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The State and Problems of Meadow-Pastures in Türkiye in The 100th Anniversary of The Republic



Güven Şahin¹  

¹ Tekirdağ Namık Kemal University, Faculty of Arts and Sciences, Department of Geography, Tekirdağ, Türkiye

Abstract

Meadows and pastures are among the most important natural botanic resources in the world in terms of diversity and genetic richness. Although meadows and pastures are often first thought of as agricultural resources and foundational areas for livestock, this perspective is rather narrow. Besides being crucial for both cultural and wildlife animals, meadows and pastures also serve as special ecosystem services that prevent erosion, regulate soil temperature, conserve water resources, support beekeeping, and provide a rich genetic reservoir. There are various types of meadows-pastures represented by various species under different climatic conditions around the world. Due to the country's unique geographical position, Türkiye's meadowlands offer richness characterised by species from three major phytogeographic regions. In this study, which examines the issue of meadows-pastures from the perspective of Agricultural Geography as Türkiye marks its first century, the findings and necessary actions are presented. In this context, the limited literature on the subject has been reviewed, followed by archival studies that have compiled scattered and incomplete statistical data. Following this, over a four-year period, meadow-pasture observations were conducted in various locations (Siirt, Bitlis, Diyarbakır, Tokat, Amasya, Manisa, Tekirdağ, Hatay) through, discussions with technical teams to address past, present, and future conditions. Ultimately, while significant successful studies have been conducted on Türkiye's meadows-pastures with positive outcomes, it has become evident that the country's meadows-pastures need to be rehabilitated through strict policies.

Keywords

Meadows • pastures • animal husbandry • Agricultural Geography • Türkiye



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✉ Corresponding author: Güven Şahin gsahin@nku.edu.tr



Introduction

Among natural resources, plant richness is undoubtedly the most important. Although meadows and pastures are initially perceived as merely an element of livestock, they are, in fact, like forests, a plant community unit considered among natural resources. Meadows and pastures are natural resources that contribute directly or indirectly to essential ecosystem services vital for human well-being (Bengtsson et al., 2019: 2; Schils et al., 2022: 1). Due to their multifaceted characteristics, meadows-pastures rank among the most important natural resources, with qualities such as being a source of animal feed, rich biological diversity, soil conservation, and water supply functions. However, when meadows and pastures are mentioned, livestock activities are undoubtedly the first thing that comes to mind among the listed functions. For this reason, meadow-pastures are always considered when planning livestock activities.

Pastures, shrubland, savannas, tundras, and highlands essentially represent similar ecosystems under different geographical conditions. Today, meadows-pastures are one of the largest ecosystems, covering nearly one-third of the world's terrestrial surface (Lemaire et al., 2011; Bengtsson et al., 2019: 2). Despite their importance, meadow-pasture areas are shrinking and degrading both globally and in Türkiye. This degradation and loss of meadow-pastures primarily cause significant problems in the ecosystem and, subsequently, in livestock, which is one of today's key economic activities.

During the establishment and development of the modern Republic of Türkiye, which passed its first century, agricultural activities have always been a priority. Within agricultural activities, livestock farming has been a critical and special place. As previously mentioned, meadows and pastures cannot be separately considered for livestock farming. The main issue here is that the lands on which the modern Republic of Türkiye was established, have been inhabited for thousands of years and constitute a significant portion of the area where the first agricultural activities began. As a result, there is an issue of meadows and pastures in Anatolia, particularly degeneration and degradation. When factors such as long-standing unsuitable grazing practices and the incompatibility between meadow-pasture resources and grazed livestock breeds and species are added to this, an even more bleak picture appears for the state of our meadow-pastures. In recent years, the misuse of land for purposes other than intended has become a significant issue, particularly in meadow-pasture areas. With this in mind, over the past century, highly successful rehabilitation and allocation projects have also been carried out in meadow-

pasture areas in Türkiye. In this study, changes in meadow-pasture areas during the 100th year of the Republic of Türkiye are examined using a holistic approach.

Purpose and Method

In this study, the meadow-pasture resources of the modern Republic of Türkiye, which has completed its first century, were examined in line with principles of agricultural geography. Generally speaking, Türkiye's meadows and pastures have often been addressed in only a few paragraphs within land use studies and have only recently become the subject of independent research as a spatial entity. In addition to Agricultural Engineering, this topic has not received much attention from other disciplines and has generally been largely neglected within the discipline of geography as well. Due to this gap in the agricultural geography literature, there is a need to specifically address meadows and pastures. In this context, the literature review formed the first step of our research, in which previous studies were examined and efforts were made to access official data on the subject from archival records. Unfortunately, it is not possible to speak of reliable statistical data regarding Türkiye's meadow-pasture resources. Statistics on meadow-pasture existence at the national and provincial levels could only be compiled intermittently from the archives of TurkStat (formerly DIE), the Ministry of Agriculture and Forestry, and the Department of Meadows, Pastures, and Forage Crops. Data from MERBİS (Pasture Information System) for 2023 provided, by the Department of Meadows, Pastures, and Forage Crops under the Ministry of Agriculture and Forestry, which contains the most reliable recent data, are used within the scope of the 1998 "Meadow Law". Based on these data, meadow-pasture data for selected years at the provincial level were digitised, and maps were prepared using ArcGIS 10.8. Field studies extending over four years were conducted in Siirt, Bitlis, Diyarbakır, Tokat, Amasya, Manisa, Tekirdağ, and Hatay, focusing on botanical composition and utilisation practices in Türkiye's meadows and pastures. Interviews were conducted with herders (11 individuals) and agricultural engineers (17 individuals) from these various locations, and an attempt was made to derive general conclusions regarding regional and overall issues as well as expectations. Additionally, in areas where successful meadow-pasture rehabilitation has been conducted, selected forage crops and grazing periods were examined as case studies relevant to the topic.

Meadow and Pasture Presence and Geographic Distribution in Türkiye

Before explaining the meadow and pasture presence in Türkiye, it is useful to briefly describe the geographical conditions affecting this natural resource. Türkiye is located in the temperate zone and generally experiences Mediterranean, humid maritime, pontic and continental climates, with occasional transitional climates in some regions. In addition, due to the diversity of the country's topography, Türkiye has a significant number of areas with microclimatic conditions, as well as extensive regions experiencing Mediterranean, continental, and temperate climatic conditions. These changes result in a wide variety of plant species across the country. Elements from the European-Siberian (Oxycoccus and Colchic flora), Iran-Turan, and Mediterranean phytogeographical regions dominate Türkiye. This is why Türkiye is rich in floristic diversity and endemic species. This richness is evident in our meadows and pastures as well although it has dramatically declined because of years of improper livestock grazing systems and incorrect land use. In particular, between 1960 and 1980, conventional agricultural practices involving the use of chemical fertilisers, herbicides, pesticides, and various soil cultivation activities led to the loss of species and varieties in pasture areas or the deterioration of floristic composition (Okuyucu and Okuyucu, 2009: 548). In Türkiye's internal regions of Türkiye, climax vegetation has been destroyed. As a result, heavy and untimely grazing, invasive and unpalatable species to ruminants gradually dominate, which is then followed by a reduction or thinning of these species.

When explaining meadow and pasture resources in Türkiye and their geographical distribution, it should be noted that there are still no definitive data on the subject. This impedes accurate assessment. According to the most recent official data in Türkiye, there are 14.6 million hectares of meadows and pastures. However, under the "National Pasture Use and Management Project", 16.3 million hectares of pasture area have been identified in only 48 provinces (Gökkuş, 2019: 150). Therefore, the actual meadow and pasture area in Türkiye exceeds 20 million hectares. Including approximately 11.5 million hectares of land that could be classified as "Degraded Forest" and considered under "Shrubland", it is possible to say that grazing areas exceed 30 million hectares. Moreover, considering that maquis (scrublands) might also be included in pasture areas, and Türkiye has about 7.5 million hectares of maquis, it can be clearly stated that the meadow and pasture resources are much more extensive and significant. Conversely, with the enactment of the 4342 Law on Pastures in

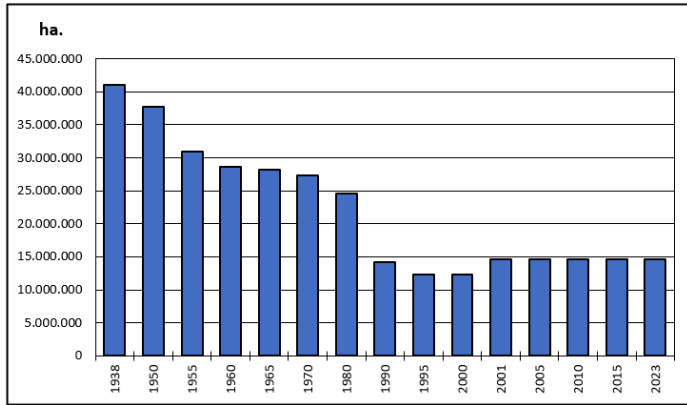
1998, more accurate data began to be collected following the start of identification and assignment efforts. As a result, since 2001, official data for Türkiye indicate 14.6 million hectares of meadows and pastures, with 13.2 million hectares identified by 2023 (Ministry of Agriculture and Forestry, Directorate of Meadows, Pastures, and Fodder Plants, 2024). However, historical data for Türkiye and provincial scales are based on the Turkish Statistical Institute data and generally the "General Agricultural Censuses" conducted every 10 years in the past.

When evaluating the 100-year period in Türkiye as a whole, it is observed that there have been significant initial declines meadow-pasture areas. While the total meadow-pasture area in Türkiye was over 40 million hectares in 1938, it decreased to 37.8 million ha. in the 1950s, 28.6 million ha. in 1960, 27.3 million ha. in 1970, 14.2 million ha. in 1990, and 14.6 million ha. as of 2023 (Figure 1). Accordingly, meadows-pastures, which had a large share of 54% of the national surface area in 1938, declined to 40% in 1955, 36% in 1965 (Cillov, 1972: 208), and finally to 18.9% in 2023. As shown in Figure 1, some of the dramatic declines in some years are due to sudden changes resulting from the alteration of the status of the pastures. For example, the "Law on Land Allocation for Farmers" enacted on June 11, 1945, led to a significant reduction in the number of pastures. This was influenced by the fact that the lands allocated to farmers were generally pasture lands, resulting in a notable decline in meadow-pasture areas by the 1950s. Accordingly, it is possible to say that a significant amount of pasture lands were converted into agricultural lands. Of course, this situation further increased livestock pressure on shrinking meadow-pasture areas. Nevertheless, according to the data on land holdings from *Zirai Bünye* and *İstihsal Bülteni* for 1949, meadow-pastures still represented the largest share with 50% in the land distribution (Bayar, 2004: 42). Later, with the establishment of the Ministry of Forestry on August 11, 1969, a notable second decline in meadow-pasture areas occurred when 7.5 million hectares of scrubland, classified as "Degraded Forest / Scrubland", were transferred to the jurisdiction of the newly established ministry. Indeed, the forested area in Türkiye, which was 10.6 million ha. in 1965, increased to 18.3 million hectares by 1969 (TurkStat, 2013). Lastly, with the change in land classification in 1980, a third decline occurred, and the status of some areas was altered. The conversion of pasture lands into agricultural areas and the change in their status also played a significant role in the reduction of these areas. For instance, from 2006 to 2012, a significant portion of pasture areas whose status changed, about 72%, was converted into dry and irrigated agricultural lands (Bayar, 2018: 196). As a result, meadow-pasture areas in

Türkiye decreased from 21.7 million ha. to 14.6 million hectares. Of this, 13.2 million hectares are pastures, whereas 1.4 million hectares are meadows.

Figure 1

Changes in Türkiye's Meadow-Pasture Areas over Selected Years



Source: TurkStat (Previously DiE) data (Agricultural Statistics Summaries, General Agricultural Censuses 1991, 2001); Cillov, 1972: 208

When examining the geographical distribution of meadows-pastures in Türkiye, as seen in Figure 2, these natural resources are concentrated in the country's interior regions. Generally, the availability of meadows-pastures decreases from east to west, with significant scarcity in the Marmara Region, particularly in Thrace. Similarly, in southeastern Anatolia, especially south of the southeastern Taurus Mountains, there is a noticeable reduction in meadow-pasture resources. Türkiye's relatively limited meadow areas, as shown in Figure 2, are observed as a belt along the north-facing slopes of the mountains in the Eastern Black Sea region, scattered in the north of Erzurum, and widely present in Ardahan on

the Georgian border. These areas are also known for their prevalence in cattle farming.

Following the enactment of the Pasture Law in Türkiye in 1998, within the 25-year period up to 2023, fieldwork has been completed for 90% (13,171,518 ha.) of the existing 14,616,687 ha. of meadow-pasture areas. Significant restriction work has been carried out on 87.5% of the current meadow-pasture areas, while 61.4% of these areas have been subjected to allocation. However, there are no definitive data on meadow-pasture resources in Türkiye. As of 2024, meadow-pasture identification studies are ongoing, and values are continually being updated. Therefore, it is expected that Türkiye's 14.6 million hectares of meadow-pasture resources will be updated in the future.

Looking at the trends in the studies over the selected years, as seen in Table 1, quite a variable development can be observed. For example, from 2000 to 2020, the meadow-pasture areas identified increased from 386,597 ha. to 1,248,841 ha. However, the process has followed a fluctuating development, with only 306,028 ha. of meadow-pasture area identified in 2010. Restriction studies, except 2020, generally fluctuated within a certain range and remained around 280 thousand hectares, with a remarkable increase to 889,572 hectares only in 2020. Allocation areas have remained much more limited than in other categories. Often remaining below 100,000 ha, allocation areas reached their highest value of 797,495 ha. in 2020 (Table 1). The main factors affecting this include security issues leading to the closure of some pastures and the resting of some pastures during management activities.

Figure 2

Geographical Distribution of Meadows-Pastures in Türkiye



Table 1

Determination, Limitation, and Appropriation Quantities of Meadows-Pastures in Türkiye by Year (ha.)

Years	Determination	Limitation	Appropriation
2000	386.597	284.860	38.020
2005	690.026	244.673	85.417
2010	306.028	299.716	574.898
2015	414.637	288.368	64.280
2020	1.248.841	889.572	797.495
2023 Total	13.171.518	12.793.113	8.984.257

Source: Republic of Türkiye Ministry of Agriculture and Forestry, General Directorate of Pasture, Forage Crops, and Livestock, 2024

Based on 2023 data from the Pasture Information System (MERBİS), the geographical distribution of meadow-pasture areas indicates that the Eastern Anatolia Region has 5.7 million ha. as determined, 5.6 million ha. as limited, and 3.3 million ha. as appropriated areas (Figure 3). The Eastern Anatolia Region, one of the most problematic regions in Türkiye, is also considered the country's livestock centre due to its topography and floristic characteristics. The meadow-pasture resources support this economic activity. The Central Anatolia Region follows this region, with a total of 4.2 million ha. of determined meadow-pasture areas. In this region, the limited area is 4.1 million ha., and the appropriated area is 3.6 million ha. (Figure 3). These two geographical regions together account for a significant portion (75.8%) of Türkiye's total meadow-pasture areas, or approximately 10 million ha. The Black Sea Region ranks third, with 1.1 million ha. determined, 1 million ha. limited, and 530.069 ha. appropriated areas. Among the geographical regions, the Black Sea Region has the largest discrepancy between identified and allocated meadow-pasture areas. Following the leading region, the Southeastern

Anatolia Region has 741.351 hectares determined, 735.032 hectares limited, and 643.450 hectares appropriated. The other three coastal regions, particularly the Marmara Region, have very low proportions of meadow-pasture resources (Figure 3). As of 2023, the appropriation ratios of determined meadow-pasture areas by region are as follows: 87.6% in the Marmara Region, 86.8% in the Southeastern Anatolia Region, 85% in the Central Anatolia Region, 64% in the Mediterranean Region, 64% in the Aegean Region, 57.3% in the Eastern Anatolia Region, and 47.2% in the Black Sea Region. The low appropriation ratio of meadow-pasture areas in the Eastern Anatolia Region is particularly due to the closure of some pastures for security reasons. In contrast, in the Marmara Region, where meadow-pasture resources are quite limited, a significant portion of the study area has been opened to livestock activities.

When examining meadow-pasture resources at the provincial level, data from past General Agricultural Censuses indicate that provinces in the inner regions (such as Erzurum, Van, Ankara, Kayseri, Konya, Kars) stand out. As a general trend, meadow areas in the provinces of the western regions are beginning to occupy smaller areas (Figure 4). Although meadow-pasture areas appear to have diminished from 1991 to 2022, the key point to emphasise is that this perception is largely due to the lack of reliability in historical meadow-pasture data.

Finally, the map prepared based on the 2023 data in Figure 4 uses current and reliable data obtained from the Meadow-Pasture Information System (MERBİS). According to these findings, meadow-pasture areas in the inner provinces cover a broader area at the provincial scale. Meadow-pasture areas, extending in a band-like manner from the provinces of the Eastern Anatolia Region, are beginning to thin out in the

Figure 3

Determination, Limitation, and Appropriation Values of Meadow-Pastures in Geographical Regions

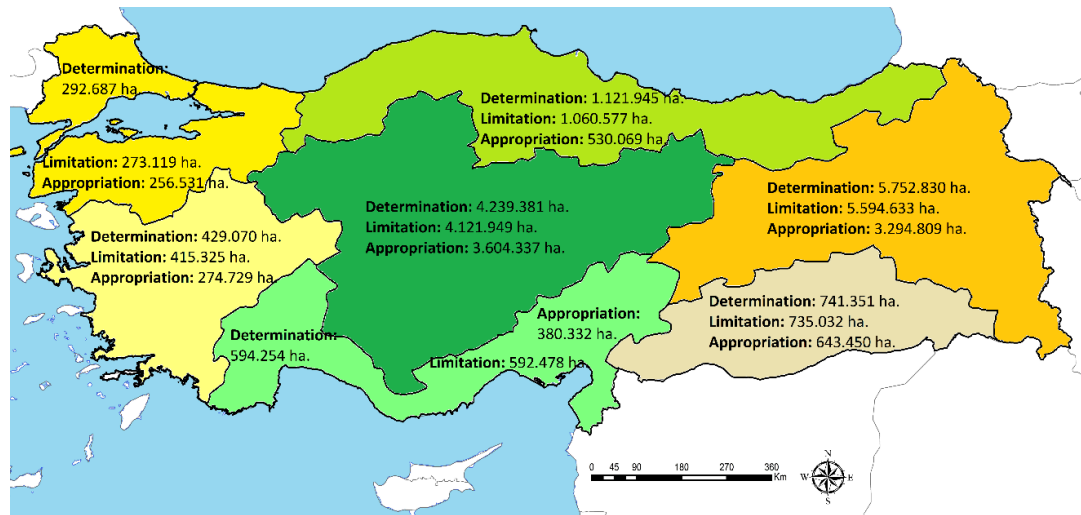
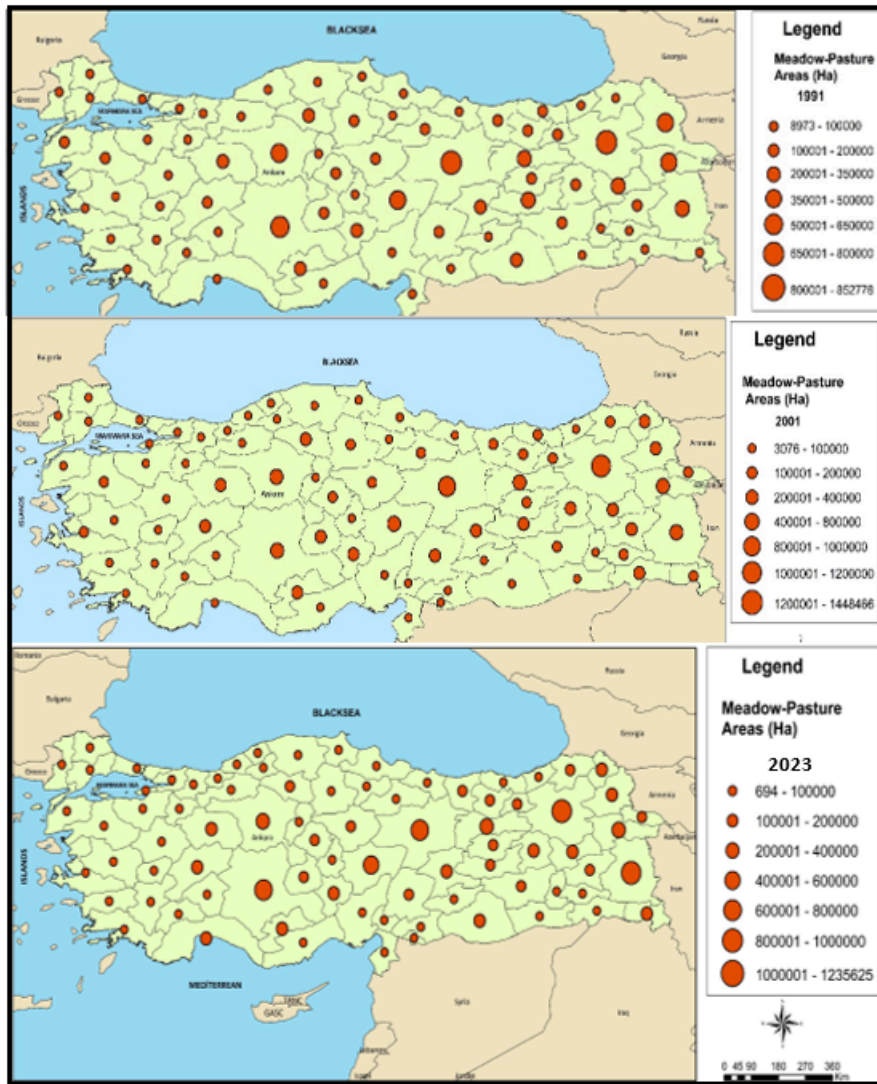


Figure 4

Distribution of Meadows-Pastures by Province in Türkiye for the Years



Aegean and Marmara regions. Notably, the weakness in Trakya is striking. When examining the determination, limitation, and appropriation amounts and proportional values of leading provinces in Türkiye, only Antalya from the coastal provinces is among the top 15 provinces, ranking 15th (Table 2). Van, the province with the highest meadow-pasture resources, has determined 1.2 million hectares of meadow-pasture, with almost all of it appropriated, making up 76.4% of the total agricultural land (Table 2). However, the appropriation rates show that only 44.2% of the existing meadow-pastures are used for livestock. Erzurum, ranks second, with over 1 million hectares of meadow-pasture resources, with these areas making up 71.5% of the total agricultural land. Unlike Van, approximately 80% of the meadow-pastures in Erzurum are in use. The third-ranked province is Konya, which has the largest meadow-pasture resources in the Central Anatolia Region. A significant portion of Konya's identified 845.580 hectares has been restricted, and meadow-pastures constitute only 30% of

the province's vast agricultural land (Table 2). Among other notable provinces, Sivas is one. Almost all the meadow-pasture areas in the province (96.2%) were allocated for livestock use. A similar situation applies to Şanlıurfa, Ankara, and Muş. A notable aspect of Ankara is that it has the smallest proportion of meadow-pastures among the top 15 provinces in terms of total agricultural land. The low allocation rate in Hakkari is due to the closure of many pastures for security reasons. In Kars, where livestock is a significant activity, the both limited meadow-pasture rate is very low, and the appropriated areas are very limited. This increases livestock pressure on used meadows and pastures.

Improvement and Management of Meadows and Pasture in Türkiye

In Türkiye, the first and most significant development in the improvement and management of meadows and pastures was the establishment of the "Meadow-Pasture and

Table 2*The Top 15 Provinces in Türkiye with the Largest Meadow and Pasture Area as of 2023*

Cities	Determination	Limitation	Rate of Limitation of Total Agricultural Land (%)	Appropriation	Rate of Appropriation within the Total Meadow and Pasture Areas (%)
Van	1.248.970	1.235.625	76.4	552.290	44.2
Erzurum	1.072.172	1.036.393	71.5	855.692	79.8
Konya	845.580	816.559	30.2	680.351	80.4
Sivas	830.362	800.214	50.5	799.336	96.2
Kayseri	638.791	620.319	50.7	559.916	87.6
Ağrı	537.422	530.747	60.7	333.261	62.0
Erzincan	435.064	435.075	75.3	218.797	50.3
Ankara	424.713	407.916	26.0	407.876	96.0
Kars	417.936	341.784	59.3	198.711	47.5
Şanlıurfa	335.242	342.237	23.3	335.242	100.0
Muş	334.928	350.868	53.8	320.797	95.8
Malatya	303.294	279.422	50.8	195.225	64.3
Eskişehir	292.088	287.231	34.5	191.009	65.4
Hakkâri	254.498	254.331	37.0	2.623	1.0
Antalya	235.861	237.460	42.2	72.710	30.8

Source: Republic of Türkiye Ministry of Agriculture and Forestry, General Directorate of Pasture, Forage Crops, and Livestock, 2024

Animal Husbandry Research Institute” under the Ministry of Agriculture in 1952, and shortly thereafter, the “Meadow-Pasture, Forage Plants, and Feeding Research Institute” was established on May 29, 1959 (Anonymous, 1982: 1). This marked a significant step in both the conservation and utilisation of these natural resources, as well as in achieving integrated development with animal husbandry. The next major development was the establishment of the “Meadow Commission” under the leadership of a Deputy Governor under Law No. 4342 on Meadows.

When considering meadows and pastures in Türkiye, the most important topics include DLA (Determination – Limitation – Appropriation) and meadow improvement and management. Meadow improvement is defined as “the facilities and arrangements established on meadows to increase their productivity and quality, and to ensure that grazing animals benefit more and more easily from the produced forage.” Thus, the primary aim of improvement is to increase the density of plants with high forage value and to promote the spread of species that are preferred, nutritious, and easy to digest for animals. Selecting suitable species for geographic conditions and ensuring sustainable pasture management is crucial. In addition to high-nutrition cereal and legume forage plants, preventing the suppression of native flora is also important for the continuity of the ecosystem. This will make meadows useful both economically and ecologically for both domestic and wild animals.

In meadow management or administration, the capacity of the meadow and the rule/programs on how the meadows are used are established. Based on geographic conditions, the “Provincial Meadow Commissions” declare each year which types of animals will graze, and when and where they will graze, in light of vegetation elements and climatic conditions in a given area. This prevents excessive and untimely grazing of meadows. In Türkiye, the grazing season is roughly defined as between April and October (Table 3). However, depending on geographical conditions, different periods can be set within the same province. For example, in the southern part of Diyarbakır, the grazing season is from March 15 to September 15, whereas in the northern districts, it begins with a delay of about two weeks and ends on September 15 as well (Table 3). The same situation applies to Bolu, Hakkâri, Iğdır, and Adana. The altitude and distance of the meadows from the villages also affected the schedule. For instance, in the Bozkır district of Konya, the start date for grazing is May17 for areas with an altitude of 1200 metres or higher, and the end date is October 20 for areas below 1200 metres and October 5 for areas at 1200 meters or higher. However, it would be incorrect to consider only natural conditions when determining the grazing season. The number of animals to be grazed and their characteristics (whether they are culture or native breeds) are also considered. Additionally, grazing dates may vary each year depending on factors such as spring and autumn grazing, rotational grazing, and proximity to settlements.

Table 3*Grazing Season in Different Locations in Türkiye (2021–2024)*

Location	Season	Location	Season
Diyarbakır (Merkez, Çınar, Bismil, Ergani, Çermik, Eğil, Kocaköy, Silvan)	15 March–15 September	Kırklareli	20 April–20 October
Diyarbakır (Kulp, Lice, Dicle, Hazro, Çüngüş, Hani)	1 April–15 September	Niğde (Çamardı, Çiftlik, Ulukışla)	1 May–15 October
Mersin	1 April–15 October	Isparta	1 May–15 October
Bolu (Göynük, Mudurnu, Seben)	1 April–15 October	Bayburt	1 May–15 November
Bolu (Diğer ilçeler)	15 April–15 October	Burdur (Tefenni)	1 May–20 October
Iğdır (Merkez, Aralık, Karakoyunlu)	1 April–1 October	Hakkâri (Şemdinli, Çukurca, Derecik)	25 April–15 November
Iğdır (Tuzluca)	15 April–15 October	Hakkâri (Merkez, Yüksekova)	5 May–30 October
Erzincan	10 April–31 October	Van	15 May–15 October
Edirne	15 April–1 November	Adana (Aladağ, Feke, Saimbeyli, Tufanbeyli, Pozantı)	1 May–15 October
Kayseri	15 April–30 September	Gümüşhane	15 May–31 October
Niğde (Merkez, Altunhisar, Bor)	15 April–15 October	Giresun	20 May–10 October
Çanakkale	15 April–15 November		

In the management of pastures, determining the carrying capacity of the land and understanding its geographical conditions, including flora characteristics, are crucial. This is particularly important because industrial cattle farming, which has a significant impact on global climate change, must be addressed when considering pastoral farming on pasture. It is noteworthy that animals that graze freely on pastures typically do not experience vitamin and mineral deficiencies (Gökkuş, 2014: 151). At this stage, “Determination – Limitation – Appropriation” constitutes three basic steps. Initially, areas designated for permanent use as pastures must be determined and registered under the “Public Common Goods Registry” as “Pasture Special Registry” in accordance with relevant regulations. In evolving socioeconomic conditions, decisions regarding the reclassification of pastureland should be made by a team consisting of the Governor, Municipality, Village Head and, the Elderly Council. During the limitation phase, the pastures are delineated and divided into parcels for sustainable pasture management. The parceling process is essentially a form of allowing pastures to open. In this way, instead of allowing an entire pasture area to be exhausted in a single season, the area is opened for grazing in sections, and the ecosystem’s health is maintained in the rested parcels. In the appropriation phase, the areas designated for grazing, the time of year, and the capacity to meet the needs of a particular herd are considered. The land is then allocated to the village, neighbourhood, or municipal legal entity. In addition, pastures may be rented for improvement. Indeed, in Türkiye, a significant area of 4.645.374 hectares was leased for this purpose from 2002 to 2023 (Pasture and Forage Crops Department, 2024).

After identifying pasture and meadow areas and making them available for use according to certain principles, the improvement and management of existing pastures and meadows becomes the most pressing issue. This is because pastures in Türkiye are very weak and are greatly degraded. At this stage, it is essential to first understand the vegetation well, address flora elements that are suitable for geographical conditions, and support livestock activities. Under the “Pasture Law” No. 4342 in Türkiye, pastures are classified into various quality grades based on the types of vegetation (decreasing, increasing, invasive, etc.). However, at classification based solely on species (weak, medium, good, very good) is often insufficient, as some researchers have mentioned. It would be more appropriate to determine quality by considering the species density. Given that nearly ¾ of the country’s pastures require improvement and management, monitoring changes in vegetation structures and managing the process with up-to-date strategies (İspirli et al., 2016: 15).

In Türkiye, a mid-latitude country with predominantly continental conditions, pastures in the interior regions have been significantly worn out because of heavy grazing over the years. Therefore, drought-resistant, nutrient-rich cereal and legume forage plants should be widely used for pasture improvement. While doing so, a plant pattern suitable for geographical conditions and regional ecology must be established. Generally, rising temperatures lead to the dominance of perennial legumes in pastures; in semi-arid conditions, the plant pattern includes perennial cereals and legumes, as well as annual plants. In arid conditions, annual species and shrubby formations become dominant (Tahtacıoğlu, 2008: 76). At this point, measures should also be

taken to improve pasture to address global climate change and extreme weather events.

Under Türkiye's geographical conditions and sustainable pasture management, plants suitable for selection include high meadow grass (*Agropyron elongatum*), which is highly drought-resistant and moderately tolerant to salinity; pasture button (*Potaryum sanguisorba*), known for its drought resistance and disease resistance; meadow fescue (*Festuca pratensis*), which is also highly drought-resistant; bermudagrass (*Cynodon dactylon*), noted for its excellent drought resistance; smooth brome (*Bromus inermis*), which can withstand both drought and cold; and bird's foot trefoil (*Lotus corniculatus*), ideal for saline and arid soils. In dry and semi-dry climates, a balanced mix of cereals, legumes, shrubs, and certain tree species can be used for pasture improvement. In particular, drought-resistant shrubs are valuable as they provide feed during dry seasons. Examples of such shrubs and erosion-controlling plants include *Acacia ligulata*, *Acacia salicina*, *Atriplex halimus*, *Atriplex nummularia*, *Coronilla minima*, and *Bassia* (*Kochia*) *prostrata*. In addition, species such as kermes (Holly) oak (*Quercus coccifera*), sage-leaved cistus (*Cistus salviifolius*), and hairy cistus (*Cistus creticus*) are valuable woody pasture formations. Some shrubs, although not highly preferred by animals, can still be used in areas with degraded plant compositions and erosion-prone Mediterranean climates. For example, the spiny broom (*Calicotome villosa*), which is thorny but helps with erosion control and provides an alternative feed source in dry conditions, can be beneficial. On the other hand, invasive shrubs such as common juniper (*Juniperus communis*), prickly juniper (*Juniperus oxycedrus*), dyer's sumac (*Cotinus coggygria*), rhododendron, and daphne (*Daphne pontica* L.) should be removed from pastures because they generally offer no feed value and, some can be toxic.

In addition to the recommended improvement plants, some species need to be removed from pastures. As previously mentioned, the number of climax plants in Türkiye's pasture lands is decreasing, and the proportion of desired species in the plant composition is decreasing. This results in the dominance of thorny and toxic species, which can prevent animals from grazing properly and may even lead to animal death. Examples of species that should be removed or controlled in pastures include spurge (*Euphorbia*), poison hemlock (*Conium maculatum*), water hemlock (*Cicuta virosa*), deadly nightshade (*Atropa belladonna*), astragalus (*Astragalus*), redroot pigweed (*Amaranthus retroflexus*), St. John's wort (*Hypericum perforatum*), and mullein (*Verbascum*). Toxic species must be eliminated from pastures to ensure the safety of ruminants. Some species, although potentially

harmful to animals at certain growth stages, are still used in pasture improvement. For instance, sorghum (*Sorghum*) can contain hydrocyanic acid during its early growth phase (up to 50 cm in height), which may lead to poisoning or even death in grazing animals. Although they are good nutritional sources, certain species can be harmful due to their thorns. For example, Christ's thorn (*Paliurus spina-christi*) appears to be a valuable food source due to its high nutritional value, but it can damage the udders of small livestock due to its thorns and complicate pasture improvement due to its invasive nature. Therefore, careful selection of species is crucial for improving pasture quality. In areas that are either rested or previously used as fields and are now being considered or pastured, there can be significant increases in invasive species populations. Plants like marsh horsetail (*Equisetum palustre*), nodding thistle (*Carduus nutans*), lesser knotweed (*Veronica gentianoides*), and male ferns (*Dryopteris filix-mas*) can become problematic in ecosystems, despite their low nutritional value. Weed control in pastures is a critical issue for organic farming and animal health. The use of herbicides to control weeds can lead to undesirable results in the ecosystem. It is also important to note that pastures should not be managed solely for livestock purposes. These areas are also valuable for beekeeping and should be managed with a holistic approach that considers both the selection of plants (including nectar plants) and the impact of herbicides on bees. This approach will ensure sustainable livestock and poultry management.

It has previously been noted that selecting species for sustainable pasture improvement solely based on animal feed concerns is a flawed approach. One crucial aspect to consider in species selection is erosion, which is one of Türkiye's significant challenges. It is essential to include species that contribute to erosion control and to pay close attention to invasive characteristics. For Turkish conditions, particularly dry and semi-arid conditions, species such as buffalo grass (*Buchloe dactyloides*) and smooth brome (*Bromus inermis*) are recommended because of their ability to prevent erosion and their high nutritional value. These species exhibit rapid growth, regenerate easily, protect the soil effectively against wind erosion, and contribute organic matter to it. In humid areas, plants like white clover (*Trifolium repens*), timothy (*Phleum pratense*), and reed canary grass (*Phalaris arundinacea*) can cover the soil within 1-2 years when planted with alfalfa, making them suitable for erosion control. In arid and high-altitude areas, crested wheatgrass (*Agropyron cristatum*), which is ideal for pasture establishment, also positively impacts erosion control in the harsh winter conditions of Eastern Anatolia. At this point, it is

crucial for shepherds to promote and introduce species that offer both erosion control and animal feeding. Additionally, it is important to include nectar plants favoured by bees in the pasture composition. Species from the mint family (*Lamiaceae*), such as thyme (*Thymus*) and borage (*Borago officinalis*), are examples of nectar-rich plants that can benefit both the ecosystem and apiculture.

When it comes to improving and managing pastures and meadows, plant-based interventions are often the first consideration; however, certain physical facilities are also essential for animal welfare and sustainability. These include scratching posts, shelters, troughs, feeders, salt licks, protective areas, and resting spots for shepherds. Creating optimal conditions for shepherds is particularly important, given the increasing and chronic issues in livestock management, and these facilities are crucial for the sector.

In Türkiye, the improvement and management of pastures and meadows have seen significant progress, particularly since the 1990s. Although successful efforts have been made in this area, they have not been sufficient. The implementation of Law No. 4342, known as the “Pasture Law”, and related regulations that came into effect in 1998 accelerated the improvement of these areas, and the practice of leasing pastures for improvement purposes has been a significant step. In 2023, a total of 451.684 hectares of pastureland across 37 provinces were leased for seasonal improvement, and over the last five years, the leased area amounted to 1.728.700 hectares (Ministry of Agriculture and Forestry, 2024). Between 1998 and 2023, 2.958 pasture improvement and management projects were implemented. These projects involved improvement and management activities on 2.201.297 hectares of pastureland, which constitutes 15% of the existing pasture and meadow areas. Under the United Nations Convention to Combat Desertification (UNCCD) “Land Degradation Neutrality (LDN)” targets, restoration efforts have been carried out on 585.000 hectares of land, with a goal of achieving 750.000 hectares of pasture improvement by 2030 (Anonymous, 2016: 19). As of 2021, the targeted area represents 5.1% of the existing pasture and meadow area in Türkiye.

Between 2000 and 2023, Türkiye conducted 2.958 pasture and meadow improvement projects across 2.201.297 hectares, which accounted for 15.1% of the country’s total pasture and meadow area (Table 4). Analysing the distribution of these projects by region, the Eastern Anatolia Region, which ranks first in terms of pasture and livestock activities, has 632 projects conducted between 2002 and 2023, covering 915.095 hectares (Table 4). The Central Anatolia Region ranks second with 471 projects covering 486.448 ha. In the Black Sea Region, which features the largest pasture and meadow area among

coastal regions, 592 projects were carried out over 363.348 hectares. These three regions together account for 80.2% of the total area that has been improved through these projects. In the Aegean Region, which has a total of 429.070 hectares of pasture and meadow, only 55.037 hectares have undergone improvement. In summary, improvement efforts are concentrated in areas where pastures and meadows are most heavily used, most degraded, and where the potential for livestock farming is highest.

Table 4

Distribution of Pasture Improvement and Management Projects by Region in Türkiye (2000 – 2023)

Regions	Number of Projects	Project Area (ha.)	Share in Türkiye (%)
The Eastern Anatolia Region	632	915.095	41.6
Central Anatolia Region	471	486.448	22.1
The Black Sea Region	592	363.348	16.5
Mediterranean Region	350	172.301	7.8
The Southeastern Anatolia Region	259	129.448	5.9
Marmara Region	381	79.618	3.6
Aegean Region	273	55.037	2.5
TOTAL	2.958	2.201.297	15.1
Total Meadow-Pasture Area in Türkiye	-	14.616.687	100.0

Source: Republic of Türkiye Ministry of Agriculture and Forestry, General Directorate of Pasture, Forage Crops, and Livestock, 2024

The positive outcomes of these reclamation efforts have been observed. Significant improvements in dry forage yields were observed due to pasture and meadow reclamation. For example, between 2003 and 2009, 73 pasture reclamation and management projects conducted in collaboration with the Çukurova Agricultural Research Institute and Çukurova University Faculty of Agriculture resulted in dry forage yield ranging from 35 kg to 260 kg per decare before the projects, which increased to values between 90 and 1.500 kg per decare after the projects (Çınar et al., 2009: 580). In 2010, the “Golden Flag” incentive was introduced to raise awareness and highlight successful pasture and meadow reclamation projects across Türkiye. Meadows with exemplary and successful reclamation projects were awarded the “Golden Flag” award. Successful pasture and meadow reclamation projects in Samsun (Bafra/Emenli), Erzurum (Narman/Şekerli), İstanbul (Silivri/Fenerköy), Ordu (Mesudiye/Bayırköy), Niğde (Merkez/Aşlama), Edirne (Merkez/Demirhanlı), Tekirdağ (Süleymanpaşa/Kaşıkçı), Isparta (Yalvaç/Kumdanlı), Hatay (Kırıkhan/Kodallı), and Malatya (Akçadağ/Karacadağ) received the “Golden Flag”

award. According to discussions with agricultural engineers about the productivity of the awarded meadows in Samsun, Hatay, Tekirdağ, and Edirne, it was noted that the forage yield exceeded by 2-3 times.

Problems with Pastures and Meadows in Türkiye

When listing issues related to pastures and meadows in Türkiye, overgrazing and the resulting floristic impoverishment are at the top. This situation leads to severe problems such as erosion, resulting in dramatic damage and even collapse of the pasture-meadow ecosystem. Moreover, considering that Anatolia has been one of the oldest settlement areas throughout our civilisation history, it can be said that the natural resources of pastures and meadows have been more extensively degraded compared to many parts of the world due to thousands of years of pastoral activities. Despite covering a significant portion of Türkiye's land area (18.6%), approximately 87.6% of the pastures and meadows are in poor condition. In addition, approximately 64% of our pasture areas experience various levels of erosion (Anonymous, 2016: 19). This negative situation is particularly pronounced in our interior regions. Studies from the 1970s showed that 70% of the pastures in these interior regions had deteriorated significantly, and the beneficial forage plants had decreased by 80% to 90% (Anonymous, 1977: 16). This has further intensified the already severe erosion in these areas.

Some problems related to pasture and meadow resources in Türkiye have become chronic, while others have emerged, particularly in recent years. These include:

- Grazing out of time without considering geographical conditions,
- Overgrazing
- Conventional farming practices
- Changes in plant patterns
- Non-purposeful use (such as mining, land development)

The main problem with Türkiye's pastures and meadows in Türkiye is untimely and excessive grazing. Grazing occurring outside the schedule determined by geographical conditions has led to the dominance of unwanted plant species in pastures. Early grazing, particularly when plants are at their weakest, poses the greatest threat to pasture and meadow areas. Along with untimely grazing, excessive grazing is also prevalent in Türkiye, leading to the near or complete disappearance of high-quality forage plants that support livestock. Unfortunately, there are significant mismatches between the flora of pastures and meadows and the breeds

and numbers of livestock in Türkiye. The prevalence of high-performance cultured breeds has increased the pressure on pastures and meadows. Current pastures and meadows do not meet the needs of these cultured breeds. Therefore, it is essential to conduct meadow improvements in parallel with livestock breed improvements. In addressing this issue, pastures should be managed with different animal species, i.e. in a mixed grazing system. For instance, sheep prefer broad-leaved, short, and mostly leguminous forage plants, whereas cattle consume tall, cereal-type forage plants.

Another practice that disrupts plant composition is conventional agricultural activities. Between 1960 and 1980, the use of chemical fertilisers, herbicides, and insecticides led to the loss of many plant species and disruption of the floristic composition in pasture areas (Okuyucu and Okuyucu, 2009: 549). This situation also poses a serious problem for organic livestock farming.

In recent years, one of the most frequently discussed issues regarding pastures registered as public common property has been the change in their purpose of use. In essence, the "Pasture Law" protects our pastures to prevent inappropriate use. However, in certain cases (such as mining, urban development, allocation to industrial zones, or conversion to arable farming), the designated purposes can be altered, thereby removing the status of pastures. Mining is one of the primary inappropriate uses that impact pastures. Mining is not an economic activity that can be carried out based on personal preferences but has to be conducted where the resource is located. As a result, if mineral resources are found near a forest area or other natural resources (such as lakes or rivers), their use often leads to serious public debate worldwide. Mining activities have also significantly affected pastures. Although mining activities on pastures designated for public use are subject to permits, the status of these areas is often changed to facilitate mining operations. According to relevant regulations, if mining is required on a pasture, an application must first be submitted to the General Directorate of Mining and Petroleum Affairs. Following this, a report is prepared through an examination by the Ministry of Agriculture and Forestry and the provincial directorate and, then sent to the Ministry along with the governor's approval. At this stage, monitoring the duration of mining activities and post-mining conditions is crucial. Certain mining sectors, especially gold mining, can cause serious environmental damage, even with the slightest negligence. Even if mining activities cease, livestock farming in the affected area may become impossible. Therefore, performing a "Pasture Rehabilitation Project" with the relevant mining company and

ensuring its implementation in accordance with the relevant geographic conditions is of utmost importance.

In recent years, there has been an increase in the practice of changing the designation of pasture lands for mining activities in Türkiye. Examples of locations where this has occurred include Kastamonu (Hanönü: 65 ha), Aydın (Ömerler: 120 ha), Tokat (Reşadiye-Kuyucak: 28.3 ha), Balıkesir (Karaayıt-Bulutçeşme: 10 ha), Afyonkarahisar (Sinanpaşa: 2 ha), and Ordu (Kargan-Aybastı: 0.5 ha). However, it is worth noting that in some of these locations, successful "Pasture Rehabilitation Projects" have been conducted. For instance, in the Hanönü district of Kastamonu, there is a total of 97 ha of pasture, and the neighbourhoods of Merkez (16.7 ha) and Vakıfgeymene (8.6 ha), as well as the villages of Bağdere (18.5 ha), Küreçayı (21.6 ha), and Gökçe ağaç, have been directly impacted by mining activities (Anonymous, 2017: 48). In response, a 5.3-hectare pasture rehabilitation project has been planned for the Karayaprak area, in collaboration with an operating mining company and the Provincial Directorate of Agriculture and Forestry. However, it is not always possible to mention such rehabilitation efforts in all areas where the designation has been changed.

One of the most common activities that leads to changes in the allocation of pasture lands after mining activities is their conversion into Organised Industrial Zone (OSB in Turkish) areas. Because these facilities are generally established outside urban areas, pasture lands are often preferred for this purpose. However, this practice frequently encounters resistance in Türkiye, especially in rural communities, and the issue is often brought to legal proceedings. In Türkiye, serious disputes have occurred regarding the allocation of certain pasture areas for OSBs in districts such as Meram and Çumra in Konya, Bergama in İzmir, Taşova in Amasya, Eskin in Aksaray, Terme in Samsun, and Merkez in Niğde. In some of these areas, Organised Industrial Zones have been established, while in others, the legal process is ongoing.

A controversial issue regarding the use of pastures for different purposes is their conversion to crop farming. Although it might seem like it serves an agricultural purpose, this is an undesirable situation. Pastures are natural resources, whereas agricultural fields are areas where various farming activities are carried out and are exposed to human impact. Moreover, the recycling of pastures converted to farmland is often not very effective. The natural regeneration of pasture features in areas transformed into farmland, especially in arid regions, is a very lengthy process. For example, in Erzurum, it has been noted that it takes at least 35 years for the plant cover and soil of a lightly sloped, abandoned pasture to regain its natural pasture

characteristics (Gökkuş, 2014: 152). Such areas can only be restored through the establishment of artificial pastures, which involve significant costs and a complex management process.

Conclusion

Meadows and pastures, which cover a vast area globally and in our country and serve many functions, can be considered strategic natural resources. The value of these areas in the ecosystem and the lack of alternatives for sustaining livestock activities are the most important factors affecting their preservation and use. On the other hand, both globally and in Türkiye, these areas are among the natural resources that are experiencing the fastest changes in their characteristics and a trend towards decline.

As Türkiye celebrates its 100th anniversary, meadows and pastures, which have long been among the most neglected spatial units, have been greatly overlooked when examined through the lens of Agricultural Geography. The lack of reliable statistical data and the fragmented collection of such data have emerged as the biggest barriers to accurately interpreting the chronology of meadows and pastures. Researchers consider the early years of the Republic and the period after 1998 as the most reliable periods for Türkiye's meadows and pastures. Field observations at various locations, discussions with technical teams, and limited literature have been used to address the issues as a whole. According to this, Türkiye's meadows and pastures are largely degraded, with a significant portion on the brink of being lost, and have suffered from long-standing improper grazing methods that have disrupted plant composition. They have also been excessively used for non-intended purposes. Indeed, existing meadows and pastures are far from meeting even half of Türkiye's 55 million tons of roughage. This situation has caused serious problems both economically and ecologically. Ecologically, issues include erosion, loss of genetic resources, decrease in bee populations, increase in soil temperature, and loss of water resources. Economically, problems such as decreased animal welfare, which affects meat and milk production, and inability to meet the needs of breed-specific requirements, pose challenges for producers and, consequently, the national economy. In this regard, Determination–Limitation–Appropriation are crucial steps for our pastures, followed by focusing on management efforts, which are of vital importance.

In terms of Türkiye's meadow and pasture resources, significant improvements have been made through successful restoration and management projects, the implementation of pasture fallows, the establishment of grazing schedules at

the provincial level, and the leasing system. Additionally, the practice of “Golden Flag” has encouraged pasture restoration, and the establishment of artificial pastures, albeit limited, represents hopeful developments. However, it should be noted that these successes have occurred only in a very small fraction of our existing meadow and pasture areas.

The issues that need to be urgently addressed, as identified by us, are as follows:

- When selecting high-yielding livestock breeds, existing meadow and pasture resources must also be considered. High-yielding breeds cannot achieve the expected performance in weak or insufficient meadows and pastures.
- If organic farming is to be practised, especially in meadows and pastures where restoration work has been carried out or in areas being converted from cropland back to meadows, the use of chemical fertilisers, herbicides, and pesticides must be considered. Otherwise, it would not be possible to claim that organic farming and animal products are being produced.
- A broad-based committee should determine the process of changing the use and designation of meadows and pastures, rather than a legal advisory board. Furthermore, the “Pasture Rehabilitation Project” should also be the result of a broad-based and multidisciplinary effort.
- When assessing meadows and pastures for livestock activities, animal welfare must be prioritised, and management plans should be developed accordingly. There are significant inadequacies in this regard in Türkiye’s meadows and pastures.
- The populations of invasive and toxic species in our meadows and pastures should be monitored and reported by both technical teams and shepherds. In particular, there are significant problems with regard to the meadows and pastures of Türkiye’s inland regions.



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Author Details

Güven Şahin (Doç. Dr.)

¹ Tekirdağ Namık Kemal University, Faculty of Arts and Sciences, Department of Geography, Tekirdağ, Türkiye

0000-0002-5054-3711 gsahin@nku.edu.tr

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