

## Aquatic Macrophytes and Soil Features On Karamik Lake Coastal Ecosystem In Afyonkarahisar (Turkey)\*

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### ABSTRACT

Karamik Lake and marshlands is located in inner-west Anatolia and Afyonkarahisar boundaries, being in B3 square according to the grid system. Most of the study area is covered by Quaternary lands. Bioclimate of the area is a combination of little rainy - cold Mediterranean climates. The precipitation regime shows the characteristic of eastern Mediterranean. Most of the study area has alluvial soils, hydromorphic alluvial and colluvial soils with dunes and marshes of land type. Floristic region of the area is a Irano-Turanian type and about 50 vascular plant types have been identified. 6 plant communities are identified regarding to Braun-Blanquet(1932) in the research area. These are *Lycopus europaeus*, *Tetragonolobus maritimus*, *Scirpoides holoschoenus*, *Schoenoplectus litoralis*, *Sparganium erectum* subsp. *microcarpum*, *Carex distans*. To accomplish the research the communities of plant have been pulled up with their soil and the analysed and evaluated. To find the relationship with this plantcommunities 0-30 and 30-60 cm soil samples retrieved from the depths and their physical-chemical analyses and commented.

**Key Words:** Karamik Lake and marshlands (Afyonkarahisar), Aquatic macrophytes, Aquatic macrophytes and soil features, Coastal ecosystem

## Karamik Gölü (Afyonkarahisar) Kıyı Ekosisteminde Sucul Makrofitler ve Toprak Özellikleri

### ÖZET

Karamik Gölü ve Bataklığı, İç-Batı Anadolu'da Afyonkarahisar sınırları içinde bulunup grid sisteme göre B3 karesine girmektedir. Çalışma alanının büyük bölümünü Kuvaterner arazisi kaplamaktadır. Çalışma alanı "Az yağışlı, soğuk Akdeniz biyoiklimine" sahiptir. Alanda "Doğu Akdeniz Tipi" yağış rejimi görülmektedir. Çalışma alanında Alüvyal, Hidromorfik Alüvyal ve Kolüvyal topraklar ile arazi tipi olarak sazlıklar ve bataklıklar bulunmaktadır. Irano-Turanian floristik bölgesi içindeki çalışma alanından yaklaşık 50 vasküler bitki teşhis edildi. Çalışma alanı Braun-Blanquet yöntemine göre incelenerek 6 bitki topluluğu tanımlandı. Bunlar *Lycopus europaeus*, *Tetragonolobus maritimus*, *Scirpoides holoschoenus*, *Schoenoplectus litoralis*, *Sparganium erectum* subsp. *microcarpum* ve *Carex distans*' dir. Bu bitki topluluklarının topraklarla ilişkisini bulmak için 0-30 ve 0-60 cm derinlikler arasından toprak örnekleri alındı ve bunların fiziksel-kimyasal analizleri yapılarak yorumlandı.

**Anahtar Kelimeler:** Karamik Gölü ve Bataklığı (Afyonkarahisar), Sucul makrofitler, Sucul makrofitler ve toprak özellikleri, Kıyı ekosistemi

### INTRODUCTION

Karamik lake aquatic macrophytes in coastal ecosystems have been determined and compared to the distribution of macrophytes soil properties were determined.

The interest with the research area has mostly been on geological, soil, biological, chemical and ecological aspects.

In the study area, Gunduz (1984), Gönülol and Obalı (1986), Kavurt (1993), Anonymous (1994), Şen *et al.* (1994), Emir (1994), Anonymous (1996), Kazancı *et al.* (1999), Kavuşan and Orhan (2005), Kutlu and Ozturk (2006), Kıvrak (2011) and Anonymous (2012) 's research have been found.

By this research, by 50 takson that are collected from the research area and 30 sample area studies, it is aimed to decrease the lack of information about the area.

Karamik Lake is located in inner-west Anatolia and between Afyonkarahisar boundaries, being in B3 square according to the grid system (Figure 1).

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In this study, Karamik from the designated place on the shores of lake ecosystems, soils and vegetation that grow in this soil, species diversity and ecological impacts have been identified.

This research is done to determine the relation of 6 macrophyt community that are found on Karamik lake with soils.

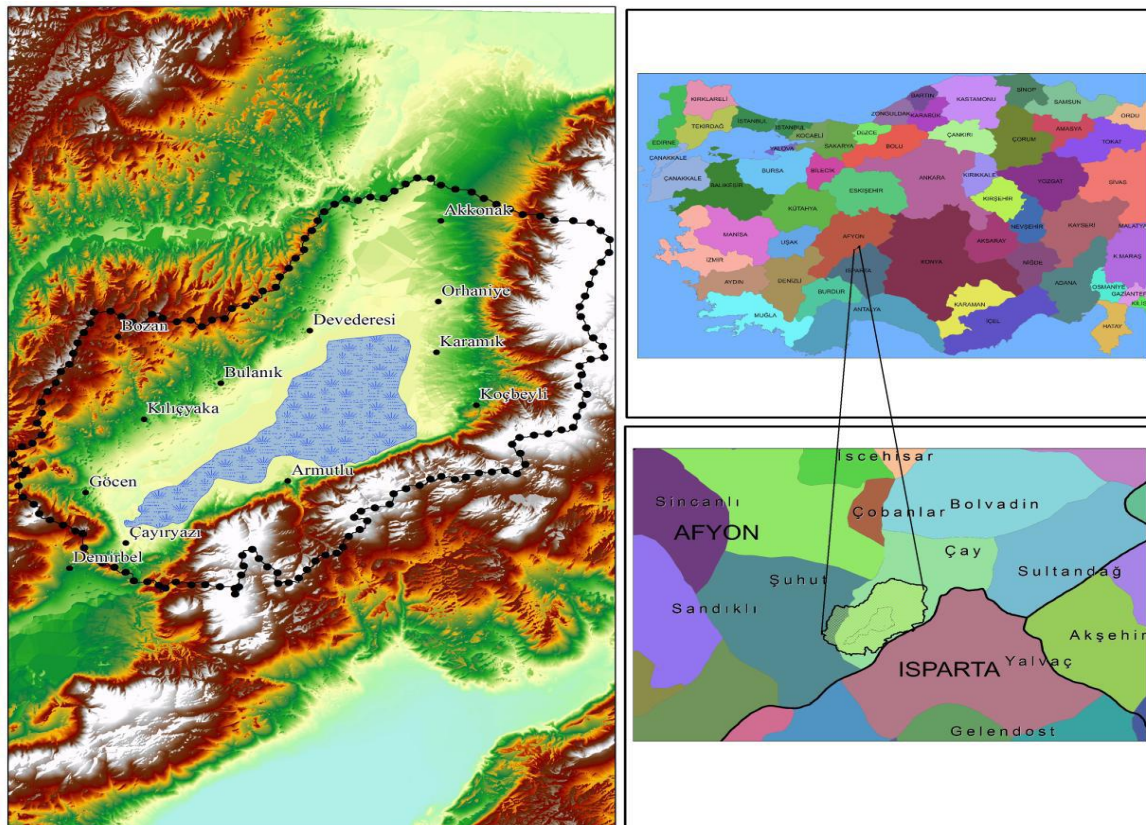


Figure 1. Afyonkarahisar Karamik Lake Location Map (Anonymous 2012).

## MATERIALS AND METHODS

Afyonkarahisar is located in 20 km southwest of Çay District, Karamik Lake, has a surface area of approximately 38 km<sup>2</sup>. 1067 m above sea level, this lake has an average depth of 2-3 m. In terms of productivity, stated to be eutrophic (Gündüz *et al.*, 1984; Şen, 1994)

The plant examples are collected during the land studies which are done during the years of 2010-2014. In the identification of the plants, Davis (1965-1985), Davis *et al.* (1988) and Güner *et al.* (2000)'s "Flora of Turkey and the East Aegean Islands" are considered to be the primary sources, in addition to that, Afyon Kocatepe University herbarium is utilised. The vegetation of the region is classified according to Braun Blanquet(1932) method. The data on climate is received from Afyonkarahisar Bölge Meteoroloji Md.(Directorate of Afyonkarahisar Region Meteorology)(Anonymous 2011) and geological and hydrogeological information is received from MTA(General Directorate of Mineral Research and Exploration)(Anonymous 1996). To find the relation of the plant community with soils, 12 soil examples which have a high capability of representation were taken from the deepness of 0-30 and 0-60 cms and their physical and chemical analysis were done in Ankara Toprak Gübre ve Su Kaynakları Merkez Araştırma Enstitüsü (Ankara Soil Fertilizer and Water Resources Central Research Institute) laboratories according to the methods determined by Tüzüner (1990).

## Findings

### *Geographical Position*

Afyonkarahisar, Karamik Lake, Çay districts within the boundaries of the Dinar - Çay is located in the area close to the highway. Surface area of 40 km<sup>2</sup>, the deepest point at an altitude of 3 meters and 1,001 meters. Duden southern waters (suayutı an underground river) is feeding through Eğirdir Lake. Coordinate data (latitude and longitude): 38 ° 25'7 "N 30 ° 48'53" E shape (INT1).

### *Geology*

Karamik lake and surrounding marshes, the Sultan of the west of the Paleozoic (metamorphic schists), Mesozoic (Hacialabaz, Taşevi limestone) and Cenozoic age (Beyşehir-Hoyran ophiolitic mélange, volcanic units, old alluvium) rocks formed by an old foundation sits on (Kavuşan and Orhan, 2005).

### *Climate*

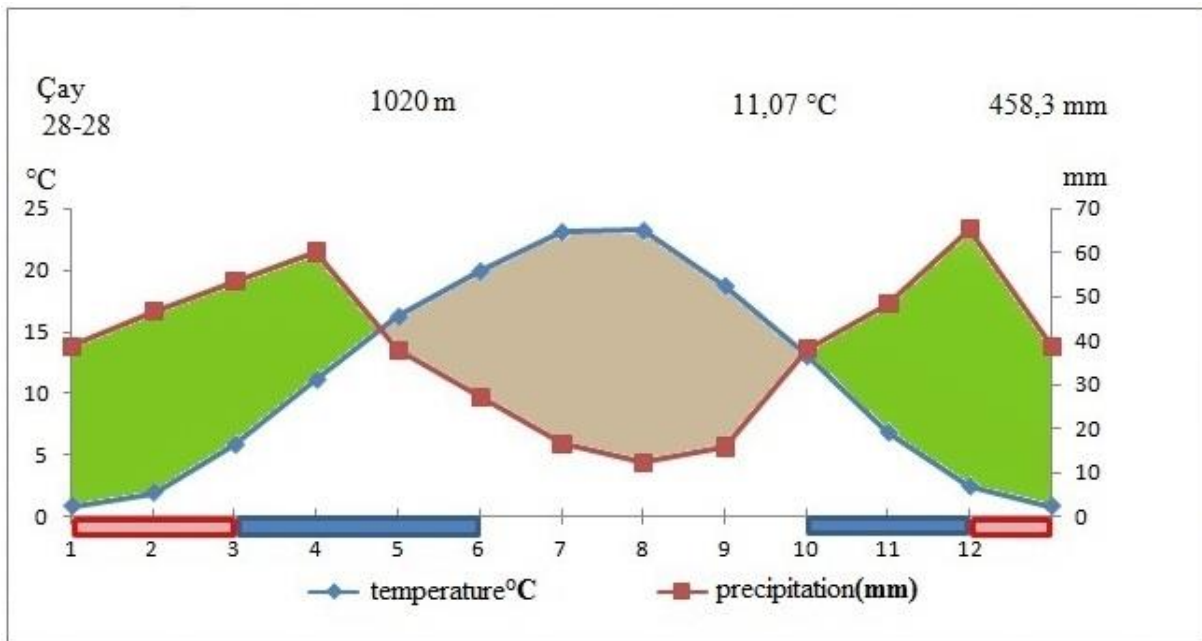
To reflect the climate values of the region, for the nearest meteorology station Çay district of Afyonkarahisar province, the climate diagram has been drawn (Gausson 1954, Walter 1954, Uslu 1958) (Figure 2). When we apply the climate data of Çay district of Afyonkarahisar province Meteorology Station to Emberger (1952)'s climate classification formula, Çay-Afyonkarahisar shows a low precipitated cold The Mediterranean bioclimate (Akman and Daget, 1971). Also shown in table 1 and table 2, Precipitation regimes of Çay station (Akman 2011) and Determination of bioclimatic zones of Mediterranean climate where Q and P values of Çay station (Emberger 1952).

**Table 1.** Stations belonging to the precipitation regimes [(S.W.A.S.), S:Spring, W: Winter, A: Autumn, S: Summer] (Akman 2011).

Station	Observation year	Spring		Summer		Autumn		Winter		Annual	Precipitation regime
		mm	%	mm	%	mm	%	mm	%	mm	
Çay	28	150,9	32,86	55,4	12,10	101,8	22,24	150,2	32,80	458,3	(S.W.A.S.)

**Table 2.** Determination of bioclimatic zones of Mediterranean climate where Q and P values (Emberger 1952).

Station	SANTIGRAD VALUE °C		CALVIN VALUE		P	Q
	m	M	m	M		
Çay	-3,1	30,5	269,9	303,5	458,3	46,70



**Figure 2.** Walter Climate diagram of Çay district Afyonkarahisar Province.

### **Soil**

In the study area, there are three big soil groups (A, H and K) and one land type. In the study area; as big soil groups Alluvial, Hydromorphic Alluvial and Kolluvial as land type overflowing riverbeds exist (Anonymous 1994). All the 12 soil examples belong to those big soil groups (Table 3.).

### **Biotic Factors and Environmental Problems**

Grazing in the study area, vehicle traffic, running over and various damages that a lot of people cause by coming there especially during the spring and summer months like (grazing, cutting of plants and burning of plants) can be listed.

**Table 3.** Analysis of the soil results.

Plant community	Depth cm	Physical Analysis %							Chemical Analysis																		
		Sand %	Silt %	Clay %	Tex. %	Water s. %	Field cap. %	Wilt. Point %	Soluble								pH	CaCO <sub>3</sub> %	Total Salt %	EC	Org. M. %	Chang. Na Me/100 gr	SAR me/100 gr	Chang. K Me/100 gr	Bor ppm	P <sub>2</sub> O <sub>5</sub> Kg/da	K <sub>2</sub> O Kg/ac.
									Cations Me/100 gr				Anions Me/100 gr														
									Na <sup>+</sup>	K <sup>+</sup>	Ca <sup>++</sup>	Mg <sup>++</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>-</sup>	CO <sub>3</sub> <sup>-</sup>	HCO <sub>3</sub> <sup>-</sup>											
*	0-30	22,30	28,44	49,26	C	80	40,18	29,73	608,70	8,972	4,00	3,90	54,51	554,98	0	13,1	8,15	41,2	0,241	4,43	1,42	63,60	34,40	17,83	4,79	11,32	562,40
*	30-60	21,85	30,80	47,35	C	81	40,64	31,36	560,50	8,024	3,45	3,25	50,62	510,62	0	11,95	8,09	40,15	0,215	4,24	1,25	60,20	353,6	16,54	4,41	10,25	496,41
**	0-30	28,83	29,73	41,45	C	89	41,41	32,36	575,20	8,135	3,56	3,40	51,37	515,31	0	12,26	8,41	44,5	0,222	4,28	2,01	61,30	121,6	15,39	4,32	10,54	585,25
**	30-60	24,54	29,74	45,72	C	86	44,99	30,00	656,90	9,92	4,44	4,40	58,40	599,34	0	14,25	8,63	43,25	0,227	4,73	1,56	67,00	12,19	20,27	5,17	9,12	628,43
***	0-30	21,88	31,19	46,93	C	84	25,70	22,26	642,20	9,809	4,55	4,55	57,65	594,65	0	13,94	9,52	46,1	0,268	4,62	1,59	65,90	149,2	19,12	5,26	12,39	539,55
***	30-60	21,58	23,62	54,80	C	86	55,48	35,75	596,23	8,546	3,76	3,73	51,24	585,62	0	12,67	9,17	46,31	0,273	4,21	2,11	60,38	12,98	15,98	4,29	10,94	524,51
****	0-30	24,29	29,52	46,19	C	82	28,27	19,72	587,56	8,475	3,82	3,64	52,67	578,41	0	11,78	9,24	41,65	0,245	4,19	1,26	61,25	1,190	16,24	4,12	11,02	538,62
****	30-60	23,12	31,58	45,30	C	90	47,68	28,54	574,38	8,369	3,28	3,46	52,92	591,24	0	11,43	9,47	40,81	0,242	4,08	1,34	60,95	8,580	16,97	4,18	11,19	529,73
*****	0-30	28,26	30,18	41,57	C	88	34,65	27,47	569,62	8,694	3,61	3,81	53,07	569,36	0	12,06	8,23	42,2	0,298	4,58	1,29	60,86	8,830	15,48	4,31	10,73	518,30
*****	30-60	36,91	25,88	37,21	C	84	31,04	22,39	592,55	8,741	3,59	3,38	50,39	589,81	0	11,84	8,38	41,35	0,287	4,91	1,22	61,97	15,78	14,89	4,52	10,87	542,80
*****	0-30	13,61	22,97	63,42	C	81	24,62	15,87	624,85	9,398	4,41	3,99	58,63	524,34	0	14,36	8,26	46,1	0,184	4,01	1,62	66,82	0,210	20,77	5,29	11,91	600,30
*****	30-60	15,90	27,49	56,61	C	82	30,09	21,48	621,17	9,469	4,39	4,07	57,78	531,55	0	13,53	8,34	46,75	0,195	4,67	2,01	65,95	0,660	18,69	5,46	9,01	586,20

\**Lycopus europaeus*, \*\**Tetragonolobus maritimus*, \*\*\**Scirpoides holoschoenus*, \*\*\*\**Schoenoplectus litoralis*, \*\*\*\*\**Sparganium erectum* subsp. *microcarpum*, \*\*\*\*\**Carex distans*

### **Flora of the Study Area**

In the study area of Karamik Lake, more than 50 plant species are found out. In the recognition of the plants, Davis(1965-1985), Davis *et al.*(1988) and Güner *et al.* (2000)'s "Flora of Turkey and the East Aegean Islands" were considered to be the basis and Afyon Kocatepe University herbarium was utilised. The research area appears in B3 square according to the grid system that is determined by Davis(1965-1988).

### **Vegetation and Soil Relationship**

6 macrophyte communities are identified regarding to Braun-Blanquet(1932) in the research area. Those are *Lycopus europaeus*, *Tetragonolobus maritimus*, *Scirpoides holoschoenus*, *Schoenoplectus litoralis*, *Sparganium erectum* subsp. *microcarpum*, *Carex distans*. To accomplish the research the communities of plant have been pulled up with their soil and then analysed and evaluated.

## **RESULTS AND DISCUSSIONS**

### **Lycopus europaeus Community**

The group consists of plants whose lengths vary between 40-60 cm. The group's dominant species are *Iris pseudacorus*, *Typha domingensis* and *Bolboschoenus maritimus*. In the group, cover of the vegetation is 60%- %70 and the number of species in the group is about 8-10. In the group's study field, Alluvial exist in the soils. Soils are in clayey structure. The soil samples taken from the group are moderate salty, highly calcareous, organic material in the samples vary from low to good and phosphorus in the samples vary from very little to medium with a high level of potassium. Soils are characterised by strong alkali with respect to pH (Tüzüner, 1990).

### **Tetragonolobus maritimus Community**

The group consists of plants whose lengths vary between 20-30 cm. The group's dominant species are *Lycopus europaeus*, *Typha latifolia* and *Bolboschoenus maritimus*. In the group, cover of the vegetation is 50%- %60 and the number of species in the group is about 7-8. In the group's study field, Alluvial exist in the soils. Soils are in clayey structure. The soil samples taken from the group are mild salty, highly calcareous, organic material in the samples vary from low to good and phosphorus in the samples vary from very little to medium with a high level of potassium. Soils are characterised by strong alkali with respect to pH (Tüzüner, 1990).

### **Scirpoides holoschoenus Community**

The group consists of plants whose lengths vary between 50-70 cm. The group's dominant species are *Lycopus europaeus*, *Typha latifolia* and *Bolboschoenus maritimus*. In the group, cover of the vegetation is 60%- %80 and the number of species in the group is about 6-7. In the group's study field, Hydromorphic Alluvial exist in the soils. Soils are in clayey structure. The soil samples taken from the group are salty, highly calcareous, organic material in the samples vary from low to good and phosphorus in the samples vary from very little to little with a high level of potassium. Soils are characterised by very strong alkali with respect to pH (Tüzüner, 1990).

### **Schoenoplectus litoralis Community**

The group consists of plants whose lengths vary between 80-120 cm. The group's dominant species are *Juncus inflexus*, *Typha angustifolia* and *Phragmites australis*. In the group, cover of the vegetation is 70%- %90 and the number of species in the group is about 8-10. In the group's study field, Alluvial exist in the soils. Soils are in clayey structure. The soil samples taken from the group are salty, highly calcareous, organic material in the samples vary from low to good and phosphorus in the samples vary from high to very high with a high level of potassium. Soils are characterised by very strong alkali with respect to pH (Tüzüner, 1990).

### **Sparganium erectum subsp. microcarpum Community**

The group consists of plants whose lengths vary between 40-60 cm. The group's dominant species are *Nymphaea alba*, *Utricularia australis* and *Butomus umbellatus*. In the group, cover of the vegetation is 80%-90 and the number of species in the group is about 8-10. In the group's study field, Hydromorphic Alluvial exist in the soils. Soils are in clayey structure. The soil samples taken from the group are moderate salty, highly calcareous, organic material in the samples vary from low to good and phosphorus in the samples vary from very little to medium with a high level of potassium. Soils are characterised by strong alkali with respect to pH (Tüzüner, 1990).

### **Carex distans Community**

The group consists of plants whose lengths vary between 70-90 cm. The group's dominant species are *Bolboschoenus maritimus* var. *maritimus* and *Juncus articulatus*. In the group, cover of the vegetation is 80%-90 and the number of species in the group is about 8-10. In the group's study field, Hydromorphic Alluvial exist in the soils. Soils are in clayey structure. The soil samples taken from the group vary from moderate salty to very salty, highly calcareous, organic material in the samples vary from low to good and phosphorus in the samples vary from very little to medium with a high level of potassium. Soils are characterised by strong alkali with respect to pH (Tüzüner, 1990).

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