



Research Article

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THE EFFECTS OF THE DAM ON THE ECOSYSTEM AND LANDSCAPE DESIGN PROPOSAL: THE CASE OF AKKAYA DAM

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Abstract

The coastal areas offer natural, cultural, economic and aesthetic facilities and they are distinguished by their significant functions such as creating habitat for urban flora-fauna at the city center and the environment close to it, giving people the recreation opportunity, regulating the urban ecology. The Akkaya dam in the Niğde region is an example. The presence of Akkaya dam birds on the migration route and the reed areas around the dam are places frequented by migratory birds. Not only bird species but also different species of fish are hosted. The dam is used for irrigation of agricultural lands used for human beings, in order to meet the water needs of wild animals, grazing in the region. However, increasing pollution of dam water creates adverse effects particularly on the animals. The aim of the study is to determine the potential effects of Akkaya Dam on the living creatures and offer suggestions about it. Sampling will be made by using geographic information systems (GIS). In the light of this information, landscape development areas will be created for natural conservation, landscape restoration, and visual landscape improvements and planning of recreational potential of dam lake, data will be evaluated and alternative solutions options for the area will be proposed.

Keywords: Akkaya Dam, Animal feeding, Landscape design, Landscape restoration, Niğde

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1. Introduction

Increasing needs of the population in Niğde City cause decrease of agricultural land and increase of concrete structures on fertile soils. While this is an important phenomenon in terms of providing accommodation for the people, it causes a number of problems arising from the reduction of arable land. These problems may lead to inadequate provision of food for humans and a further

decline in numbers of animals in natural habitats. For this reason, it is inevitable to obtain yield at the maximum level from the unit area using the available agricultural areas. The physical structure of Niğde province is a steppe. 29% of the provincial territory consists of mountains, 41% of the areas are plateau and %30 of the areas are the plains (Anonymous, 2016a). The Akkaya dam located in the center of Niğde province is a dam constructed between 1962 and 1967 as a means of

irrigation of the Tabakhane River. The body volume of the dam is 426,000 m³, the height of the waterfall is 18.00 m, the volume of the lake at normal water level is 5.80 hm³ and the area of the lake at normal water level is 1.38 km². It provides irrigation services to an area of 2277 hectares (Anonymous, 2016b).

In addition to the many benefits of dams for the development of water resources in the world and our country, the impact on the environment is also known. The way people use habitat and nature has changed as hunting and gathering have led to settled living and agriculture (Sarıyıldız et al., 2008). The desire and necessity to provide the desired amount of water, which is one of the biggest necessities of mankind, has served the purpose of preventing floods as well as accumulation of water in agricultural production and use, by making the dam / pond on the rivers with irregular precipitation and flow regime. The creation of water areas has led to the creation of different living environments between water and land.

The water borders that make up the transitional areas between waterborne ecosystems and land-based ecosystems are important habitats for different plant and wildlife species at the same time. Water shores offer many natural, cultural, economic and aesthetic possibilities and they stand out as areas with important functions such as urban living flora and fauna, urban recreation possibility and regulation of urban ecology (Tülek and Barış, 2014).

The areas with water shores that affect the natural and cultural environment in the positive direction in the cities are areas that create invaluable opportunities with all artificial and natural formations in regions with arid climates such as Niğde city. For this reason, turning the Akkaya dam into a recreation area with appropriate landscaping activities can create pleasant spaces for urban people and students. Within the scope of this study, Akkaya dam, which is one of the important water surfaces and recreation areas within the campus area of Niğde University, was evaluated according to ecological criteria and suggestions were made in terms of landscape planning and design. Appropriate landscape planning studies will contribute to improving the habitat of bovine and ovine creatures.

The Akkaya dam environment of Niğde province is used as an important area especially for wildlife and small family businesses. It is home to wild animals during certain seasons of the year.

Total meat production in our country, While poultry meat, cattle meat production and small ruminants meat production was expressed respectively 1.4 million tons, 622 thousand tons, 159 thousand tons in 2010, poultry meat, cattle meat production and small ruminants meat production was had been 2.2 million tons, 989 thousand tons, 138 thousand tons in 2017 (TÜİK, 2017)

2. Material and Method

Located in Niğde Central District, Akkaya Dam is located roughly between Niğde-Bor highway and Kayseri-Adana highway. In other words, Niğde-Bor highway passes from the north of the dam, and Adana-Kayseri railway and road pass from the south. The distance between Niğde city and Bor city is approximately 17 km and Akkaya Dam is located between this short distance (Bulut and Ceylan, 2011) (Figure 1 and 2).

In the research area, the lake volume at the normal water level is 6 million m³. The irrigation area is 2277 ha. It is 3688.11 m².

The Akkaya Dam was constructed in 1974 for irrigation purposes and has a depth of 18 m from the thalweg. The lake area is about 1 km² (1.38 km²) and the lake extends in northeast-southwest direction. The irrigation area of Akkaya Dam is 2000 ha. The body volume of the dam which is constructed in the soil body fill type is 426.000 m³. Since Akkaya Dam facility operation and maintenance activities are transferred to Bor Municipality, the operation is carried out by this municipality.

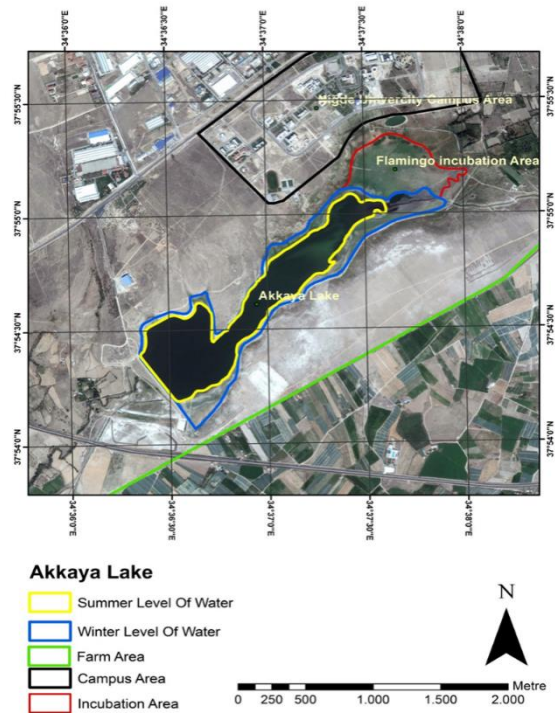


Figure 1. Study area.

The study area is limited to the campus area of Niğde University. There are agricultural areas, cattle and sheep farming around the area.

3-step method was followed in the research (Table 1).

Table 1. Research Flowchart

	Collection and evaluation of data
Stage I	<ul style="list-style-type: none"> • The literature review • Investigation of water coast's contribution to urban ecology and landscape • Collection of data related to the research field
Stage II	<ul style="list-style-type: none"> • Suggestions for making appropriate planting studies in order to reduce the spread of the odor in the dam, which is polluted by the wastewater coming from the research area and wastes coming from the organize industry, into the city.
Stage III	<ul style="list-style-type: none"> • Formation of opinions and suggestions related to research field.

3. Results and Discussion

Water borders are a source of important functions both recreationally and functionally in the landscape. The design and planning studies about water should be reconcile the different needs of the community such as industrial waste disposal, transportation, fisheries, agricultural use, clean water, energy acquisition and recreational activities as well as environmental principles.

One of the main objectives of the landscape architecture professional discipline is to keep the continuity and productivity of the natural resources by preventing them from being used over the capacities and the ecological balances, and to place the human activities in an ecological framework. The basic principle of this, is to make ecological planning (landscape planning) to assess the suitability of the available resources against the proposed socio-economic plans. Designing recreation areas in urban and rural areas, restoring damaged areas for various reasons, and making them suitable for any activity by improving ecological conditions so that

people can live physically and mentally in a healthy way are among the landscape architecture studies (Güney and Hepcan, 1994).

In addition, the feed material will be provided for the people who are feeding around.

People have chosen the edges of the water to meet their needs, since the settled life. There should be no pollutants in this area which is very important to humans. Arrangements to be made in such areas may make it possible to create a relaxing environment by replicating the wooded areas.

Niğde is another important place for Akkaya since there are no other lakes or dams. Especially in order to evaluate the Akkaya dam as a recreational area

3.1. Examination of Urban Areas and Waterside in the Surrounding Area in Terms of Ecological Criteria

According to Dugan (1990); ecological importance of water areas in urban areas and their immediate surroundings has been explained with criteria such as, fragmentation that forms a living environment and achieving biodiversity, providing coastal strip and erosion control, flood control, microclimate formation and preventing water and environmental pollution.

Watersides make it possible for many species of life to live, breed and feed and have ecological importance in terms of creating a habitat and biodiversity. Appropriate landscape designs are needed to contribute to the protection of ecological balance. The planting work prevents the occurrence of the flood, especially after heavy rainfall. This is due to both the soil structure and the plants they contain. At the time of precipitation, the water absorbed by the soil and plants is stored as groundwater. In arid seasons plants use water stored in this underground. In this context, in addition to the aesthetic effect of the selected plants, the functionality and suitability of the plant is also important in the design studies to be carried out in the vicinity of the lake shores and wetlands (Tülek and Barış, 2014).

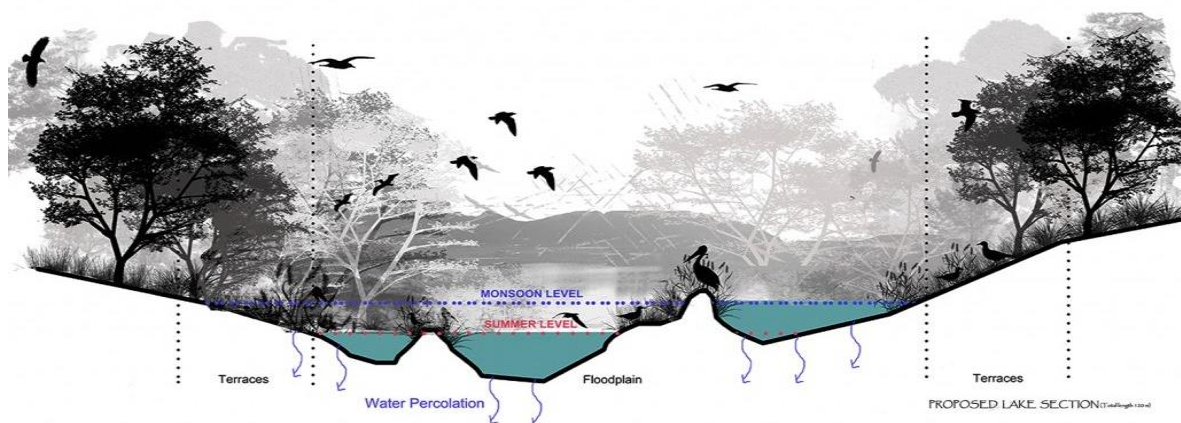


Figure 2. Recommended area usage.

Pollutants that are in the environment with plant growing around are used during photosynthesis to prevent water pollution. The refreshing effect that the water gives has a positive effect on the living things. In

order to make the use of the area without deteriorating the ecological balance, the recommended section is given in Figure 2. The plant types foreseen to be preferred to the area are given in Table 2.

Table 2. Plant species that can be used in the study field

Latin Name	Family	Turkish Name
<i>Alnusglutinosa</i>	<i>Betulaceae</i>	Kızılağaç
<i>Amorphafruticosa*</i>	<i>Fabaceae</i>	Yalancı civit
<i>Aralia sieboldi</i>	<i>Araliaceae</i>	Aralia
<i>Arundodonax</i>	<i>Poaceae</i>	Kamış
<i>Arundodonaxvariegata</i>	<i>Poaceae</i>	Alacalı Kamış
<i>Aponogetondistachyos</i>	<i>Aponogetonaceae</i>	Su Alıcı
<i>Bambusaaurea</i>	<i>Poaceae</i>	Bambu
<i>Bambusametak</i>	<i>Poaceae</i>	Bambu
<i>Calocedrus sp.</i>	<i>Cupressaceae</i>	Su sediri
<i>Canna pretoria</i>	<i>Cannaceae</i>	Alacalı Yapraklı Kanna
<i>Cortaderiaselloana</i>	<i>Gramineae, Poaceae</i>	Pamba otu
<i>Gliricidia sepium*</i>	<i>Fabaceae</i>	Bekçikakao
<i>Iris laevigata</i>	<i>Iridaceae</i>	Mor ve Beyaz süsen
<i>Iris laevigatarosa queen</i>	<i>Iridaceae</i>	Alacalı Yapraklı Pembe Süsen
<i>Leucaenaleucocephala*</i>	<i>Fabaceae</i>	-
<i>Populus alba</i>	<i>Salicaceae</i>	Akkavak
<i>Populusnigra</i>	<i>Salicaceae</i>	Kara kavak
<i>Robiniapseudoacacia*</i>	<i>Fabaceae</i>	Yalancı akasya
<i>Salix babylonica</i>	<i>Salicaceae</i>	Salkım söğüt
<i>Salix caprea L.</i>	<i>Salicaceae</i>	Keçi söğüdü
<i>Tamarindusindica*</i>	<i>Fabaceae</i>	Demirhindi
<i>Typha minima</i>	<i>Typhaceae</i>	Hasırotu

Plant species foreseen as suitable for use in the field of research do not contain any harmful substances for animals as well as for landscape evaluation. It is also possible to grow different kinds of animals around the dam. We could contribute to of animal husbandry in the study area and in the region by the encouragement of breeding buffalo which love wetlands. Small businesses require at least 2 da of space (Anonymous, 2018). Akkaya dam and the size of the surrounding area suitable for farming.

This situation may be an alternative form of production for our country's livestock production and meeting the demand from the increasing need for red meat. At the same time, the production of buffalo in our country is decreasing day by day. In 2017, the number of bovine animals increased by 13.2% compared to the previous year and total number is 16 million 105 thousand head. The number of cattle in bovine animals increased by 13.2% to 15,144,000, while the number of buffalo increased by 13.6% to 161,439 (TUİK, 2018). For this reason, it is also possible to increase the production of buffaloes with different project-based supports.

In addition to improving the ecological aspect of the dam edge of field landscaping studies, providing feed plants suitable for the animals cultivated in the region will indirectly contribute to animal husbandry by providing different feed plants to grow. This situation will be encouraged by the provision of a more economical breeding.

4. Conclusion

With the improvement of the study area, clean and more suitable habitats for animals could be created. In the studies of Seçer and Boğa (2016) on the Niğde region; although the presence of ovine livestock rangelands is the best utilized production line, they stated that the area in Niğde is sufficient in terms of size but insufficient in terms of quality. They indicated that the improvement of the ranges would increase the productivity and quality, which would affect the producers' income in a positive way. They have indicated in their work that it is very important to improve the quality of the ranges rapidly with inter-institutional studies. As the researchers indicate, opening up rangelands will be important in terms of animal husbandry. The preparation of the Akkaya Dam and its surroundings as common pasture areas of the region will also be an important place in terms of animal husbandry in the region. Different studies that were carried out on Niğde province pointed out that pasture areas were insufficient in the province. Ceyhan et al., (2015) said that the land ownership of Niğde province was 779,522 hectares and 46.0% of the land was meadow and pasture land, 35.4% agricultural land and 18.6% forest and other fields. In their studies, about 25% of the grassland and pasture land are poor, 50% are medium and 25% are of good quality. They stated that such areas are seen as an important opening husbandry practices in terms of meeting the nutrient requirements of an important livestock arm for Niğde Province. Especially it may also be important in terms of

animal breeding in the region and in meeting the increasing animal protein needs. At the same time, preservation of natural life and living in wild animals living in these areas may be even more important with the project work to be prepared.

Suggestions for the protection of the Akkaya dam and the improvement of its environment can be listed as follows;

1. The Akkaya dam is a open green space where the nature permeates the city and the ecological processes continue in this context. Due to the microclimatic property of the area, it has a rich herbaceous area characteristic of natural vegetation cover. Considering that biodiversity in Niğde is rapidly declining and many tropics are missing, the area is also important and rare in this context. The habitat values of natural plant communities should also not be lowered in landscape planning studies. In this context, all of the plants used in arrangement of the Akkaya dam were selected from natural species. In order to ensure water and plant integrity, the water impact on the project has been emphasized.
2. Large water surfaces in landscaping planning and design are the assets that make a relaxing effect on people. For this reason, the influence of the water should be taken into consideration in the landscape planning studies to be carried out in this area.
3. Informative studies should be carried out on the active flora and fauna groups in the area and the periods during which they are effective. At that time, it is important to discuss with the authorized people and especially to protect the area during spawning period. The necessary information can be made on the area with signs.
4. Necessary precautions should be taken to minimize the effect of pollutants damaging the Akkaya Dam.

These suggestions can contribute to the discovery of the natural beauties of the area, the creation of recreational areas for people, and the creation of living environments for animals.

Conflict of interest

The authors declare that there is no conflict of interest.

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