MANURE FROM LIVESTOCK FARMING IN THE EUPHRATES BASIN AND ITS POTENTIAL ENVIRONMENTAL IMPACT ON WATER RESOURCES

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Abstract

Food of animal origin derived from livestock farming establishments is necessary to meet the needs of human beings. The wastes generated during the production stages of cattle breeding (manure, ground covers, etc.) create a danger to the environment and water resources when they are released to the environment randomly. Therefore, the waste generated by livestock farming establishments should be stored in a controlled manner and should not cause environmental pollution. The research was carried out in the Euphrates basin and covered four provinces (Adiyaman, Sanliurfa, Gaziantep, and Kilis) and 35 districts. In the context of this study, the number of the cattle bred in the establishments in 328 villages which are at least 150 m and at the most 5 km distance to the flow path of the Euphrates was taken into consideration. In the study, Erdas Imagine 9.3 and ArcMAP 10.0 software were used; the number of the cattle and the distance to the rivers were evaluated as a layer. The subject of the study was the investigation of the potential pollution effects of the cattle breeding on the Euphrates River and its tributaries, and it was carried out to determine risky, non-risky and partially risky areas and attract attention to this issue. As a result, it was concluded that 4 districts and villages of Sanliurfa Region would be classified as risky areas, 3 districts and villages of Gaziantep Region would be classified as partially-risky areas, and 3 districts and villages of Adiyaman Region and all districts and villages of Kilis Region would be classified as non-risky areas.

Key words: Euphrates Basins, Livestock, Manure management, Water resources.

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INTRODUCTION

Animal manure is a natural waste of biological cycle process from feed to product and, in general, it contains soluble and easily degradable organic materials and inorganic components. Nitrogen (N), together with phosphorus (P), is known as the most controversial element in the context of relations between livestock production and the environment. As a result of the chemical transformation, nitrogen contained in the feces can be transformed into various gasses such as nitrate, nitrous oxide (N_2O), nitrogen monoxide (NO) and nitrogen dioxide (NO_2). The characteristics of the manure obtained from livestock shelters largely vary from farm to farm. The age, gender, ration of the animal, production system and other factors can be mentioned as factors affecting the content of manure characteristics (Tamminga and Verstegen, 1996).

Environmental problems are caused by the pollution in soil and groundwater created by the nitrogen compounds in feces and urine. The type of animal, applied farming methods and the level of intensive breeding affect the pressure of the manure on the environment. (Van Horn et al., 1994).

The nitrogen and phosphorus content of the manure is mainly influenced by the style of feeding (Powers and Angel, 2008).

Excessive use of commercial fertilizers and excessive animal manure raise the plant nutrients to an amount which will cause serious pollution to the environment (Atilgan et al., 2006).

Animal manure includes many microorganisms with feces, bedding materials, and feed waste origin (Tanski et al., 2006).

Microorganisms can cause health risks if they each plants, water, animals and people that are more sensitive. Livestock enterprises that are built in locations not suitable for water resources and settlements and have no adequate infrastructure in terms of waste disposal, reclamation and treatment are known as a source for many health problems (Pell, 1997; Gilchrist et al., 2007).

The most negative impact of animal production on the environment is that it creates a source of infectious disease agents. These factors may spread to the environment in the form of direct or indirect disposal. The pits in which the wastes disposed of the sheds are stored create great threat as a source of infection for humans and animals. That some disease agents arising from the animals can live in nature for a period ranging from one week to 3 years is important, for it shows that the pollution to be created may be effective for a very long time (Ergul, 1989).

The internal environment of the shelter consists of temperature, humidity, airflow and various gas, odors and dust while the external environment consists of slaughterhouse products generated by slaughtering and procedures applied to dead animals. Since other auxiliary buildings located in the courtyard outside the shelter create the agricultural enterprise together with the shelter, environmental pollution emerges as a result of the procedures applied in these areas. Therefore, the hazardous waste adversely affecting animal and human health both within and outside the agricultural building must be eliminated, if this is not achieved, it must be kept below the tolerance values not to harm the environment (Alagoz et al., 1996).

Modernization and intensive operations in the rapidly developing livestock enterprises brought a number of problems. Waste which is also an important economic potential is a significant problem for the environment in the direct proportion to the number of animals. If the necessary precautions are not taken, waste generated by the livestock enterprises can contaminate surface and underground water resources as potential pollutants. For this purpose, necessary storage and project designing criteria must be investigated in order the waste generated from livestock enterprises not to create adverse environmental conditions (Karaman, 2005).

The use of manure ignorantly and with inappropriate techniques in the agricultural production also reduces the effectiveness of manure. As a result of keeping manure under unsuitable conditions or implementing it randomly in the land, it loses a significant amount of nutrient composition due to washing and evaporation, and the expected benefits from agricultural manure in terms of agricultural production and soil fertility cannot be achieved (Boyaci, et al., 2011).

Livestock sector in our country still has the largest share after agriculture. Due to the significant increase in the capacities of farms and hence the amount of manure in recent years, environmental problems caused by the manure came to the agenda. Due to the development of agriculture and the increase in the number and capacity of integrated animal farms, environmental problems caused by animal waste are increasing (Inan, 2012).

This study covers Adiyaman, Gaziantep, Kilis and Sanliurfa provinces in the Euphrates Basin, and its aim is to determine the effect of the potential pollution caused by cattle breeding enterprises on water resources using the Geographic Information System (GIS) methods. In this context, the study was carried out to determine risky, non-risky and partially risky areas and attract attention to this issue.

MATERIALS AND METHODS

The research was carried out in the area covering cattle breeding enterprises located at least 150 m and at most 5 km distance to the river coast in Adiyaman, Gaziantep, Sanliurfa and Kilis provinces and their districts which are within the flow path of the Euphrates.

The Euphrates River is the most productive river in Turkey with the highest water potential. After determining province borders of Erzincan, Elazig, Malatya, Diyarbakir, Adiyaman, Gaziantep, Sanliurfa provinces, the Euphrates River enters first into Syria and then

Iraq. The most important tributaries of the Euphrates are the Murat River, the Karasu River, the Streams of Tohma Creek, Peri, Calti, and Munzur.

The total length of the river is 2.800 km, and the length of the section within the borders of Turkey is 1.263 km. It has 720.000 km^2 catchment area (Anonymous, 2015).
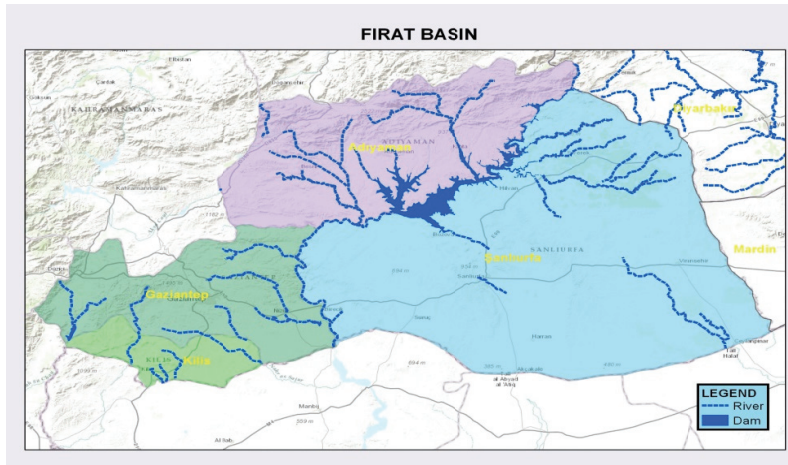

Figure 1. Provinces in the study area

Livestock activities around four provinces and districts covering the research area are being carried out intensively. The number of cattle fed in the agricultural enterprises along the Euphrates River was determined as 17.078 for Adiyaman province, 53.955 for Sanliurfa province, 109.519 for Gaziantep province and 2.978 for Kilis province, and 183.530 in total (Anonymous, 2014).

In the study, in above-mentioned provinces on the basis of districts, it was aimed to evaluate the presence of cattle and the effect of its presence on the environment in the setting of Geographic Information System (GIS). For this purpose, these places were digitized in the setting of GIS as polygons based on first province borders and then district borders. ArcMap 10.0 software was used for this purpose. The topographic base map within the said software was used. Since the program works based on layers, any qualification obtained was considered as a layer. First, the borders of the study area were digitalized by making geographical corrections. The whole boundary was divided into a separate layer on the basis of provinces in order the inquiries for each province to be carried out independently from other provinces. Similarly, the districts of each province were

divided as separate layers based on the borders of the districts. Evaluating the present bedding materials and identifying the water resources of the region, they were digitalized as a separate layer. The database (attribute data) was created in these layers prepared using the statistical information obtained from governmental bodies. All water resources (rivers, lakes, etc.) along the Euphrates River were digitalized, and the cattle breeding enterprises were chosen. This process was prepared using Analysis Tools/Buffer command within the ArcMAP 10.0 software. The classification of the number of animals was performed using the attribute table in order to evaluate the effects of the number of animals.

The number of cattle in 2014 was evaluated within 5 layers and shown on the map of the basin by different coloring (Table 1).

Table 1. Representation of the number of Livestock on The Study Area Map

Cattle Number in Enterprises	Display Color on the Map
1- 9	🟢
10- 22	🟢
23- 41	🟡
42- 82	🟠
83- 83+	🔴

RESULTS AND DISCUSSIONS

The most important water resource of the region is the Euphrates River that has a wide range area together with the dams between Adiyaman and Sanliurfa provinces and its tributaries. Animal numbers are quite variable between provinces and regions. While the number of animals in certain regions is over 1500, it remains even below 50 in some regions. When particularly the villages and towns near water resources were considered, it was observed that water resources in the villages and towns having more than 1500 cattle were under a higher pollution risk. 77 villages/towns in Gaziantep, 104 villages/towns in Adiyaman, 26 villages/towns in Kilis and 121 villages/towns in Sanliurfa, 328 villages/ towns in total were evaluated by provinces in the basin with particular attention to choosing the villages/towns close to the water resources; 26742 cattle in this region are grown for commercial purposes (Table 2).

Table 2. Livestock and Cattle Population

Study Area	Village	The number of villages close to water resources	Number of cattle in the villages nearby on water resources
Adiyaman	478	104	2.803
Sanliurfa	881	121	11.849
Gaziantep	473	77	10.742
Kilis	113	26	1.348
Total	1945	328	26.742

Gaziantep and Kilis: The number of cattle in the enterprises in these regions is high; therefore, the potential pollution generated by these enterprises may be high.

However, these regions are considered to be partially-risky areas, for there is fertilizer use possibility in the industry in these regions (Figure 2).

In Adiyaman region, the potential pollution effects caused by the livestock enterprises were predicted as low, for the enterprises are not close to water resources, and the number of cattle in the enterprises lose to water resources is low compared to other provinces, and it was concluded that this region may be classified as non-risky area (Figure 3).

In Sanliurfa Region, the number of cattle in villages/towns located in the areas close to water resources was determined as high (Figure 4). Considering that cattle produces 1 ton/ month manure (Bengtsson and Whitaker, 1986), 11849 tons/month manure that will have an effect on water resources will be produced in Sanliurfa region.

Therefore, the potential pollution effects caused by livestock enterprises in the province were predicted to be high compared to other provinces, and this region was classified as the risky area (Figure 4).
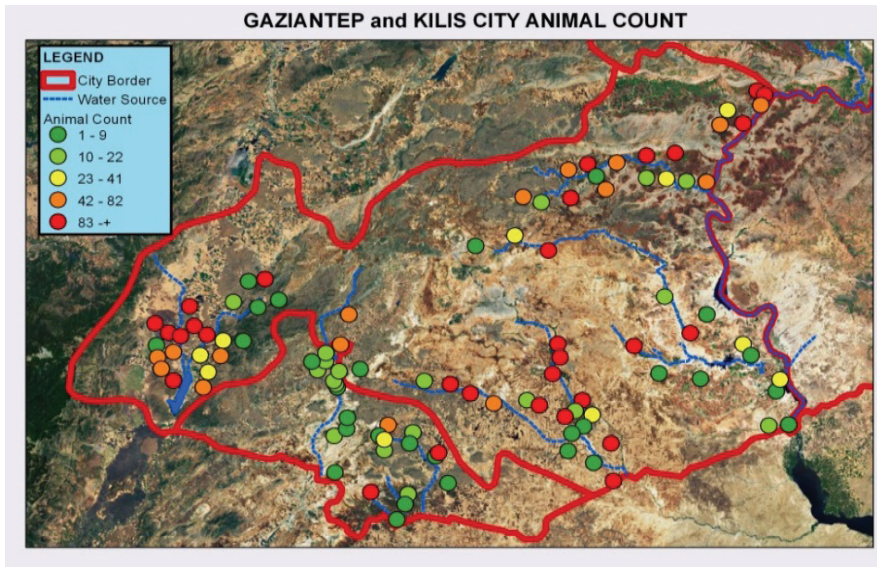

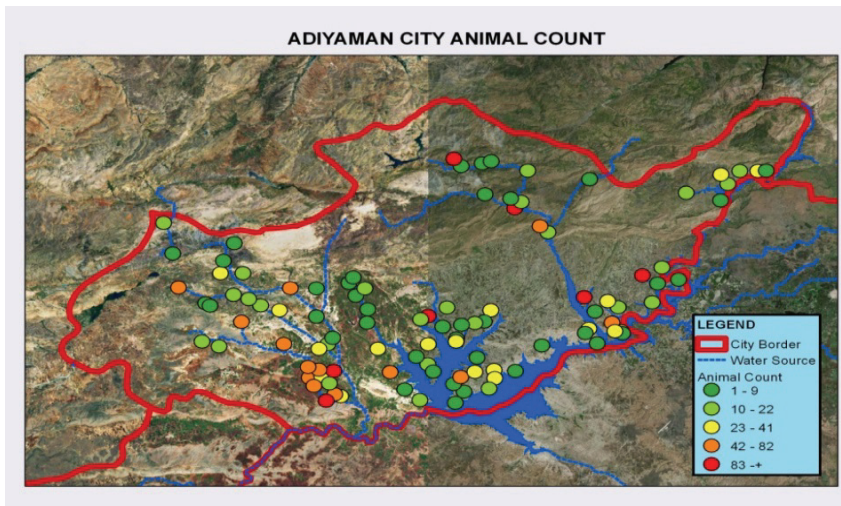Figure 2. Gaziantep and Kilis City Cattle Population
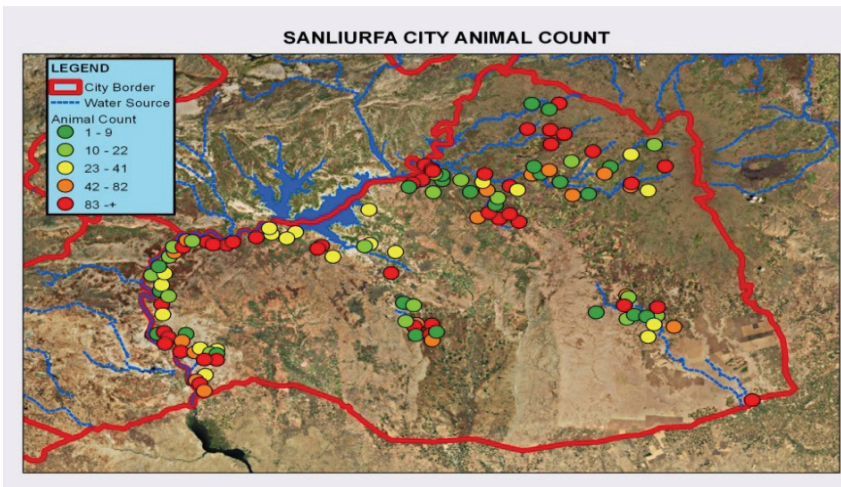
Figure 3. Adiyaman City Cattle Population

Figure 4. Sanliurfa City Cattle Population

When the general structure of livestock enterprises in the Euphrates Basin was examined, it was observed that intensive cattle breeding activities were carried out in the areas close to water resources, but operators were not sensitive to the issue of waste management. It was observed that the waste storage buildings are within the boundaries of Gaziantep province, and many establishments were insufficient in this regard (Figure 5).

It is understood that manure and waste generated from the production activities of enterprises must be stored appropriately not to pollute water resources and the environment. If the manure generated from these enterprises is stored outside randomly in piles, they can be a potential source of pollution for water resources by causing environmental pollution, visual pollution, and odor pollution. Due diligence must be taken when storing manure generated from livestock enterprises and burying it for crop production.

The interference of animal waste with water resources during manure management reduces the aquatic quality and causes the death of aquatic life. Ammonia, pathogens and organic substances with biological oxygen values contained in the waste lead to water pollution.
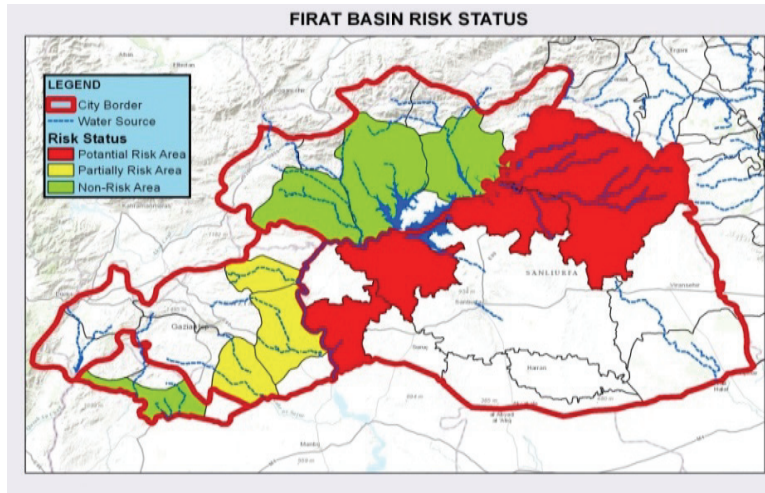
Figure 5 Euphrates Basins Potential Risk Area

CONCLUSIONS

In this study, it was tried to determine the risky areas for the environment and water resources that would be created by the manure generated by cattle breeding enterprises operating along the bank of the Euphrates River. According to this, it was concluded that Bozova, Siverek, Hilvan and Birecik districts and their villages located close to the part of the Euphrates River within the boundaries of Sanliurfa province could be classified as risky areas, Nizip, Yavuzeli and Oguzeli districts and their villages in Gaziantep province could be classified as partially risky areas, City center, Besni and Kahta districts and their villages of Adiyaman province and all districts and villages of Kilis province could be classified as non-risky areas. The results of this study are expected to contribute to the improvement of manure management implementations of the establishments in the study area and attract attention to the pollution potential of the manure for water resources.

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