Acta Biologica Turcica 33 (3) 147-157 2020 Received 02 Mar. 2020; Accepted 21 Apr. 2020

ACTA BIOLOGICA TURCICA
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E-ISSN: 2458-7893, http://www.actabiologicaturcica.com

Research article

Economic valuation of Balikdami Wetland (Eskişehir/Turkey)

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Abstract: Balikdami Wetlands valuation was done with Central Hunting penalties for biodiversity, CVM to protect biodiversity and valuation of goods and services with market value. Fish value in Balikdami Wetland was calculated as 66.340,00 ₺, bird value 4.095.550,00 ₺, mammal value 10.200,00 ₺, WTP 94.800,00 ₺, 4.043.529,39 ₺ from milk production, 16.230.436 ₺ from meat production., 505,403,72 ₺ from pasture grass production, 63.222,28 ₺ from vegetable production, 81.191,20 ₺ from animal manure, 558.683,41 ₺ from biofuel production, 1.504.449,70 ₺ from water used in cultivation areas and 301.623,81 ₺ from waste holding capacity. The total economic value of Balikdami Wetland is 27.555.429,51 ₺.

Keywords: Wetland valuation, Contingent Valuation Method (CVM), market value, Total Economic Value (TEV).

Citing: Biler, L., & Altındağ, A. 2020. Economic valuation of Balikdami Wetland (Eskişehir/Turkey). *Acta Biologica Turcica, 33*(3): 147-157.

Introduction

Wetlands support millions of people, including goods and services (Barbier et al., 1997). The global value of wetlands and their associated ecosystem services has been estimated at 14 trillion US $ annually (Costanza et al., 1997). Wetlands provide fertile soil for agriculture, fish, trees, reeds, and recreational opportunities. Rural households use natural products for food, medicines, cosmetics, or materials for shelter (Barbier et. al., 1997; Adaya et al., 1997). Also, the water itself is valuable. It provides flood attenuation and water purification. Wetlands also have values like cultural heritage or religious values associated with them (Barbier et. al., 1997).

Wetlands are highly sensitive ecosystems. Due to this, they are vulnerable to degradation (Turner et al., 2000). Wetlands are highly endangered ecosystems and becoming threatened day by day (Barbier et al., 1997; Turner et al., 2000). Therefore, there is international and national legislation to protect wetlands (Bergstrom and Stoll, 1993). Since 1900 more than half of the world's wetlands have been destroyed or lost (Barbier, 1993).

Economic valuation gives an idea of the real costs and benefits for ecosystem use and degradation and helps for correct decision making (Pearce et al., 1994). It provides the benefits receiving from wetlands, the prices of their loss, and profits and incomes form land usage (Emerton, 1998). The economic valuation of the environment reveals the monetary value of the goods and services. It eases the decision making for better social well-being (Batie and Shabman, 1982), as well as promoting policies to protect the environment (Helm, 1991). Due to the knowledge of the services provided by wetlands, converted land uses in the past are now restored at high costs (Stuip et al., 2002). The knowledge of the impacts of development would have been far more efficient (Turpie et al., 2010).

Ecosystem valuation includes direct use, indirect use, and non-use values. For these three values, the Total Economic Value (TEV) is used. The primary conception of these values is to make sure not to double-counting (Turpie et al., 2010).

Although many studies have conducted on the importance of wetlands in Turkey, researches on valuing almost don't exist (Biler, 2019). Wetland valuation is

necessary to understand the importance of wetlands (Turpie et al., 2010).

This research aims to value Balikdami Wetland, which is one of the critical wetlands in Turkey. In this manner, the Total Economic Value of Balikdami Wetland was revealed.

Materials and Methods

Study area

Balikdami wetland is in Eskişehir province with an altitude of 799 m and an area of 898 ha (Figure 1). Balikdami wetland declared as a Protection Area in 1988, Wildlife Conservation Area in 1994, and Wildlife Development Area in 2005. Ballıhisar (14 km northwest), Ertuğrul (8 km northwest), İlyaspaşa (12 km southeast), Yenidoğan (5 km southeast), Göktepe (13 km southwest), Ahiler (3 km west) and Kurtşeyh (8 km west) villages are at the surrounding (OSIB, 2011, OSİB, 2016).

Material

The material of the study consisted of statistical data and publications prepared by national and international organizations, and field and survey studies conducted in the field. Turkey Statistical Institute (TSI) statistical data were used. Come forward to determine the total economic value of the Balikdami Wetland, field and survey studies were conducted. In this context, the contingent valuation method (CVM) was used. The ones closer to the lake and those whose lands are adjacent to the lake were selected for valuation. In this regard, field surveys were carried out in Yenidogan, Kurtşeyh, Ertuğrulköy, and Ahiler villages, and surveys were conducted with local people. The studies were carried out between 2016 and 2018 between May and September. Also, goods and services that are directly used and have market value were evaluated and combined with the value obtained by the Contingent Valuation Method. Thus, the wetland was provided to form a more accurate value.

CVM Sampling size

Turkey Statistical Institute (TSI) Census 2010 data were used to evaluate demographic data in four villages (Yenidogan, Kurtşeyh, Ertuğrulköy, and Ahiler). 397 households were counted in the four villages. The sample size was determined as 119, with a margin of 0.15 error.

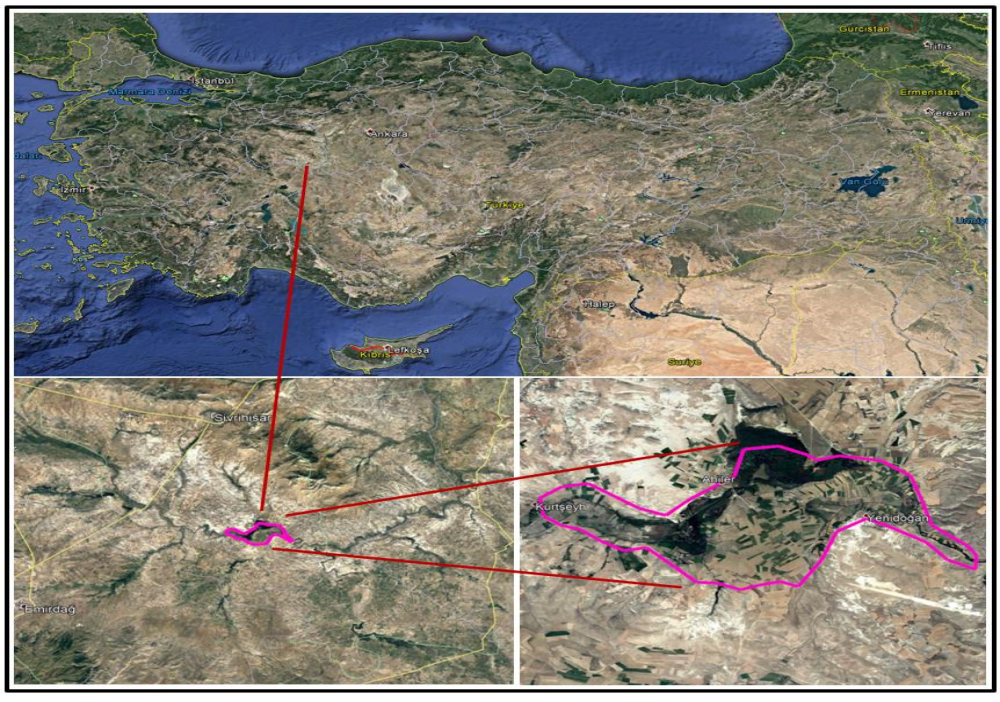

Figure 1. Location of Balikdami Wetland

Data types

Primary data constitute the field studies for biodiversity in Balıkdam wetland. Visual material was provided to the participants in the survey studies using these data. While collecting data on biological diversity, studies, especially for mammalian, bird, fish, reptile, and amphibian species were carried out and used by supporting with literature data.

Secondary data are taken from research surveys. Visual material support was provided to the participants by using

the primary data. Survey studies were carried out in four villages (Yenidogan, Kurtşeyh, Ertuğrulköy, and Ahiler).

Structure of the survey

In order to evaluate the economic value of the Balıkdam Wetland, a questionnaire was created by adapting from Gürlük (2006) and OSIB (2011). In order to increase the survey response rate, the participants were guaranteed the confidentiality of the answers.

The survey consists of three parts. The first part was created to obtain the background information of the participant. This section consists mostly of socio-economic and demographic data. This section, which includes age, gender, education level, income level, occupation, marital status, and household size, was used to identify socio-economic factors affecting willingness to pay (WTP). The second part was about wetland knowledge. The way the participants use the area, and their distance from the area was evaluated. The third section includes how to contribute to the valorization of the wetland. Within the scope of CVM, it was assessed how individuals are willing to pay to protect the wetland. Those who did not want to contribute were asked about the reason.

Data processing

The collected data were sorted first and then analyzed using appropriate tools. Both qualitative and quantitative methods were used. SPSS 15.0 was used in the analysis.

Method

In determining the total economic value of Balikdami Wetland, for biodiversity Central Hunting Commission penalties and CVM have been applied. In addition, goods and services that are directly used and have market value were used to strengthen the valuation.

Results

Participants in the survey used the wetland extensively for agricultural irrigation (52.1%), followed by grazing (24.4%), recreation (3.4%), and fishing (0.8%) activities. As a result of the survey studies, 19.3% stated that they did not use wetland.

Valuing biodiversity

As a result of the studies on the determination of biological diversity between 2016 and 2017, the area's fluorotic and faunistic values were revealed. Biological features and literature data are used to evaluate the cost and conservation of the biological diversity of the area, and the participation of the local people (WTP) was carried out in 2018 by applying a survey study.

***Plant value*:** Economic evaluation of natural plants is impossible. In addition, since the plants collected in the area and used within the scope of ethnobotany are not sold, they could not be included in the scope of valuation.

***Fish Value*:** Amateur fishing activity is carried out by only one person in Balikdami Wetland. The caught *Esox lucius* is sold for 30 ₺, *Cyprinus carpio* 20 ₺, *Squalius pursakensis* 25 ₺ and *Scardinius erythrophthalmus* 15 ₺. As a result of the interviews conducted, the amateur fisher hunted on weekends in May - September (5 months) declared that he caught and sold 100 *Esox lucius*, 150 *Cyprinus carpio*, 200 *Squalius pursakensis* and 100 *Scardinius erythrophthalmus* species in 1 month. In this context;

- for *Esox lucius*: 100 individuals X 30 ₺ X 5 months = 15.000 ₺/year,
- for *Cyprinus carpio*: 150 individuals X 20 ₺ X 5 months = 15.000 ₺/year
- for *Squalius pursakensis*: 200 individuals X 25 ₺ X 5 months = 25.000 ₺/year, and
- for *Scardinius erythrophthalmus:* 100 individuals X 15 ₺ X 5 months = 7.500 ₺/year.

A total of 62,500 ₺/year is calculated.

According to the Fisheries Law No. 1380, in order to protect the generation of aquaculture in the inland waters fishing in the period between 1 April - 30 of Carp, Broadcast, Velvet, Siraz, Freshwater Chub is prohibited. To amateur fishermen who were found to be hunting during the inspections to be made during the hunting ban period, 480 ₺ administrative fines and commercial fishermen; an administrative fine of 1.635 ₺ is applied.

In this context, due to the fact that the fishing activity carried out two months in the Balikdami Wetland is in the prohibited period and every weekend is considered as a penalty (480 ₺ X 2 months X 4 weekends) = 3.840 ₺ is added as a value from the penalty. In conclusion, the total amount obtained from fish is 66.340 ₺.

Amphibious and Reptile Value: No value studies have been conducted for amphibian and reptile species. Within the scope of the Central Hunting Commission Decisions of 2019-2020 Hunting Period published by the Ministry of Agriculture and Forestry, there are no penal sanctions for amphibian and reptile species. Therefore, they could not be included in the scope of valuation.

***Bird Value*:** While creating the bird fauna of Balikdami Wetland, it was benefited from literature sources as well as field observations. Especially the Ph. D. thesis by Albayrak (2002), Mid-Winter Bird Counts (KOSK), and eBird counts were used (Anonymous, 2019). In addition, the species identified as a result of the studies carried out in the field were also noted, photographed, and counted. The valuation of the avifauna was made using the penalties determined for the species that are prohibited from being hunted within the scope of the Central Hunting Commission Decisions determined by the Ministry of Agriculture and Forestry. In addition, within the scope of the report prepared by OSİB (2012), the number of penalties determined for the species without penalties were used. The highest counted number for the species was used, and 1 for the species without observation counts was written. Accordingly, species list, counts, and penalty values are given in Table 1.

Table 1. Avifauna list, counts and penalty values

Species	Common Name	Max. KOSK counts	Max. Ebird counts	Max. Observation	Max. counted ind.	Penalty (ind./₺)*	Value ₺
Tachybaptus ruficollis (Pallas, 1764)	Little Grebe	6	3	0	6	300	1.800
Podiceps cristatus (Linnaeus, 1758)	Great Crested Grebe	2	0	0	2	300	600
Egretta garzetta (Linnaeus, 1766)	Little Egret	3	2	1	3	2.000	6.000
Ardea purpurea Linnaeus, 1758	Purple Heron	0	0	0	1	2.000	2.000
Ardea alba Linnaeus, 1758	Great White Egret	12	3	2	12	2.000	24.000
Ardeola ralloides (Scolopoli, 1769)	Squacco Heron	0	0	0	1	2.000	2.000
Ardea cinerea (Linnaeus, 1758)	Grey Heron	2	3	0	3	2.000	6.000
Ciconia ciconia (Linnaeus, 1758)	White Stork	0	0	5	5	1.500	7.500
*Plegadis falcinellus (*Linnaeus, 1766)	Glossy Ibis	0	0	0	1	2.000	2.000
Tadorna ferruginea (Pallas, 1764)	Ruddy Shelduck	192	355	10	355	400	142.000
Tadorna tadorna (Linnaeus, 1758)	Common Shelduck	37	41	0	41	400	16.400
Mareca penelope (Linnaeus, 1758)	Eurasian Wigeon	336	156	0	290	400	116.000
Mareca strepera (Linnaeus, 1758)	Gadwall	30	0	0	30	400	1.200 0
Anas crecca Linnaeus, 1758	Common Teal	3503	465	0	3503	400	1.401.200
Anas platyrhynchos Linnaeus, 1758	Mallard	350	15	1	350	400	140.000
Anas acuta Linnaeus, 1758	Northern Pintail	250	89	0	250	400	100.000
Spatula clypeata (Linnaeus, 1758)	Northern Shoveler	100	257	0	257	400	102.800
Spatula querquedula (Linnaeus, 1758)	Garganey	0	5	0	5	400	2.000
Netta rufina (Pallas, 1773)	Red-Crested Pochard	101	0	0	101	400	40.400
Aythya ferina (Linnaeus, 1758)	Common Pochard	62	5	0	62	400	24.800
Anser anser (Linnaeus, 1758)	Greylag Goose	0	5	0	5	400	2.000
Cygnus columbianus (Ord, 1815)	Tundra Swan	0	3	0	3	2.000	6.000
Cygnus cygnus (Linnaeus, 1758)	Whooper Swan	0	1	0	1	2.000	2.000
Buteo buteo (Linnaeus, 1758)	Eurasian Buzzard	0	3	1	3	7.500	22.500
Buteo rufinus Cretzschmar, 1827	Long-Legged Buzzard	0	2	1	2	7.500	15.000
Circus aeruginosus (Linnaeus, 1758)	Western Marsh-Harrier	0	22	1	22	7.500	165.000
Circus cyaneus (Linnaeus, 1766)	Hen Harrier	0	1	0	1	7.500	750 0
Falco tinnunculus L., 1758	Common Kestrel	0	4	0	4	7.500	30.000
Falco columbarius Linnaeus, 1758	Merlin	0	1	0	1	7.500	7500
Fulica atra Linnaeus, 1758	Common Coot	5300	2000	250	5300	300	1.590.000
Gallinula chloropus (Linnaeus, 1758)	Common Moorhen	4	4	0	4	400	160 0
Himantopus himantopus (Linnaeus, 1758)	Black-Winged Stilt	0	0	5	5	350	1750
Vanellus vanellus (Linnaeus, 1758)	Northern Lapwing	108	0	0	60	350	21.000
Tringa totanus (Linnaeus, 1758)	Common Redshank	34	15	0	34	350	11.900
Tringa erythropus (Pallas, 1764)	Spotted Redshank	14	0	0	14	350	4.900
Tringa nebularia (Gunnerus, 1767)	Common Greenshank	2	0	0	2	350	700
Tringa ochropus Linnaeus, 1758	Green Sandpiper	3	3	0	3	350	1.050
Calidris pugnax (Linnaeus, 1758)	Ruff	1	0	0	1	350	350
Gallinago gallinago (Linnaeus, 1758)	Common Snipe	3	1	0	3	350	1.050
Calidris alpina (Linnaeus, 1758)	Dunlin	15	0	0	15	350	5.250
Larus ridibundus Linnaeus, 1766	Black-Headed Gull	2	0	0	2	300	600
Columba livia (Gmelin, 1789)	Rock Dove	0	40	0	40	300	12.000
Streptopelia decaocto Frivaldszky, 1838	Eurasian Collared-Dove	0	10	0	10	300	3.000
Alcedo atthis (Linnaeus, 1758)	Common Kingfisher	0	2	0	2	300	600
Merops apiaster Linnaeus, 1758	European Bee-Eater	0	0	0	1	300	300
Upupa epops Linnaeus, 1758	Common Hoopoe	0	0	0	1	300	300
Galerida cristata (Linnaeus, 1758)	Crested Lark	0	15	5	15	300	4.500
Hirundo rustica Linnaeus, 1758	Barn Swallow	0	0	0	1	300	300

Species	Common Name	Max. KOSK counts	Max. Ebird counts	Max. Observation	Max. counted ind.	Penalty (ind./₺)*	Value ₺
Motacilla alba Linnaeus, 1758	White Wagtail	0	0	0	1	300	300
Oenanthe isabellina (Ruppel, 1826)	Isabelline Wheatear	0	0	0	1	300	300
Iduna pallida (Hemprich-Ehrenberg, 1833)	Olivaceous Warbler	0	0	0	1	300	300
Acrocephalus scirpaceus (Hermann, 1804)	Common Reed-Warbler	0	0	0	1	300	300
Lanius collurio Linnaeus, 1758	Red-Backed Shrike	0	0	0	1	300	300
Lanius minor (Gmelin, 1788)	Lesser Grey Shrike	0	0	0	1	300	300
Pica pica (Linnaeus, 1758)	Eurasian Magpie	0	11	2	11	50	550
Corvus monedula Linnaeus, 1758	Eurasian Jackdaw	0	20	0	20	50	1.000
Corvus frugilegus (Linnaeus, 1758)	Rook	0	50	0	50	50	2.500
Corvus cornix Linnaeus, 1758	Hooded Crow	0	30	2	30	50	1.500
Sturnus vulgaris Linnaeus, 1758	Common Starling	0	0	0	1	150	150
Passer domesticus (Linnaeus, 1758)	House Sparrow	0	0	20	1	150	3.000
Passer montanus (Linnaeus, 1758)	Eurasian Tree Sparrow	0	0	0	1	150	150
Emberiza calandra Linnaeus, 1758	Corn Bunting	0	5	0	5	150	750
Emberiza schoeniclus (Linnaeus, 1758)	Reed Bunting	0	2	0	2	150	300
Phalacrocorax carbo (Linnaeus, 1758)	Great Cormorant	4	0	0	4	800	3.200
Athene noctua (Scopoli, 1769)	Little Owl	0	1	0	1	5000	5.000
Panurus biarmicus (Linnaeus, 1758)	Bearded Reedling	0	15	0	15	300	4.500
Phoenicopterus roseus Pallas, 1811	Greater Flamingo	0	2	0	2	1.500	3.000
	Total						**4.095.550**

* ind.: individual, taken from OSIB, 2012

There are 67 bird species in the Balikdami Wetland, and the value is calculated as 4.095.550 ₺.

***Mammal Value*:** Information about mammals was obtained as a result of observations during field studies and interviews with local people. The valuation of the mammals was made using the penalties determined for the species that are prohibited from being hunted within the scope of the Central Hunting Commission Decisions determined by the Ministry of Agriculture and Forestry. In addition, within the scope of the report prepared by OSİB (2012), the number of penalties determined for the species without penalties were used. The highest counted number for the species was used, and 1 for the species without observation counts was written. Accordingly, species list, counts, and penalty values are given in Table 2.

There are eight mammal species in the Balikdami Wetland, and the value is calculated as 200,00 ₺.

Table 2. Mammal fauna list, counts and penalty values

Species	Common Name	Counts of local people	Max. Observation	Max. counted ind.	Penalty (ind/₺)*	Value ₺
Vulpes vulpes (Linnaeus, 1758)	Red Fox	3	2	3	500	1.500
Felis chaus Guldensteadt, 1776	Jungle Cat	1	1	1	3.200	3.200
Meles meles (Linnaeus, 1758)	Eurasian Badger	1	1	1	300	300
Sus scrofa (Linnaeus, 1758)	Wild Boar	5	3	5	300	1.500
Sciurus anomalus Chreber, 1758	Caucasian Squirrel	1	1	1	300	300
Spermophilus xanthoprymnus Bennet, 1835	Anatolian Souslik	1	1	1	300	300
Erinaceus concolor Martin, 1838	Southern White-Breasted Hedgehog	7	5	7	300	2.100
Lepus europaeus Pallas, 1778	European Hare	2	2	2	500	1.000
Total						**10.200,00**

The Contingent Valuation (CVM)

WTP was presented in Turkish Lira (₺). Participants were asked to pay 100 ₺ to 500 ₺ monthly. 70 of 119 participants did not want to contribute. Among the participants who are willing to pay, the number of people who want to support 100 ₺ per month is 23, the number of people who want to support 200 ₺ is 22, and the number of people who want to support 300 ₺ is 4. Among the participants, no one wanted to provide 400 ₺ and 500 ₺ monthly to support.

As a result of the surveys, it has been calculated that there is a total monthly desire to pay 7.900 ₺ and 94.800 ₺ annually.

Correlations were made to determine whether there is a relationship between WTP and various variables. As a result, it is understood that the WTP depending on the usage of the area, the age of the participant, the distance to the wetland, gender, education level, occupation, household size, marital status, and income level by 83% (Table 3).

Table 3. Multiple regression results for WTP

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.913(a)	0.833	0.818	0.21083

a Predictors: (Constant), WTP, Distance to the wetland (m), household size, age, gender, occupation, usage of the area, marital status, education level, income level

A regression analysis was used to analyse the relationship between WTP and the socio-economic characteristics of respondents. For this purpose, gender, age, education level, and income level variables were used.

Regression analysis was carried out to analyse a functional relationship between dependent and independent variables. The results show a positive and negative relationship. Regression analysis showed that household size, income level, education level, and gender were significantly associated with WTP at P> 0.05 (Table 4). These results can be interpreted as follows;

- WTP in the gender variable decreases by 0.181 % to protect the area; if the gender is a woman,
- age also has an inverse relationship. As age increases, WTP for protection decreases by 0.016 %,
- as the level of education increases, the desire for WTP increases by 0.492 %. This situation can be explained by the rise in the level of education increased awareness of conservation of natural resources,
- income increase by one level means that the probability of WTP related to protecting the area increases by 0.396 %, and
- as the household size increases by one unit, WTP for protection reduces by 0.132 %.

Table 4. Regression analyses results*

Model	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
Constant	-259.499	91.373	0.000	-2.840	0.005
Gender	39.078	12.840	0.181	3.043	0.003
Age	-0.304	1.273	-0.016	-0.239	0.811
Educational Level	58.414	7.743	0.492	7.544	0.000
Income Level	47.213	9.843	0.396	4.797	0.000
Household Size	-8.648	4.291	-0.132	-2.015	0.046

*Dependent Variable: WTP

Goods and services that are directly used and have market values

Animal production (milk production and meat production), vegetal production, pasture production, fertilizer production, biofuel production, amount of water used, and organic matter value were valued in the Balıkdam Wetland.

Animal production

In the Yenidogan, Kurtşeyh, Ertuğrulköy, and Ahiler villages, there are a total of 1427 cattle and 21658 small cattle Table 5.

Milk production

There are 694 cows and 21,166 sheep in total in the villages of Balikdami Wetland, where milk can be obtained. In the study of İnci et al. (2007) on Altınova brown cattle, it was stated that cows had a milk yield of 305 days and an average of 17 liters, while Ertuğrul (1993) had a milk yield of 11.84 liters of 215 days in a study conducted on Southeastern Anatolian Cattle. Accordingly, the annual milk yield is between 2,545 and 5,340 liters for a cow. Turkey Milk Producers Union determined the price per liter of raw milk as 1,47 ₺. With the acceptance of an average annual yield of 3.942 liters, a yearly income of 4.021.549,56 ₺ was obtained, while a total of 2.735.748 liters of milk was collected.

In the studies conducted by Boztepe et al. (1999), 148,7 days lactation period 290 ml milk production for a sheep, and Altın and Çelikyürek (1999) 167 days lactation period and 380 ml milk production for sheep were determined per year. Based on the assumption that half of the total animals give milk and the lactation period is 155, and the milk production is 345 ml, a total of 7.302,27 liters of milk will be produced. Turkey Milk Producers Union determined the price of raw milk 3,01 ₺ for sheep per liter. Thus, income from sheep's milk was obtained 21.979,83 ₺. There was no milk income from goat according to the

interviews in the villages. 4.043.529,39 ₺ of income was derived from milk obtained from cattle and sheep.

Table 5. Animal counts

Village	Small Cattle		Total	Cattle		Total
	Sheep	Goat		n male	n female	
Ahiler	4.177	117	4.294	389	300	689
Ertuğrulköy	6.517	2	6.519	114	102	216
Yenidoğan	5.346	6	5.352	154	135	289
Kurtşeyh	5.126	367	5.493	76	157	233
Total	**21.166**	**492**	**21.658**	**733**	**694**	**1.427**

Meat production

According to the purchase price of live animals of the General Directory of Meat and Milk Board, the cost of 1 cattle is 17.060,00 ₺ with 170 kg, the price of one cow with 145 kg is 3.335,00 ₺, one sheep with 23 kg is 483,00 ₺, and one goat with 23 kg is 414,00 ₺.

The amount of meat for beef is 124.610 kg, and the value of meat is 3.489.080,00 ₺, the amount of meat for cow is 100.630 kg and the value of meat is 2.314.490,00 ₺, the amount of meat for sheep is 486.818 kg, and the value of meat is 10.223.178,00 ₺, and the amount of meat for goat is 11.316 kg, and meat value has been calculated as 203.688,00 ₺. In total, animal meat production was estimated at 16.230.436,00 ₺.

Agricultural Value

Ahiler, Yenidogan, and Kurtseyh villages are located within the boundaries of Balikdami Wetland. Ertuğrulköy is not included in the evaluations since the farming areas are outside the Balikdami Wetland. Agricultural data were calculated using Eskişehir Agriculture and Forestry Directorate and TSI data. A total area of 2,769.7 hectares of Ahiler, Yenidogan, and Kurtseyh villages are used for agriculture.

Ertuğrulköy has the most abundant agricultural land (56.67 %) in the Balikdami Wetland. This is followed by Ahiler Village (32.1 %) and Yenidogan Village (11.23 %).

According to the data in Table 6, the production quantities of the products and gross income are summarized.

The total gross income from these products is 63.222,28 ₺/year.

Pasture Weed Production Value

Agricultural land classification related to Balıkdam Wetland was transferred to the geographical information system. The land covers 3.112,09 hectares, and 333,16 hectares are used as pasture.

Table 6. Production quantities of products and gross incomes

Crop	Produce amount (Kg)			Gross Income (₺)		
	Ahiler	Ertuğrul	Yenidoğan	Ahiler	Ertuğrul	Yenidoğan
Aniseed	2.25	0.00	0.00	13.20	0.00	0.00
Barley	4.772.22	8.251.84	1.255.89	3.722.33	6.436.43	979.60
Safflower	0.00	28.27	0.00	0.00	27.42	0.00
Wheat	1.687.75	5.415.16	629.81	1.485.22	4.765.34	554.23
Rye	556.86	2.663.58	502.40	406.50	1.944.41	366.75
Trefoil	36.83	240.86	8.96	17.31	113.21	4.21
Common Vetch	10.42	13.93	0.00	5.52	7.38	0.00
Hash	367.80	0.00	141.90	2.758.50	0.00	1.064.25
Corn	192.85	0.00	0.00	144.64	0.00	0.00
Onion	4032.00	0.00	216.00	2.257.92	0.00	120.96
Sugar Beet	129.497.64	9.311.10	2.8125.94	27.194.50	1.955.33	5.906.45
Clover	1417.40	190.41	144.79	751.22	100.92	76.74
Oat	48.03	0.00	0.00	41.78	0.00	0.00

The average dry herb unit prices that will be taken as basis in calculating the 20-year grass price determined by Eskişehir Provincial Agriculture and Forestry Directorate in 2018 were defined as 0,82 ₺.

The annual grass yield in pasture areas is between 92,12 and 279,2 kg per decare (Çelik, 2015). When the average dry grass yield is taken as an average of 185 kg/year, 616,346 kg (616,346 tons) dry grass yield is provided in an area of 333,16 hectares (3331,6 da) in total. Dry grass yields of 505.403,72 ₺ can be obtained from the pasture in 2018.

Biofuel Production (fertilizer and biogas) Value

The animal manure that emerges daily varies depending on productivity. In fertilizer quantity calculations, 10-20 kg/day wet manure yield or 5-6% of the live weight can be taken as the daily fertilizer amount for cattle. Similarly, wet manure yield for sheep and goats can be accepted as 2 kg/day or 4-5% of live weight as daily fertilizer production. Daily fertilizer production for chicken is 0,08-0,1 kg/day or 3-4 % of live weight.

Fertilizer obtained according to another approach, varies according to the type of animals. According to this;

- 3,6 tons/year wet manure from 1 bovine animal,
- 0,7 tons/year wet manure from 1 small cattle,
- 0,0 0,022 ton/year wet manure is composed of 1 poultry.

Based on these values,

- 33 m^3/year of biogas from one ton of beef manure,
- 58 m^3/year biogas from one ton of sheep manure,
- 78m^3/year of biogas is produced from a ton of poultry manure (Berkes and Kışlalıoğlu, 1993).

Using these data, there are 1,427 cattle and 21,658 small cattle in the settlements in Balıkdam Wetland. According to the account;

- For cattle: 1,427 X 3,6 = 5.137.2 tons/year of manure
- For small ruminants: 21.658 X 0,7 = 15.160,6 tons/year fertilizer is obtained.

The tone of raw animal manure is sold at a price of 3-5 ₺. Accordingly, when the sales price of 20,297.8 tons of animal manure is accepted as an average of 4 ₺, it may generate 81.191,20 ₺/year income (OSIB, 2012).

Considering that approximately 1/3 of the fertilizers are lost in the pastures, the fertilizer and biogas calculation of the region;

- from cattle; 5.137,2 X 2/3 X 33 = 113.018,4 m^3/year biogas,
- from small ruminants; 15.160,6 X 2/3 X 58 = 586.209,9 m^3/year biogas is obtained.

The value of 1 m^3 of biogas in terms of electrical energy is 4.70 kW/h energy (OSIB, 2012). Accordingly, the amount of biogas (m^3/year) and income that can be obtained from bovine and ovine fertilizers in Balikdami Wetland are summarized in Table 7.

The total annual biogas amount that can be obtained from the Balikdami Wetland and its surrounding cattle, sheep, and goats is 699.228,3 m^3, the electrical energy is 3.286.373,01 kWh, and the income is 558.683,41 ₺/year.

Table 7. The amount of biogas (m^3/year) and income that can be obtained from bovine and ovine fertilizers in Balikdami Wetland (₺/year) *

Animal breed	Biogas that can be obtained (m^3/year)	Electric energy equivalent (kWh/year)	₺/year amount that can be obtained *
Cattle	113.018,4	531.186,48	90.301,70
Small cattle	586.209,9	2.755.186,53	468.381,71
Total	**699.228,3**	**3.286.373,01**	**558.683,41**

* Energy Market Regulatory Authority Tariff Tables were taken from consumer tariffs used for Agricultural Irrigation (0,17 ₺)

Value of Water Used in Agricultural Areas

In the agricultural areas close to the Sakarya River, water is taken directly from the Sakarya River, and the best example of this is the moto pump station built just downstream of the Karabent Bridge. The mentioned station was built by the state, and the waters taken from the Sakarya River are promoted by pumps and used for irrigation of agricultural areas in the region for a fee.

As part of the valuation, the amount of water drawn for use in cultivation areas and the energy costs incurred on a hectare basis were tried to be calculated. The product pattern that is being applied in the villages located in and around Balikdami Wetland was created from the data obtained from the Agricultural District Directorates and Mukhtars.

The amount of water used in the BalikdamiWetlands Balikdami is used by the source prepared by General Directorate of Agricultural Research and Policy (TAGEM) and DSI "Evapotranspiration of irrigated plants in Turkey".

Water withdrawal from water resources in Turkey is carried out with the help of pumping. As a result of the studies of DSI, it has been calculated that the amount of

energy spent on water withdrawals is 1357 kW/ha per hectare.

KW fee is determined as 0,54 ₺, and it is seen that the cost of farmers irrigating 1 hectare of land with the help of energy is approximately 730 ₺.

In the villages in Balikdami Wetland, the annual amount and value of water used in cultivation areas are given in Table 8. The agricultural lands within the boundaries of the Balikdami Wetland, the total energy expenditures are 1.504.449,70 ₺.

Table 8. Annual amount and value of water used in cultivation areas in the villages in Balikdami Wetland

Village	Total Cultivated Area (ha)	Plant Water Requirement (BSI) mm/ha	Energy Expenditure Per Hectare	Total Energy Expense ₺
Ahiler	746,25	6862	730 ₺	544.762,50
Ertuğrulköy	1100,21	4416		803.153,30
Yenidoğan	214,43	4683		156.533,90
Total				**1.504.449,70**

Waste Retention Value

TUİK bulletins were used to determine the amount of wastewater generated in the villages, and the amount of wastewater produced per person was taken as 183 L/person/day. The population in the Balikdami Wetland basin is 1,567 people. The annual amount of wastewater corresponding to this population was found to be 286,761 L/year (286.76 m^3/year).

In the economic valuation calculations, the activated sludge process, which is the most common process in the world and in Turkey, has been chosen (OSIB, 2012).

Calculations have been made by assuming that all village domestic wastewater in the Balikdami Wetland Basin and which discharges the domestic wastewater by surface water resources or directly discharges will be treated with a single treatment facility. Cost calculations of treatment plants were basically evaluated under two headings: initial investment cost and operating cost.

The initial process values of investment and operating costs are summarized in Table 9.

Table 9. Process Cost Information for activated sludge in Turkey (OSIB, 2012)

Treatment Process	Initial Investment Cost (€/person)	Operating Cost (€/m^3)
LEA	30,5	0,0523

The initial investment costs and annual operating expenses of activated sludge are given in Table 10. As a result, the economic value of Balikdami Wetland waste retention value was calculated as 301.623,81 ₺.

Table 10. Value of Balikdami Wetland Waste Retention Capacity

Population Served	Initial Investment Cost	Operating Cost
1.567	30,5 € X 1567 person X 6,309 ₺* = 301.529,19 ₺	0,0523 € X 286,76 m^3 X 6,309 ₺* = 94,62 ₺

* Land cost is not considered, and the exchange rate unit (6,309) is based on the official figures of the Central Bank of the Republic of Turkey on 05 July 2019 (https://www.tcmb.gov.tr/kurlar/kurlar_tr.html).

Conclusions and Discussion

The total value of Balikdami Wetland is summarized in Table 11.

As a result of the calculations, analyzes, and evaluations, the total value of Balikdami Wetland was calculated as 27.555.429,51 ₺.

When compared valuation studies in Turkey; Ortaçeşme et al. (2002) in the study titled "Determining the Economic Value of the Kursunlu Waterfall Nature Park", the travel cost method was applied, and the annual consumer surplus of the park was estimated as 50 billion ₺. In the study of Başar (2007), Dilek Peninsula obtained a value of 41.990.000 ₺ as a result of the travel cost method in order to determine the recreational use value of Büyük Menderes Delta National Park. Gürlük ve Rehber (2008) has valued the birdwatching activity in Manyas Lake National Park and determined a contribution of USD 1.614.376 per household per year. Since the visitor record was not kept in Balikdami Wetland, the travel cost method could not be applied, and a comparison was made.

Pak and Türker (2004) estimated the value of the Kapıçam Forest Resting Area to be 22 billion ₺ using CVM. Gürlük (2006) has obtained a total value of 14.809.183,74 ₺/year by considering the ecosystem and recreation values by the CVM in Lake Manyas. Gürlük (2010) estimated the total economic value in Lake Uluabat

between 4.848.000.00 US dollars/year and 8.100.000.00 US dollars/year, introducing its benefits in a management plan as an indicator for local government and all stakeholders. The reason for the CVM of the Balikdami Wetland is far below these studies is that there are no visitor records in the wetland. In addition, the fact that the local people have not developed the consciousness of nature has also affected this appreciation.

Table 11. Summarized Balikdami Wetland Value

Values	Amount (₺)
CVM	94.800,00
Fauna Value	
Aquatic Fauna Value	66.340,00
Avi-fauna Value	4.095.550,00
Mammals Value	10.200,00
Directly Used Goods and Services Market Value	
Livestock Value	
Milk Production Value	4.043.529,39
Meat Production Value	16.230.436,00
Agricultural Value	63.222,28
Pasture Weed Production Value	505.403,72
Fertilizer Production Value	81.191,20
Biofuel Production Value	558.683,41
Value of Water Used in Agricultural Areas	1.504.449,70
Waste Retention Value	301.623,81
Total	**27.555.429,51**

As a result of the studies carried out by the General Directorate of Nature Conservation and National Parks in the Sultan Sazlığı National Park, the total value of the Sultan Sazlığı Wetland was determined as 1.447.996.364,87 ₺. Within the scope of the project, biological diversity, and market goods and services were valued (OSIB, 2012). The methods used for Sultan Sazlığı National Park were used in the valuation of Balikdami Wetland, and CVM was also carried out. However, the smaller area of Balikdami Wetland than Sultan Sazlığı National Park and less control, livestock, and agriculture caused this value to be lower.

Acknowledgments

This study was produced from the Ph.D. Thesis of the first author. The authors wish to thank Assistant Professor Dr. Saniye Cevher Özeren, Assistant Professor Dr. Bahadır Akman, and Bekir Narin.

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