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AEGEAN GRASSLANDS AS ENDANGERED ECOSYSTEMS IN TURKEY

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Abstract

In all 86 grasslands were investigated in the Aegean region of Turkey. Out of these 10 are found among the red-pine, black-pine, beech-fir, oak-pine and degraded oak-maqui forests. A total of 699 taxa of plants belonging to 68 families are distriburted in these grasslands. Out of these taxa only 104 are of good fodder value, 66 taxa belonging to the family Fabaceae and 38 to Poaceae. Aboveground biomass production in Aydin (139.18 g), Balikesir (122.68 g) and Canakkale (103.78 g) was maximum in Spring, whereas belowground values for Aydin (80 g) and Canakkale (80 g) were highest during spring and for Balikesir (80 g) during winter. In the provinces of Izmir (1144 g), Kutahya (400 g), Usak (800 g), and Manisa (1312 g) aboveground biomass production was highest during Autumn, whereas belowground production was maximum during winter at Usak (600 g), Izmir (1360 g), and Kutahya (910 g). In Denizli aboveground biomass production was higher in summer (400 g) and belowground in autumn (350 g). The biomass production in general was highest in the fenced as compared to open areas. The calorific values of the species in the fenced areas too were higher (107.2 cal.) as compared to the open areas (99.40 cal.). Borulceagac and Maltepe were the best areas from the point of view of calorific values. The grasslands of Isikeli, Pamucak, Karateke, Halitpasa, Urganli, and Gullucam were observed to be the best as regards the biomass production. However,nomadic activities like summer grazing, trampling and summer tourism are exerting a great pressure on these, leading towards a degradation and ultimately a loss of eco-diversity in the grassland ecosystems of the region. This paper enlightens the general plant composition and biomass potential of Aegean grasslands.

Dedicated to Dr. Mehmet Pirdal, a collaborator in this project at the start who lost his life in the devastating Golcuk Earthquake in 1999.

Introduction

The terms "Grassland" or "Rangeland" have several definitions and many local impacts are seen in this connection depending on their disributional area. According to the definition of UNESCO grasslands are areas of the land covered with herbaceous plant cover with less than 10 percent tree and shrub cover (White *et al.,* 2000; Suttie & Reynolds, 2003).These are among the largest ecosystems in the world,with an area estimated to be 52.5 million km^2 which is equivalent to approximately 40 percent of the Earth's land surface excluding Greenland and Antarctica (Anon., 2000); dominated mainly by plant taxa belonging to the family Poaceae, and typically characterised by low productivity because of water and nutrient limitation or both, variable rainfall, and complex natural vegetation (Naz *et al.*, 2010 Knezevic *et al.,* 2012). Approximately 500 million ha are in the high and medium land use categories, while 3000 million ha are in low and zero categories (Reynolds and Frame, 2005). They contribute to the livelihoods of over 800 million people including many poor small holders. Our aim here is to present the situation of these ecosystems in Turkey which could be included under endangered ecosystems.

Turkey is the world's 37th-largest country in terms of area (783,562 km^2), located between 35° and 43° N latitudes, and 25° and 45° E longitudes. It is one of the oldest continuously inhabited regions in the world (Anon., 1999; Anon., 2005; Thissen, 2007; Immerfall, 2011); being nearly 2000 km long and 800 km wide, encircled by the Aegean Sea to the west, the Black Sea to the north and the Mediterranean to the south (Anon., 2006). The country is divided into 7 geographical divisions (Fig. 1) but, according to the classification developed by State Institute of Statistics (SIS, 2002) there are 9 agricultural zones; Central North, Aegean, Marmara and Thrace, Mediterranean, North East, South East, Black Sea, Central East, and Central South. The work done on the herbaceous plant communities constituting the grassland biome in the 9 agricultural zones include the studies carried out by Tosun *et al.*,(1977), Kurt & Tan (1984), Tan (1984a,b), Karagoz *et al.,* (1991), Koc & Gokkus (1996), Koc & Oztas (2000), Koc e*t al.,* (2004,2008), Oztas *et al.,* (2003), Comakli *et al.,* (2004), Comakli (2008), Bakoglu (2009), Erkovan *et al.,* (2009), Dasci *et al.,* (2010), Unal *et al.,* (2011).

This paper deals with the Aegean Agroecological zone which extends from the Aegean coast to the western part of Central Anatolia. Diverse topography and favorable climate has resulted in a rich biodiversity of communities in this zone. Forest lands are dominant together with fertile alluvial plains. The plains make the wealth of the region, which rests on olives, grapes, cotton, and figs. There is a dense growth of sclerophyllous maquis plant communities of *Ceratonia siliqua, Olea europaea*, *Pistacia sps., Arbutus sps.*, *Quercus sps.*, *Styrax officinalis, Myrtus communis* and *Laurus nobilis*. The forests are dominated by the species like *Pinus brutia*, *Pinus nigra,* and *Juniperus* sps. (Ozturk *et al.,*1983). An extreme geo-climatic diversity allows the production of a wide range of livestock and crops. The grasslands are distributed from sea level to high altitudes, which belong to the state and are main source of feed, open for common use. Nearly 5 percent of the Turkish grasslands with a hay yield of approximately 600 kg/ha and a quarter of the goat population are present in the Aegean region. The cattle are taken to higher elevations for 7-8 months due to dry arid conditions along the coast.

The studes undertaken on the grasslands of the Aegean region include those of Genckan (1985), Genckan *et al.,* (1989), Avcioglu (1986), Avcioglu *et al.,* (1991, 2000). These deal with forage crops, legumes and grains, and grazing losses. Very few studies have been carried out on the biomass yield of natural grassland communities (Ozturk & Pirdal, 1988,1991; Hameed *et al.*, 2008). Grasslands in this region are facing a serious threat due to urbanisation, industrialisation, tourism and other pressures. Historically they have been considered as the cheapest feed and therefore exploited excessively with no care for their sustainability.The new scenarios published on climate change represent an additional source of stress on an already at-risk pillar of these ecosystems. Land use change as well as nitrogen deposition also pose risks to them. They are expected to be particularly vulnerable to invasive species due to their moderate diversity together with relative ecological isolation. Our aim here is to present the results on the plant composition and biomass potential of grasslands in the Aegean region.

Fig. 1. Geographical divisions of Turkey.

Material and Methods

A total of 86 natural grasslands (Fig. 2) distributed in the 9 States of Aegean region were surveyed during 1984-2010, and their plant composition was recorded. The area shows typical mediterranean climatic features (Fig. 3). The plant determinations were made with the help of "Flora of Turkey and East Aegean Islands" (Davis *et al.,* 1965-1985, 1988; Guner *et al.,* 2000). For primary productivity determinations harvesting method was used, data on aboveground and belowground parts in fenced and unfenced areas was recorded on seasonal basis. All fenced areas were $1m^2$ and 5 areas were fenced at random in each site (Buschermohl *et al.,* 2002). The harvested aboveground and belowground parts were oven dried at 85^oC to constant weight and results recorded as grams. The calorific values of the biomass were determined by using "bomb calorimeter".

Results and Discussion

Grasslands cover a very large proportion of the globe and are a very important source of livestock feed and of livelihoods for stock raisers and herders (Suttie & Reynolds, 2004; Upton, 2004). Their primary environmental importance lies in the fact that they are as important as forests in the recycling of greenhouse gases and large carbon sinks, with almost equivalent soil organic matter as in tree biomass (Lipper & Cavatassi, 2003). They are sources of many products other than food for grazing livestock, seeds are used as cereals, some wild grass species are harvested as fruit and vegetables, some are of medicinal value and good for local use and sale, some are used as wood and fuel; but grassland scientists are limiting their use to grazing resources. They are partly reserves of biodiversity, provide important wildlife habitat and *in situ* conservation of genetic resources, management of catchments, wildlife landscapes, tourism, recreation and hunting (de Haan *et al.*,1997; Pagiola *et al*., 2004; Aumeeruddy-Thomas *et al*., 2004; Wright, 2005).

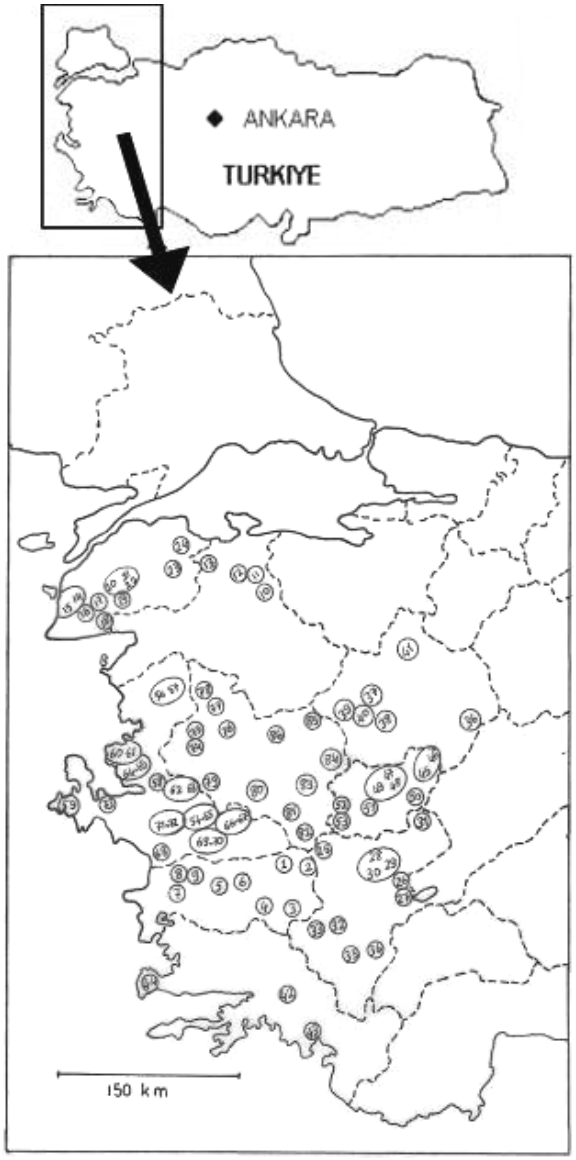

Fig. 2. Map showing the localities (86) surveyed.

General situation of the grasslands in Turkey: Turkey has changed much during the last decades from a mainly pastoral country to crop production. This has resulted in a great reduction in the grassland area, however no parallel reduction has been observed in livestock, which increased in numbers. Therefore cropping systems replaced grazed fallow with pulses and other cash crops, further reducing grazing resources. Relatively small number of animals were grazed on natural grasslands at the beginning of 20th century. There were no serious management problems. The area of natural grasslands in 1945 was around 440 000 km^2 and about 20 million livestock units were grazing on this area (Kaymakci *et al.,* 2000). In the following years the number of cattle remained same but grazing areas decreased. With the passage of time the number of animals grazing on grasslands increased nearly 4 times but the area of grazing lands decreased due to mainly mechanization of agriculture. In 1980 area decreased to 217 000 km^2 (Munzur, 1987). Turkey's pastures are now stocked well above their carrying capacity. They are the major plant source of forage species in the country. Major forage legumes are represented by 57 species of wild *Vicia* including *Vicia sativa*, *V. Ervilia*, 59 of *Lathyrus*, 52 of *Onobrychis*, 95 of *Trifolium*, 30 of *Medicago* and 10 of *Melilotus*. Major grass taxa are *Agropyron, Festuca* and *Lolium*. The productivity as well as quality of the grasslands has decreased and desirable plant taxa in the botanical composition is 20 %, but may reach 50 percent depending on the zone and grazing pressure (Gokkus & Altin,1986).

Grassland plant diversity of aegean region: Approximately 5 percent of the Turkish grasslands are distributed in the Aegean Agroecological zone (Fig. 4a,b,) with a hay yield of 600 kg/ha. The values for the area lie around 615 900 ha with a total dry matter production around 369 540 tons. Nearly quarter of the goat population in Turkey is found in this region (Fig. 5a,b). The cattle are taken to higher elevations for 7-8 months.

During our investigations a total of 699 plant taxa belonging to 68 families were collected from the 86 representative grasslands covering 9 states.Out of these 104 species were of high fodder value. The species most frequently met are 68 in number, 40 are annuals like *Dactylis glomerata,Trifolium repens,T. resupinatum,T. pratense* and 28 are shrubs/tall shrubs like *Vitex agnus-castus.* The dominating families are Fabaceae (14.02%), Asteraceae (11.02%), and Poaceae (11.44%). Most important taxa are the species of *Poa, Phleum, Alopecurus, Agropyron, Lolium, Lotus, Medicago, Trifolum, Vicia, Lathyrus, Hordeum, Koeleria, Melilotus, Festuca, Panicum, Bromus,* and *Dactylis glomerata, Cynodon dactylon, Phalaris paradoxa.* These plant taxa belong to the Mediterranean (133), East Mediterranean (71), Irano-Turanian (39), Euro-Siberian (37), and Euxin (2) phytogeographical elements; whereas 16 are Cosmopolitan and 28 taxa are Endemics, rest are unknown.

The grasslands start from the coastal zone where halophytes dominate the area, followed by maquis vegetation cover reaching up to 1000 m along the valleys. According to Genckan (1985) and Avcioglu *et al.,* (2000) nearly 75 percent of the species in the maquis of this region are characteristic species of grasslands and 56 percent of these were recorded from the grasslands investigated by us. Out of these 104 species are of high fodder value, 66 belong to the family Fabaceae and 38 to Poaceae. A list of the important taxa is given in Table 1.

General biomass productivity values for above and belowground parts (Table 2) varies between 1360-1366 and 1360-1361 g respectively. The calorific values determined during spring, summer, autumn and winter seasons in the fenced areas are either higher than unfenced areas or equalent to these. The highest (99.4 cal) and the lowest (34.08 cal) calorific values were found at Borukeagac and Etili respectively. In the fenced areas highest calorific value (107.92 cal) was recorded in the Muradiye grassland and lowest (32.66 cal) in the Maltepe grassland.

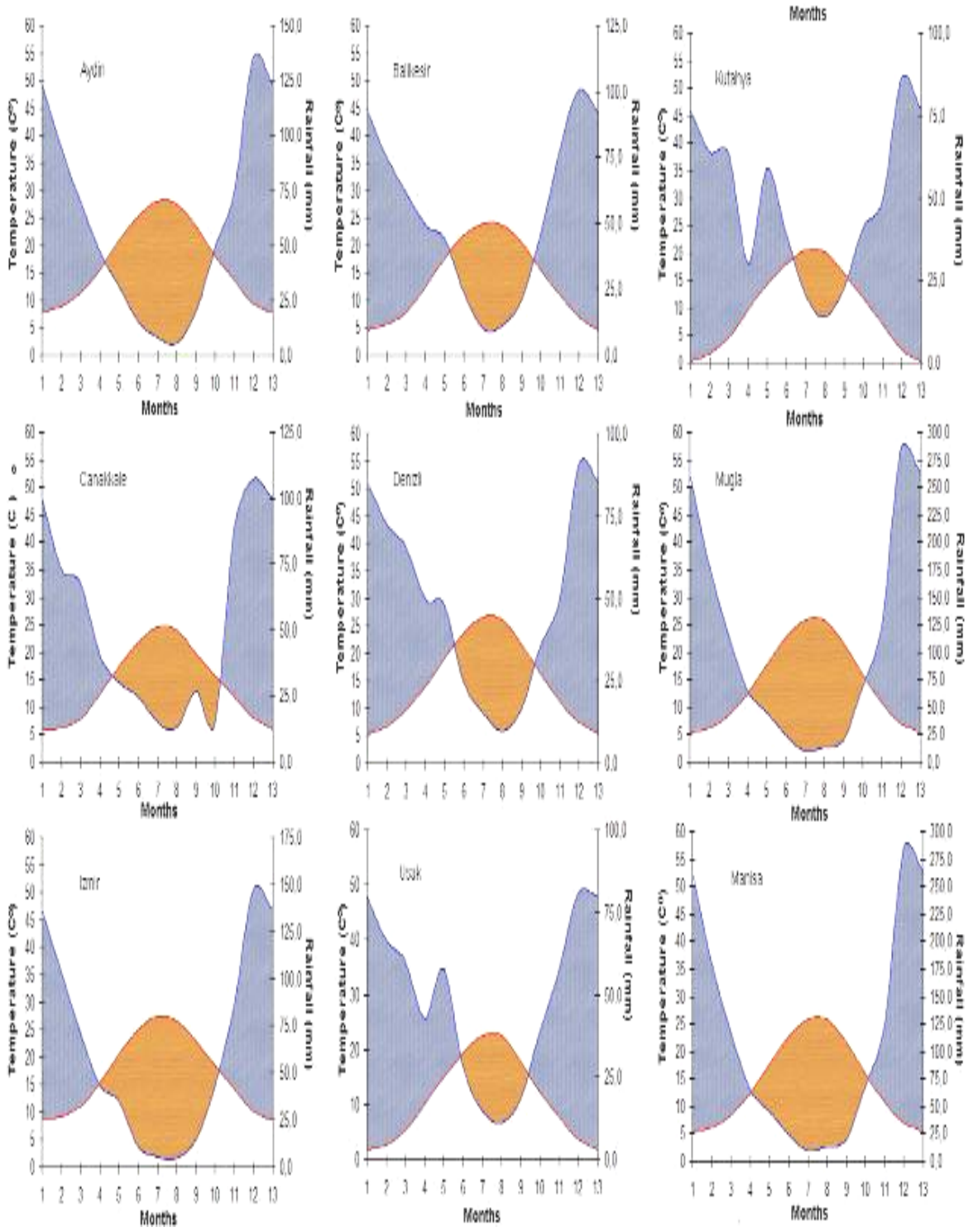

Fig. 3. Climatic diagrams of the Aegean Agroecological zone.

The endemics collected from the grasslands are; *Alyssum pterocarpum, Asperula liliaciflora* ssp.*phyrgia, Campanula lyrata* ssp. *lyrata, Centaurea calolepis, C. cariensis, C. calcitrapa, Dianthus cibrarius, Erysimum alpestre, Euphorbia anacampseros, Gypsophila tubulosa, Laserpitium petrophilium, Linaria corifolia , L.genistifolia* ssp. *linifolia, Linum hirsutum, Maltkia aurea, Origanum spyleum, Parnonychia chionaea, Phlomis nissolii, Ranunculus reuterianus, Salvia pisidica, Stachys cretica* ssp. *smyrnea, Veronica cuneifolia,V.multifida,* and *Wiedemannia orientalis.*

Fig. 4a,b. General views of the grasslands from the Aegean region.

Fig. 5a,b. Animal grazing in the grasslands.

Table 1. List of important plant taxa from the Aegean grasslands.

Alismataceae	*Medicago minima* var. *minima*
Alisma lanceolatum	*Medicago polymorpha* var. *vulgaris*
Amaranthaceae	*Medicago longifolia* subsp. *typhoides* var. *typhoides*
Suaeda prostrata subsp. *prostrata*	*Ononis spinosa* subsp. *antiquorum*
Anacardiaceae	*Ononis viscosa* subsp. *brevifolia*
Pistacia terebinthus subsp. *terebinthus*	*Pisum sativum* subsp. *elatius* var. *elatius*
Araceae	*Scorpiurus muricatus* var. *subvillosus*
Arum orientale subsp. *orientale*	*Trifolium angustifolium* var. *angustifolium*
Berberidaceae	*Trifolium plebeium*
Leontice leontopetalum subsp. *leontopetalum*	*Trifolium arvense* var. *arvense*
Boraginaceae	*Trifolium echinatum* var. *carmeli*
Alkanna tinctoria subsp. *tinctoria*	*Trifolium fragiferum* var. *pulchellum*
Anchusa azurea var. *azurea*	*Trifolium hybridum* var. *anatolicum*
Anchusa undulata subsp. *hybrida*	*Trifolium nigrescens* subsp. *petrisarii*
Cerinthe minor subsp. *auriculata*	*Trifolium pratense* var. *Pratense*
Onosma aucheranum	*Trifolium purpureum* var. *purpureum*
Onosma tauricum var. *tauricum*	*Trifolium repens* var. *repens*
*Moltkia aurea**	*Trifolium resupinatum* var. *resupinatum*
Myosotis ramosissima subsp. *ramosissima*	*Trifolium stellatum* var. *stellatum*

Table 1. (Cont'd.).

Campanulaceae	*Trigonella supruneriana* var. *supruneriana*
Asyneuma limonifolium subsp. *limonifolium*	*Vicia cracca* subsp. *stenophylla*
*Campanula lyrata ssp lyrata**	*Vicia grandiflora* var. *grandiflora*
Capparaceae	*Vicia villosa* subsp. *eriocarpa*
Caprifoliaceae	*Vicia lunata* var. *lunata*
Sambucus nigra	**Liliaceae**
Caryophyllaceae	*Allium pallens*
Arenaria rhodia subsp. *rhodia* var. *rhodia*	*Allium scrodosporasum* subsp. *rotundum*
Cerastium dichotomum subsp. *dichotomum*	*Gagea granatellii*
Dianthus calocephalus	*Gagea peduncularis*
*Dianthus cibrarius**	*Muscari muscarimi*
Dianthus leucophaeus var. *leucophaeus*	*Ornithogalum pyrenaicum*
Dianthus zonatus var. *zonatus*	*Ruscus aculeatus* var. *angustifolius*
*Gypsophila tubulosa**	**Linaceae**
Minuartia juressi subsp. *asiatica*	*Linum corymbulosum*
Minuartia hybrida subsp. *hybrida*	*Linum hirsutum* subsp. *anatolicum* var. *anatolicum**
Moenchia mantica subsp. *mantica*	**Lythraceae**
Petrorhagia alpina subsp. *olympica*	**Malvaceae**
Silene dichotoma subsp. *dichotoma*	*Althaea hirsuta*
Silene vulgaris var. *vulgaris*	**Oleaceae**
Stellaria media subsp. *media*	*Olea europaea* var. *sylvestris*
Vaccaria pyramidata var. *grandiflora*	**Onagraceae**
Chenopodiaceae	**Orchidaceae**
Chenopodium album subsp. *album* var. *album*	*Orchis anatolica*
Cistaceae	**Orobanchaceae**
Helianthemum nummularium subsp. *lycaonicum*	**Papaveraceae**
Tuberaria guttata var. *guttata*	*Fumaria judaica*
Compositae	*Roemeria hybrida* subsp. *hybrida*
Achillea nobilis subsp. *sipylea*	**Pinaceae**
Anthemis chia	**Plantaginaceae**
Anthemis cretica subsp. *leucanthemoides*	*Plantago coronopus* subsp. *commutata*
Anthemis pectinata var. *pectinata*	**Plumbaginaceae**
Anthemis tinctoria var. *tinctoria*	*Acantholimon acerosum* var. *acerosum*
Carduus pycnocephalus subsp. *pycnocephalus*	**Poaceae**
Centaurea calcitrapa subsp. *calcitrapa**	*Aegilops umbellulata* subsp. *umbellulata*
*Centaurea calolepis**	*Aegilops triuncialis* subsp. *triuncialis*
Centaurea cariensis subsp. *cariensis*	*Agropyron cristatum* subsp. *pectinatum* var. *pectinatum*
Centaurea solstitialis subsp. *solstitialis*	*Aira caespitosa*
Cirsium hypoleucum	*Aira elegantissima* subsp. *elegantissima*
Cirsium arvense var. *arvense*	*Aira elegantissima subs pambiqua*
Cirsium creticum subsp. *creticum*	*Alopecurus utriculatus* subsp. *utriculatus*
Chondrilla juncea var. *juncea*	*Anthoxanthum odoratum* subsp. *odoratum*
Cnicus benedictus var. *benedictus*	*Avena sterilis* subsp. *sterilis*
Crepis foetida subsp. *rhoeadifolia*	*Avena barbata* subsp. *barbata*
Echinops viscosus subsp. *viscosus*	*Avena fatua* var. *fatua*
Erigeron olympicus	*Brachypodium retusum*
Filago vulgaris	*Bromus inermis*
Gundelia tournefortii var. *tournefortii*	*Bromus cappadocicus* subsp. *cappadocicus*
Helichrysum stoechas subsp. *barrelieri*	*Catapodium rigidum* subsp. *rigidum* var. *majus*
Hypochaeris glabra	*Cynodon dactylon* var. *dactylon*
Matricaria chamomilla var. *recutita*	*Dactylis glomerata* subsp. *hispanica*
Rhagadiolus stellatus var. *stellatus*	*Elymus repens* subsp. *repens*

Table 1. (Cont'd.).

Scorzonera elata	*Elymus panormitanus*
Scorzonera laciniata subsp. *laciniata*	*Elymus caninus*
Sonchus asper subsp. *glaucescens*	*Festuca holmbergii*
Taraxacum hellenicum	*Festuca rubra* subsp. *pseudorvularis*
Taraxacum minimum	*Hordeum marinum* var. *marinum*
Tragopogon longirostris var. *longirostris*	*Hordeum marinum* var. *pubescens*
Tussilago farfara	*Hordeum murinum* subsp. *glaucum*
Xanthium strumarium subsp. *strumarium*	*Koeleria cristata*
Crassulaceae	*Lolium temelentum* var. *temelentum*
Sedum acre	*Panicum repens*
Cruciferae	*Panicum miliaceum*
Aethionema arabica	*Paspalum dilatatum*
Alyssum foliosum var. *foliosum*	*Paspalum paspalodes*
Alyssum minus var. *minus*	*Phalaris canariensis*
Alyssum murale var. *murale*	*Phleum subulatum* subsp. *subulatum*
*Alyssum pterocarpum**	*Piptatherum miliaceum* subsp. *miliaceum*
Alyssum strigosum subsp. *strigosum*	*Poa nemoralis*
Barbarea verna	*Poa diversifolia*
Cardaria draba subsp. *draba*	*Sorghum halepense* var. *halepense*
*Erysimum alpestre**	*Stipa pulcherrima* subsp. *crassiculmis*
Cupressaceae	*Taeniatherum caput-medusae* subsp. *crinitum*
Cyperaceae	*Vulpia muralis*
Carex flacca subsp. *serrulata*	*Vulpia ciliata* subsp. *ciliata*
Dipsacaceae	**Polygalacea**
Knautia integrifolia var. *bidens*	*Polygala pruinosa* subsp. *pruinosa*
Ericaceae	**Polygonaceae**
Erica manipuliflora	*Polygonum pulchellum*
Euphorbiaceae	**Portulacaceae**
*Euphorbia anacampseros**	**Primulaceae**
Fagaceae	*Anagallis arvensis* var. *parviflora*
Quercus ithaburensis subsp. *macrolepis*	*Lysimachia verticillaris*
Frankeniaceae	**Ranunculaceae**
Gentianaceae	*Adonis aestivalis* subsp. *aestivalis*
Centaurium erythraea subsp. *turcicum*	*Consolida regalis* subsp. *paniculata* var. *paniculata*
Geraniaceae	*Nigella arvensis* var. *involucrata*
Erodium cicutarium subsp. *cicutarium*	*Ranunculus marginatus* var. *marginatus*
Geranium molle subsp. *molle*	*Ranunculus reuterianus**
Guttiferae	**Resedaceae**
Hypericum avicullariifolium subsp. *avicullariifolium* var. *avicullariifolium*	*Reseda lutea* var. *nutans*
Illecebraceae	**Rhamnaceae**
*Parnonychia chionaea**	**Rosaceae**
Iridaceae	*Alchemilla mollis*
Crocus biflorus subsp. *biflorus*	*Crataegus monogyna* subsp. *azarella*
Crocus pallasii subsp. *pallasii*	*Rubus canescens* var. *canescens*
Iris pseudocorus	*Sanguisorba minor* subsp. *muricata*
Juncaceae	**Rubiaceae**
Juncus gerardi subsp. *gerardi*	*Asperula liliaciflora ssp phyrgia**
Labiatae	*Galium graecum* subsp. *graecum*
Marrubium parviflorum var. *parviflorum*	*Galium murale*
Mentha spicata subsp. *spicata*	**Santalaceae**
Micromeria graeca subsp. *graeca Nepeta italica*	**Scrophulariaceae**
*Origanum spyleum**	*Digitalis feruginea* subsp. *feruginea*

Table 1. (Cont'd.).

Origanum vulgare subsp. *hirtum*	*Linaria corifolia**
*Phlomis nissolii**	*Linaria genistifolia ssp linifolia**
Phlomis pungens var. *laxiflora*	*Parentucellia latifolia* subsp. *latifolia*
Phlomis pungens var. *hirta*	*Scrophularia canina* subsp. *bicolor*
Salvia argentea	*Verbascum glomeratum*
*Salvia pisidica**	*Veronica cuneifolia* subsp. *cuneifolia**
Scutellaria orientalis subsp. *pinnatifida*	*Veronica multifida**
Sideritis curvidens	*Veronica triloba*
*Stachys cretica ssp smyrnea**	**Solanaceae**
Stachys tmolea	*Solanum nigrum* subsp. *schultesii*
Stachys annua subsp. *annua* var. *annua*	**Tamaricaceae**
Teucrium scordium subsp. *scordioides*	**Typhaceae**
Teucrium chamaedrys subsp. *chamaedrys*	**Umbelliferae**
Thymus zygoides var. *zygoides*	*Bupleurum euboeum*
*Wiedemannia orientalis**	*Eryngium campestre* var. *virens*
Ziziphora taurica subsp. *taurica*	*Ferula communis* subsp. *communis*
Leguminosae	*Ferulago humilis*
Ajuga chamaepitys subsp. *chia* var. *chia*	*Huetia cynapioides* subsp. *macrocarpa*
Anthyllis vulneraria subsp. *praepropera*	*Laserpitium petrophilium**
Astragalus angustifolius subsp. *angustifolius* var. *angustifolius*	*Oenanthe pimpinelloides*
Astragalus ptilodes var. *ptilodes*	*Pimpinella tragium* subsp. *litophila*
Coronilla varia subsp. *varia*	*Scandix australis* subsp. *australis*
Glycyrrhiza glabra var. *glandulifera*	*Torilis arvensis* subsp. *purpurea*
Lathyrus aphaca var. *Pseudoaphaca*	**Urticaceae**
Lathyrus laxiflorus subsp. *laxiflorus*	**Valerianaceae**
Lotus corniculatus var. *Corniculatus*	**Verbenaceae**
Lupinus angustifolius subsp. *angustifolius*	*Phyla nodiflora*
Lupinus hispanicus	

Table 2. Maximum and minimum values of biomass productivity of aboveground and belowground parts on seasonal basis.

States		Biomass productivity aboveground (g)				Biomass productivity belowground (g)			
		Spring	**Summer**	**Autumn**	**Winter**	**Spring**	**Summer**	**Autumn**	**Winter**
Aydin	Unfenced	25.9-97.1	12-27	10-70	15-40	3.5-18.5	4-40	5-70	40-65
	Fenced	32.9-139.1	30-62	24-100	20-40	3.7-35.5	10-58	10-80	50-70
Balikesir	Unfenced	28.3-69.3	15-32	15-36	15-35	10.9-33	18-30	8-38	40-68
	Fenced	23.3-122.6	24-80	34-54	18-40	11.2-26.5	16-64	14-46	50-80
Çanakkale	Unfenced	17.4-101.4	6-50	14-30	10-30	1.3-17.2	1-50	4-40	20-60
	Fenced	22.4-103.7	16-110	20-80	20-50	1.6-23.1	6-30	6-34	30-80
Denizli	Unfenced	45-240.8	40-360	50-200	50-100	17.3-247.5	40-400	20-400	100-250
	Fenced	45.9-403.9	60-400	90-350	100-300	32.6-285.1	50-220	90-350	175-250
İzmir	Unfenced	70-1036.4	32-1200	36-1120	56-1020	14-937	9-786	17.5-1150	21-1280
	Fenced	288-800	282-842	102-1144	174.4-784	10-440	24-416	40-946	96-1360
Kütahya	Unfenced	102-245.1	60-190	30-350	50-200	25.1-249.5	25-250	40-100	100-250
	Fenced	125.4-257.5	80-300	85-400	75-250	25.5-187.8	50-340	60-440	175-250
Manisa	Unfenced	112-1136	144-1248	112-1312	96-1232	11.4-544	144-560	96-368	96-336
	Fenced	128-1360	160-1264	192-1280	96-1152	192-910	304-688	208-560	208-512
Muğla	Unfenced	64.5-288.3	90-130	50-100	50-100	9.3-51.3	30-150	30-70	100-150
	Fenced	91.5-317	180-500	75-225	100-150	95.1-99.1	30-300	35-75	175-225
Uşak	Unfenced	46.5-194	30-200	60-300	50-250	20.1-80.7	10-250	20-240	100-350
	Fenced	50.2-190.8	80-220	80-800	75-400	8.3-90.6	20-250	20-450	150-600

Conclusions

Grasslands have been considered as the cheapest feed historically and thus exploited excessively with no care for their sustainability. All discussion on the grasslands are within the framework of animal production and humans gaining their livelihood from them (Riveros, 1993). This has lead towards their degradation as well as reduction in productivity (Haris, 2001).

Although Turkey faces several constraints on productivity of grasslands and forage crops, there is a great potential for developing forage sources. It is quite obvious that current animal numbers are in excess of the carrying capacity of the grasslands. Therefore all opportunities should be taken to improve the feed resources to reduce the grazing pressure. Researchers have determined means of improving feed resources including the best grassland rehabilitation and management activities and forage crop production systems (Holechek *et al.,* 2004).

Rapid urbanization has increased demand for forages for peri-urban smallholder dairies. Keeping this in view management of extensive grasslands is of prime importance. Greater use can be made of forages under tree crops and agroforestry systems. Production policies are needed to remunerate pastoralists who manage grasslands (Anon., 2000a; Hervieu, 2002). Most cattle are still under traditional management relying mainly on extensive grazing, and farms are small-fragmented, 85% under 10 ha. Since young rurals are abandoning the villages labour requirements are not properly met (Akman *et al.,* 2000; Thornton *et al.,* 2002).

On the other hand animal producers are increasing their herd sizes without paying any attention to the rotational grazing because it requires extra investment (Delgado *et al.,* 1999). The land tenure system is a major constraint to grassland management. Common areas are grazed free of charge, so are not managed properly. Boundaries of pastures are not clearly determined nor assigned to the villagers. Labour is becoming scarce in pastoral areas as people move to towns, so flocks are not well herded. Therefore the users have no incentives to invest in grassland resources (Anon., 2004; Ellis, 2000; Dixon *et al.,* 2001). It is quite obvious that current animal numbers are in excess of the carrying capacity of the grasslands.Therefore all opportunities should be taken to improve the feed resources to reduce the grazing pressure (Dost, 2001). Greater attention should be paid to the wider ethnobotanical matters. Sustainable management is a matter of widespread interest and is not limited to those who gain their livelihoods therefrom (Horne *et al.,* 2005). Introduction of invasive plants that are better adapted to arid conditions could outcompete the grassland vegetation in the Aegean region (DiTomaso, 2000). Cadastral work to define the boundaries of pastures should be completed. It will have a positive impact on pasture management and rehabilitation. Pastures can be assigned to municipalities or villagers.

Fertilizing is one of the most effective inputs to increase grassland productivity (SIS, 2002; Buyukburc,1983; Buyukburc *et al*., 1990; Gokkus & Altin, 1986; Gokkus,1987; Manga *et al*., 1986), however it is still not widely accepted because of the land ownership regime. Pastures are considered common areas so the farmers do not invest in fertilizers for this purpose.

Rotational grazing is a basic principle of pasture management, however it requires an extra fencing investment depending on the topography of the area. Although the herdsmen are well aware of the benefits of rotational grazing, they continue to graze all the parts of the grasslands from early spring until winter. The effect of rotational grazing on the yield and rangeland vegetation was investigated by several researchers. Recovery of degraded pastures requires longer than expected.

Establishment of temporary or seasonal grazing areas is a feasible way of forage crop production (Munzur *et al*., 1991; Peeters,2004). The best mixture for a seasonal pasture was 40 percent cereal and 60 percent vetch (Munzur, 1978). Karabulut *et al*., (1989) state that it is possible to obtain a liveweight gain of up to 10.5 and 9.5 kg with lambs and ewes, on a spring sown legume cereal mixture. Lucerne is sown on more than 230000 ha, and sainfoin on over 93000 ha. to compensate the cattle feed deficiency. Similarly area of maiz has increased from 1097173 ha to 1114 000 ha.

Crop residues, especially straws and stovers are very important as livestock feed in both commercial and traditional systems; their conservation and use together with hay and straw is stressed by Suttie (2000), t'Mannetje (2000) and Suttie & Reynolds (2003).

The lean seasons vary being winter in some areas but in tropics it is the dry season. In the Mediterranean; which includes our study area too; it is the hot, dry summer. In many cases, transhumant systems are used to palliate its effects. Although grasslands are of primary environmental importance they are rarely fmentioned (Hu & Zhang, 2003).When discussing sustainable development of grasslands Anon., (2003) points out that improperly managed feeding can be very detrimental to pasture condition.

Very few incentives exist for farmers to reduce grazing pressure such as limiting number of animals, grazing period and timely grazing of pastures. But the villagers rarely plan the management of grasslands, in fact they leave them to the mercy of shepherds. Productive pastures are found only on better soils and in more isolated areas with lower grazing pressure. This source is still capable of supplying sufficient roughage when properly managed (Farqher, 1993; Torok *et al.,* 2011).

The newly passed "Pasture Law" brings a new regime to pasture ownership (Büyükburc and Arkac, 2000). According to the Pasture Law, pastures will be assigned to municipalities or village communities once their boundaries are determined and certified (Anon., 2000). After certification is completed, carrying capacity and duration of grazing will be determined for each area, then the villages will be given the right to graze the previously determined and certified areas for a given period of time with the set number of animals.

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