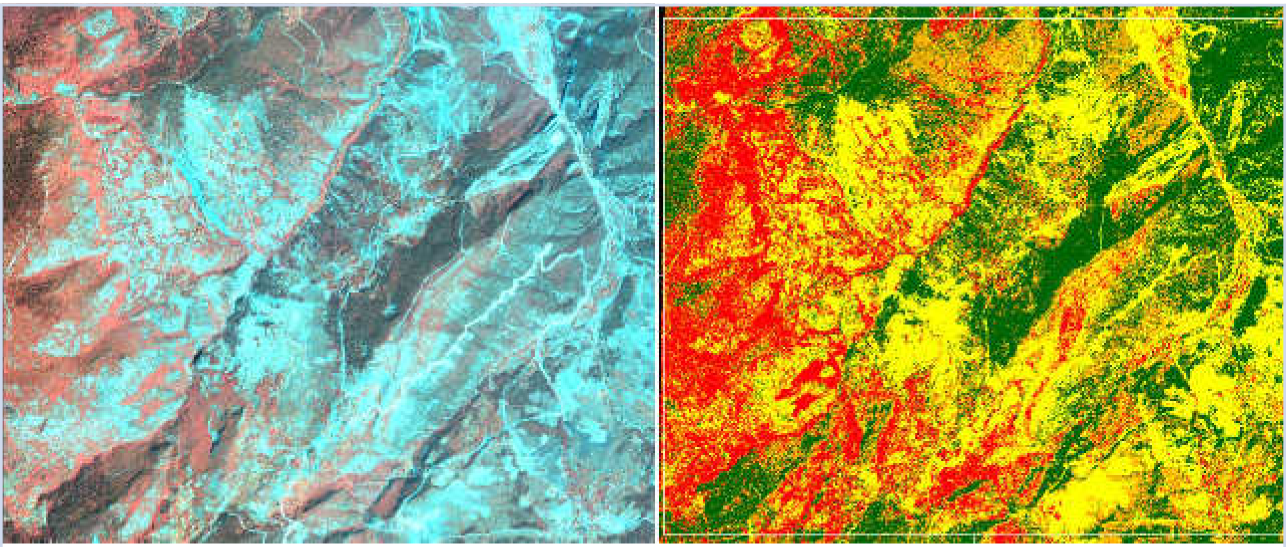


Figure 13. RapidEye MS image (right), unsupervised classification image (red: broadleaved forest, green: coniferous forest, yellow: low vegetation density areas)

3.2.2.3 *NDVI applications*

NDVI applications yielded significant results in terms of vegetation density and its variation in sites (Figure 14). They have been particularly useful in reviewing the boundaries of agricultural areas and determining the adjacent destroyed forest areas. Besides, they are also useful in determining meadows in montane and high montane areas.

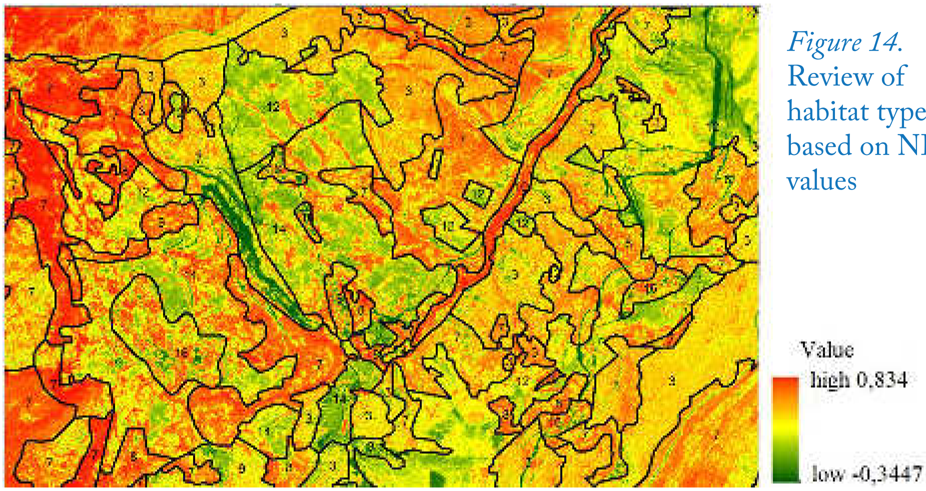


Figure 14. Review of habitat types based on NDVI values

3.3 USE OF GEOGRAPHIC INFORMATION SYSTEM

The data base information of polygons belonging to forest stand types digitally included in a Geographic Information System (GIS) formed the basis for assigning habitat types. Spatial changes obtained by visual interpretation have been corrected by directly editing the polygons in GIS. The raster data from the unsupervised classification and NDVI were converted into vector data which were extracted to master vectoral maps. Dissolve technique has been used to bring the similar forest stand types together. For this purpose, similar stand types were queried from the data base. New habitat types were labelled by assigning numerical codes to each habitat type. GIS was also used for obtaining the digital elevation data (Figure 15).

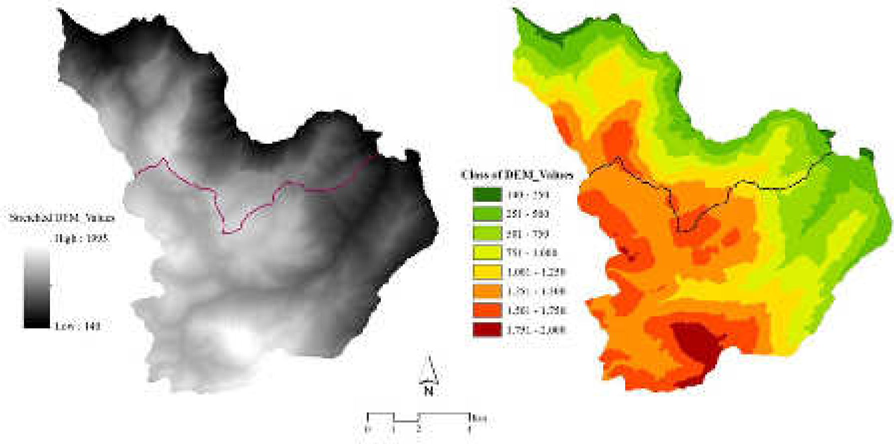


Figure 15. Altitudinal variation in the study sites

3.4 NATURA 2000 HABITAT TYPES

3.4.1 Biogeographical properties

Meteorological data of a station at an altitude of 400 m located at some distance of the city of Karabük revealed Mediterranean climate with water scarcity in summer periods (Türkiş, 2016; Figure 16).

Figure 16. Climatic diagram based on data of the meteorological station of Karabük (Türkiş, 2015)

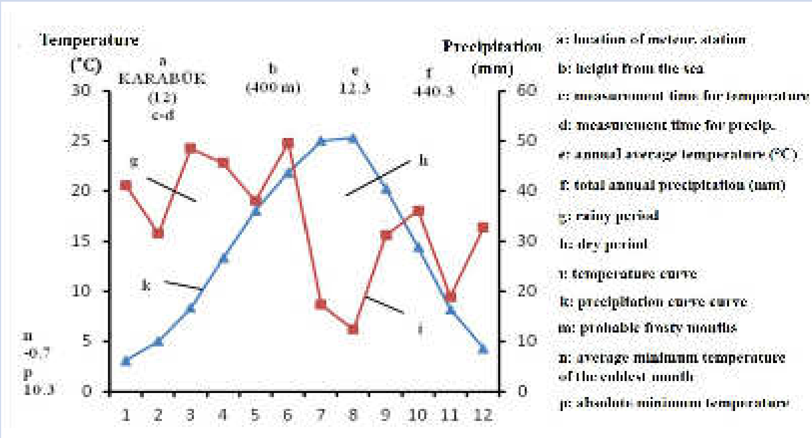


Table 2. Climatic data of meteorological stations located in the Western Black Sea Region (Demirörs and Kurt, 2005).

Meteorological stations	H (m)	P (mm)	PE (mm)	PE/ ME	Precipitation regime	M (°C)	m (°C)	Q2	Bioclimate
Zonguldak	136	1123.8	225.3	9.0	Black Sea coastal (coastal)	25.0	3.1	194.6	Oceanic
Bartın	20	1042.7	204.9	7.3	Black Sea coastal (coastal)	27.8	0.8	134.4	Oceanic
Devrek	100	788.1	164.0	5.5	Black Sea coastal (Mediterranean centred)	29.8	1.6	96.8	Sub-Mediterranean
Karabük	400	461.2	67.1	2.0	Interior Black Sea	32.3	0.3	49.8	Mediterranean

H: Altitude, P: Annual Precipitation, PE: Total rainfall in summer months, ME: Maximum temperature mean of summer months, PE/ME: Emberger drought index, M: The mean of the maximum temperatures of the hottest month in the year, m: The mean of the minimum temperatures of the coldest month in the year, Q2: Corresponds to the pluviothermic quotient of Emberger which is equal to at meteorological stations

In the bioclimatic synthesis provided by Demirörs and Kurt (2005) for the Western Black Sea region, Karabük has been characterized by Mediterranean-type climate (Table 2). The project sites, however, are approximately 17 km away from Karabük city and at an average altitude of 950 m. The Mediterranean-type climate is attenuated with altitude. In a study carried out by Aksoy (1978) in Karabük Büyükdüz forest, it has been established that the annual mean temperature is 6.2 °C and the annual rainfall is between 1040-1372 mm. Although one third of the annual total of precipitation falls in the vegetation period, water supply is lowest in summer. The distance of the project sites to the Black Sea coast is slightly more than the Büyükdüz forest.

In the vegetation study carried out in Kavaklı, it was found that 83 out of 177 plant species had Euro-Siberian phytogeographical distribution, including the Euxine element, and only 7 of Mediterranean and 3 of Irano-Turanian distribution. In the vegetation study carried out in Eğriova, it has been established that 57 out of 150 plant species were distributed in the Euro-Siberian phytogeographical region (or in a part thereof), 7 with Mediterranean and 5 with Irano-Turanian distribution (Table 3). The project sites are located in the montane section of the Black Sea biogeographical region (Figure 17). This region as circumscribed by EEA (2017) constitutes one of three biogeographical regions in Turkey (Figure 18).

Table 3. Distribution of phytogeographical regions in the study sites of Eğriova and Kavaklı.

Site	Euxine(ha)	Subeuxine	Mediterranean	(Sub)Alpine (ha)
Eğriova	2108,51	3778,55	472,32	198,24
Kavaklı	3795,07	630,97	58,11	-

Figure 17. Physiography of the Black Sea biogeographical region

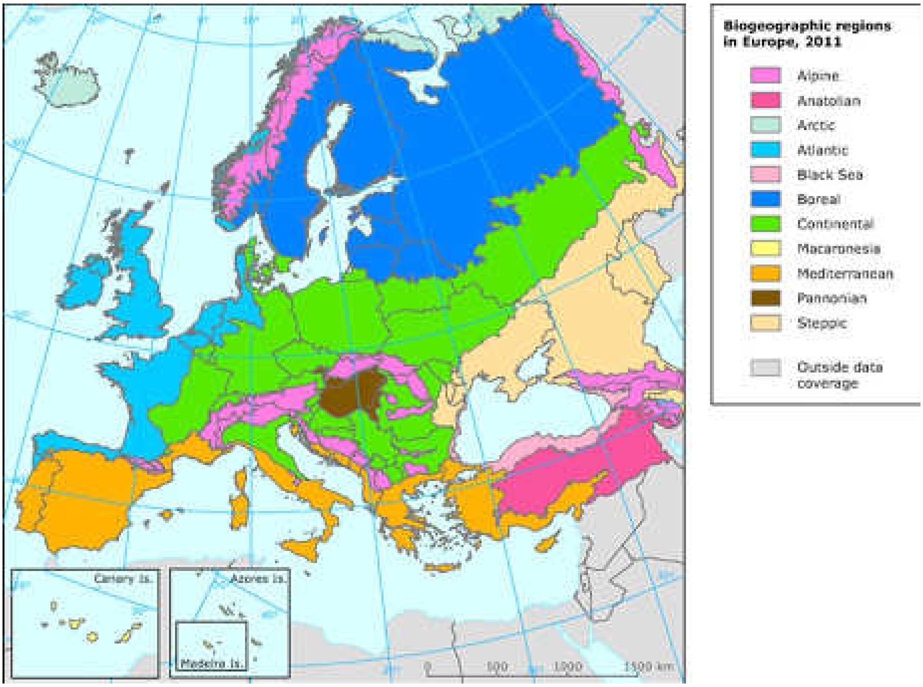


Figure 18. European biogeographical regions (European Environment Agency, 2017)

3.4.2 Natura 2000 habitats

The project sites have typical forest vegetation from the colline to the subalpine belt, varying in character depending on the elevation. The twenty-four vegetation types have been determined as a result of vegetation study. The vegetation types were grouped to eleven habitat types according to the principles specified in Annex I of the European Union Habitats Directive (European Commission, 2003, 2013; Figure 19), and information describing each habitat type has been arranged as in the example given below (Table 4). Furthermore, endemic and endangered plant species belonging to each habitat type have been listed. All tables generated for Natura 2000 habitat types are given in Annex I. The hornbeam and oak mixed forests have been grouped as mixed oak forests. Eight beech forest vegetation types occurring in both sites were assigned to a single beech habitat type. The vegetation where black pine and Scots pine are pure or dominant, have been classified as Montane pine forests of Euxine distribution. The fir forests, both pure or mixed with other coniferous or broadleaved tree species, have been grouped as Montane fir forests of the Black Sea region. Oak mixed evergreen shrubs with Mediterranean character have been arranged as Silvopastoral oak mixed forests or shrubs.

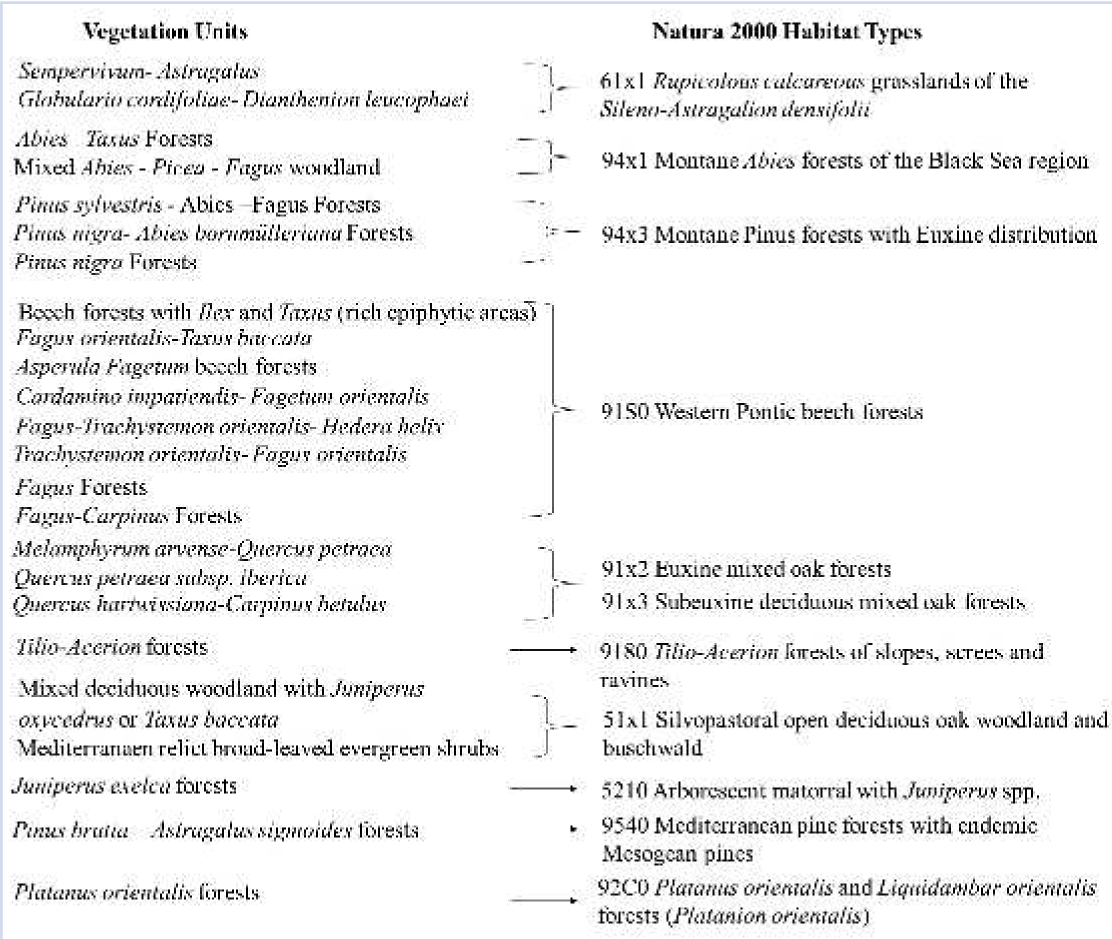


Figure 19. Assignment of vegetation types to Natura 2000 habitat types

Table 4. Tabularization of the Natura 2000 habitat types. For full tables see Annex 1.

Site	**EUNIS**	**Vegetation Communities**	**Natura 2000 Habitats**
Name of Project Site	Code	(A) Vegetation Association (B) Plants (C) Sources	Natura 2000 Code
Endemic and other species in need of protection			**Vulnerability by IUCN**
Species name	Endemism		Threat Category

In this study, we identified and defined five forest habitat types (and a non-forest grassland type) peculiar to Turkey that are not included in Annex I of the EU Habitats Directive. The "x" character has been added to their codes (Figure 19; Table 5). The distribution of the habitat types in the project sites is shown in Figure 20. Euxine beech forests have the largest distribution area of 50% in the Kavaklı site, followed by Euxine oak forests with 25.24%. Montane fir forests have the largest distribution area of 41% in the Eğriova site, followed by montane pine forests with 22.45%. Linden forests exist only in Kavaklı while arborescent juniper shrubland is found only in arid stony areas of Eğriova. Euxine and subeuxine oak forests exist in Kavaklı site while only subeuxine oak forests are located in Eğriova. The rarest forest habitat types are riparian gallery-shaped forests occurring with 0.24% in Eğriova, and silvopastoral oak mixed forests or shrubs occurring with 0.22% in Kavaklı. The habitats in mountainous areas are more homogeneous and more widely distributed in both sites, whereas in lower altitudes with settlements and agricultural areas different habitat types form a mosaic with patches of small area size (Figure 20).

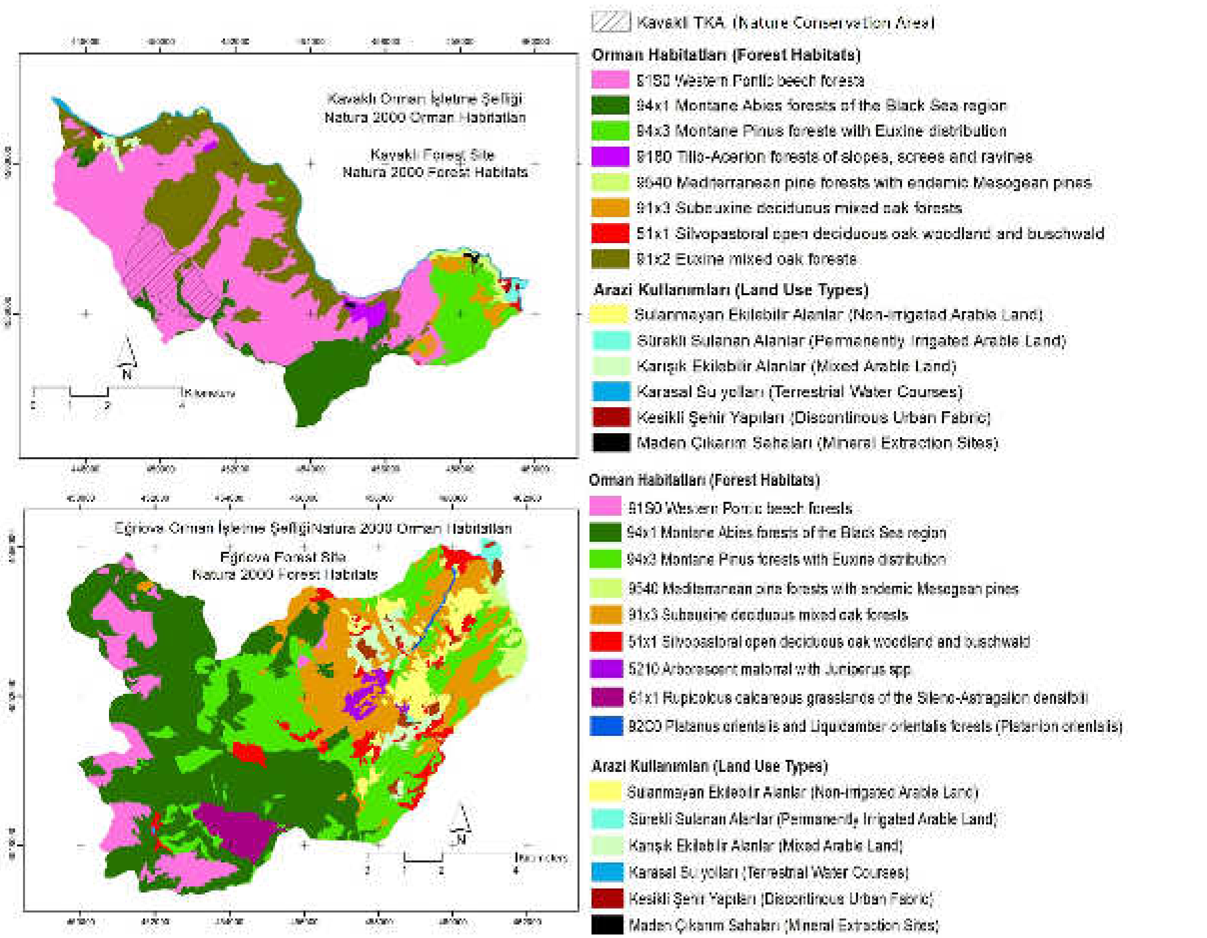


Figure 20. Distribution of Natura 2000 forest habitats in Kavaklı (upper) and Eğriova (lower)

Table 5. Area size and proportions of Natura 2000 habitat types and CORINE land cover types in the project sites

Natura 2000 Code	Natura 2000 Habitat Types	EĞRİOVA		KAVAKLI	
		Area Size (ha)	% Cover	Area Size (ha)	% Cover
91S0	Western Pontic beech forests	620.60	9.46	2257.10	50.34
91x2	Euxine mixed oak forests	-	-	1131.57	25.24
91x3	Subeuxine deciduous mixed oak forests	1068.49	16.29	110.02	2.45
9180	Tilio-Acerion forests of slopes, screes and ravines	-	-	57.77	1.29
92C0	Platanus orientalis and Liquidambar orientalis forests (Platanion orientalis)	15.78	0.24	-	-
94x1	Montane Abies forests of the Black Sea region	2710.06	41.33	520.94	11.62
94x3	Montane Pinus forests with Euxine distribution	1472.13	22.45	348.62	7.77
9540	Mediterranean pine forests with endemic Mesogean pines	106.42	1.62	48.03	1.07
51x1	Silvopastoral open deciduous oak woodland and buschwald	293.08	4.47	10.07	0.22
5210	Arborescent matorral with Juniperus spp.	72.82	1.11	-	-
61x1	Rupicolous calcareous grasslands of the Sileno-Astragalion densifolii	198.24	3.02	-	-
	Total	6557.62	100.00	4484.14	100.00
CORINE Code	**CORINE Land Cover Types**				
112	Sulanmayan Ekilebilir Alanlar (Non-irrigated Arable Land)	343.17	49.69	8.70	5.47
211	Sürekli Sulanan Alanlar (Permanently Irrigated Arable Land)	34.84	5.05	18.61	11.69
242	Karışık Ekilebilir Alanlar (Mixed Arable Land)	231.23	33.48	34.34	21.58
511	Karasal Su Yolları (Terrestrial Water Courses)	3.34	0.48	78.11	49.09
112	Kesikli Şehir Yapıları (Discontinous Urban Fabric)	78.06	11.30	9.91	6.23
131	Maden Çıkarım Sahaları (Mineral Extraction Sites)	-	-	9.44	5.94
	Total	690.65	100.00	159.11	100.00
	Total	**7248.26**		**4643.25**	

The selection forest management is implemented in the fir and beech forests located in the mountainous areas. In this type of forestry in which the purpose of management is to create stands with a certain stem diameter, it is most commonly possible to observe sub-compartments aiming to reach highest stem diameters. This is an important basis for the establishment of old-growth forests. Besides, it is very important not to use random skidding ways when removing the trees cut by being selected outside forest by means of skidding in this type of management. The economically most important forests for the production of wood raw material in the project sites are fir and beech forests where selection management has been implemented. Most important for the livelihood of the villagers in the region is the employment in forestry activities including wood cutting. The forests close to settlements or adjacent to agricultural areas are mostly used for grazing. Of these pasture woodlands, silvopastoral oak mixed forest and shrubs as well as subeuxine oak and hornbeam mixed broadleaved forests located at paths and roadsides had often been degraded and overexploited (Figure 21). On the other hand, it has been observed that young trees started to grow thickly in former agricultural areas that have not been exploited for approximately 20-25 years.

Figure 21. Silvopastoral oak mixed forests and scrub around agricultural areas

4. DISCUSSION and CONCLUSIONS

The forest stand and vegetation types and the properties characterizing them have been used to define forest vegetation types in the project sites of Kavaklı and Eğriova as Natura 2000 habitat types. While forest vegetation in Eğriova is represented chiefly by montane and subeuxine habitats, Kavaklı is characterised mainly by Euxine broadleaved forest habitats. The degree of human impact has been ignored while grouping the habitat types. In this way, forest stands mapped as the same Natura 2000 habitat type may occur as natural stands as well as forest stands more or less affected by human activities. Consequently, they would have to be assessed different conservation status.

As a major problem it emerged to which habitat type a vegetation type should be assigned. At this point, the approach requires vegetation ecological, biogeographical and phytosociological expertise. As yet, studies on Turkish forests based on habitat type definitions in the EU Habitats Directive are very limited. In addition, the absence of a common and widely accepted nomenclatural and syntaxonomical basis for vegetation classification of forest habitats in the respective biogeographical zones of Turkey has also emerged as a problem. Lack of vegetation mapping studies throughout Turkey, together with increasing environmental change as a result of human impacts both locally and globally, form constraints for a valid forest habitat type assessment throughout the entire country. It should be noted that studies carried out on Natura 2000 habitat types in Turkey have been made in the context of other studies but unevenly and not representatively for the whole country. For example, while most Oriental beech, hornbeam and Scots pine stands in Turkey occur in the Black Sea phytogeographical region, geobotanical overviews of these species focus on the Mediterranean and Irano-Turanian regions with their very different tree, shrub and herbaceous species composition (Cansaran et al. 2012; Gücel et al., 2008). It is quite obvious that existing Natura 2000 habitat types will change both in extent and number of subtypes, and that new habitat types will have to be defined when the concept of Natura 2000 is adapted to Turkey. Indeed, the number of habitat types of priority included in Annex I of the EU Habitats Directive increased in parallel to the enlargement of the EU.

The first important step when applying the Natura 2000 concept in Turkey is to improve the availability of sufficient reliable science-based data. Concerning the implementation of Natura 2000 areas in the whole country, it turned out that the distribution and variation of habitats and species is but insufficiently known and that there are gaps in particular regarding local to regional case studies. There is also a general lack of high-quality phytosociological studies. While there are some noteworthy floristic and vegetation studies referring to wider geographical areas in the country such as mountain ranges, valleys or basins (Yurdakulol et al., 2002), well sampled phytosociology-based vegetation studies at the level of administrative units such as of the western Black Sea region that covers the project sites, or at the province/district level are largely missing. Independently conducted phytosociological studies are often incompatible due to differences in field and classification methodology and syntaxonomy (Ketenoğlu et al., 2010). Additionally, another general problem for Turkish vegetation studies is that the scale-based synthesis of vegetation types frequently does not reflect the area adequately due to insufficient sample numbers (Uğurlu et al., 2012). It is necessary to set up expert groups of mainly scientists and relevant NGOs in order to define the needs and eliminate the mentioned shortcomings. To meet current needs, such expert groups can review and assess the previously conducted studies. Such groups can also identify priority work areas. Especially for the existing protected areas sufficient species- and habitat-related information is missing or is to be completed or updated. These protected areas are outstanding both as potential Natura 2000 areas and in terms of the required representation and connectivity of habitats. Furthermore, it is necessary in such areas to monitor the turnover in vegetation composition and habitat quality, changes which are commonly the result of land use change as observed in our study area as well as in many parts of the country.

Turkey's nature is unique and has an important place among the range of European countries. For instance, Turkey holds a major part and by far the widest elevational range of the Black Sea biogeographical region (Güngöroğlu, 2017). As yet, habitats and plant species specific to Turkey are not included in the annexes of the EU Habitats Directive. However, as the three biogeographical regions in Turkey, the Anatolian, the Mediterranean, and the Black Sea biogeographical region, are integral parts in the wider European biogeography, they are to be taken as a basis for identifying Turkey's habitat types, especially its endemic and subendemic ones that exist only in Turkey or which are represented chiefly in Turkey. It is these habitat types, and its plants and animals respectively, for which Turkey has main responsibility and should be ready to shoulder its share of conservation tasks.

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Annex 1. Habitat Types of the Kavaklı and Eğriova study areas. Plants given under (B) are exemplaric and non-exhaustive. Taxonomic and nomenclatural reference (with few exceptions): Davis (1965-1985).

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	41.12	(A) Beech forests with *Ilex* and *Taxus* (rich epiphytic areas) (B) Plants: *Rhododendron luteum, Pteridium aquilinum, Trachystemon orientalis, Rubus hirtus, Melica uniflora* (C) References: Günay and Küçük (2007). Bergmeier et al. (2018)	91S0 *Western Pontic beech forests
Endemic and other species in need of protection			**Vulnerability by IUCN**
Corydalis caucasica subsp. *abantensis*	Endemic		EN
Crocus speciosus subsp. *ilgazensis*	Endemic		LC
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	G1.A	(A) *Tilio-Acerion* forests of slopes, screes and ravines (B) Plants: *Ulmus glabra, Ostrya carpinifolia, Populus tremula, Alnus glutinosa, Lysimachia verticiliaris* (C) References: Hill et al. (2004b)	9180 **Tilio-Acerion* forests of slopes, screes and ravines
Endemic and other species in need of protection			**Vulnerability by IUCN**
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC
Verbascum ponticum	Endemic		VU

Site	**EUNIS**	**Vegetation Communities**	**Natura 2000 Habitats**
Kavaklı	41.13	(A) *Asperulo-Fagetum* beech forests (B) Plants: *Galium odoratum, Cardamine impatiens, Carex sylvatica, Epipactis pontica, Crataegus microphylla, Melica uniflora, Sanicula europaea, Neottia nidus-avis* (C) References: Günay and Küçük (2007), Project studies, Bergmeier et al. (2018)	91S0 *Western Pontic beech forests
Endemic and other species in need of protection			**Vulnerability by IUCN**
Epipactis pontica	Endemic		LC
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC

Site	**EUNIS**	**Vegetation Communities**	**Natura 2000 Habitats**
Kavaklı ve Eğriova	…	(A) *Cardamino impatientis-Fagetum orientalis* (B) Mostly on granite bedrock, sometimes shows are spread over rhyolite and limestone bedrock. Plants: *Rhododendron ponticum, Lauracerasus officinalis, Hedera helix, Circaea lutetiana, Cardamine bulbifera, Ruscus hypoglossum, Calamintha grandiflora, Ajuga reptans, Sanicula europaea* (C) References: Akman *et al.* (1988), Project studies, Bergmeier et al. (2018)	91S0 *Western Pontic beech forests
Endemic and other species in need of protection			**Vulnerability by IUCN**
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC
Epipactis pontica	Endemic		LC
Corydalis caucasica subsp. *abantensis*	Endemic		EN
Crataegus tanacetifolia	Endemic		LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	G4.6	(A) Mixed *Abies-Picea-Fagus* woodland (B) Plants: *Abies nordmanniana* subsp. *bornmuelleriana, Hedera helix, Moneses uniflora, Pyrola chlorantha, Circaea lutetiana, Calamintha grandiflora, Sanicula europaea* (C) References: Hill *et al.* (2004a), Özalp (1993), Bergmeier et al. (2018)	94x1: Montane *Abies* forests of the Black Sea region. A new habitat type to be added to the Natura 2000 Annex I.
Endemic and other species in need of protection			**Vulnerability by IUCN**
Verbascum ponticum	Endemic		VU
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC
Cephalanthera rubra	-		LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	6000-6200	(A) *Globulario cordifoliae- Dianthenion leucophaei* (B) Plants: *Sempervivum armenum subsp. armenum, Sempervivum gillianii, Valeriana alliariifolia, Festuca valesiaca, Geranium tuberosum, Scorzonera pygmaea subsp. nutans, Onosma bornmuelleri, Astragalus hirsutus* (C) References: Akman et al. (1988), Project studies	61x1 *Rupicolous calcareous* grasslands of the *Sileno-Astragalion densifolii* A new habitat type to be added to the Natura 2000 Annex I.
Endemic and other species in need of protection			**Vulnerability by IUCN**
Verbascum ponticum	Endemic		VU
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC
Cephalanthera rubra	-		LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	6000-6200	(A) *Sempervivum-Astragalus* (B) Plants: *Astragalus vulnerariae, Gypsophila brachypetala, Dianthus leucophaeus, Centaurea reuterana* var. *phrygia, Minuartia anatolica subsp. anatolica, Sempervivum gillianii, Geranium tuberosum, Festuca* spec. *Rhinanthus minor, Onosma bornmuelleri, Linum bienne, Daphne oleoides* subsp. *oleoides* (C) Project studies	61x1 *Rupicolous calcareous* grasslands of the Sileno-Astragalion densifolii A new habitat type to be added to the Natura 2000 Annex I.
Endemic and other species in need of protection			**Vulnerability by IUCN**
Astragalus vulnerariae		Endemic	LC
Minuartia anatolica subsp. *anatolica*		Endemic	LC
Dianthus leucophaeus		Endemic	LC
Gypsophila brachypetala		Endemic	VU
Sempervivum gillianii		Endemic	CD

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	…	(A) *Fagus-Trachystemon orientalis-Hedera helix* (B) Plants: *Rubus idaeus*, *Pteridium aquilinum*, *Galium odoratum*, *Sanicula europaea*, *Dryopteris filix-mas*, *Petasitas albus*, *Carex pendula*, *Ranunculus ficaria* subsp. *ficariiformis*, *Scilla bithynica*, *Sanicula europaea*, *Festuca heterophylla* (C) References: Project studies, Bergmeier et al. (2018), Mayer and Aksoy (1986)	91S0 *Western Pontic beech forests
Endemic and other species in need of protection			**Vulnerability by IUCN**
Geranium asphodeloides subsp. *sintenisii*		Endemic	LC
Crocus speciosus subsp. *ilgazensis*		Endemic	LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	…	(A) *Fagus orientalis–Taxus baccata* (Altitude: 900 m- 1350 m; Bedrock: Limestone (B) Plants: *Melica uniflora, Daphne pontica, Rhododendron ponticum, Lathyrus laxiflorus* subsp. *laxiflorus, Buxus sempervirens, Ruscus aculeatus, Cardamine bulbifera, Asperula taurina* subsp. *taurina, Galium odoratum, Galium rotundifolium, Staphylea pinnata, Viola odorata, Cyclamen coum* var. *coum, Mercurialis perennis, Actaea spicata, Circaea lutetiana, Corydalis caucasica* subsp. *abantensis* (C) References: Project studies, Çoban, S. (2016), Bergmeier et al. (2018)	91S0 *Western Pontic beech forests
Endemic and other species in need of protection			**Vulnerability by IUCN**
Corydalis caucasica subsp. *abantensis*	Endemic		EN
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	G1.6K1	(A) *Trachystemon orientalis–Fagus orientalis* (B) Plants: *Hedera helix, Rubus hirtus, Laurocerasus officinalis, Festuca drymeja, Daphne pontica, Acer platanoides, Acer campestre* subsp. *campestre, Lathyrus laxiflorus, Euphorbia amygdaloides, Rubus idaeus, Crataegus microphylla, Dactylis glomerata, Melica uniflora, Polygonatum multiflorum, Crataegus monogyna* subsp. *monogyna, Sanicula europaea* (C) References: Hill et al. (2004a), Hill et al. (2004b), Bergmeier et al. (2018)	91S0 *Western Pontic beech forests
Endemic and other species in need of protection			**Vulnerability by IUCN**
Corydalis caucasica subsp. *abantensis*	Endemic		EN
Geranium asphodeloides subsp. *sintenisii*	Endemic		LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	41.1	(A) *Fagus* Forests rainy and humid climate type. (Altitude: 900 m- 1200 m; Bedrock: limestone, flysch (B) Plants: *Rhododendron ponticum*, *Laurocerasus officinalis*, *Stellaria media*, *Galium odoratum*, *Asperula involucrata*, *Lathyrus laxiflorus* subsp. *laxiflorus*, *Daphne pontica*, *Melica uniflora*, *Corydalis integra*, *Cephalanthera rubra*, *Cephalanthera longifolia*, *Corydalis caucasica* subsp. *abantensis*, *Sorbus torminalis*, *Viola odorata*, *Chaerophyllum aromaticum*, *Polygonatum multiflorum*, *Calamintha grandiflora* (C) References: Bergmeier et al. (2018), Çoban, S. (2016), Davies *et al.* (2004), Hill et al. (2004), Mayer and Aksoy (1986)	91S0 *Western Pontic beech forests

Endemic and other species in need of protection		Vulnerability by IUCN
Corydalis caucasica subsp. *abantensis*	Endemic	EN
Cephalanthera rubra	-	LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	G4.9	(A) Mixed deciduous woodland with *Juniperus oxycedrus* or *Taxus baccata* (B) Plants*: Juniperus communis, Hedera helix, Ilex colchica, Veronica serpyllifolia, Galium odoratum, Ranunculus ficaria* subsp. *ficariiformis, Ranunculus gracilis, Fritillaria pontica, Festuca drymeja, Calamintha grandiflora, Helleborus orientalis, Euphorbia amygdaloides, Polygonatum multiflorum, Acer platanoides, Epipactis pontica, Epipactis helleborine, Corydalis integra, Chaerophyllum aromaticum, Sanicula europaea,* (C) References: Project studies, Hill et al. (2004), Bergmeier et al. (2018)	51x1 Silvopastoral open deciduous oak woodland and buschwald A new habitat type to be added to the Natura 2000 Annex I.

Endemic and other species in need of protection		Vulnerability by IUCN
Epipactis pontica	Endemic	LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova ve Kavaklı	…	(A) *Fagus-Carpinus* Forests (B) Plants: *Hedera helix, Lauracerasus orientalis, Ilex colchica, Galium odoratum, Ranunculus ficaria* subsp. *ficariiformis, Cardamine bulbifera, Fritillaria pontica, Festuca drymeja, Calamintha grandiflora, Helleborus orientalis, Euphorbia amygdaloides, Polygonatum multiflorum, Acer platanoides, Epipactis pontica, Epipactis helleborine, Corydalis integra, Chaerophyllum aromaticum, Sanicula europaea, Aristolochia pontica* (C) References: Project studies, Bergmeier et al. (2018)	91S0 *Western Pontic beech forests
Endemic and other species in need of protection			**Vulnerability by IUCN**
Epipactis pontica	Endemic		LC
Campanula latiloba subsp. *latiloba*	Endemic		LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Kavaklı	…	(A) *Abies–Taxus* Forests (B) Plants: *Pteridium aqulinum, Helleborus orientalis, Asperula taurina* subsp. *taurina, Galium odoratum, Melica uniflora, Crataegus monogyna* subsp. *monogyna, Corydalis integra, Lathyrus laxiflorus* subsp. *laxiflorus, Polygonatum multiflorum* (C) References: Project studies, Bergmeier et al. (2018), Mayer and Aksoy (1986)	94x1: Montane *Abies* forests of the Black Sea region A new habitat type to be added to the Natura 2000 Annex I.
Endemic and other species in need of protection			**Vulnerability by IUCN**
Crocus speciosus subsp. *ilgazensis*	Endemic		LC

Site	EUNIS	Vegetation Communities	Related Natura 2000 Forest Habitats
Eğriova ve Kavaklı	…	(A) *Abies-Fagus* Forests (B) Plants: *Hedera helix, Staphylea pinnata, Mercurialis perennis, Actaea spicata, Circaea lutetiana, Corydalis caucasica* subsp. *abantensis, Lathyrus laxiflorus* subsp. *laxiflorus, Sanicula europaea, Carex sylvatica, Geranium asphodeloides* subsp. *sintenisii* (C) References: Project studies, Bergmeier et al. (2018), Mayer and Aksoy (1986)	91S0 *Western Pontic beech forests

Endemic and other species in need of protection		Vulnerability by IUCN
Corydalis caucasica subsp. *abantensis*	Endemic	EN
Geranium asphodeloides subsp. *sintenisii*	Endemic	LC
Crocus speciosus subsp. *ilgazensis*	Endemic	LC
Cephalanthera rubra	-	LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	… Temperate mountainous coniferous forests	(A) *Pinus nigra* Forests (*Pinus nigra* subsp. *pallasiana*) (B) Plants: *Fritillaria pinardii, Helleborus orientalis, Ranunculus constantinopolitanus, Doronicum orientale, Platanthera bifolia, Festuca drymeja, Ornithogalum wiedemannii* var. *wiedemannii, Juniperus communis* (C) References: Project studies, Devillers *et al.* (2001), Bergmeier et al. (2018)	94x3: Montane *Pinus* forests with Euxine distribution A new habitat type to be added to the Natura 2000 Annex I.

Endemic and other species in need of protection		Vulnerability by IUCN
Lonicera caucasica pallas ssp. orientalis	Endemic	LR (LC)
Linaria corifolia	Endemic	LR (LC)

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	… Temperate mountainous coniferous forests	(A) *Pinus nigra-Abies bornmuelleriana* Forests (B) Plants: *Cerasus avium, Doronicum orientale, Astragalus anthylloides, Astragalus micropterus, Asphodeline sp., Scorzonera pygmaea* subsp. *nutans, Pyrola chlorantha, Melampyrum arvense, Cephalanthera rubra, Tragopogon coloratus, Vicia cassubica, Vicia crocea, Asarum europeaum, Lonicera caucasica subsp. caucasica, Juniperus oxycedrus, Chamaecytisus hirsutus* (C) References: Project studies, Bergmeier et al. (2018)	94x3: Montane *Pinus* forests with Euxine distribution A new habitat type to be added to the Natura 2000 Annex I.

Endemic and other species in need of protection		Vulnerability by IUCN
Astragalus micropterus	Endemic	LC
Scorzonera pygmaea subsp. *nutans*	Endemic	CD
Lonicera caucasica subsp. *orientalis*	Endemic	LR(LC)
Cephalanthera rubra	-	LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	… Temperate mountainous coniferous forests	(A) *Pinus sylvestris–Abies–Fagus* Forests (Altitude: 1000 m- 1600m; Bedrock: flysch, clay, sandstone, limestone) (B) Plants: *Cerasus avium, Acer trautvetteri, Acer campestre* subsp. *campestre, Doronicum orientale, Briza media, Salvia tomentosa, Vicia cassubica, Vicia crocea, Lonicera caucasica* subsp. *caucasica, Chamaecytisus hirsutus* (C) References: Project studies, Bergmeier et al. (2018), Çoban (2016), Mayer and Aksoy (1986)	94x3: Montane *Pinus* forests with Euxine distribution A new habitat type to be added to the Natura 2000 Annex I.

Endemic and other species in need of protection		Vulnerability by IUCN
Lonicera caucasica subsp. *orientalis*	Endemic	LR(LC)

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	…	(A) *Melampyrum arvense-Quercus petraea* (Altitude: 800 m- 1300 m; Bedrock: marmorean, clay, sandstone) (B) Plants: *Cerasus avium, Sorbus torminalis, Malus sylvestris* subsp. *orientalis, Briza media, Rosa canina, Ferulago thirkeana, Psorelea bituminosa, Dorycnium graecum, Trifolium medium var. medium, Trifolium nigrescens, Dactylis glomerata* (C) References: Project studies, Çoban (2016)	91x3 Subeuxine deciduous mixed oak forests A new habitat type to be added to the Natura 2000 Annex I.

Endemic and other species in need of protection		Vulnerability by IUCN
Ferulago thirkeana	Endemic	NT
Crataegus tanacetifolia	-	LC
Cephalanthera rubra	-	LC

Site	EUNIS	Vegetation Communities	Natura 2000 Habitats
Eğriova	… Temperate mountainous coniferous forests	(A) *Quercus petraea* subsp. *iberica* (B) Plants: *Acer platinoides, Acer campestre* subsp. *campestre, Crataegus tanacetifolia, Crataegus monogyna, Cornus sanguinea, Asperula taurina* subsp. *taurina, Lathyrus laxiflorus* subsp. *laxiflorus, Melica uniflora, Epipactis pontica, Cephalanthera rubra, Epipactis helleborine, Neottia nidus-avis, Astrantia maxima* subsp. *haradjianii, Corydalis integra, Scilla bifolia, Calamintha nepeta, Iris kerneriana* (C) References: Project studies	91x3 Subeuxine deciduous mixed oak forests A new habitat type to be added to the Natura 2000 Annex I.

Endemic and other species in need of protection		Vulnerability by IUCN
Crataegus tanacetifolia	Endemic	LC
Epipactis pontica	Endemic	LC
Astrantia maxima subsp. *haradjianii*	Endemic	NE
Iris kerneriana	Endemic	LC
Cephalanthera rubra	-	LC

Site	**EUNIS**	**Vegetation Communities**	**Natura 2000 Habitats**
Eğriova	… Temperate mountainous coniferous forests	(A) *Quercus hartwissiana-Carpinus betulus* (B) Plants: *Crataegus tanacetifolia, Epipactis helleborine, Epipactis pontica, Neottia nidus-avis, Astrantia maxima* subsp. *haradjianii, Galium paschale, Ranunculus brutius, Corydalis integra, Scilla bifolia, Calamintha nepeta* (C) References: Project studies	91x3 Subeuxine deciduous mixed oak forests A new habitat type to be added to the Natura 2000 Annex I.

Endemic and other species in need of protection		**Vulnerability by IUCN**
Crataegus tanacetifolia	Endemic	LC
Epipactis pontica	Endemic	LC
Astrantia maxima subsp. haradjianii	Endemic	NE

1_ All lands with tree cover of canopy density between 10% and 100%

2_ All forest lands with poor tree growth mainly of small or stunted trees having canopy density less than 10 percent

BIRD AND MAMMAL FAUNA IN EĞRİOVA AND KAVAKLI FORESTS

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Summary

Biodiversity represents the whole genes in a region, the species that carry these genes, the ecosystems that has been hosting these species and the ecological processes that has been interconnecting them. Recently, excessive increase of population has led to a hike in the needs of humans, and consequently, the loss of biodiversity. With the damages becoming more tangible, important actions were taken to preserve biodiversity. To this end, various protective strategies at global scale have been developed and signatory countries are getting involved into agreements to preserve biodiversity. Turkey has also became a signatory to several conventions to complement its liabilities in the EU accession process. One and the most important of these conventions is the Natura 2000, the largest network of protected areas around the world. Turkey, because of being under the impact of three different phytogeographical regions has led to formation of various vegetations and different climatic systems, and thus a richer biodiversity as compared to geographical areas in the same latitudes. Natura 2000 efforts are very important to preserve this rich biodiversity of Turkey. In the scope of these efforts, field studies were conducted and reported on bird and mammal species in the habitats in Eğriova and Kavaklı Forest Sub-District Directorates. According to this, 33 mammal species and 74 bird species were identified in the study area, and bio-ecological information on important species were presented. The factors that threaten the habitats of birds and mammals that comprise the basis for Natura 2000, were identified in field and literature studies, and potential protective measures were suggested. In this context, it is considered as important to demonstrate critical national habitats where critical species are hosted via Natura 2000 efforts, to promote and continue with this project and similar projects, and to reinforce protective and control mechanisms in terms of feasibility. To conclude, the practices under Natura 2000 will become a guide to restrict industrial activities in critical areas to be identified or to logistically use non-critical areas.

1. INTRODUCTION

Biodiversity represents the whole of the genes, species, eco-systems and ecological events in a particular area. In other words, biodiversity represents the whole genes in a region, the species that carry these genes, the ecosystems that host these species and the occurrences (processes) that interconnect them. Biodiversity is an indispensable element in human life. The food, clothing, medicine and the necessary materials to produce these for people are sourced from the nature and their domesticated forms. Recently, the excessive increase of population has led to a hike in the needs of humans, and consequently, the loss of biodiversity. With this damage becoming more visible, preservation of biodiversity has come into focus, particularly in the last decade. To this end, various protective strategies at global scale have been developed and signatory countries are getting involved into agreements to preserve biodiversity. Turkey has an applicable legislation to protect species and habitats. Turkey has also became a signatory to several conventions to complement its liabilities in the EU accession process. These are the Habitat Directive (92/43/EEC), Bird Directive (79/409/EEC) and the EU Directives associated with the CITES Convention (338/97/EC, 1808/2001/EC). It has started efforts to complete the preparation process for the Natura 2000 ecological network, which is the basis of the Habitat Directive. It is also known that the identification of Natura 2000 areas is a very long working process that will require conducting detailed scientific studies in cooperation with numerous experts. Biodiversity studies have been started and ongoing per provinces to support this system.

1.1 BIRD DIRECTIVE (2009/147/EC)

The Bird Directive is the Directive 2009/147/EC of the European Parliament and the European Commission which came into effect on 30 November 2009 to protect wild birds (Directive 79/409/EEC as amended. The Directive stipulates the protection of 194 bird species and sub-species which have been identified as to be under risk and require special protective measures. There are various components for the implementation of the Directive (European Commission, 2014a, Table 1):

· Member states are required to allocate "Special Protected Areas (SPA)" for 194 birds at risk and for all migrating birds under Bird Directive Annex-I. SPA's are critical areas which are scientifically identified to sustain the livelihood of targeted species (e.g. wetlands). SPA's are part of the Natura 2000 ecology network that was established according to the Habitat Directive 92/43/EEC.

· A second component is the prohibition of purposeful killing or catching of birds, destroying their nests, gathering their eggs and trading of live or dead birds (except for a few exceptions) that directly threaten birds.

· A third component is the restriction of the number of birds listed in Annex-III, which can be hunted (82 species and sub-species), and the time period for hunting these species. This component also describes the permitted hunting methods (e.g. non-selective hunting is prohibited).

Table 1. Annexes to the Bird Directive

Annex	Description
I	Species under special protective measures related to habitats to support their proliferation in their range and to ensure their survival
II	Species may be hunted under national legislation. Member states shall ensure that hunting activities will not prevent the protective efforts in the diffusion area of the birds
III	Sales of species, transportation for sales, storage for sales and sales of live or dead birds or any recognizable parts or variables of birds are not prohibited, provided that the birds are legally killed, caught or seized in other legal methods

1.2 HABITAT DIRECTIVE (92/43/EEC)

The Habitat Directive 92/43/EEC came into effect in 1992. The main purpose of the Directive is to preserve biodiversity with due to consideration of economic, social, cultural and regional requirements. Although the Directive contributes to the overall objective of sustainable growth, it aims to protect approximately 450 animal species and 500 plant species, which are rare, endemic and at risk. Also, approximately 200 rare and special habitat species were included in the protection objectives in terms of their characteristics (European Commission, 2014a). The Habitat Directive, along with the Bird Directive, comprises the basis for the natural protection policy of Europe. The Directive has two pillars: Natura 200 network of protected areas and the solid system for protection of species. Under the Directive, more than 1000 plant and animal species and more than 200 habitat types in Europe (e.g. Special forest types, grasslands, wetlands, etc.) are protected. Annex-I and Annex-II of the Directive covers habitat types and species that require allocation of special areas for protection. Some of these are defined as "priority" habitats or species (at risk of extinction). The description of annexes to the Habitat Directive are presented in Table 2.

Table 2. Annexes to the Habitat Directive

Annex	Description
I	Natural habitat types of community interest that require declaration of special area to be protected for protection
II	Plant and animal species of community interest that require declaration of special area to be protected for protection
III	Selection criteria of areas that are community interest and that are eligible to be declared special area for protection
IV	Plant and animal species of community interest that require strict protective measures
V	Plant and animal species of community interest that require strict management measures for gathering and use

1.3. BIOLOGICAL WEALTH OF TURKEY

The diversity of topography and climate conditions of Anatolia, which can be defined as a small continent, are the main characteristics that make it a unique piece of land. The proximity of mountain ranges, volcanoes, closed-basin lakes, flood plains, karstic plateaus, seas and small and large rivers are resulted in having diverse climates side by side in the same time interval. The diversity in the topography and climate is reflected on the biodiversity in Turkey in two dimensions. The first one is the diversity of "eco-systems", i.e. natural habitats: Floodplain forests, scrubs, peatlands, steppes, high-mountain eco-systems and salt lakes are the best examples to this. The other aspect is the elusive biodiversity of Anatolia in terms of physically and climatically isolated areas. The impact of physical insulation is deepened with the temporal changes in climatic characteristics and the variability in the soil structure and in geomorphology. All of these, create the geographical conditions which comprise endemism, which is one of the fundamental concepts that improve biodiversity. High mountain summits, deep river valleys, closed-basin lakes are the areas that host many peculiar, or endemic species because the physical insulation is at the highest level. Therefore, Turkey functions as a bridge between Asia, Europe and African continents: Due to various topographical structures and climate conditions, it is home to various habitats, such as sand dunes, steppes, alluvial plains, lakes and rivers, and thus a rich diversity of species. Turkey being under the impact of three different phytogeographical regions have led to the formation of various vegetations and different climatic systems, and thus a richer biodiversity of fauna as compared to geographical areas in the same latitudes. This diversity brings some species from different zoo-geographical origins to Anatolia. For example, the Crane which reproduces in northern latitudes, the Cirl Bunting which is a member of the Mediterranean Bio-geography, the See-See Partridge from the southern latitudes, all meet inside the borders of Turkey.

There are 9916 known species of birds around the world (Green and Moorhouse, 1995). According to the International Union for Conservation of Nature (IUCN) there are 10,064 species of birds in the world (Anonymous, 2012). Some records suggest that there are 10,052 species of birds in the world (Anonymous, 2013). According to Newton and Dale (2001), the Palearctic region covers 14% of the bird breeds and 10% of the bird species in the world. Cox (2010) suggested that there are 9930 bird species in 204 families in the world, that at least 2600 species in 141 migrating families migrate, and that this number represents approximately 26,2% of all species. There are various numbers of bird species in Turkey. The number is 403 according to Ergene (1945), 500-550 according to Kumerloeve (1962), 376 according to Baran and Yılmaz (1984), 426 according to Kiziroğlu (1989), 421 according to

Turan (1990), 449 according to Bilgin (1994), 4450 according to Kasparek and Bilgin (1996), 453 according to Kirwan et al. (1998), and 450 according to Kiziroğlu (2009). It is believed that approximately 305 bird species reproduced in Turkey. Turkey, which is a member of the Western Palearctic Zoo-geographical region, comprises 2% of this region in terms of surface area; however, it hosts approximately 35% of the bird species reproducing in this region. Therefore, Turkey has a relatively rich ornithofauna.

There are 5416 known species of mammals around the world (Wilson and Redeer, 2003). Today, approximately 170 mammal species live in Turkey. There have been numerous studies on the mammal fauna of Turkey (Mursaloğlu B., 1965; Kumerloeve, 1965; Spitzenberger and Vauk, 1966; Felten et al., 1973; Corbet and Southern, 1977; Corbet, C.B., 1978; Mursaloğlu, 1978; Kumerloeve, H., 1978; Kral and Benli, 1979; Kumerloeve, H., 1980; Huş and Göksel, 1981; Tunçdemir, 1988; Doğramacı, 1989; Kaya, 1989; Helversen, 1989; Çolak et al.,1994; Kefelioğlu, 1995; Çolak et al., 1997; Çolak et al., 1997; Benda and Horacek, 1998; Özkurt et al., 1999; Yiğit and Çolak, 2002; Krystufek et al., 2002; Yiğit et al., 2005; Çolak et al., 2005; Kryštufek and Vohralik, 2005; Yiğit et al., 2006). Mammals are engaged in nutrition and reproduction in different seasons. In general, mammals reproduce from March to October, and have different nutritional regimes during the day or night. The habitat requirements of mammals vary according to climate conditions. Some mammal species go into the hibernating period in winter, and some are active during the winter season.

2. MATERIALS and METHOD

2.1 RESEARCH AREA

In this project, field study was performed in areas in Eğriova and Kavaklı Forest Sub-District Directorates (see Chapter 3) in May and June 2017 by Assoc. Prof. Şafak BULUT and Expert Biologist Murat DOĞAN, and the previous expert studies and literature review were compiled into a report.

2.2 METHOD

2.2.1 Methodology for the Mammals

The basic objectives of the studies on mammals are to identify the species of mammals living in the project area, to observe the large mammal species in and/or around forestlands depending on tree species that form a stand, to establish the numbers of populations of mammal species and to compare them with the populations in the whole country, to discuss the lists or living spaces of mammal species that have been identified in previous studies in the area or region, to identify the anthropogenic risks against certain species or against all mammals in general during the field study, and to use a methodological approach based on forest types in identifying the mammals.

In this scope,

· Data were gathered from the field observation activities during field studies in the project area in order to identify the mammals. Nevertheless, the literature information obtained during studies that were conducted in previous years, and interviews (questionnaires) with local people were also used.

· The animal species were identified by using the presence of habitats convenient for the preferences of the species, nests-offsprings-hairballs-footprints (particularly for the identification of large mammal species), faeces-food residue-lair holes (particularly for identification of mammals), and residues of skin-horns-shells and bones.

· During faunistical field studies, no animals were hunted-gathered-killed to identify the species in the area.

· Photo traps were used to identify large mammals (fox, marten, boar) and medium-sized mammals (squirrel, weasel, etc.), and audio recording devices were used to identify the bats.

· Trapans, nets and live traps (Sherman's trap) were used to identify small mammals, reptiles and amphibians, and the animals which were caught and identified, were then released back to the wildlife.

· Maps of 1/25.000 scale and satellite images are used in field studies. Besides, GPS was used to identify the altitudes and geographical coordinates during mapping studies.

· Field studies had started early in the morning and continued until sunset.

· Night-time field studies had also conducted for nocturnal species (particularly bats and large mammals).

· The tables of species list, include the scientific name and Turkish name of each species, its presence inside and/or outside the activity area, relative density of population, its endemism status and presence and eligibility of alternative areas in the immediate vicinity, among other data.

· IUCN Red List, Bern Convention and CITES lists were used to establish the international risk categories for the fauna elements. In establishing the national risk categories, Kiziroğlu (2009), Demirsoy (2002) and MAK Decisions (2017-2018) were used as reference.

Several images of the field study are presented in Figure 1.

Figure 1. Images from field studies.

In the project, a total of 8 photo traps were installed in both Directorates, and the information about these installations is presented in Table 3. The areas where photo traps were installed are marked and demonstrated on Google Earth images, which are presented in Figure 2.

Figure 2. Google Earth image of areas where photo traps were installed and birds are monitored by using the point transect method

Table 3. Information on photo trap locations

Photo Trap No.	UTM Coordinates		Altitude (m)	Number of Active Days	Installed On	Removed On
	X	Y				
1	4559834 K	449543 D	422	37	29.05.2017	04.07.2017
2	4558755 K	449596 D	675	37	29.05.2017	04.07.2017
3	4558012 K	450185 D	906	37	29.05.2017	04.07.2017
4	4553019 K	452970 D	1376	37	29.05.2017	04.07.2017
5	4551995 K	455849 D	1441	37	29.05.2017	04.07.2017
6	4550418 K	453564 D	1189	30	04.06.2017	04.07.2017
7	4547627 K	452755 D	1390	30	04.06.2017	04.07.2017
8	4547683 K	453761 D	1559	30	04.06.2017	04.07.2017

2.2.2 Methodology for the Bird Species

During the observations along the line, the research methods prepared by Bibby et al. (2006) were used, and the area stretching along the monitored line was scanned to record the birds species that were seen and heard. Point counting method is an effective method which is often used in monitoring wetlands. However, this method can also be applied by counting in a non-wetland area, by making the count from an open area with a good view. This method was rarely used, although it was applied in several stages (when for listening owl sounds at night, etc.) of the project. Considering the natural structure of Karabük province, the trackside counting method is more effective. Therefore, the trackside counting method was used in almost all studies. For example, the duration of the observation and the distance of the road that was covered was shorter as a relatively vast area was scanned from a location where birds were easily seen and heard. Several of taken pictures during land studies in various habitats where land studies were conducted are presented in Figure 3.

Svensson (2009) was considered as a reference in identification of the bird species detected in the area, Heinzel et al. (1995) in Turkish denomination of the species, IOC World Bird List (v 4.3) in denomination in Latin, and Kılıç and Eken (2004) for their status in Turkey. Besides, in the periodically updated titles, the international protection status was given according to IUCN Red List (2014.3) and the MAK titles were given according to Central Hunting Commission's (MAK) decisions in 2017-2018. In the title for the Ministry of Forestry and Water Affairs, the decision no 28977 published in the Official Gazette on 19/04/2014 was taken as a basis.

Figure 3. Images from field studies on birds

3. RESULTS

3.1 MAMMAL SPECIES

This chapter covers findings of the land fauna studies conducted under this project. In this context, a list of species identified during the land studies performed in May and June 2017 is presented. The systematic categories of the fauna species in these tables (Ordo-Family), denominations in Latin and Turkish, international (IUCN, BERN, CITES) and national (2017-2018 Central Hunting Commission Decisions, Turkish Red List Status) risk and protection status and data resources are specified.

Some mammal species identified are protected under the Bern Convention. 10 species protected under the Bern Convention are presented in Annex List-2 (faunma species to be strictly protected), and 9 species are presented in Annex List-3 (Fauna species to be protected)[1].

According to IUCN, 1 species in the project areas which is included in categories that are at global risk (*Miniopterus schreibersii*) is categorized as NT (Near Threatened), 32 species are included in the LC (Least Concern) category; and the regions has the vast-proliferating species in Turkey in general and in the Western Palearctic zoo-geographical region[2].

According to CITES, 3 species (*Ursus arctos, Cervus elaphus, Canis lupus*) are in the ANNEX 1 category, and 3 species (*Canis aureus*, *Martes foina, Vulpes vulpes*) in the ANNEX 3 category. The other species are excluded from the list[3].

1- http://conventions.coe.int/Treaty/EN/Treaties/Html/104.htm (Bern Convention)

2- http://www.iucnredlist.org/ (IUCN Red List)

3- http://www.cites.org/eng/resources/species.html (CITES Appendices)

According to MAKK (Decisions of Central Hunting Commission), 1 species (*Meles meles*) is included in ANNEX 1 (Hunting Animals Protected by the Central Hunting Commission as specified by the Ministry of Forestry and Water Affairs), and 5 species (*Canis aureus, Martes foina, Vulpes vulpes, Sus scrofa, Lepus europaeus)* are included in ANNEX 2 (Hunting Animals Which Can Be Hunted During Certain Periods as permitted by the Central Hunting Commission)[4].

According to the Ministry of Forestry and Water Affairs, 8 species (*Dryomys nitedula, Martes martes, Ursus arctos, Lynx lynx, Capreolus capreolus, Felis silvestris, Cervus elaphus, Canis lupus)* are under protection[5].

4- http://www.milliparklar.gov.tr/av/Makkarar.pdf

5- http://www.milliparklar.gov.tr/AnaSayfa/yabanHayatiDairesi/yh_turkoruma_sube_mudurlugu.aspx?sflang=tr

Figure 4. Ursus arctos (Grizzly Bear)

Figure 5. Canis lupus (Wolf)

Figure 6. Vulpes vulpes (Red Fox)

Figure 7. Lynx lynx (Lynx)

Figure 8. Felis silvestris (Wild Cat)

Figure 9. Capreolus capreolus (Roe)

Figure 10. Hunting activity

Figure 11. Mushroom picking in the study site

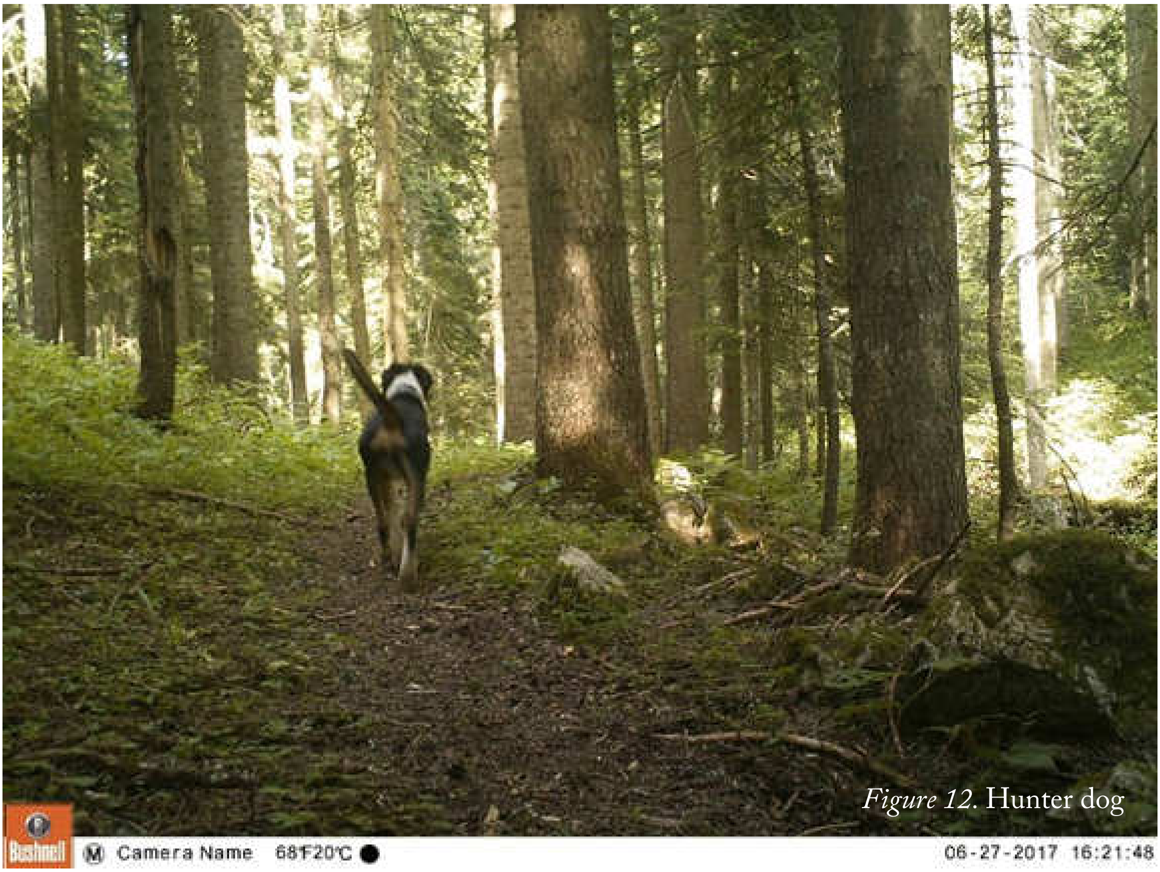

Figure 12. Hunter dog

Table 4. Mammal species identified in the study area (G: Observation, L: Literature)

No	Scientific Name	Turkish Name	ENDEMIC	IUCN	CITES	BERN	OSB	MAKK	METHOD OF IDENTIFICATION
1	*Erinaceus concolor*	Hedgehod	-	LC	-	-	Not under protection	-	G
2	*Myotis mystacinus*	Whiskered Bat	-	LC	-	-	Not under protection	-	L
3	*Myotis myotis*	Greater Mouse-Eared Bat	-	LC	-	ANNEX-II	Not under protection	-	L
4	*Myotis emarginatus*	Geoffroy's Bat	-	LC	-	ANNEX-II	Not under protection	-	L
5	*Myotis blythii*	Smaller Mouse-Eared Bat	-	LC	-	-	Not under protection	-	L
6	*Rhinolophus blasii*	Blasius's Horseshoe Bat	-	LC	-	ANNEX-II	Not under protection	-	L
7	*Pipistrellus pipistrellus*	Common Pipistrelle	-	LC	-	ANNEX-III	Not under protection	-	L
8	*Eptesicus serotinus*	Serotine Bat	-	LC	-	ANNEX-II	Not under protection	-	L
9	*Hypsugo savii*	Savi's Pipistrelle	-	LC	-	ANNEX-II	Not under protection	-	L
10	*Miniopterus schreibersii*	Common Bent-Wing Bat	-	NT	-	ANNEX-II	Not under protection	-	L
11	*Nyctalus leisleri*	Leisler's Bat	-	LC	-	-	Not under protection	-	L
12	*Lepus europaeus*	European Hare	-	LC	-	ANNEX-III	Not under protection	ANNEX II	L
13	*Sciurus anomalus*	Squirrel	-	LC	-	ANNEX-II	Not under protection	-	L
14	*Apodemus flavicollis*	Yellow-Necked Mouse	-	LC	-	-	Not under protection	-	G
15	*Apodemus mystacinus*	Broad-Toothed Field Mouse	-	LC	-	-	Not under protection	-	L
16	*Apodemus witherby*	Steppe Field Mouse	-	LC	-	-	Not under protection	-	L

No	Scientific Name	Turkish Name	ENDEMIC	IUCN	CITES	BERN	OSB	MAKK	METHOD OF IDENTIFICATION
17	*Myodes glareolus*	Bank Vole	-	LC	-	-	Not under protection	-	L
18	*Mus macedonicus*	Macedonian Mouse	-	LC	-	-	Not under protection	-	L
19	*Rattus rattus*	Rat	-	LC	-	-	Not under protection	-	L
20	*Dryomys nitedula*	Forest Dormouse	-	LC	-	ANNEX-III	Under protection	-	L
21	*Martes foina*	Beech Marten	-	LC	ANNEX-III	ANNEX-III	Not under protection	ANNEX II	G
22	*Martes martes*	Pine Marten	-	LC	-	ANNEX-III	Under protection	-	L
23	*Canis aureus*	Common Jackal	-	LC	ANNEX-III	-	Not under protection	ANNEX II	L
24	*Canis lupus*	Common Wolf	-	LC	ANNEX-I	ANNEX-II	Under protection	-	L
25	*Vulpes vulpes*	Red Fox	-	LC	ANNEX-III	-	Not under protection	ANNEX II	G
26	*Meles meles*	Badger	-	LC	-	ANNEX-III	Not under protection	ANNEX I	L
27	*Mustela nivalis*	Least Weasel	-	LC	-	ANNEX-III	Not under protection	-	L
28	*Ursus arctos*	Grizzly Bear	-	LC	ANNEX-I	ANNEX-II	Under protection	-	G
29	*Lynx lynx*	Lynx	-	LC	-	ANNEX-III	Under protection	-	G
30	*Felis silvestris*	Wildcat	-	LC	-	ANNEX-II	Under protection	-	G
31	*Sus scrofa*	Wild boar	-	LC	-	-	Not under protection	ANNEX II	G
32	*Capreolus capreolus*	Roe	-	LC	-	ANNEX-III	Under protection	-	G
33	*Cervus elaphus*	Red Deer	-	LC	ANNEX-I	-	Under protection	-	L

3.2. BIRD SPECIES

Under the project of identification of Biological Diversity in Karabük Province in 2014, a bird species list was prepared by Bird Expert Ergün Bacak and by Assoc. Prof Dr. Şafak Bulut in June 2017, according to the land, literature and habitat studies, and in this list, it was reported that a total of 74 bird species may be living in the project sites. According to this, 74 bird species are considered in 11 ordoes and 29 families. The distribution of these species according to national and international protection criteria is presented below.

According to IUCN (European Red List)**:** according to the evaluations based on the European Red list of IUCN, among the bird species identified in the area, *Streptopelia turtur* is included in the "**VU**: Vulnerable" category. The other bird species which were identified in the project site are included in the "LC: Least Concern" category. 1 bird species was identified in the project site which is defined as critical (VU, EN and CR) according to IUCN, and this species use the site for reproduction and feeding[6].

According to the Bern Convention: According to the results of the assessment performed under the annex lists of the Bern Convention, among the wild animal species identified in the project site and its immediate vicinity, 54 bird species are included in ANNEX-2, i.e. "Species Under Strict Protection" and 17 bird species are included in ANNEX-3, "Species Under Protection", and the remaining 3 bird species are not included in annex lists of the Bern Convention[7].

According to CITES Convention: According to CITES (Convention of Trading of Endangered Wild Animal and Plant Species), none of the bird species are included in Annex-2 (*which comprises non-endangered species, however trading of these species is restricted to prevent their usage in a way that does not support their survival*) and in Annex-3 (*which comprises species that are under protection in at least 1 country and which require application to other signatory countries of CITES for controlling their trade*)[8].

According to MAK Decisions: As a result of the assessments that performed according to the final protection lists prepared by General Directorate of Nature Protection and National Parks, Central Hunting Commission ad updated for 2017-2018 season, 13 species are included in Annex-I (*Wild Animals Protected by the Ministry of Forestry and Water Affairs*), and 7 species are included in Annex-II (*Animals Permitted for Hunting During Certain Periods)* lists. The other species are not included in the lists of hunting animals[9].

6- http://www.iucnredlist.org/ (IUCN Red List)

7- http://conventions.coe.int/Treaty/EN/Treaties/Html/104.htm (Bern Convention)

8- http://www.cites.org/eng/resources/species.html (CITES Appendices)

According to the Bird Directive (2009/147/EC): 8 bird species that may potentially exist in the project site are included in ANNEX-I list, and 8 species are included in ANNEX-II-A and ANNEX-II-B lists[10]. Detailed information on the species included in Annex-I list of the Bird Directive is presented in Chapter 4.

Considering the bird species according to their seasonal status; out of 74 bird species were identified in the project site, 17 are defined as migrant species. 2 of these species are involved in local migrations or some of their populations migrate. 4 bird species are winter visitors and use the area for overwintering. 1 species is wintering or transit migrating. 50 of the identified bird species are local, i.e. they use the site in all seasons (Table 5).

Considering their population sizes; 8 species from Suliformes, Pelecaniformes, Accipitriformes and Falconiformes ordoes are wide-winged or gliding species. These species are at the top of the food chain, and their populations vary from 1 to 10. The cormorant and heron species are not seen in large numbers in land habitats. They are believed to use the project site for straying and feeding purposes or during transit between wetlands. The numbers of these species are very high in wetlands in Turkey, and the numbers of individuals in the project sites are very low. This is an expected situation as their feeding and reproduction habitats are outside the habitats in the project site.

There are 2 species from the Charadiformes ordo, which use the rivers in the project site for feeding. The populations of these species are also represented by a few individuals. They are being observed very frequently in rivers and lakes without dense forestation in Turkey, their population is very big. Due to the vegetation of the project site, having a few individuals is expected.

3 species were recorded from the Columbiformes ordo. Among these species, the rock doves make a population near settlement areas, and they do not prefer dense forest areas. It is a cosmopolitan species which has a vast proliferation area in global scale. The stock dove, which is another species from this ordo, uses the forest areas for overwintering. The numbers of individuals in the population is about 80-100, and this also applies in Turkey. The turtle dove is included in the VU (=Vulnerable) category under IUCN, and it is under international protection. They are frequently observed in glades in forests and in ecotone areas. There is a decline in their population in global scale. Therefore, their populations inside the project sites, should be identified and protected. It is believed that there is a couple of turtle doves per 10 decares in ecotone areas in the study area.

9- http://www.milliparklar.gov.tr/av/Makkarar.pdf

10- http://ec.europa.eu/environment/nature/conservation/wildbirds/threatened/index_en.htm

There is one species each of the Cuculiformes and Bucerotiformes ordoes. The cuckoo and hoopoe reproduce in the glades inside the forests. Their populations are estimated at 50-70 individuals in all project sites. Their populations in Turkey are very healthy, and they live in similar numbers in the project site.

The Strigiformes ordo is represented by two owl species. The little owl produces at the edges of forests and near settlement areas. Their population status is very good at both global and national scale. The tawny owl nests inside the forest and old tree hollows in ecotone areas. They are frequently observed in this and similar areas in Turkey.

5 species were recorded from the Piciformes ordo. The green woodpecker and Syrian woodpecker reproduce outside the forests. The great-spotted woodpecker and middle spotted woodpecker reproduce inside the forest and in old tree trunks in ecotone areas. They are also known to use the nests of squirrels and forest dormouse. The population status of these 4 species is equivalent to the other populations in Turkey. A significant portion of the black woodpecker population in Turkey lives in the project sites. Although the exact numbers are unknown, one of their major reproduction areas in Turkey is located inside the project sites.

52 species of the Passeriformes ordo were identified. Among these, the green warbler which was identified in the area, is known from a few registered areas in Turkey. Therefore, it is an important record for the site. The Krüper's nuthatch reproduces at altitudes above 1000 m in the project site. They often use the hollows in coniferous trees for reproduction.

Tree-creepers and nuthatch also reproduce and feed inside the trunks of coniferous trees. Therefore, the project site is important for these species. The other songbirds have vast proliferation across Turkey.

Considering the projects sites in terms of migration routes; In June 2017 when the studies were conducted, the migration activity of the birds was observed at a low scale. In conclusion, by June 2017, when ornithology studies were conducted, the site is not on the migration route of wide-winged, gliding migrant birds. Therefore, the sub-district forest directorate and its immediate vicinity is not used as a resting area for migrant birds. Pictures of several bird species identified in the project site are presented below.

Figure 13. Pernis apivorus (European Honey Buzzard)

Figure 14. Accipiter nisus (Eurasian Sparrowhawk)

Figure 15. Streptopelia turtur (European Turtle-Dove)

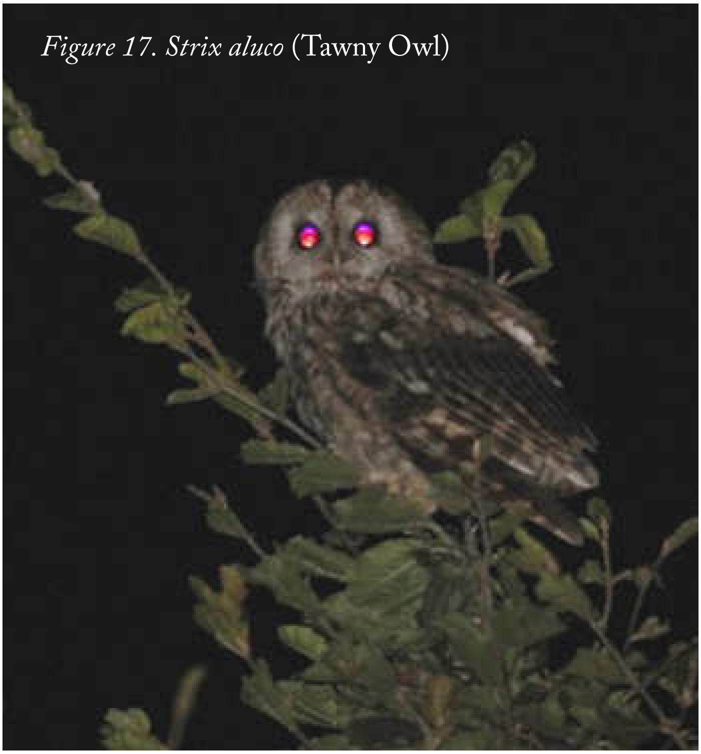

Figure 17. Strix aluco (Tawny Owl)

Figure 16. Dendrocopos major (Great Spotted Woodpecker)

Figure 18. Carpodacus erythrinus (Common Rosefinch)

Figure 19. Loxia curvirostra (Red Crossbill)

Figure 20. Sitta krueperi (Krüper's Nuthatch)

Table 4. Bird species identified in the study area, their protection and reproduction status and seasonal status

NO	ORDO	FAMILY	CODE	SCIENTIFIC NAME	TURKISH NAME	ENGLISH NAME	IUCN	BERN	CITES	EU BIRD DIRECTIVE	STATUS	MAK (2017-2018)	REPRODUCTION
1	Suliformes	Phalacrocoracidae	720	*Phalacrocorax carbo*	Karabatak	Great Cormorant	LC	ANNEX-III			Y	ANNEX-I	
2	Pelecaniformes	Ardeidae	1210	*Ardea alba*	Büyük Ak Balıkçıl	Great White Egret	LC	ANNEX-II			K		
3	Pelecaniformes	Ardeidae	1220	*Ardea cinerea*	Gri Balıkçıl	Grey Heron	LC	Annex-III			K	ANNEX-I	
4	Accipitriformes	Accipitridae	2310	*Pernis apivorus*	Arı Şahini	Honey Buzzard	LC	ANNEX-II	–	ANNEX-I	G		
5	Accipitriformes	Accipitridae	2690	*Accipiter nisus*	Atmaca	Sparrowhawk	LC	ANNEX-II	–		Y		+
6	Accipitriformes	Accipitridae	2870	*Buteo buteo*	Şahin	Buzzard	LC	ANNEX-II	–		G, Y		+
7	Falconiformes	Falconidae	3100	*Falco subbuteo*	Delice Doğan	Hobby	LC	ANNEX-II	–		G		
8	Falconiformes	Falconidae	3040	*Falco tinnunculus*	Kerkenez	Kestrel	LC	ANNEX-II	–		Y		+
9	Charadiiformes	Charadriidae	4690	*Charadrius dubius*	Halkalı Küçük Cılıbıt	Little Ringed Plover	LC	ANNEX-II			K		+
10	Charadiiformes	Scolopacidae	5530	*Tringa ochropus*	Yeşil Düdükçün	Green Sandpiper	LC	ANNEX-II			K, T		
11	Columbiformes	Columbidae	6650	*Columba livia*	Kaya Güvercini	Rock Dove	LC	ANNEX-III		ANNEX-II-A	Y	ANNEX-II	
12	Columbiformes	Columbidae	6680	*Columba oenas*	Gökçe Güvercin	Stock Dove	LC	ANNEX-III		ANNEX-II-B	K	ANNEX-I	
13	Columbiformes	Columbidae	6870	*Streptopelia turtur*	Üveyik	Turtle Dove	**VU**	ANNEX-III		ANNEX-II-B	G	ANNEX-II	+
14	Cuculiformes	Cuculidae	7240	*Cuculus canorus*	Guguk	Cuckoo	LC	ANNEX-III			G		+
15	Strigiformes	Strigidae	7570	*Athene noctua*	Kukumav	Little Owl	LC	ANNEX-II	–		Y		+
16	Strigiformes	Strigidae	7610	*Strix aluco*	Alaca Baykuş	Tawny Owl	LC	ANNEX-II	–		Y		+

NO	ORDO	FAMILY	CODE	SCIENTIFIC NAME	TURKISH NAME	ENGLISH NAME	IUCN	BERN	CITES	EU BIRD DIRECTIVE	STATUS	MAK (2017-2018)	REPRO-DUC-TION
17	Bucerotiformes	Upupidae	8460	*Upupa epops*	İbibik	Eurasian Hoopoe	LC	ANNEX-II			G		
18	Piciformes	Picidae	8560	*Picus viridis*	Yeşil Ağaçkakan	Green Woodpecker	LC	ANNEX-II			Y		+
19	Piciformes	Picidae	8630	*Dryocopus martius*	Kara Ağaçkakan	Black Woodpecker	LC	ANNEX-II		ANNEX-I	Y		+
20	Piciformes	Picidae	8760	*Dendrocopos major*	Orman Ağaçkakanı	Great-Spotted Woodpecker	LC	ANNEX-II			Y		+
21	Piciformes	Picidae	8780	*Dendrocopos syriacus*	Alaca Ağaçkakan	Syrian Woodpecker	LC	ANNEX-II		ANNEX-I	Y		+
22	Piciformes	Picidae	8830	*Dendrocopos medius*	Ortanca Ağaçkakan	Middle Spotted Woodpecker	LC	ANNEX-II		ANNEX-I	Y		+
23	Passeriformes	Alaudidae	9740	*Lullula arborea*	Orman Toygarı	Woodlark	LC	Annex-III		ANNEX-I	Y	ANNEX-I	
24	Passeriformes	Hirundinidae	9910	*Hirundo rupestris*	Kaya Kırlangıcı	Crag Martin	LC	ANNEX-II			G		
25	Passeriformes	Motacillidae	10090	*Anthus trivialis*	Ağaç İncirkuşu	Tree Pipit	LC	ANNEX-II			G		
26	Passeriformes	Motacillidae	10190	*Motacilla cinerea*	Dağ Kuyruksallayanı	Grey Wagtail	LC	ANNEX-II			Y		
27	Passeriformes	Motacillidae	10200	*Motacilla alba*	Ak Kuyruksallayan	Pied Wagtail	LC	ANNEX-II			Y		
28	Passeriformes	Cinclidae	10500	*Cinclus cinclus*	Derekuşu	Dipper	LC	ANNEX-II			Y		
29	Passeriformes	Troglodytidae	10660	*Troglodytes troglodytes*	Çıtkuşu	Wren, Winter Wren	LC	ANNEX-II			Y		+
30	Passeriformes	Muscicapidae	10990	*Erithacus rubecula*	Kızılgerdan	Robin	LC	ANNEX-II			Y		+

NO	ORDO	FAMILY	CODE	SCIENTIFIC NAME	TURKISH NAME	ENGLISH NAME	IUCN	BERN	CITES	EU BIRD DIRECTIVE	STATUS	MAK (2017-2018)	REPRO-DUC-TION
31	Passeriformes	Muscicapidae	11040	*Luscinia megarhynchos*	Bülbül	Nightingale	LC	ANNEX-II			G		+
32	Passeriformes	Muscicapidae	11210	*Phoenicurus ochruros*	Kara Kızılkuyruk	Black Redstart	LC	ANNEX-II			Y		+
33	Passeriformes	Muscicapidae	11390	*Saxicola torquata (=S. torquatus)*	Taşkuşu	Stonechat	LC	ANNEX-II			G		+
34	Passeriformes	Turdidae	11870	*Turdus merula*	Karatavuk	Blackbird	LC	Annex-III		ANNEX-II-B	Y	ANNEX-II	+
35	Passeriformes	Turdidae	12000	*Turdus philomelos*	Öter Ardıç	Song Thrush	LC	Annex-III		ANNEX-II-B	G	ANNEX-II	
36	Passeriformes	Turdidae	12020	*Turdus viscivorus*	Ökse Ardıcı	Mistle Thursh	LC	Annex-III		ANNEX-II-B	Y	ANNEX-I	
37	Passeriformes	Sylviidae	12670	*Sylvia melanocephala*	Maskeli Ötleğen	Sardinian Warbler	LC	ANNEX-II			Y		
38	Passeriformes	Sylviidae	12750	*Sylvia communis*	Ak Gerdanlı Ötleğen	Whitethroat	LC	ANNEX-II			G		
39	Passeriformes	Sylviidae	12770	*Sylvia atricapilla*	Kara Başlı Ötleğen	Blackcap	LC	ANNEX-II			G		
40	Passeriformes	Sylviidae	12910	*Phylloscopus (trochiloides) nitidus*	Yeşil Çıvgın	Green Warbler	LC	ANNEX-II			**G,Y**		
41	Passeriformes	Sylviidae	13110	*Phylloscopus collybita*	Çıvgın	Chiffchaff	LC	ANNEX-II			Y		+
42	Passeriformes	Sylviidae	13120	*Phylloscopus trochilus*	Söğütbülbülü	Willow Warbler	LC	ANNEX-II			**G**		
43	Passeriformes	Reguliidae	13140	*Regulus regulus*	Çalıkuşu	Goldcrest	LC	ANNEX-II			Y		+
44	Passeriformes	Reguliidae	13150	*Regulus ignicapillus*	Sürmeli Çalıkuşu	Firecrest	LC	ANNEX-II			Y		+

NO	ORDO	FAMILY	CODE	SCIENTIFIC NAME	TURKISH NAME	ENGLISH NAME	IUCN	BERN	CITES	EU BIRD DIRECTIVE	STATUS	MAK (2017-2018)	REPRO-DUC-TION
45	Passeriformes	Aegithalidae	14370	*Aegithalos caudatus*	Uzun Kuyruklu Baştankara	Long-Tailed Tit	LC	Annex-III			Y	ANNEX-I	+
46	Passeriformes	Paridae	14400	*Parus palustris*	Kayın Baştankarası	Marsh Tit	LC	ANNEX-II			Y		+
47	Passeriformes	Paridae	14410	*Parus lugubris*	Ak Yanaklı Baştankara	Sombre Tit	LC	ANNEX-II			Y		+
48	Passeriformes	Paridae	14610	*Parus ater*	Çam baştankarası	Coal Tit	LC	ANNEX-II			Y		+
49	Passeriformes	Paridae	14620	*Parus caeruleus*	Mavi Baştankara	Blue Tit	LC	ANNEX-II			Y		+
50	Passeriformes	Paridae	14640	*Parus major*	Büyük Baştankara	Great Tit	LC	ANNEX-II			Y		+
51	Passeriformes	Sittidae	14690	*Sitta krueperi*	Anatolian Sıvacısı	Krüper's Nuthatch	LC	ANNEX-II		ANNEX-I	Y		+
52	Passeriformes	Sittidae	14790	*Sitta europaea*	Sıvacı	Nuthatch	LC	ANNEX-II			Y		+
53	Passeriformes	Certhiidae	14860	*Certhia familiaris*	Orman Tırmaşıkkuşu	Tree Creeper	LC	ANNEX-II			Y		+
54	Passeriformes	Certhiidae	14870	*Certhia brachydactyla*	Bahçe Tırmaşıkkuşu	Short-Toed Tree Creeper	LC	ANNEX-II			Y		+
55	Passeriformes	Laniidae	15150	*Lanius collurio*	Kızıl Sırtlı Örümcekkuşu	Red-Backed Shrike	LC	ANNEX-II		ANNEX-I	G	ANNEX-I	
56	Passeriformes	Corvidae	15390	*Garrulus glandarius*	Alakarga	Jay, Eurasian Jay	LC	-		ANNEX-II-B	Y	ANNEX-II	+
57	Passeriformes	Corvidae	15670	*Corvus cornix*	Leş Kargası	Hooded Crow	LC	-		ANNEX-II-B	Y	ANNEX-II	
58	Passeriformes	Corvidae	15720	*Corvus corax*	Kuzgun	Raven	LC	Annex-III			Y	ANNEX-I	+
59	Passeriformes	Passeridae	15910	*Passer domesticus*	Serçe	House Sparrow	LC	-			Y	ANNEX-II	+

NO	ORDO	FAMILY	CODE	SCIENTIFIC NAME	TURKISH NAME	ENGLISH NAME	IUCN	BERN	CITES	EU BIRD DIRECTIVE	STATUS	MAK (2017-2018)	REPRO-DUC-TION
60	Passeriformes	Fringillidae	16360	*Fringilla coelebs*	İspinoz	Chaffinch	LC	Annex-III			Y	ANNEX-I	+
61	Passeriformes	Fringillidae	16380	*Fringilla montifringilla*	Dağ İspinozu	Brambling	LC	Annex-III			Y	ANNEX-I	+
62	Passeriformes	Fringillidae	16400	*Serinus serinus*	Küçük İskete	Serin	LC	ANNEX-II			Y		
63	Passeriformes	Fringillidae	16490	*Carduelis chloris*	Florya	Greenfinch	LC	ANNEX-II			Y		+
64	Passeriformes	Fringillidae	16530	*Carduelis carduelis*	Saka	Goldfinch	LC	ANNEX-II			Y		
65	Passeriformes	Fringillidae	16600	*Carduelis cannabina*	Ketenkuşu	Linnet	LC	ANNEX-II			Y		
66	Passeriformes	Fringillidae	16660	*Loxia curvirostra*	Çaprazgaga	Crosbill	LC	ANNEX-II			Y		+
67	Passeriformes	Fringillidae	16790	*Carpodacus erythrinus*	Çütre	Common Rosefinch	LC	ANNEX-II			G		+
68	Passeriformes	Fringillidae	17100	*Pyrrhula pyrrhula*	Şakrak	Bullfinch	LC	Annex-III			Y	ANNEX-I	+
69	Passeriformes	Fringillidae	17170	*Coccothraustes coccothraustes*	Kocabaş	Hawfinch	LC	ANNEX-II			Y		+
70	Passeriformes	Emberizidae	18580	*Emberiza cirlus*	Bahçe Kirazkuşu	Cirl Bunting	LC	ANNEX-II			Y		
71	Passeriformes	Emberizidae	18600	*Emberiza cia*	Kaya Kirazkuşu	Rock Bunting	LC	ANNEX-II			Y		
72	Passeriformes	Emberizidae	18660	*Emberiza hortulana*	Kirazkuşu	Ortolan	LC	Annex-III		ANNEX-I	G	ANNEX-I	
73	Passeriformes	Emberizidae	18810	*Emberiza melanocephala*	Karabaşlı Kirazkuşu	Black-Headed Bunting	LC	ANNEX-II			G		
74	Passeriformes	Emberizidae	18820	*Miliaria calandra*	Tarla Kirazkuşu	Corn Bunting	LC	Annex-III			G	ANNEX-I	

4. DISCUSSION AND CONCLUSIONS

4.1 THREATS AGAINST BIRDS AND MAMMALS

4.1.1 Illegal Hunting

As it can be understood from the information from local people and from the officials of the General Directorate of Nature Protection and National Parks during the project studies and from the images obtained with the photo traps, illegal hunting is a serious threat against mammal species. Particularly the intense population of roes in the operation sites and in Karabük in general, is an attraction for hunters. Illegal hunting is a known phenomenon inside the sub-district directorates, and it has been documented with photo traps during this project. Illegal hunting is also one of the major threats against bird species. It is emphasized that many of the species listed in EU Bird Directive ANNEX-I and which see a decline in population, are taken under protection as a result of unconscious hunting. Therefore, hunting should be controlled, hunters should undergo strict trainings, hunting activities should be prohibited in areas that are protected and in which will be protected, and otherwise deterrent penalties should be sanctioned or works should be started to execute deterrent penalties, during the implementation process of Natura 2000. It is recommended that hunters are carefully monitored, considering that the project sites hosts species under protection.

4.1.2 Clearing and fragmentation of habitat

Woodcutting is performed in accordance with the functional forest management plans inside the Sub-District Directorates of Kavaklı and Eğriova. There is no deforestation in Kavaklı Wildlife Protection Area and Kavaklı Arboretum located inside the Sub-District Directorate of Kavaklı. Unconscious deforestation of old trees causes significant damage to tree-dependent species, such as *Nyctalus leisleri* (Leisler's Bat), *Dryomys nitedula* (Forest Dormouse) and *Martes martes* (Beech Marten). Sub-forest species such as *Myodes glareolus* (Bank Vole) are vulnerable to various activities such as deforestation. Deforestation is one of the factors that affect species whose populations are rapidly declining. Insensible deforestation should be avoided particularly in the project sites. The trees that create the required production sites for Krüper's nuthatch and woodpecker species should be marked and protected.

4.1.3 Wildfire

Wildfires which took place in the region according to the interviews with local people cause a significant damage on wildlife. Due to the fires, mammal and bird species lose their habitats, and those which cannot flee are perished. Nevertheless, wildfires are ecologically necessary natural phenomena in the natural process. However, the areas that are affected by wildfires should be left to natural growth process. In this case, wildlife will proliferate and become more dynamic.

4.2 ASSESSMENT UNDER BIRD DIRECTIVE

Natural 2000 network of protected areas has been created by implementing the Bird Directive of 1979 and the Habitat Directive of 1992. Bird Directive stipulates creating Special Protected Areas (SPA) for the birds. Habitat Directive stipulates creation of Special Areas for Conservation (SAC) for the living things and habitats other than birds. SPA and SAC together create the NATURA 2000 network. The European Commission directive 79/409/EEC of 02/04/1979 on protection of wild birds identifies 194 bird species and sub-species, including those at risk ad require special conservation, and comprehensively guarantees the protection of wild birds in all of Europe. The member states are liable to create Special Protected Areas (SPA) for 194 species and migrant bird species that are at high risk. SPA's are scientifically defined areas which are very important to ensure survival of targeted species, and examples include the wetlands. These areas are the parts of the Natura 2000 network which has been defined under the Habitat directive 92/43/EEC. The second component guarantees that any activity threatening the life of birds are prohibited. These include intentional killing of birds, seizing them, destroying their nests, gathering their eggs and trading live or dead birds (excluding a few exceptions). The third component regulates the restrictions on numbers of birds that can be hunted and the hunting seasons. Besides, it also defines the permitted methods for hunting. The Special Protected Areas (SPA), which have been defined to protect and manage the areas that are used for reproduction, feeding, overwintering and migration by rare birds that require protection, are defined under the Bird Directive. The list of rare birds that require protection is presented in the annexes of the Bird Directive.

In this project study, the bird species in ANNEX I of the Bird Directive are listed as the species that are endangered, whose populations are declining due to the changes in their habitats, as well as rare species which have small populations, which have restricted local distribution, and which require special protection due to various reasons that are peculiar to their habitats. According to this, there are 8 bird species that comply with these criteria in the project sites:

4.2.1 Pernis apivorus (European Honey Buzzard)

It is approximately 60 cm tall, and has colours like the hawk (*Buteo buteo*). However, it has wider wings, a smaller head and a narrower neck. It is a migrant species. During its reproduction season, the European Honey Buzzard prefers glades for hunting, and forests for nesting. It often feeds on insects and small birds. The reason for its inclusion in the Annex-I list is: Hunting particularly during migration, destruction of its habitat, and a fall in its hunting stock due to use of pesticides and climate change.

It probably uses the project sites for migration. However, considering that there are apiary activities in the project sites, it probably uses the project sites for resting and feeding during migration. The natural structure in Turkey and intense apiary activities offer a vast feeding area for this species. Besides, it is not particularly hunted in Turkey.

4.2.2 Dryocopus martius (Black Woodpecker)

It is the largest Woodpecker species, with its average height of 46 cm, and the males are completely black with a red crown. The females have a red "postal stamp" around the neck. It nests in old forests, inside pure pine or deciduous trees at various ages or sizes (beech grass). It feeds on insects in various trees, particularly ants and coleoptera, and rarely on fruits. It is a settled species. This species is at risk due to intense deforestation activities and loss of their habitat which means increased cutting down of deciduous forests and old forests. An additional problem is illegal hunting.

It uses old coniferous trees in the project sites for nesting, and reproduces in the site. It is one of the few known habitats of this species in Turkey. It is a rare species and very important for forest ecosystems because of their feeding preferences. The habitats and nesting areas of this species should be protected.

4.2.3 Dendrocopos syriacus (Syrian Woodpecker)

It is a medium-sized species of woodpecker (22 cm), and is distinguished from the great spotted woodpecker with the absence of a black strip on its face, which makes it “whiter”. It commonly nests in woodlands, and around parks, gardens, plantations and nearby settlements. It feeds on insects, and it is a local species. The potential major threats are destruction of its habitat and loss of diversity.

It cannot outnumber the great spotted woodpecker in the project sites, and prefers the locations near settlement areas. It is the most common woodpecker species in Turkey. Deforestation activities should be controlled to protect its habitats.

4.2.4 Dendrocopos medius (Middle Spotted Woodpecker)

It is often confused with the Great Spotted Woodpecker (*Dendrocopos major*), but it is distinguished with its smaller size (20 cm) and full red crown. It often lives in deciduous forest areas that contain oaks in mild climates. In winter, it feeds on insects on trees and seeds. It is a settled species. Being dependent on old deciduous forests, this species is at serious risk due to destruction and degradation of such forests.

4.2.5 Lullula arborea (Woodlark)

It is similar to skylark (*Alauda arvensis*), yet smaller (12 cm), with a shorter tail and wide whitish rings around the eyes. It sings melodically during night and morning. It lives in forest areas, diffused trees and glades, and in mountain pastures and rural areas with sparse trees. The feed on insects and spiders in summer, and on seeds in other seasons. It is a migrant species. The main reasons for the decline in its population is the loss and degradation of their habitats due to intense agricultural activities, and decreased pastoral and afforestation activities. It is observed in glades inside the forests in the project sites, and no threats are identified.

4.2.6 Sitta krueperi (Krüper’s Nuthatch)

It is a small nuthatch (12 cm) that lives on tree-tops, in particularly higher parts. It has a very narrow eye strip, a characteristic rusty red patch on the chest, and bluish feathers. It is commonly seen in pine forests, among spruce and cedar trees. It feeds on insects, and it is also a local species. It is believed in to be reproducing in approximately 500 couples. In addition to the very limited population size of the species, the wildfires and loss of habitats due to deforestation are considered as the major threats. The species is believed in to be living in more than 20 couples in the project sites, and its global population is considered to be more than 500 couples. The main threat against this species is the insensible deforestation of old trees, which is particularly used for nesting by the species.

4.2.7 Lanius collurio (Red-Backed Shrike)

It is a medium-sized songbird which is approximately 17 cm tall. Males are red-brown with a black mask. It reproduces in glades, forest areas and trunked bushes, particularly in thorny plants (blackberry and thorn apple). It feeds on large insects, and it is a migrant species. There is a wide-scale and sustained decline in the population of this species in Europe. Probably the main factors are the loss or degradation of habitats through intense agricultural activities, including increased usage of agricultural pesticides and afforestation. Several couples are believed to reproduce in suitable habitats, although they are not commonly seen in project sites.

4.2.8 Emberiza hortulana (Ortolan Bunting)

It is similar to the other ortolans with an average height of 16 cm; however, it is distinguished by its yellow-pink or peach coloured body, olive coloured head and chest, and yellow neck. This species uses various living spaces along its distribution range. It often lives in an open agricultural lands where sparse trees and diversity of grains are important. It mainly feeds on seeds and small invertebrate animals. It is a migrant species. There is a significant decline in the populations of this species in many countries in Europe. The main reasons for the decline are the changes in agriculture and landscape structure, and excessive hunting. Agricultural changes results in a decline in product diversity during the cultivation season, and the increase in antropogenic disturbances result in a decline in populations.

4.3 ASSESSMENT OF THE IMPLEMENTATION OF NATURA 2000 IN TURKEY

There are certain national and international conventions in effect to protect existing wildlife in Turkey. However, these conventions fall short of protecting species and habitats. Particularly in the last decade, the industrial growth in Turkey has resulted with a visible loss in biodiversity. Therefore, protective measures for habitats and species should be implemented in a strict and sustainable way, which requires implementation of Natura 2000. Natura 2000 is one of the priority responsibilities of Turkey in the EU accession process. Natura 2000 Ecological Network, which is created on the basis of the Habitat and Bird Directives, is based on biodiversity. Many projects are prepared and implemented in Turkey by public authorities (Ministries, State Planning Organization, etc.), and research organizations (Scientific and Technological Research Council of Turkey (TÜBİTAK), etc.), universities and NGO's. These projects primarily aim at addressing the needs of the organization which is preparing the project, and many of them focus on a specific subject. These projects are sometimes implemented with the financial resources of organizations/authorities and sometimes with EU funds. It is known that fulfilling the liabilities for identification of Natura 2000 sites and for protection of these sites are costly. Natura 2000 sites are closely related with the study subjects of various organizations/authorities, and they may have an affect on their future investments, activities and project. Therefore, it is a must rather than an accurate approach to ensure that various organizations/authorities, universities and NGO's combine their financial powers and direct their financial resources for common objectives for Natura 2000 which requires high costs. That is because the implementation of Natura 2000 in Turkey, requires common activities and projects by multiple organizations, rather than a single organization. The threats against the species listed above concentrate around three main reasons: Excessive use of pesticides in agricultural areas, deforestation of old trees in forest areas, and insensible hunting activities. We should now recognize that species can only be protected when their habitats are protected. The phenomena that cause destruction of habitats are well known. In this context, the critical national habitats where critical species are hosted should be demonstrated via Natura 2000 efforts, this project and similar projects should be promoted and continued, and protective control mechanisms in terms of feasibility should be reinforced. In conclusion, the practices under Natura 2000 will become a guide to restrict industrial activities in critical areas to be identified or to logistically use non-critical areas.

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EVALUATION OF NATURA 2000 PRACTICES IN TURKEY'S FORESTS BY LOCAL STAKEHOLDERS INVOLVEMENT

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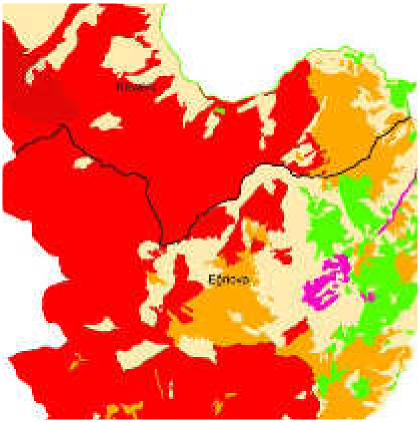

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Abstract

Participation of local stakeholders is very important in selection and creation of Natura 2000 areas. There is not a standard procedure that has been developed by the EU in this respect. This is explained by the EU commission that they confine themselves with merely making various suggestions on the issue, due to the socio-cultural sensitivities and differences in economical and ecological values among member states. This study primarily aims to establish the characteristics related to potential participation of stakeholders in Natura 2000 practices in Turkey. A project has been created that looks into the applicability of the Natura 2000 concept in the forest areas in Turkey. To this end, two different forest sub-district directorates in Karabuk and Yenice in the Western Black Sea region have been selected as sample research areas. The locals of the areas in this project have been considered as the primary actors in participation of stakeholders to ensure civil society dialogue in the project. Information meetings and a workshop have been held to ensure civil society dialogue. The participants took a survey at the workshop, where the results of the project were announced. It has been established that the revenues from forestry via forestry cooperatives in villages has significant importance. It has been revealed during observations and interviews that Natura 2000 is similar to other protected areas, and thus the village headmen, who think that forestry works will be prohibited in most of the forest areas have remained aloof to the project from the beginning. Therefore, intermediary information activities, which were not planned before, have become obligatory. Potential Natura 2000 areas and their protection methods have been created to spatially materialise the impact of project outcomes on the locals. The village headmen were consulted for their opinions on these areas. In addition, the economic benefits of Natura 2000 in EU member states were explained. As a result of the evaluation of the surveys that were taken at the end of the workshop, it has been understood that the disposition of the village headmen was positively changed as compared to the beginning of the project. It has been stressed that there are different characteristics of participation from various stakeholders across EU countries, with regard to ownership and management of forest areas in Turkey.

1. INTRODUCTION

Participation of stakeholders has become a necessary, fundamental principle not only in development and application of Natura 2000 management plans but also in other practices of protected areas around the world. However, this principle is not exactly implemented since it is often implemented as top-to-down, authoritarian, science-oriented and/or technocratic practices. There are reactions to this situation in various EU countries in the Western Europe. While participation of stakeholders in Natura 2000 practices is ensured with institutional diligence in these countries, it is rather loosely coordinated in some other EU countries (Snethlage et al. 2012). When the Natura 2000 concept was first implemented across EU, it was perceived negatively by local stakeholders in member states. This problem was encountered both in the western Europe and in countries of the eastern Europe which became members of the EU (WWF, 2004). Participation of stakeholders, which is costly in terms of time and resources, may lead to further social conflict when implemented in an improper way. Therefore, it is important that the assessments of risk related to the contribution of stakeholders to protection of nature and management of biodiversity and identification of opportunities are completed in advance (Young et al. 2013). It is often stated that the main reason for the weak image of Natura 2000 in EU member states is the lack of information, consultation and participation of stakeholders in the stages of selection and design of Natura 2000 areas (Snethlage et al. 2012). The human factor has been reported as a key component in the successful planning of participants related to sectoral activities in implementation of Natura 2000. This is important as a factor that will lead to changes in living environments of people, in power and influence, and to an increasing load from traditional societies to modern societies, and from urban values to rural landscape (Snethlage et al. 2012).

There are various studies on the economic benefits of Natura 2000 areas. In a study, 20 studies were selected among the studies conducted in different countries and in different Natura 2000 areas, and 34 estimates related to Natura 2000 values were taken from these studies. As a result of the analysis of the data of these available estimates, it has been demonstrated that Natura 2000 areas brings beneficial values in a wide range. It has been established that the financial value of these benefits ranges from 50 € to approximately 20.000 € per year (EC, 2013). Materialising these economic benefits of Natura 2000 areas is very important to ensure that these areas are embraced by local stakeholders.

One of the two overall purposes of the project in this publication is "to strengthen the civil dialogue on the basis of EU policies to protect nature in forest areas in Turkey." Further evaluation of the participation of the locals in the project area and their opinions about the project was planned to understand the impact of the problems related to penetration in the first core countries in the EU and the other countries which later became full members, in Turkey. This has been considered to be important to foresee the potential problems of penetration in the future, and to ensure civil dialogue.

2. MATERIALS and METHOD

2.1 STUDY SITE

Project study sites are located in central Karabük province and Yenice district in Western Black Sea region (see Chapter 3). It is managed by Egriova Forest Sub-District (FSD), Karabuk Forest District Directorate (FDD), and covers the villages of Demirciler, Sipahiler, Salmanlar and Senler. Kavakli FSD is managed by Yenice FDD, and covers the villages of Kuzdag and Bolkuş.

2.2 METHOD

In the beginning of the project, a meeting was held in Karabuk on 24.04.2017 to inform local stakeholders on Natura 2000 concept, the purpose and the content of the project. A separate meeting was held on 16.06.2017 with village headmen, and they were asked to identify land use types on the basis of divisions. Information on the project was also provided during this meeting. During a workshop held on 18.07.2017, the concept, content and economics of Natura 2000, and field-based project outcomes were presented. At the and the workshop, village headmen were asked to make assessments on the map. Also, at the end of this workshop, a survey consisting of six questions was conducted with all participants. They were asked to mark the answers in the order of priority or enter their own answer in the "other" section. Village headmen were also asked questions about the size of population, changes in the population and average household income. The answers given in the survey were interpreted in the order of priority. Six village headmen, and eleven experts from public institutions and NGO's took the survey.

3. RESULTS

All villages in the project areas have their forestry cooperatives. The share of forestry in the household income of the villagers is about 60%, according to the information provided by village headmen (Figure 1). During the observations at field surveys and interviews with village headmen, it has been understood that agriculture and livestock breeding is barely sufficient to meet the needs of a household (Figure 2). 82,8% of Egriova forest sub-district directorate, and 95,28% of Kavakli directorate consists of forest areas (Figure 3). The ownership and management of forest areas is completely controlled by General Directorate of Forestry, i.e. the state. The Nature Protection Area inside the Kavakli area is managed by the General Directorate of Nature Protection and National Parks. Owned agricultural areas per capita in Kuzdağ and Bolkuş villages in Kavaklı is remarkably less than those in Egriova (Table 1). The average population density in both villages is 4,95 people/km^2. In 2016, the population density in Turkey was 102 people/km^2, and in Karabuk it was 59 people/km^2.

Figure 1. Employment of villagers in forestry works

Figure 2. Main land use types in project areas

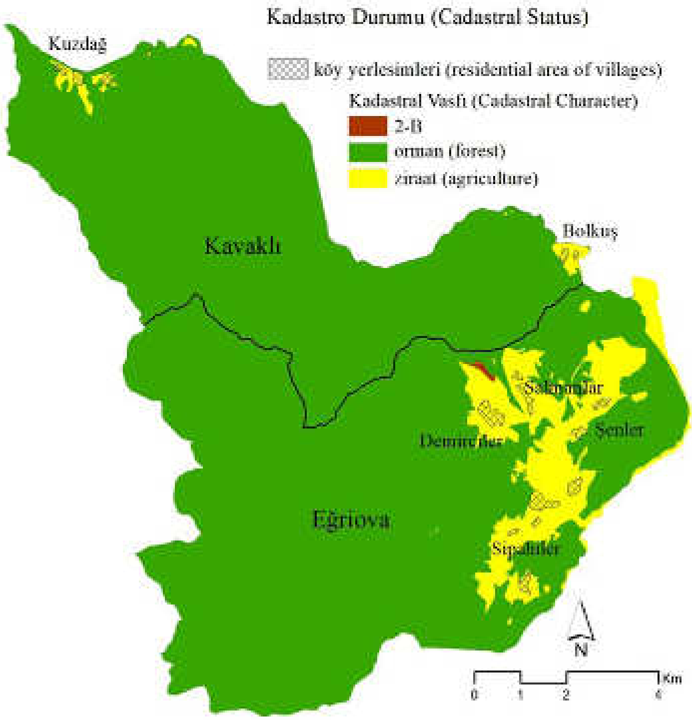

Figure 3. Status of forest cadastre in project areas

Table 1. The relation of forest cadastre with village population in project areas.

Site	Agriculture (ha)	Forest (ha)	2-B (ha)	Number of Villages (unit)	Total population (number)	Population density (number/km^2)
Eğriova	969,05	6267,71	7,78	4	341	4,7
Kavaklı	80,36	4668,59	-	2	248	5,33

Village headmen, Zonguldak Regional Directorate of Forestry, Karabuk and Yenice Forest Sub-District Officials, Officials from Regional and Karabuk branches of National Parks, District Governor of Yenice and other representatives of public institutions and three NGO representatives participated in the first opening meeting held after the start of the project (Figure 4). Although posters were hung in villages and village headmen were contacted via telephone, only two village headmen participated in the meeting. When the village headmen and forest sub-district officials were asked why the other village headmen did not attend the meeting, they said they believed that the project would close the areas to forestry and grazing in the village, and these areas would be protected like National Parks. Therefore, an intermediary meeting, which was not initially planned, was held only with the village headmen on 16.06.2017 (Figure 5). Five village headmen attended the meeting. A sixth village headman was interviewed in Yenice after making an appointment. They were asked about their questions about the project. The same reason as above was stated again. The Natura 2000 concept was explained once again at this meeting. They were asked to mark the areas on the map which they consider important for grazing and agriculture in the village. The impression at the end of the meeting was that the village headmen still had some questions.

Figure 4. Activities for the information meeting and workshop

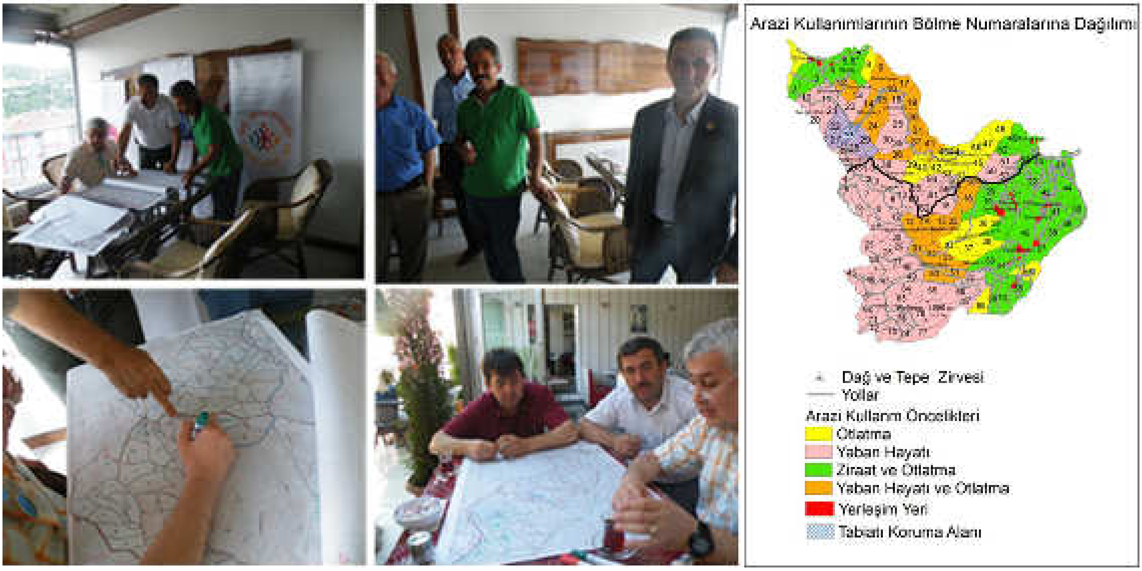

Figure 5. Intermediary information meeting with village headmen

At a workshop held in Karabuk in 18.07.2017, the project outcomes were explained to participants, including village headmen. The areas qualified for Natura 2000 in the areas were identified with endemic and endangered species in habitat types, and the merits for protection were demonstrated accordingly. The participants were also informed about the methods of protection demonstrating the protection of habitats that have been identified to merit for protection. Later, the village headmen and other participants were given the surveys and asked to complete them. 6 village headmen and 11 representatives of public institutions, universities and NGO's took the survey. Then, the village headmen were given maps of protections merit and protection methods (Figure 6), and they were asked to mark the areas of protection methods they were hesitant about. As a result, they marked the protection method that involves "immediate and high-level reduction of pressures" which has been identified for the habitats that are adjacent to village settlements and agricultural areas, which have been degraded due to grazing and which have lost their ability to regenerate.

In the survey, village headmen were asked to assign numbers to important income resources in their villages, in the order of priority. All village headmen placed forest workmanship at the top of the list. Livestock breeding was in the second place, and agriculture in the third place. Some questions asked to the village headmen and to other participants were the same in the survey. Comparing the perspective of these two groups about the Natura 2000 concept, 50% of village headmen and 80% of experts had a positive approach.

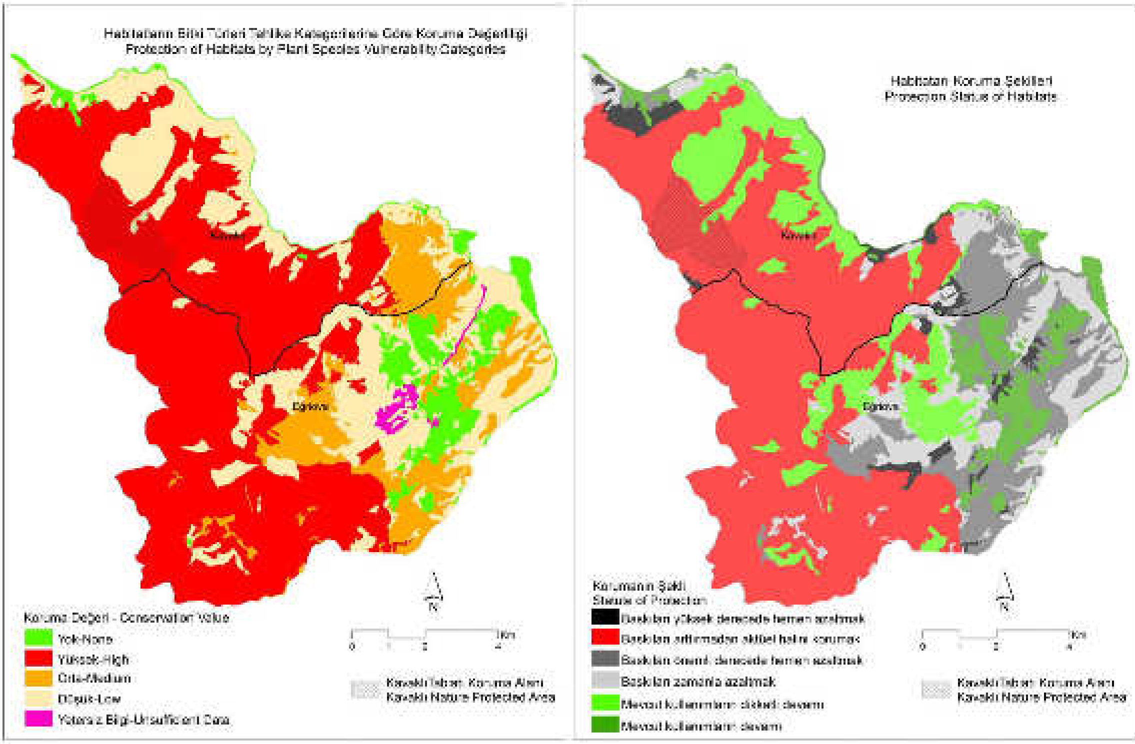

Figure 6. Conservation value (left) and protection statue (right) of habitats.

When the village headmen were asked about the positive aspects of Natura 2000 for them, the aspects of promotion of the village, increased income and contribution to protection of nature were distributed evenly (Table 2). The group of experts answered the same question with an even distribution of “contribution to protection of nature” and “increased income” in the top rank, which was followed by “promotion of villages.” When the village headmen were asked about the negative aspects of Natura 2000 for them, “reduction of income” was ranked in the first place, “reduction of income” and “shrinking of land use areas” in the second place, and “increased population of foreigners” in the third place. When the same question was asked to experts, “shrinking of land use areas” was ranked in the first place, “reduced income” in the second place,” and “no negative aspects” in the thirds place.

Table 2. Survey questions and distribution of answers in the order of priority

Questions	**Answers**	Public institutions, universities and NGO's								Village headmen					
		Priority								Priority					
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**
The most important shortcoming in sustainability of life in villages	Insufficient works in forests	1	2			2	1	1	2	1	2		1		
	Insufficient agricultural areas	2			1	1	1		1	2	1				
	Insufficient infrastructure		1	1	2	1	2				2	1			
	Insufficient grazing areas		1		1			4	1			2			
	Insufficient healthcare services		1	2		1			3			2			1
	Insufficient transportation facilities			1	1	2	2			1	1		1	1	
	Insufficient educational services	2	2		1		1	1		3			1		
	Increase/decrease in population	3		2	1			1		1	1				
How does the implementation of an area that is based in Protection and Use in the villages contribute to the development of villages?	positive	10								4					
	negative	1								2					
	I don't know														
Please list the following in the order of priority of their contribution to the development of villages.	Improving transportation industry	1	1	2	3					2	2	1	1		
	Sales of local products	5	4	1						5	1				
	Bed&breakfast business	2	3	4	1						3	1	1		
	Guiding in the area (guiding)	2	2	1	2						1	4			

Questions	Answers	Public institutions, universities and NGO’s								Village headmen					
		Priority								Priority					
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**
What is your perception of Natura 2000?	positive	9								3					
	negative	1								1					
	I don’t know	1								1					
	Other (more information needed)									1					
What are the positive aspects of Natura 2000 for you?	Promotion of the village	6								2					
	Increased income	9								2					
	Contribution to protection of nature	10								2					
	Other (identification of natural resources)	1													
What are the negative aspects of Natura 2000 for you?	Increased population of foreigners	1								1					
	Decreased income	3								4					
	Shrinking of land use areas	5								3					
	Other (none)	2													

4. DISCUSSION

It has been understood that the negative approach of village headmen in the beginning of the project was positively changed after the project outcomes were explained. The main reason for this has been identification of protection methods of the areas that are qualified for Natura 2000 after their protection merit was established. Selection forests for beech and fir are the most valuable areas for wood production in forestry. Therefore, selective beech and fir forests are economically the most valuable forests for forest cooperatives in villages. Due to the principles of selective forest management, and considering the topography and road network in the areas, the selective forest management that has been implemented so far has ensured the principle of continuous forests. The forest officials and village headmen have positively embraced the idea that these forests, which are valuable for forest management and as an income source for villagers, can be continued without further increasing the output. The total area of these lands in both areas is more than 6000 ha. Nevertheless, there were objections to areas where pressures have to be immediately reduced at a high level as a protection method. These areas are mixed oak-hornbeam forests and maquis with mixed oak, which are adjacent to village settlements and agricultural areas and which have lost their ability to regenerate. The total area of these lands in both areas is around 178 ha, mostly located in Egriova.

The village headmen and other participants were asked about the positive aspects of Natura 2000 concept. Approximately one thirds of village headmen pointed out to the contribution to protection of nature. This assessment was weighed evenly with two other answers. It has been concluded hereby that a positive approach to the objectives of Natura 2000 can be ensured through concrete, informative events. Nevertheless, it is understood that the concern for reduced forestry works is the main reason underlying the fact that reduced income is the main negative aspect that is perceived. This concern has been considered as normal. That is because the household income in Turkey was 16.515 TRL in Turkey, while the household income per year is 20.400 TRL as revealed by village headmen. When they are asked to estimate the monthly household income, the lowest level is at 1500 TRL, the highest level is at 2000 TRL, i.e. the average monthly income is 1700 TRL. It has been reported that there has been a certain increase in population of villages which have an average monthly household income of 1800 TRL or more, and there is no significant change in population in the other villages.

The population density is very low in the project areas. Also, the density concentrates in the certain locations in the project areas. This can be interpreted as a relieving impact of the pressure on forests. Building on the idea that Natura 2000 concepts offers the locals a certain economy, they were asked about the priority activities to be adopted in villages in the scope of eco-tourism revenues, sales of local products has been selected the new direct source of income. This was followed by improvement of transportation industry (roads and vehicles). According to the survey results of forest sub-district directors in the group of experts, there are some hesitations about Natura 2000, which are similar those of village headmen. It is considered that this is due to their direct contact with the village headmen and forest cooperatives in their territories in terms of a relationship between an employer and employee.

5. CONCLUSION

During the launch of the project, the village headmen had the idea that their living spaces would be confined with an approach of protected areas; however, after the project results were explained, they did not have any objections to the protection approach that has been identified for the areas. This change has been due to demonstration through continuous informative activities and project results that Natura 2000 is not a protected area status in the traditional sense, and that it aims at ensuring sustainable use. Each forest village has its own forest cooperative, and they make remarkable contribution to their household income through the contracts they get from the directorate via these cooperatives. The villagers have been informed that selective forest management can be continued in forest areas that merit protection, as long as they comply with the techniques. Besides, they have reservations about the idea that the forest areas which are located near agricultural and settlement areas and which have been extremely degraded need more protection and that these areas should be restored. Also, the presentation of experts at the workshop about the examples to economic benefits of Natura 2000 areas in EU countries have been found striking.

It should be considered usual that the problems of local or industrial stakeholders in management of biological diversity and protected areas in forests which are almost completely owned or controlled by the state differ from the management of biological diversity and protected areas in Europe where most of the forest areas are owned by real or legal persons such as individuals, foundations or municipalities. In Europe, the integration of the elements in forest management by real or legal persons and the principles of planning and management established by the national protection policy for species and areas is ensured on the basis of ownership. However, in Turkey, there is the livelihood of local stakeholders which have a limited ownership that is limited by forests on one hand, and the authority of the administration of forestry which has been centrally organized on the basis of constitutional rights. This significantly influences the methods and principles for participation of local stakeholders. There are various examples which demonstrate that the top-to-down, technocrat methods which involve authority, etc. to ensure participation of local stakeholders whose existing sources of income are being spatially confined do not yield results (Snethlage et al. 2012). The success of Turkey in ensuring participation of stakeholders in its approach to protection of species and areas should be reviewed. In EU countries, half of Natura 2000 areas are forest areas. Considering the wealth of forest habitats and species in Turkey would make it easier to estimate the size of potential Natura 2000 areas. Besides, Natura 2000 concept is based on the fundamental principle of sustainable protection and use, instead of a strict protection. Turkey will have to have the skills and capacity to successfully manage these two phenomena of the local stakeholder structure which is based on ownership, and its wealth of biological diversity. Turkey has to start working on this in management of existing protected areas and species to build this capacity, instead of waiting until full membership to EU. Initially, it is recommended to study similar models around the world which have similar conditions as Turkey. In this study, there were some findings that demonstrate the reasons of the approach and disposition of local stakeholders in creation of Natura 2000 status in state-owned forest areas. Basically, it is understood that their fundamental source of income is their way of indirectly using areas that are owned and managed by the state. On the other hand, the principles for sustainable protection and use in the Natura 2000 concept offer new economic and social opportunities in decreasing migration from forest villages towards cities or in maintaining the labour that may be required for activities of the forest administration, such as restoration, afforestation, maintenance, protection, recreation, etc.

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TURKISH FOREST HABITAT TYPES – AN ANNOTATED CONSPECTUS BASED ON THE EU HABITATS DIRECTIVE WITH SUGGESTIONS FOR AN UPGRADE

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Abstract

Turkey, a country of exceptionally rich biodiversity, makes a major contribution to three Palaearctic biogeographical regions, the Euro-Siberian, the Mediterranean, and the Irano-Turanian. With this contribution we provide a first-ever conspectus of forest and scrub habitat types in Turkey, cross-referencing general information such as species composition, ecology and distribution with the habitat coding of the EU Habitats Directive Annex I, and syntaxonomic-phytosociological characterization. The conspectus includes a total of 51 habitat types of woodland and scrub in Turkey of which 30 are established Annex I habitat types which were amended in parts to fit more precisely the Turkish environmental and biogeographical conditions. About 40 %, in total 21, have been recognized as new and were added. The latter group comprises habitat types exclusive to Turkey (or extending to other non-EU countries chiefly in the Caucasus or Near East) and others which extend to EU member states but have been neglected hitherto. Specifically, the conspectus includes descriptions and practical hints for the habitat types given below which may be grouped as (code digits as in European Commission (2013); in brackets the number of habitat types): 91.. Forests of temperate Europe (14); 92.. Mediterranean deciduous forests (9); 93.. Mediterranean sclerophyllous forests (8); 94.. Temperate montane coniferous forests (2); 95.. Mediterranean and Macaronesian montane coniferous forests (6); 96.. Irano-Anatolian deciduous oak forests and open steppe woods (4); 52.. Mediterranean arborescent matorral (3); 53.. Thermo-Mediterranean and pre-steppe brush (2); 40.. Temperate heath and scrub (1); 22.. Sea dunes of the Mediterranean coast (2).

9180 **Tilio-Acerion* forests of slopes, screes and ravines

91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

91F0 Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmenion minoris*)

91M0 Pannonian-Balkanic turkey oak-sessile oak forests

91S0 *Western Pontic beech forests

91AA *Eastern white oak woods

91x1 Colchic beech forests

91x2 Euxine deciduous oak forests

91x3 Subeuxinian deciduous oak mixed forests

91x4 *Thermo-hygrophytic species-rich deciduous mixed forests of ravines and steep slopes rich in *Tilia* spp. and *Acer* spp., and with relict species, in the southern Balkans and Anatolia

91x5 *Colchic alluvial forests with *Alnus barbata*

91x6 Pioneer deciduous forests and scrub with *Populus tremula* and *Betula pendula* of the Balkanic and Anatolian mountains

91x7 Central Anatolian deciduous oak forests

91x8 Euxine-Colchic Nordmann fir forests

9250 *Quercus trojana* woods

9260 *Castanea sativa* woods

9280 *Quercus frainetto* woods

9290 *Cupressus* forests (*Acero-Cupression*)

92A0 *Salix alba* and *Populus alba* galleries

92C0 *Platanus orientalis* and *Liquidambar orientalis* woods (*Platanion orientalis*)

92D0 Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)

92x1 Southern Anatolian deciduous oak forests

92x2 *Woodlands with *Quercus vulcanica*

9320 *Olea* and *Ceratonia* forests

9340 *Quercus ilex* and *Quercus rotundifolia* forests

9350 *Quercus macrolepis* forests

9370 *Palm groves of *Phoenix*

93A0 Woodlands with *Quercus infectoria* (*Anagyrido foetidae-Quercetum infectoriae*)

93x1 *Quercus coccifera* s.l. forests of the eastern Mediterranean

93x2 **Quercus aucheri* woods

93x3 *Quercus ithaburensis* subsp. *ithaburensis* woodlands

9410 Acidophilous *Picea* forests of the montane to alpine levels (*Vaccinio-Piceetea*)

94x1 North and central Anatolian *Pinus sylvestris* forests

9530 *(Sub-) Mediterranean pine forests with endemic black pines

9540 Mediterranean pine forests with endemic Mesogean pines

9560 *Endemic forests with *Juniperus* spp.

9580 *Mediterranean *Taxus baccata* woods

95x1 **Abies cilicica* forests

95x2 **Cedrus libani* forests

96x1 *East Anatolian deciduous oak forests

96x2 *Southeast Anatolian deciduous oak forests

96x3 Anatolian and East Mediterranean wooded pastures

96x4 Wild Orchards and other wild fruit woodlands

5210 Arborescent matorral with *Juniperus* spp.

5230 * Arborescent matorral with *Laurus nobilis*

52x1 East Mediterranean thermo-mesophytic evergreen forest or maquis with *Arbutus andrachne*

5310 *Laurus nobilis* thickets

5330 Thermo-Mediterranean and pre-desert scrub

4060 Alpine and boreal heaths

2250 *Coastal dunes with *Juniperus* spp.

2270 *Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*

Keywords: Anatolian Region; Black Sea Region; EU Habitats Directive; Forests of Turkey; Forest type identification; Habitat types; Mediterranean Region; Phytosociological survey.

INTRODUCTION

In the course of the 20th century, biodiversity loss has become a global threat to the future and well-being of humankind. To meet that challenge, during the UN conference of Rio de Janeiro on the global environment and its development, UNCED, 1992, targets have been formulated and ratified since by almost all nations worldwide. The targets emphasize the importance of maintenance and preservation of the biological diversity at all levels and the need to respect principles of sustainability in its use. The European Union, in an attempt to implement the UNCED targets, adopted the Directive 92/43/EEC, known as Habitats Directive, which, together with the Birds Directive (79/409/EEC), aims at the preservation of natural habitats and wildlife. The Habitats Directive, in the present version of its Annex I, lists 233 habitat types of common interest which are listed and outlined in an Interpretation Manual (European Commission 2013), henceforth referred to as IM. Representative sites of the habitat types have been selected in all EU member states and biogeographical regions to form a coherent network of conservation areas across Europe, known as Natura 2000. For the protected natural resources, the habitat types as well as the populations of plants and animals, a favourable conservation status is to be maintained or developed. It is mandatory for each member state to safeguard that the situation of the habitats, plants and animals is not worsened or impaired by human impact.

Turkey is a country of exceptional biological wealth and diversity. The enormous richness in plant and animal species, but also in landscape and habitat diversity is unparalleled in European and Palaearctic context. Turkey makes a major contribution to three Palaearctic biogeographical regions, the Euro-Siberian, the Mediterranean, and the Irano-Turanian. In previous years, Turkey has made considerable efforts to set the scene for the conservation of the countries natural resources and align its catalogue of environmental guidelines and legislation with the standards of the European Union. To approach such *acquis communautaire*, Turkey and Germany had been contracting partners in a project 10-14 years back to establish the necessary institutional capacity to transpose and implement the EU Nature Conservation Directives, namely the Birds Directive and the Habitats Directive, as well as the CITES Convention and related European regulations. One of the baseline aims of the partners was to translate the Annex I habitat types to the Turkish natural environment and to define and outline eminent sites for Natura 2000 on the Turkish territory. Towards the end of the project, in 2007, the first and second author (EB, HW) provided a draft manual of forest habitat types of Turkey on the basis of the Directive's Annex I (Bergmeier & Walentowski, unpubl.). In 2017, a project of the Foresters' Association of Turkey, seeking expertship in matters concerning the EU Habitats Directive for a case study in the province of Karabük in the Turkish Black Sea region, brought together EB and CG. The scope of the project was to test the practicability of the EU Natura 2000 concept in forested areas of Turkey (TR 2011-0135-15-01-012). This project prompted us to update the draft catalogue of Turkish forest habitat types, to align it with further developments in the Annex I as well as in phytosociology, taxonomy and biogeography, and to make it generally accessible to a wider public. The aim of the present contribution is to provide, for the first time, a conspectus of forest habitat types in Turkey, to describe them briefly in terms of species composition, ecology and distribution, and to relate them to both the Annex I coding of the Habitats Directive, using the version EUR28 of the EU Interpretation Manual (IM; European Commission, 2013) as basis, and the phytosociological nomenclature of European syntaxa, using the recent synopsis by Mucina et al. (2016), extended to cover the Anatolian Turkey which was not included in that work.

The present paper is a scientific reference document. It aims at providing a conspectus of habitat types of forest and (mostly arborescent) scrub in Turkey. The catalogue includes brief descriptions of habitats existing in Turkey and elsewhere in Europe as well as other Turkish habitat types not listed in IM-EUR28 (European Commission 2013). The habitats are named and classified along Annex I of the EU Habitats Directive; new habitat types have been inserted if and where appropriate.

The conspectus, updated from an earlier draft catalogue from 2007, is based on the following sources:

- The Interpretation Manual of European Union Habitats, EUR28, vs. April 2013 (European Commission, 2013)
- A compilation of woodland records provided by Mayer & Aksoy (1986)
- Other literature, namely Turkish local and regional phytosociological studies as well as syntaxonomic surveys and revisions from neighbouring countries (e.g., Quézel & Barbéro 1985; Dimopoulos et al. 2006; Biserkov et al. 2015), as far as known and available to us
- Expert knowledge as a result of own field work and numerous discussions among the authors as well as with peers.

The present catalogue of forest habitat types should be understood as a basis for further research and discussion. We did our best to provide a comprehensive and at the same time practicable account and, therefore, included hints for the identification and mapping of specific habitat types whenever it appeared useful. We would be happy if it stimulates constructive critique and suggestions for improvement. We would also like to inspire complementary works on other – non-forest – habitat types which in Turkey are even less well known than the forest habitat types. The distribution, ecology and variation of many, almost all, Turkish habitat types are imperfectly known, and the same is true for its conservation status and vulnerability.

We are aware of the limitations of the current conspectus and suggest it to be used and tested by conservation practitioners, foresters, vegetation ecologists and phytosociologists alike. To give an example: We refrained from creating analogues of European beech (*Fagus sylvatica*) forest habitat types on the basis of their base content and nutrient supply in the Northern Turkish domain of Oriental beech (*Fagus orientalis*). While units such as 9110, 9130 and 9150 (*Luzulo-Fagetum*, *Galio odorati-Fagetum* and limestone beech forests, respectively) are well founded in Europe, present knowledge does not suggest the application of such a concept in Turkey. Similar scientific gaps or uncertainties are numerous, if you go into detail, and, while some habitat types and subtypes lack sufficient scientific recording, global climate change and regional land-use change may alter the conservation status of certain habitat types for the worse. An important phytosociological paper of Çoban & Willner (2018) on the classification and syntaxonomy of Northwest Turkish forest types, which was published upon completion of our typescript, was duly noted but not fully evaluated.

METHODS AND RATIONALE

Based on an evaluation of *Wälder der Türkei* (Mayer and Aksoy 1986), the first and up to date only comprehensive and singularly detailed account of forest types covering the whole country, as well as other basic literature on woody vegetation in Turkey (see References) we interpreted the woodland types described in literature in an attempt to allocate them to the hierarchy of EU habitat types. Woodland types were assigned to established Annex habitat types whenever possible, taking into consideration the present geographical, ecological and floristic circumscription as given in the IM (European Commission, 2013). Each habitat type was defined and described following a standard rationale. Existing IM definitions of European habitat types were adapted or amended if necessary in order to match the regional situation. We collected information per habitat type on the following parameters: overall and regional distribution, regional variation, records, ecology, significant and diagnostic plants, reference to Mayer and Aksoy (1986), reference to phytosociological categories (syntaxa), references to literature sources.

The habitat types have been grouped following the hierarchical coding used in the IM (European Commission, 2013). We treated the following habitat type groups (woody formations) as far as represented in Turkey:

- Forests of temperate Europe (91..)
- Mediterranean deciduous forests (92..)
- Mediterranean sclerophyllous forests (93..)
- Temperate montane coniferous forests (94..)
- Mediterranean and Macaronesian montane coniferous forests (95..)
- Submediterranean and temperate scrub (51..)
- Mediterranean arborescent matorral (52..)

Three more habitat type groups were treated as far as arborescent vegetation is concerned:

- Thermo-Mediterranean and pre-steppe brush (53..)
- Temperate heath and scrub (40..)
- Sea dunes of the Mediterranean coast (22..)

One new group of habitat types largely restricted to Asia Minor and the Near East was added by us:

- Irano-Anatolian deciduous oak forests and open steppe woods (96..)

Within each habitat type group the habitat types are arranged following IM. Newly suggested habitat types not considered in the current IM are listed within each habitat type group and a provisional code is assigned.

For each habitat type the following information categories are arranged in a standardized way:

The four-digit **Natura 2000 code**; see IM (European Commission, 2013). New habitat types appear under provisional codes in the hierarchical context.

Name of habitat type; an asterisk (*) indicates a priority habitat as established in the current IM.

Definition: Brief description regarding vegetation, overall distribution, syntaxa and environmental features.

Site conditions: Notes on the ecology of the habitat type including abiotic conditions and anthropogenic effects.

Distribution and variability in Turkey: The overall distribution of habitat types in Turkey to the best of our knowledge and available geobotanical literature. The regional distribution is regarded on the level of biogeographical (sub-)regions (Erol 1982, European Environment Agency 2017; Fig. 1), and is presented in a scheme (Fig. 2). **Subtypes** in Turkey are outlined if applicable and as far as sufficient information is available.

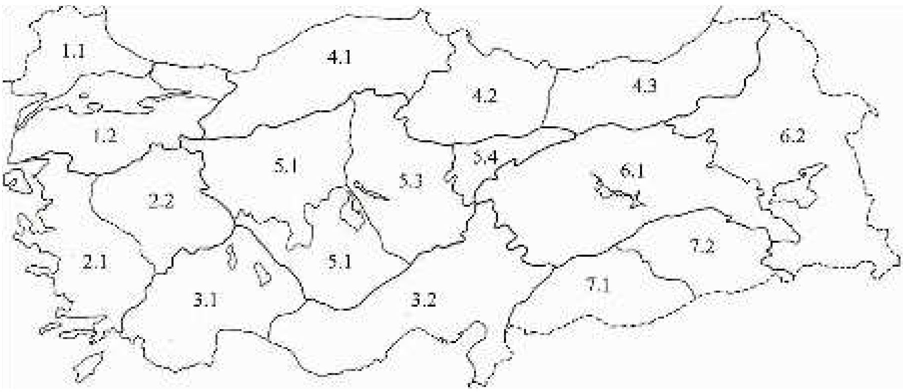

Figure 1. Biogeographic Regions (European Environment Agency 2017) and their subdivision (adapted from Erol 1982). 1-3 Mediterranean Region: 1 Marmara (with 1.1: Northern Marmara, 1.2 Southern Marmara), 2 Aegean (with 2.1 Coastal, 2.2 Inner West Anatolian), 3 Turkish Mediterranean (with 3.1 Antalya Subregion, 3.2 Mersin-Adana-Hatay Subregion); 4 Black Sea Region (with 4.1 Western Black Sea, 4.2 Central Black Sea, 4.3 Eastern Black Sea); 5-7 Anatolian Region: 5 Central Anatolian (with 5.1 Upper Sakarya, 5.2 Konya, 5.3 Middle Kızılırmak, 5.4 Upper Kızılırmak), 6 East Anatolian (with 6.1 Upper Euphrat, 6.2 Eastern Anatolian Subregion), 7 South-east Anatolian Region (with 7.1 Western Subregion, 7.2 Eastern Subregion).

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Figure 2. Scheme displaying the regional distribution of a particular habitat type in Turkey. Biogeographic regions and sub-regions are coded as in Figure 1. (Sub-)Regions with assignable records are shaded grey.

Plants: Diagnostic, common and significant plants (compiled chiefly from Mayer and Aksoy 1986, but taxonomically updated following Euro+Med (2006-2017) or, if not treated there, along Davis (1965-1986) and Davis et al. (1988) are listed per habitat type, for the most part subdivided to growth-form categories such as trees, shrubs, and herbs.

The tree species combination is of particular importance for the identification of habitats, mapping, and conservation status assessment. For more precision in habitat mapping two criterions have to be met: (i) The stated tree species (and shrubs in coppice-woods and scrub formations) occupy at least 70 % accumulated cover in crown projection; (ii) the dominant tree (or shrub) species (underlined), if any, occupies a minimum of 30 % canopy cover.

Additional notes is an optional category explaining how to distinguish the habitat type from other, similar, ones. Further, it provides pieces of information not given elsewhere (e.g., on vulnerability, size and pattern of stands, dynamics and successional processes).

Records: We allocated selected forest types recorded in Mayer and Aksoy (1986) to particular habitat types. For each forest type record the following information is given:

- Names of prevailing plants, chiefly trees, as indicated in Mayer & Aksoy (1986)
- Locations of the forest as reported by Mayer and Aksoy (1986)
- Ecological annotations
- Paragraph code and page numbers in Mayer and Aksoy (1986)

Phytosociology: Provides syntaxa, i.e. alliances and associations, applicable to a particular habitat type. We restricted the associations listed to those from Turkey and with literature reference. No attempt was made to check the synonymies and nomenclatural correctness of the associations.

References: Literature with reference to Turkish occurrences of the habitat type or vegetation type.

9180 ******Tilio-Acerion* **forests of slopes, screes and ravines**

Definition

Cool-humid deciduous mixed forests of steep, often unconsolidated slopes, and in shady ravines with *Acer, Tilia, Ulmus* and *Fraxinus* species, preferrably at the base of steep rocky slopes with boulders; confined in Turkey to the East Black Sea region.

Site conditions

The habitat type occurs on nutrient-rich soils with litter accumulated in cool ravines and at the foot of slopes. It is found in shady sites on calcareous and siliceous substrates associated with coarse scree, boulders, cliffs and ravines. It often occurs scattered and grading into other types of woodland on the ground of valleys and uphill, or along streams, sometimes with a relatively open canopy and correspondingly rich herb groundlayer. Ravine forests on sites with high dynamics provide numerous temporal niches and spatial microhabitats. This habitat type is ecologically variable, as expressed by the different dominant tree species.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Floristic differences due to variation in slope, aspect and substrate add to the diversity of the habitat. There is much regional variation in Central and Eastern Europe where the habitat type is found chiefly in submontane to montane environments. In Turkey, it is restricted to humid environments in the Black Sea bioclimatic region, currently known only in the Eastern Black Sea reagion (Doğu Black Sea Dağları).

Plants

Trees: *Tilia platyphyllos, Ulmus glabra, Acer platanoides, Quercus petraea* subsp. *iberica, Castanea sativa, Carpinus betulus*.

Herbs: The ground flora is species-rich and variable but ferns (*Asplenium scolopendrium, Dryopteris* spp., *Polystichum* spp., *Thelypteris limbosperma*) and tall forbs (*Aruncus dioicus*, *Salvia glutinosa*) are usually present, further nitrophytes such as *Geranium robertianum*.

Additional notes

Ravine forests with *Tilia*, *Ostrya* and *Acer* in warm-humid wintermild coastal regions, chiefly in north-west Turkey, are referred to habitat type 91x4.

Records

Ulmus glabra-Tilia platyphyllos; Sumela (Sümela Manastırı near Maçka, Province of Trabzon); silicolous, 900-1000 m, bottom of ravine, boulders and S exposed rocky sites; EuxDI4b: 125

Phytosociology

Alliance: *Tilio-Acerion* (*Acer*, *Ulmus* and *Tilia* forests in the montane belt and cool ravines of the mountains of Central and East Europe)

References: Erik (1976)

91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

Definition

Alluvial and riparian forests dominated mostly by *Alnus glutinosa* subsp. *glutinosa* along foothill and montane watercourses, near springs and streams, on periodically inundated soils. In Turkey, common alder (*Alnus glutinosa* subsp. *glutinosa*) is the most characteristic tree species, in southern Anatolia replaced by subsp. *antitaurica*.

Site conditions

The habitat type occurs mostly on nutrient-rich alluvial soils along watercourses of different size and topography. Due to the relief and hydrological conditions along watercourses, alder woods are highly dynamic; the habitat type includes tall herb fringes and willow shrub communites of earlier stages in the succession series. The herbaceous flora consists of mesophilous and hygrophilous plants, shade-demanding under the canopy, light-demanding at the fringes.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Ash-alder woodlands of *Alnus glutinosa* subsp. *glutinosa* occur chiefly in the western and central Black Sea region, mostly at submontane to montane levels (up to about 1500 m) but locally slightly above sea level. Forests of the South Anatolian alder, *Alnus glutinosa* subsp. *antitaurica*, are tentatively assigned here.

Plants

Trees: <u>*Alnus glutinosa* subsp. *glutinosa*</u>, *A. g.* subsp. *antitaurica*, *Carpinus betulus*, *Castanea sativa*, *Fraxinus excelsior* subsp. *excelsior*, *Populus nigra*, *P. tremula*, *Salix alba*, *S. fragilis*

Shrubs and woody climbers: *Cornus sanguinea*, *Corylus avellana*, *Dioscorea communis*, *Frangula alnus*, *Ligustrum vulgare*, *Salix purpurea*, *Smilax excelsa*, *Viburnum opulus*, *Vitis vinifera*.

Herbs: *Aegopodium podagraria*, *Ajuga reptans*, *Allium phrygium*, *Aruncus dioicus*, *Athyrium filix-femina*, *Calystegia sepium*, *Cardamine amara*, *C. lazica*, *C.*

raphanifolia, Carex pendula, C. remota, C. sylvatica, Chelidonium majus, Circaea lutetiana, Cirsium appendiculatum, Dryopteris filix-mas, Equisetum arvense, Eupatorium cannabinum, Euphorbia dulcis, Filipendula ulmaria, Glechoma hederacea, Lamium album, Lysimachia punctata, L. verticiliaris, L. vulgaris, Lycopus europaeus, Lythrum salicaria, Petasites hybridus, Ranunculus repens, Rhynchocorys elephas, Salvia glutinosa, Sambucus ebulus, Scrophularia alata, Stachys sylvatica, Stellaria nemorum, Urtica dioica, Veronica anagallis-aquatica.

Additional notes:

Ecotones from wet alder woods to drier woodland and transitions from open to more closed communities provide important components of ecosystem diversity and are included here. Note that transitions to adjacent forest habitat types such as to *Tilio-Acerion* forests of slopes, screes and ravines (9180), *Alno-Quercion* ash forests (91F0) and *Castanea sativa* woods (9260) are not uncommon locally. In Northeast Anatolia, the habitat type 91E0 is replaced by 91x5 (Colchic alluvial forests with *Alnus barbata*).

Habitat structure and function are best maintained when communities of open earlier successional stages are included in the habitat type. Alder woods suffer from human impact such as coppicing (*Alnus*), pollarding (*Salix, Populus*), and planting of non-native tree species (poplar hybrids, *Eucalyptus*).

Records

Alnus glutinosa subsp. *glutinosa*, Yayla Çayi in the NW of Eldivan Dağı; riparian forest in high valleys, 1300-1500 m, alluvial sands; EuxBII8b: 102

Phytosociology

Alliances: *Alnion incanae* Pawłowski et al. 1928 (Alder-ash riparian floodplain forests on nutrient-rich alluvial soils in the nemoral zone of Europe); *Alno-Quercion roboris* (Alder-oak riparian floodplain forests on nutrient-rich alluvial soils of the temperate regions of the Balkan Peninsula and the Black Sea)

Associations not currently known in Turkey

References: Kavgacı et al. (2011); Kavgacı et al. (2016)

91F0 Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmenion minoris*)

Definition

Riparian mixed hardwood forests along major rivers with a natural flooding regime. The dominant species are ash (*Fraxinus angustifolia* and its subspecies, *F. pallisae*), elm (*Ulmus laevis, Ulmus minor*) and oak (*Quercus robur*). In the lower, more frequently flooded, parts of the river bed ash woodlands form mosaics with willow (*Salix*), poplar (*Populus*) or alder (*Alnus glutinosa*) forests and scrub.

Habitat conditions

The hydromorphic alluvial soils are regularly flooded with rising water level and mostly rich in organic matter. Due to the alluvial deposits the woodlands are nitrophytic, with a lush herb and shrub layer, and in forests called "longos" often rich in tree species and lianas.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Although the habitat type has been recorded in Turkey to date only in the Black Sea and Marmara regions, it occurs in riparian landscapes in the Taurus and Amanos lowlands and probably elsewhere in the country. *Fraxinus angustifolia* is represented in Turkey by three subspecies (subspp. *angustifolia*, *oxycarpa* and *syriaca*) and in Thrace (Doğu Trakya) moreover by the similar *F. pallisae*. A modern revision of the floodplain forests of the Turkish Black Sea region has been provided by Kavgacı et al. (2016). All forests with *F. angustifolia* and its allies in Turkey have suffered serious human impact (clearcutting of major parts; drainage) and what has remained requires efficient protection very urgently and decisively. The stands of subsp. *syriaca*, a taxon which occurs otherwise only in adjacent Lebanon and Syria, are particularly vulnerable due to land-use change and overexploitation.

Figure 3. Ash-oak floodplain grazed forest dominated by Fraxinus angustifolia (91F0), Black Sea region, province of Samsun. Photo: U. Hauke, July 2005.

Plants

Trees: *F. angustifolia* (in Turkey with subsp. *angustifolia*, subsp. *oxycarpa* and subsp. *syriaca*), *F. excelsior, F. pallisae, Alnus glutinosa* s.l., *Juglans regia, Populus alba, Pterocarya fraxinifolia, Quercus robur* s.l., *Ulmus laevis, U. minor*

Shrubs, herbs and lianas: *Arum euxinum, Cornus mas, C. sanguinea, Dioscorea communis, Euonymus europaeus, Ficaria verna, Glechoma hederacea, Humulus lupulus, Leucojum aestivum, Lycopus europaeus, Lysimachia punctate, Oenanthe silaifolia, Periploca graeca, Pyracantha coccinea, Rubus sanctus, Smilax excelsa, Solanum dulcamara, Stachys sylvatica, Urtica dioica, Vitis vinifera.*

Additional notes

Riparian hardwood forests are vulnerable to changes of the river water regime and threatened throughout most of Europe and Turkey by reservoir construction, river regulation, drainage, clearcutting and urbanisation. The habitat type depends on a largely intact flooding regime (including flooding through raising ground water table). Riparian dry woods which are no longer subject to natural flooding or isolated from the river by dikes or levees should be considered as of development potential where more natural examples are lacking. Hardwood riparian forests may develop towards oak-hornbeam forests where flooding is prevented. Such stands may be transitional to, and difficult to distinguish from, oak-hornbeam forests that occur on higher river banks where the flooding frequency is naturally low. Small slightly elevated oak-hornbeam patches within regularly flooded hardwood forests should be included in the present habitat type 91F0.

Records

Fraxinus angustifolia subsp. *angustifolia*; Black Sea coast near Demirköy (Iğneada) (900 ha); estuarine, on frequently flooded riparian soils; EuxBI4h: 76

Fraxinus angustifolia subsp. *oxycarpa;* Süleymaniye Dişbudak ormani' between Hendek and Adapazarı at the river Sakarya, similarly near Adapazarı / Dokuna-Döşeme, İzmit, Sinop; in river valleys and depressions; EuxBI4i: 77

Fraxinus angustifolia subsp. *oxycarpa-Alnus glutinosa*; near Adapazarı; widespread in NW Anatolia (also Taurus, Amanus); 50-100 m, humid soil; EuxBI4k 77

Ulmus minor-Fraxinus angustifolia subsp. *oxycarpa*; west of Samsun; near-shore humid lower slopes; EuxCI3b: 108

Pterocarya fraxinifolia-Fraxinus excelsior-Alnus glutinosa subsp. *glutinosa;* coastal: Samsun-Gelemen, Taflan, Kızılırmak and Yeşilırmak deltas; near-coast alluvial and colluvial sites; EuxCI3a: 107

Ulmus minor; riparian forest on mature mull-loam soils; EuxCII6c: 117

Phytosociology

Alliances: *Lauro nobilis-Fraxinion angustifoliae* (Riparian ash and mixed forests of the submediterranean regions of the Apennine and Balkan Peninsulas, and of Northwest Anatolia); *Alno-Quercion roboris* Horvat 1950 (Alder-oak riparian floodplain forests on nutrient-rich alluvial soils of the temperate regions of the Balkan Peninsula and the Black Sea)

Associations: *Fraxino angustifoliae-Ulmetum laevis* Slavić 1952 *typicum, juglandetosum regiae* Kavgacı et al. 2011, *alliarietosum petiolatae* Kavgacı et al. 2016; *Leucojo aestivi-Fraxinetum angustifoliae alnetosum glutinosae* Glavač 1959; *Pterocaryo pterocarpae-Fraxinetum angustifoliae* Kutbay, Kilinç et Kandemir 1998; *Aro hygrophili-Fraxinetum angustifoliae* (Kutbay et al. 1998) Kavgacı et al. 2016; *Smilaco excelsae-Fraxinetum angustifoliae prunelletosum vulgaris* Pavlov et Dimitrov 2002; *Platanthero chloranthae–Fraxinetum oxycarpae* Korkmaz et al. 2012; *Apocyno veneti-Fraxinetum angustifoliae* (Ozen 2010) Kavgacı et al. 2016; *Euphorbio strictae-Fraxinetum angustifoliae* (Aydogdu 1988) Kavgacı et al. 2016

References: Kutbay et al. (1998); Kavgacı et al. (2010b); Kavgacı et al. (2011); Kavgacı et al. (2016)

91M0 Pannonian-Balkanic turkey oak-sessile oak forests

Definition

Sub-continental thermo-xerophile forests dominated by *Quercus cerris, Q. frainetto* or in upper elevations *Q. petraea* subsp. *iberica*, often with the continental *Acer tataricum*, of the Pannonic region and in lowlands and low mountains of the northern and eastern Balkans; in Turkey restricted to East Thrace and the Marmara region.

Site conditions

With annual precipitation of 575-675 mm (60-100 mm in summer) the Thracian climate is more humid than the Anatolian steppe areas and it is milder (with moderate frost), supporting a mixture of nemoral steppe plants and submediterranean plants. This oak forest habitat type occurs on various substrates including limestones, loess, clay, and sand, on slightly acidic, usually deep brown soils. The steppic character of the forests is particularly obvious on grumosols (heavy clayey-loamy soils). The woodlands are commonly used as pasture and coppice-woods.

Distrbution and subtypes in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Occurrences in Turkey are limited to the Thracian steppe forest region (Northern Marmara subregion) at elevations between 100 and 400 (700) m.

Plants

Trees: *Q. cerris*, *Q. frainetto*, *Quercus petraea* subsp. *iberica*, *Q. pubescens*, *Acer campestre*, *A. tataricum*, *Fraxinus ornus*, *Sorbus torminalis*

Shrubs: *Cornus mas*, *Crataegus monognya*, *Euonymus europaeus*, *Juniperus oxycedrus*, *Ligustrum vulgare*, *Paliurus spina-christi*, *Prunus spinosa*, *Pyrus elaeagnifolia*

Herbs: *Brachypodium pinnatum*, *Euphorbia amygdaloides*, *Festuca heterophylla*, *Oenanthe pimpinelloides*, *Ranunculus constantinopolitanus.*

Additional notes

In Turkey, the habitat type is restricted to the Northern Marmara Subregion

(1.1). Similar oak forests near the Marmara coast and in the Southern Marmara subregion (1.2) belong to the submediterranean *Quercus frainetto* woods and are mapped as 9280. The woodlands are commonly treated as pasture and the trees have been coppiced. They may form woodland complexes with *Quercus pubescens* forests of the habitat type 91AA and with dry grasslands with *Bothriochloa ischaemum* and *Chrysopogon gryllus*.

Minimum structural criteria of 91M0 forest stands are area size (> 1 ha), tree height (> 4 m) and canopy closure (> 40 %). More open stands with solitary or widely spaced trees may be considered as 51x1.

Records

Quercus cerris: Tekirdağ – Muratlı; 200 m, grey-yellow forest soil; StepI2a: 148

Quercus petraea subsp. *iberica*-*Quercus pubescens*; upland oak forest; StepI2b: 148

Quercus frainetto; lowland forest, warm sites, StepI2c: 149

Quercus cerris; hilly; StepI2c: 149

Quercus cerris; S of İnebolu; colline, on poor initial soils on sandy slopes; EuxBI4e: 76

Phytosociology

Alliance: *Quercion confertae* (Thermophilous deciduous oak forests on slightly acidic deep soils of the Central and eastern Balkans and north-western Turkey)

Associations: *Quercetum frainetto-cerris* Rudski 1949,p.p.; *Salvio forsskaolei-Quercetum cerridis* Akman, Barbéro et Quézel 1979; *Tanaceto cinerei-Quercetum petraeae ibericae* Kavgacı et al. 2010

References: Dönmez (1969); Kantarci (1975); Aydın et al. (2008); Kavgacı et al. (2010b)

91S0 * Western Pontic beech forests

Definition

Fagus orientalis forests of the western Pontic range, the Strandja-Istranca Mountains and the eastern Balkan Range. They are typically rich in laurophyllous shrubs such as *Rhododendron ponticum* subsp. *ponticum*, *Daphne pontica*, *Prunus laurocerasus*, *Ilex colchica*, *Ruscus hypoglossum*, *Vaccinium arctostaphylos* and herbs of Euxinian affinities such as *Aristolochia pontica*, *Trachystemon orientalis*, *Teucrium lamiifolium*, *Cyclamen coum* and *Epimedium pubigerum*.

In Turkey, *Fagus orientalis* is almost exclusive to the Black Sea region, having its optimum in the perhumid montane belt between 700 and 1200 m. At higher elevations (up to 1300 m) beech forests are mixed with *Abies nordmanniana* subsp. *equi-trojani* (incl. subsp. *bornmuelleriana*) and *Pinus nigra*.

Habitat conditions

The Black Sea (Euxine) region receives high amounts of rainfall and in the beech forest belt has moderate temperatures throughout the year. Rainfall increases and temperature decreases with altitude. The Western Pontic *Fagus* forests occur on various types of siliceous and calcareous bedrock. The brown soils are markedly to slightly acidic (pH 4.5-6.0) due to the leaching effects of high precipitation (Atalay 1992). Organic matter content in the topsoil is generally high (>5%). The soil texture varies between sandy loam and loamy clay (Atalay 1992; Peters 1997).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

- Euxinian *Fagus* forests occur as low as near sea level (e.g., near Sögütlü) or elsewhere from 600 m. The optimum range is between 1000-1200 m, and the uppermost stands, chiefly mixed beech-fir forests, rarely exceed 1300 m.
- Subeuxinian *Fagus* forests are accompanied by submediterranean species and lack part of the Euxinian element but are still influenced by wintermild climate. Another group of subeuxinian beech forests belongs to the *Carpino betuli-Acerion hyrcani* and occurs at supramediterranean levels in the northwestern Anatolian mountains between Eskişehir, Kütahya and Balıkesir.

Figure 4. West Euxine Oriental beech (Fagus orientalis) forest (91S0), Yedigöller National Park, province of Bolu, Black Sea region, Northwest Anatolia. Photo: U. Hauke, June 2005.

Figure 5. Oriental beech (Fagus orientalis) forest (91S0), province of Karabük, Western Black Sea region, North Anatolia. Photo: C. Güngöroğlu, June 2017.

Plants

Trees: *Fagus orientalis*, *Abies nordmanniana* subsp. *equi-trojani* (incl. *A. bornmuelleriana*), *Carpinus betulus*, *C. orientalis*, *Castanea sativa*, *Pinus sylvestris*, *Quercus cerris*, *Q. petraea* subsp. *iberica*, *Staphylea pinnata*, *Tilia argentea*.

Shrubs and woody climbers: *Daphne pontica*, *Hedera colchica*, *H. helix*, *Ilex colchica*, *Prunus laurocerasus*, *Rhododendron luteum*, *R. ponticum* subsp. *ponticum*, *Smilax excelsa*, *Vaccinium arctostaphylos*.

Herbs: *Actaea spicata*, *Aristolochia pontica*, *Asarum europaeum*, *Athyrium filix-femina*, *Calamintha grandiflora*, *Cardamine bulbifera*, *Carex sylvatica*, *Cyclamen coum*, *Dryopteris filix-mas*, *Drymochloa drymeja*, *Euphorbia amygdaloides*, *Galium odoratum*, *Lamium galeobdolon*, *Lathyrus aureus*, *Lilium martagon*, *Melica uniflora*, *Neottia nidus-avis*, *Polygonatum multiflorum*, *Primula acaulis* subsp. *rubra*, *Sanicula europaea*, *Trachystemon orientalis*.

Additional notes

In the Black Sea region, intensive human impact especially in the surroundings of settlements caused locally dramatical forest disturbance, creating a lower timberline of beech and mixed beech forests at elevations above 1000 m (Atalay 1992).

Species-poor beech forest on very acid and poor sites and stands with considerable proportions of *Acer* (e.g., Yedigöller National Park) are tentatively included in the habitat type.

Note that not only pure beech forests, but also mixed beech forest with fir and pines are included. They are distinguished from 91x8 (Euxine-Colchic Nordmann Fir forests) by beech dominance, characteristics of the ground layer and site conditions. Azonal forests with scattered beeches on screes and in ravines may belong to type *91x4 (Thermophilous deciduous mixed forests). Woodlands with *Fagus orientalis* occur also on north and north-west facing slopes of some Aegean mountains and the Nur Mountains (Nur Dağları). These occurrences are mapped under type 9280 (*Quercus frainetto* woods) and 92x1 (South Anatolian oak forests), respectively.

Records

Western Black Sea:

Vaccinium arctostaphylos-Fagus; Yıldız (Istranca) Dağları; zonal, slopes and summits between 600-800 m, siliceous, acidic humus, podsolic soils; EuxBI6b: 79

Aristolochia pontica-Ilex colchica-Fagus; Cide-Kastamonu, Yıldız (Istranca) Dağları; (400-)500-1000(-1100) m, mostly shady slopes, almost exclusively siliceous substrata (sandstone, schist); EuxBI6a: 79

Rhododendron ponticum-Ilex colchica-Fagus and (*Abies*-)*Fagus*; Cide-Kastamonu; 800-1200 m, shady, humid, rich in finegrained soil, both calcareous (with mull humus) and siliceous (sandstone, schist), substituting *Aristolochia-Ilex-Fagus* forest at higher altitudes; EuxBI7c: 82

Abies-Fagus, fern-rich; Kuş-Tepe near İnebolu-Kastamonu; mesic, loamy brown soil; EuxBI8a: 84

Telekia speciosa-Abies-Fagus; NW of Azdavay-Mayadut (Kizilcasu, Araç, Kastamonu); (950-)1200-1450 m, moderately steep shady slopes on limestone, rarely schist; EuxBI8b: 84

Trachystemon orientalis-Fagus and *Abies Fagus*; Uludağ, NE side and Mayzit valley, Cide-Ilgaz-Kastamonu; humus-rich brown soil, N and E slopes, metamorphic schist, marl, rarely limestone, no mediterranean influence; EuxBI8c: 84

Rhododendron ponticum-Abies-Fagus; Karabük, Büyükdüz; low montane, semihumid, lime-poor flysch, variety with pure Fagus on shady slopes, with Abies on less steep upper slopes; EuxBI7d: 83

Pinus sylvestris-Abies-Fagus; Karabük, Büyükdüz; steep upper and middle slopes, S and W-exposed; EuxBI8d 85

Ostrya carpinifolia-Fagus; very rarely in Karabük and Büyükdüz; extrazonal, skeletal soils, semi-consolidated screes; EuxBI6c: 80

Buxus-Laurocerasus officinalis-Fagus; 800-1000 m, SW slopes, limestone; EuxBI5b: 78

Fagus (colline); Belgrade Forest (Bosporus) and near Adapazarı, 100-300 m, near coast; EuxBI7a: 82

Central Black Sea:

Veronica magna-Fagus; 1300-1500 m, siliceous steep slopes on andesite and schist, heavy mull-brown soil with thick leaf-litter layer; EuxCI5b: 112

Aristolochia pontica-Ilex colchica-Fagus; W of Samsun; (500-)600-1000(-1100) m, shady slopes, silicolous; EuxCI5a: 112

Vincetoxicum nigrum-Fagus; near Dereli, Yavuzkemal; 1600-1700 m, S exposed limestone slopes; EuxCI6b: 113

Phytosociology

Alliance: *Fagion orientalis* (incl. *Carpino-Fagion orientalis* and *Violo odoratae-Fagion orientalis*; Oriental beech and beech-fir forests of the Euxine, Colchic and Caucasus regions)

Associations: *Ilici colchicae-Fagetum orientalis* Akman, Barbéro et Quézel 1978 (other reference see Yurdakulol et al. 2002), *Galio odorati-Fagetum orientalis* Özen et Kilinç 2002, *Trachystemono orientalis-Fagetum orientalis* Akman, Barbéro et Quézel 1979; *Pruno laurocerasi-Fagetum orientalis* Quézel, Barbéro et Akman 1980, *Pyrolo secundae-Fagetum orientalis* Akman, Barbéro et Quézel 1979; *Rhododendro pontici-Fagetum orientalis* (Stefanov 1924) Horvat, Glavač et Ellenberg 1974; "Units 3, 4, and 5" (Kavgacı et al. 2012: 471); *Galium odoratum-Fagus orientalis* dominated forest (Kavgacı et al. 2013)

References: Alemdag (1963); Horvat et al. (1974); Quézel et al. (1980); Atalay (1992); Eşen (2000); Özen & Kilinç (2002); Aydın et al. (2008); Kavgacı et al. (2012); (Kavgacı et al. 2013)

91AA *Eastern white oak woods

Definition

Quercus pubescens-dominated submediterranean-subcontinental xero-thermophytic mixed oak woods of the Black Sea plains and hills of Turkey-in-Europe and of the northern Thracian plain of southern and southeastern Bulgaria. The mixed oak forests occur mostly in patches surrounded and interspersed by steppic grasslands.

Site conditions

The climate in Eastern Thrace is transitional between the Mediterranean, continental and Euxinian climates. The 91AA forests occur on dry and warm south- or west-faced slopes with rock outcrops. The substrate varies but is mostly base-rich, often calcareous. The soils are often eroded and shallow leptosols. The woods have been used as pasture and as coppice providing firewood.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees and shrubs: *Quercus pubescens*, *Q. cerris*, *Q. frainetto*, *Acer campestre*, *A. monspessulanum*, *Carpinus orientalis*, *Clematis viticella*, *Fraxinus ornus*, *Juniperus oxycedrus*, *Paliurus spina-christi*, *Pistacia terebinthus*, *Prunus argentea*, *Pyrus elaeagrifolia*

Herbs: *Achnatherum bromoides*, *Buglossoides purpurocaerulea*, *Dictamnus albus*, *Festuca heterophylla*, *Filipendula vulgaris*, *Inula ensifolia*, *Potentilla micrantha.*

Additional notes

91AA-*Quercus pubescens* and *Carpinus orientalis* forests may co-occur with 91M0 oak forests dominated by *Q. cerris* and/or *Q. frainetto*. The former occur generally on the drier, more exposed sites with poorer soils.

Minimum structural criteria of 91AA forest stands are area size (> 1 ha), tree height (> 4 m) and canopy closure (> 40 %). More open stands with widely spaced or solitary trees may be considered as 51x1.

Records

Paliurus spina-christi-Quercus pubescens; 100-200 m; StepI2a: 147

Quercus pubescens-Quercus frainetto; Hisarlidağ; StepI2a: 147

Quercus pubescens; Korudağ; 200-400 (-700) m, upland; mixed oak forest; StepI2b: 148

Quercus pubescens; Korudağ; 200-400 m, lowland; mixed oak forest; StepI2b: 148

Quercus pubescens; NE Thrace, Istranca Dağları; warm sites; StepI2c: 149

Phytosociology

Alliance: *Quercion confertae* (Thermophilous deciduous oak forests on slightly acidic deep soils of the Central and eastern Balkans and north-western Turkey)

Associations representing 91AA are currently not known from Turkey.

References: Akman et al. (1978/1979); Karaer et al. (1999)

91x1 Colchic beech forests

Definition

Fagus orientalis and mixed beech forests of the Eastern Black Sea (Doğu Black Sea Dağları). They are typically rich in laurophyllous shrubs such as *Rhododendron luteum*, *R. ponticum*, *Daphne pontica*, *Prunus laurocerasus*, *Ilex colchica*, *Vaccinium arctostaphylos* and Euxinian herbs such as *Trachystemon orientalis*, *Teucrium lamiifolium*, *Veronica magna* and *Epimedium pubigerum*.

Fagus orientalis has its optimum on the perhumid low to high montane northern slopes between (500) 700 m and 1700 (1,900) m, sometimes higher. Various other deciduous tree species and conifers may be associated, among the latter *Abies nordmanniana* subsp. *nordmanniana* and *Picea orientalis*. Above elevations of 1400-1500 m, the proportion of *Fagus* decreases, giving way to *Abies* and *Picea*.

Habitat conditions

The Doğu Black Sea Dağları receive high amounts of rainfall through orographic precipitation with ascending humid air masses from the Black Sea. Temperatures are mild but decrease with altitude. The Euxine-Colchic *Fagus* Forests occur on various types of siliceous and calcareous bedrock. The brown soils are well developed except on very steep slopes. They are acidic or (sub) neutral (pH 4.5-6.0) with high amounts of organic matter (> 5%). The soil texture varies between sandy loam and loamy clay (Atalay 1992; Peters 1997).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees: *Fagus orientalis*, *Abies nordmanniana* subsp. *nordmanniana*, *Carpinus betulus*, *Castanea sativa*, *Picea orientalis*, *Pinus sylvestris*, *Q. petraea* subsp. *iberica*.

Shrubs and woody climbers: *Daphne pontica*, *Hedera colchica*, *Ilex colchica*, *Rhododendron luteum*, *R. ponticum*, *Smilax excelsa*, *Vaccinium arctostaphylos*.

Herbs: *Actaea spicata*, *Aristolochia pontica*, *Asarum europaeum* subsp. *caucasicum*, *Athyrium filix-femina, Carex sylvatica, Dryopteris filix-mas, Galium odoratum, Lamium galeobdolon, Neottia nidus-avis, Polygonatum multiflorum, Prenanthes petiolata, Sanicula europaea, Trachystemon orientalis, Veronica magna, V. peduncularis.*

Additional notes

Species-poor beech forests on very acid and nutrient-poor sites are included in the habitat type. *Fagus* forests mixed with fir and spruce are distinguished from 91x8 (Euxine-Colchic Nordmann fir forests) by beech dominance. Similarly, oak-beech forests belong here, if beech is prevailing. Note that azonal forests with beech on screes and in ravines may belong to *91x4 (Thermophilous deciduous mixed forests).

Figure 6. Colchic beech-fir forest (Fagus orientalis, Abies nordmanniana), with Rhododendron ponticum and R. luteum (91x1), province of Artvin, Northeast Anatolian Black Sea region. Photo: U. Hauke, September 2005.

Records

Fagus (montane); Zigana region and eastward: Erbaa - Tortepe, Kulakaya, Kodana - Giresun, Tonya, Hamsiköy, Zigana - Trabzon; (1200-)1400 - 2200 m, siliceous mesic, fine-grained but well-drained soils, EuxDI5a: 125

Rhododendron ponticum-Fagus; Kelkit, Gümüşhane; 900-1200(-1500) m; EuxCI5c: 112, EuxDI5c: 127

Taxus baccata-Buxus sempervirens-Fagus; 600-800 m, both sun-exposed and shady sites, Rendzina soils, calcareous; EuxCI6a: 112, EuxDI5c 127

Fagus-Carpinus betulus; Trabzon - Sumela; 700 - 900(-1000) m, skeletal ridges and steep slopes; EuxDI3c 124

Vincetoxicum nigrum-Fagus; 1600-1700 m, S side of the mountains, limestone, thermophytic; EuxDI6c 132

Phytosociology

Alliance: *Fagion orientalis* (Oriental beech and beech-fir forests of the Euxine, Colchic and Caucasus regions), incl. V*eronico peduncularis-Fagion orientalis* nom. inval.

Associations: *Ilici colchicae-Fagetum orientalis* Akman, Barbéro et Quézel 1978, *Trachystemono orientalis-Fagetum orientalis* Akman, Barbéro et Quézel 1979; Galio odorati-Fagetum orientalis Özen & Kılınç (2002);

Alliance: *Veronico peduncularis-Fagion orientalis* (Colchic-Caucasian upper montane humid beech-conifer, fir and spruce forests)

Veronico magnae-Fagetum orientalis Quézel, Barbéro et Akman 1980 nom. mutat. propos. [The name *Veronico melissifoliae-Fagetum orientalis* ("*-melissaefoliae-*") applied by Quézel et al. 1980 is proposed here to be corrected to *Veronico magnae-Fagetum orientalis* (ICPN art. 44). *Veronica melissifolia* auct. is a later homonym of *V. melissifolia* Poiret. The correct name for the former taxon applied in Fl. Turkey 6: 732 is *V. magna* M. A. Fischer.]; "Unit 1" (Kavgacı et al. 2012: 471)

References: Quézel et al. (1980a); Atalay (1992); Eşen (2000); Özen & Kılınç (2002); Kavgacı et al. (2012)

91x2 Euxine deciduous oak forests

Definition

Mixed deciduous forests with *Quercus petraea* s.l., *Q. hartwissiana*, *Carpinus betulus*, *C. orientalis* and *Castanea sativa* of the maritime, wintermild coastal belt of the Black Sea region

Habitat conditions

Euxine hornbeam-oak forests grow mostly on clayey or silty siliceous and alluvial soils, rarely calcareous, on neogene or metamorphic bedrock. The climate is submediterranean or warm-temperate.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees: *Carpinus betulus*, *Quercus hartwissiana*, *Q. petraea* subsp. *iberica*, *Acer cappadocicum*, *A. trautvetteri*, *Albizia julibrissin*, *Carpinus orientalis*, *Castanea sativa*, *Fagus orientalis*, *Ostrya carpinifolia*, *Pinus sylvestris*, *Sorbus torminalis*; *Tilia rubra*; locally in the northeast: *Picea orientalis*

Shrubs and woody climbers: *Arbutus unedo*, *Cornus mas*, *C. sanguinea* subsp. *australis*, *Corylus avellana*, *C. maxima*, *Daphne pontica*, *Diospyros lotus*, *Erica arborea*, *Euonymus latifolius*, *Hedera colchica*, *H. helix*, *Ilex colchica*, *Laurus nobilis*, *Phillyrea latifolia*, *Prunus laurocerasus*, *Pyracantha coccinea*, *Mespilus germanica*, *Rhamnus imeretina*, *Rhododendron ponticum*, *R. luteum*, *Rubus platyphyllus*, *R. hirtus*, *Ruscus aculeatus*, *R. hypoglossum*, *Smilax excelsa*, *S. aspera*, *Tamus communis*, *Vaccinium arctostaphylos*.

Herbs: *Achillea biserrata*, *Blechnum spicant*, *Calluna vulgaris*, *Campanula alliariifolia*, *Carex sylvatica* s.l., *Drymochloa drymeja*, *Epimedium pinnatum* subsp. *colchicum*, *Helleborus orientalis*, *Hypericum androsaemum*, *H. calycinum*, *H. xylosteifolium*, *Iris lazica*, *Omphalodes cappadocica*, *Oplismenus hirtellus* subsp. *undulatifolius*, *Polystichum aculeatum*, *Pteridium aquilinum*, *Sambucus ebulus*, *Sanicula europaea*, *Schedonorus giganteus*, *Sophora jaubertii*.

Records

Black Sea:

Erica arborea-Carpinus orientalis; Ünye, Rize, Giresun, Tirebolu, Trabzon, Dereli, Of; schist, both sun-exposed (- 400(-650) m) and shady sites (- 300 (-400) m); EuxDI3a: 123

Quercus petraea subsp. *iberica-Fagus-Carpinus betulus*; Ilgaz Mts. (Ilgaz Dağları); 1000-1300 m, low slopes in shady valleys, on limestone, marl, schist; EuxBII4b 94

Pinus sylvestris-Quercus petraea subsp. *iberica*; Ilgaz Mts. (Ilgaz Dağları); 1100-1300 m, shady moderately steep slopes, schistose, calcareous and metamorphic rock; EuxBII4c 94

Daphne pontica-Quercus petraea subsp. *iberica*; near Azdavay (Kastamonou); 850-1200 m, shady slopes on schist, sandstone and limestone; EuxBII4a: 94

Quercus hartwissiana-Carpinus betulus; between Adapazarı and Zonguldak; up to 1300 m, brown soil, in high altitude locally acidic humus (mor) brown soil over siltstone-schist; EuxBI4d: 76

Marmara:

Quercus petraea subsp. *iberica-Carpinus betulus*; Belgrade forest (Belgrad Ormanı, İstanbul); 50-220 m, moderately warm, semihumid; well aerated Devonian sandstone, schist, and grauwacke soils as well as clayey neogene soils; EuxBI4b: 71

Quercus petraea subsp. *iberica*; Belgrade forest (Belgrad Ormanı, İstanbul), and near Adapazarı; redbrown forest soils, coastal to montane, primarily on southern slopes, on shady slopes replacing degraded beech forest; EuxBI4c: 75

Quercus hartwissiana-Carpinus betulus; near Adapazarı, Çitdere, Yenice; 50-1000 m, brown soil; EuxBI4d: 76

Phytosociology

Alliance: *Trachystemono orientalis-Carpinion betuli* (Euxine mixed broadleaved forests with *Quercus* spp., *Castanea*, *Carpinus*, *Ostrya*, *Tilia* and *Fagus*, on humid slopes with mostly deep soil)

Associations: *Erico arboreae-Carpinetum orientalis* Quézel, Barbéro et Akman 1980; *Daphno ponticae-Quercetum ibericae* Quézel, Barbéro et Akman 1980; *Geranio robertiani-Carpinetum betuli* Kavgacı et al. 2011; *Trachystemono orientalis-Carpinetum betuli* Kavgacı et al. 2011

References: Quézel et al. (1980a); Kutbay & Kılınç (1995); Kutbay et al. (1999); Aydın et al. (2008); Kavgacı et al. (2011); Kavgacı et al. (2016)

91x3 Sub-Euxine deciduous oak mixed forests

Definition

Northern Anatolian deciduous oak mixed forests with *Quercus macranthera*, *Q. petraea* s.l., *Carpinus* and *Acer* species transitional between the Black Sea and Anatolian bioclimatic regions

Habitat conditions

Sub-Euxine deciduous oak mixed forests are chiefly associated with subhumid conditions and submediterranean-temperate climate transitional between the maritime, windward Black Sea coastal ranges in the north and the continental regions in the south. They occur moreover in ecologically equivalent locations further north or south. Soils are variable and include deep brown soils but also lithomorphic soils over siliceous or calcareous bedrock. On the more or less steep slopes soils are commonly shallow and the texture varies between sandy and loamy clay.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Subtypes from the western, central and eastern Black Sea regions may be distinguished (see below); they differ in ground layer species composition.

Plants

Trees: *Carpinus betulus*, *C. orientalis*, *Quercus cerris*, *Q. macranthera* subsp. *syspirensis*, *Q. petraea* subsp. *iberica*, *Q. pubescens*, *Acer campestre*, *A. cappadocicum*, *A. hyrcanum*, *Pinus nigra*, *P. sylvestris*, *Pyrus communis*, *Sorbus torminalis*

Shrubs: *Cornus mas*, *Corylus avellana*, *Cotinus coggygria*, *Crataegus orientalis*, *C. pentagyna*, *Euonymus europaeus*, *Prunus mahaleb*

Herbs: *Aristolochia pallida*, *Astragalus glycyphylloides*, *Brachypodium pinnatum*, *Cirsium hypoleucum*, *Dictamnus albus*, *Helleborus orientalis*, *Physospermum cornubiense*, *Poa nemoralis*, *Stellaria holostea*, *Tanacetum poteriifolium*

Figure 7. Subeuxinian thermophilous mixed oak forest (91x3) on calcareous substrate, province of Karabük, Western Black Sea region, North Anatolia. Photo: C. Güngöroğlu, Mai 2017.

Figure 8. Subeuxinian oak forest (Quercus petraea subsp. iberica, 91x3) on debris-covered ground, Yedigöller National Park, province of Bolu, Northwest Anatolia. Photo: U. Hauke, June 2005.

Records

Western Black Sea and Marmara region:

Dictamnus albus-Quercus macranthera subsp. *syspirensis*; Eskipinar - Safranbolu; 400-800(-1100) m, shady N and W slopes on sandstone, marly limestone and calcareous schist; EuxBII3a: 92

Carpinus betulus-Quercus macranthera subsp. *syspirensis*; Ilgaz Mountains (Ilgaz Dağları: Kastamonu - Kanligöl - Beşdeğirmenler, Diphan); 800-1450 m, limestone and marl, N-W-E exposed shady slopes, also depressions, lower slopes and foothills; EuxBII3b 93

Pinus nigra-Quercus petraea subsp. *iberica*; Büyükdüz, Karabük; up to 1000(-1100) m, S-exposed, flysch; EuxBII4d: 94

Quercus pubescens; near Beypazarı; 800-1400 m, marly lımestone wıth brown soıl; EuxBII2c: 91

Quercus petraea subsp. *iberica-Pistacia terebinthus*; SW foothills of Uludağ, 200 m, Macchie-type vegetation; EuxBI3d: 69

Central Black Sea:

Carpinus betulus-Carpinus orientalis; Sinop - Samsun – Dereköy; 300-1000 m, locally near the coast, marls, sandstone and schist; EuxCI4a: 109

Ruscus aculeatus-Carpinus orientalis; near Samsun (Büyüklüköy - Dereköy); 300-1000 m, including warm lowland sites of submediterranean character (E, S) on schist, marl or colluvium; EuxCI4b: 109

Crataegus curvisepala-Quercus cerris-Carpinus orientalis; near Samsun and Erbaa; 500-750 m, moderately steep, slopes sun-exposed and averted, schist, siliceous materials, andesite; EuxCII3a: 113

Quercus pubescens; Ankara - Samsun, Çorum; southern slopes, chiefly limestone; EuxCII3d: 115

Acer cappadocicum-Quercus petraea subsp. *iberica* and *Quercus cerris-Carpinus orientalis*; near Samsun; 500-1000 m, shady slopes on schist, marl and sandstone, in depressions and valleys as low as 400(-300) m; EuxCI4d: 111

Quercus petraea subsp. *iberica*; N of Erbaa, also Karadağ; 1000-1100 m, marl, shady S slopes of the coastal mountain chain; EuxCII3b 115

Dictamnus albus-Quercus macranthera subsp. *syspirensis-Carpinus orientalis-Carpinus betulus*; near Destek – Ladik; 1050-1200 m, shady slopes, skeletal dolomitic limestone; EuxCII3c 115

Eastern Black Sea:

Crataegus orientalis-Quercus macranthera subsp. *syspirensis*; S of Trabzon (Kürtün, Torul, Harşit), canyon of Artvin; 400-600(-1000) m, sun-exposed, limestone and andesite, at 100-200m on talus near Artvin; EuxDII3a: 135

Carpinus orientalis-Quercus petraea subsp. *iberica*; submontane; EuxDII3b: 136

Pimpinella lazica-Carpinus orientalis; valley near Kürtün (Kelkit Çayi, Çoruh-Nehri), S of the Zigana pass; 1000-1300 m, in sun and shade expositions on limestone; EuxDII3c 136

Phytosociology

Alliance: *Carpino betuli-Acerion hyrcani* (Sub-Euxine oak and mixed deciduous and coniferous forests)

Associations: *Carpino-Quercetum cerridis* Kutbay et Kilinç 1995, *Cephalanthero rubrae-Quercetum cerridis* Karaer, Kilinç et Kutbay 1999, *Dictamno albi-Quercetum syspirensis* Quézel, Barbéro et Akman 1980, *Scaligerio tripartitae-Carpinetum betuli* Akman, Barbéro et Quézel 1978, *Crataego curvisepalae-Quercetum cerridis* Quézel, Barbéro et Akman 1980, *Rusco aculeati-Carpinetum orientalis* Quézel, Barbéro et Akman 1980, *Querco ibericae-Aceretum cappadocici* Quézel, Barbéro et Akman 1980, *Carpino betuli-Quercetum petraeae* Yurdakulol et al. 2002, *Argyrolobio-Quercetum cerridis* Türe et al. 2005; "Unit 7" (Kavgacı et al. 2012: 471)

References: Kutbay & Kılınç (1995); Kutbay et al. (1998); Kutbay et al. (1999); Karaer et al (1999); Aydın et al. (2008); Kavgacı et al. (2012)

91x4 *Thermo-hygrophytic species-rich deciduous mixed forests of ravines and steep slopes rich in *Tilia* spp. and *Acer* spp., and with relict species, in the southern Balkans and Anatolia

Definition

Warm-humid submediterranean-subeuxinian deciduous mixed forests on shady slopes, screes, and in ravines, with a variety of deciduous trees (*Acer, Tilia, Ulmus, Fraxinus, Fagus, Ostrya, Carpinus, Corylus, Aesculus*) and mesophilous herbs, locally with Tertiary and interglacial relics.

Site conditions

Ravines and bouldery slopes with siliceous or calcareous bedrock support very species-rich woods on colluvial and skeletal soils. Habitat dynamics is high on the steep warm-humid slopes and in ravines with poorly consolidated substrata. Together with suitable topographic and soil conditions, a favourable microclimate (high humidity, sheltered from wind and strong insolation) is crucial. Diversity of trees and herbs is commonly high and includes pre-glacial and interglacial relict species highlighting the refugial character of the localities.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

- Some occurrences on the Istranca Dağlari and locally further east in the Black Sea region (and probably those of the Amanus Mountains) represent a more thermophilous subeuxinian subtype (approaching or in contact with meso-thermophytic shrub communities, *Buxo-Staphylion pinnatae*).

- *Fagus*-dominated forests have been described from deeply incised ravines of Istranca Dağlari.

- Occurrences above the southern coast of the Marmara Sea might be assigned to a subtype of submediterranean character approaching *Quercion confertae.*

Plants

Trees: *Tilia platyphyllos, T. rubra, T. tomentosa, Ulmus glabra, Acer platanoides, Fagus orientalis, Fraxinus ornus, F. excelsior, Ostrya carpinifolia, Carpinus betulus, Corylus colurna, Juglans regia, Taxus baccata;* in the South Balkans: *Aesculus hippocastanum, Fagus sylvatica.*

Shrubs: *Buxus sempervirens Ilex colchicum, Laurus nobilis, Phillyrea latifolia, Prunus laurocerasus, Sambucus nigra, Staphylea pinnata.*

Herbs: *Asplenium scolopendrium, Polystichum setiferum, Ruscus hypoglossum, Salvia glutinosa, Stachys sylvatica.*

Additional notes

Ravine forests in cool-humid montane sites in the Black Sea region (*Kuzey Anatolian Dağları*), chiefly in north-east Turkey, are referred to habitat type 9180.

Records

Tilia argentea; Istranca Dağları, Zonguldak; coastal, sheltered, siliceous bolders; EuxBI4f: 76

Rhododendron ponticum-Fagus orientalis; Istranca Dağları; submontane ravine forest, 800-1000 m, shady sheltered sites, brown soil and colchic yellow soil; EuxBI7b 82

Phytosociology

Alliances: *Ostryo carpinifoliae-Tilion platyphylli* (Submediterranean xero-thermophilous broad-leaved scree and ravine forests of the Balkan Peninsula); *Trachystemono orientalis-Carpinion betuli* (Euxine mixed broadleaved forests with *Quercus* spp., *Castanea*, *Carpinus*, *Ostrya*, *Tilia* and *Fagus*, on humid slopes with mostly deep soil); *Buxo-Staphylion pinnatae* (Mesic deciduous scrub with evergreen components in shady habitats of the Black Sea region)

Association: Approaching “Unit 1” (Kavgacı et al. 2012: 471)

References: Stefanov (1924); Horvat et al. (1974); Kavgacı et al. 2012)

91x5 * Colchic alluvial forests with *Alnus barbata*

Definition

Northeast Anatolian alluvial and riparian forests dominated by *Alnus glutinosa* subsp. *barbata* along watercourses in ravines, near springs, rivers and streams from lowland to montane levels, on periodically inundated or seepage soils. Other woody species may abound in marginal situations.

Site conditions

The habitat type occurs on moderately base-rich nutrient-rich alluvial soils along watercourses of different size and topography in the humid, wintermild climates of the East Euxine-Colchic region. Alder woods are highly dynamic; the habitat type includes tall herb and shrub communites of earlier stages in the succession series. Due to the topographic and dynamic variation, the lush ground flora is variable and diverse.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The Eastern Euxine (Colchic) *Alnus glutinosa* subsp. *barbata* forests are accompanied by a Hyrcanic-Colchic flora and understory including evergreen shrubs and lianas

Plants

Trees: <u>*Alnus glutinosa* subsp. *barbata*</u>, *Carpinus betulus*, *Castanea sativa*, *Pterocarya fraxinifolia*

Shrubs and woody climbers: *Cornus sanguinea*, *Corylus avellana*, *C. maxima*, *Dioscorea communis*, *Hedera colchica*, *Ligustrum vulgare*, *Lonicera caucasica* subsp. *orientalis*, *Rhododendron ponticum*, *Smilax excelsa*, *Viburnum opulus*, *V. orientale*, *Vitis vinifera*.

Herbs: *Aegopodium podagraria*, *Allium phrygium*, *Aruncus dioicus*, *Athyrium filix-femina*, *Calystegia sepium*, *Cardamine lazica*, *C. raphanifolia*, *Carex pendula*, *C. sylvatica*, *Circaea lutetiana*, *Chrysosplenium dubium*, *Datisca cannabina*, *Dryopteris filix-mas*, *Eupatorium cannabinum*, *Euphorbia dulcis*, *Equisetum arvense*, *Heracleum crenatifolium*, *Hypericum androsaemum*, *Lysimachia punctata*, *L. verticillaris*, *Petasites hybridus*, *Ranunculus repens*, *Rhynchocorys elephas*, *Salvia glutinosa*, *Sambucus ebulus*, *helypteris limbosperma*, *Urtica dioica*.

Additional notes:

Ecotones from wet alder woods to drier woodland and transitions from open to more closed communities provide important components of ecosystem diversity and are included here. Transitions to other forest habitat types of steep slopes and ravines (9180) and *Castanea sativa* woods (9260) may be common locally.

Habitat structure and function are best maintained when communities of open earlier successional stages are included in the habitat type. Where accessible, alder woods have been affected by plantations of non-native tree species (poplar hybrids, *Eucalyptus*).

Records

Thelypteris limbosperma-Alnus glutinosa subsp. *barbata*; Samsun - Rize, lowlands near Rize; 300-1300 m, deep gleyic soils, shady, also in schistose ravines; EuxDI4a 124

Phytosociology

Alliances: *Alnion barbatae* (Euxine-Colchic alluvial riparian alder forests)

Associations: *Thelypterido limbospermae-Alnetum barbatae* Quézel, Barbéro et Akman 1980 *Pterocaryo pterocarpae-Alnetum barbatae* Quézel et al. ex Quézel et al. 1992; *Sambuco ebuli-Alnetum barbatae* (Korkmaz et al. 2012) Kavgacı et al. 2016

References: Quézel et al. (1980a); Kutbay et al. (1998); Kavgacı et al. (2011); Kavgacı et al. (2016)

91x6 Pioneer deciduous forests and scrub with *Populus tremula* and *Betula pendula* of the Balkanic and Anatolian mountains

Definition

Deciduous woods composed of pioneer and pre-forest tree species such as *Betula pendula* and *Populus tremula*, mostly with open canopy on unstable stony ground in the Mediterranean, Balkan and Anatolian mountains.

Habitat conditions

Populus tremula and *Betula* pre-forests and pioneer stands occur on unstable mostly non-calcareous soils, on screes or in steep wooded terrain damaged by storms or landslides. The habitat type is widespread but local in Mediterranean, Balkan and Anatolian mountains. In Turkey, it occurs chiefly in the north-east, near timberline, with *Betula pendula* reaching its southernmost limits of distribution in Central Anatolia (Erciyas Dağı).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

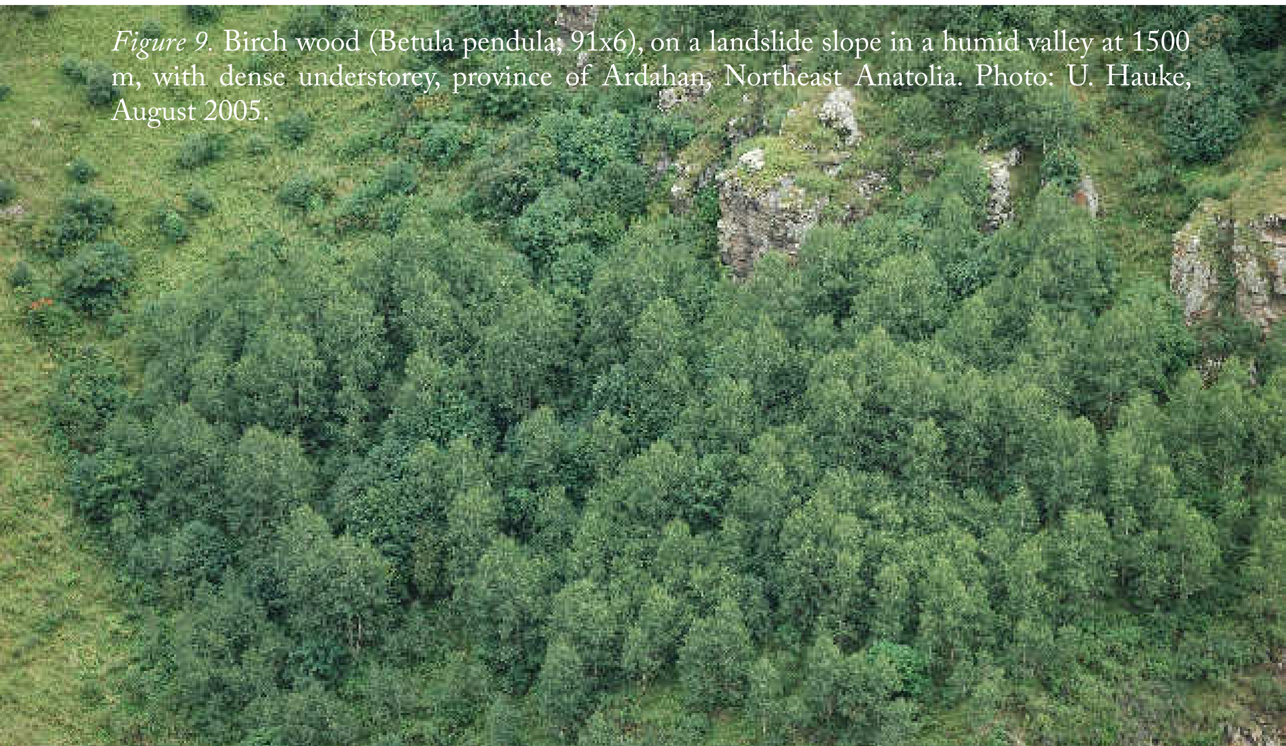

Figure 9. Birch wood (Betula pendula; 91x6), on a landslide slope in a humid valley at 1500 m, with dense understorey, province of Ardahan, Northeast Anatolia. Photo: U. Hauke, August 2005.

Figure 10. Populus tremula pioneer woodland (91x6) in the province of Hakkâri, Southeastern Anatolia. Photo: U. Hauke, July 2005.

Plants

Trees and shrubs: *Populus tremula*, *Betula pendula*, *Sorbus aucuparia*, *S. tamamschjanae*, *S. umbellata*, *Lonicera caucasica*, *Berberis crataegina*, *B. integerrima*, *Juniperus communis*, *Ribes orientale*, *Rosa pimpinellifolia*, *Rosa pulverulenta*.

Herbs: *Falcaria vulgaris*, *Arabis sagittata*, *Valeriana alliariifolia*, *Lathyrus pratensis*.

Additional notes

The habitat type requires consideration and detailed mapping of occurrences in natural situations. Stands that have established along forest roads and at artificial forest margins are excluded. Natural pioneer woodlands should be exempted from forestry, together with the sourrounding undisturbed forest.

Betula and *Populus tremula* pioneer forests are to be included in conservation concepts for wider areas and entire forest ecosystems comprising all phases of forest development, including pioneer stages. Natural conditions and dynamics should be maintained in areas with *Betula* occurrence and kept free from forestry impact.

Records

Populus tremula; widespread in the mountains of Nemrut Dağı / Van; 2100-2800 m; StepIII2d: 172

*Betula pend*ula; Sardar Bulag between Greater and Little Ararat (*Ağrı Dağı*); Nemrut Dağı / Van Gölü; 2200-2800 m, snow-rich shade side of the mountain; StepIII2e: 172

Betula pendula; near Hınıs – Bingöl; 1400-2100 m, edge of plateau in a sheltered valley; StepIV2c: 178

Populus tremula; N of Ankara: Işık Dağı, Kızılcahamam, Karagöl; 1400-1600 m, andesite, gleyic soils in shady valleys and depressions; StepII8: 164

Betula pendula; Erciyas Dağı; treeline scrub at 2000-2200 m; StepII11: 165

Populus tremula; S slope of Işık Dağı; pioneer wood at 1600-1800 m, andesite, in contact with *Pinus nigra* and *Pinus sylvestris* forest on humid brown soil; EuxBII8a: 102

Populus tremula; on south Anatolian mountains in sites with favourable water supply; MeditA20: 233

Phytosociology

Alliance: *Fragario vescae-Populion tremulae* (Relict extrazonal temperate deciduous birch-poplar woods on mineral soils of Europe and Anatolia)

Association: *Dorycnio hirsuti-Populetum tremulae* Varol et Tatlı 2001

References: Sadik-Erin (1974); Akman, Y. (1976); Ketenoğlu (1977); Akman et al. (1979); Varol & Tatlı (2001)

91x7 Central Anatolian deciduous oak forests

Definition

Central Anatolian xerophytic oak woods of the Irano-Turanian region with *Quercus pubescens* ("subsp. *anatolica"), Q. cerris* or *Q. robur* subsp. *pedunculiflora* as dominant trees. The woodlands are rich in species of the continental steppe and geophytes of the *Quercion anatolicae*.

Site conditions

The climate in Central Anatolia is semi-arid, continental, with hot summers and cold winters. The substrate consists of loam and marls. The steppe forest has its lower altitudinal limits at about 700-800 m (limiting factor: water supply), and its upper limits at about 2000 m (limiting factor: temperature). The annual precipitation is 350 mm (upper limit against arid steppe) to 500 mm with a maximum in winter and a secondary maximum in spring. Soil types encompass shallow greyish-brown steppe soils to deep brown soils. The woodlands are commonly treated as pasture and as resources for firewood.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The natural variability of the Anatolian steppe oak forests corresponds with the gradients of continentality and humidity.

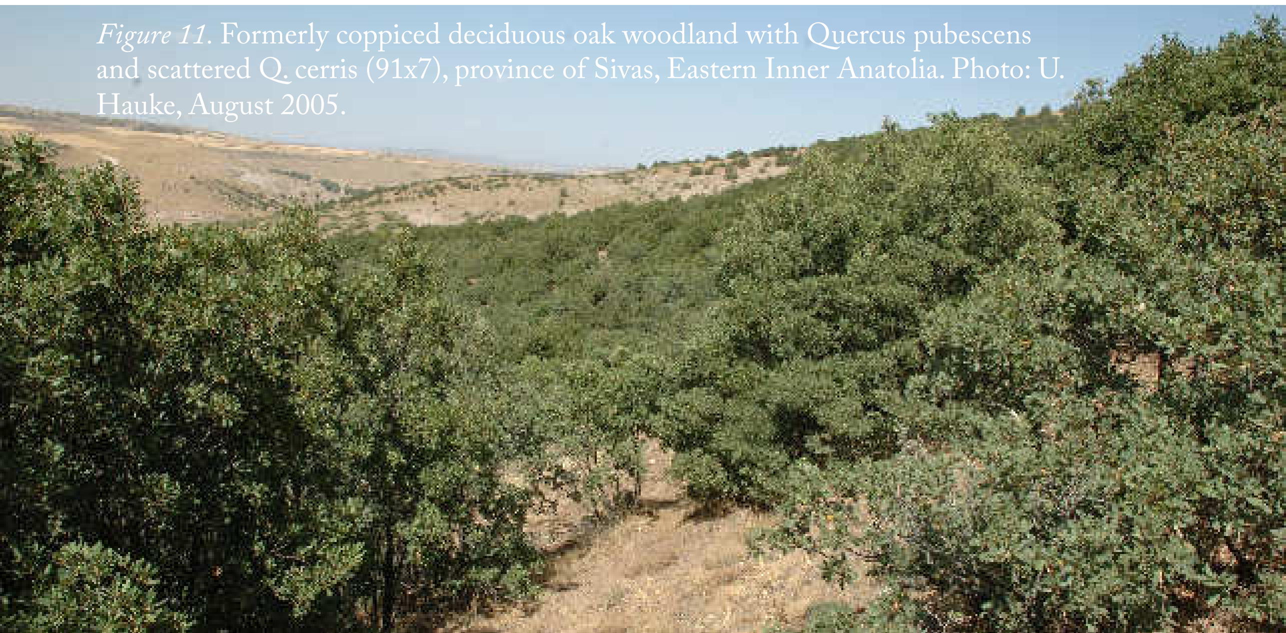

Figure 11. Formerly coppiced deciduous oak woodland with Quercus pubescens and scattered Q. cerris (91x7), province of Sivas, Eastern Inner Anatolia. Photo: U. Hauke, August 2005.

Plants

Trees: *Quercus pubescens*, *Q. cerris*, *Q. robur* s.l., *Celtis australis*, *Pyrus elaeagrifolia*.

Shrubs: *Acantholimon acerosum, Berberis crataegina, Colutea cilicica, Juniperus oxycedrus, Prunus argentea, Rosa hemisphaerica.*

Herbs: *Asparagus verticillatus, Carex halleriana, Echinophora sibthorpiana, Echinops spinosissimus* subsp. *bithynicus, Falcaria vulgaris, Globularia orientalis, G. trichosantha, Lathyrus czeczottianus, Lathyrus digitatus, Marrubium parviflorum, Melica persica, Onobrychis armena, Paronychia kurdica, Phlomis nissolii, Scabiosa ochroleuca, Stipa holosericea, Teucrium chamaedrys, Thymus sipyleus, Verbascum armenum, Vicia dalmatica.*

Additional notes:

Minimum structural criteria of 91x7 forest stands are area size (> 1 ha), tree height (> 3 m) and canopy closure (> 40 %). More open stands with widely spaced or solitary trees may be considered as 51x1.

Records

Quercus pubescens; Kargasekmez (Ankara - Kızılcahamam); 950-1250 m, semi-arid, clayey loam from schist, grauwacke, volcanic rock, said to substitute Pinus nigra forest; StepII3c: 159

Trifolium medium-Vicia dalmatica-Quercus pubescens; near Işik Dağı, Beypazarı, Ayaş, near Ankara and in the Beynam forest; 700-1150 m, on andesite in SE aspect, also siliceous (Perm) and serpentine (Beynam) bedrock; StepII4a: 161

Pyrus elaeagrifolia-Quercus pubescens; most widespread subtype of steppe woodland: Mudurnu - Ankara, Ayaş, Beypazarı, Nallihan, Beynam near Ankara; 700-900 m, limestone, sun-exposed, drier and more pronouncedly semi-arid than in the subtype with Trifolium medium; StepII4a: 162

Helianthemum canum-Quercus pubescens; Erciyas Dağı, NE side, 1500-1800 m; andesite; StepII4a: 162

Prunus divaricata-Quercus cerris; Erciyas Dağı; 2000-2200 m, shady side, andesite; StepII6: 164

Quercus cerris-Quercus pubescens; near Uşak, near Kütahya; 1000 m, brown soil on limestone; StepII4a: 162

Quercus robur subsp. *robur*; near Ankara; steppe wood at 1000 m, metamorphic rock, grey-brown steppe soils; StepII5: 163

Lathyrus czeczottianus-Quercus cerris; Hasan Dağı near Niğde; 1300-1850 m, shady sides, volcanic rock; StepII6: 164

Paeonia peregrina-Quercus pubescens-Quercus cerris; Sündiken Dağları and Türkmen Dağı; (700-)800-1200(-1300) m, N, E and S exposed, greenrock and peridotite, siliceous soils, wintercold, semi-arid, rather dry; MeditB11d: 251

Phytosociology

Alliance: *Quercion anatolicae* (Central Anatolian steppe forests with xerothermophilous oaks)

Associations: *Onobrychido tournefortii-Quercetum anatolicae* Karaer, Kilinç et Kutbay 1999, *Trifolio medii-Quercetum anatolicae* Akman, Barbéro et Quézel 1979, *Pyro elaeagrifoliae-Quercetum anatolicae* Akman, Barbéro et Quézel 1977, *Paeonio peregrinae-Quercetum cerridis* Akman, Barbéro et Quézel 1979

References: Akman et al. (1978/1979); Karaer et al. (1999)

91x8 Euxine-Colchic Nordmann fir forests

Definition

Coniferous and mixed forests dominated by *Abies nordmanniana* s.l. of the lower montane to upper montane belt (1100 – 2000m a.s.l) of the Black Sea and Marmara regions. The ground layer is rich in boreal and temperate forest plants including species of the Euxine element. Broadleaved trees (*Fagus*, *Acer*, *Carpinus*) may occur under the canopy of fir or as subdominant species. Near tree line Nordmann firs tend to be columnar and narrow-crowned.

Site conditions

The Euxine mountain climate of the Nordmann fir forest belt is cool and humid. There is considerable habitat variation due to differences in aspect and inclination. Towards the interior sector of the Pontic Mountains (Kuzey Anatolian Dağları) where the proportion of fir forests decreases the climate becomes more continental, subeuxine, with less precipitation, warmer summers and colder winters. The bedrock under fir forests is variable and includes igneous (e.g. andesite, granite), metamorphic (e.g. quartzite, sandstone, siltstone, crystalline limestone) or sedimentary rock (e.g. mudstone, flysch, schist, marl). Turkish fir (*Abies nordmanniana* subsp. *equi-trojani*) forests in the upper montane zone (1300-1600 m a.s.l.) of Mount Ida (Kaz Dağı) grow on metamorphic siliceous substrate mostly on northern slopes. Due to the short vegetation period in the montane belt and poorly decomposable litter, organic matter tends to accumulate in high elevation fir forests. On accumulated humus firs and pines are known to rejuvenate better than beech.

Turkish fir (*Abies nordmanniana* subsp. *equi-trojani*) reaches 22–30 m in height and 40–65 cm trunk diameter in 70 years, while *Pinus nigra* reaches 17–22 m in height and 25–40 cm trunk diameter in the same period in the same forest sites of the Ida Mountains. When black pine and Turkish fir regenerate simultaneously, the former will be eliminated from the stand in 15 to 25 years due to the rapid growth of fir.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

- Turkish fir (*Abies nordmanniana* subsp. *equi-trojani*) forests in a limited area (5,500 ha) at Mount Ida (Kaz Dağı) at the edge of mild Mediterranean and colder central Anatolian climate zones.
- West (Sub-)Euxine: Turkish fir (*Abies nordmanniana* subsp. *equi-trojani* incl. subsp. *bornmuelleriana*) forests are widespread in the western Pontic Mountains, particularly on the northern slopes of the Abant, Bolu and Ilgaz Mountains (Köroğlu Dağları, Ilgaz Dağları).
- East (Sub-)Euxine-Colchic: Caucasian fir (*Abies nordmanniana* subsp. *nordmanniana*) forests occur in the mountains between Trabzon and Gümüşhane, at elevations of 1450(1500-)-2200(-2400) m, in high altitudes often as fir-spruce forest with *Picea orientalis*.

Other habitat variation follows gradients of continentality (north-south, euxinian-subeuxinian), altitude (low montane, high montane) and meso-scale site conditions.

Figure 12. Extensive forests of Turkish fir (*Abies nordmanniana* subsp. *equi-trojani*, syn. *A. bornmuelleriana*) (91x8), 1700 m, Ilgaz Dağları (Ilgaz Mountains), province of Kastamonu, Black Sea region, North Anatolia. Photo: U. Hauke, June 2005.

Figure 13. Turkish fir forest (*Abies nordmanniana* subsp. *equi-trojani*, syn. *A. bornmuelleriana*) (91x8), province of Karabük, Western Black Sea region, North Anatolia. Photo: C. Güngöroğlu, June 2017.

Plants:

Trees: *Abies nordmanniana* subsp. *equi-trojani* (incl. subsp. *bornmuelleriana*) (Western Black Sea and Southern Marmara regions), *A. nordmanniana* subsp. *nordmanniana* (Eastern Black Sea region), *Carpinus betulus, Castanea sativa, Fagus orientalis, Picea orientalis, Pinus nigra, P. sylvestris, Populus tremula, Quercus petraea* subsp. *iberica, Q. pubescens*

Shrubs and woody climbers: *Buxus sempervirens, Daphne pontica, Euonymus latifolius, Hedera helix, Ilex aquifolium, Juniperus communis* subsp. *nana, Lonicera caucasica* subsp. *orientalis, Sorbus umbellata Vaccinium arctostaphylos*

Herbs and mosses: *Aremonia agrimonoides, Astragalus glycyphylloides, A. glycyphyllos, Avenella flexuosa, Calamintha grandiflora, Cardamine bulbifera, Cirsium pubigerum, Corallorhiza trifida, Cyclamen coum* subsp. *caucasicum, Daphne oleoides, Doronicum orientale, D. maximum, Digitalis ferruginea, Drymochloa drymeja, D. sylvatica, Dryoptris filix-mas, Epipactis helleborine, Epipogium aphyllum, Euphorbia amygdaloides, Eurhynchium striatum, Festuca heterophylla, Galium odoratum, G. rotundifolium, Gentiana asclepiadea, Goodyera *repens, Helleborus orientalis, Hieracium murorum* (with subspp. *medianiforme, oblongum, tossianum*), *Hordelymus europaeus, Hypopitys monotropa, Lactuca muralis, Lathraea squamaria, Lathyrus czeczottianus, Lilium ciliatum, Listera cordata, Luzula sylvatica, Moneses uniflora, Neottia nidus-avis, Orthilia secunda, Oxalis acetosella, Poa nemoralis, Polygonatum multiflorum, Primula acaulis, Pteridium aquilinum, Pyrola chlorantha, P. minor, Ranunculus anatolicus, R. brutius, Rubus hirtus, Sanicula europaea, Saxifraga rotundifolia, Streptopus amplexifolius, Thuidium tamariscinum, Vaccinium myrtillus, Valeriana alliariifolia, Veronica montana, V. officinalis, Viola reichenbachiana, V. sieheana.*

Additional notes

Abies nordmanniana s.l. is not restricted to the habitat type. Nordmann firs occur in mixed forests of the habitat types 91S0 and 91x1 (Western and eastern Pontic beech forests) and 9410 (*Picea* forests of the montane to alpine levels).

Records

Southern Marmara:

Abies nordmanniana subsp. *equi-trojani*; Kaz Dağı; 1100-1600 m, shade sides (often mixed with Fagus), metamorphic siliceous substrate; MeditB17: 258

Western Black Sea:

Buxus sempervirens-Prunus laurocerasus-Abies nordmanniana subsp. *equi-trojani* (subsp. *bornmuelleriana*); widespread on steep calcareous slopes between 100-1100 m, EuxBI5c: 78

Galium odoratum-Abies nordmanniana subsp. *equi-trojani* (subsp. *bornmuelleriana*); Bolu; 1400-1600 m, brown soil, moderately inclined N and S slopes; EuxBII5a: 95

Hieracium murorum (subspp. *oblongum* and *tossianum*)-Abies *nordmanniana* subsp. *equi-trojani* (subsp. *bornmuelleriana*); Sövüşova (Ilgaz-Daday area); (1100-)1300-1800(-1900) m, steep N (or W) slopes on siliceous flysch/schist; EuxBII5b: 98

Carpinus betulus-Abies nordmanniana subsp. *equi-trojani* (subsp. *bornmuelleriana*); Acısu; shady situations in valleys, 1200-1500 m, on serpentine brown soil; EuxBII5c: 98

Daphne pontica-Abies nordmanniana subsp. *equi-trojani* (subsp. *bornmuelleriana*); Daday - Azdavay - Devrek; 900-1100 m, shady slopes on dry siliceous and calcareous rocky sites with moder humus soils; EuxBII5d 98

Moneses uniflora-Abies nordmanniana subsp. *equi-trojani* (subsp. *bornmuelleriana*); near Işık, Nallıhan; shady slopes, 1600-1900 m, acidic brown soil with moder humus; EuxBII5e: 99

Hieracium murorum subsp. *medianiforme-Pinus sylvestris-Abies nordmanniana* subsp. *equi-trojani* (subsp. *bornmuelleriana*); Ilgaz Mountains, near Bolu and Beypazarı; 1400-1700 m in shady situations on brown soil with mull humus; EuxBII5f: 99

Sesleria-Pinus sylvestris-Abies nordmanniana subsp. *equi-trojani* (subsp. *bornmuelleriana*); S side of Ilgaz: Panayirtepe, Yapraklı / Çankırı; 1900-2050 m, NW slopes near tree line; EuxBII5g: 99

Eastern Black Sea:

Lilium ciliatum-Picea orientalis-Abies nordmanniana subsp. *nordmanniana-Pinus sylvestris*; Zigana Pass (*Zigana Geçidi*) – Rize; 1150-1500(-1700) m, moderately steep shady (N, W) slopes, schist; EuxDI5g: 131

Abies nordmanniana subsp. *nordmanniana*; near Giresun (Şehitler Geçidi) and near Şavşat – Ardahan; S side of the central mountain chain at 1750-2000 m on E and W slopes; EuxDII4: 137

Phytosociology

Alliance: *Lonicero caucasicae-Piceion orientalis* (Oriental beech and beech-fir forests of the Euxine, Colchic and Caucasus regions)

Associations: *Hieracio tossiani-Abietetum bornmuellerianae* Quézel, Barbéro et Akman 1980, *Mercurialido-Abietetum bornmuellerianae* Yurdakulol et al. 2002, *Fago orientalis-Abietetum bornmuellerianae* Akman & Yurdakulol 1987, *Telekio speciosae-Abietetum bornmuellerianae* Quézel, Barbéro et Akman 1980, *Pruno laurocerasi-Fagetum orientalis abietetosum bornmuellerianae* Quézel, Barbéro et Akman 1980, *Daphno ponticae-Quercetum ibericae abietetosum bornmuellerianae* Quézel, Barbéro et Akman 1980, *Rubo caesii-Fagetum abietetosum equi-trojani* Akman, Barbéro et Quézel 1979 (other reference by Türe et al. 2005)

References: Quézel & Pamukcuoğlu (1969); Ata (1975); Akman et al. (1979); Quézel et al. (1980); Aydın et al. (2008)

9250 *Quercus trojana* woods

Definition

Supra- and meso-Mediterranean woods dominated by the semi-deciduous *Quercus trojana* s.l. The distribution area of *Quercus trojana* extends from S Italy through the Balkan Peninsula and reaches its eastern limit in southwestern Anatolia.

Site conditions

Quercus trojana occurs chiefly up to elevations of 900 m but is found to 2000 m in the western Taurus. The recently described *Q. t.* subsp. *yaltirikii* (Zieliński et al. 2006) has been found in open oak-fir woodland. The general climatic character in the south is meso- to supramediterranean or, in the northwest, submediterranean. Summers in the southern Marmara and western Anatolian mountains are moderately hot and dry, supporting oaks with semi-deciduous leaves against sclerophyllous evergreen trees and shrubs. *Quercus trojana* woods have been extensively used as pasture and for firewood.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The habitat type 9250 occurs in Turkey in the provinces of Muğla, Antalya and just into Mersin (Içel) in the southwest, and in the provinces of Bilecik, Balıkesir, Küthaya, and Uşak in the northwest.

Woody plants

Quercus trojana (in Turkey with subsp. *trojana* and *yaltirikii), Q. cerris, Q. pubescens, Carpinus orientalis, Juniperus oxycedrus, Paliurus spina-christi, Phillyrea latifolia, Pinus brutia, Pistacia terebinthus, Styrax officinalis*

Additional notes

Minimum structural criteria of 9250 forest stands are area size (> 1 ha), tree height (> 3 m) and canopy closure (> 40 %). More open stands with widely spaced or solitary trees may be considered as 51x1. Afforestations with *Pinus brutia* in overexploited *Q. trojana* woodlands do not fulfil the criterions of 9250, nor of 9540, and they do not represent a Natura 2000 habitat type. The stands of the endemic *Q. trojana* subsp. *yaltirikii* require particular attention as this taxon represents the species at the southeastern margins of its distribution range.

Records

Quercus trojana; Çanakkale - Bursa - Manisa; 300-900(-1500) m, mixed wood; MeditB11e: 251

Phytosociology

Alliance: *Quercion confertae* (Thermophilous deciduous oak forests on slightly acidic deep soils of the Central and eastern Balkans and north-western Turkey)

Association: "*Quercus trojana*-Mischwald" (Mayer & Aksoy 1986: 251)

References: Yaltirik (1973); Zieliński et al. (2006)

9260 *Castanea sativa* woods

Definition

Submediterranean and Euxine-Colchic *Castanea sativa*-dominated forests and old established plantations with semi-natural undergrowth.

Site conditions

Castanea sativa prefers siliceous soils with favourable water supply in humid and subhumid sites in valleys and on shady slopes. In Turkey, it occurs in the Aegean and Black Sea regions, commonly mixed with deciduous oaks or beech.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees: *Castanea sativa*, *Fagus orientalis*, *Platanus orientalis*, *Quercus frainetto*, *Q. petraea* s.l., *Q. pubescens* s.l., *Q. robur* s.l., *Ulmus minor*

Shrubs and woody climbers: *Arbutus unedo*, *Cornus mas*, *Cistus laurifolius*, *Crataegus germanica (= Mespilus germanica)*, *Dioscorea communis*, *Erica arborea*, *Hedera colchica*, *Laurus nobilis*, *Phillyrea latifolia*, *Pyrus syriaca*, *Ruscus aculeatus*, *Sambucus nigra*, *Sophora jaubertii*

Herbs: *Campanula alliariifolia*, *Dactylorhiza romana*, *Geum urbanum*, *Ranunculus chius*, *Salvia tomentosa*, *Saxifraga hederacea*, *Stellaria cilicica*, *Viola suavis*

Additional notes

Sweet chestnut (*Castanea sativa*) is native in Turkey but also planted. Old plantations with thick-stemmed old-growth trees are included in 9260. In the Black Sea region, *Castanea sativa* is an occasional component in deciduous oak woods of 91x2 (*Trachystemono-Carpinion*).

Geobotanical Types:

Sophora jaubertii-Fagus-Ostrya-Castanea; Cide-Azdavay, Ünye, Ordu - Samsun; 200-500(-1000) m, siliceous, schist, rarely limestone, moderately steep N and E-facing shady slopes; EuxBI4a: 71, EuxCI4c: 109

Castanea sativa; favourable climatic conditions in western Anatolia; well watersupplied soils, mostly siliceous; MeditB12a: 251

Platanus orientalis-Castanea sativa; mesic soil, schistose; MeditB12a: 252

Quercus robur subsp. *robur-Quercus pubescens-Castanea sativa*; mesic brown soil; MeditB12a: 252

Campanula alliariifolia-Castanea sativa; Dereli, Giresun, Rize, Of, Trabzon; 250-1000 m, close to the sea, chiefly shady slopes, at higher elevations also S-exposed; moderately steep, deep soil, schist; EuxDI3b: 123

Phytosociology

Alliances: *Quercion confertae* (Thermophilous deciduous oak forests on slightly acidic deep soils of the Central and eastern Balkans and north-western Turkey); *Trachystemono orientalis-Carpinion betuli* (Euxine mixed broadleaved forests with *Quercus* spp., *Castanea*, *Carpinus*, *Ostrya*, *Tilia* and *Fagus*, on humid slopes with mostly deep soil)

Associations: *Sophoro jaubertii-Castanetum sativae* Quézel, Barbéro et Akman 1980, *Campanulo alliariifoliae-Castanetum sativae* Quézel, Barbéro et Akman 1980, *Hedero colchicae-Castanetum sativae* Yurdakulol et al. 2002

9280 *Quercus frainetto* woods

Definition

Meso-thermophilous deciduous mixed forests of *Fagus* (in Turkey *F. orientalis*) and *Quercus*, chiefly *Q. frainetto* and *Q. petraea* s.l., of the central and eastern parts of the Balkan peninsula, mainland Greece and western Anatolia, including the transition zone between the supramediterranean and montane levels, characterised by numerous submediterranean species of the *Quercion confertae*.

Site conditions:

The habitat type is submediterranean (subhumid) with climatic conditions including recognizable but not pronounced summer drought and mild winters. It occurs chiefly on shady slopes with increased air humidity, where beech prevails on deep calcareous (rendzina) or siliceous brown soils. The stands are commonly coppice-woods and/or wood pasture.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

- Western Anatolian thermophilous deciduous mixed oak forests of the Aegean and the Marmara region.
- Western Anatolian *Fagus orientalis* forests. Lacking the Euxine-Colchic laurophyllous element they differ considerably in species composition from the Pontic (Euxine) beech forests (91S0, 91x1).

Plants

Trees: *Fagus orientalis*, *Quercus cerris*, *Q. frainetto*, *Q. infectoria*, *Q. petraea* s.l., *Acer campestre*, *A. tataricum*, *Carpinus betulus*, *C. orientalis*, *Castanea sativa*, *Juglans regia*, *Ostrya carpinifolia*, *Sorbus torminalis*, *Tilia tomentosa*.

Shrubs: *Cornus mas*, *Crataegus monogyna*, *Juniperus oxycedrus*, *Ligustrum vulgare*, *Crataegus germanica (= Mespilus germanicus)*, *Pyrus elaeagrifolia*.

Herbs: *Achillea grandiflora*, *Aristolochia pallida*, *Asparagus acutifolius*, *Campanula persicifolia*, *Clematis viticella*, *Drymochloa drymeja*, *Geranium asphodeloides*, *Helleborus orientalis*, *Geocaryum capillifolium*, *Inula salicina*, *Lathyrus digitatus*, *L. laxiflorus*, *L. niger*, *Aegonychon purpurocaeruleum*, *Oenanthe pimpinelloides*, *Paeonia peregrina*, *Ruscus aculeatus*, *Salvia forsskaolei*, *Silene coronaria*, *Trifolium alpestre*, *Veronica chamaedrys*.

Additional notes

Stands of < 1 ha size should be considered only if no more sizable occurrences can be found. Canopy cover should be at least 40 % for most of the stand, and there should be old-growth trees of oak, hornbeam and/or beech involved. Open stands with solitary or widely scattered trees do not belong here but may be treated as type 51x1.

Thracian lowland or submontane oak forests of the Northern Marmara subregion may be similar but belong to 91M0. Forests of dominant *Quercus trojana* or *Castanea sativa* are to be mapped as 9250 and 9260, respectively. Meso-thermophilous mixed oak and beech forests of South Anatolia (Mediterranean Region) belong to the alliance *Ostryo-Quercion pseudocerridis* and represent a habitat type in its own right (92x1).

Records

Quercus cerris-Juglans regia; Mahmut Dağı / İzmir; 800 m, screes; MeditB12b: 252

Pimpinella tripartita-Carpinus betulus; near Mudurnu, Bursa, Meyzit, Aksu, Türkmen Dağı; 1100-1300 m, shade sides, marl and alluvial deposits; MeditB13a: 252

Quercus petraea subsp. *iberica-Carpinus betulus*; Türkmen Dağı and Sündiken Dağları, Karagöl, Meyzit; 1000-1500 m, northern slopes, depressions, marl, serpentine and andesite; MeditB13b: 253

Submediterranean mixed oak wood, widespread between NW of Aydın and along Eskişehir – Adapazarı; MeditB11a: 250

Quercus frainetto-Quercus cerris; Adapazarı, İzmit, Bilecik, Bursa, Balıkesir, further east to Uşak, south to Aydın; (100-)300-1200(-1400) m, siliceous substrate derived from metamorphic, volcanic or flysch, subhumid to humid; MeditB11b: 250

Salvia forsskaolei-Quercus cerris; region of Bilecik - Bursa – Balıkesir; 400-950(-1000) m, finegrained silceous humus-rich brown soil; MeditB11c: 251

Orthilia secunda-Fagus orientalis; Kaz Dağı, Türkmen Dağı, Çavusini, Pınar Deresi, Eskişehir, Kütahya, Balıkesir; supra-Mediterranean, shade slopes, siliceous (greenrock); MeditB16a: 257

Orthilia secunda-Fagus orientalis; Kaz Dağı, Uludağ, valley of Meyzıt, Türkmen Dağı; (sub)montane, 800-1200(-1300) m, shade slopes; MeditB16b: 258

Phytosociology

Alliances: *Quercion confertae* (Thermophilous deciduous oak forests on slightly acidic deep soils of the Central and eastern Balkans and north-western Turkey)

Associations: *Quercetum frainetto-cerris* Rudski 1949, p.p.; *Trifolio physodis-Quercetum cerris* Tatlı et al. 2005; *Pino sylvestris-Fagetum orientalis* Tatlı et al. 2005

References: Dönmez (1967/68); Dönmez (1969); Akman et al. (1979); Ekim & Akman (1990); Tatli et al. (2005)

9290 *Cupressus* forests (*Acero-Cupression*)

Definition

Mediterranean coniferous and mixed woodlands from sea level to the montane belt, in the south-east (Crete, Cyprus, west and south Anatolia) dominated by *Cupressus sempervirens*.

Site conditions

Cupressus forests (9290) typically occur in mediterranean-montane climate conditions In Anatolia (specifically in the Taurus Mountains, *Toros Dağları*), Cyprus and the South Aegean where cypress woodlands are widespread and *Cupressus sempervirens* is a native tree the Mediterranean climate is pronounced and the period of summer drought exceeds four and sometimes six months. Prevailing bedrocks under *Cupressus* forests are limestone and Köprülü conglomerates.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The most extensive natural occurrences of *Cupressus sempervirens* in Turkey are found in the western Taurus Mountains in the Antalya subregion such as on Babadağ southeast of Fethiye, and in the Köprülü Kanyon National Park near Serik, Beşkonak and Altınkaya and further east in the Mersin-Adana subregion near Silifke. In Turkey, sclerophyllous evergreen species are more prominent in the south (Taurus Mountains) than in western Anatolia.

Plants

<u>*Cupressus sempervirens*</u>, *Arbutus andrachne*, *Cistus creticus*, *Erica manipuliflora*, *Myrtus communis*, *Olea europaea*, *Phillyrea latifolia*, *Pinus brutia*, *Pistacia terebinthus* subsp. *palaestina*, *Quercus coccifera*, *Spartium junceum*.

Additional notes

Cypress plantations and spontaneously established groups of trees of fastigiate cypress cultivars (var. *pyramidalis*, '*Fastigiata*', '*Stricta*') are not included in this habitat type.

Records

Cupressus sempervirens; near Antalya, Kemer, Mersin, Kaş, Köprülü Kanyon; (50-)600-1100(-1500) m, chiefly on limestone; MeditA11: 205

Cupressus sempervirens; Samsun Dağı (Dilek Dağı); steep slopes; MeditB9: 248

Phytosociology

Alliance: *Aceri sempervirentis-Cupression sempervirentis* (Supramediterranean cypress forests of the Aegean)

Associations: *Arbuto andrachne-Cupressetum sempervirentis* Ayaşligil 1987

References: Ayaşlıgıl (1987); Ghazal (2008)

92A0 *Salix alba* and *Populus alba* galleries

Definition

Mediterranean, Anatolian and temperate Eurasian riverine forests and galleries with *Salix* spp., *Populus* spp., *Ulmus* spp., *Alnus* spp., *Tamarix* spp., *Juglans regia*, and lianas. In Turkey, tall poplars (*Populus alba*, *P. euphratica*) and/or *Salix alba* are usually dominant.

Site conditions

Riparian poplar-willow pioneer forests occur on frequently flooded alluvial soils. Depending on the water regime, adjacent land use and topography, they often form narrow galleries along the rivers. Water reservoirs, river regulation and interventions in groundwater and drawdown have widely and severely affected the ecosystem balance of riverine forests.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees, shrubs and woody climbers: *Populus alba*, *P. euphratica*, *Salix alba*, *Salix pedicellata, S. purpurea, S. triandra, S. viminalis, Alnus glutinosa, Elaeagnus angustifolia, Fraxinus angustifolia* subspp. *syriaca* and *angustifolia, Hippophae rhamnoides, Humulus lupulus, Juglans regia, Tamarix tetrandra, T. smyrnensis, Ligustrum vulgare, Pyracantha coccinea, Sambucus nigra, Ulmus minor, Vitis vinifera.*

Herbs: *Carex pendula, Erianthus ravennae, Equisetum telmateia, Glycyrrhiza glabra, Lycopus europaeus, Lythrum salicaria, Parietaria officinalis, Prunella vulgaris, Solanum dulcamara.*

Records

Salix alba; widespread riparian forest in the Central Black Sea region on frequently flooded alluvial loamy soils; EuxCII6a: 116

Salix alba-Populus alba; widespread riverine forest of 7-10 m on alluvial deposits along the major rivers in the Central Black Sea region; EuxCII6b: 117

Salix alba-Salix viminalis; Central Anatolian riparian galleries along streams and smaller periodically flooded serpentine rivers; StepII10: 165

Populus euphratica; Central Anatolian riparian gallery woods in contact to Salix alba galleries; StepII10: 165

Salix alba; Southeast Anatolian riverine forest along permanent streams at the Cilo Dağı in the region of Hakkâri; StepIV2d: 178

Populus euphratica; South Anatolian riparian subsaline gallery woods; MeditA13b: 206

Phytosociology

Alliances: *Salicion albae (*Willow and poplar open forests of lowland to submontane river alluvia in the nemoral zone of Europe); *Populion albae* (Lowland submediterranean and mediterranean riparian and lakeshore pioneer forests); *Populion euphraticae* Golub et Kuzm. 1996 (Poplar open forests and riparian galleries of the Irano-Turanian biogeographic region)

Associations*: Salicetum albae* Issler 1926; *Populetum albae* Br.-Bl. ex Tchou 1948; *Populetum euphraticae* Zohary 1940

References: Zohary (1962); Özdeniz et al. (2017)

92C0 *Platanus orientalis* and *Liquidambar orientalis* woods (*Platanion orientalis*)

Definition

Eastern Mediterranean riparian forests dominated by *Platanus orientalis* or *Liquidambar orientalis*, belonging to the *Platanion orientalis* alliance. While *Platanus orientalis* gallery forests are distributed throughout much of the East Mediterranean including Mediterranean and Euxinian Turkey, *Liquidambar orientalis* is a Tertiary relic confined to western Turkey (Akman et al. 1993) and the island of Rodos (Dodecanese, Greece).

Site conditions

The habitat comprises riparian forests colonising poorly stabilised alluvial gravel or boulder deposits of permanent or temporary streams and shady ravines, where they constitute communities rich in helophytes and hygrophilous plants.

Distribution and variability in Turkey:

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Platanus riparian forests have been recorded in all Mediterranean and the west and central of the Black Sea subregions and in the East Anatolian upper Euphrat subregion. *Liquidambar* riparian forests are commonly associated with *Platanus* but restricted to the coastal Aegean and the Antalya subregions.

Figure 14. Platanus orientalis riparian forest (92C0) along a stream in the Salmanlar village, province of Karabük, Western Black Sea region, North Anatolia. Photo: C. Güngöroğlu, Mai 2017.

Plants

Trees: *Platanus orientalis*, *Liquidambar orientalis*, *Alnus glutinosa*, *A. orientalis*, *Castanea sativa*, *Cercis siliquastrum*, *Ficus carica*, *Fraxinus angustifolia* subsp. *oxycarpa*, *Laurus nobilis*

Shrubs and woody climbers: *Hedera helix*, *Nerium oleander*, *Periploca graeca*, *Pistacia eurycarpa*, *P. khinjuk*, *Punica granatum*, *Rubus caesius*, *R. sanctus*, *Salix pedicellata*, *Smilax aspera*, *S. excelsa*, *Ulmus minor*, *Vitex agnus-castus*, *Vitis vinifera*.

Records

Platanus orientalis; widespread riverine forest in the western Black Sea subregion, in narrow valleys at north-facing slopes, initial alluvial soils; EuxBI4l: 77

Platanus orientalis; widespread on sandy and gravelly alluvial substrate along rivers; EuxCII6d: 117

Platanus orientalis; Ovacık (Tunceli, East Anatolia); damp sites in valley; StepIII2f: 173

Platanus orientalis; widespread in southern Anatolia, periodically flooded ravines and footslopes; MeditA8a: 195

Alnus orientalis; Taurus Mountains; streams and depressions; MeditA8b: 196

Liquidambar orientalis; near Köyceğiz - Muğla, Milas and Fethiye: Bozburun Dağı, Antalya, Aydin, Gülek; mesic or hygrophilous riparian forest comprising 6300 ha, along permanent streams with high (10-20 cm) stagnant water level and frequent flooding; MeditA8c: 196

Platanus orientalis; South Anatolian riverine forest on matured alluvial substrate with favourable water supply, frequently in ravines, depressions and at slopes with water belowground; MeditA13a: 206

Populus nigra-Platanus orientalis; near İzmir, Samsun Dağı; riparian woods at 30-700 m, base-rich alluvial deposits; MeditB18a: 261

Platanus orientalis-Liquidambar orientalis; Marmaris – Fethiye; hygrophytic riparian forest; MeditB18b: 261

Phytosociology

Alliance: *Platanion orientalis* (*Platanus* and *Liquidambar* riparian gallery forests of the Eastern Mediterranean)

Associations: *lrido xanthospuriae-Liquidambaretum orientalis* Akman et al. 1993; *Alno pubescentis-Liquidambaretum orientalis* Akman et al. 1993; *Lauro-Liquidambaretum orientalis* Brullo et al. 2004, *Alno orientalis-Platanetum orientalis* Brullo et al. 2004

References: Akman et al. (1993); Brullo et al. (2004)

92D0 Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)

Definition

Circum-Mediterranean coastal thickets and riparian scrub of *Tamarix*, *Nerium* and *Vitex*, and similar low ligneous formations, of permanent or temporary streams and wetlands of the thermomediterranean zone, with *Tamarix smyrnensis* scrub extending to the Pontic and Irano-Turanian regions of western Eurasia.

Site conditions

Along permanent or temporary Mediterranean streams and at other groundwater influenced sites; flooding can be seasonal, temporary, or episodic. The habitat type includes coastal and inland *Tamarix smyrnensis* scrub of brackish wetlands.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The habitat type is insufficiently recorded in Turkey and the distribution is thus imperfectly known.

Plants

Shrubs and woody climbers: *Nerium oleander*, *Tamarix smyrnensis*, *Vitex agnus-castus*, *Periploca graeca*, *Pistacia lentiscus*, *P. terebinthus* subsp. *palaestina*, *Rubus sanctus*, *Smilax excelsa*

Herbs: *Cynodon dactylon*, *Phragmites australis*, *Lycopus europaeus*, *Scirpoides holoschoenus*, *Eupatorium cannabinum*, *Pulicaria dysenterica*

Records

Riparian pioneer scrub widespread in the Black Sea region, recorded near Tortum Gölü; occurring on sandy-loamy and clayey-loamy soils; EuxCII6d 117;

Tamarix smyrnensis; riverine scrub at the Sakarya River; 400-500 m, sandy alluvial soils; MeditB18c 261

Vitex agnus-castus; riverine scrub near İzmir; 50 m, flooded in winter, dense soil; MeditB18d 261

Phytosociology

Alliance: *Rubo sancti-Nerion oleandri* (Thermomediterranean oleander riparian scrub of the Eastern Mediterranean)

Associations: *Tamarico smyrnensis-Viticetum agni-casti* Gehu et al. 1992; *Vitico agni-casti-Tamaricetum smyrnensis* Karaer, Kilinç et Kutbay 1999; *Acantho dioscoridi-Viticetum agni-casti* Kaya et al. 2009

References: Karaer et al. (1999); Brullo et al. (2004); Kaya et al. (2009)

92x1 Southern Anatolian deciduous oak forests

Definition

Deciduous meso-thermophytic oak and mixed forests of the supramediterranean belt of the southern Anatolian Taurus and Amanus Mountains (Toros Dağları, Nur Dağları). Typical oak species are *Quercus infectoria* subsp. *boissieri* and *Quercus cerris* var. *cerris* (= *Quercus pseudocerris*). The forests are classified as communities of the alliance *Ostryo-Quercion pseudocerridis*.

Site conditions

The general climate character is Mediterranean-montane but mesoclimatically modified by the topographical situation. The supramediterranean woodlands occur chiefly on eroded soils derived from limestone and volcanic mafic green rock. They have been frequently used as wood-pasture.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Corresponding to the subdivision of 9280 (*Quercus frainetto* woods) of western Anatolia the following groupings may be distinguished within the habitat type of southern Anatolian deciduous forests:

- South Anatolian deciduous oak mixed forests,
- South Anatolian *Fagus orientalis* forests.

Plants

Trees: *Fagus orientalis*, *Quercus cerris*, *Q. infectoria* subsp. *boissieri*, *Q. petraea* subsp. *pinnatiloba*, *Q. coccifera*, *Q. libani*, *Carpinus orientalis*, *Fraxinus ornus*, *Ostrya carpinifolia*, *Pinus nigra*, *Sorbus torminalis*

Shrubs: *Arbutus andrachne*, *Celtis glabrata*, *Cercis siliquastrum*, *Crataegus azarolus*, *C. monogyna*, *Cornus mas*, *Fontanesia phillyreoides*, *Hippocrepis emerus* subsp. *emeroides*, *Juniperus oxycedrus*, *Paliurus spina-christi*, *Pistacia terebinthus* s.l., *Prunus cocomilia*, *Pyrus spinosa*, *P. syriaca*, *Styrax officinalis*

Herbs: *Achillea grandifolia*, *Arabis laxa*, *Asphodelus ramosus*, *Cephalanthera kurdica*, *Daphne gnidioides*, *Dianthus strictus*, *Elymus panormitanus*, *Eremopoa capillaris*, *Galium heldreichii*, *G. spurium* subsp. *ibicinum*, *Grammosciadum daucoides*, *Helleborus vesicarius*, *Hypericum montbretii*, *Limodorum abortivum*, *Origanum syriacum, Paeonia mascula, Parentucellia latifolia subsp. flaviflora, Poa angustifolia, Phlomis fruticosa, Tanacetum parthenium, Teucrium capitatum, Vicia dalmatica, V. crocea*

Records

Tanacetum parthenium-Quercus cerris; widespread in Amanus, East and Central Taurus: Feke, Saimbeyli, Maran Yaylasi, Anamur – Abanos; 1000-1400 m, on eroded soils over limestone and mafic green rock, sunexposed but humid sites in depression and along rivulets; MeditA14b: 208

Ostrya carpinifolia-Quercus cerris; 550-1350 m, limestone; MeditA14c: 208

Quercus infectoria subsp. *boissieri-Quercus cerris*; near Adana; 700-1000 m, limestone, brown soil, loamy; MeditA14d: 209

Quercus pubescens-Quercus cerris; near Silifke; 700 m; MeditA14e: 209

Fraxinus ornus-Quercus cerris; near Eğirdir; limestone; MeditA14f: 209

Stachys pinetorum-Quercus cerris; Amanus; 1000-1400 m, on limestone and green rock, S and W aspect, deep clayey soils, humus-rich; MeditA14g: 209

Abies cilicica-Quercus cerris; Amanus; 1200-1500 m; MeditA14h: 210

Cornus sanguinea subsp. *australis-Ostrya carpinifolia*; EasternTaurus and Amanus: Saimbeyli - Obruk, also Namrum - Mersin, Gülek Boğazi; (600-)700-1300(-1400) m, S, W and E aspects, limestone, rarely ophiolite, humus-rich brownsoil, well watersupplied, in depressions and valleys; MeditA15: 212

Vicia crocea-Fagus orientalis; Relictic forest in the Mediterranean-montane belt of the Amanus and East Taurus Mountains: Vayvaylı valley, Ziyaret Tepe / Pos; Amanus: 1100-1900(-2100) m, shady slopes, brown soil; Taurus: Aladağ shade side, ophiolite, 1700-2000 m; MeditA16: 214

Phytosociology

Alliance: *Ostryo-Quercion pseudocerridis* (Supramediterranean deciduous forests of southern Anatolia)

Associations: *Galio tenuissimi-Quercetum cerridis, Galio ibicini-Quercetum pinnatilobae, Lagoecio cuminoidis-Styracetum officinalis* (all in the Çimen Mountain / Kahramanmaraş, described by Varol et Tatlı 2001*), Corno australis-Ostryetum carpinifoliae* Akman, Barbéro et Quézel 1979, *Tanaceto parthenii-Quercetum pseudocerridis* Akman, Barbéro et Quézel 1979, *Potentillo crantzii-Fagetum orientalis* Varol et Tatlı 2001 (Çimen Mountain / Kahramanmaraş)

References: Ayaşlıgıl (1987); Varol & Tatlı (2001); Kargıoğlu & Tatlı (2005); Ghazal (2008)

*92x2 * Woodlands with Quercus vulcanica*

Definition

Quercus vulcanica woodlands on base-rich calcareous and volcanic bedrock of southern and central Anatolian mountains.

Site conditions

Quercus vulcanica, endemic to Turkey, forms open woodlands, either pure stands or mixed forests up to 20-30 m height. The trunks of exceptional trees were 1.6 m in diameter at breast height. The structure of *Q. vulcanica* woodlands varies and includes tall old-growth oak forest, coppice-woods and shrubland, and *Pinus nigra* woodland with oak subcanopy. *Q. vulcanica* occurs mainly on volcanic slopes and calcareous (Miocene) brown forest soils, between 1300 and 1500 (1800) m and annual precipitation of c. 1000 mm. In the Davras Dağı *Q. vulcanica* grows on deep soils with good water supply, preferably on the bottom of dolines, tolerating winter-cold but sheltered conditions (Atalay 1994, p. 264). Stands between 1700 and 2000 m on the volcanic cone north of Erciyes Dağı grow between andesite boulders and on debris.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

An extensive forest of 1300 hectares is found in the Nature Reserve Davraz Dağı near Yukarı Gökdere, 25 km from Eğirdir in the western central Taurus. Other remarkable stands have been described from Central Anatolia (Hasan Dağı, Erciyes Dağı).

Plants

Trees: *Quercus vulcanica*, *Acer hyrcanum* subspp. *tauricolum* and *sphaerocarpum*, *Cedrus libani*, *Juniperus excelsa*, *Pyrus salicifolia*, *Quercus cerris*, *Q. ithaburensis* subsp. *boissieri*, *Q. pubescens*, *Q. trojana*, *Sorbus torminalis*.

Herbs and subshrubs: *Astrantia maxima subsp. haradjianii*, *Asyneuma michauxioides*, *Clinopodium vulgare*, *Dianthus cribrarius*, *Helichrysum plicatum* subsp. *isauricum*, *Lathyrus laxiflorus*, *Paeonia mascula* subsp. *mascula*, *Phlomis samia*, *Postiella capillifolia*, *Salvia tomentosa*, *Scutellaria brevibracteata*, *Vicia dalmatica*.

Additional notes

Severe human impact (wood cutting, clearing, overgrazing) leads to all kinds of transitional stages towards steppe formations. For mapping and conservation status assessment such degradation stages should be distinguished.

Records

Quercus vulcanica; N of Erciyas Dağı on a secondary volcano near İncesu; 1700-2000 m, andesite, coarse screes, marginally much browsed and treated as coppices with short rotation cycles; StepII7: 164

Phytosociology

Alliance: *Ostryo-Quercion pseudocerridis* (Supramediterranean deciduous forests of southern Anatolia)

Associations: *Diantho cribrarici-Quercetum vulcanicae* Kurt et al. 1996

References: Atalay (1994); Kurt et al. (1996); Kargıoğlu et al. (2009)

9320 *Olea* and *Ceratonia* forests

Definition

Thermomediterranean woodland dominated by arborescent *Olea europaea* var. *sylvestris*, *Ceratonia siliqua*, *Pistacia lentiscus* or, in the Canary Islands, by *Olea europaea* subsp. *guanchica* and *Pistacia atlantica*.

In Turkey, among more than 40 sclerophyllous shrub species, olive (*Olea europea)* and carob *(Cerotonia siliqua)* are the principal trees forming woodlands of mostly 3-6 m height with more or less closed canopy.

Site conditions

The climate is characterized by dry, hot summers and cool rainy winters. Precipitation amounts decrease from west to east, ranging from 1000-1100 mm around Antalya to 600-800 mm in Mersin, Adana, and İskenderun. Stands occur typically on inclined, sun-exposed rocky places, near sea leavel also north-exposed, on a variety of bedrock types.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

In Turkey restricted to western Anatolia along the Aegean coast and the Mediterranean region from Kemer in the west to the bay of İskenderun in the east.

Plants:

Trees and tall shrubs: *Ceratonia siliqua*, *Olea europaea* var. *sylvestris*, *Arbutus andrachne*, *Calicotome villosa*, *Ephedra foeminea*, *Euphorbia dendroides*, *Juniperus phoenicea*, *Myrtus communis*, *Pistacia lentiscus*, *P. terebinthus* subsp. *palaestina*, *Punica granatum*, *Quercus coccifera (*incl. var. *calliprinos)*, *Rhamnus lycioides* subsp. *oleoides*, *Rubia tenuifolia*.

Herbs, lianas and small shrubs: *Arisarum vulgare, Asparagus acutifolius, A. aphyllus, Cistus creticus, C. salviifolius, Clematis cirrhosa, Erica manipuliflora, Genista acanthoclada, Osyris alba, Pipthatherum coerulescens, P. miliaceum, Phagnalon rupestre, Prasium majus.*

Additional notes

The *Olea-Ceratonia* woods in Turkey, as elsewhere, are largely degraded (Akman 1995). Communities with supposedly wild olive are fairly well preserved around Antalya and in the Köprülü Kanyon National Park and near Feke (Adana). Maquis formations may be similar in species composition but differ in lower canopy and extremely dense undergrowth; species-rich maquis formations with *Arbutus andrachne* may be listed as arborescent matorral (52x1) or as East Mediterranean garigue (5330), but a few stands may have a sufficiently tall, closed canopy to qualify for this unit (9320). Stands similar in species composition but with an open canopy of *Pinus brutia*, e.g. on marls, gabbro and ophiolite, are referable to habitat type 9540 (*Mediterranean pine forests with endemic Mesogean pines*).

Olive and carob woods and maquis represent Mediterranean culture. Both trees have been cultivated since millennia and are significant for their edible fruits. Moreover they provide fodder and shelter for livestock as well as fuelwood. Trees of wild stock and others that escaped from cultivation centuries ago are often indistinguishable. Together with most other sclerophyllous woody plants, olive and carob regenerate rapidly even after repeated cutting and burning, although such stands recover to garigue or maquis rather than to woodland.

Records

Olea europapea-Ceratonia siliqua; Adana, Tarsus, Kozan, between Mersin and Antalya; near Kaş, Feke, Göksun valley, Beşkonak, Köprülü-Kanyon, Gulf of İskenderun, near Antakya (Amanus, Dörtyol), Phaselis (Kemer); mostly as coppice, in sheltered valleys near the coast, best developed on terra rossa over limestone; MeditA4: 187

Olea europapea-Ceratonia siliqua; southwestern Anatolia from the western Taurus foothills to İzmir, also near Çatalca-Kocaeli; thermomediterranean coppice-wood, 0-600 m; MeditB2: 242

Phytosociology

Alliance: *Ceratonio-Pistacion lentisci* (Thermomediterranean sclerophyllous evergreen maquis of the Eastern Mediterranean)

Associations: *Ceratonio-Pistacetum lentisci* Eig 1946, *Rubio tenuifoliae-Pistacietum lentisci* Gehu, Costa et Uslu 1990

References: Ayaşlıgıl (1987); Akman (1995); Atalay (1994); Schwarz (1936); Uslu (1977); Géhu et al. (1990)

9340 *Quercus ilex* and *Quercus rotundifolia* forests

Definition

Forests dominated by *Quercus ilex* (from northern Spain to western Turkey) or *Quercus rotundifolia* (in the Iberian Peninsula), of the mesomediterranean zone, extrazonally reaching the thermomediterranean (in ravines) and supramediterranean zones (south-exposed calcareous slopes).

Site conditions

Quercus ilex woodlands are well developed at relatively humid places, chiefly in the western and central Mediterranean. Throughout the range they grow on a variety of schistose or calcareous substrata on deep but well-drained and often stony soils. *Q. ilex* is a monodominant species especially at advanced stages of vegetation succession but retrogressive high-maquis stages (caused by human interference such as coppicing and pasture) which retained a high proportion of *Quercus ilex* are included in this habitat type. Such *Quercus-Arbutus* high maquis relics which have the potential for progressive succession towards *Q. ilex* forest are of particular importance in western Anatolia at the eastern distribution limits of this habitat type.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

In Turkey, in contrast to the western and central Mediterranean, *Quercus ilex* forests are rare and largely extrazonal. There is a clear differentiation between the dry Aegean and Mediterranean subregions where *Q. ilex* forests are restricted to the most humid habitats, and the very scattered occurrences of *Q. ilex* along the perhumid Black Sea coast where Mediterranean-type forests are confined to locally dry rocky sites with shallow soils.

Plants

Trees: *Quercus ilex*, *Acer sempervirens*, *Carpinus orientalis*, *Cercis siliquastrum*, *Fraxinus ornus*, *Laurus nobilis*, *Ostrya carpinifolia*, *Pinus brutia*, *Platanus orientalis*, *Styrax officinalis*

Shrubs and lianas: *Arbutus andrachne*, *A. unedo*, *Asparagus acutifolius*, *Dioscorea* *communis, Hedera helix, Hypericum empetrifolium, Jasminum fruticans, Lonicera etrusca, Myrtus communis, Phillyrea latifolia, Pistacia terebinthus, Quercus coccifera, Rosa sempervirens, Rubia peregrina, Ruscus aculeatus, Smilax aspera*

Herbs: *Asplenium onopteris, Brachypodium sylvaticum, Cyclamen hederifolium, Pteridium aquilinum, Selaginella denticulata*

Records

Arbutus andrachne-Acer sempervirens-Quercus ilex; northern foot of Samsun Dağı, Kemer, Fethiye; 100-300(-1100) m, north-facing ravines, limestone and siliceous schist, brown soil; MeditB5: 244

Quercus ilex-Corylus avellana-Daphne pontica; Elmali reservoir near Üsküdar (Bosporus); 100 m (Meyer 1969)

Quercus ilex-Laurus nobilis-Crataegus germanica-Phillyrea latifolia-Staphylea pinnata; 1-4 km E of Alaplı (W of Zonguldak) 20-40 m; Sinop Peninsula, clifftops, 110-140 m; 3 km E of Samsun, 20 m (Meyer 1969)

Phytosociology

Alliances: *Erico-Quercion ilicis* (Evergreen and semideciduous mesophilous holm oak forests and high maquis in humid Central and East Mediterranean and Black Sea regions); *Arbuto andrachnes-Quercion cocciferae* (Calcicolous meso-xerophytic semideciduous and evergreen oak forests and high maquis in humid East Mediterranean and Black Sea coastal regions)

Associations: Orno-Quercetum ilicis Horvatić ex Horvatić 1958; Arbuto andrachne-Quercetum ilicis Oberd. ex Krause, Ludwig et Seidel 1963

References: Meyer (1969)

9350 *Quercus macrolepis* forests

Definition

Woods dominated by the semi-deciduous valonia oak, *Quercus ithaburensis* subsp. *macrolepis* (*Q. macrolepis*), often fairly open, mostly of the mesomediterranean zone, in western Anatolia commonly reaching the supramediterranean zone. Valonia oak forests occur from Italy (very locally in Apulia) through Albania, Greece including some of its larger islands, to western and southwestern Turkey. Further east, from southern Anatolia to Syria, Lebanon, Israel and Jordan the taxon is replaced by *Q. i.* subsp. *ithaburensis* (see below under habitat type 93x3).

Site conditions

Valonia oak forests grow in regions with subhumid and warm mesomediterranean climate, often on deep alluvial soils but stands on rocky eroded soils are not uncommon. The woodlands occur from near sea level to 1000 m, in the Inner West Anatolian Province (2.2) up to 800 m (Hütteroth & Höhfeld 2002). Most groves are grazed, have an open canopy and the understory consists of light-demanding herbs and subshrubs. Other trees may have been eliminated to support the formerly economically valuable 'valonia oak' of Turkey with its fruit cupules containing high amounts of tannines.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees: <u>*Quercus ithaburensis* subsp. *macrolepis*</u>, *Q. cerris*, *Q. coccifera*, *Q. infectoria* subsp. *infectoria*, *Q. pubescens*, *Pyrus syriaca*

Shrubs: *Cistus creticus*, *C. laurifolius*, *Crataegus monogyna*, *C. laciniata*, *Juniperus oxycedrus*, *Olea europaea*, *Pistacia lentiscus*, *Prunus webbii*, *Rhamnus lycioides*

Records

Quercus ithaburensis subsp. *macrolepis*; near Kaş (Antalya); 300-600 m, south side, on limestone and schist; MeditA6b: 193

Quercus ithaburensis subsp. *macrolepis*; widespread in the Aegean subregion near İzmir, Uşak, Turgutlu, Salihli, Banaz, Güre; Meso- to supramediterranean mixed forests on plains, (200-)500-900(-1000) m, alluvial deposits as well as gneiss, basalt and dolerite; MeditB7: 246

Phytosociology

Alliance: *Quercion macrolepidis* (Mesomediterranean deciduous oak forests of the East Mediterranean)

Association: *Quercetum macrolepidis* Zohary & Orshan 1966, *Querco trojanae-Quercetum macrolepidis* Akman, Barbéro et Quézel 1979

References: Akman et al. (1978)

9370 * Palm groves of Phoenix

Definition

Woods, riparian or coastal, formed by the two endemic palm species *Phoenix theophrasti* and *Phoenix canariensis*. The palm groves of *Phoenix theophrasti* are restricted to coastal locations in Crete and southwestern Anatolia (Yaltirik & Boydak 1991). Canarian palm groves are found on the Canary Islands of Gran Canaria, La Gomera, Tenerife and La Palma.

Site conditions

Phoenix theophrasti is the only native palm species of Turkey and a relict endemic of the South Aegean (Boydak & Yaka 1983; Boydak 1985), found as riparian woods or isolated small trees in deep valleys or damp sandy coastal sites.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

In Turkey, palm groves of *Phoenix theophrasti* are restricted to the deep coastal valleys of Datça and Karaöz, Kumluca, with additional populations in Gölköy, Bodrum. One of the largest populations is on the Datça Peninsula, where it grows in two valleys: Hurmalıbük, facing south, which has the larger population, and Eksere, facing north.

Plants

Trees and shrubs: *Phoenix theophrasti*, *Erica arborea*, *Nerium oleander*, *Pistacia lentiscus*, *Rubus sanctus*

Herbs: *Scirpoides holoschoenus*, *Juncus* sect. *Maritimus*, *Piptatherum miliaceum*

Records

Phoenix theophrasti; Datça Peninsula; near coast in sheltered valleys, 20-250 m; MeditB3: 242

Phytosociology

Alliance: *Rubo sancti-Nerion oleandri* (Thermomediterranean oleander riparian scrub of the Eastern Mediterranean)

Associations: *Nerio-Phoenicetum theophrasti* Brullo et al. 2004

References: Boydak & Yaka (1983); Boydak (1985); Yaltirik & Boydak (1991); Brullo et al. (2004)

93A0 Woodlands with *Quercus infectoria* (*Anagyrido foetidae-Quercetum infectoriae*)

Definition

East Mediterranean deciduous oak woodland dominated by *Quercus infectoria* subsp. *infectoria* or subsp. *veneris.*

Site conditions

Quercus infectoria subsp. *veneris* woodlands constitute the natural vegetation between 600-700 to 1000-1100 m on base-rich substrate and in particular marly limestone of the Troodos Mountains (Cyprus). In western and southern Anatolia, *Quercus infectoria* woods (subsp. *infectoria* in the western part extending to the East Aegean, and subsp. *veneris* in the eastern Mediterranean subregion) occur at meso- and supramediterranean levels on a variety of substrata including limestone, schist and serpentine. Deep alluvial soils with sufficient water supply are preferred.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees: *Quercus infectoria* s.l., *Q. cerris, Q. pubescens, Acer syriacum, Cupressus sempervirens, Pinus brutia, Ostrya carpinifolia,*

Shrubs and lianas: *Arbutus andrachne, A. unedo, Aristolochia sempervirens, Asparagus acutifolius, A. aphyllus, Cistus creticus, Dioscorea communis, Fontanesia phillyreoides, Genista monspessulana, Jasminum fruticans, Lonicera etrusca, Osyris alba, Paliurus spina-cristi, Pistacia terebinthus* subsp. *palaestina, Phillyrea latifolia, Quercus coccifera* s.l., *Rosa sempervirens, Rubia peregrina, Ruscus aculeatus, Styrax officinalis, Thymbra spicata*

Herbs: *Centaurea ptosimopappa, Cyclamen persicum, Eryngium falcatum, Hypericum lanuginosum, Viola sieheana.*

Additional notes

Dense oak forests on the alluvial plain of Çukurova (Adana) have been mentioned in 19th century travel reports (Kotschy 1858, cited in Hütteroth & Höhfeld 2002); these extensive forests were predominantly of Aleppo oak, *Quercus infectoria* subsp. *veneris,* and have since been transformed to irrigated agricultural areas.

Records

Quercus infectoria-Quercus cerris; Mediterranean Anatolia such as near Anamur, Mersin, Gazipaşa, Kaş, Yerkesık (Muğla); 500-800 m, slightly inclined slopes of limestone and schist; MeditA6b: 193

Centaurea ptosimopappa-Quercus infectoria subsp. *veneris*; Nur Dağları (Amanos Dağları, Amanus); on shady slopes to 600 m, sun-exposed to 900 m, serpentine; MeditA12: 206

Quercus infectoria subsp. infectoria; Aegean West Anatolia near Aydın, Bursa, Eskişehir, İzmir, Uşak; mixed woodland on alluvial plains; MeditB6: 246

Phytosociology

Alliance: *Quercion macrolepidis* (Mesomediterranean deciduous oak forests of the East Mediterranean)

Association: *Anagyrido foetidae-Quercetum infectoriae* (Barbero & Quézel) Brullo et Spampinato 2004

References: Brullo & Spampinato (2004)

93x1 *Quercus coccifera* s.l. forests of the eastern Mediterranean

Definition

Mesomediterranean *Quercus coccifera* (including var. *calliprinos*) sclerophyllous forests of the eastern Mediterranean (*Quercion calliprini*). They are distributed from eastern Sicily through southern Greece, southwestern and southern Anatolia, to Syria, Lebanon and Israel. This habitat type is defined to include tall old-growth forest with trees up to 15-20 m as wells as kermes oak coppice-woods with more or less closed canopy of more than 4 m height.

Site conditions

In Mediterranean Turkey, well developed forests occur generally between 400 and 1200 (-1400) m on southern slopes, and from 200 to 900 m in shady situations. Evergreen woody species prevail but deciduous species are involved too. The habitat type is found both on compact limestone (mostly with rendzina soils) and siliceous rock (with xeromorphous ranker soils).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Figure 15. Sacred grove of Quercus coccifera (93x1) on a cemetery in the province of İzmir, western Anatolia. Photo: U. Hauke, May 2006.

Plants:

Trees: *Quercus coccifera* (including varieties called *rigida* and *calliprinos*), *Q. infectoria* subsp. *veneris*, *Carpinus orientalis*

Shrubs and woody climbers: *Arbutus andrachne, Asparagus acutifolius, Dioscorea communis, Hippocrepis emerus* subsp. *emeroides, Fontanesia phillyreoides, Jasminum fruticans, Lonicera etrusca, Paliurus spina-christi, Phillyrea latifolia, Pistacia terebinthus* subsp. *palaestina, Rhamnus punctata, R. lycioides, Rosa sempervirens, Rubia peregrina, Ruscus aculeatus, Smilax aspera, Styrax officinalis.*

Additional notes

Quercus coccifera includes *Q. calliprinos* which is regarded here, following the *Flora of Turkey* (Hedge & Yaltirik 1982) as well as Euro+Med (2006-2017), a taxonomic synonym of *Q. coccifera*.

Maquis- or pseudomaquis-type scrub of *Q. coccifera* is widespread and may be considered under habitat type 52x2, if applicable. Such stands may result from clearcutting and long-term overgrazing.

Records

Quercus coccifera; widespread in the southern and eastern Taurus (Seyhan, Göksun); 300-600(-1100) m, sun-exposed, limestone, gneiss; MeditA5a: 189

Pistacia terebinthus subsp. *palaestina-Quercus coccifera*; near İskenderun; (400-)500-1300(-1400) m (sun-exposed), 200-900(-1000) (shady mountain sides) on proto-rendzina over limestone or xero-ranker from schist; MeditA5b: 190

Carpinus orientalis-Quercus coccifera; near İzmir, Bursa and İstanbul; on siliceous and calcareous ground, to 600(-900) m, mostly sunexposed; MeditB4: 243

Quercus coccifera; coppice-wood as narrow coastal strip at the Marmara Sea; StepI2a: 148

Phytosociology

Alliance: *Quercion calliprini* (Sclerophyllous evergreen kermes oak forests of the Eastern Mediterranean)

Associations: *Pistacio palaestinae-Quercetum calliprini* Eig 1934; *Siderito dichotomae-Quercetum cocciferae* Karaer, Kilinç et Kutbay 1999, *Pistacio palaestinae-Quercetum calliprini* Eig 1946, *Quercetum calliprino-aucheri* Brullo et Spampinato 2004, *Quercetum calliprino-pseudocerridis* Brullo et Spampinato 2004

References: Zohary (1955); Quézel & Pamukcuoğlu (1973); Akman et al. (1978); Karaer et al. (1999); Brullo & Spampinato (2004)

93x2 * *Quercus aucheri* woods

Definition

Sclerophyllous evergreen low forest or shrub of *Quercus aucheri* or the latter mixed with *Q. coccifera*, generally more than 3 m in height. *Q. aucheri* is a regional endemic of the thermomediterranean zone of western Aegean Turkey extending to the Dodecanese island of Rodos (Greece). Degraded *Quercus aucheri* low maquis with the potential to progressive succession is included.

Site conditions

The thermomediterranean climate in the south-east Aegean is almost frost-free and has mean maximum annual temperatures of 21-22 °C; annual precipitation is between 500 to 600 mm. *Quercus aucheri* grows chiefly on calcareous soils. *Q. aucheri* woods have been used for coppicing and as wood-pasture. Oak trees higher than 5 m are rare.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Habitat variation is related to the local environment (topography, soil thickness) and human impact (browsing, coppicing). Mayer & Aksoy (1986) do not communicate a woodland type that corresponds to the present habitat type.

Plants

Trees, shrubs and lianas: *Quercus aucheri*, *Q. coccifera*, *Arbutus andrachne*, *Pistacia terebinthus* subsp. *palaestina*, *Rubia tenuifolia*, *Smilax aspera*

Figure 16. East Aegean open sclerophyllous grazed woodland of *Quercus aucheri* and *Q. coccifera* (93x2), province of İzmir, Aegean region. Photo: U. Hauke, April 2006.

Phytosociology

Alliance: *Arbuto andrachnes-Quercion cocciferae* (Calcicolous meso-xerophytic semideciduous and evergreen oak forests and high maquis in humid East Mediterranean and Black Sea coastal regions)

Association: *Quercetum calliprino-aucheri* Brullo et Spampinato 2004

References: Meyer (1969); Akman et al. (1978); Brullo & Spampinato (2004)

93x3 *Quercus ithaburensis* subsp. *ithaburensis* woodlands

Definition

Thermo-Mediterranean subsclerophyllous woods of the semi-deciduous *Quercus ithaburensis* subsp. *ithaburensis*, often as mixed forest with the evergreen *Quercus coccifera* (*Q. calliprinos*). The habitat type occurs in Jordania, Israel, Syria and southern Anatolia. The stands may appear as coppice-woods or groves with open canopy.

Site conditions

The woods are pronouncedly xerothermophytic and grow on Mediterranean rendzina or on alluvial soils. Silvopasture is common with overgrazing clearly indicated by the ground layer composition and abundance of ruderal herbs. The *Quercus ithaburensis* woods should be considered a priority habitat type for conservation. The least disturbed and old-growth sites require urgent protection.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Woody plants

Quercus ithaburensis subsp. *ithaburensis*, *Q. coccifera*, *Pistacia terebinthus* subsp. *palaestina*, *Rubia tenuifolia*, *Styrax officinalis*, *Ziziphus lotus*

Records

Quercus ithaburensis subsp. *ithaburensis*; lowlands and west foot of Amanos Dağları (Amanus), plain of Antakya, Adena; thermomediterranean, 0-300(-500) m; MeditA6a: 192

Phytosociology

Alliance: *Quercion calliprini* (Sclerophyllous evergreen kermes oak forests of the Eastern Mediterranean)

Association: *Quercetum ithaburensis* Eig 1934

References: Eig (1934); Brullo & Spampinato (2004); Dufour-Dror & Ertaş (2004)

9410 Acidophilous *Picea* forests of the montane to alpine levels (*Vaccinio-Piceetea*)

Definition

Montane and sub-alpine conifer forests dominated by *Picea abies* and *Picea orientalis*. In contrast to the rest of Europe, in Turkey a very distinct subtype with *Picea orientalis* is to be distinguished where in the understorey and ground layer mesophilous and hygrophilous herbs and shrubs of the Euxine-Colchic element grow together with boreal-temperate plants. Oriental spruce occurs in pure stands or as mixed forests with *Pinus* or with *Abies* and *Fagus* at montane to sub-alpine levels of the Eastern Black Sea region and further in the Caucasus.

Site conditions

The habitat type comprises natural or semi-natural coniferous evergreen forests on siliceous and calcareous soils between (900-)1200-2000(-2400) m. While generally occurring on soils with favourable water supply, there is much variation in humidity.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The 9410 habitat subtype of Turkey (Oriental spruce forests) differs considerably from other subtypes in the rest of Europe where red spruce (*Picea abies*) occurs. However, as 9410 is defined by IM (European Commission 2013: 136) in such a way as to include *Picea orientalis* forests (although the latter species is not native to any present EU member state), Northeastern Anatolian *Picea orientalis* forests are treated here as a distinct subtype of 9410. In Northeast Anatolia, about 150,000 ha of Oriental spruce pure and mixed forests occur, most of which in the districts of Giresun, Torul Saraç, Trabzon, Gümüşhane, Artvin, Şavşat and Borçka.

Plants

Trees: *Picea orientalis*, *Abies nordmanniana* subsp. *nordmanniana*, *Pinus sylvestris*, *Fagus orientalis*

Shrubs*:* *Rhododendron ponticum*, *Daphne pontica*, *Ilex colchica*, *Rubus platyphyllus*, *Vaccinium arctostaphylos*

Herbs and subshrubs: *Aconitum nasutum, A. orientale, Aquilegia olympica, Aremonia agrimonoides, Arenaria rotundifolia, Astrantia maxima, Cardamine pectinata, Cyclamen parviflorum, C. coum* subsp. *caucasicum, Doronicum macrophyllum, Dryopteris aemula (D. liliana), Euphorbia oblongifolia, Galium odoratum, G. rotundifolium, Geranium ibericum, G. gracile, Jacobaea trapezuntina, Lactuca mulgedioides L. racemosa, Lapsana communis* subsp. *grandiflora, Lilium monadelphum, Luzula pilosa, Milium effusum, Oxalis acetosella, Paris incompleta, Pedicularis comosa, Peucedanum caucasicum, Ranunculus cappadocicus, R. brachylobus, Sanicula europaea, Saxifraga cymbalaria, Symphytum asperum, Telekia speciosa, Vaccinium myrtillus, Veratrum album, Veronica peduncularis*.

Records

Rhododendron ponticum-Fagus orientalis-Picea orientalis; Zigana, Giresun, Şebinkarahisar - Tonya, Vakfikebir; (700-)1150-1650 m, on the mountain range near the coast, shady slopes on schist, andesite (rarely limestone); EuxDI5d: 127

Paris incompleta-Picea orientalis; Giresun, Rize, near the Georgian border; 1200-1700 m, moderately steep, shady and more rarely sun-exposed slopes on schist, andesite, more rarely limestone; EuxDI5e: 128

Telekia speciosa-Picea orientalis; from Trabzon - Zigana eastward; forest on well water-supplied soils, rich in mesophilous tall forbs, 1250-1800 m, moderately steep shady slopes, schist; EuxDI5f: 129

Vaccinium myrtillus-Picea orientalis-Pinus sylvestris; near Giresun - Şebinkarahisar, near Artvin; 1650-1950 m, mixed coniferous forest on deep siliceous soils over schist and andesite at moderately steep slopes; EuxDII5a: 137

Doronicum macrophyllum-Abies nordmanniana-Picea orientalis; S side of the Eastern Black sea region (Doğu Black Sea Dağları); 1200-1400 m, shady slopes on limestone; EuxDI6b: 132

Phytosociology

Lonicero caucasicae-Piceion orientalis (Euxine-Caucasian upper montane humid fir and spruce forests)

Associations: *Fago orientalis-Piceetum orientalis* Quézel, Barbéro et Akman 1980; *Pario incompletae-Piceetum orientalis* Quézel, Barbéro et Akman 1980; *Telekio speciosae-Piceetum orientalis* Quézel, Barbéro et Akman 1980, *Doronicum macrophyllum-Picea orientalis* comm. Quézel, Barbéro et Akman 1980

References: Quézel et al. (1980)

94x1 North and central Anatolian *Pinus sylvestris* forests

Definition

Meso-xerophytic montane *Pinus sylvestris* forests on the plateaus of the continental inner parts of the North, West and East Anatolian Mountains. Species of Euxinian and subeuxinian distribution are significant in some areas.

Site conditions

The habitat type is found in mountainous areas with subcontinental climate (warm summers, cold winters) on a variety of bedrocks and soils. The open pine forests support ground vegetation which includes species of supramediterranean/submediterranean woodlands, high-mountain shrublands (e.g., *Juniperus communis* subsp. *nana*) and steppe (*Astragalus* div. spec., *Acantholimon* div. spec., *Bromopsis tomentella, Festuca valesiaca*). In the mountain forests, especially at high altitudes, wildfires caused by lightning are not uncommon. The prevalence of conifers and easily inflammable litter increase the risk of wildfires particularly in spring and autumn when pine woodlands and surrounding steppe vegetation attain simultaneously high flammability. Thunderstorm frequency is high in the end of May and early June.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

There is considerable habitat variability in Anatolian *Pinus sylvestris* forests. The following groups may be distinguished:

- High montane and subalpine *Pinus sylvestris* forests of the central and south (inner) Pontic range, in snow-rich environments, at the edge of subeuxinian, relatively wintermild with high precipitation, and continental inner Anatolian climate conditions
- West central Anatolian *Pinus sylvestris* forests of montane to high montane levels in mountain ranges such as Sündiken Dağı, Türkmen Dağı and Işık Dağı; similar to the previous but slightly influenced by Mediterranean climate conditions
- Low (from sea level to 400 m) Euxine-Colchic pine forests with *Pinus sylvestris* var. *kochiana* on steep slopes of the Eastern Black Sea subregion, rare and recorded only from the province of Trabzon (near Of)

Figure 17. High montane Scots pine forest (*Pinus sylvestris*) mixed with *Abies nordmanniana* subsp. *equi-trojani* (94x1), Ilgaz Dağları (Ilgaz Mountains), province of Kastamonu, Black Sea region, North Anatolia. Photograph: U. Hauke, June 2005.

- East and east central Anatolian high steppe pine forests typical of very wintercold climate conditions

Plants

Trees: *Pinus sylvestris*, *P. nigra*, *Populus tremula*

Shrubs: *Juniperus communis* subsp. *nana*, *Chamaecytisus austriacus* subsp. *pygmaeus*, *Cistus laurifolius*, *Daphne glomerata*, *D. pontica*

Herbs: *Acantholimum puberulum*, *Asperula involucrata*, *Astragalus fragrans*, *Brachypodium pinnatum*, *B. sylvaticum*, *Bromopsis tomentella*, *Dactylis glomerata* subsp. *hispanica*, *Doronicum orientale*, *Dorycnium graecum*, *D. pentaphyllum* subsp. *herbaceum*, *Festuca valesiaca*, *Fragaria vesca*, *Galium rotundifolium*, *Hieracium murorum* subsp. *medianiforme* and *oblongum*, *Lathyrus laxiflorus*, *Luzula forsteri*, *Moneses uniflora*, *Orthilia secunda*, *Pilosella cymosa*, *P. hoppeana*, *Poa nemoralis*, *Polygala alpestris*, *P. supina*, *Potentilla micrantha*, *Pteridium aquilinum*, *Pyrola chlorantha*, *P. media*, *Ranunculus buhsei*, *R. brutius*, *Teucrium chamaedrys*, *Trifolium caudatum*, *Veronica chamaedrys*, *Viola sieheana*.

Records

Western Black Sea:

Orthilia secunda-Pteridium aquilinum-Pinus sylvestris; Şerif Yüksel/Bolu, and near Işik; 1400-1600 m, shallow soils, shady but more often sun-exposed slopes; EuxBII6a: 99

Dorycnium graecum-Pinus sylvestris; near Nallıhan, near Karaşar; 1550-2000 m, all expositions, on andesite with redbrown forest soils; EuxBII6b: 100

Calamintha grandiflora-Pinus sylvestris; near Köroğlu, İnebolu; 1500-1800 m, volcanic rock, W, E and S expositions; EuxBII6c: 100

Central Black Sea:

Pinus sylvestris; S slopes, province of Kastamonu, Küre Dağları National Park near Pınarbaşı, EuxCII4b 115

Eastern Black Sea:

Daphne glomerata-Pinus sylvestris; Zigana Pass (Kürtün, Hamsiköy); 1450-2250 m, shady mountain side (rarely south-exposed), steep slopes with rather dry schistose soils, very snow-rich (7-8 months); EuxDII5b: 139

Epimedium pinnatum subsp. *colchicum-Pinus sylvestris* var. *kochiana*; E of Of (Trabzon); 0-400 m, steep slopes and ridges on schist, deep soil, Euxine-Colchic maritime climate, high temperature, high annual precipitation (> 2000 mm) and air humidity;

East Anatolian:

Pinus sylvestris; widespread near Pınarbaşı (Kayseri), Akdağ near Sivas, Erzincan, Erzurum, Sarıkamış, Ak Dağları near Akdağmadeni; high steppe pine forest, 1800-2600(-2700) m, trees near tree line often forked or sabre-shaped (Zwiesel, Säbelwuchs) due to snow pressure; StepIII2c: 170

West Anatolian:

Orthilia secunda-Pinus sylvestris; near Karaşar - Nallıhan, Işık Dağı, Sündiken Dağı, Türkmen Dağı, Kızılcahamam; supra- to oromediterranean, 700-1700 m, ridges and southern slopes, micaschist, andesite, brown-soil; MeditB15: 256

Phytosociology

Alliances: *Geranio-Pinion* (Xero-mesophytic montane to subalpine pine forests of the Pontic Mountains and the Caucasus)

Associations: *Pyrolo secundae-Pinetum sylvestris* Akman, Barbéro et Quézel 1979; *Lilio ciliati-Pinetum sylvestris* Quézel, Barbéro et Akman 1980; *Epimedio colchici-Pinetum sylvestris* Quézel, Barbéro et Akman 1980, *Daphno glomeratae-Pinetum sylvestris* Quézel, Barbéro et Akman 1980, *Vaccinio myrtilli-Pinetum sylvestris* Quézel, Barbéro et Akman 1980; *Daphno ponticae-Pinetum sylvestris* Kutbay & Kilinc 1995; *Ranunculo buhsei-Pinetum sylvestris* Karaer, Kilinç et Kutbay 1999; *Fragario vescae-Pinetum sylvestris* Tatlı et al. 2005

References: Akman et al. (1979); Quézel et al. (1980); Karaer et al. (1999); Özen & Kılınç (2002); Tatlı et al. (2005); Aydın et al. (2008)

9530 * (Sub-) Mediterranean pine forests with endemic black pines

Definition

Supra- and oromediterranean coniferous forests dominated by pines of the *Pinus nigra* group, on marly or crystalline limestone, dolomite or ophiolitic substrata. In Turkey, black pine forests represented by *Pinus nigra* subsp. *pallasiana* occur typically above the subeuxinian and supramediterranean deciduous oak forests, chiefly at oromediterranean levels between 1200 and 1800-2000 m a.s.l. at the northern, western and southern margins of Central Anatolia. In the Aegean subregion black pine forests may form the tree line (e.g. Eğriboz Dağı).

Site conditions

Forests of black pine (in Turkey represented by *Pinus nigra* subsp. *pallasiana*) grow on poor and mostly shallow soils on a wide range of geological substrata including siliceous (e.g., andesite, schist), calcareous (marl, limestone) and ultrabasic (serpentine, "Grünstein") rock. Black pine occurs in all kinds of topographic situations but mostly on exposed ridges, upper slopes and precipitous terrain where soils are eroded or poorly developed. The canopies of natural forests are vertically and horizontally differentiated and show small-scale structural heterogeneity. The trees are variable in height and shape; older trees have umbrella-shaped crowns. Trees of high altitudes may be stunted due to snow pressure. On shady slopes, in the high mountains of western and northern Anatolia, and with increasing continentality towards Central Anatolia, *Pinus nigra* forests are frequently replaced by *P. sylvestris* forests (habitat type 94x1; e.g., Gümüş Dagı/Küthaya and Türkmen Dagı).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

There is enormous habitat variability in Turkish *Pinus nigra* forests, first of all due to biogeographic affinities (Mediterranean, euxinian, and continental Anatolian influences), moreover local-scale on account of altitudinal variation, topography and bedrock. Below we made an attempt to group the Turkish subtypes in (a) North and Northwest Anatolian (Black sea and Marmara mountain ranges), (b) West Central Anatolian, (c) Aegean and (d) Mediterranean South Anatolian (Taurus and Amanos mountain ranges).

Plants

Trees: *Pinus nigra* subsp. *pallasiana*, *Populus tremula*, *Quercus petraea* subsp. *iberica*, *Q. pubescens*, *Sorbus torminalis*, *S. umbellata*

Shrubs: *Adenocarpus complicatus*, *Berberis crataegina*, *Cistus laurifolius*, *Colutea cilicica*, *Cotoneaster nummularius*, *Crataegus monogyna*, *C. orientalis*, *C. tanacetifolia*, *Cytisus austriacus* subsp. *pygmaeus*, *Genista lydia*, *Juniperus communis* subsp. *nana*, *J. oxycedrus*, *Pyrus elaeagrifolia*, *Viburnum lantana*

Herbs: *Arabis laxa*, *Asyneuma rigidum*, *Brachypodium pinnatum*, *B. sylvaticum*, *Bupleurum falcatum* subsp. *cernuum*, *Campanula lyrata*, *Carex coryogyne*, *C. distachya*, *Cephalanthera rubra*, *Cerastium fragillimum*, *Cicer anatolicum*, *Clinopodium vulgare*, *Daphne oleoides*, *D. pontica*, *Digitalis ferruginea*, *Doronicum orientale*, *Dorycnium pentaphyllum* subsp. *herbaceum*, *Ferulago galbanifera*, *Galium peplidifolium*, *Helleborus orientalis*, *Hypericum heterophyllum*, *H. montbretii*, *Iris sintenisii*, *Lapsana communis* subsp. *intermedia*, *Lathyrus czeczottianus*, *L. laxiflorus*, *Limodorum abortivum*, *Luzula forsteri*, *Paeonia arietina*, *P. peregrina*, *Poa nemoralis*, *Polygala supina*, *Potentilla micrantha*, *Pyrola chlorantha*, *Rubus canescens*, *Silene italica*, *Laser trilobum*, *Solidago virgaurea*, *Tanacetum parthenium*, *T. poteriifolium*, *Trifolium grandiflorum*, *T. medium*, *Verbascum flavidum*, *Vicia dalmatica*, *Viola sieheana*.

Additional notes

Pine stands are susceptible to canopy fires. Wildfires, deforestation and overgrazing in areas of transhumance resulted in severe degradation particularly of high-altitude black pine forests. Mixed stands of *Pinus nigra* and *P. sylvestris* are classified and mapped as habitat types 9530 or 94x1 according to the predominant conifer. More or less even-aged and monotonous afforestations of black pine, often substituting deciduous or evergreen degraded scrubland, are not included in this habitat type.

Records

Marmara, Western and Central Black Sea:

Quercus petraea subsp. *iberica*-*Pinus nigra*; North coast of Thrace, relict forest on ridges and upper slopes on acidic skeletal dry soils; in contact to *Q. p. iberica* oak forest on deeper soils; EuxBI4g 76

Orthilia secunda-*Pinus nigra*; Ilgaz Dağları and Uludağ; 1350-1700 m; EuxBII7d: 102

Sesleria-*Pinus nigra*; Ilgaz Dağları; 2000-2100 m; EuxBII7e: 102

Sesleria-*Pinus nigra*; near Mudurnu – Nallıhan; 1300-1500 m, on calcareous marly green schist on north and west mountain sides, fuscous rendzina soil;

StepII3a: 157

Cytisus austriacus subsp. *pygmaeus-Pinus nigra*; near Kastamonou and on the S slopes of the Ilgaz Dağları, also near Çankırı, Yenice Irmaği and Kirkpinar; submediterranean, 800-1300 m, steep sunny slopes on marl and slate; EuxBII7a: 100

Crataegus tanacetifolia-Pinus nigra; SW of Bolu near Köroğlu; 1150-1450 m, south slopes, on andesite; EuxBII7c: 101

Pinus nigra; near Erbaa; 700-900 m, submediterranean woodland above *Pinus brutia* (below 500 m) and oak belt (500-700 m); EuxCII4a: 115

West Central Anatolia:

Quercus pubescens-Pinus nigra; Işık Dağı, between Beypazarı and Karaşar; 1000-1600 m, south slopes, on andesite; EuxBII7b: 101

Lathyrus czeczottianus-Pinus nigra; region of Beypazarı - Karaşar - Işık Dağı (between Ankara and Bolu); 1250-1500 m, sun-exposed slopes, on andesite; StepII3a: 157

Ferulago galbanifera-Pinus nigra; Sündiken Dağları, Türkmen Dağı; 1100-1500 m, SW aspect, more rarely NW, schist and green schist with acidic brown soil; StepII3a: 156

Cistus laurifolius-Pinus nigra; Ayaş, Beynam (near Ankara); substeppe woodland, 1200-1500 m, marl and serpentine; StepII3b: 158

Cytisus austriacus subsp. *pygmaeus-Pinus nigra*; Ayaş Dağları, 1000-1600 m, on limestone and marl, all aspects; StepII3b: 158

Quercus pubescens-Pinus nigra; Beynam Forest (Beynam ormanları), near Ankara; 1300 m, grey-brown serpentine soil; StepII3b: 158

Aegean:

Pinus nigra, widespread on siliceous substrates: south part of Kaz Dağı, Aydın - İzmır, Muğla, Madran (Baba) Dağı, Oyuklu Dağ (Denızli), Sandras Dağı, Fethıye, between Muğla and Yılanlı; (1200-)1400-1700(-2000) m, on gneiss, micaschist, volcanic rock; MeditB14a: 253

Pinus nigra, widespread on calcareous substrates: Kaz Dağı, Muğla, Yılanlı, near İzmir; 1000-1500 m, limestone, dolomite; MeditB14b: 256

Mediterranean South Anatolia:

Pinus nigra; Amanos (Nur Dağları), Gülek Boğazı (Mersin), near Antalya - Gödene, Akseki (Antalya), Pos; supramediterranean, 700-1300 m, basalt tuff, ophiolite, limestone; MeditA17a: 217

Asperula cymulosa-Pinus nigra; Central Taurus (Orta Toroslar): Pos, Amanos (Nur Dağları); submediterranean, 1100-1600 m, brown soil, ophiolite, rarely limestone; MeditA17b: 217

Thymus revolutus-Pinus nigra; near Karaman; substeppic forest, limestone and volcanic rock; MeditA17c: 218

Thlaspiceras oxyceras-Pinus nigra; Feke, Saimbeyli (Central Taurus, Orta Toroslar), 1500-1700(-1800) m, flysch and marl; Amanos (Nur Dağları): 1300-1500(-1800) m; chiefly on shady slopes, serpentine; MeditA17d: 218

Pterocephalus pinardii-Cicer anatolicum-Pinus nigra; Central Taurus (Orta Toroslar) near Ermenek and N of Oyuklu Dağ; marl, up to 2000 m; MeditA17d: 219

Symphytum brachycalyx-Pinus nigra; Central Taurus (Orta Toroslar) Adana, Acıpınar, Saimbeyli; 1450-1650 m, sandstone, moderately steep slopes, N, E and W aspects, deep soils, MeditA17d: 219

Phytosociology

Alliance: *Cisto laurifolii-Pinion pallasianae* (Meso-xerophytic sub-Euxine and western Central Anatolian *Pinus nigra* forests)

Associations: *Seslerio argenteae-Pinetum pallasianae* Akman, Barbéro et Quézel 1979; *Lathyro czeczottianae-Pinetum pallasianae* Akman, Barbéro et Quézel 1979; *Carici coriogynis-Pinetum pallasianae* Aydoğlu 1988, *Ferulagini galbaniferae-Pinetum pallasianae* Ekim et Akman 1990; *Junipero-Pinetum nigrae* Özen & Kılınç 2002; *Astragalo aucheri-Pinetum pallasianae* Karaer, Kılınç et Kutbay 1999; *Stellario holosteae-Pinetum pallasianae* Türe et al. 2005; *Dorycnio graeci-Pinetum pallasianae* Tatlı et al. 2005; *Cisto-Pinion* Akman, Barbero & Quézel 1978; *Cistus laurifolius-Pinus nigra* dominated forest (Kavgacı et al. 2013); *Pteridium aquilinum-Pinus nigra* dominated forest (Kavgacı et al. 2013); *Fagus orientalis-Pinus nigra* dominated forest (Kavgacı et al. 2013)

Alliance: *Adenocarpo complicati-Pinion nigrae* (Supra-oromediterranean *Pinus nigra* forests of western and southern Anatolia)

Associations: *Adenocarpo complicati-Pinetum pallasianae* Akman et al. 1983; *Symphyto brachycalycis-Pinetum pallasianae* Akman, Barbéro et Quézel 1979; *Asperulo cymulosae-Pinetum pallasianae* Akman, Barbéro et Quézel 1978; *Thlaspio oxyceradis-Pinetum pallasianae* Akman, Barbéro et Quézel 1979; *Symphyto palaestini-Pinetum pallasianae* Akman, Barbéro et Quézel 1979; *Centaureo lycopifoliae-Pinetum pallasianae* Varol et al. 2006

References: Akman et al. (1983); Aydoğdu, M. (1988); Ekim & Akman (1990); Özen & Kılınç (2002); Tatlı et al. (2005); Varol et al. (2006); Kavgacı et al. (2013)

9540 Mediterranean pine forests with endemic Mesogean pines

Definition

Mediterranean, Euxine and thermo-Atlantic forests of xero-thermophilous pines (*Pinus brutia, P. halepensis, P. pinaster*, *P. pinea*) grow chiefly on eroded shallow soils in the thermo- and mesomediterranean climate belts. In Turkey, *Pinus brutia* and *Pinus pinea* forests occur, the former widespread in the Mediterranean-Aegean regions and locally in the Black Sea region, the latter scattered in the Mediterranean and Black Sea regions near the coast. Long-established plantations of these pines, within their natural area of occurrence, and with undergrowth basically similar to that of natural forest on eroded or azonal soils ("paraclimactic formations"), are included.

Site conditions

Pinus brutia, sometimes referred to as Aegean pine, occurs from Greece to Lebanon, is widespread in Turkey and common especially in southern thermomediterranean Anatolia, reaching supramediterranean levels. It grows on shallow initial or eroded soils with low water storage capacity, on calcareous marls, ultramafic rock, gabbro and dolomite. In the Black Sea region *P. brutia* is scattered at low and extrazonally up to submontane levels in the domain of deciduous oak forests, chiefly on shallow soils over limestone and calcareous marl.

Stands of *Pinus pinea*, stone pine, are to be included in this habitat type only if growing on inland or coastal rocky slopes, such as on gneiss in the district of Koçarli, central Aegean. Stands on coastal fixed dunes or aeolian sands belong to the habitat type 2270.

Pinus halepensis or Aleppo pine, a tree of chiefly central Mediterranean distribution, is known in Turkey from two localities in the Mediterranean subregion.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The habitat type 9540 occurs in all coastal regions (Mediterranean, Aegean, Black Sea) of Turkey and is extremely variable. *Pinus brutia,* and exceptionally *P. pinea*, grow on more or less steep rocky slopes with eroded soils on a variety of substrates. *Pinus brutia* forests of the Black Sea differ greatly from those of the Marmara-Aegean subregions and of the South Anatolian Taurus-Amanos mountain ranges. While they are all influenced, to some degree, by the temperature-balancing maritime climates, they belong to three phytosociological alliances (see below), reflecting different biogeographical affinities. The Aegean *Pinus brutia* stands occur mostly at low to submontane levels, exceptionally up to 700 m. The South Anatolian *P. brutia* forests are the most diverse in habitat variability and species composition and reach supramediterranean levels of up to 1200 m, and locally even higher.

Figure 18. Pinus brutia woods (9540) in the western Taurus, province of Antalya, South Anatolia. Photo: U. Hauke, October 2006.

Figure 19. Extensive Pinus brutia forests (9540), Taurus Mountains, province of Antalya, Southwest Anatolia. Photo: C. Güngöroğlu, July 2012.

Figure 20. Stone pine forest (*Pinus pinea*) on siliceous rocky slopes (9540), province of Aydın, Aegean region. Photo: U. Hauke, April 2006.

Plants

Trees: *Pinus brutia*, *P. halepensis*, *P. pinea*, *Olea europaea* var. *sylvestris*, *Quercus infectoria* subsp. *infectoria* and subsp. *veneris*

Shrubs and woody climbers: *Adenocarpus complicatus*, *Arbutus andrachne*, *Asparagus acutifolius*, *Ceratonia siliqua*, *Cistus creticus*, *C. laurifolius*, *C. salviifolius*, *Clematis flammula*, *Colutea cilicica*, *Cotinus coggygria*, *Crataegus azarolus*, *Ephedra foeminea*, *Erica arborea*, *Genista anatolica*, *G. lydia*, *Gonocytisus pterocladus*,*Jasminum fruticans*, *Juniperus oxycedrus*, *Lavandula pedunculata* subsp. *cariensis*, *Lithodora hispidula*, *Lonicera etrusca*, *Myrtus communis*, *Paliurus spina-christi*, *Phillyrea latifolia*, *Pistacia lentiscus* *P. terebinthus* s.l., *Quercus coccifera*, *Rhamnus alaternus*, *R. lycioides* subsp. *graeca*, *Rhus coriaria*, *Rosa sempervirens* *Rubia tenuifolia*, *Ruscus aculeatus*, *Smilax aspera*, *Thymbra spicata*.

Herbs: *Anarrhinum orientale*, *Asperula brevifolia*, *Campanula lyrata*, *Brizochloa humilis*, *Centaurea babylonica*, *C. cariensis*, *C. cassia*, *C. cataonica*, *C. ptosimopappa*, *C. ptosimopappoides*, *Cytisopsis pseudocytisus* subsp. *reeseana*, *Dorycnium graecum*, *D. pentaphyllum* subsp. *herbaceum* and subsp. *haussknechtii*, *Eryngium falcatum*, *E. thorifolium*, *Euphorbia erubescens*, *Falcaria vulgaris*, *Ferulago macrosciadia*, *Hedysarum varium* subsp. *syriacum*, *Helichrysum pamphylicum*, *Limodorum abortivum*, *Linum aroanium*,*Melica rectiflora*, *Odontarrhena discolor*, *Onobrychis kotschyana*, *Piptatherum coerulescens*, *Putoria calabrica*, *Salvia aramiensis*, *Scorzonera kotschyi*, *Teucrium sandrasicum*, *Thymelaea aucheri*.

Additional notes

The distinction between self-sown forests and long-established plantations of natural appearance is difficult and sometimes impossible. The latter are thus included in this habitat type, while recent artificial plantations are not.

Records

Black Sea:

Pinus brutia; widespread but scattered, e.g. near Beypazarı, Nallıhan, Safranbolu, Kastamonu, Karabük, further east near Erbaa, Sakarya; steep sun-exposed calcareous slopes, 300-750(-1000) m; EuxBII2b: 91

Quercus infectoria-Pinus brutia; near Erbaa; 200-500 m, Mediterranean relic woods; EuxCII2b: 113

Pinus pinea; Trabzon Province; scattered fragments on volcanic rock between cultivated lands; EuxDI2b: 120

Marmara:

Quercus coccifera-Pinus brutia; Gelibolu Peninsula; StepI2b: 148

Pinus pinea with *Quercus coccifera*; Bosporus near Sarıyer; macchia, 80 m; EuxBI3e: 69

Pinus brutia; district of Gelibolu, chiefly peninsula and Prince Islands (Kızıl Adalar); EuxBI3f: 71

Aegean:

Pinus pinea; Aydın, Bergama - Kozak, near Kavacık, near Karacaali; coastal and, probably planted ages ago, (300-)800-1200 m, granite, gneiss; MeditB8: 247

Pinus brutia; widespread in the West Anatolian Aegean between Marmara Sea and İzmir; Mediterranean woods; MeditB10a: 249

Veronica pectinata-Pinus brutia; scattered in the West Anatolian Aegean and Marmara hinterland on the foothills of Sündiken Dağları, near Eskişehir, Sögüt; submediterranean woods in the domain of deciduous oaks on sunexposed schist slopes, 400-700(-900) m; MeditB10b: 249

Mediterranean South Anatolia:

Quercus coccifera-Pinus brutia; widespread near Mersin, Silifke, Tarsus, Anamur, Gazipaşa; on calcareous and siliceous metamorphic and igneous rock up to 700 m, mainly south-exposed slopes; MeditA9a: 197

Helichrysum pamphylicum-Pinus brutia; widespread near Antalya, Akseki, Mersin, Silifke, Manavgat, Anamur; on marl, up to 300(-500) m, sun-exposed slopes; MeditA9a: 198

Hedysarum varium-Pinus brutia; widespread near Pos, Adana, Sarçam; Tarsus, Merzin, in the Amanos Mountains (Nur Dağları); on marl, up to 550 m on sun and shade sides, MeditA9b: 198

Centaurea ptosimopappus-Pinus brutia; Dörtyol, İskenderun, Osmaniye; (0-)300-900 m, on peridotite and other ultramafic rock, gabbro and serpentine; MeditA9b: 200

Quercus infectoria subsp. *veneris-Pinus brutia*; lowlands of Amanos; 300-500 m, gabbro-diorite, peridotite and pyroxenite; MeditA9b: 200

Astragalus schizopterus-Pinus brutia; widespread near Kaş, Manavgat, Anamur, Mersın, Feke, Adana; on calcareous rock and schist, sun-exposed to 800(-900) m, more rarely on shady southern slopes up to 500(-1300) m, on rendzina soils; MeditA9c: 201

Cytisopsis pseudocytisus subsp. *reeseana-Quercus infectoria* subsp. *infectoria-Pinus brutia*; Fethiye, Muğla, Kemer, Köyceğiz; 50-500 m, serpentine rock, shallowly sloped sunny (here up to 800(-1000) m) and shady hillsides; MeditA9c: 201

Pinus brutia; Antalya, Feke; supramediterranean forest up to 1100(-1200) m, locally to 1600 m; MeditA9d: 202

Pinus brutia; west and central Taurus, widespread in the *Querco-Cedretalia libani* domain at 700-1220(-1400) m, limestone and schist; MeditA9e: 202

Ostrya carpinifolia-Pinus brutia; near Feke (central Taurus); 900-1400 m, on shady mountain sides; MeditA9e: 202

Acer hyrcanum-Pinus brutia; western Taurus, near Manavgat – Antalya; 700-1200(-1600) m; MeditA9e: 202

Digitalis cariensis-Pinus brutia; western Taurus, near Antalya/Termessos - Gödene, Pos/Adana; up to to 1500(-1600) m; MeditA9e: 203

Centaurea ptosimopappoides-Pinus brutia; east central Taurus near Pos; 850-1250 m, moderately steep slopes of all aspects, serpentine, gabbro, ophiolite; MeditA9f: 203

Centaurea babylonica-Pinus brutia; central Taurus: hinterland of Mersin; N, E and W aspects, moderately steep slopes, ophiolite, serpentine, limestone; MeditA9f: 203

Glycyrrhiza flavescens-Quercus cerris-Pinus brutia; central Taurus, mixed forest at 500-900 m; MeditA9f: 204

Lathyrus tukhtensis-Pinus brutia; western Taurus: Muğla, Erkin Dağı; 700-1200(-1400) m, moderately steep gneiss and micaschist slopes, sun and shade aspects, submediterranean; MeditA9g: 204

Pinus brutia-Pinus halepensis; near Sarıçam and Karatepe, Ceyhan River (Ceyhan Nehri), near Kızyusuflu / Kadirli; small stands on limestone; MeditA9h: 204

Phytosociology

Alliance: *Campanulo sibiricae-Pinion brutiae* (Euxine-West Caucasian thermophilous *Pinus brutia* and related Mediterranean pine forests on dry calcareous substrates)

Association: *Querco infectoriae-Pinetum brutiae* Karaer et al. 1999; Lauro-Pinetum brutiae Yurdakulol et al. 2002 p.p.; *Crucianello ponticae-Pinetum pineae* Varol et al. 2003

Alliance: *Salvio fruticosae-Pinion brutiae* (Thermo-mesomediterranean pine forests on calcareous substrates of the Aegean)

Associations: *Querco calliprini-Pinetum brutiae* (Barbero & Quézel 1979) Brullo et al. 2004; *Phlomido bourgaei-Pinetum brutiae* Akman et al. 1998; *Junipero phoeniceae-Pinetum brutiae* Akman et al. 1998

Alliance: *Gonocytiso pterocladi-Pinion brutiae* (Thermo-mesomediterranean *Pinus brutia* forests on calcareous and volcanic rocks of South Anatolia, Syria and Lebanon)

Associations: *Hedysaro variae-Pinetum brutiae* Akman, Barbéro et Quézel 1978, *Centaureo ptosimopappoidis-Pinetum brutiae* Akman, Barbéro et Quézel 1978; *Centaureo babylonicae-Pinetum brutiae* Akman, Barbéro et Quézel 1978; *Lathyro tukhtensis-Pinetum brutiae* Akman, Barbéro et Quézel 1978; Centaureo lycopifoliae-Pinetum brutiae Varol & Tatlı 2001; *Medicagini coronatae-Pinetum brutiae* Varol et al. 2006; *Potentillo calycinae-Pinetum brutiae* Varol et al. 2006

Alliance: *Ptosimopappo-Quercion microphyllae* Barbéro, Chalabi, Nahal & Quézel 1977 (Thermo-meso-supramediterranean pine-oak woods on ultramafic rocks of the southern Anatolian Amanos Mountains and Syria)

Associations: *Ptosimopappo-Pinetum brutiae* Barbéro, Chalabi, Nahal & Quézel 1977; *Glycyrrhizo flavescentis-Pinetum brutiae* Barbéro, Chalabi, Nahal & Quézel 1977

References: Akman et al. (1978/1979); Akman et al. (1998); Brullo et al. (2004); Varol & Tatlı (2001); Yurdakulol (2002); Varol et al. (2006); Ghazal (2008); Karaer et al. (2010)

9560 * Endemic forests with *Juniperus* spp.

Definition

Open forest formations of medium and high elevations dominated by species of *Juniperus*. In Turkey, they are represented by *Juniperus excelsa*, *J. foetidissima* (frequently co-occurring) and *J. drupacea* (*Arceuthos drupacea*). Arborescent matorrals of the same species are frequently associated. However, they do not belong here but represent habitat type 5210.

Site conditions

Juniper woodland occurs on slopes and plateaus of medium to high elevations, locally forming the upper tree line. Extensive stands exist in summer-dry and rather continental areas, on various substrates including slate, sandstones, serpentine and limestone, chiefly in the southern and eastern parts of Inner Anatolia including the northern slopes of the Taurus Mountains. *Juniperus drupacea* forms pure stands of up to10-12 m height. Forest stands mixed with *Abies cilicica*, *Cedrus libani* and *Pinus nigra* are not uncommon and should be included in the habitat types 95x1, 95x2, and 9550, respectively. Forest dominated by *Juniperus excelsa* and/or *J. foetidissima* is generally rather open (rarely more than 50 % and sometimes less than 20 % canopy cover) and the trees may grow to 20-25 m height. More frequently are juniper trees of 4-10 m.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

- Woodlands dominated by *Juniperus excelsa*, often with *J. foetidissima*, and sometimes codominated by the latter, in the Taurus Mountains (Toros Dağları, South Anatolia) from supramediterranean to alpine levels

- Relict juniper-oak woodlands influenced by Black Sea airmasses, dominated by *Juniperus excelsa* and *J. foetidissima*, in the Marmara region and in the Black sea region (Black Sea Dağları, North Anatolia)

- Syrian juniper (*Juniperus drupacea*) woods of South Anatolia (Toros Dağları and Nur Dağları), extending to the Parnon Mountains (Peloponnisos, South Greece) and Syria.

Figure 21. Juniperus excelsa and *J. foetidissima* open woodland (9560) on karstified slopes of the western Taurus Mountains, province of Antalya, South Anatolia. Photo: U. Hauke, October 2006.

Figure 22. High montane juniper woodland with *Juniperus excelsa* and *J. foetidissima* (9560), Western Taurus Mountains, Manavgat, province of Antalya, Southwest Anatolia. Photo: C. Güngöroğlu, August 2011.

Plants

Trees and tall shrubs: *Juniperus excelsa*, *J. foetidissima*, *J. drupacea*, *J. oxycedrus*, *Carpinus orientalis*, *Pinus nigra* subsp. *pallasiana*

Others woody plants: *Berberis crataegina*, *Buxus sempervirens*, *Cotoneaster nummularius*, *Genista anatolica*, *G. lydia*, *Jasminum fruticans*, *Paliurus spina-christi*, *Pistacia terebinthus* subsp. *palaestina*, *Prunus argentea*, *Pyrus elaeagrifolia*, *Quercus coccifera*, *Q. pubescens*

Herbs: *Anemone blanda*, *Eryngium thorifolium*, *Globularia trichosantha*, *Stipa holosericea*, *Teucrium chamaedrys*, *T. sandrasicum*, *Vincetoxicum tmoleum*

Records

Juniperus foetidissima-Juniperus excelsa; near Artvin, canyon at 100-150 m, elsewhere on rocky steep slopes at 200-800 m; EuxDII2b: 134

Juniperus foetidissima-Juniperus excelsa; Sündiken Dağları, also not uncommon at the Taurus north face; steppic woodland, limestone; StepII9: 165

Juniperus excelsa-Juniperus foetidissima-Pinus nigra; central Taurus near Pos; 1300-1600 m, stunted to 1800 (-2000) m, Devonic marl and Permian sandstone; MeditA17e: 219

Juniperus drupacea; South Anatolia; MeditA21c: 235

Juniperus excelsa-Junperus foetidissima; western Taurus near Korkuteli – Elmalı; submediterranean woodland at 1000-1300 m, shallowly sloped with southern and eastern aspect, semiarid, limestone; MeditA21d: 235

Juniperus foetidissima-Juniperus excelsa; Saımbeylı, Abanos - Anamur, Elmalı, Akdağ supramediterranean to subalpine shrubland, 1450-2050 m; MeditA21e: 236

Juniperus excelsa; Taurus, shrubland of north-faced slopes culminating at tree line; 2100-2400(-2750) m, limestone, serpentine; MeditA21f: 236

Phytosociology

Alliance: *Juniperion excelso-foetidissimae* (Supramediterranean montane tall juniper woods on shallow soils over limestone, marls and ultramafic substrates of the south-central Balkans, Greece and western Anatolia)

Associations: *Anemono blandae-Juniperetum excelsae* Brullo et al. 2001; *Junipero foetidissimae-Juniperetum excelsae* Türe et al. 2005

Alliance: *Jasmino-Juniperion excelsae* (Peri-Euxine submediterranean open juniper-oak woods of edaphically dry habitat conditions)

Associations: "*Juniperus foetidissima-Juniperus excelsa*-Gebüsch" sensu Mayer and Aksoy 1986: 134

Alliance: *Berberido creticae-Juniperion foetidissimae* (Oromediterranean to subalpine juniper and pine woods and related scrub of continental Greece, Cyprus, Anatolia, Syria and Lebanon)

Associations: "Kulminale *Juniperus excelsa*-Waldgrenzen-Gesellschaft" sensu Mayer and Aksoy 1986: 236; "*Juniperus excelsa-Juniperus foetidissima-Pinus nigra*-Wald" sensu Mayer and Aksoy 1986: 219; "*Arceuthos drupacea*-Gebüsch" sensu Mayer and Aksoy 1986: 235

References: Brullo et al. (2001); Türe et al. (2005)

9580 * Mediterranean *Taxus baccata* woods

Definition

Woods dominated by yew (*Taxus baccata*) of very local occurrence, often with other evergreen below-canopy trees and shrubs such as of *Ilex* and *Buxus*. This habitat type is represented in Turkey as a distinct subtype in the domain of Pontic *Fagus orientalis* forest. There are only a few records from the western Black Sea region.

Site conditions

The Turkish habitat subtype of yew forests occurs in submontane to montane altitudes between (500-)700 and 1200 m a.s.l. It grows exclusively on deep calcareous soils (calcareous luvisol) on shaded wooded slopes and ravines. *Taxus* is said to form the upper canopy with trees of up to 22 m height (Aksoy 1982, Mayer & Aksoy 186: 79, Quezel et al. 1980: 463).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Trees and shrubs: *Taxus baccata*, *Acer platanoides*, *A. trautvetteri*, *Buxus sempervirens*, *Carpinus betulus*, *Fagus orientalis*, *Fraxinus ornus*, *Ilex colchica*, *Lonicera caucasica*, *Prunus laurocerasus*, *Staphylea pinnata*, *Tilia platyphyllos*

Herbs and climbers: *Asperula cymulosa*, *Asplenium scolopendrium*, *Campanula latifolia*, *Cirsium hypoleucum*, *Dioscorea communis*, *Helleborus orientalis*, *Laser trilobum*, *Tanacetum parthenium*, *Trifolium pannonicum*

Additional notes

The habitat type is currently recognized in only a few EU countries, chiefly as relict mixed deciduous yew and oak forests of Corsica and Sardinia (*Lathyro veneti-Taxion baccatae*) (Čarni & Mucina in Willner et al. 2015), while the IM definition (European Commission 2013) of "Mediterranean *Taxus baccata* woods" considers the habitat type as occurring either in the "senescent phase of a beech wood or beech-fir wood, made up of clusters of *Taxus* after the fall of the tall species, surrounded by layered stands of beech-yew" or as residual *Taxus* stands where taller trees have disappeared altogether. In fact, the habitat type appears to represent mostly a facies or stage in the development dynamics of old-growth beech or mixed deciduous-coniferous forests in topographically and mesoclimatically specific forest environments.

Records

Buxus sempervirens-Taxus baccata-Fagus orientalis; Kavaklı - Yenice, Karabük; 500-1200 m, shady, calcareous luvisol; EuxBI5d: 79

Phytosociology

Alliance: *Trachystemono orientalis-Carpinion betuli* (Euxine mesic broadleaved mixed forests with *Castanea*, *Carpinus*, *Tilia* and *Fagus*, on warm-humid slopes and in ravines)

Associations: *Pruno laurocerasi-Fagetum taxetosum baccatae* Quézel, Barbéro et Akman 1980

References: Aksoy (1982); Quézel et al. (1980)

95x1 * *Abies cilicica* forests

Definition

Coniferous forests dominated by Cilician fir (Taurus fir, *Abies cilicica* with subspecies *cilicica* and *isaurica*) occur between 1150 and 2000 m on north-facing slopes and at 1450-1550 m on south-facing slopes in the central Taurus Mountains. Areas of excellent growth of the firs are generally between 1200 and 1800 m. *A. cilicica* stands are commonly mixed with *Pinus nigra* and *Cedrus libani*. Pure fir stands are mainly found on northern slopes. Two subspecies of the Taurus fir are distinguished: *A. cilicica* subsp. *isaurica* is a regional endemic of southwest Turkey while the distribution range of subsp. *cilicica* comprises extensive areas in southern Anatolia and small areas in Lebanon and Syria.

Site conditions

The harsh Mediterranean mountain climate is comparatively humid with cold snowy winters. The rocky slopes with dolomitic, limestone and ophilitic substrates and poorly developed soils are prone to severe erosion. The canopy of the fir forests is mostly open. Many stands are mixed coniferous; pure fir stands may occur in places where cedar and black pine had been cleared for timber (Atalay 1987).

Distribution and variability inTurkey:

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

There is a west-east biogeographical gradient in Turkish *Abies cilicica* forests along the Taurus Mountain range reflected by habitat variability and species compostion, not least by the geographically and genetically more or less isolated fir populations themselves.

- *Abies cilicica* subsp. *cilicica* occurs in much of the Central Taurus Mountains (Cilician Taurus) and the Nur Mountains (Amanos, Nur Dağları).
- *Abies cilicica* subsp. *isaurica* has a restricted area in the western (Isaurian) Taurus (provinces of Antalya and Konya east of the line Antalya – Burdur) including the protected area of the Köprülü Kanyon National Park. Much of the forest is degraded chiefly due to the effects of wildfires, grazing and cutting. IUCN Red list assessment considers subspecies *isaurica* vulnerable and its population trend decreasing (Gardner & Knees 2013).

Furthermore, the habitat type shows considerable altitudinal and topoclimatic variation:

- At supramediterranean levels *Abies* occurs in meso-xerophytic pure stands or mixed with black pine, oaks, Oriental hornbeam and/or junipers (*Pinus nigra, Quercus libani, Carpinus orientalis, Juniperus drupacea, J. oxycedrus*).
- *Abies* forms often mixed coniferous stands in the oromediterranean belt with *Cedrus libani* or *Juniperus excelsa*.
- On shady slopes and in ravines fir occurs together with deciduous oak, maple and hop hornbeam trees (*Quercus petraea* subsp. *pinnatiloba*, *Acer hyrcanum, A. platanoides, Ostrya carpinifolia*)
- Successional development stages may be indicated by species such as *Populus tremula*.

Plants

Trees and shrubs: *Abies cilicica* subsp. *cilicica* and subsp. *isaurica*, *Acer cappadocicum, A. hyrcanum* subsp. *tauricolum, A. platanoides, Berberis crataegina, Carpinus orientalis, Cedrus libani, Cotoneaster nummularius, Crataegus orientalis, Genista albida, Hippocrepis emerus* subsp. *emeroides, Juniperus drupacea, J. excelsa, J. foetidissima, J. oxycedrus, Lonicera nummulariifolia, Pinus nigra* subsp. *pallasiana, Rubus canescens, Quercus cerris, Q. libani, Q. petraea* subsp. *pinnatiloba, Ostrya carpinifolia, Sorbus torminalis, Viscum album* subsp. *abietinum*

Herbs: *Alyssum strigosum* subsp. *cedrorum, Anemone blanda, Aremonia agrimonoides, Asyneuma amplexicaule, Brunnera orientalis, Bunium microcarpum, Campanula psilostachya, Cephalanthera rubra, C. kurdica, Clinopodium vulgare, Corydalis tauricola, Crepis reuteriana, Cyclamen cilicium, Drymocallis calycina, Euphorbia erubescens, Galium peplidifolium, Geum heterocarpum, Hypericum lydium, Lactuca fenzlii, L. microcephala, Laser trilobum, Lathyrus cilicicus, L. spathulatus* subsp. *elongatus, Lecokia cretica, Noccaea haussknechtii, N. violascens, Phlomis samia, Physospermum cornubiense, Potentilla kotschyana, Scilla cilicica, Securigera libanotica, Sesleria alba, Silene aegyptiaca, S. italica, Tanacetum cilicium, Thlaspiceras oxyceras, Trifolium caucasicum, Verbascum amanum, Vicia dalmatica, Viola cilicica, V. sieheana.*

Additional notes

Records in the last four decades show that summer temperatures in southern Anatolia are rising and the annual rainfall has decreased significantly. These trends are creating an increased risk of fire, and are also contributing to a decrease in the general health of the trees which makes them more vulnerable to pathogen attack and causes canopy die-back (http://www.iucnredlist.org/

details/42275/0). Fire risk in the montane coniferous belt is also increased by growing tourist numbers and recreational activities.

Mixed coniferous forests of *Abies cilicica* where *Pinus nigra*, *Cedrus libani,* or arborescent *Juniperus* dominate belong to the habitat types 9530, 95x2 or 9560, respectively.

Records

Potentilla calycina-Abies cilicica; near Pos (Central Taurus); 1300-1500(-2000) m, steep shady (N, W, E) slopes on limestone and serpentine; MeditA18c: 221

Lecokia cretica-Abies cilicica; Bolkar Dağları near Namrun (Çamlıyayla); 1400-1800 m, karstic terrain, limestone-dolomite, S, E and W aspects; MeditA18d: 221

Acer hyrcanum subsp. *tauricolum-Abies cilicica*; scattered between Amanos (Nur Dağları) and Akseki (western Taurus); 1400-1900 m, karstic terrain, limestone-dolomite; MeditA18e: 222

Sesleria alba-Abies cilicica; Aladağ, Maden-Emli Ormanı; 1600-2000 m, hard limestone; MeditA18f: 223

Vicia crocea-Abies cilicica; Amanos (Nur Dağları); 1600-2100 m, shade aspect, siliceous brown soil; MeditA18h: 226

Phytosociology

Alliance: *Abieto cilicicae-Cedrion libani* (Relict supra- and oromediterranean fir and cedar coniferous woods of the central Taurus and the Amanos Mountains, Southern Anatolia)

Associations: *Potentillo calycinae-Abietetum cilicicae* Akman, Barbéro et Quézel 1979, *Lecokio creticae-Abietetum cilicicae* Akman, Barbéro et Quézel 1979, *Acero tauricoli-Abietetum cilicicae* Akman, Barbéro et Quézel 1979, *Thlaspio cataonici-Abietetum cilicicae* Akman, Barbéro et Quézel 1979, *Verbasco amani-Abietetum cilicicae* Varol et al. 2006

References: Kürschner (1982); Kürschner (1984); Quézel (1973); Quézel et al. (1980); Quézel & Pamukçuoğlu (1973); Varol et al. (2006)

95x2 * *Cedrus libani* forests

Definition

Cedrus libani subsp. *libani* is an endemic tree species of the mountains adjacent to the northeastern Mediterranean coast from Southern Turkey to Lebanon and Syria. Turkey hosts by far the most extensive forests. They range from 800 to 2000 m on the southern supra- to oromediterranean slopes of the Taurus Mountains. *Cedrus* forms the tree line in the inner parts of the mountain range at 2200 m.

Site conditions

Cedrus libani forests occur chiefly at north-faced and westerly slopes, avoiding the pronouncedly maritime region as well as the continental climate of the Anatolian plateau. Its optimum is the transitional area between the Mediterranean and the Inner Anatolian region (Atalay 1987). The winters are moist and cool with abundant snow in the high mountains. Cedar forests occur in mixed and pure stands, at elevations of (800-)1000–1800(-2000) m in the southern West and Central Taurus, between (1400-)1550 and 2000(-2100) m on the shady Taurus slopes, from (500-)600 to 1800(-2000) m in the Amanos Mountains, and in the Black Sea region near Erbaa-Tortepe at (700-)1000–1300 m. The southern slopes have a Mediterranean montane climate with summer drought and high amounts of snow in winter. Annual precipitation ranges from 800 to 2000 mm. Cedar grows on all kinds of calcareous bedrock including Tertiary marls and Mesozoic limestones, rarely also on quartzite. The floristic composition and syntaxonomic position is controlled chiefly by biogeographical affinities and aspect rather than by soil type (Fontaine et al. 2007; Kavgacı and Čarni 2012).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The total area of cedar forests in Turkey has been estimated as 400,000 hectares (Kavgacı et al. 2010a).

The best preserved cedar forests occur between Bozdağ (Acıpayam, Denizli) in the west and Ahır Dağı (Maraş, Kahramanmaraş) in the east and the province of Hatay (Amanos, Nur Dağları) in the southeast. In addition there are two small remnant subpopulations in the Black Sea region (Erbaa, Niksar) (Boydak 1996). Its distribution range continues towards the southern boundary of Inner Anatolia. Approximately one third of the cedar forests are in a severely degraded state (Boydak 1996). The populations of *Cedrus libani* are fragmented and the species is considered vulnerable with decreasing population trend (Gardner 2013).

Supramediterranean cedar stands are often mixed with *Pinus nigra* or even *P. brutia*, while at higher elevations *Abies cilicica* and *Juniperus excelsa* are frequently associated. In the Western Antalya area (West Taurus) the topographical gradient mainly determines the floristic differentiation patterns of cedar forests (Kavgacı et al. 2010a; Kavgacı and Čarni 2012).

Figure 23. Extensive Cedrus libani forest (95x2) of the western Taurus mountains, province of Antalya, South Anatolia. Photo: U. Hauke, October 2006.

Figure 24. Oromediterranean Cedrus libani forest (95x2) on karstified bedrock of the western Taurus mountains, province of Antalya, South Anatolia. Photo: U. Hauke, October 2006.

Plants

Trees: *Cedrus libani*, *Abies cilicica*, *Juniperus drupacea*, *J. excelsa*, *J. foetidissima*, *J. oxyxedrus*, *Pinus nigra* subsp. *pallasiana*, *P. sylvestris*, *Quercus cerris*, *Q. infectoria*, *Q. libani*, *Sorbus torminalis*

Shrubs: *Berberis crataegina*, *Cotoneaster nummularius*, *Crataegus orientalis*, *S. umbellata*, *Rosa pulverulenta*, *Lonicera etrusca*, *L. nummulariifolia* (subspp. *glandulifera* and *nummulariifolia*)

Herbs: *Elymus panormitanus*, *Alyssum strigosum* subsp. *cedrorum*, *Anemone blanda*, *Asyneuma amplexicaule*, *A. michauxioides*, *A. rigidum*, *Brizochloa humilis*, *Bunium microcarpum*, *Corydalis tauricola*, *Cyclamen parviflorum*, *Delphinium fissum* subsp. *anatolicum*, *Doronicum orientale*, *Dorycnium pentaphyllum* subsp. *anatolicum*, *Galium peplidifolium*, *Geum heterocarpum*, *Helleborus vesicarius*, *Lapsana communis*, *Lecokia cretica*, *Medicago pamphylica*, *Pimpinella tragium* subsp. *polyclada*, *Piptatherum holciforme*, *Potentilla kotschyana*, *Sesleria alba*, *Silene aegyptiaca*, *S. compacta*, *Arabis laxa*, *Vicia dalmatica*, *V. lunata*, *Viola sieheana*.

Additional notes

Mixed coniferous forests with cedar are assignable to 9530, 95x1 or 9560, if *Pinus nigra*, *Abies cilicica* or arborescent junipers (*Juniperus excelsa, J. foetidissima*), respectively, are the predominating trees.

Traditional transhumance (Yaylak pastoralism) in the Taurus Mountains has affected the forest vegetation through many centuries and long-term overgrazing depressed the tree line in most mountains. While the significance of pastoralism is widely decreasing in Turkey, tourism and recreational activities in the mountains are currently increasing and may affect the fir and cedar forests by increasing risk of fire. Climate change entails rising temperatures and decreasing annual precipitation in the eastern Mediterranean and is thus also increasing the risks of wildfires, canopy die-back and pest attacks for cedar forests.

Records

Black Sea:

Pinus sylvestris-Pinus nigra-Cedrus libani; small relic stands near Erbaa and Niksar; (700-)1000-1300 m, south and east aspect, moderately steep slopes on schist and andesite; EuxCII5: 116

Mediterranean South Anatolia:

Noccaea haussknechtii-Cedrus libani; east central Taurus: Feke - Maran Yaylası, Çatıoluk, Taşçı (Bakirdağ, Develi); 1600-1900 m, limestone, flysch, moderately steep N, E and W slopes; MeditA19b: 228

Quercus petraea subsp. *pinnatiloba-Cedrus libani*; Amanos (Nur Dağları); 1400-1800 m, rocky sites, limestone, quartzite, grauwacke; MeditA19b: 228

Sesleria alba-Cedrus libani; west central Taurus: Elmalı Boğazı and Bolkar Mountains (Bolkar Dağları); MeditA19b: 229

"Alliaria officinalis"-Cedrus libani; western Taurus: Çığlıkara Nature Reserve, Kumluca (Bey Dağları) (Antalya); 1600-2000 m, karstic limestone; MeditA19c: 231

Piptatherum holciforme-Cedrus libani; (1000-)1400-1600 m, rendzina, karstic limestone; MeditA19c: 233

Paeonia kesrouanensis (*P. turcica*)-*Cedrus libani*; humid valley sites, brown rendzina; MeditA19c: 233

Vicia dalmatica-Cedrus libani; metamorphic limestone, mull rendzina, 1450-1950 m; MeditA19: 233

Phytosociology

Alliance: *Lonicero nummulariifoliae-Cedrion libani* (Supra- and oromediterranean *Cedrus* forests of the western Taurus Mountains)

Associations: *Alliario officinalis-Cedretum libani* Akman, Barbéro et Quézel 1979, *Oryzopsido holciformis-Cedretum libani* Akman, Barbéro et Quézel 1979; *Festuco valesiacae-Cedretum libani* Kavgacı et al. 2010; *Hyparrhenio hirtae-Cedretum libani* Kavgacı et al. 2010; *Verbasco pycnostachyi-Cedretum libani* Kavgacı et al. 2010;

Alliance: *Abieto cilicicae-Cedrion libani* (Relict supra- and oromediterranean fir and cedar coniferous woods of the central Taurus and the Amanos Mountains, Southern Anatolia)

Associations: *Thlaspio microstyli-Cedretum libani* Varol et Tatlı 2001; Thlaspio cataonici-Cedretum libani Akman, Barbéro et Quézel 1979; *Abieto-Cedretum libani* Ocakverdi and Çetik 1987; "*Cedrus libani* forest" (Ayaşlıgil 1987); *Lathyro variabilis-Cedretum libani* Duman 1995; *Cedretum libani* Bekat 1987; *Cicerbito variabilis-Cedretum libani* Serin and Eyce 1994; *Alysso mouradicae-Cedretum libani* Serin 1996.

References: Schwarz (1936); Sevim (1952); Quézel (1973); Quézel and Pamukçuoğlu (1973); Quézel et al. (1980); Kürschner (1982); Kürschner (1984); Ayaşlıgil (1987); Atalay (1994); Serin and Eyce (1994); Duman (1995); Varol and Tatlı (2001); Kavgacı et al. (2010a); Kavgacı and Čarni (2012); Gardner (2013)

96x1 * East Anatolian deciduous oak forests

Definition

The habitat type includes semideciduous steppe oak forests of East Anatolia with *Quercus petraea* subsp. *pinnatiloba, Q. libani* and *Q. robur* subsp. *pedunculiflora*. The habitat type reaches into adjacent Armenia, Iran and Iraq, and biogeographic affinities are Irano-Turanian. The lower altitudinal limit is about 700 m (submontane), while the upper exceeds 2300 m (subalpine). Different oak species predominate while rosaceous trees and shrubs and arborescent junipers, often stunted, are admixed.

Site conditions

The montane forest steppe climate has continental character with a marked summer drought, rainy springs and large annual temperature amplitude, intensified in the mountains by high thermal radiation due to the altitude. The ecological boundaries (hygric tree line) of semi-humid forest and semi-arid steppe are estimated at 300–350 mm per year. Soils associated with steppe vegetation and cultivated lands in East Anatolia include kastanozems.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The habitat variability, distribution, syntaxonomic affinities and conservation status of the East Anatolian deciduous oak forests is insufficiently known.

Figure 25. Quercus libani grazed open coppice woodland (96x1), province of Tunceli, East Anatolia. Photo: U. Hauke, July 2006.

Figure 26. Erosion-prone slope with oak woodland (96x1) of fairly natural character, province of Bitlis, East Anatolia. Photo: U. Hauke, July 2005.

Plants

Trees and shrubs:, *Quercus libani*, *Q. petraea* subsp. *pinnatiloba*, *Q. robur* subsp. *pedunculiflora*, *Q. brantii*, *Q. infectoria* subsp. *veneris*, *Q. macranthera* subsp. *syspirensis, Acer monspessulanum* subsp. *cinerascens, A. tataricum, Anagyris foetida, Celtis tournefortii, Cercis siliquastrum, Cotoneaster nummularius, Crataegus azarolus, C orientalis, C. pseudoheterophylla, Colutea cilicica, Daphne mucronata, Fontanesia phillyreoides, Juniperus drupacea, J. excelsa J. oxycedrus, Lonicera nummulariifolia, Malus sylvestris* subsp. *orientalis, Malus trilobata, Paliurus spina-christi, Pistacia khinjuk, Populus tremula, Prunus argentea, P. dulcis, P. mahaleb, P. microcarpa, Pyrus elaeagrifolia, P. syriaca, Rhamnus kurdica, Sorbus persica, S. tamamschjanae, S. takhtajanii, S. umbellata*

Herbs: *Astracantha diphtherites, Marrubium parviflorum, Phlomis kurdica, P. armeniaca.*

Additional notes

Most stands have been used as wood pasture and the arboreal components have commonly been coppiced or have been cut irregularly for firewood. To distinguish the forests of habitat type 96x1 from more open or fragmented woody formations the following structural minimum standards are defined. The list of criteria should be included in the mapping guidelines; each criterion is to be fulfilled:

- Wooded stand area at least 4 ha
- Minimum stand height 3 m
- Minimum canopy (crown) closure of the ground area 30 %, i.e. low to densely wooded stands are included but not sparsely or very sparsely wooded stands (Jennings et al. 1999).

Very open savannah-like pastures with solitary or widely scattered trees should be mapped as habitat type 96x3 (Anatolian wooded pastures).

Records

Juniperus excelsa-Quercus petraea subsp. *pinnatiloba*; N side of Nemrut Dağı; steppe wood between (1700-)1800 and 2600(-2700) m; StepIII2a: 170

Quercus robur subsp. *pedunculiflora*; Murat valley, sheltered slopes between Muş and Erzurum, steppe coppice-wood, 1300-1500 m; StepIII2b: 170

Quercus libani; Tunceli, Elâzığ – Bingöl; StepIV2b: 178

Phytosociology

No appropriate phytosociological concept within the *Quercetalia brantii* appears to be available for the Inner Anatolian xerophytic deciduous oak and juniper steppe forests.

Associations: "*Juniperus excelsa-Quercus petraea* subsp. *pinnatiloba*-Steppenwald" (Mayer and Aksoy 1986: 170), "*Quercus robur subsp. pedunculiflora*-Steppenwald" (Mayer and Aksoy 1986: 170); *Astragalo lamarckii-Quercetum brantii* Tel 2001

References: Zohary (1973); Mayer and Aksoy (1986); Tel (2001)

96x2 * Southeast Anatolian deciduous oak forests

Definition

Xerophytic semideciduous steppe oak forests with *Quercus brantii*, of the Irano-Turanian biogeographic region, extending from southeastern Anatolia into Lebanon, Syria, Iraq, and the Iranian Zagros Mountains.

Site conditions

Mountain steppe forest in continental-semiarid montane climates with pronounced summer drought, intensified by high thermal radiation depending on altitude. At an altitude of about 1200 m the yearly precipitation amounts to 750-850 mm and mean annual temperature is 11.5 °C. *Quercus brantii*, the most representative species of the oak forest remnants, is tolerant of aridity and low temperatures but sensitive to heavy snowfall. Bedrock in wooded areas is frequently volcanic. Soils in cultivated areas of Southeast Anatolia are fertile and include kastanozems.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The habitat variability, distribution, syntaxonomic affinities and conservation status of the Southeast Anatolian xerophytic deciduous oak forests are insufficiently known.

Figure 27. Heavily grazed open deciduous mixed oak forest (96x2) of *Quercus infectoria* subsp. *veneris*, *Q. brantii* and *Q. cerris* in the province of Şanlıurfa, Southeast Anatolia. The woodland lacks oak regeneration and is therefore in poor conservation status. Photo: U. Hauke, May 2005.

Figure 28. East Anatolian mixed deciduous forest (96x2) of pollarded and irregularly coppiced oaks at 1400 m in the Nemrut National Park, province of Adıyaman, Southeast Anatolia. Photo: U. Hauke, May 2005.

Plants

Trees and shrubs: *Quercus brantii*, *Q. libani* *Q. cerris*, *Q. infectoria* subsp. *veneris*, , *Acer monspessulanum* subsp. *cinerascens*, *Anagyris foetida*, *Celtis tournefortii*, *Colutea cilicica*, *Cotoneaster nummularius*, *Crataegus azarolus*, *C. orientalis*, *Paliurus spina-christi*, *Pistacia atlantica* subsp. *mutica*, *P. khinjuk*, *Prunus argentea*, *P. cocomilia*, *P. dulcis*, *P. microcarpa*, *Pyrus syriaca*, *Rhamnus kurdica*, *Sorbus persica*, *S. tamamschjanae*, *S. takhtajanii*, *S. umbellata*

Herbs: *Astracantha diphtherites*, *A. lamarckii*, *Corydalis haussknechtii*, *Crocus leichtlinii*, *Hyacinthella siirtensis*, *Iris persica*, *Nepeta trachionitica*, *Phlomis kurdica*, *Viola modesta.*

Additional notes

Most stands have been used as wood pasture and coppice-woods or have been cut irregularly for firewood. To distinguish the oak forests of habitat type 96x2 from very open or fragmented woody formations in Southeast Anatolia the following structural minimum standards are defined. The list of criteria should be included in the mapping guidelines; each criterion is to be fulfilled:

- Wooded stand area at least 2 ha
- Minimum stand height 2 m
- Minimum canopy (crown) closure of the ground area 30 %, i.e. low to densely wooded stands are included but not sparsely or very sparsely wooded stands (Jennings et al. 1999).

Very open savannah-like pastures with solitary or widely scattered trees and shrubs are also of considerable nature conservation value especially in East and Southeast Anatolia and should be mapped as habitat type 96x3 (Anatolian wooded pastures).

Records

Quercus cerris; N of Malatya; StepIV2c: 178

Quercus brantii; Diyarbakır – Ziyaret Tepe; brown soils, heavily browsed scrub of 1-2 m; StepIV2a: 177

Phytosociology

No appropriate phytosociological concept within the *Quercetalia brantii* appears to be available for the Southeast Anatolian xerophytic semi-deciduous oak steppe shrubs and forests.

Associations: "*Quercus brantii*-Steppenwald" (Mayer & Aksoy 1986: 177); *Nepeto trachioniticae-Quercetum brantii* Kaya et al. 2009; *Astragalo lamarckii-Quercetum brantii* Tel et al. 2010

References: Zohary (1973); Mayer and Aksoy (1986); Kaya et al. (2009); Basiri (2010); Tel et al. (2010)

96x3 Anatolian and East Mediterranean wooded pastures

Definition

The habitat type includes extensive dehesa-like landscapes under agroforestry and pastoral land use systems of Anatolia and the eastern Mediterranean encompassing copses, open wood and shrub patches and adjacent pastures. They form mosaic patterns of woody vegetation, dry or mesic grassland and sometimes arable or fallow fields. Light-demanding species prevail, and species richness is generally high due to diverse ecological structures and ecotones, dynamics and human land use history. The ecosystems depend to various degrees on non-intensive multiple land use such as pastoralism, coppicing, pollarding, and small-scale agriculture.

Site conditions

Climate and soils vary according to geographical, topographical and geological conditions. Soil developments, mineralization and organic matter content depend on the abiotic conditions and land use. Many Anatolian locations of agro-silvopastoral systems have been subject to human impact since many centuries or even millennia. Much of the ancient semi-natural woodlands in Anatolia have been coppiced for firewood, irregularly or following cycles of 15-25 years. Coppicing is frequently associated with wood pasture and pollarding, while arable fields may be included in suitable topographic and edaphic situations. Small-scale pastoral, agricultural historical and silvicultural historical land use is still practiced in different regions of Anatolia and the eastern Mediterranean. Continuous overexpoitation of wood resources has led to a serious decline of the wood component of pastures in East and Southeast Anatolia in the past decades. Very open savannah-like pastures with solitary or widely scattered trees and shrubs are of considerable nature conservation value. Many such open woodlands harbour remarkable gnarled old trees which provide a variety of microhabitats such as bark crevices, dead wood and tree cavities supporting rare fungi, invertebrates and bats. Wooded pastures also encompass the local diversity of hedges, scrub, field margins and grassland. The habitat type incorporates much of the biodiversity of the cultural landscapes in rural Turkey.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The habitat type as defined here occurs throughout Turkey, the East Mediterranean, further in parts of the Near East and the southern Balkans. In Turkey, the following regional subtypes may be distinguished:

A: East Thracian and Northwest Anatolian wooded pastures with remnants of deciduous and evergreen copses;

B: North and Northeast Anatolian wooded pastures with remnants of deciduous and evergreen mixed copses;

C: Central Anatolian wooded pastures with remnants of deciduous oak copses and scrub;

D: Aegean and South Anatolian wooded pastures with remnants of deciduous and evergreen oak copses, juniper matorral and garigues;

E: East and Southeast Anatolian wooded pastures with remnants of semideciduous oak copses and *Pistacia* scrub. Very open savannah-like pastures with solitary or widely scattered trees and shrubs are of considerable nature conservation value especially in East and Southeast Anatolia because of the serious and continuous overexploitation of woods in those areas in the recent decades.

Figure 29. Agro-silvopastoral landscape (96x3) with coppiced and pollarded oaks (*Quercus brantii)*, province of Mardin, Southeast Anatolia. Photo: U. Hauke, March 2006.

Figure 30. Pollarded oaks scattered in cultivated cereal fields (96x3), Nemrut National Park, province of Adıyaman, Southeast Anatolia. Photo: U. Hauke, May 2005.

Woody plant species

(A) *Quercus cerris, Q. frainetto, Q. trojana, Q. pubescens, Q. petraea, Q. infectoria, Acer campestre, A. tataricum, Carpinus orientalis, Fraxinus angustifolia, Prunus cocomilia, Pyrus elaeagrifolia, Ulmus minor*

(B) *Quercus cerris, Q. macranthera* subsp. *syspirensis, Q. petraea* subsp. *iberica, Q. pubescens, Acer campestre, A. cappadocicum, A. hyrcanum, Carpinus betulus, C. orientalis, Castanea sativa, Fagus orientalis, Fraxinus angustifolia, Pinus nigra, P. sylvestris, Prunus spinosa, Pyrus elaeagrifolia, Staphylea pinnata*

(C) *Quercus pubescens, Q. cerris, Q. robur s. l., Celtis australis, Pyrus elaeagrifolia*

(D) *Q. cerris, Q. coccifera, Q. ithaburensis* subsp. *macrolepis, Carpinus orientalis, Colutea arborescens, Fraxinus ornus, Q. infectoria, Q. petraea* subsp. *pinnatiloba, Q. libani, Pinus brutia, P. nigra, Pistacia lentiscus, P. terebinthus*

(E) *Quercus brantii, Q. libani, Q. robur* subsp. *pedunculiflora, Q. cerris, Acer monspessulanum* subsp. *cinerascens, A. tataricum, Fraxinus ornus, Juniperus excelsa, J. oxycedrus, Pistacia atlantica, P. khinjuk, Pyrus syriaca.*

Additional notes

Only extensive wooded pastures, characteristic at the landscape scale, are included. As land-use conditions for the residents are subject to change the character of the wooded pasture is and will be changing too. Regular monitoring is essential to trace the local and regional effects on vegetation and habitat structures of altering environmental conditions and new economic and political incentives.

To distinguish the wooded pastures of habitat type 96x3 from woodland habitat types the following structural minimum standards are defined. The criteria should be included in the mapping guidelines; each criterion is to be fulfilled:

- Wooded pasture area at least 100 ha (eventual discontinuities, e.g., other habitat types or settlements, are possible and not to be included in the total minimum area)
- Maximum canopy (crown) closure (Jennings et al. 1999) of the ground area 30 %, i.e. sparsely or very sparsely wooded stands are included but not more densely wooded stands; the latter would be assignable to the appropriate forest habitat type.

Open woodlands with a high proportion of wild fruit trees and shrubs are to be distinguished and mapped as habitat type 96x4 (Wild orchards).

Phytosociology

The habitat type 96x3 (Wooded pastures) includes a great number of phytosociological associations, most of which as yet undescribed. While most groves and copses belong to forest alliances (e.g., *Carpino betuli-Acerion hyrcani, Quercion anatolicae, Quercion confertae, Ostryo-Quercion pseudocerridis, Quercion brantii*), hedges and scrub may be referable to alliances such as the *Buxo-Staphylion pinnatae, Berberidion vulgaris, Eryngio campestris-Paliurion spinae-christi, Berberido creticae-Prunion cocomiliae*, and no doubt to other units that await cognition. The vegetation of many linear formations and ruderal sites, which are also included, are virtually unknown in Turkey.

96x4 Wild orchards and other wild fruit woodlands

Definition

The habitat type includes groves of wild fruit trees scattered within, or at the margins of, arable or fallow fields or pastures ("wild orchards") as well as natural and semi-natural open wild fruit woodlands on rocky outcrops specifically in Inner Anatolia. Wild orchards are remnants of an ancient cultural landscape. Due to increasing intensification of agriculture they have disappeared to a large extent.

Site conditions

Natural fruit woodlands and shrublands occur chiefly between 800 and 1600 m in areas with annual precipitation amounts of 400-1000 mm on grey steppe soils and brown soils over igneous rock. Wild orchards occur locally and by human selection and are irregularly distributed. They may be associated with certain geological conditions (such as volcanic rock outcrops).

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The distribution, habitat variability and conservation status of wild orchards and fruit woodlands in central, eastern and southeastern Anatolia is poorly known.

"Wild orchards" are assemblages of wild fruit trees in the vicinity of cultived lands and villages, kept for the crop of fruit and to provide shady resting places in the hot Anatolian summers. In addition, the trees may be used as stock for grafted fruit varieties, e.g. domestic pears have been grafted upon *Pyrus elaeagrifolia* or *P. spinosa*, almonds on *Prunus webbii*.

The habitat type as defined here includes moreover native fruit tree and shrub species in natural environments such as rock outcrops; such associations are dominated by *Crataegus*, *Prunus* (incl. *Amygdalus*, *Cerasus*), *Pyrus* and others.

Figure 31. Western Inner Anatolian open fruit-tree wood-pasture with *Pyrus elaeagrifolia* (96x4), about 1400 m, province of Ankara. Photo: U. Hauke, June 2005.

Woody plant species

Pyrus elaeagrifolia, P. spinosa, P. syriaca, Prunus argentea, P. cerasifera, P. cocomilia, P. balansae, P. spinosa, P. webbii, Berberis crataegina, Celtis tournefortii, Cotoneaster nummularius, Crataegus monogyna, C. orientalis, Jasminum fruticans, Juglans regia, Lonicera etrusca, Malus sylvestris s.l., *Malus trilobata, Rhamnus lycioides* s.l., *R. saxatilis* subsp. *rhodopea, Rosa* div. spec., *Ulmus minor*

Additional notes

East Anatolian *Juglans regia* mixed woodlands are tentatively included here.

To enable characterization, assessing and mapping of the habitat type, the following structural minimum standards are defined. The list of criteria should be included in the mapping guidelines; each criterion is to be fulfilled:

- Surface area size of each single stand at least 0.5 ha (discontinuities, e.g., other habitats or settlements, are possible; separate stands in close proximity are to be regarded cumulatively)
- Minimum height of scattered fruit trees and bushes at least 2 m

- Mean distance of scattered trees in "wild orchards" at least 30 m or, correspondingly, 10 trees per hectare.

Records

Thymus sipyleus-Pyrus elaeagrifolia; scattered in Inner Anatolia: Beyşehir, Erciyes Dağı; 1100-1800 m, grey steppe soils, open steppe woodland; StepII4b: 163

Crataegus monogyna; near Ankara; margins of pubescent oak woods; brown soils on basalt; StepII4b: 163

Pyrus elaeagrifolia-Pyrus syriaca; near Erzincan; 2000 m, south-faced slopes; wild fruit steppe woodland and scrub; StepIII2f: 172

Juglans regia; Elazığ – Malatya; mixed steppe wood; StepIV2c: 178

Phytosociology

The plant communities involved appear to be neglected and are phytosociologically undescribed.

References: Woldring & Cappers (2001)

5210 Arborescent matorral with *Juniperus* spp.

Definition

Thermo- to supramediterranean evergreen sclerophyllous scrub with arborescent junipers. Of the subtypes of juniper-dominated matorral recognized in Europe, the following have been recorded in Turkey: *Juniperus drupacea*, *J. excelsa*, *J. foetidissima*, *Juniperus oxycedrus* s.l. and *Juniperus phoenicea* s.l. Arborescent matorrals dominated by *Juniperus excelsa* and/or *J. foetidissima* are a particularly prominent habitat type in Inner Anatolia and the Near East.

Site conditions

Juniperus oxycedrus and *J. excelsa* are found in Turkey up to the high mountains. They may be dynamically related and spatially associated with *Juniperus excelsa* woodlands which belong to the habitat type 9560 (Endemic forests with *Juniperus* spp.). In fact, if not in topoclimatically exposed sites, the *J. excelsa* matorral is often the result of cutting and long-term overexploitation of the *Juniperus* woodland. Otherwise, the environmental conditions of the "forest" and the "matorral" habitats are similar.

Matorral of *Juniperus phoenicea* s.l. grows chiefly near the coasts in Turkey and, if on dunes or other sandy substrates, belongs to habitat type 2250.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Figure 32. Juniperus excelsa arborescent open matorral (5210), province of Sivas, Eastern Inner Anatolia. Photo: U. Hauke, August 2005.

Figure 33. Juniper arborescent matorral with *Juniperus excelsa* and *Paliurus spina-christi* (5210), province of Karabük, North Anatolia. Photo: C. Güngöroğlu, June 2017.

Plants

Trees and shrubs: *Juniperus excelsa*, *J. oxycedrus s.l.* (in South Anatolia perhaps also the similar *J. deltoides* which has not hitherto been distinguished in Turkey), *J. phoenicea* s.l. (probably subsp. *turbinata*); furthermore and infrequently associated: *Juniperus drupacea*, *J. foetidissima*, *Arbutus andrachne*, *Berberis crataegina*, *B. "integerrima"*, *Buxus sempervirens*, *Carpinus orientalis*, *Celtis australis*, *C. tournefortii*, *Colutea cilicica*, *Cotoneaster nummularius*, *Fontanesia phillyreoides*, *Jasminum fruticans*, *Olea europaea*, *Paliurus spina-christi*, *Phillyrea latifolia*, *Pinus brutia*, *P. nigra*, *Pistacia atlantica*, *P. lentiscus*, *P. terebinthus* s.l., *Prunus argentea*, *Punica granatum*, *Quercus coccifera*, *Q. infectoria* s.l., *Q. pubescens*, *Rhamnus lycioides* subsp. *graeca*

Additional notes

Woodland composed of arborescent juniper of medium to high elevations represents habitat type 9560 if single- or few-stemmed tall juniper trees prevail. *Juniperus* forest and arborescent matorral are composed of much the same species and may occur next to each other in similar environments.

In contrast to the forest habitat type, the junipers in habitat type 5210 are generally lower and invariable shrubby, and the stands are often denser.

Records

Black Sea:

Pistacia atlantica-Juniperus excelsa; widespread in the western Black Sea region: Safranbolu, Kastamonu, Sakarya, Erbaa (central sector), Tosya, Ilgaz Dağları; thermophytic Mediterranean-type brushwood, sun-exposed eroded limestone habitats between (200-)400-1200(-1400) m, marl and alluvia; EuxBII2a: 89

Pistacia atlantica-Juniperus excelsa; widespread in the Central Black Sea region: Mediterranean relic scrub; EuxCII2a: 113

Juniperus oxycedrus-Pistacia terebinthus; scrub in warm and dry, sheltered valley sites, siliceous rock with favourable mesoclimate; EuxDII2c: 134

Juniperus excelsa; Sakarya river valley; 200-400 m, rocky limestone outcrops; Mediterranean-type brushwood; MeditB19: 261

Mediterranean South Anatolia:

Juniperus foetidissima; near Termessos; mesomediterranean brushwood, (350-)700-900 m, south-faced slopes, eroded calcareous soils; MeditA21a: 235

Juniperus oxycedrus; widespread in meso- to oromediterranean South Anatolia; juniper scrub substituting degraded *Quercus coccifera* forest, 900-1900 m; MeditA21b: 235

Phytosociology

Alliance: *Juniperion excelso-foetidissimae* (Supramediterranean montane tall juniper woods on shallow soils over limestone, marls and ultramafic substrates of the south-central Balkans, Greece and western Anatolia)

Associations: *Anemono blandae-Juniperetum excelsae* Brullo et al. 2001

Alliance: *Jasmino-Juniperion excelsae* (Peri-Euxine submediterranean open juniper-oak woods of edaphically dry habitat conditions)

Associations: “Mediterraneer *Juniperus excelsa*-Buschwald” (Mayer & Aksoy 1986: 261)

Alliance: *Berberido creticae-Juniperion foetidissimae* (Oromediterranean to subalpine juniper and pine woods and related scrub of continental Greece, Cyprus, Anatolia, Syria and Lebanon)

Associations: “*Juniperus oxycedrus* ssp. *oxycedrus*-Gebüsch” (Mayer & Aksoy 1986: 235)

References: Brullo et al. (2001); Brullo et al. (2004)

5230 * Arborescent matorral with Laurus nobilis

Definition

Thermo-hygrophilous arborescent matorral of mesomediterranean character with prominent tall-growing laurel (*Laurus nobilis*). Similar but lower vegetation with a considerable proportion of laurel apply to the habitat code 5310.

Site conditions

In Turkey, *Laurus nobilis* reaches its eastern distribution limits and is largely confined to the windward lower slopes of the Black Sea region and scattered meso-thermophilous maquis above the South Anatolian coast. The *Phillyrea latifolia-Laurus nobilis* maquis has been recorded in southern Anatolia at supramediterranean levels, in the area east of the North Anatolian Samsun in shady sites chiefly from sea level to 100 m, on limestone and schist.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

Shrubs, trees and woody climbers: <u>*Laurus nobilis*</u>, *Arbutus unedo, Carpinus orientalis, Celtis australis, Dioscorea communis, Jasminum fruticans, Juniperus oxycedrus, Ligustrum vulgare, Myrtus communis, Phillyrea latifolia, Quercus ilex, Rhamnus alaternus, Smilax aspera, S. excelsa, Vitis vinifera*

Herbs and subshrus: *Asparagus acutifolius, Helleborus orientalis, Osyris alba, Piptatherum miliaceum, Primula acaulis.*

Additional notes

Differential species against the thermophilous low-growing type of *Laurus* thickets (5310) are mainly deciduous trees such as *Carpinus orientalis, Castanea sativa, Celtis australis, Ostrya carpinifolia*. Scattered rather than (co-)dominant may laurel also occur in other habitat types chiefly of the *Quercetalia ilicis*.

Records

Phillyrea latifolia-Laurus nobilis; narrow coastal strip of the middle Euxine region to Samsun and beyond (Trabzon); 0-100 m, shady conditions, limestone and schist; EuxCI2: 107

Laurus nobilis; Mersin-Silifke; supramediterranean; MeditA7b: 195

Phytosociology

Alliance: *Arbuto unedonis-Laurion nobilis* (Relict Mediterranean laurel forests)

Associations: *Phillyreo mediae-Lauretum nobilis* Quézel, Barbéro et Akman 1980 (variant with *Carpinus orientalis*), *Lauro-Pinetum brutiae* Yurdakulol et al. 2002 p.p.

References: Quézel et al. (1980); Yurdakulol et al. (2002)

52x1 East Mediterranean thermo-mesophytic evergreen forest or maquis with *Arbutus andrachne*

Definition

Thermophilous evergreen or semi-evergreen dense maquis, pseudomaquis or forest with species of East Mediterranean distribution such as *Arbutus andrachne*, occurring from southern Albania through Greece and parts of the Mediterranean, Aegean and Euxinian Turkey. The habitat type is commonly dominated by *Arbutus andrachne*, *Phillyrea latifolia* and *Quercus coccifera*, a drought-resistant oak which tolerates heavy browsing, but deciduous trees such as *Carpinus orientalis*, *Fontanesia phillyreoides* and *Fraxinus ornus* may also be prominent.

Site conditions

The habitat type occurs chiefly on limestone, often on rocky slopes with poorly developed or eroded calcareous soils. Most stands form low-grown dense evergreen forests or more commonly shrubby coppice-woods (evergreen maquis and semi-evergreen pseudomaquis) of 2-4 m height. Particularly on cliffs and in ravines natural stands of *Arbutus andrachne* with little or no human influence can be expected. *Quercus coccifera* and *Phillyrea latifolia* are drought-resistant and tolerate heavy browsing. All relevant species are to some degree fire-resistant and regenerate by resprouting.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

In the Black Sea region the habitat type is widespread but scattered. The vegetation is extrazonal and of mesomediterranean character and belongs mainly to the *Erico-Quercion ilicis*.

In the Marmara region and along the Aegean coast (e.g. Gelibolu) stands are often more xero-mesophytic, with a higher proportion of *Quercus coccifera*, and belong chiefly to the *Arbuto andrachnes-Quercion cocciferae*.

In thermo- and mesomediterranean levels of Southwest Anatolia and along the southern coast the thermo-mesic element is scarcer than in the Black Sea region and sclerophyllous species such as *Quercus coccifera* and *Olea europaea* dominate.

Plants

Quercus coccifera, Phillyrea latifolia, Arbutus andrachne, A. unedo, Anthyllis hermanniae, Asparagus acutifolius, Astragalus ponticus, Carpinus orientalis, Calicotome villosa, Celtis australis, Cistus creticus, C. salviifolius, Dioscorea communis, Erica arborea, Ficus carica, Fontanesia phillyreoides, Helleborus orientalis, Juniperus oxycedrus, Osyris alba, Pistacia terebinthus s.l., *Punica granatum, Quercus pubescens, Rhamnus lycioides Rhus coriaria, Ruscus aculeatus, Scutellaria albida, Spartium junceum, Styrax officinalis*

Additional notes

Mediterranean-type coppice-woods in topographically moderate situations in the north-east have been largely destroyed and the sites cultivated with olive plantations.

Records

Black Sea:

Arbutus andrachne-Phillyrea latifolia; near İnebolu and Zonguldak; scrub on south-faced slopes and sheltered north-faced slopes, calcareous and volcanic rock; EuxBI3b: 69

Phillyrea latifolia-Carpinus orientalis; widespread in the central and eastern Black Sea region: Ünye, between Giresun and Trabzon, Zigana, Rize, Çoruh valley; relictic Mediterranean coppice-woods and maquis up to 500 m, limestone habitats with favourable mesoclimate; EuxDI2a: 120

Mediterranean South Anatolia:

Quercus coccifera; Marmara coastal lowlands; scrub; StepI2b: 148

Quercus coccifera, *Olea europaea*, *Arbutus andrachne*; near Mersin and Silifke; various types of thermo- to supramediterranean maquis between 50 and 1200 m, all aspects, Mediterranean soils of the terra rossa and terra fusca types; MeditA7b 195

Quercus coccifera; Amanos foothills; sclerophyllous maquis; MeditA5c 192

Phytosociology

Alliances: *Erico-Quercion ilicis* (Evergreen and semideciduous mesophilous holm oak forests and high maquis in humid Central and East Mediterranean and Black Sea regions); *Arbuto andrachnes-Quercion cocciferae* (Calcicolous meso-xerophytic semideciduous and evergreen oak forests and high maquis in humid East Mediterranean and Black Sea coastal regions)

Associations: *Phillyreae mediae-Carpinetum orientalis* Quézel, Barbéro et Akman 1980; *Siderito dichotomae-Quercetum cocciferae* Karaer et al. 1999; *Cotino coggyriae-Arbutetum andrachnes* Karaer et al. 1999; *Paliuro spina-christi-Fontanesietum phillyreoidis* Karaer et al. 1999; *Spiraeo crenatae-Oleetum sylvestris* Karaer et al. 2010; *Buxo sempervirenti-Arbutetum unedonis* Karaer et al. 2010

References: Karaer et al. (1999); Karaer et al. (2010)

5310 *Laurus nobilis* thickets

Definition

Laurus nobilis thickets represent a lower facies of the arborescent matorral described under 5230.

Site conditions:

The habitat type of low-growing *Laurus nobilis* thickets occurs under environmental conditions similar to those of the tall-growing laurel matorral but the former are generally shaped by wildfire and/or cutting. The thickets grow up to 2(-3) m in height. They are transitional in climate character between thermo- and mesomediterranean and have been found from near sea level up to 850 m in Mediterranean South Anatolia.

Distribution and variabilityin Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Plants

<u>*Laurus nobilis*</u>, *Arbutus unedo*, *Ceratonia siliqua*, *Cistus creticus*, *C. salviifolius*, *Clematis flammula*, *Colutea cilicica*, *Cotinus coggygria*, *Erica arborea*, *Ficus carica*, *Myrtus communis*, *Olea europaea*, *Phillyrea latifolia*, *Pistacia terebinthus* s.l., *Rhamnus alaternus*, *Ruscus aculeatus*, *Smilax aspera*, *S. excelsa*, *Spartium junceum*

Additional notes

Differential features of the habitat type 5310 against the type 5230 of tall-growing laurel matorrals are the stand height (up to 2(-3) m vs. more than 3 m) and the absence of *Quercus ilex* and deciduous tall trees.

Records

Phillyrea latıfolıa-Laurus nobilis-Myrtus communis; between İnebolu and Karasu, Cide, Zonguldak; both sunny and shady slopes; on calcareous and volcanic rock; EuxBI3: 67

Ceratonia siliqua-Laurus nobilis; Mersin-Silifke; maquis, 50-850 m terra rossa and fusca; MeditA7b: 195

Phytosociology

Alliance: *Arbuto unedonis-Laurion nobilis* (Relict Mediterranean laurel forests)

Associations: *Phillyreo mediae-Lauretum nobilis* Quézel, Barbéro et Akman 1980

References: Quézel et al. (1980); Yurdakulol et al. (2002)

5330 Thermo-Mediterranean and pre-desert scrub

Definition

This habitat type includes scrub formations that are best developed or most widespread in the thermomediterranean zone. They occur on a variety of substrates and the species composition depends on the local biogeographic, climate and soil conditions. Many different woody species have the potential to prevail but in most cases only one or two dominate. The vegetation is a small-scale mosaic of low shrubs, subshrubs, and herbaceous vegetation, corresponding to garrigue. For Turkey two subtypes are distinguished here based on present knowledge but others may await recognition.

Site conditions

While the regional climate is typically thermomediterranean, the local climate depends much on aspect, inclination, distance from sea, and bedrock. In particular *Euphorbia dendroides* scrub tends to prevail on hard limestone rocks near the coast and on steep slopes in ravines that offer a certain amount of shelter and humidity. *Pistacia lentiscus* garrigue is generally fully insolated and occurs on a variety of soft and hard calcareous and schistose poorly developed soils that are often slightly exposed to salt spray.

Distribution and variabilityin Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

- Thermomediterranean scrub with *Euphorbia dendroides* occurs on the Balearics, Corsica, Sardinia, Sicily, Isles Eolie, Egadi, Pelagi, Pantelleria, Crete, and, very locally, at the coasts of northern Catalonia, south-eastern France, peninsular Italy, central Greece, notably on slopes facing the gulf of Corinth, the Peloponnese, the Aegean archipelagos, and scattered in the Mediterranean periphery of southwest Anatolia and the Levant, moreover on a few coastal and isolated inland sites in Mediterranean North Africa. The particular plant community with *E. dendroides* of south-west Turkey is known moreover from the islands of the Dodecanese.

- Thermomediterranean low evergreen garrigue-type scrub, wind-pruned and mostly 0.5-1.5 m in height, of the eastern Mediterranean, with *Pistacia lentiscus*, *Ceratonia siliqua*, *Asparagus aphyllus* and *Rubia tenuifolia*.

It is particularly common along the coasts and on coastal cliffs of southern Greece, the Aegean islands, Aegean and southern Anatolia, Cyprus, and Mediterranean North Africa.

Plants

Euphorbia dendroides, Pistacia lentiscus, Anagyris foetida, Asparagus aphyllus subsp. *orientalis, Calicotome villosa, Ceratonia siliqua, Cistus creticus, C. parviflorus, Euphorbia hierosolymitana, Fumana arabica, Genista acanthoclada, Helianthemum stipulatum, Micromeria nervosa, Origanum syriacum, Phlomis viscosa, Prasium majus, Quercus coccifera, Rubia tenuifolia, Salvia fruticosa, Sarcopoterium spinosum, Teucrium creticum, Thymbra capitata.*

Additional notes

Mayer & Aksoy (1986) do not provide locality information on subtypes that match the present habitat type.

Phytosociology

Alliance: *Phlomido fruticosae-Euphorbion dendroidis* (Thermomediterranean calcicolous garrigue on steep coastal slopes of the Eastern Mediterranean)

Associations: *Rubio tenuifoliae-Euphorbietum dendroidis* Géhu, Costa and Uslu 1990

Alliance: *Ceratonio-Pistacion lentisci* (Thermomediterranean sclerophyllous evergreen macchia of the Eastern Mediterranean)

Associations: *Rubio tenuifoliae-Pistacietum lentisci* Gehu, Costa and Uslu 1990

References: Géhu et al. (1990); Brullo et al. (2004)

4060 Alpine and boreal heaths

Definition

Small, cushion-like or prostrate shrub formations of the alpine and sub-alpine zones of the mountains of Eurasia dominated by ericaceous species, *Dryas octopetala*, or *Juniperus communis* subsp. *nana*. The habitat type is represented in Turkey by low shrub formations dominated by dwarf juniper and by *Vaccinium* and *Rhododendron* heaths at or above tree line.

Site conditions

While dwarf juniper (*Juniperus communis* subsp. *nana*) occurs primarily above the tree line it may grow in patches on pastures below timberline, and was found to pervade high montane *Pinus sylvestris* and deciduous woodland opened and depleted through long-term overgrazing and fire. The natural altitudinal range of dwarf juniper heathland in Turkey is between 1700 and 2700 m, locally lower. Juniper heaths occur on stony ground on both metamorphic igneous and siliceous substrata, frequently on windswept ridges and not too dry slopes. *Rhododendron* heathlands are characteristic vegetation growing on undecomposed humus soils in the high mountains of the Northeast Black Sea region.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

- In the eastern Black Sea subregion subalpine and alpine *Rhododendron* heaths with *Rhododendron luteum*, *R. ponticum* and near the border to Georgia *R. caucasisum*.
- Elsewhere in the Black Sea region (Black Sea Dağları) and the Uludağ *Juniperus communis* subsp. *nana* forms a characteristic altitudinal belt of subalpine scrub just above tree line.
- In East Anatolia (e.g., Erciyes Dağı) *J. communis* subsp. *nana* forms scrub in shady sites above the tree line up to 2200 m. At the tree line of the same mountain, stunted *Betula pendula* scrub occurs next to tragacanth alpine heaths. Near Erzincan under sub-Euxine climate influence dwarf juniper is associated with *Convolvulus calvertii* and many other grasses and herbs; further northeast (Mount Djimal) *Vaccinium uliginosum* grows with *Juniperus communis* subsp. *nana*.

Figure 34. High montane low scrub of *Juniperus communis* subsp. *nana* (4060) together with stands of Turkish fir (*Abies nordmanniana* subsp. *equi-trojani*, syn. *A. bornmuelleriana*) (91x8), Ilgaz Dağları (Ilgaz Mountains), province of Kastamonu, Black Sea region, North Anatolia. Photo: U. Hauke, June 2005.

Plants

Juniperus communis subsp. *nana*, *Rhododendron caucasicum*, *R. luteum*, *R. ponticum* subsp. *ponticum*, *Betula pendula*, *Artemisia austriaca*, *Berberis crataegina*, *Convolvulus calvertii*, *Daphne oleoides*, *Genista lydia*, *Hypericum linarioides*, *Polygonum cognatum*, *Prunus prostrata*, *Ribes biebersteinii*, *Sorbus subfusca*, *Vaccinium uliginosum*.

Additional notes

Northeast Anatolian subalpine *Spiraea hypericifolia* scrub, locally with *Fraxinus excelsior* subsp. *coriariifolia*, may also belong to habitat type 4060. There is, however, no vegetation record to confirm this.

Records

Juniperus communis subsp. *nana*; Northwest Anatolian mountains, such as Ilgaz Dağları: 2000-2500 m, metamorphic and calcareous rock; 1800-2000 m, siliceous substrate, replacing degraded coniferous woodland: EuxBII9: 103

Rhododendron luteum-Rhododendron ponticum; Eastern Black Sea region (Doğu Black Sea Dağları); heathland at 2200-2700 m; EuxDI7b: 133

Juniperus communis subsp. *nana*; widespread in Turkey, e.g. Black sea region (Black Sea Dağları), near Bitlis (East Anatolia) and in the province of İzmir (Aegean Turkey); 1700-2700 m, windexposed stony slopes, humid places, snow patches; EuxDI7c: 133

Juniperus communis subsp. *nana*; Erciyes Dağı; up to 2200 m, shady sites above timberline; StepII9: 165

Juniperus communis subsp. *nana*; Mount Ida (Kaz Dağı); 1650-1750 m; MeditB20a: 262

Convolvulus calvertii-Juniperus communis subsp. *nana*; near Erzincan; 2060-2200 m, stony ground; StepIII2g: 173

Phytosociology

Alliances: *Aconito nasuti-Juniperion communis* (Subalpine chionophobous silicicolous low juniper scrub of the Caucausus); *Daphno oleoidis-Juniperion alpinae* (Subalpine and supramontane chionophobous calcicolous dry low juniper scrub of the Central and Southern Apennines, the southern Balkans and Anatolia); *Rhododendrion caucasici* (Rhododendron-dominated ericoid chionophilous low scrub of the Caucasus and the Eastern Black Sea region)

Associations: *Juniperetum nano-depressae* Brullo, Giusso and Guarino 2001, *Helictotricho longifoliae-Juniperetum nanae* Akman, Quézel, Barbero, Ketenoglu and Aynoldu 1991; *Daphno oleoidis-Juniperetum nanae* Quézel, Yurdakulol, Ketenoglu, Demirors ex Brullo, Giusso and Guarino 2001

References: Brullo et al. (2001)

2250 * Coastal dunes with *Juniperus* spp.

Definition

Juniper formations of *Juniperus macrocarpa* (*J. oxycedrus* subsp. *macrocarpa*) or *Juniperus phoenicea* subsp. *turbinata* (*J. turbinata*), outside Turkey also *J. oxycedrus* subsp. *transtagana* (*J. navicularis*) and *J. communis*, of Mediterranean and thermo-Atlantic coastal dunes and dune slacks.

Site conditions

Juniperus macrocarpa grows as 2-6 m scrub or low wood on thermomediterranean coastal dunes; its extensive root system reaches ground water resources in several metres depth. The sands are erodible and may sometimes expose some of the flat tree roots, while others may be buried by accumulating sands. The trees are sometimes wind-blown.

Juniperus phoenicea s.l. (almost certainly subsp. *turbinata* in Turkey) also occurs on dunes or sands blown onto coastal calcareous sedimentary or igneous rock, sometimes together with *J. macrocarpa*, but it grows also further inland.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

The precise distribution in Turkey is poorly known.

Plants:

Juniperus macrocarpa, J. phoenicea subsp. *turbinata, Asparagus aphyllus* subsp. *orientalis, Daphne gnidioides, Pistacia lentiscus, Rhamnus lycioides* s.l.

Records

Juniperus phoenicea; widespread in Southwest Anatolia; brushwood on dune sands with favourable water supply; MeditA13c: 207

Phytosociology

Alliances: *Rhamno graecae-Juniperion lyciae* (Aegeo-Anatolian and Cypriotic low-grown coastal juniper garrigue); *Asparago orientalis-Juniperion macrocarpae* (Thermomediterranean juniper scrub of the Central and Eastern Mediterranean coastal dunes)

Association: *Daphno gnidioidis-Juniperetum turbinatae* Brullo et al. 2004

References: Brullo et al. (2004)

2270 * Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*

Definition

Coastal dunes colonised by Mediterranean and Atlantic thermophilous pines. In Turkey *Pinus pinea*, stone pine, applies to this habitat type. *P. pinea* is an iconic Mediterranean tree which grows mostly on ancient littoral dunes and sandy soils near the coast.

Site conditions

P. pinea stands are rare in Turkey. It is a tree of coastal distribution and grows almost exclusively on ancient dunes and sandy alluvia. Most noteworthy are occurrences in the Bergama area (northern coastal Aegean) on aeolian sands and sandy soils derived from granitic rock, and along the Mediterranean coast on littoral sands between Side and Serik.

Distribution and variability in Turkey

Mediterranean						Black Sea			Anatolian							
1		2		3		4			5				6		7	
1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2

Indigeneity of the Black Sea occurrences of stone pine is questionable. Many stone pine stands are likely to originate from early plantations as ornamental trees and for their edible seeds. However, long-established plantations of these pines, within their natural area of occurrence, and with undergrowth basically similar to that of natural forest on eroded or azonal soils ("paraclimactic formations"), are included.

Plants

<u>*Pinus pinea*</u>, *Juniperus phoenicea* s.l. *Pistacia lentiscus*, *Rhamnus lycioides* s.l.

Additional notes

The distinction between self-sown forests and long-established plantations of natural appearance is unusually difficult and sometimes impossible. The latter are thus included in this habitat type, while recent artificial plantations are not. For instance, indigenuous or long-established *Pinus pinea* woods, fine examples of which occur between Antalya and Alanya and around the Lake Bafa (Bafa Gölü) are to be recorded as habitat type 2270 while ornamental plantations in urban and picnic areas are excluded.

Records

Pinus pinea; Aydın, Bergama - Kozak, near Kavacık, near Karacaali; coastal; MeditB8: 247

Pinus pinea; E of Antalya near Side (Sorgun); dune forest on coastal sands (0-20 m) and eastward slopes; MeditA10: 205

Phytosociology

Alliance: *Pinion pineae* (Thermomediterranean *Pinus pinea* forests on leached sandy soils of ancient coastal dunes and inland alluvia of the Central and Eastern Mediterranean)

Association: "Dünen-*Pinus pinea*-Wald" (Mayer and Aksoy 1986: 205)

Phytosociological synopsis of the higher-ranking syntaxa of Turkish woody habitat types

Vaccinio-Piceetea Br.-Bl. in Br.-Bl. et al. 1939
(Holarctic coniferous forests in the boreal zone and at high altitudes of mountains in the nemoral zone of Eurasia)

Abieti nordmannianae-Piceetalia orientalis Çoban and Willner 2018
(Euxino-Caucasian upper montane coniferous and mixed forests)

Lonicero caucasicae-Piceion orientalis Çoban and Willner 2018
(Euxine-Caucasian upper montane humid fir and spruce forests)

Carpino-Fagetea sylvaticae Jakucs ex Passarge 1968
(Mesic deciduous and mixed forests of temperate Europe, Anatolia, the Caucasus and Southern Siberia)

Rhododendro pontici-Fagetalia orientalis Passarge 1981
(Euxine, Caucasian and Hyrcanian Oriental beech and mixed forests)

Fagion orientalis Soó 1964
(Oriental beech and beech-fir forests of the Black Sea and Caucasus regions)

Lathyro-Carpinetalia caucasicae Passarge 1981
(Euxino-Hyrcanian thermo-mesic oak-hornbeam forests) (syn. *Querco cerridis-Carpinetalia orientalis* Quézel, Barbéro et Akman 1980 ex Quézel et al. 1992)

Trachystemono orientalis-Carpinion betuli Çoban et Willner 2018
(Euxino-Pontic thermo-mesic oak-hornbeam-chestnut forests in humid habitats) (syn. *Castaneo sativae-Carpinion betuli* Quézel, Barbéro et Akman 1980 ex Quézel et al. 1992 nom. inval.)

Aceretalia pseudoplatani Moor 1976 nom. conserv. propos.
(Scree and ravine maple-lime forests of the nemoral zone of the temperate Europe)

Ostryo carpinifoliae-Tilion platyphylli (Košir et al. 2008) Čarni in Willner et al. 2016 (Submediterranean xero-thermophilous broad-leaved scree and ravine forests of the Balkan Peninsula and Anatolia)

Tilio-Acerion Klika 1955
(*Acer*, *Ulmus* and *Tilia* forests in the montane belt and cool ravines of the mountains of Central and East Europe and the western Black Sea region)

Quercetea pubescentis Doing-Kraft ex Scamoni et Passarge 1959
(Oak, mixed deciduous and conifer open forests of warm regions in the cool-temperate nemoral zone of Central and Southern Europe and in the supramediterranean belt of the Mediterranean, Asia Minor and Middle East)

Querco-Carpinetalia orientalis Quézel, Barbéro et Akman 1980 nom. inval.
(Broadleaved oak-hornbeam and mixed forests of subeuxinian and West Central Anatolian distribution)

Carpino betuli-Acerion hyrcani Akman, Barbéro et Quézel 1977 nom. inval.
(Subeuxine oak and mixed deciduous forests)

Quercetalia pubescenti-petraeae Klika 1933
(Oak forests of the warm cool-temperate nemoral and supramediterranean regions in Central and South Europe and Anatolia)

Quercion confertae Horvat 1958
(Submediterranean deciduous oak forests on slightly acidic deep soils of the central and eastern Balkans and north-western Turkey)

Quercetalia brantii Zohary 1973 nom. inval.
(Xerothermophilous semi-deciduous oak steppe woods of central and eastern Anatolia and the Near East)

Quercion brantii Zohary 1973 nom. inval.
(Xerothermophilous oak forest remnants of dry steppe habitats in eastern Anatolia and the Near East)

Quercion anatolicae Quézel, Barbéro et Akman 1977 ex Quézel et al. 1992
(Xerothermophilous oak forest remnants of Central Anatolian steppe habitats)

Querco-Cedretalia libani Barbéro et al. 1974
(Relict supra-oromediterranean fir, cedar and mixed oak forests of South Anatolia, Syria, Lebanon and Cyprus)

Ostryo-Quercion pseudocerridis Akman, Barbéro et Quézel 1977
(Supramediterranean meso-thermophytic deciduous oak and mixed forests of southern Anatolia)

Abieto cilicicae-Cedrion libani Barbéro, Loisel et Quézel 1974
(Relict supra- and oromediterranean Cilician fir and cedar coniferous woods of the central Taurus and the Amanos Mountains, South Anatolia)

Lonicero nummulariifoliae-Cedrion libani Quézel, Barbéro et Akman

1978 (Supra- and oromediterranean cedar forests of the western Taurus Mountains, South Anatolia)

Quercetea ilicis Br.-Bl. ex A. Bolòs et O. de Bolòs in A. Bolòs y Vayreda 1950 (Thermo-, meso- and supramediterranean evergreen pine and oak forests and associated macchia of the Mediterranean)

Quercetalia ilicis Br.-Bl. ex Molinier 1934
(Meso-sclerophyllous evergreen and semi-deciduous meso- to supramediterranean oak and relict laurel forests of Mediterranean and Black Sea regions)

Erico-Quercion ilicis S. Brullo et al. 1977
(Evergreen and semideciduous mesophilous holm oak forests and high maquis in humid Central Mediterranean and Black Sea regions)

Arbuto andrachnes-Quercion cocciferae Barbero et Quézel 1979
(Calcicolous meso-xerophytic semideciduous and evergreen oak forests and high maquis in humid East Mediterranean and Black Sea coastal regions)

Quercion macrolepidis Zohary ex Di Pietro et al. ined.
(Mesomediterranean valonia oak and similar semi-deciduous forests of the East Mediterranean)

Arbuto unedonis-Laurion nobilis Rivas-Mart. et al. 1999
(Relict Mediterranean laurel forests)

Quercetalia calliprini Zohary 1955
(Sclerophyllous evergreen oak and conifer forests and associated maquis in the thermo- to supramediterranean belts of the East Mediterranean)

Quercion calliprini Zohary 1955
(Sclerophyllous evergreen kermes oak forests of the Eastern Mediterranean)

Aceri sempervirentis-Cupression sempervirentis Barbero et Quézel ex Quézel et al. 1993
(Supramediterranean cypress forests of the Aegean)

Pistacio lentisci-Rhamnetalia alaterni Rivas-Mart. 1975
(Thermo-mesomediterranean low-growing matorral, maquis and garrigue of the Mediterranean Basin)

Ceratonio-Pistacion lentisci Zohary et Orshan 1959
(Thermomediterranean sclerophyllous evergreen maquis of the East Mediterranean)

Rhamno graecae-Juniperion lyciae M. Costa et al. 1984
(Aegaeo-Anatolian and Cyprian low-growing coastal juniper garrigue)

Phlomido fruticosae-Euphorbion dendroidis Mucina et Dimopoulos in Mucina et al. 2016
(Thermomediterranean calcicolous tree spurge garrigue on steep coastal slopes of the East Mediterranean)

Asparago orientalis-Juniperion macrocarpae (Díez-Garretas et Asensi 2013) Mucina in Mucina et al. 2016
(Thermomediterranean juniper scrub of the Central and East Mediterranean coastal dunes)

Pinetalia halepensis Biondi, Blasi, Galdenzi, Pesaresi et Vagge in Biondi et al. 2014
(Thermo-mesomediterranean pine forests of the Central and East Mediterranean)

Salvio fruticosae-Pinion brutiae Konstantinidis, Mucina et Bergmeier ined. (Aegaeo-West Anatolian thermo-mesomediterranean pine forests on calcareous substrates)

Gonocytiso pterocladi-Pinion brutiae Barbéro, Chalabi, Nahal et Quézel 1977 (Thermo-mesomediterranean pine forests on calcareous and volcanic rocks of South Anatolia, Syria and Lebanon)

Ptosimopappo-Quercion microphyllae Barbéro, Chalabi, Nahal et Quézel 1977
(Thermo-meso-supramediterranean pine-oak woods on ultramafic rocks of the southern Anatolian Amanos Mountains and Syria)

Pinion pineae Feinbrun 1959
(Thermomediterranean stone pine forests on leached sandy soils of ancient coastal dunes and inland alluvia of the Central and Eastern Mediterranean)

Pino-Juniperetea Rivas-Mart. 1965
(Relict supra-oromediterranean and orotemperate dry pine forests, juniper woods and related scrub of the Mediterranean and Anatolia)

Berberido creticae-Juniperetalia excelsae Mucina in Mucina et al. 2016
(Relict submediterranean-orotemperate and supramediterranean dry pine and juniper woods of the Central and East Mediterranean and Anatolia)

Juniperion excelso-foetidissimae Em ex Matevski et al. 2010
(Submediterranean-montane tall juniper dry woods on shallow soils over limestone, marls and ultramafic substrates of the south-central Balkans, Greece and western Anatolia)

Jasmino-Juniperion excelsae Didukh, Vakarenko et Shelyag-Sosonko ex Didukh 1996
(Peri-Euxine submediterranean open juniper-oak woods of edaphically dry habitats)

Berberido creticae-Juniperion foetidissimae S. Brullo et al. 2001
(Oromediterranean juniper dry woods and related scrub of mainland Greece, Cyprus, Anatolia, Syria and Lebanon)

Erico-Pinetea Horvat 1959
(Relict pine forests and related scrub on calcareous and ultramafic substrates of the Balkans, the Alps, the Carpathians, Anatolia and Crimea)

Erico-Pinetalia Horvat 1959
(Montane calcareous relict pine forests of Anatolia, the Balkans, the Apennines, the Alps and Carpathians)

Geranio-Pinion Quézel, Barbéro et Akman 1980 ex Quezel et al. 1992
(Xero-mesophytic montane to subalpine pine forests of the Pontic Mountains and the Caucasus)

Adenocarpo complicati-Pinion nigrae Quézel, Barbéro et Akman 1977
(Supra-oromediterranean black pine dry forests of western and southern Anatolia)

Cisto laurifolii-Pinion pallasianae Akman, Barbéro et Quézel 1980
(Meso-xerophytic subeuxinian and western Central Anatolian black pine forests)

Campanulo sibiricae-Pinion brutiae Litvinskaya et Postarnak ex Mucina in Mucina et al. 2016
(Pontic-West Caucasian thermophilous *Pinus brutia* and related Mediterranean pine forests on dry calcareous substrates)

Salicetalia purpureae Moor 1958
(Willow and tamarisk scrub and low open forests of riparian habitats in the temperate to arctic zones of Europe and the Black Sea region)

Salicetalia purpureae Moor 1958
(Willow scrub and low open forests of riparian habitats in the temperate to arctic zones of Europe and the Black Sea region)

Salicion albae Soó 1951
(Willow and poplar open forests of lowland to submontane river alluvia in the nemoral zone of Europe, the Mediterranean mountains and the Black Sea region)

Alno glutinosae-Populetea albae P. Fukarek et Fabijanić 1968
(Riparian gallery forests of the Eurosiberian and Mediterranean regions)

Alno-Fraxinetalia excelsioris Passarge 1968
(Floodplain riparian forests on nutrient-rich alluvial soils of temperate and boreal Europe)

Alno-Quercion roboris Horvat 1950
(Alder-oak riparian floodplain forests on nutrient-rich alluvial soils of the temperate regions of the Balkan Peninsula and the Black Sea)

Alnion incanae Pawłowski et al. 1928

(Alder-ash riparian floodplain forests on nutrient-rich alluvial soils in the nemoral zone of Europe)

Alnion barbatae Quézel, Barbéro et Akman 1980 ex Quézel et al. 1992
(Euxine-Colchic alluvial riparian alder forests)

Populetalia albae Br.-Bl. ex Tchou 1949 nom. conserv. propos.
(Mediterranean and submediterranean riparian gallery forests)

Lauro nobilis-Fraxinion angustifoliae I.Kárpáti et V. Kárpáti 1961
(Riparian ash and mixed forests of the submediterranean regions of the Apennine and Balkan Peninsulas, and of Northwest Anatolia)

Populion albae Br.-Bl. ex Tchou 1949
(Lowland Mediterranean and submediterranean riparian and lakeshore poplar pioneer forests)

Platanion orientalis I. Kárpáti et V. Kárpáti 1961
(*Platanus* and *Liquidambar* riparian gallery forests of the East Mediterranean)

Populetalia euphraticae Zohary 1962 nom. inval.
(Riparian gallery forests and scrub of the Irano-Turanian biogeographic region)

Populion euphraticae Golub et Kuzm. 1996
(Poplar open forests and riparian galleries of the Irano-Turanian biogeographic region)

Nerio-Tamaricetea Br.-Bl. et O. de Bolòs 1958
(Circummediterranean and Macaronesian riparian scrub)

Tamaricetalia africanae Br.-Bl. et O. de Bolòs 1958
(Circummediterranean and Macaronesian riparian scrub)

Rubo sancti-Nerion oleandri S. Brullo et al. 2004
(Thermomediterranean oleander riparian scrub of the East Mediterranean)

Crataego-Prunetea Tx. 1962 nom. conserv. propos.
(Scrub and mantle vegetation seral or marginal to broad-leaved forests in the nemoral zone and the submediterranean regions of Europe)

Paliuretalia Trinajstić 1978 (Thermophilous mantle, pseudomaquis and šibljak fringing oak forests of the submediterranean regions of southeastern Europe and the Black Sea region)

Buxo-Staphylion pinnatae Quézel, Barbéro et Akman 1980 ex Quézel et al. 1992 (Mesic deciduous scrub with evergreen components in shady habitats of the Black Sea region)

Brachypodio pinnati-Betuletea pendulae Ermakov et al. 1991 (Hemiboreal pine and birch-pine herb-rich open forests on fertile soils of the Southern Urals and Southern Siberia, and relict birch-poplar forests of Europe, Asia Minor and the Caucasus)

Fragario vescae-Populetalia tremulae Willner et Mucina in Willner et al. 2016 nom. inval.
(Relict extrazonal temperate deciduous birch-poplar woods on mineral soils of Europe, Asia Minor and the Caucasus)

Fragario vescae-Populion tremulae Willner et Mucina in Mucina et al. 2016 ined. (Relict extrazonal temperate deciduous birch-poplar woods on mineral soils of Europe and Anatolia)

Loiseleurio procumbentis-Vaccinietea Eggler ex Schubert 1960 (Arctic-boreal tundra scrub and alpine acidophilous dwarf-heath mountain tundra of Eurasia and North America)

Vaccinio microphylli-Juniperetalia nanae Rivas-Mart. et M. Costa 1998 (Subxeric and subthermophilous low juniper scrub in the supramontane to subalpine belts of Southern Europe and the Caucasus)

Aconito nasuti-Juniperion communis Onipchenko 2002
(Subalpine low juniper scrub of the Caucausus)

Daphno oleoidis-Juniperion alpinae Stanisci 1997
(Subalpine and supramontane calcicolous dry low juniper scrub of the Central and Southern Apennines, the southern Balkans and Anatolia)

Rhododendro ferruginei-Vaccinietalia Br.-Bl. in Br.-Bl. et Jenny 1926 (Nemoral subalpine and alpine acidophilous ericoid dwarf-heath mountain tundra of Western, Central and Southern Europe, and the Caucasus

Rhododendrion caucasici Onipchenko 2002
(*Rhododendron*-dominated ericoid chionophilous low scrub of the Caucasus and the East Pontic Mountains)

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NOTES:

THE FORESTERS' ASSOCIATION OF TURKEY

The Foresters' Association of Turkey (TOD) was established on December 26th, 1924 with the name of "Forest Academy Graduates Society" by Abdulkadir SORKUN – Pharmacist and Forest Engineer MSc., Dr. Tevfik Ali CINAR -Forest Engineer MSc. and Asaf IRMAK -Forest Engineer MSc..

It is one of the oldest Civil Society Organizations (CSOs) in the history of Republic of Turkey. It is among established institutions which had led the establishment of Union of Chambers of Turkish Architects and Engineers (TMMOB). It had gained the status of association working for the benefit of public in 1951 by the decision of Council of Ministers.

The Foresters' Association of Turkey had been the leading institution on the establishment of "Atatürk Forest" which is now called the lung of Ankara. The association played a significant role from the decision to established stages of the forest between 1957-1958.

The eco-tourism group, is a member of Eco-Tourism Association (TIES) based in USA, has been organizing public eco-tourism trips. During these trips, at least two competent team leaders being members of our association are guiding to participants and sharing their knowledge and experiences regarding wildlife and flora of the area. Our association, which carries out many national and international projects, is performing studies on protection of endemic species, hot points of Europe and other characteristics relevant to nature and wildlife. Our association is also the member of AIFM (Association for Mediterranean Forests) located in France.

Fotoğraf: Süleyman ALKAN

The Forest and Hunting Magazine is being published regularly since 1928. Our Ali Kemal YIGITOGLU library, including more than 15.000 publications such as books and magazines mostly on the subject of forestry and environment, is one of the largest libraries on this subject.

The Foresters' Association of Turkey intends to ensure the spread of love for forest, environment and nature through its operations since 1924 and to be established, to raise the awareness of public, to ensure the improvement of science and technique of forestry, and to resolve the problems of forestry as per scientific principles by observing the requirements of country and nation and the benefit of public.

The Foresters' Association of Turkey is is an accredited CSO to the UNCCD (United Nations Convention to Combat Desertification).

TOD (The Foresters' Association of Turkey), being one of the main organizers of World Wood Day 2015, had gathered International Wood Culture Society (IWCS) and Eskisehir Odunpazari Municipality, had realized the first and the largest wood festival of our country in which 350 craftsmans and artsits specialized in wood, academicians and researchers from 93 different countries and Turkey came together in between March 7th -27th, 2015.

The Foresters' Association of Turkey provides service in whole Turkey through its two branches at Istanbul and Antalya, its agencies at 21 different areas and its Faculty of Forestry representation offices. TOD undersigns significant national and international cooperations and projects with the ISO 9001:2015 Quality Management System Certificate it owns.

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