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Status and health of some natural pastures in south east Anatolia region of Turkey

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Abstract
To study the status and health of pastures in Derik district of Mardin province in south east Anatolia region, seven natural pastures were surveyed by modified wheel point with loop. Total of 45 plant species were recorded in studied pastures. The study was carried out during May and June 2015. Plant species were divided into three different groups: decreasers, increasers and invaders according to the palatability of the plant species for the grazing animals. Average vegetation cover ratio was found as 70.0%. Plant cover percentages of grasses, legumes and other family plants in the total plant cover were 21.53%, 29.19% and 49.28%, respectively. Invasive species were found dominant in these studied pastures. Thus pastures of Mardin province were highly degraded, and sustainable management and rehabilitation techniques need to be urgently applied to stop this on-going continuous degradation.

Keywords: Botanical composition, Invader species, Pasture condition, Plant cover

Introduction

Although different sources indicate different values, but it is fact that pasture acreages of Turkey has declined by about three quarters from 44 million hectares to 14.6 million hectares during last 50 years (TSI, 2019). In the province of Mardin there is a total of 55,602 ha of pasturelands (Anonymous, 2017a). Global warming and drought in the last quarter of the century affected not only the life forms of the world but also the pasture vegetation of our Turkey. Due to climate change, Turkey's semi-arid and sub-humid regions are under threat of desertification (Anonymous, 2017b). Climate change and global warming reduce the durability of arable land against degradation, while desertification and drought reduce soil fertility, leading to deterioration in vegetations (Karagullu and Kendüzler, 2008). The situation and health of the pasture vegetations are worsening due to desertification and recurrent droughts. It is a fact that Turkish pastures have been overgrazed for a very long time and need urgent rehabilitation (Ayan *et al*., 2007). Appropirate method for the rehabilitation of pastures was recorded earlier by Cacan and Kokten (2019), where it was proved that fertilization + stone picking + weed control was the ideal improvement method for eastern Anatolian pastures of Turkey. But before starting the rehabilitation work, it is needed to record vegetative characteristics, condition and health of the pastures (Bakir, 1969). Because it is not possible to apply the correct treatment method without specifying the above characteristics precisely. Indeed, pasture health is defined as ensuring continuity in ecological conditions and pasture status as ideal vegetation (Altin *et al*., 2017). With this background, the present study was conducted to record the pasture status and health of seven natural pastures in Mardin province of Turkey.

Materials and Methods

In this study, seven different rangelands representing some natural pasture areas related to Derik district of Mardin province in south east Anatolia region of Turkey were selected and field studies were carried out at these stations.

Study area: The study was carried out in May and June 2015 and general information on pasture areas from seven villages were recorded (Table 1). These areas are defined within the boundaries of the topographic map scale of 1/25000 scale and at least one sample to represent these pasture areas was taken. When sampling points were determined, areas with pasture characteristics were extracted from the land use classes in the digital land map database.

Table 1. Some geographical information about pasture areas

Village	Altitude (m)	Slope	Pasturage	Latitude	Longitude	Soil depth (cm)
Çagil	542	Slightly inclined (2-5%)	Intensive	37° 27'	40° 18'	Shallow (20-49)
Ilica	615	Slightly inclined (2-5%)	Intensive	37° 30'	40° 27'	Shallow (20-49)
Üçtepe	705	Slightly inclined (2-5%)	Intensive	37° 38'	40° 08'	Shallow (20-49)
Adakent	519	Medium sloped (6-11%)	Intensive	37° 25'	40° 26'	Shallow (20-49)
Alanköy	1035	Medium sloped (6-11%)	Intensive	37° 42'	40° 32'	Shallow (20-49)
Besbudak	438	Almost flat (0-1%)	Intensive	37° 14'	40° 20'	Shallow (20-49)
Tasit	1092	Slightly inclined (2-5%)	Medium	37° 41'	40° 31'	Shallow (20-49)

Table 2. Pasture status class and health assessment

Pasture status class		Pasture health classification	
Proportion of types (%)	Status class	Soil coverage ratio (%)*	Health class
76–100	Very Good	>70	Healthy
51–75	Good	55-70	Risky
26–50	Medium	55	Problematic
0–25	Weak		

**Modified according to wheeled ring method data*

Vegetation readings and classification method: In the vegetation study, a modified wheel point method with loop was applied based on Koc and Çakal (2004). A total of 400 sample readings were made, one for each 50 cm on two 100 m lines perpendicular to each other. Bottom coverage areas and free areas of species found in pasture vegetation were not considered. Pasture condition was determined as very good, good, moderate and poor according to the decreasing, increasing and invader plant species, and pasture health was determined as healthy, risky and problematic according to the field covered with plants (Koc *et al*., 2003). Plant species were classified as decreasing, increasing and invasive in the context of their taste and preference and their response to grazing (Anonymous, 2005). For 'Pasture Status classification', all determined decreasers and 20% of the increasers were taken into account. The soil cover ratio of the vegetation cover was determined by the ratio of the number of points encountered during the vegetation survey to the total number of measured points (Gokkus *et al*., 2000). The values of each plant species read out were compared to the total number of plants to determine the proportions of species in the botanical composition. The status and health classifications of the pastures were determined based on methods of Koc *et al*. (2003) and Holechek *et al*. (2010) (Table 2).

Results and Discussion

Vegetations of village pastures: Plant species, families, lifespan of species, land cover ratios were identified in the seven villages of Derik district of Mardin province and these were recorded in the study (Table 3).

In Cagil village pasture, a total of nine plant species were identified, two from poaceae, two from leguminosae and five from other families, where two species were decreasing, one is increasing and six were invasive. According to the lifespan of detected species, three were perennial, one was biannual and five were annual (Table 3). In the village of Ilica there were a total of 12 plant species, three of which were from poaceae, two from leguminosae and seven from other family species, where two were increasing and others were invasive species. According to the lifespan of the species encountered, two were perennial and 10 were annual plants. A total of 12 plant species were found in pasture of Uctepe village where three were gramineane, three were leguminosae and six were from other family species. According to the status of the plant species that were encountered in Uctepe village pasture, one was decreaser, one was increaser and 10 were invasive species. Two of the species encountered were perennial and the others were composed of annual plants (Table 3).

A total of eight plant species were identified in Adakent village where two were graminae, one was leguminosae and five were from other family species. All identified plant species were invasive annual species. A total of 15 plant species were found in the pasture of Alanköy village, of which three were poaceae, six were leguminosae and remaining six were from other families. Depending on the effects of the plants detected, all plants were invasive and all plants were made up of annual plants based on their life span. According to their lifespan, three plants were perennial and 12 were annual plants (Table 3). A total of seven plant species were identified in the village

of Besbudak, of which two were gramineae, two were leguminosae and three from other families. According to the effects of the detected plants, all plants were invasive, and all plants were composed of annual plants. A total of nine plant species were found in the Tasit village, among those, one was poaceae, two were leguminosae and 6 were from other family species. According to the effects of the plants encountered, one was decreaser and eight were invasive species. According to the life span of the plants encountered, one was annual and rest were perennial plants.

Composition of species in the pastures: Garden burnet (*Sanguisorba minor*), alfalfa (*Medicago sativa*), cock's-foot (*Dactylis glomerata*), perennial ryegrass (*Lolium perenne*) and common meadow-grass (*Poa pratensis*) were detected as decreaser species whereas bulbous bluegrass (*Poa bulbosa*), bermuda grass (*Cynodon dactylon*) and blood pink (*Dianthus calocephalus*) were detected as increaser species in the examined pastures. Other detected species were invasive species.

Table 3. Families, lifespan, effects and coverage ratios of the species identified in natural pastures

Species	Familly	Lifespan	Effect	Coverage ratio
Cagil village				
Hordeum murinum	Poaceae	Annual	Invasive	5.48
Avena sterilis	Poaceae	Annual	Invasive	3.55
Capsella bursa-pastoris	Brassicaceae	Annual	Invasive	12.90
Carduus pycnocephalus	Asteraceae	Annual	Invasive	20.97
Silybum marianum	Asteraceae	Biannual	Invasive	3.87
Medicago polymorpha	Fabaceae	Annual	Invasive	35.48
Sanguisorba minor	Rosaceae	Perennial	Decreaser	6.45
Medicago sativa	Fabaceae	Perennial	Decreaser	4.84
Dianthus calocephalus	Caryophyllaceae	Perennial	Increaser	6.45
Ilica village				
Capsella bursa-pastoris	Brassicaceae	Annual	Invasive	2.31
Centaurea iberica	Asteraceae	Annual	Invasive	8.46
Erodium cicutarium	Geraniaceae	Annual	Invasive	4.62
Hordeum murinum	Poaceae	Annual	Invasive	10.00
Hypecoum imberbe	Fumariaceae	Annual	Invasive	1.15
Poa bulbosa	Poaceae	Perennial	Increaser	13.46
Senecio vernalis	Asteraceae	Annual	Invasive	2.69
Trifolium resupinatum	Fabaceae	Annual	Invasive	3.85
Trifolium bullatum	Fabaceae	Annual	Invasive	5.38
Hedypnois cretica	Rubiaceae	Annual	Invasive	34.23
Plantago afra	Plantaginaceae	Annual	Invasive	5.00
Cynodon dactylon	Poaceae	Perennial	Increaser	8.85
Uctepe village				
Bromus scoparius	Poaceae	Annual	Invasive	14.23
Capsella bursa-pastoris	Brassicaceae	Annual	Invasive	16.21
Carduus pycnocephalus	Asteraceae	Annual	Invasive	1.58
Crepis sancta	Asteraceae	Annual	Invasive	5.14
Hirschfeldia incana	Brassicaceae	Annual	Invasive	7.11
Hordeum murinum	Poaceae	Annual	Invasive	1.19
Medicago polymorpha	Fabaceae	Annual	Invasive	6.72
Notobasis syriaca	Asteraceae	Annual	Invasive	1.58
Poa bulbosa	Poaceae	Perennial	Increaser	8.70
Trifolium nigrescens	Fabaceae	Annual	Invasive	22.53
Trifolium bullatum	Fabaceae	Annual	Invasive	7.11
Dactylis glomerata	Poaceae	Perennial	Decreaser	7.91

Species	Familly	Lifespan	Effect	Coverage ratio
Adakent village				
Bombycilaena erecta	Asteraceae	Annual	Invasive	1.37
Bromus scoparius	Poaceae	Annual	Invasive	1.03
Trifolium nigrescens	Fabaceae	Annual	Invasive	11.99
Centaurea iberica	Asteraceae	Annual	Invasive	20.55
Hirschfeldia incana	Brassicaceae	Annual	Invasive	26.03
Hordeum spontaneum	Poaceae	Annual	Invasive	2.74
Malva nicaeensis	Malvaceae	Annual	Invasive	33.22
Urtica pilulifera	Urticaceae	Annual	Invasive	3.08
Alankoy village				
Astragalus hamosus	Fabaceae	Annual	Invasive	18.84
Carduu spycnocephalus	Asteraceae	Annual	Invasive	6.88
Echinops orientalis	Asteraceae	Perennial	Invasive	8.70
Erodium cicutarium	Geraniaceae	Annual	Invasive	5.43
Hordeum murinum	Poaceae	Annual	Invasive	4.71
Medicago rigidula	Fabaceae	Annual	Invasive	2.17
Poa bulbosa	Poaceae	Perennial	Increaser	6.16
Scandix iberica	Umbelliferae	Annual	Invasive	1.09
Senecio vernalis	Asteraceae	Annual	Invasive	14.86
Trigonella monantha	Fabaceae	Annual	Invasive	2.54
Trifolium nigrescens	Fabaceae	Annual	Invasive	16.67
Poa pratensis	Poaceae	Perennial	Decreaser	6.88
Lathyrus vinealis	Fabaceae	Annual	Invasive	0.72
Arabis montbretiana	Brassicaceae	Annual	Invasive	2.90
Vicia lathyroides	Fabaceae	Annual	Invasive	1.45
Besbudak village				
Centaurea iberica	Asteraceae	Annual	Invasive	24.81
Hordeum murinum	Poaceae	Annual	Invasive	29.77
Medicago minima	Fabaceae	Annual	Invasive	5.73
Medicago rigidula	Fabaceae	Annual	Invasive	11.83
Notobasis syriaca	Asteraceae	Annual	Invasive	10.69
Taeniatherum caput-medusae	Poaceae	Annual	Invasive	8.40
Phlomis kurdica	Lamiaceae	Annual	Invasive	8.78
Tasit village				1.63
Anthemis cotula	Asteraceae	Annual	Invasive	
Astragalus hamosus	Fabaceae	Annual	Invasive	14.98
Capsella bursa-pastoris	Brassicaceae	Annual	Invasive	11.40
Carduus pycnocephalus	Asteraceae	Annual	Invasive	8.14
Centaurea iberica	Asteraceae	Annual	Invasive	3.26
Lolium perenne	Poaceae	Perennial	Decreaser	9.45
Picnomon acarna	Asteraceae	Annual	Invasive	6.19
Sinapis arvensis	Brassicaceae	Annual	Invasive	5.21
Trifolium nigrescens	Fabaceae	Annual	Invasive	39.74

The ratio of the decreasing species to the botanical composition was found to be 11.29% in Çagil village, 7.91% in Üçtepe village, 6.88% in Alanköy village and 9.45% in Tasit village. Ilica, Adakent and Besbudak villages did not have any decreaser species. The proportion of increaser species in botanical composition according to the coverage area was determined as 6.45% in Cagil village, 22.31% in Ilica village, 8.70% in Uctepe village and 6.16% in Alankoy village. No increaser species was detected in Adakent, Besbudak and Tasit villages. The ratio of the invasive species in botanical composition according to the coverage area were 82.26% in Cagil village, 77.69% in Ilica village, 83.39% in Uctepe village, 100% in Adakent village, 86.39% in Alanköy village, 100% in Besbudak village and 90.55% in Tasit village pastures (Table 4).

Table 4. Ratios of decreasing, increasing and invasive species in botanical composition (%)

Village	Decreasing	Increasing	Invasive
Cagil	11.29	6.45	82.26
Ilica	0.00	22.31	77.69
Uctepe	7.91	8.70	83.39
Adakent	0.00	0.00	100.00
Alankoy	6.88	6.16	86.96
Besbudak	0.00	0.00	100.00
Tasit	9.45	0.00	90.55

The number of families, genus and species, ratio of plant-covered areas, ratio of families in plant-covered areas in the studied pastures were also recorded (Table 5). A total of 45 plant species belonging to 40 genus and 14 different plant families were found in studied seven different pastures. The number of species in similar studies in natural pastures in Turkey were found as 111 in Kilis pastures by Sen (2010), as 68 in Kahramanmaraþ pastures by Uslu (2005), and as 60 in Van pastures by Barlak (2012). Differences in the number of species were probably due to variation in climate, soil structure, direc-tion, method of measuring vegetation and selected pastures. According to the results obtained from the present study, the ratio of covered area in seven different surveyed pastures ranged from 63.25 to 77.5%, which was found statistically significant (Table 5). The highest plant covered area ratio was obtained in the valley of Cagil village with 77.5%, followed by Tasit village with 76.75% and Adakent village with 73.0%. The lowest plant coverage ratio was recorded in Uctepe village pasture as 63.25%. The fact that the ratio of the area covered with plants in the village of Çagil was higher than the other ones, because the ground water level was high and the land was slightly inclined. The plant-covered area ratio values recorded for the examined pastures were lower than the values reorded earlier in Van province pastures (77.0%) by Barlak (2012), in Kahramanmaraþ pastures (81.6%) by Uslu (2005), in Bingöl pastures (85.8%) by Agin and Kokten (2013), whereas it was higher than the values obtained in the Diyarbakir pastures (43.92% and 59.8%) by Seydosoglu *et al*. (2015a, b). This might be due to differences in vegetation measuring methods, as well as differences in soil, climate and rainfall, grazing pressure, sheltering status of examined pastures etc. The proportion of poaceae was 9.03 to 38.17%, legumes was 3.77 to 54.72% and other family plants was 31.61to 84.25% in plant-covered areas of studied pastures and these variations were statistically significant. The ratio of poaceae family species covered area within the plant covered area was highest in pasture of Besbudak village (38.17%), which was followed by Ilica and Uctepe villages. The ratio of poaceae species in plant covered area was lowest in Cagil (9.03%) and Tasit (9.45%) village pastures. In similar studies in Turkey from protected and natural pastures, proportions of poaceae in plant covered areas were observed as 32.63% and 51.87% in Diyarbakir pastures (Seydosoglu *et al*., 2015a, b). The percentages of poaceae recorded in pastures in this study were also varied based on soil structure, altitude, slope, orientation, grazing pressure etc.

Table 5. Vegetation cover characteristics of the studied villages

Village	Number of families	Number of genus	Number of species	Plant covered area ratio (%)	Plant covered area		
					Poaceae (%)	Legum. (%)	Other families (%)
Çagil	6	9	9	77.50a	9.03cd	40.32b	50.65b
Ilica	8	11	12	65.00bc	32.31ab	9.23d	58.46b
Üçtepe	4	11	12	63.25c	32.02ab	36.37c	31.61d
Adakent	6	8	8	73.00ab	11.98d	3.77d	84.25a
Alanköy	6	15	15	69.00ac	17.75bc	42.39bc	39.86c
Besbudak	4	6	7	65.50bc	38.17a	17.56d	44.27c
Tasit	4	9	9	76.75a	9.45cd	54.72a	35.83c
Total/Avg.	14	40	45	70.00	21.53	29.19	49.28

The highest ratio of legumes in plant-covered areas of pastures was found in Tasit village (54.72%) and it was lowest in Adakent village (3.77%). In similar studies carried out in pastures, the ratio of legumes in plant-covered areas was found 32.57% in Diyarbakýr pastures by Seydosoglu *et al*. (2015a). The legumes ratios recorded in the survey were within the ranges reported earlier. Differences in botanical composition among the pastures were arised from differences in climate, soil structure and method of measuring vegetation. The ratio of other family plants in plant covered areas in the studied pastures was highest in Adakent village (84.25%), while the lowest ratio was found in Uctepe village (31.61%).

Classification of pastures: According to the vegetation surveys conducted in seven different villages connected to Derik district of Mardin province, all pastures were classified as poor. When evaluated in terms of pasture health, three pastures were healthy and four pastures were under risk. It was found that the common species in these pastures were California burclover (*Medicago polymorpha*), Cretanweed (*Hedypnois cretica*) and False barley (*Hordeum murinum*). The predominant species were invasive and annual species and these pastures were in need of further studies to identify appropriate pasture improvement methods. In similar studies earlier, the natural pastures of Turkey was reported as 'weak pastures' (Seydosoglu, 2015a). The reasons for classifiying of these pastures as 'poor or weak' were shortage of palatable/desirable plant species, grazing by inappropriate animal species, free/overgrazing by animals in pastures and the arid climate of these pastures.

Conclusion

Average vegetation cover ratio was found as 70.0%. Plant cover percentages of grasses, legumes and other family plants in the total plant cover were 21.53%, 29.19% and 49.28%, respectively. It was also recorded that majority of plant species studied in natural pastures of Turkey were invasive. Therefore, a rehabilitaion programme for these natural pastures needs to be considered and applied which may start with removal of invasive plant species or weed management and closing of vegetations/ ranges for animal grazing.

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