Ormancılık Araştırma Dergisi
Turkish Journal of Forestry Research
2026, 13:2, 242-256

DOI: https://doi.org/10.17568/ogmoad.1985676
Ekoloji/Ecology
Araştırma makalesi/Research article

Floristic composition and ecological characteristics of riparian areas in the Yeşilırmak Basin (Amasya Province, Türkiye)

Amasya ili Yeşilırmak Havzası riperyan alanlarının floristik yapısı ve ekolojik özellikleri

Bilge Tunçkol[1]
Ahmet Ayteğin[2]

[1] Bartın University, Bartın, Türkiye
[2] Düzce University, Düzce, Türkiye

Sorumlu yazar (*Corresponding author)*
Ahmet Ayteğin
ahmetaytegin@gmail.com

Geliş tarihi *(Received)*
02.07.2026
Kabul Tarihi *(Accepted)*
21.10.2026

Sorumlu editör (*Corresponding editor)*
Mehmet Güvenç Negiz
mehmetnegiz@isparta.edu.tr

Atıf *(To cite this article)***:** Ayteğin, A., & Tunçkol, B., (2026). Amasya ili Yeşilırmak Havzası riperyan alanlarının floristik yapısı ve ekolojik özellikleri, Ormancılık Araştırma Dergisi, 13(2):242-256 DOI: https://doi.org/10.17568/ogmoad.1985676

Creative Commons Atıf - Türetilemez 4.0 Uluslararası Lisansı ile lisanslanmıştır.

Abstract

This study aimed to identify vascular plant taxa and assess the floristic composition and ecological characteristics of riparian areas in the Yeşilırmak Basin, Amasya Province, Türkiye. Field surveys conducted in late May 2023 covered 80 stations encompassing riverbanks, streambeds, floodplains, alluvial meadows, reedbeds, marshes, and the margins of slow-flowing or standing waters. A total of 163 vascular plant taxa belonging to 57 families were recorded. The families with the highest taxon richness were Cyperaceae, Lamiaceae, Ranunculaceae, Asteraceae, Potamogetonaceae, Brassicaceae, and Rosaceae. Cryptophytes dominated the life-form spectrum at 41.1%, followed by hemicryptophytes at 26.4%, phanerophytes at 19.0%, and therophytes at 13.5%. Widely distributed species accounted for 46.0% and Euro-Siberian elements for 36.2% of the flora. Based on occurrence across sampling stations, *Glyceria fluitans* was the most frequent taxon at 17.5%, followed by *Bolboschoenus maritimus* subsp. *maritimus*, *Euphorbia helioscopia*, *Malva neglecta*, and *Schoenoplectus lacustris* subsp. *lacustris*, each at 16.3%. The findings indicate that riparian areas form transitional zones between aquatic and terrestrial ecosystems and provide valuable habitats for wetland plant communities. This study provides an updated inventory of the regional riparian flora and a scientific basis for conservation, monitoring, and ecological restoration.

Keywords: Amasya Province; Yeşilırmak Basin; riparian flora; vascular plants; wetland ecosystems; phytogeography; biodiversity; riparian habitats

Öz

Araştırma, Amasya ili Yeşilırmak Havzası'nın riperyan alanlarındaki vasküler bitki taksonlarını belirlemek ve floristik yapı ile ekolojik özellikleri değerlendirmek amacıyla gerçekleştirilmiştir. Mayıs 2023 sonunda nehir kenarları, dere yatakları, taşkın ovaları, alüvyal çayırlar, sazlık-bataklık alanlar ve yavaş akışlı/durgun su kıyılarını kapsayan 80 istasyonda 57 familyaya ait 163 vasküler bitki taksonu kaydedilmiştir. En zengin familyalar Cyperaceae, Lamiaceae, Ranunculaceae, Asteraceae, Potamogetonaceae, Brassicaceae ve Rosaceae olarak belirlenmiştir. Yaşam formu spektrumunda kriptofitler yüzde 41,1 ile baskınken, hemikriptofitler yüzde 26,4, fanerofitler yüzde 19,0 ve terofitler yüzde 13,5 oranında temsil edilmiştir. Geniş yayılışlı türler yüzde 46,0, Avrupa-Sibirya elementleri yüzde 36,2 oranıyla floranın çoğunluğunu oluşturmuştur. İstasyonlarda kaydedilme durumları esas alınarak yapılan değerlendirmede Glyceria fluitans yüzde 17,5 ile en yaygın takson olmuş; *Bolboschoenus maritimus* subsp. *maritimus*, *Euphorbia helioscopia*, *Malva neglecta* ve *Schoenoplectus lacustris* subsp. *lacustris* yüzde 16,3 bulunma oranıyla bu taksonu izlemiştir. Bulgular, riperyan alanların sucul ve karasal ekosistemler arasında geçiş zonu oluşturduğunu ve sulak alan bitki toplulukları için değerli habitatlar sağladığını göstermektedir. Çalışma, bölgenin riperyan florasına ilişkin güncel bir envanter sunarak koruma, izleme ve ekolojik restorasyon çalışmalarına bilimsel altyapı sağlamaktadır.

Anahtar kelimeler: Amasya, Yeşilırmak Havzası, riperyan flora, vasküler bitkiler, sulak alan ekosistemleri, fitocoğrafya, biyoçeşitlilik, riperyan habitatlar

1. Introduction

Riparian habitats are dynamic ecosystems situated at the interface between fluvial and adjacent terrestrial environments, where they regulate the exchange of matter, energy, and organisms between aquatic and terrestrial systems. These habitats are recognized for their high biodiversity, pronounced habitat heterogeneity, and critical ecological functions. Riparian vegetation provides a wide range of ecosystem services, including flood attenuation, sediment retention, bank stabilization, water quality improvement, nutrient and organic matter cycling, and carbon sequestration (Naiman et al., 2010; Stella et al., 2013; Riis et al., 2020). In addition, the riparian zones serve as essential habitats, breeding sites, feeding grounds, and dispersal corridors for numerous plant and animal species, thereby maintaining ecological connectivity across river catchments.

The composition and structure of riparian and wetland plant communities are governed by the combined influence of multiple environmental drivers, including hydrological regime, flood frequency, groundwater dynamics, alluvial soil characteristics, topography, microclimatic conditions, and anthropogenic disturbances. Among these factors, fluctuations in water level and flood dynamics play a pivotal role in determining the establishment and persistence of hygrophytic, helophytic, and hydrophytic plant species. Owing to the close interactions between vegetation and hydromorphological processes, riparian vegetation is widely regarded as a key indicator in river management, ecological assessment, and restoration planning (Richardson et al., 2007; González del Tánago et al., 2021).

In recent decades, riparian ecosystems have been increasingly threatened by climate change, land-use change, urban expansion, agricultural intensification, and river regulation practices. A substantial proportion of the world's wetlands has been lost over the past century, resulting in widespread declines in biodiversity, habitat fragmentation, and the degradation of ecosystem services (Davidson, 2014; IPBES, 2019). Similar trends have been reported in Türkiye, where growing anthropogenic pressures on river corridors and wetlands are substantially altering the composition, structure, and species diversity of riparian plant communities (Ataol and Onmuş, 2021; Aktürk et al., 2024).

Türkiye is recognized as one of the world's major centres of plant diversity owing to its location at the intersection of the Euro-Siberian, Mediterranean, and Irano-Turanian phytogeographical regions. This unique biogeographical setting, together with pronounced climatic and environmental heterogeneity, has promoted the coexistence of a remarkable diversity of plant taxa adapted to a wide range of ecological conditions (Davis, 1965-1988; Davis et al., 1988; Güner et al., 2000; Güner et al., 2012; Noroozi et al., 2019). Although numerous floristic studies such as cited in the article have focused on mountain ecosystems, steppes, and forest vegetation in Türkiye, comprehensive investigations of riparian flora associated with riverbanks, floodplains, alluvial meadows, and wetlands remain comparatively scarce. However, these habitats represent biodiversity-rich ecosystems that are among the most vulnerable to anthropogenic disturbances, highlighting the need for systematic floristic inventories and long-term ecological monitoring.

Amasya Province is situated in the inland part of the Black Sea Region, within the transitional zone between the Black Sea Region and the Central Anatolia Region biogeographical regions. Owing to this strategic location, its flora reflects the combined influence of the Euro-Siberian and Irano-Turanian phytogeographical regions. Previous floristic studies (Canlı and Çetin, 2014; Yıldırım et al., 2020; Cansaran and Yıldırım, 2022; Yıldırım et al., 2022) have demonstrated that Amasya Province supports a rich and diverse flora, particularly within its mountainous landscapes, forest-steppe transition zones, and terrestrial ecosystems. However, comprehensive floristic investigations specifically targeting riparian habitats, including riverbanks, stream channels, floodplains, and alluvial meadows, within the Amasya Province section of the Yeşilırmak Basin remain limited.

Recent studies on wetlands and riparian ecosystems in Türkiye have highlighted the urgent need to evaluate these habitats in terms of both their floristic diversity and increasing anthropogenic pressures. A recent floristic survey conducted in the Melen Basin (Ayteğin and Özcan, 2025) documented 199 vascular plant taxa within wetland habitats and identified agricultural activities and habitat degradation as the principal drivers of changes in floristic composition. Similarly, studies in the Hacıosman Forest nature reserve in the nearby Samsun province emphasized the critical role of protected wetland forests in preserving regional biodiversity (Ürker, 2020). At the national scale, widespread wetland loss and ongoing land-cover changes within riparian zones further underscore the necessity of conserving and systematically monitoring these ecosystems (Ataol and Onmuş, 2021; Aktürk et al., 2024).

The Yeşilırmak Basin constitutes one of the principal components of the natural and cultural landsca-

pe of Amasya Province. However, riparian habitats throughout the basin are increasingly exposed to multiple anthropogenic pressures, including agricultural expansion, riverbank modification, urban development, alterations in hydrological regimes, and habitat fragmentation. In particular, the conversion of floodplains to agricultural land has contributed to the degradation of natural riparian vegetation and the fragmentation of habitats supporting aquatic and semi-aquatic plant communities. These pressures are consistent with documented land-cover changes in riparian zones across Türkiye (Aktürk et al., 2024).

The objectives of this study were to document the vascular plant taxa occurring in the riparian habitats of the Yeşilırmak Basin and to evaluate their life-form spectrum, phytogeographical affinities, endemism, and habitat preferences in order to characterize the ecological attributes of the regional riparian vegetation. Furthermore, the study discusses the potential influence of anthropogenic pressures on riparian flora and provides a scientific basis for the conservation, monitoring, and ecological restoration of riparian habitats along the Yeşilırmak River.

2. Materials and Methods

2.1. Study area

The study was conducted within the riparian ecosystems of the Yeşilırmak Basin in Amasya Province, northern Türkiye. The study area encompasses the main channel of the Yeşilırmak River together with its tributary streams, floodplains, alluvial flats, moist meadows, and riverbank habitats. Situated in the inland part of the Black Sea Region, within the transitional zone towards the Central Anatolia Region, Amasya Province occupies a biogeographically important position where the Euro-Siberian and Irano-Turanian phytogeographical regions converge, contributing to the high floristic diversity of the area (Figure 1).

The study area is located approximately between 40°26′-41°08′ N and 35°15′-37°20′ E. Elevation ranges from approximately 250 meters (m) along the Yeşilırmak Valley to nearly 2,400 m a.s.l. in the surrounding mountainous terrain. The river corridor is characterized by extensive alluvial soils, seasonal flooding, high soil moisture, and well-developed gallery vegetation, creating a wide variety of environmental conditions that support diverse riparian plant communities. These geomorphological and hydrological characteristics make the basin one of the most important riparian habitats in the region for the establishment and persistence of wetland and riverine vegetation.

Amasya Province is characterized by a transitional climate between the humid Black Sea climate and the continental climate of Central Anatolia. (Yıldırım et al., 2020; Yıldırım et al., 2022). Consequently, humid riparian habitats occur in close proximity to comparatively dry hillslopes and lowland ecosystems, creating pronounced environmental heterogeneity across the landscape. Along the Yeşilırmak River and its tributaries, riparian zones generate distinctive microclimatic conditions that promote the establishment and persistence of aquatic and semi-aquatic plant communities, thereby contributing to the high ecological diversity of the basin.

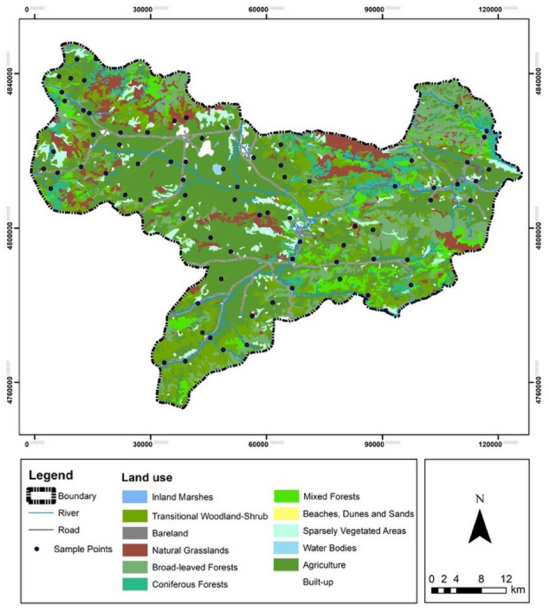


Figure 1. The study area in the Yeşilırmak Basin
Şekil 1. Yeşilırmak Havzası'ndaki araştırma sahası

2.2. Field surveys and sampling

Field surveys were conducted in late May 2023 to encompass the phenological development of riparian vegetation across 80 sampling sites. Sampling sites were selected across the Yeşilırmak River and its tributary network to represent distinct hydrological and riparian zones, including riverbanks, stream margins, floodplains, marshes, and alluvial meadows. At each sampling site, floristic inventories were conducted using standardized 5 m×20 m (100 m^2) sampling plots oriented parallel to the water's edge to capture the lateral zonation of riparian vegetation.

At each sampling site, all vascular plant taxa were recorded through comprehensive floristic surveys.

Woody species, shrubs, herbaceous plants, aquatic macrophytes, and semi-aquatic species were documented separately to ensure adequate representation of the different vegetation components. For each recorded taxon, information on species occurrence, habitat preference, phenological stage, and visible anthropogenic disturbances was systematically recorded using standardized field data sheets. Plant specimens that could not be reliably identified in the field were collected and subsequently examined under laboratory conditions for accurate taxonomic identification.

2.3. Taxonomic identification and classification

Plant specimens collected during the field surveys were processed following standard herbarium procedures, including pressing, drying, mounting, and labelling. For each specimen, detailed collection data were recorded, including locality, habitat type, elevation, geographic coordinates, sampling date, and relevant ecological observations. Taxonomic identification was based primarily on diagnostic morphological characters, including floral, fruit, leaf, stem, root, and rhizome characteristics (Ann. Table 1).

Species identification was carried out primarily using Flora of Turkey and the East Aegean Islands (Davis, 1965-1988), supplemented by other authoritative taxonomic references for the Turkish flora. Current nomenclature and taxonomic validity were verified using the Checklist of the Flora of Türkiye (Vascular Plants) (Güner et al., 2012) together with up-to-date taxonomic databases. All taxa were classified at the family, genus, and species levels. In addition, each taxon was assigned to its corresponding life-form category based on the Raunkiær (1934) classification system, phytogeographical element, and endemism status based on the available floristic literature (bizimbitkiler.org, 2026).

2.4. Data analysis

The floristic data obtained from the field and laboratory surveys were compiled and analysed to characterize species composition, family representation, life-form spectrum, phytogeographical affiliations, and habitat preferences. The distribution of taxa among plant families was determined, and the most species-rich families together with the dominant life-form categories were identified using descriptive statistics.

Species frequency analysis was performed to evaluate the distribution and relative occurrence of each taxon across the study area (Mueller-Dombois and Ellenberg, 1974). Species frequency (%) was calculated as:

$$\text{Frequency } (\%) = (n / N) \times 100$$

Where n is the number of sampling sites in which a taxon was recorded and N is the total number of sampling sites (80). Taxa with higher frequency values were considered more widespread within the riparian habitats of the Yeşilırmak Basin.

Phytogeographical affiliations were classified into the Euro-Siberian, Irano-Turanian, Mediterranean, Euxinian (Black Sea), cosmopolitan, widely distributed, and alien/cultivated categories according to the available floristic literature. Observed anthropogenic disturbances were qualitatively categorized based on the dominant pressure types recorded at each sampling site, including agricultural activities, riparian habitat degradation, grazing, urban development, road construction, waste accumulation, hydrological modification, and the presence of alien or invasive plant species.

Anthropogenic pressures (such as agricultural encroachment, channel modification, grazing, and urbanization) were recorded qualitatively at each sampling site based on visual field observations, without applying a numerical scoring index.

3. Results

3.1. Floristic composition

Field surveys conducted within the riparian habitats of the Yeşilırmak Basin documented a total of 163 unique vascular plant taxa belonging to 57 families. The recorded taxa were distributed across a range of riparian habitat types, including riverbanks, stream channels, floodplains, alluvial meadows, marshes, wetlands, and the margins of slow-flowing or standing waters. The floristic inventory reflects the considerable habitat diversity of the study area, encompassing both terrestrial and aquatic–semi-aquatic vegetation within the riparian corridor.

The most species-rich families were Cyperaceae, Lamiaceae, Ranunculaceae, Asteraceae, Potamogetonaceae, Brassicaceae, Rosaceae, Poaceae, and Plantaginaceae (Table 1). Families typically associated with aquatic and wetland habitats, including Cyperaceae, Potamogetonaceae, Typhaceae, Juncaceae, and Alismataceae, constituted a substantial component of the recorded flora. In contrast, the occurrence of taxa belonging to Lamiaceae, Asteraceae, Brassicaceae, and Rosaceae reflected the floristic contribution of adjacent riparian habitats, including moist meadows, riparian shrublands, alluvial openings, and disturbed habitat margins.

The woody riparian vegetation was primarily represented by *Alnus glutinosa, Populus alba, P. nigra, Salix alba, S. amplexicaulis, S. caprea, Platanus orientalis, Fraxinus angustifolia, Ulmus minor, Acer tataricum, Cornus sanguinea, C. mas*, and *Rosa canina*.

Wetland habitats characterized by reed beds and marshes were dominated by *Phragmites australis, Typha angustifolia, T. latifolia, T. laxmannii, T. shuttleworthii, Schoenoplectus lacustris, S. litoralis, S. tabernaemontani, S. triqueter, Carex riparia, C. acutiformis, C. otrubae*, and taxa of genus *Juncus*.

Aquatic and semi-aquatic vegetation was represented by *Lemna minor, L. gibba, L. trisulca, Spirodela polyrhiza, Azolla filiculoides, Ceratophyllum demersum, C. submersum, Myriophyllum spicatum, Najas minor, Potamogeton crispus, P. lucens, P. natans, P. nodosus, P. perfoliatus, Stuckenia pectinata, Hydrocharis morsus-ranae, Nuphar lutea, Nymphaea alba, Utricularia australis,* and *Zannichellia palustris.* These taxa were primarily recorded from slow-flowing river sections, lentic water bodies, shallow littoral zones, and habitats experiencing seasonal fluctuations in water level, reflecting the diversity of aquatic environments present within the study area.

Table 1. The most species-rich plant families recorded in the riparian habitats of the Yeşilırmak Basin
Tablo 1. Yeşilırmak Havzası'nın riperyan habitatlarında kaydedilen en fazla tür çeşitliliğine sahip bitkilerin familyaları

Rank	Family	Number of taxa	Percentage (%)
1	Cyperaceae	13	8.0
2	Lamiaceae	11	6.7
3	Ranunculaceae	8	4.9
4	Asteraceae	8	4.9
5	Potamogetonaceae	8	4.9
6	Brassicaceae	7	4.3
7	Rosaceae	7	4.3
8	Poaceae	6	3.7
9	Plantaginaceae	6	3.7
10	Fabaceae	5	3.1
11	Salicaceae	5	3.1
12	Typhaceae	5	3.1

3.2. Life-form spectrum

Analysis of the life-form spectrum revealed that cryptophytes were the dominant life-form category, comprising 67 taxa and accounting for 41.1% of the recorded flora (Table 2). Hemicryptophytes represented the second most abundant group, with 43 taxa (26.4%), followed by phanerophytes with 31 taxa (19.0%) and therophytes with 22 taxa (13.5%).

The predominance of cryptophytes is consistent with the riparian and wetland character of the study area. The ability of these species to survive through belowground organs, such as rhizomes, bulbs, or other perennating structures, enables them to tolerate seasonal flooding, fluctuations in water level, prolonged soil saturation, and periodic drying.

The relatively high proportion of hemicryptophytes reflects the abundance of moist meadows, open riparian habitats, and ecotonal environments within the river corridor. Likewise, the substantial representation of phanerophytes indicates that woody gallery vegetation constitutes a prominent structural component of the riparian ecosystems in the Yeşilırmak Basin.

Table 2. Distribution of the recorded vascular plant taxa according to life-form categories in the riparian habitats of the Yeşilırmak Basin
Tablo 2. Yeşilırmak Havzası riperyan habitatlarında kaydedilen vasküler bitki taksonlarının yaşam formu sınıflarına dağılımı

Life-form	Number of taxa	Percentage (%)
Cryptophytes- Kriptofitler	67	41.1
Hemicryptophytes- Hemikriptofitler	43	26.4
Phanerophytes- Fanerofitler	31	19.0
Therophytes- Terofitler	22	13.5

3.3. Species frequency analysis

The frequency of occurrence of vascular plant taxa across the sampling sites was evaluated to identify the most widespread species within the study area. According to the species frequency analysis,

Glyceria fluitans was the most frequently recorded taxon, occurring in 17.5% of the sampling sites. It was followed *by Bolboschoenus maritimus* subsp. *maritimus, Euphorbia helioscopia, Malva neglecta*, and *Schoenoplectus lacustris* subsp. *lacustris*, each recorded at 16.3% of the sampling sites (Table 3).

Most of the taxa with the highest frequency values were hygrophytic or hydrophytic species characteristic of reed beds, marshes, and riparian margins. In contrast, a large proportion of the recorded taxa occurred at only a limited number of sampling sites, indicating considerable spatial heterogeneity in species distribution across the riparian habitats of the Yeşilırmak Basin.

Table 3. The ten most frequently recorded vascular plant taxa in the riparian habitats of the Yeşilırmak Basin

Tablo 3. Yeşilırmak Havzası'nın riperyan habitatlarında en sık kaydedilen damarlı on vasküler bitki taksonu

Rank	Taxon	Number of sampling sites (n)	Frequency (%)
1	*Glyceria fluitans*	14	17.5
2	*Bolboschoenus maritimus* subsp. *maritimus*	13	16.3
3	*Euphorbia helioscopia*	13	16.3
4	*Malva neglecta*	13	16.3
5	*Schoenoplectus lacustris* subsp. *lacustris*	13	16.3
6	*Carex acutiformis*	11	13.8
7	*Juncus articulatus*	11	13.8
8	*Platanus orientalis*	11	13.8
9	*Salix amplexicaulis*	11	13.8
10	*Tanacetum vulgare*	11	13.8

3.4. Phytogeographical affinities

Analysis of the phytogeographical affiliations of the recorded taxa showed that widely distributed species constituted the largest group, comprising 75 taxa (46.0% of the recorded flora). Euro-Siberian elements represented the second-largest phytogeographical group, with 59 taxa (36.2%), followed by cosmopolitan taxa, which accounted for 14 taxa (8.6%). Mediterranean elements were represented by 11 taxa (6.7%), whereas Irano-Turanian, Euxinian (Black Sea), and alien or cultivated taxa were represented by comparatively few taxa (Table 4).

Table 4. Distribution of the recorded vascular plant taxa by according to phytogeographical affiliations in the riparian habitats of the Basin

Tablo 4. Havza'nın riperyan habitatlarında kaydedilen vasküler bitki taksonlarının fitocoğrafik bağlantılara göre dağılımı

Phytogeographical Element	Number of Taxa	Percentage (%)
Widely distributed	75	46.0
Euro-Siberian	59	36.2
-Euxinian (sub-element)	1	0.6
Mediterranean	11	6.7
Irano-Turanian	2	1.2
Other (Cosmopolitan & Alien)	15	9.2
Total	163	100.0

The predominance of widely distributed and cosmopolitan taxa is consistent with the dynamic ecological conditions of riparian habitats, which facilitate species dispersal and colonization. River corridors function as natural dispersal pathways, promoting the transport of seeds and vegetative propagules and thereby supporting the establishment of widely distributed plant species. The relatively high representation of Euro-Siberian elements is also consistent with the geographical location of Amasya Province in the transitional zone influenced by the Black Sea, where the humid microclimatic conditions associated with the Yeşilırmak Valley provide suitable habitats for mesic plant species.

Analysis of the phytogeographical spectrum revealed that widely distributed taxa represented the largest proportion of the riparian flora, comprising 75 taxa (46.0%). Among the taxa restricted to specific phytogeographical kingdoms, Euro-Siberian elements were the most dominant, represented by 59 taxa (36.2%). Within this group, Heracleum platytaenium was identified as an Euxinian sub-element (0.6%), reflecting the climatic influence of the Black Sea maritime zone on the river valley. Mediterranean elements were represented by 11 taxa (6.7%), while Irano-Turanian elements accounted for 2 taxa (1.2%), reflecting the transitional position of the basin towards Central Anatolia.

In addition to the three main phytogeographical regions, 14 taxa (8.6%) were classified as cosmopolitan (e.g., Ceratophyllum demersum, Lemna minor, Potamogeton perfoliatus), which is characteristic of dynamic riparian and wetland ecosystems facilitating long-distance hydrochorous dispersal. Furthermore, only one taxon, Ailanthus altissima (0.6%), was recorded as an alien (introduced and potentially invasive) species, primarily confined to anthropogenically disturbed riverbank sections.

3.5. Endemism and taxa of conservation interest

Most of the vascular plant taxa recorded in the study area are non-endemic and are primarily categorized as Least Concern (LC) according to the International Union for Conservation of Nature (IUCN) criteria due to their broad geographical distributions. However, *Heracleum platytaenium* Boiss. was recorded as a taxon of particular phytogeographical interest. Although historically treated as a strict endemic species to Türkiye in the *Flora of Turkey and the East Aegean Islands*, contemporary national taxonomic frameworks (such as the *Illustrated Flora of Turkey*) recognize that its distribution extends slightly to the neighboring Aegean Islands. Consequently, in this study, *H. platytaenium* is classified as a sub-endemic (regionally native) Euxinian element rather than a strict national endemic.

The overall low level of endemism observed in the study area is consistent with the dynamic nature

of riparian ecosystems, where recurrent flooding, sediment deposition, erosion, and hydrochorous dispersal favour the establishment and persistence of widely distributed aquatic and semi-aquatic species. Nevertheless, the presence of endemic and regionally important taxa highlights the conservation value of these habitats and emphasizes their importance for biodiversity management.

Ailanthus altissima was recorded as an alien taxon within the study area. Its occurrence was primarily associated with riparian habitats affected by anthropogenic disturbance, suggesting a potential influence on the composition of native riparian vegetation. However, additional studies focusing on population size, spatial distribution, and invasion dynamics are required to assess its ecological impact within the Yeşilırmak Basin.

3.6. Anthropogenic disturbances

Field observations indicated that the riparian habitats of the Yeşilırmak Basin were exposed to varying levels of anthropogenic disturbance. The principal disturbance factors recorded during the surveys included agricultural activities, riverbank modification, urban development, road construction, grazing, waste accumulation, and hydrological alteration. In sections where floodplains had been converted to agricultural land, the natural riparian vegetation was noticeably reduced, and the woody gallery vegetation frequently exhibited a fragmented structure.

Field observations indicated that sampling sites visibly affected by human activities, such as agricultural encroachment and riverbank modification, frequently supported disturbance-tolerant and ruderal taxa, including Ailanthus altissima, Artemisia annua, Bromus tectorum, Capsella bursa-pastoris, Cirsium arvense, Lepidium draba, Malva neglecta, Plantago major, Senecio vulgaris, and Urtica dioica. Conversely, relatively undisturbed riparian sections with intact hydrological connectivity tended to retain typical aquatic and semi-aquatic helophytes and cryptophytes.

4. Discussion and Conclusions

4.1. Ecological interpretation of the floristic diversity

The present study demonstrates that the riparian habitats of the Yeşilırmak Basin support a high level of floristic diversity, comprising 163 vascular plant taxa belonging to 57 families. This richness indicates that the riparian corridor extends beyond a narrow riverbank vegetation belt and instead consists of a heterogeneous habitat mosaic, including gallery forests, reed beds, marshes, alluvial meadows, slow-flowing aquatic habitats, and anthropogenically disturbed riparian margins. The coexistence of these habitat types provides a wide range of ecological niches that contribute to the high plant diversity recorded in the study area.

The observed floristic richness is likely driven by the combined influence of the geomorphological and hydrological characteristics of the Yeşilırmak Valley together with the biogeographical setting of Amasya Province. Topographic heterogeneity, alluvial soil development, seasonal flooding, and fluctuations in water level create diverse environmental conditions that support species with contrasting ecological requirements. Consequently, obligate aquatic, semi-aquatic, and terrestrial taxa were able to coexist within the same riparian corridor, reflecting the ecological complexity and environmental heterogeneity characteristic of riparian ecosystems.

A recent floristic survey conducted in the Melen Basin documented 199 vascular plant taxa, further emphasizing the high floristic richness of wetland and riparian ecosystems in river basins influenced by the Black Sea climate (Ayteğin and Özcan, 2025). Although the number of taxa recorded by us in the Yeşilırmak Basin was lower than that reported for the Melen Basin, the present study nevertheless demonstrates a considerable level of floristic diversity. Differences in species richness between the two basins are likely attributable to variations in climatic moisture availability, the diversity and extent of wetland habitats, land-use intensity, and sampling design, including the survey effort and habitat coverage.

4.2. Family composition and species frequency patterns

The predominance of Cyperaceae, Lamiaceae, and Potamogetonaceae in the study area is consistent with the hydrological characteristics of riparian ecosystems. In particular, members of Cyperaceae are characteristic components of marshes, reed beds, and seasonally flooded habitats, and their high representation reflects the strong wetland character of the Yeşilırmak riparian corridor. Similarly, the diversity of Potamogetonaceae further highlights the ecological importance of aquatic habitats within the basin.

Species frequency analysis showed that the most frequently recorded taxa, including *Glyceria fluitans, Bolboschoenus maritimus* subsp. *maritimus*, *Schoenoplectus lacustris* subsp. *lacustris*, *Carex*

acutiformis, and *Juncus articulatus*, are primarily associated with aquatic or semi-aquatic environments. Although hydrological variables were not directly measured in this study, the frequent occurrence of these taxa indicates the persistence of microhabitats with adequate localized moisture conditions along certain sections of the riparian corridor. Conversely, the large number of taxa recorded at only a few sampling sites indicates pronounced habitat heterogeneity, with different microhabitats supporting distinct plant assemblages across the riparian landscape.

4.3. Life-form spectrum

The predominance of cryptophytes, accounting for approximately 41% of the recorded flora (Table 2), highlights the strong influence of hydrological conditions on the life-form composition of the riparian vegetation. The persistence of cryptophytes through belowground perennating organs, such as rhizomes, tubers, and bulbs, enables them to tolerate recurrent flooding, seasonal water-level fluctuations, and temporary drying. Consequently, cryptophytes are widely recognized as the dominant life-form in wetlands and riparian ecosystems (Mitsch and Gosselink, 2015).

The relatively high representation of phanerophytes further emphasizes the ecological importance of the gallery forests developed along the Yeşilırmak River. Woody riparian species, particularly those belonging to the genera of *Salix, Populus, Alnus*, and *Platanus*, play fundamental roles in maintaining riparian ecosystem functioning by stabilizing riverbanks, providing canopy cover, contributing organic matter, and enhancing habitat connectivity (Riis et al., 2020).

4.4. Phytogeographic structure and characteristics of the transition zone

The phytogeographical composition of the recorded flora was dominated by widely distributed taxa and Euro-Siberian elements. The predominance of widely distributed species is consistent with the role of river systems as natural dispersal corridors that facilitate the transport of seeds and vegetative propagules. In addition, the recurrent disturbance regime characteristic of riparian habitats, including periodic flooding, sediment deposition, and habitat renewal, favours species with broad ecological amplitudes and high colonization capacity.

The substantial representation of Euro-Siberian elements reflects the geographical position of Amasya Province within the inland zone influenced by the Black Sea climate. Humid microclimatic conditions associated with the Yeşilırmak Valley provide suitable environments for mesophytic and moisture-demanding species that typically characterize the Euro-Siberian phytogeographical region. Conversely, the occurrence of Mediterranean and Irano-Turanian elements reflects the transitional nature of the study area between the Black Sea Region and Central Anatolian Region biogeographical regions. These findings indicate that the floristic composition of the Yeşilırmak Basin cannot be explained by a single phytogeographical region but instead results from the combined influence of humid Black Sea conditions, the more continental climate of Central Anatolia, and the local environmental heterogeneity created by the river valley.

Türkiye is internationally recognized as one of the principal centres of plant diversity in the Mediterranean Basin because of its location at the intersection of multiple phytogeographical regions and its exceptional environmental heterogeneity (Noroozi et al., 2019).

Previous floristic and vegetation studies conducted in Amasya Province have similarly emphasized the transitional biogeographical character of the region (Yıldırım et al., 2020; Cansaran and Yıldırım, 2022; Yıldırım et al., 2022). The findings of the present study further support this interpretation by demonstrating that the riparian habitats of the Yeşilırmak Basin function as ecologically diverse transition zones where floristic elements of different phytogeographical origins coexist.

4.5. Endemism and conservation value

The low level of endemism observed in the present study is consistent with the ecological characteristics of riparian ecosystems. River corridors are inherently dynamic environments that are continuously influenced by flooding, erosion, sediment deposition, and hydrochorous dispersal (Naiman et al., 2010; Mitsch and Gosselink, 2015). These processes generally favour widespread, competitive, and rapidly colonizing species while limiting the persistence and local differentiation of narrowly distributed endemic taxa. Consequently, levels of endemism in riparian habitats are typically lower than those reported for relatively stable ecosystems such as mountainous regions, steppe slopes, or isolated rocky habitats.

4.6. Effects of anthropogenic disturbances on floristic composition

The field observations indicate that agricultural activities, riverbank modification, urban development, road construction, waste accumulation, and

hydrological alteration constitute major pressures affecting the continuity and ecological integrity of riparian habitats in the Yeşilırmak Basin, consistent with documented wetland loss and land-use change in riparian zones across Türkiye (Ataol and Onmuş, 2021; Aktürk et al., 2024). In particular, the conversion of floodplains to agricultural land has reduced the extent of natural gallery vegetation and contributed to the fragmentation of riparian habitats.

Comparable patterns have also been reported for the Melen Basin, where agricultural expansion, habitat degradation, and other human-induced disturbances were identified as major drivers of changes in wetland floristic composition (Ayteğin and Özcan, 2025). The similarities observed between the two river basins suggest that riparian and wetland ecosystems in Türkiye are exposed to common anthropogenic pressures despite regional environmental differences. Accordingly, the conservation of riparian buffer zones, the maintenance of continuous native riparian vegetation, and the regulation of agricultural and urban expansion along river corridors should be considered key priorities for the long-term conservation of these ecosystems.

The occurrence of *Ailanthus altissima* within the study area further highlights the importance of monitoring non-native species in anthropogenically disturbed riparian habitats. Although its presence alone does not demonstrate an ongoing biological invasion, the species has the potential to compete with native vegetation, particularly in disturbed environments. Future studies should therefore evaluate its population size, spatial distribution, and interactions with native riparian plant communities in order to assess its long-term ecological implications.

4.7. Floristic perspectives on hydrological vulnerability and climate resilience: Study limitations and broader implications

While the present study was based exclusively on a floristic inventory without empirical hydrometric measurements or regional climate modeling, the documented plant assemblages provide valuable indirect insights into ecosystem sensitivity. Riparian and wetland ecosystems are widely recognized as being vulnerable to climate change because their structural dynamics are linked to hydrological regimes. As highlighted in broader literature, shifts in precipitation patterns and temperature regimes can modify water levels, nutrient cycling, and the ecological functioning of wetland habitats (Salimi et al., 2021).

Within the transitional biogeographical setting of Amasya Province, between the Black Sea Region and Central Anatolia, the high representation of moisture-dependent taxa, particularly cryptophytes (41.1%), reflects the structural reliance of the local riparian vegetation on saturated soil conditions. From a floristic viewpoint, prolonged summer droughts, altered river discharge, and increased water abstraction pose potential risks by reducing suitable niches for strict hydrophytic and helophytic species. However, evaluating the extent and rate of such ecological shifts exceeds the scope of purely floristic observations, underscoring the necessity of future long-term monitoring studies that integrate vegetation dynamics with empirical hydrological and climatic data.

4.8. Conclusions

This study provides the first comprehensive floristic inventory specifically targeting the riparian habitats of the Yeşilırmak Basin within Amasya Province. Rather than merely presenting an annotated plant list, the investigation defines the transitional ecological characteristics of the river corridor, demonstrating that the basin sustains an ecotonal habitat mosaic where Euro-Siberian and widely distributed wetland elements converge. The documented dominance of cryptophytes (41.1%) underlines the structural adaptation of the regional flora to high water tables, while the high representation of phanerophytes emphasizes the critical role of woody gallery belts along the river system.

A primary strength of this research lies in establishing an up-to-date, plot-based floristic baseline across 80 standardized sampling points along the fluvial network. However, several limitations should be acknowledged. The inventory reflects a targeted survey window in late May 2023, which effectively captures peak spring vegetative development but does not account for late-season phenological variations. Furthermore, anthropogenic pressures and ecological vulnerabilities were evaluated through qualitative observations rather than continuous hydrometric measurements, quantitative disturbance indices, or multi-year climatic modeling.

From a practical riparian management and conservation perspective, the findings highlight several actionable priorities:

Establishment and Enforcement of Buffer Strips: Mandatory vegetative buffer zones (at least 15–30 m wide) consisting of native woody taxa (Salix alba, *Alnus glutinosa* subsp. *glutinosa*, *Platanus orientalis*) should be delineated and protected to mitigate agricultural runoff and bank erosion.

Regulation of Floodplain Conversion: Ongoing agricultural encroachment and channel modification in active floodplains should be restricted to preserve localized micro-refugia supporting hygrophytic specialist taxa.

Early Detection and Control of Invasives: Targeted monitoring protocols should be established for disturbance-associated non-native taxa, particularly Ailanthus altissima, to prevent their establishment in newly degraded riverbank sections.

Integrated Ecological Monitoring: Future management initiatives must transition from static floristic assessments to multi-parameter monitoring frameworks that integrate vegetation cover metrics with empirical water quality, discharge dynamics, and seasonal hydrology.

Acknowledgements

The research was financially supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK) under Grant No. 121Y430

Authors' contributions

Both authors contributed equally to the conception and design of the study, fieldwork, data analysis, interpretation of the findings, and preparation of the manuscript. Both authors read and approved the final version of the manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest related to this study.

Ethics Statement

The authors declare that this study is original, has not been previously published, and was conducted and prepared in accordance with the principles of research and publication ethics.

References

Akturk, E., Guney, K., Aydin, M., Yildiz, F., Kaya, O., 2024. Land cover dynamics and environmental implications in Türkiye's riparian zones: A comprehensive seven-year study. *Forests*, 15(7): 1177. Doi.org/10.3390/f15071177

Ataol, M., Onmuş, O., 2021. Wetland loss in Turkey over a hundred years: Implications for conservation and management. *Ecosystem Health and Sustainability*, 7(1): 1930587. Doi.org/10.1080/20964129.2021.1930587

Ayteğin, A., Özcan, M., 2025. Floristic diversity and anthropogenic impacts on wetland ecosystems in the Melen watershed, Düzce]. *Turkish Journal of Forestry*, 26(3): 224-232. Doi.org/10.18182/tjf.1742094

Bizimbitkiler. (2026). Türkiye bitkileri veri tabanı. http://www.bizimbitkiler.org.tr (Erişim tarihi: 12 Ekim 2026).

Canlı, K., Çetin, B., 2014. The moss flora of Akdağ Mountain (Amasya, Turkey). *The Scientific World Journal*, 2014, 860379. Doi.org/10.1155/2014/860379

Cansaran, A., Yıldırım, C. (2022). Direkli, Yassıçal ve Abacı Köyleri (Amasya, Türkiye) arasındaki bölgenin sintaksonomik analizi. *Türler ve Habitatlar*, 3(2), 55-74. Doi.org/10.53803/turvehab.1116980

Davidson NC. (2014) How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research*, 65: 934-941. Doi.org/10.1071/MF14173

Davis, P. H., 1965-1988. Flora of Turkey and the East Aegean Islands (Vols. 1-10). Edinburgh University Press.

Davis, P. H., Mill, R. R., Tan, K. (Eds.). (1988). Flora of Turkey and the East Aegean Islands (Vol. 10, Supplement). Edinburgh: Edinburgh University Press.

González del Tánago, M., Martínez-Fernández, V., Aguiar, F. C., Bertoldi, W., Dufour, S., García de Jalón, D., Garófano-Gómez, V., Mandzukovski, D., Rodríguez-González, P. M., 2021. Improving river hydromorphological assessment through better integration of riparian vegetation: Scientific evidence and guidelines. *Journal of Environmental Management*, 292: 112730. Doi.org/10.1016/j.jenvman.2021.112730

Güner, A., Özhatay, N., Ekim, T., & Başer, K. H. C. (Eds.). (2000). Flora of Turkey and the East Aegean Islands (Vol. 11, Supplement 2). Edinburgh: Edinburgh University Press.

Güner, A., Aslan, S., Ekim, T., Vural, M., Babaç, M. T., 2012. Türkiye bitkileri listesi (damarlı bitkiler). Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını

Naiman, R. J., Decamps, H., McClain, M. E., 2010. Riparia: ecology, conservation, and management of streamside communities. Elsevier

Noroozi, J., Zare, G., Sherafati, M., Mahmoodi, M., Moser, D., Asgarpour, Z., Schneeweiss, G. M., 2019. Patterns of endemism in Turkey, the meeting point of three global biodiversity hotspots, based on three diverse families of vascular plants. *Frontiers in Ecology and Evolution*, 7: 159. Doi.org/10.3389/fevo.2019.00159

Mitsch, W. J., Gosselink, J. G., 2015. Wetlands. John Wiley & Sons

Mueller-Dombois, D., & Ellenberg, H. (1974). Aims and Methods of Vegetation Ecology. John Wiley & Sons.

IPBES, W., 2019. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Summary for Policy Makers of the Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-policy Platform on Biodiversity and

Ecosystem Services. IPBES Secretariat, Bonn

Ürker, O. (2020). Hacıosman Ormanı Tabiatı Koruma Alanı (Samsun) Florası, Vejetasyon ve Habitat Yapısı ile Genel Bitki Ekolojisi Özellikleri Üzerine Bir Değerlendirme. *Bitlis Eren* Üniversitesi *Fen Bilimleri Dergisi*, *9*(1), 168-193. Doi.org/10.17798/bitlisfen.679543

Raunkiær, C. (1934). The Life Forms of Plants and Statistical Plant Geography. Oxford University Press.

Richardson, D. M., Holmes, P. M., Esler, K. J., Galatowitsch, S. M., Stromberg, J. C., Kirkman, S. P., ... Hobbs, R. J., 2007. Riparian vegetation: degradation, alien plant invasions, and restoration prospects. *Diversity and Distributions*, 13(1): 126-139

Riis, T., Kelly-Quinn, M., Aguiar, F. C., Manolaki, P., Bruno, D., Bejarano, M. D., Clerici, N., Fernandes, M. R., Franco, J. C., Pettit, N., Portela, A. P., Tammeorg, O., Tammeorg, P., Rodríguez-González, P. M., Dufour, S., 2020. Global overview of ecosystem services provided by riparian vegetation. *BioScience*, 70(6): 501-514 Doi.org/10.1093/biosci/biaa041

Salimi, S., Almuktar, S. A. A. A. N., Scholz, M., 2021. Impact of climate change on wetland ecosystems: A critical review of experimental wetlands. *Journal of Environmental Management*, 286: 112160. Doi.org/10.1016/j.jenvman.2021.112160

Stella, J. C., Rodríguez-González, P. M., Dufour, S., Bendix, J., 2013. Riparian vegetation research in Mediterranean-climate regions: Common patterns, ecological processes, and considerations for management. *Hydrobiologia*, 719: 291-315. Doi.org/10.1007/s10750-012-1304-9

Yıldırım, C., Yalçın, E., Cansaran, A., Alpınar, A., 2020. Vascular plant diversity of Mount Akdağ in Amasya, Turkey. *Türler ve Habitatlar*, 1(2). 66-105. Dergipark.org.tr/en/pub/turvehab/article/748758

Yıldırım, C., Yalçın, E., Cansaran, A., 2022. Syntaxonomy and vegetation-environment relationships in Mount Akdağ (Amasya/Türkiye). Rendiconti Lincei. *Scienze Fisiche e Naturali*, 33: 673-696. Doi.org/10.1007/s12210-022-01091-8

Ann. Table 1. Vascular plant taxa identified in riparian areas of the Yeşilırmak Basin in Amasya Province
Ek Tablo 1. Amasya ili Yeşilırmak Havzası'nın riperyan alanlarında tespit edilen vasküler bitki taksonları

	Family	Taxon	Life form	Phytogeographic region
1	Acoraceae	*Acorus calamus* L.	Cryptophytes	Widely distributed
2	Alismataceae	*Alisma gramineum* Lej.	Cryptophytes	Euro-Siberian (Euxinian)
3	Alismataceae	*Alisma lanceolatum* With.	Cryptophytes	Mediterranean
4	Alismataceae	*Alisma plantago-aquatica* L.	Cryptophytes	Euro-Siberian
5	Anacardiaceae	*Cotinus coggygria* Scop.	Phanerophytes	Euro-Siberian
6	Apiaceae	*Heracleum platytaenium* Boiss.	Hemicryptophytes	Euro-Siberian
7	Apocynaceae	*Periploca graeca* L.	Phanerophytes	Mediterranean
8	Apocynaceae	*Vinca herbacea* Waldst. & Kit.	Hemicryptophytes	Widely distributed
9	Araceae	*Lemna gibba* L.	Cryptophytes	Cosmopolitan
10	Araceae	*Lemna minor* L.	Cryptophytes	Cosmopolitan
11	Araceae	*Lemna trisulca* L.	Cryptophytes	Cosmopolitan
12	Araceae	*Spirodela polyrhiza* (L.) Schleid.	Cryptophytes	Cosmopolitan
13	Asteraceae	*Artemisia annua* L.	Therophytes	Widely distributed
14	Asteraceae	*Cirsium arvense* (L.) Scop.	Hemicryptophytes	Widely distributed
15	Asteraceae	*Eupatorium cannabinum* L.	Hemicryptophytes	Euro-Siberian
16	Asteraceae	*Matricaria chamomilla* L.	Therophytes	Widely distributed
17	Asteraceae	*Petasites hybridus* (L.) G.Gaertn., B.Mey. & Scherb.	Cryptophytes	Euro-Siberian
18	Asteraceae	*Senecio vulgaris* L.	Therophytes	Widely distributed
19	Asteraceae	*Tanacetum vulgare* L.	Hemicryptophytes	Euro-Siberian
20	Asteraceae	*Tragopogon dubius* Scop.	Hemicryptophytes	Widely distributed
21	Azollaceae	*Azolla filiculoides* Lam.	Cryptophytes	Cosmopolitan
22	Betulaceae	*Alnus glutinosa* (L.) Gaertn. subsp. *glutinosa*	Phanerophytes	Euro-Siberian
23	Betulaceae	*Carpinus orientalis* Mill.	Phanerophytes	Euro-Siberian
24	Betulaceae	*Corylus avellana* L.	Phanerophytes	Euro-Siberian
25	Boraginaceae	*Anchusa officinalis* L.	Hemicryptophytes	Euro-Siberian
26	Boraginaceae	*Buglossoides arvensis* (L.) I. M. Johnst.	Therophytes	Widely distributed
27	Boraginaceae	*Myosotis laxa* subsp. *cespitosa* (Schultz) Hyl. ex Nordh.	Hemicryptophytes	Widely distributed
28	Brassicaceae	*Barbarea vulgaris* W.T.Aiton	Hemicryptophytes	Euro-Siberian
29	Brassicaceae	*Capsella bursa-pastoris* (L.) Medik.	Therophytes	Widely distributed
30	Brassicaceae	*Lepidium draba* L.	Hemicryptophytes	Widely distributed
31	Brassicaceae	*Nasturtium officinale* R.Br.	Cryptophytes	Widely distributed
32	Brassicaceae	*Rorippa amphibia* (L.) Besser	Cryptophytes	Widely distributed
33	Brassicaceae	*Rorippa sylvestris* (L.) Besser	Hemicryptophytes	Widely distributed
34	Brassicaceae	*Sisymbrium officinale* (L.) Scop.	Therophytes	Widely distributed
35	Butomaceae	*Butomus umbellatus* L.	Cryptophytes	Euro-Siberian
36	Cannabaceae	*Celtis australis* L.	Phanerophytes	Mediterranean
37	Caprifoliaceae	*Valeriana erotica* Christenh. & Byng	Hemicryptophytes	Irano-Turanian
38	Caryophyllaceae	*Silene vulgaris* (Moench) Garcke	Hemicryptophytes	Euro-Siberian
39	Ceratophyllaceae	*Ceratophyllum demersum* L.	Cryptophytes	Cosmopolitan
40	Ceratophyllaceae	*Ceratophyllum submersum* L.	Cryptophytes	Cosmopolitan
41	Cornaceae	*Cornus mas* L.	Phanerophytes	Euro-Siberian
42	Cornaceae	*Cornus sanguinea* L.	Phanerophytes	Euro-Siberian
43	Crassulaceae	*Sedum pallidum* M.Bieb.	Therophytes	Mediterranean
44	Cupressaceae	*Juniperus excelsa* M.Bieb.	Phanerophytes	Mediterranean
45	Cupressaceae	*Juniperus oxycedrus* L. subsp. *oxycedrus*	Phanerophytes	Widely distributed
46	Cyperaceae	*Bolboschoenus maritimus* (L.) Palla	Cryptophytes	Widely distributed
47	Cyperaceae	*Carex acutiformis* Ehrh.	Cryptophytes	Euro-Siberian
48	Cyperaceae	*Carex leersii* F.W.Schultz	Hemicryptophytes	Euro-Siberian
49	Cyperaceae	*Carex otrubae* Podp.	Hemicryptophytes	Euro-Siberian
50	Cyperaceae	*Carex riparia* Curtis	Cryptophytes	Euro-Siberian

Ann. Table 1. Vascular plant taxa identified in riparian areas of the Yeşilırmak Basin in Amasya Province (Continue)
Ek Tablo 1. Amasya ili Yeşilırmak Havzası'nın riperyan alanlarında tespit edilen vasküler bitki taksonları (Devamı)

	Family	Taxon	Life form	Phytogeographic region
51	Cyperaceae	*Cyperus capitatus* Vand.	Cryptophytes	Mediterranean
52	Cyperaceae	*Cyperus longus* L.	Cryptophytes	Widely distributed
53	Cyperaceae	*Eleocharis palustris* (L.) Roem. & Schult.	Cryptophytes	Widely distributed
54	Cyperaceae	*Schoenoplectus lacustris* (L.) Palla	Cryptophytes	Widely distributed
55	Cyperaceae	*Schoenoplectus litoralis* (Schrad.) Palla	Cryptophytes	Widely distributed
56	Cyperaceae	*Schoenoplectus tabernaemontani* (C.C.Gmel.) Palla	Cryptophytes	Widely distributed
57	Cyperaceae	*Schoenoplectus triqueter* (L.) Palla	Cryptophytes	Widely distributed
58	Cyperaceae	*Scirpus sylvaticus* L.	Hemicryptophytes	Euro-Siberian
59	Equisetaceae	*Equisetum arvense* L.	Cryptophytes	Widely distributed
60	Equisetaceae	*Equisetum palustre* L.	Cryptophytes	Euro-Siberian
61	Equisetaceae	*Equisetum telmateia* Ehrh.	Cryptophytes	Euro-Siberian
62	Euphorbiaceae	*Euphorbia palustris* L.	Cryptophytes	Euro-Siberian
63	Euphorbiaceae	*Euphorbia helioscopia* L.	Therophytes	Widely distributed
64	Fabaceae	*Lathyrus aphaca* L.	Therophytes	Widely distributed
65	Fabaceae	*Medicago sativa* L.	Hemicryptophytes	Widely distributed
66	Fabaceae	*Melilotus officinalis* (L.) Desr.	Hemicryptophytes	Widely distributed
67	Fabaceae	*Onobrychis viciifolia* Scop.	Hemicryptophytes	Widely distributed
68	Fabaceae	*Trifolium pratense* L.	Hemicryptophytes	Widely distributed
69	Fagaceae	*Fagus orientalis* Lipsky	Phanerophytes	Euro-Siberian
70	Fagaceae	*Quercus cerris* L.	Phanerophytes	Mediterranean
71	Fagaceae	*Quercus infectoria* subsp. *infectoria* Oliv.	Phanerophytes	Mediterranean
72	Geraniaceae	*Geranium robertianum* L.	Therophytes	Widely distributed
73	Haloragaceae	*Myriophyllum spicatum* L.	Cryptophytes	Cosmopolitan
74	Hydrocharitaceae	*Hydrocharis morsus-ranae* L.	Cryptophytes	Widely distributed
75	Hydrocharitaceae	*Najas minor* All.	Cryptophytes	Cosmopolitan
76	Iridaceae	*Iris pseudacorus* L.	Cryptophytes	Euro-Siberian
77	Juncaceae	*Juncus articulatus* L.	Hemicryptophytes	Euro-Siberian
78	Juncaceae	*Juncus effusus* L.	Hemicryptophytes	Widely distributed
79	Juncaceae	*Juncus inflexus* L.	Hemicryptophytes	Euro-Siberian
80	Juncaceae	*Luzula campestris* (L.) DC.	Hemicryptophytes	Euro-Siberian
81	Juncaginaceae	*Triglochin palustris* L.	Cryptophytes	Widely distributed
82	Lamiaceae	*Ajuga reptans* L.	Hemicryptophytes	Euro-Siberian
83	Lamiaceae	*Lamium purpureum* L.	Therophytes	Euro-Siberian
84	Lamiaceae	*Lycopus europaeus* L.	Hemicryptophytes	Euro-Siberian
85	Lamiaceae	*Mentha aquatica* L.	Cryptophytes	Euro-Siberian
86	Lamiaceae	*Mentha longifolia* subsp. *longifolia* (L.) L.	Cryptophytes	Widely distributed
87	Lamiaceae	*Mentha spicata* subsp. *spicata* L.	Cryptophytes	Widely distributed
88	Lamiaceae	*Nepeta cataria* L.	Hemicryptophytes	Widely distributed
89	Lamiaceae	*Salvia verticillata* L.	Hemicryptophytes	Euro-Siberian
90	Lamiaceae	*Stachys annua* (L.) L.	Therophytes	Widely distributed
91	Lamiaceae	*Stachys sylvatica* L.	Hemicryptophytes	Euro-Siberian
92	Lamiaceae	*Ziziphora capitata* L.	Therophytes	Irano-Turanian
93	Lentibulariaceae	*Utricularia australis* R.Br.	Cryptophytes	Widely distributed
94	Malvaceae	*Malva neglecta* Wallr.	Hemicryptophytes	Widely distributed
95	Menyanthaceae	*Menyanthes trifoliata* L.	Cryptophytes	Widely distributed
96	Nymphaeaceae	*Nuphar lutea* (L.) Sm.	Cryptophytes	Widely distributed
97	Nymphaeaceae	*Nymphaea alba* L.	Cryptophytes	Widely distributed
98	Oleaceae	*Fraxinus angustifolia* subsp. *angustifolia* Vahl	Phanerophytes	Euro-Siberian
99	Onagraceae	*Epilobium hirsutum* L.	Hemicryptophytes	Widely distributed
100	Onagraceae	*Epilobium parviflorum* Schreb.	Hemicryptophytes	Euro-Siberian

Ann. Table 1. Vascular plant taxa identified in riparian areas of the Yeşilırmak Basin in Amasya Province (Continue)
Ek Tablo 1. Amasya ili Yeşilırmak Havzası'nın riperyan alanlarında tespit edilen vasküler bitki taksonları (Devamı)

	Family	Taxon	Life form	Phytogeographic region
101	Onagraceae	*Ludwigia palustris* (L.) Elliott	Cryptophytes	Widely distributed
102	Orchidaceae	*Orchis laxiflora* subsp. *laxiflora* Lam.	Cryptophytes	Mediterranean
103	Papaveraceae	*Papaver rhoeas* L.	Therophytes	Widely distributed
104	Plantaginaceae	*Callitriche brutia* Petagna	Cryptophytes	Mediterranean
105	Plantaginaceae	*Callitriche stagnalis* Scop.	Cryptophytes	Euro-Siberian
106	Plantaginaceae	*Gratiola officinalis* L.	Hemicryptophytes	Euro-Siberian
107	Plantaginaceae	*Plantago major* L.	Hemicryptophytes	Widely distributed
108	Plantaginaceae	*Veronica anagallis-aquatica* L.	Cryptophytes	Widely distributed
109	Plantaginaceae	*Veronica beccabunga* L.	Cryptophytes	Euro-Siberian
110	Platanaceae	*Platanus orientalis* L.	Phanerophytes	Widely distributed
111	Poaceae	*Alopecurus myosuroides* Huds.	Therophytes	Euro-Siberian
112	Poaceae	*Bromus tectorum* L.	Therophytes	Widely distributed
113	Poaceae	*Glyceria fluitans* (L.) R. Br.	Cryptophytes	Euro-Siberian
114	Poaceae	*Phleum pratense* L.	Hemicryptophytes	Euro-Siberian
115	Poaceae	*Phragmites australis* subsp. *australis* (Cav.) Trin. ex Steud.	Cryptophytes	Euro-Siberian
116	Poaceae	*Poa pratensis* L.	Hemicryptophytes	Widely distributed
117	Polygonaceae	*Persicaria amphibia* (L.) Delarbre	Cryptophytes	Widely distributed
118	Polygonaceae	*Rumex acetosa* L.	Hemicryptophytes	Euro-Siberian
119	Polygonaceae	*Rumex crispus* L.	Hemicryptophytes	Widely distributed
120	Polygonaceae	*Rumex hydrolapathum* Huds.	Cryptophytes	Euro-Siberian
121	Potamogetonaceae	*Groenlandia densa* (L.) Fourr.	Cryptophytes	Widely distributed
122	Potamogetonaceae	*Potamogeton crispus* L.	Cryptophytes	Widely distributed
123	Potamogetonaceae	*Potamogeton lucens* L.	Cryptophytes	Euro-Siberian
124	Potamogetonaceae	*Potamogeton natans* L.	Cryptophytes	Widely distributed
125	Potamogetonaceae	*Potamogeton nodosus* Poir.	Cryptophytes	Cosmopolitan
126	Potamogetonaceae	*Potamogeton perfoliatus* L.	Cryptophytes	Cosmopolitan
127	Potamogetonaceae	*Stuckenia pectinata* (L.) Börner	Cryptophytes	Cosmopolitan
128	Potamogetonaceae	*Zannichellia palustris* L.	Cryptophytes	Cosmopolitan
129	Ranunculaceae	*Adonis aestivalis* L.	Therophytes	Widely distributed
130	Ranunculaceae	*Ranunculus arvensis* L.	Therophytes	Widely distributed
131	Ranunculaceae	*Ranunculus constantinopolitanus* (DC.) d'Urv.	Hemicryptophytes	Widely distributed
132	Ranunculaceae	*Ranunculus muricatus* L.	Therophytes	Widely distributed
133	Ranunculaceae	*Ranunculus peltatus* Schrank	Cryptophytes	Widely distributed
134	Ranunculaceae	*Ranunculus repens* L.	Hemicryptophytes	Widely distributed
135	Ranunculaceae	*Ranunculus sceleratus* L.	Therophytes	Widely distributed
136	Ranunculaceae	*Ranunculus trichophyllus* Chaix ex Vill.	Cryptophytes	Widely distributed
137	Rhamnaceae	*Paliurus spina-christi* Mill.	Phanerophytes	Widely distributed
138	Rosaceae	*Malus sylvestris* (L.) Mill.	Phanerophytes	Euro-Siberian
139	Rosaceae	*Potentilla reptans* L.	Hemicryptophytes	Widely distributed
140	Rosaceae	*Prunus mahaleb* L.	Phanerophytes	Euro-Siberian
141	Rosaceae	*Prunus spinosa* L.	Phanerophytes	Euro-Siberian
142	Rosaceae	*Pyrus communis* L.	Phanerophytes	Widely distributed
143	Rosaceae	*Rosa canina* L.	Phanerophytes	Widely distributed
144	Rosaceae	*Rubus sanctus* Schreb.	Phanerophytes	Widely distributed
145	Rubiaceae	*Galium odoratum* (L.) Scop.	Hemicryptophytes	Euro-Siberian
146	Rubiaceae	*Galium aparine* L.	Therophytes	Widely distributed
147	Salicaceae	*Populus alba* L.	Phanerophytes	Euro-Siberian
148	Salicaceae	*Populus nigra* L.	Phanerophytes	Euro-Siberian
149	Salicaceae	*Salix alba* L.	Phanerophytes	Widely distributed
150	Salicaceae	*Salix amplexicaulis* Bory & Chaub.	Phanerophytes	Widely distributed

Ann. Table 1. Vascular plant taxa identified in riparian areas of the Yeşilırmak Basin in Amasya Province (Continue)
Ek Tablo 1. Amasya ili Yeşilırmak Havzası'nın riperyan alanlarında tespit edilen vasküler bitki taksonları (Devamı)

	Family	Taxon	Life form	Phytogeographic region
151	Salicaceae	*Salix caprea* L.	Phanerophytes	Euro-Siberian
152	Salviniaceae	*Salvinia natans* (L.) All.	Cryptophytes	Euro-Siberian
153	Sapindaceae	*Acer tataricum* L.	Phanerophytes	Euro-Siberian
154	Scrophulariaceae	*Scrophularia scopolii* Hoppe ex Pers.	Hemicryptophytes	Widely distributed
155	Simaroubaceae	*Ailanthus altissima* (Mill.) Swingle	Phanerophytes	Alien (introduced/invasive)
156	Tamaricaceae	*Tamarix smyrnensis* Bunge	Phanerophytes	Mediterranean
157	Typhaceae	*Sparganium erectum* L.	Cryptophytes	Euro-Siberian
158	Typhaceae	*Typha angustifolia* L.	Cryptophytes	Widely distributed
159	Typhaceae	*Typha latifolia* L.	Cryptophytes	Cosmopolitan
160	Typhaceae	*Typha laxmannii* Lepech.	Cryptophytes	Euro-Siberian
161	Typhaceae	*Typha shuttleworthii* W.D. J. Koch & Sond.	Cryptophytes	Widely distributed
162	Ulmaceae	*Ulmus minor* Mill.	Phanerophytes	Euro-Siberian
163	Urticaceae	*Urtica dioica* L.	Hemicryptophytes	Euro-Siberian