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# Preliminary Red List Assessment of Turkish *Sphagnum* (Sphagnopsida)

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**Abstract**

The present study assessed the IUCN categories of 27 taxa belonging to genus *Sphagnum* from Turkey. Result of this evaluation showed that two taxa, *S. flexuosum* and *S. fimbriatum* are Critically Endangered; 5 taxa, *S. angutifolium, S. fuscum, S. rubellum, S. squarrosum* and *S. warnstorfii,* are vulnerable; and 6 taxa, *S.contortum, S. medium, S. quinquefarium, S. papillosum, S. subfulvum* and *S. tenellum, are* endangered. Moreover, 4 taxa were assessed as Near Threatened and 9 taxa were assessed as Least Concern. Lastly, *S. cuspidatum* which has been reported recently from Turkey was evaluated as data deficient. At the end of study, it has been determined that habitat losses are the most important threatening factor and conservation strategies are proposed for each species.

**Key words**: Bryophytes, Bryophyta, IUCN categories, Conservation, Peat, Blanket bog

# Türkiye Sphagnum'larının (Sphagnopsida) Ön Kırmızı Liste Değerlendirmesi

**Öz**

Bu çalışmada Türkiye'de yayılış gösteren *Sphagnum* cinsine ait toplam 27 takson IUCN kategorilerine göre değerlendirilmiş ve 2 takson, *S. flexuosum* ve *S. fimbriatum* kritik olarak tehlike altında, 5 takson *S.angutifolium, S. fuscum, S. rubellum, S. squarrosum* ve *S. warnstorfii* hassas ve 6 takson *S.contortum, S. medium, S.quinquefarium, S. papillosum, S. subfulvum* ve *S. tenellum* tehlike altında olarak bulunmuştur. 4 takson tehdite yakın, 9 takson ise düşük riskli olarak değerlendirilmiştir. Son olarak Türkiye'den yakın zamanda kaydı verilen *S. cuspidatum* veri yetersiz olarak değerlendirilmiştir. Çalışmanın sonunda, Türkiye Sphagnumlarını tehdit eden en önemli faktörün habitat kayıpları olduğu belirlenmiş ve her takson için koruma stratejileri önerilmiştir.

**Anahtar kelimeler**: Karayosunları, Yapraklı karayosunları, IUCN kategorileri, Koruma, Turba, Battaniyemsi bataklıklar

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## 1. Introduction

The IUCN Global Species Programme working with the IUCN Species Survival Commission (SSC) has been assessing the conservation status of species, subspecies, varieties and even selected subpopulations on a global scale for the past 50 years, in order to highlight taxa threatened with extinction, and thereby promote their conservation (URL1). The IUCN red list of threatened species is widely recognized as the most comprehensive and objective global approach for evaluating the conservation status of plant and animal species (1994). After this date, IUCN categories and criteria were improved, and the last version was published in 2022. It is clear that specialist groups will continue to revise these IUCN categories and criteria in the future.

In 1974, the European Council decided to take some precautions in order to protect nature, and in 1977 the "RED DATA BOOK" list covering about 1500 plant species was published for European countries in relation to these decisions. In 1982, this list was revised, benefiting from the finalization of the publication of the European Flora, and published again in 1983. In these reports, Turkish endemics which were taken from published floras were included without any classification. The second and final 'Turkey Plant Red Data Book' was published again in 2000 with the collaboration of Turkey's famous botanist of the same association (Ekim et al., 2000). At present, the revised Red List book on Turkish flowering plants is preparation.

European Committee for the Conservation of Bryophytes (ECCB) was established at the first conference on Bryophyte Conservation in Uppsala 1990 and the first red data book was published in 1995 using the old IUCN categories and criteria. The second and revised one was published by Hodgetts in 2015 using essentially modified version of IUCN criteria for the European bryophyte flora (Hodgetts, 2015). The bryophyte list of European part of Turkey was given in this report without country red list (Hodgetts, 2015). Lastly, Hodgetts and Lockhart (2020) published the updated version of the European bryophyte checklist.

The genus *Sphagnum* is represented with 26 taxa in Turkish bryophyte flora. Studies on Turkish *Sphagnum* were initiated in 1896 and plenty of studies, most of which are floristic records, have been carried out since that time (Schiffner, 1896; Erata and Batan, 2020; Kırmacı and Kürschner 2013, 2017; Kırmacı et al., 2019; Kürschner et al., 2019; Ören et al., 2017, Erata, 2021a,b; Kırmacı, 2021).

The red list categories of Turkish Sphagnum were evaluated in the present study. This is quite important in terms as it is the first Red List study conducted for the Turkish bryophytes. We expect that it will serve as a valuable contribution to the knowledge of nature conservation surveys of Turkish Sphagnum and bryophytes.

## 2. Material and Methods

Materials of this study were collected and evaluated between 2011-2020. Intensive sampling was carried out during the revision study (supported by TÜBİTAK TBAG 113Z631) on the genus *Sphagnum*, especially between 2013 and 2017. Also all studies on the genus *Sphagnum* in Turkey were taken into consideration. All locality data (habitat, abundance, extent of occurrence, population size, rarity ect.) were recorded during the field trip. Accepted name of taxa were checked from Topicos (URL 2).

The IUCN Red List Categories and Criteria divides species into nine categories: Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW) and Extinct (EX) (see, URL3).

The IUCN categories and criteria for allocating species to each category as described in IUCN version 3.1 published in 2001 and second edition in 2012 with the application guidelines for bryophytes were used (Hallingbäck, 2006, 2007; Hodgetts, 2015; Hodgetts et al, 2019; Mišíková et al., 2020, 2021).

The IUCN Red List is recognised as a robust system for assessing the risk of extinction of organisms, but there are difficulties in applying the criteria to bryophytes and other clonal and colonial organisms. Three critical terms are addressed – generation length, mature individual and severe fragmentation – and definitions are given in order to facilitate the use of the IUCN Red List criteria for bryophytes (Bergami et al., 2019). Criterion A is based on the rapid decline of species or habitats. According to the data we have, there are no taxa that can be evaluated according to this criterion. And also criterion C has not been used due to the lack of information for bryophytes in the Turkey. Species classification of threat categories like B (subcriteria B1 and B2) and D (subcriterion D2) of IUCN criterion were taken into account in the evaluation process.

Table 1. Explanation of Applied Criteria (IUCN Standards and Petitions Subcommittee 2019; Mišíková, 2020

| **Criterion B** – Geographic Range In The Form Of B1 (Extent Of Occurrence) And/Or B2 (Area Of Occupancy) | | | |
|---|---|---|---|
| | **CR** | **EN** | **VU** |
| B1 (EOO – extent of occurrence) | <100 $km^2$ | <5000 $km^2$ | <20,000 $km^2$ |
| B2 (AOO – area of occupancy) and at least 2 of the following 3 conditions | <10 $km^2$ | <500 $km^2$ | <2000 $km^2$ |
| a. severely fragmented or number of locations | =1 | ≤5 | ≤10 |
| b. continued decline observed, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) extent, area and/or habitat quality; (iv) number of locations or subpopulations; (v) number of mature individuals | | | |
| c. extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals | | | |
| **Criterion D** – very small and restricted population | | | |
| | **CR** | **EN** | **VU** |
| **D**. Number of mature individuals | <50 | <250 | D1. <1000 |
| **D2.** Only applies to the VU category Restricted area of occupancy or number of locations with a possible future threat that could drive the taxon to CR, RE or EX in a short time | - | - | D2. AOO <20 $km^2$ or number of locations≤5 |

## 3. Results and Discussion

*Sphagnum* is one of the largest genus within the Turkish Bryophyte Flora and at the present moment, 26 taxa belonging to this genus have been recorded (Kırmacı et. al, 2019; Erata, 2021a,b). These taxa are presented in Table 2 with distribution, old records, status of European redlist, redlist criteria and status.

Our studies on the genus *Sphagnum* and their habitats in Turkey have been continuing intensively since 2011. The data of the present study was obtained over a period of 10 years. All taxa belonging to genus *Sphagnum* previously sampled were recollected during the revision project from the first collecting localities. It is not possible to compare the habitats and population sizes of the taxa collected before 2011.

27 taxa belonging to *Sphagnum* were assessed (Table 2). Among these, two taxa as CR (7,40 %), 6 taxa as EN (22,22 %), 5 taxa as VU (18,51 %), 4 taxa as NT (14,81 %), 9 taxa as LC (33,33 %) and one taxon as DD (3,70 %) are categorized.

The presence of *S. fimbriatum* in Turkey is based on two studies. Firstly, it was collected from Ciger Lake (Çan / Çanakkale) by Tonguç Yayıntaş in 2013. This taxon was not relocated in the locality where it was first collected which is about to lose its peaty character and has a total area of only 6500 $m^2$. *S. fimbriatum*, also collected from Anzer Valley (Rize) by Erata et al. (2021), was not found in different localities during the revision project and herbarium samples of taxon could not be reached. For these reasons, the redlist category of the species was evaluated as Critically Endangered. *S. flexuosum*, which was added to Turkish bryophyte flora in 2017, is evaluated in the Critically Endangered category. It was collected from two very small localities in a total area of 1000 m2. Soğucak Plateau, where the taxon is found, is located in a region with high tourism potential. In the near future, it is inevitable that new residential buildings will be constructed for tourism activities in this area. This development means the water available in the field necessary for the survival of sphagnums will be repurposed for construction purposes.

Table 2. Red List of *Sphagnum* in Turkey (with distribution, old records, status of European redlist, redlist criteria and status.

| Taxon | Distribution | Old records Before revision project | Europaen country redlist (Hodgetts and Lockhart 2020) | IUCN Red List Category (E) Hodgetts et al., 2019) | Criteria | Turkish Sghagnum Status |
|---|---|---|---|---|---|---|
| 1. ***S. angustifolium*** (Russow) C.E.O. Jensen | Artvin (5 different localities), Rize, Trabzon (2 different localities) | Given by Çetin (1988) without locality details. | Germany (NT), Netherlands (NT), Portugal (EN), Slovakia (DD), Switzerland (NT), Hungary (NT), Montenegro (DD*), Serbia (VU) | LC | B2, b (iii) | Vulnerable (VU) |
| 2. ***S. auriculatum*** Schimp. | Artvin (3 different localities), Bursa (4 different localities), Giresun (2) (Erata et al., 2021a), İstanbul, Rize Trabzon (2 different localities), Samsun (2 different localities), Sinop (2 different localities, Söylemez et al., 2019) | Given by Çetin (1988) without locality details. | Austria (3), Luxembourg (NT), Malderia (VU), Slovakia (EN), Albania (DD*), Hungary (EN), Montenegro (VU), Romania (VU), Serbia (VU), Slovenia (NT), Estonia (EN) | LC | | Least Concern (LC) |
| 3. ***S. centrale*** C.E.O. Jensen | Artvin (6 different localities), Giresun, Gümüşhane (2 different localities), Rize (8 different localities), Trabzon (10 different localities) | Rize: Kaçkar Mountain (Abay et al., 2009) | Azores (EN), Portugal (DD), Spain (EN), Austria (EN), Belgium (Mn), Germany (DD), Hungary (EN), Montenegro (VU), Serbia (VU), Slovenia (NT) | LC | | Least Concern (LC) |
| 4. ***S. compactum*** DC. | Artvin (6 different localities), Giresun-Gümüşhane, Rize (7 different localities), Trabzon (8 different localities) | Trabzon: Ezeli (Handel-Mazzetti,1909) Rize: Kaçkar Mountain (Abay et al., 2009) | Canary Islands (DD), Maderia (EN), Germany (VU), Netherlands (VU), Slovakia (NT), Hungary (EN), Slovenia (EN), Estonia (NT), Latvia (4), Lithunia (4) | LC | | Least Concern (LC) |
| 5. ***S. contortum*** Schultz. | Rize, Trabzon | Rize: Arçahal Mountain (Kırmacı and Kürschner, 2013) | Finland (NT), Andorra (VU), Austria (2), Spain (VU), Czech Rebuplic (NT), Netherlands (VU), Germany (EN), Slovakia (VU), Albania (DD*), Hungary (VU), Montenegro (VU), Serbia (VU) | LC | B2, b(ii) | Endangered |
| 6. ***Sphagnum cuspidatum*** *Ehrh. ex Hoffm.* | Giresun (Kırmacı,2021) | | Austria (3), Luxembourg (CR), Slovakia (NT), Switzerland (NT), Bulgaria (EN), Hungary (EN), Serbia (VU) | LC | Known only one locality | Data Deficient (DD) |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7. ***S. fallax*** (H. Klinggr.) H. Klinggr. | Artvin (4 different localities), Giresun (2) (Erata et al., 2021a), Giresun-Gümüşhane, Trabzon | Trabzon:Tonya (Kırmacı and Kürschner, 2013) | Luxembourg (NT), Portugal (DD), Austria (EN), Switzerland (NT), Bulgaria (VU), Hungary (NT), Serbia (VU) | LC | | Near Threatened (NT) |
| 8. ***S. fimbriatum*** Wilson | Rize (Erata et al., 2021b) | Çanakkale, Çan, Söğütalan Village, Liver Lake (Tonguç Yayıntaş, 2013) | Slovakia (VU), Switzerland (VU), Bulgaria (NE), Hungary (NT), Slovenia (EN), Austria (3) | LC | B1, D2 (extinct in first locality) | Critically Endangered (CR) |
| 9. ***S. flexuosum*** Dozy & Molk. | Sakarya (Ören et al., 2017) | | Ireland (VU), Portugal (EN), Austria (EN), Luxembourg (VU), Switzerland (NT), Hungary (VU), Serbia (VU) | LC | B1, B2, b (iii) | Critically Endangered (CR) |
| 10. ***S. fuscum*** (Schimp.) H. Klinggr. | Gümüşhane, Rize (3 different localities), Trabzon (3 different localities) | Trabzon, Ağaçbaşı Peatland (Payne et al., 2007). | Spain (CR), Belgium (Mn), Czech Rebuplic (NT), Netherlands (VU), Poland (V), Switzerland (VU), Serbia (VU), Slovenia (VU), Great Britain (DD), Austria (3), Germany (EN), Poland (V) | LC | B2, b (iii) | Vulnerable |
| 11. ***S. girgensohnii*** Russow | Artvin (6 different localities), Gümüşhane, Rize (7 different localities), Trabzon (2 different localities) | Trabzon: Kızıl Ali Plateau (Handel-Mazzetti, 1909) | Ireland (NT), Northern Ireland (NT), Luxembourg (VU), Netherlands (CR), Hungary (EN), Serbia (VU), Portugal (CR) | LC | | Least Concern (LC) |
| 12. ***S. inundatum*** Russow | Bursa (2 different localities), Giresun (3 different localities) (Erata et al., 2021a), Rize, Trabzon (3 different localities), Samsun (2 different localities) | Bursa, Uludağ (Henderson, 1969) | Finland (EN), Portugal (DD), Czech Republic (DD), Austria (3), Germany (NT), Luxembourg (EN), Hungary (EN), Romania (VU), Serbia (VU), Slovenia (VU), Estonia (NT), Latvia (2) | LC | | Least Concern (LC) |
| 13. ***S. medium*** P. Beauv. | Trabzon (2 different localities) (Kürschner et all., 2019) | | Austria (NE) | LC | B1, B2, b (i) | Endangered |
| 14. ***S. divinum*** Flatberg & K. Hassel | Artvin (3 different localities), Rize (2 different localities), Trabzon (4 different localities) (Kürschner et all., 2019) | | Austria (NE) | LC | | Near Threatened (NT) |
| 15. ***S. molle*** (Kara-Mursa) Verbizk. | Artvin (3 different localities), Giresun, Rize (3 different | Rize, Fındıklı (Abay and Keçeli, 2014). | Finland (EN), Andorra (VU), Portugal (EN), Austria (1), | LC | | Near Threatened (NT) |

| | | | | | | |
|---|---|---|---|---|---|---|
| | localities), (Erata et al., 2021b) Trabzon (2 different localities) | | Spain (VU), Czech Republic (RE), Netherlands (VU), Germany (EN), Poland (V), Slovakia (DD), Switzerland (VU), Romania (DD), Serbia (VU), Belarus (VU), Estonia (EN), Ukraine (VU), Latvia (1), Lithunia (2) | | | |
| 16. ***S. nemoreum*** Scop ***(S.capilifolium)*** | Artvin (6 different localities), Bursa, Giresun, Giresun-Gümüşhane, Rize (4 different localities) Trabzon (4 different localities) | Trabzon, Kızıl Ali Plateau (Handel-Mazzetti, 1909). | Ireland (DD), Northern Ireland (DD), Luxembourg (VU), Netherlands (VU), Switzerland (NT), Hungary (VU), Serbia (VU), Slovenia (NT) | LC | | Least Concern (LC) |
| 17. ***S. palustre*** L. | Bursa, Gümüşhane, Çanakkale, Rize (2 different localities) Trabzon (3 different localities) | Trabzon: Of (Robinson and Godfrey, 1960)<br>Trabzon: Sürmene (Özdemir and Çetin, 1999)<br>Trabon: Ağaçbaşı Peathland (Byfield and Özhatay, 1997) | Albania (DD), Hungary (NT), Serbia (VU), Portugal (NT) | LC | | Least Concern (LC) |
| 18. ***S. papillosum*** Lindb. | Artvin (1), Rize (Erata et al., 2021b) | | Portugal (EN), Austria (3), Germany (VU), Poland (I), Slovakia (VU), Switzerland (NT), Romania (CR), Serbia (VU), Slovenia (NT), Latvia (2) | LC | B1, B2, b (i), | Endangered |
| 19. ***S. platyphyllum*** (Lindb. ex Braithw.) Sull. ex Warnst. | Artvin (2 different localities), Bursa (2), Rize (5 different localities) Trabzon (8 different localities), Samsun (2 different localities), Giresun (Erata et al., 2021a), | Bursa, Uludağ (Walther, 1967; Çetin, 1999)<br>Rize, Kaçkar Mountain (Abay et al., 2009) | Ireland (NT), Northern Ireland (NT), Andorra (VU), Portugal (DD), Austria (3), Belgium (Mn), Czech Rebuplic (CR), Luxembourg (CR), Germany (EN), Netherlands (RE), Poland(R), Slovakia (EN), Hungary (VU), Romania (NT), Serbia (VU), Slovenia (VU), Estonia (NT), Lithunia (2) | LC | | Least Concern (LC) |
| 20. ***S.quinquefarium*** (Lindb.) Warnst. | Artvin, Giresun (Erata et al., 2020) | | Netherlands (NT), Hungary (VU), Estonia (NT) | LC | B1, B2, b (i), | Endangered |
| 21. ***S. rubellum*** Wilson | Artvin, Gümüşhane, Rize, Trabzon | Trabzon: Soğanlı Dağ (Kırmacı and Kürschner, 2013) | Germany (VU), Portugal (VU), Austira (3), Luxembourg (VU), Switzerland (NT), Serbia (VU), Slovenia (NT), Slovakia (NT) | LC | B2, b (iii) | Vulnerable (VU) |

| | | | | | | |
|---|---|---|---|---|---|---|
| 22. ***S. squarrosum*** Crome | Artvin (3 different localities), Kars, Rize, Giresun (Erata et al., 2021a), | Artvin, Murgul (Henderson, 1961) | Andorra (VU), Portugal (EN), Spain (VU), Luxembourg (NT), Hungary (NT), Montenegro (VU), Serbia (VU) | LC | B1, B2, b (iii) | Vulnerable (VU) |
| 23. ***S. subfulvum*** Sjörs | Trabzon (2 different localities) | | Poland (R), Switzerland (VU), Bulgaria (VU), Estonia (VU), Latvia (1) | LC | B1, B2, b (i), | Endangered |
| 24. ***S. subsecundum*** Nees | Artvin, Bursa (3 different localities), Rize (4 different localities) Trabzon (9 different localities), Samsun (2 different localities), Giresun (Erata et al., 2021a), | Artvin, Hopa- Arhavi (Davis et al., 1965) Bursa, Uludağ (Walther, 1967; Çetin, 1999) | Ireland (NT), Azores (DD*), Sicily (DD), Austria (3), Luxembourg (EN), Germany (VU), Netherlands (CR), Hungary (VU), Serbia (VU), Slovenia (NT) | LC | | Least Concern (LC) |
| 25. ***S. tenellum*** (Brid.) Bory | Artvin (2 different localities) (Kırmacı and Kürschner, 2019) | | Luxembourg (CR), Austria (2), Germany (EN), Poland(V), Slovakia (DD), Switzerland (NT), Romania (EN), Slovenia (VU), Ukraine (VU) | LC | B1, B2, b (i) | Endangered (EN) |
| 26. ***S. teres*** (Schimp.) Ångstr. ex Hartm. | Artvin (3 different localities), Rize (2 different localities) Trabzon (2 different localities), Giresun (Erata et al., 2021a), | Artvin, Murgul (Henderson, 1961) | Ireland (NT), Northern Ireland (NT), Austria (3), Germany (VU), Luxembourg (NT), Netherlands (VU), Albania (DD*), Hungary (CR), Serbia (VU), Slovenia (EN) | LC | | Near Threatened (NT) |
| 27. ***S. warnstorfii*** Russow | Rize (4 different localities) Trabzon (3 different localities) | Trabzon, Ezeli, (Handel-Mazzetti 1909). | Ireland (VU), Northern Ireland (VU), Andorra (VU), Spain (VU), Austria (3), Germany (EN), Luxembourg (CR), Slovakia (NT), Hungary (RE), Serbia (VU), Slovenia (VU) | LC | B2, b (iii) | Vulnarable |

Another problem will be pollution. Owing to all these negative developments, the sphagnums in the area may be lost. We think it is appropriate to keep the taxon in this category until it is determined from another locality. *Sphagnum cuspidatum*, which is common in the Mediterranean (Ros et al., 2013), was found in a very narrow area in Turkey. The terrestrial form of S. cuspidatum was collected from high mountain flushes in Kürtün (Giresun) and published in 2021 (Kırmacı, 2021). It would not be correct to evaluate the taxon according to a single gathering locality thus it is classified as Data Deficient. Future studies should reevaluate the category of the taxon.

*S. contortum*, *S. medium*, *S. quinquefarium, S. papillosum, S. subfulvum* and *S. tenellum* are evaluated in the Endangered category. These taxa have just been recorded from Turkey and are known from one or more points. Similar problems with *S. flexuosum* threaten these taxa as well especially in the eastern Black Sea Mountains, where significant increases have been observed in the tourism activities in recent years. In addition, the green road project that connects all the highlands of the Black Sea was completed. These roads have made it extremely easy to reach the special habitats where sphagnums are located. This development is positive in terms of tourism but worrying in terms of its impact on nature. *S. angutifolium, S. fuscum, S. rubellum, S. squarrosum* and *S. warnstorfii* are evaluated in the vulnerable category. *S. fallax, S. divinum, S. molle* and *S. teres* are evaluated as Near Thereatened category. The remaining 8 taxa are considered in the Least Concern category. These taxa are widely distributed taxa collected from almost more than 10 localities.

Blanket bogs, the preferred habitats of Sphagnums, are extremely important for the protection of the species. There are very limited blanket bogs in Turkey such as Ağaçbaşı Peatland, Barma Yaylası Peatland, Yılanlıtaş Yaylası Peatland (Trabzon), Kabaca–Petek Yaylası Peatland, Sazak Peatland (Artvin) and Ciğer Lake Peatland (Çanakkale). Except for Ciğer Lake Peatland, all these blanket bogs are located at the north-eastern part of Turkey. Yılanlıtaş Yaylası and Ciğer Lake are almost extinct (Kırmacı et all., 2019). These areas contain 77,77 % of the total sphagnums (21 taxa). There is no protection status for these areas besides Ağaçbaşı Peatland which is Nature Park (15 taxa). At least, Sazak Peat (14 taxa), which contains numerous taxa, and its natural beauty should be protected. Hosting not only bryophytes but also many other organisms, Ağaçbaşı and Sazak peatlands together contain 20 taxa and approximately 74,07 % of the total sphagnum taxa in Turkey (Kırmacı et all., 2019). Additionally, it is a well-known fact that the protected areas such as national parks are extremely important for the protection of species. 5 taxa, *S. auriculatum, S. inundatum, S. nemoreum, S. platyphyllum* and *S. subsecundum*, known from Ağaçbaşı and Sazak Peatland were collected from Uludag National Park (Bursa). All Turkish Sphagnums have been recorded in places under the influence of the Euro-Siberian climate which affects the northern parts of the country. Although the effects of climate change are often unpredictable, the general opinion is that Turkey will be one of the most affected countries and it such situations, the habitats where the sphagnum taxa are found will be under serious threat.

A large number of field studies were carried out in the areas where Sphagnum species could be found from 2012 to 2021 (intensely within the scope of the project between 2013 and 2017). Habitats, where taxa are densely populated, were periodically visited and the status of the species was checked. Despite this intensive fieldwork, it is always possible that new areas and new records of the genus will be added to the flora.

Although, intensive studies are ongoing to determine the red list categories of bryophytes in Europe (URL 4), there is no study on the conservation of bryophytes in Turkey. Special habitats such as peatlands, whose numbers are quite limited, should be given protected status. And also monitoring studies on some sphagnum taxa such as *S. flexuosum, S. fimbriatum, S. cuspidatum* and *S. papillosum* should be start.
Evaluation of the red list category of taxa by using all criteria in real terms will give healthier results. This can only be achieved by monitoring the species in their habitats and keeping records. This is the first red list study evaluating all members of a bryophyte genus distributed in Turkey. We hope that it will be useful for future research.

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