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ARAŞTIRMA MAKALESİ **RESEARCH PAPER**

Natural Heritages of The Southeast Black Sea Mountains: Agaçbaşı, Barma and Yılantaş High Altitude Peatlands, Trabzon, Türkiye

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Abstract: The study aims to reveal the formation, geographical, climatic, and rare ecological features and the necessity of protection of the peatlands, which are the high plateau wetlands of Trabzon, which require the protection of the cooperation of the state and the public. The study, with the traditional compilation method; the earlier studies, data and information were compilated and the present situation and what needs to be done were examined. Turkey's largest high plateau peatlands are located in the southwestern Caucasus-Soğanlı Mountains. The peatland region receives high precipitation (app.1500 mm/year) with its subtropical-subpolar cool and humid climate character. Ağaçbaşı, Barma and Yılantaş are the largest highland peatlands of the region and Turkey and the southborder peatland of the northern hemisphere. These peatlands are important natural heritage sites on a global scale due to their geographical and ecological characteristics. The region has approximately 200ha high plateau peatland areas with depths of 50-450cm. Peatlands have ombrotrophic features, where the water and plant nutrients that make up the peatland are provided only by precipitation and the atmosphere, and there is no water inflow. Peatlands, which have rare flora and fauna species, are a natural archive that preserves the ecological and climatological data of the region's 8-10000-year history. 2561ha of peatland, plateau and forest area in Ağaçbaşı, Barma and Yılantaş plateau were registered and protected as natural protected areas in the 2019-2023 period. Trabzon peatlands are at high risk due to illegal construction, land/ecosystem division by roads, illegal peatcutting and other human interventions. For sustainable protection of peatlands; It is necessary to prepare Conservation Development Plans, determine the construction, and prepare and implement Site Management Plans with state-public cooperation

Keywords: Natural heritage, peatland-wetland, protection, Trabzon, Türkiye.

Doğu Karadeniz Dağlarının Doğal Mirasları: Ağaçbaşı, Barma ve Yılantaş Yüksek Rakım Turbalıkları, , Trabzon, Türkiye

Öz: Çalışmanın amacı, Trabzon'un yüksek rakım sulak alanları olan turbalıkların, kamu ve halk tarafından korunmasını gerekli kılan, oluşum, coğrafik, iklimsel, nadir ekolojik özelliklerini ve koruma gerekliliğini ortaya koymaktır. Çalışma, geleneksel derleme yöntemi ile; yapılmış çalışmaların derlenmesi,veri eldesi, mevcut durumun tespiti ve irdelemeyi kapsar. Trabzon turbalıkları Anadolu'nun kuzeydoğusunda, Güneybatı Kafkas-Soğanlı Dağları üzerinde yer almaktadır. Turbalıkların bulunduğu dağlık coğrafya, subtropikal-kutup altı serin ve nemli iklim karakteri ile, yüksek düzeyde yağış almaktadır (yak. 1500 mm/yıl). Ağaçbaşı, Barma ve Yılantaş Türkiye'nin en büyük yayla turbalıkları olup, kuzey yarımkürenin güney sınırını oluşturlar. Bu turbalıklar konumları ve ekolojik özellikleri nedeniyle, küresel ölçekte önemli, doğal miras alanlarıdır. Bölgede, 50-450cm arasında derinliğe sahip, 200ha'a yakın yüksek rakım turbalık alanlar bulunmaktadır. Bu turbalıklar, bataklıkları oluşturan su ve bitki besinlerinin sadece yağış ve atmosferden sağlandığı, dışarıdan su girişi olmayan, ombrotrofik özelliklere sahiptir. Nadir bulunan flora ve fauna türlerine sahip bölge turbalıkları, bölgenin güncel ve 8-10 bin yıllık geçmişine ait, ekolojik ve klimatolojik verileri bünyesinde saklayan, doğal bir arşivdir. İçinde turbalık alan barındıran Ağaçbaşı, Barma,Yılantaş yaylalarının, 2561ha turbalık mera,yayla ve orman alanı, 2019 -2023 döneminde doğal SİT alanı olarak tescil edilerek koruma altına alınmıştır. Trabzon turbalıkları, içinde bulundukları yayla alanlarındaki kaçak yapılaşma, yol açma nedeni ile arazi/ekosistem bölünmesi ve kaçak kesim vd insan müdahalelerine nedeni ile, yüksek risk altındadır. Önemli sulak alanlar olan turbalıklarda sürdürülebilir korunma için; mutlaka, Koruma İmar Planlarının yapılması ve yapılaşma koşullarının belirlenmesi, ve devlet- halk işbirliği ile Alan Yönetim Planlarının hazırlanması ve uygulanması gereklidir. Koruma imar ve yönetim planları olmayan ve uygulanmayan koruma alanlarında, sürdürülebilir koruma mümkün değildir.

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Anahtar kelimeler: Doğal miras, koruma, turbalık-sulak alan, Trabzon, Türkiye.

INTRODUCTION

Wetlands are ecosystems crucial for conserving biodiversity, the services they provide, and their role in sustaining livelihoods. Their function in climate regulation, especially for peatlands, has also been clearly articulated; peatlands are the most efficient terrestrial ecosystems in storing carbon. However, the current status and use of wetlands and peatlands in most parts of the world are unsustainable (DKM, 2012). Their importance has been recognized more and more in the last decade. The most important service of the wetlands is the mitigation of climate change. Peatlands provide a widespread terrestrial archive of Holocene environmental change. Wetlands, especially peatlands, are the top long-term carbon stores in the terrestrial biosphere (Parish et al, 2008). Peatlands serve us ecosystem benefits (productivity, decomposition, biogeochemical cycling, and microbial activity), biotic characteristics (flora and fauna, including rare and threatened species), and paleoecological background (Gorham, 1994).

Peatlands are important ecosystems for carbon (C) storage, provision of water resources and biodiversity (Ramchunder et al., 2009). Studies indicate that peatland ecosystems are highly threatened by their intensive use. Overview assessments of national carbon storage have been carried out in many countries, as well as for large eco-regions. Comprehensive studies on the extent of carbon storage in organic soils exist for example in Germany (Roßkopf et al., 2015), Switzerland (Leifeld et al., 2005), Russia (Alexeyev & Birdsey, 1998), Europe (Christensen et al., 2004), the northern hemisphere (Yu, 2012), (Heinickeb & Zeitz, 2016). Peatlands cover approximately 2.84% of the global terrestrial area while storing one-third to one-half of the world's soil carbon (Lia et al., 2018).

Sphagnum mosses are among the most common plant species in northern bogs and poor fens where they are commonly the main contributors to peat formation (Crum, 1992, Halsey et al., 2000). The largest terrestrial soil carbon deposits Peatlands can accumulate carbon for thousands of years (Gorham, 1991). The decomposition of plant material in the peatland is very slow due to the waterlogged soils and high recalcitrance of present Sphagnum mosses (Pullensac et al, 2016). The basement of the Ağaçbaşı and surrounding peat fields comprises Upper Cretaceous volcanic–volcaniclastic rocks and clastic units and Late Cretaceous-Paleocene granitic rocks (Çebi & Korkmaz, 2015)

The peatlands formation takes thousands of years and it is strongly influenced by climatic conditions and topography (Çolak & Günay, 2011). Today, the existing peatlands mainly started to form in the late Ice Age and the first part of the Holocene (which began 12,000 years ago) and continued accumulation since then (Halsey et al., 1998; Campbell et al., 2000; MacDonald et al., 2006).Aytuğ et al. (1975) explained that, Aytuğ's, there was a humid-temperate/warm period between 7000-2000 years ago. Humid-cold climate characteristics began to be seen in 2000 years The degradation and destruction of peatlands have major implications for biodiversity, climate change and human populations (DKM, 2012). Although tree species vary, there was a dense forest covering the peatlands until about 500 years ago. After this date, human influence has also increased on forests and peatlands (Yigitbaşoğlu, 2009).

Many mires in Turkey have been destroyed by peat cutting and drainage; the total remaining peatland area is probably no more than 30 km^2 (Çayci et al., 1988; Őz, 1996). About 85% of peatlands in Turkey has been deteriorated and the total peatland area has dropped from 24000 to 3000 ha. The majority of peatlands in Turkey are located west of Kayseri City, the south of Saraycık and Örenşehir towns, in Erciş town of the City of Van, in Göle town of Ardahan City, in Hınıs town of Erzurum City, Denizdamı area of Erzincan City, Bolu-Yeniçağa, Trabzon- Agacbası Yayla, Abant lake and Yukarı Gerede creek and Afyon-Dinar Karakuyu areas (Çebi & Korkmaz, 2015). Agacbası peatland was first investigated by Aytuğ et al. (1975) to analyze pollens and calculate the age of the peatland by ^{14}C. Investigations of Aytug et al (1975) showed that Agacbası peatland is approximately 9000 years old. The first systematic survey on peatland plants identified five species new to Turkey and one species new to science (Byfield & Őzhatay, 1997; Scholz & Byfield, 2000, Bozkır, 2012).

The study aims to reveal the formation, geographical, climatic, and rare ecological features and the necessity of protection of the peatlands, which are the high plateau wetlands of Trabzon, which require the protection of the cooperation of the state and the public. The study, with the traditional compilation method; The earlier studies, data and information were compiled and the present situation and what needs to be done were examined.

GEOGRAPHIC STRUCTURE OF THE PEATLAND REGIONS

Ağaçbaşı, Barma and Yılantaş large ombrotrophic peatlands are located 20-25 km south of the South Eastern Black Sea coast (Fig.1). Peatlands and Northeastern Black Sea Mountains are in the Southern part of the Caucasus Mountains and part of the Caucasus Critical Ecosystems (Fig 1 b). In addition, peatland and plateaus are on the route of the migratory birds from Europa to the Middle East and Africa (Fig 1 c)

Peatlands are on the ridges and slopes of the hills of the Soğanlı Mountains, which are used as a pasture of

summer plateaus of Araklı, Sürmene, Koprübası and Dernekpazarı district villagers. Plateau peatlands are located between 1800-2100 m altitudes. Plateaus and peatlands are 3-7 km far from each other but separated by deep valleys (Fig 1A). Barma is located in the middle of the Barma Plateau between 1800-1890m altitude (Fig. 2. A), Ağaçbaşı peatlands is on the north and southeast side of the Ağaçbaşı and Seslikaya Plateau between 1930-2020m (Fig 2B). While Yılantaş peatland is located between 1920 to 2090m altitude of the southeast side of the Yılantaş plateau (Fig. 2C).

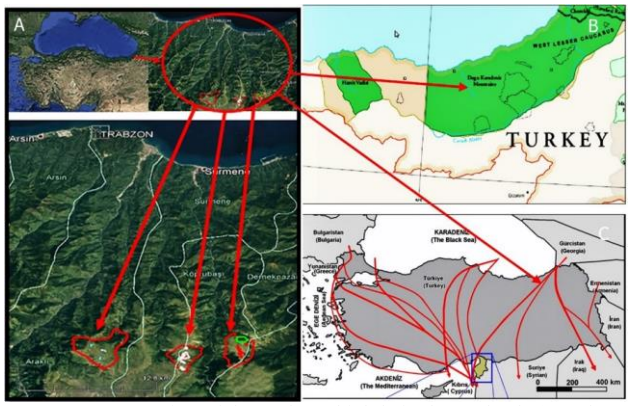

Figure 1. A- Location of the Trabzon high latitude peatlands (Agacbası, Yılantas and Barma), B- West Caucasus critical ecosystems, C- bird migration routes on the Tukey (Birben,2019; CCEPF, 2023).

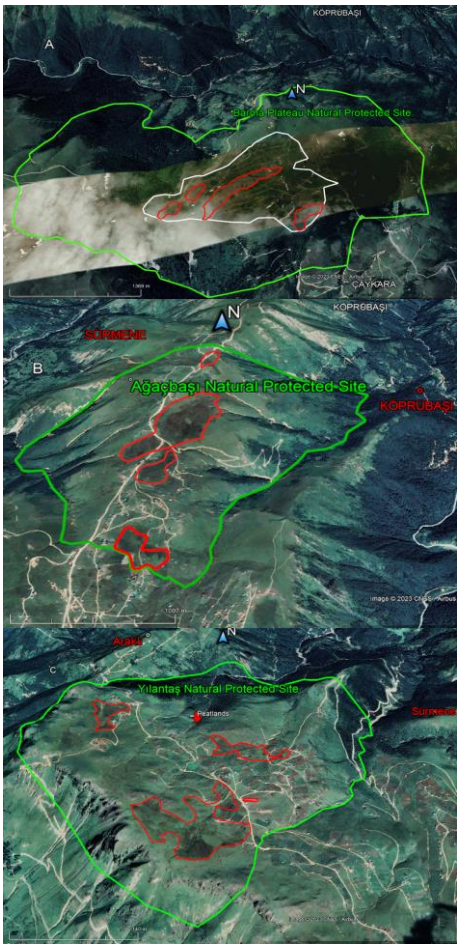

Figure 2. A-Barma, B-Ağaçbaşı , C-Yılantaş Natural Protected Sites.

The peatland areas within the natural protected areas are not a single bloc area. There are 4 peatlands in Barma and Agacbasi plateaus and three in the Yılantas plateaus (Fig 2 A, B and C). In the region, apart from these areas, there are some smaller peat formation areas.

The region receives high amount of precipitation (1500mm/y). The climate is characterized by snowy winter and rainy and foggy seasons throughout the year. Peatlands are wet all summer months. Ağaçbaşı and other peatland plateaus' average air temperatures are -6.2 °C in January and 16.2 °C in July and August (AC, 2023). Therefore, the precipitation in mountain ranges and plateaus reach almost 2200mm (Fig 2). Compared to the study of Verep et al (2002), the climate of the plateaus where the peatlands are located is wetter and colder than the climate of Uzungöl in the nearby basin.

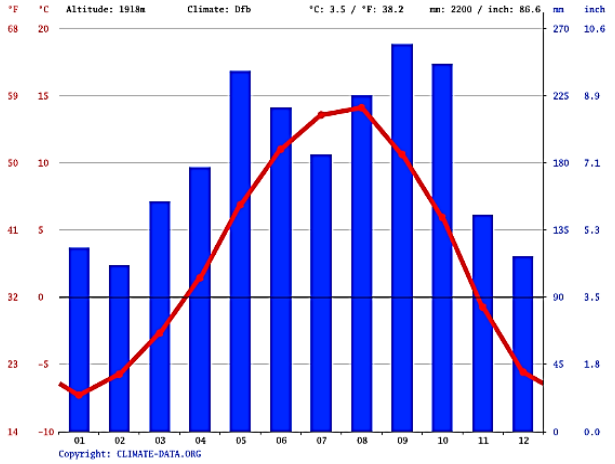

Figure 2. Precipitation and temperature changes in Ağaçbaşı and Barma plateaus and their surroundings (Arpalı Village) (AC, 2023).

Ağaçbaşı, Barma and Yılantaş peatlands are ombrotrophic and receive water and nutrients primarily from precipitation (mainly rain and snow). The slope of peatlands changes between 0 % to 10%. Peat thickness varies from 50-300cm in Ağaçbaşı, 100-450cm in Barma and 50-200cm in Yılantaş (Fig 3).

Figure 3. Ağaçbaşı peatland and peat section (Foto C. Erüz).

PEATLANDS ECOSYSTEM

Ağaçbaşı, Barma and Yılantaş peatlands thicknesses vary from 50 to 450cm. The soil of the peatlands and plateaus is mostly moist and the weather is warm between late spring to early autumn season. Rich plant diversity (Fig. 4) and suitable living conditions

ensure a rich diversity for insect fauna, including butterflies (CRPB, 2015; ETBAR Ağaçbaşı, 2018; ETBAR Yılantaş, 2019; ETBAR Barma,2019). Other groups such as microorganisms and insects have not been surveyed systematically yet, but given the isolation of the peatland areas, it is likely that many uncommon species may be present.


Ajuga orientalis *Rhododendron caucasicum* *Dactylorhiza umbros*
Eriophorum angustifolium *Sphagnum* sp. *Drosera* sp.
Viola sp. *Scilla siberica* *Carex* sp.

Figure 4. Some flora species of the Ağaçbaşı, Barma and Yılantaş peatlands and surroundings (Foto C. Erüz).

The peatlands and surrounding plateaus ecosystems have several plant species that are extremely rare in Turkey. Dominant vegetation in the peatlands are *Sphagnum sp, Carex pauciflora, Drosera rotundifolia, Drosera intermedia, Eriophorum angustifolium, Lycopodium inundatum, Rhynchospora alba, Andromeda polifolia and Carex lasiocarpa, C.magellanica ssp.irrigua , C. panicea, C.rostrata , Carex carex echinata, C.panicea, C.pauciflora, Potentilla erecta, magellanica subsp, .Parnassia palustris, Pedicularis comosa, Swerita iberica, Narthecium balansa, Nardus stricta, Polytrichum longisteum, Vaccinium uliginosum, Eriophorum angustifolim, Rhytidiadelphus squarrosus, Leucobryum glaucum*; some of them are only known from this site (Alkan, 1992; Byfield & Özhatay 1997; Payne et al. 2007a, 2008; Erüz,2013; CRPB,2015; Erüz, 2016; ETBAR Ağaçbaşı, 2018; ETBAR Yılantaş, 2019; ETBAR Barma,2019). Insect abundance attracts birds, and amphibians such as *Martencila caucasica* Salamanders and reptiles (Fig 5) The plateau and peatlands are on the eastern routes of the bird migration from Europa to the Middle East and Africa. Ağaçbaşı, Barma and Yılantaş peatlands furthermore are valuable as an archive of historical information on the environmental features of the mires and the region.

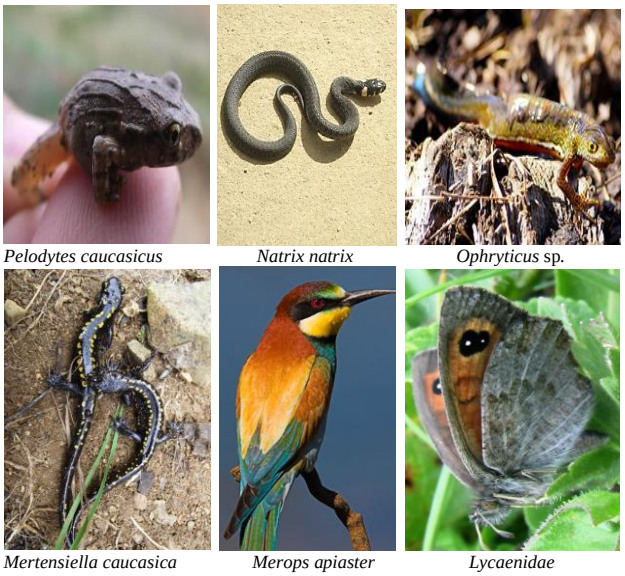
Pelodytes caucasicus *Natrix natrix* *Ophryticus* sp.
Mertensiella caucasica *Merops apiaster* *Lycaenidae*

Figure 5. Some species of peatland and plateau fauna (Foto E. Tekke, İ.Bozkır, C. Erüz).

Ağaçbaşı (2019), Barma (2019) and Yılantaş (2023) plateau pastures which include peatlands have been registered as natural protected sites. Natural protected sites are including statues of the Sustainable Conservation and Controlled Use Areas, Qualified Natural Protection Areas, and Sensitive Areas to be Strictly Protected. . The total of the 3 protected peatland areas is 2561ha. Ağaçbaşı has 620ha and 63ha of Strict Protected Peatland Areas, Barma is 1256ha the Strict Protected Peatland Areas are 30ha, Yılantaş protected area is about 685ha, and the Strict Protected Areas are about 43ha. There are nearly 200ha of peatland areas surrounding plateaus. Ağaçbaşı and Barma are the largest high plateau peatlands in the region and Turkey, one of the important natural heritage on a global scale.

The site has been affected by manual peat cutting for the last 50 years, especially between 1970 and 2010; cut peat holes have been still present across much of the turbaceous areas of the Trabzon (Byfield & Özhatay 1997, Payne et al. 2007a, 2008, Erüz, 2013). Many plant species are characteristic of the northern European peatlands and may reach their southernmost limit in these mires making them important from a biogeographic point of view. Peat-cutting operations by local people are very rare after peatland protection and social awareness projects were done from 2010 to 2013 by NGO activities (Association of the Natural and Historical Heritages Protection) (Erüz, 2013).

DISCUSSION AND CONCLUSION

Ağaçbaşı peatlands is the most known and studied and documented peatland area of the region. Barma and especially Yılantaş peatland ecology are not detailed studied yet. All peatland areas are located same altitudes (between 1800-2000m), and north slopes of the soğanlı mountain and all have the same humid and cool climate characteristics. These geographical similarities ensured that the three peatlands had largely similar ecological characteristics. But in each of the three areas, the depth of peat formation differs; There is peat formation with a depth of 0.5-1.5 m in Yılantaş plateau, between 05-3.5 m in Ağaçbaşı plateau and 0.5-4.5 m in Barma Plateau. Peatlands of Trabzon are rare ecosystems of high conservation value. The majority of peatlands are fens and only one large ombrotrophic bog.. This region, Ağaçbaşı, Barma and Yılantaş peatlands, lies on the Soğanlı Mountains in the Northeast of Turkey and at the southwest part of the Caucasus critical ecosystems corner. They are just located 25 km south of the Black Sea coast and the attitudes of 1800 to 2090 m. High local precipitation and foggy weather together with the elevation of the sites has allowed blanket peat formation to a depth of 50cm to 4.5m. These environmental conditions allow inhabiting flora and fauna of which some are extremely rare in Turkey; i.e. the plants A*ndromeda polifolia and Carex lasiocarpa* are only known from these sites (Payne et al, 2007a). Many plant species, characteristic of the Northern European peatlands, may reach their southernmost limit in this mire making it important from a biogeographic point of view as mentioned by Byfield & Őzhatay (1997), Payne et al. (2007a & 2008). More efforts to study the other groups such as insects and micro-organisms are needed in the region. Trabzon Ağaçbaşı, Barma and Yılantaş are severely threatened by human activities despite the uniqueness of the mire. The main is the peat cutting for fuel which was mitigated and became rare because of the raised social awareness by the NGO activities varied out from 2008 to 2015. Ağaçbaşı and surrounding peatlands are very important due to their unique location and ecological feature on the southern border of the northern hemisphere as high-altitude peatlands. It is very important to protect and promote this natural heritage area by raising awareness campaigns at the national and international levels. The region's peatlands have years of eco-archives for Turkey and internationally. Complex and multi discipliner studies are needed for the Trabzon peatlands. The landscape of plateaus covered by peatlands has an ecological and environmental rehabilitation potential upon major human impacts in particular through global warming, and the likelihood of substantial feedback to the global climate system. Region peatlands formed during the Holocene period after the last ice age, and have a rich archive in terms of about 8-10 thousand years old ecological and climatological data of the region. Due to these rare features, peatlands are under protection are areas where protection should be made sustainable with absolute public-state cooperation because they have high importance in the conservation of rare biodiversity. Ağaçbaşı peatlands are located at the Bayburt-Sürmene route, which is one of the most known branches of historical silk and caravan routes that lead to the Black Sea. Famous traveller Evliya Çelebi refers to the caravan route that is passing through this bog in his travelogue. There are still paved stones visible as part of historical caravan routes in the swamps. There are historical areas, hills and rock formations that are mentioned in mythological stories on the historical caravan routes, and contain the most beautiful scenes that are ideal for photography.

Trabzon peatlands are at high risk due to illegal construction, land/ecosystem division by roads, illegal peat cutting and other human interventions. For sustainable protection in peatlands; It is necessary to prepare Conservation Development Plans, determine the construction, and prepare and implement Site Management Plans with state-public cooperation. Sustainable conservation is not possible in conservation areas that do not have conservation development and management plans and are not implemented.

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