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Current Situation of Livestock in Siirt Province and Environmental Impacts

Burak Saltuk[1], Zekai Gümüş[2], Yusuf Aydin[1*] and Mehmet Solak[1]

[1]Department of Biosystems Engineering, Faculty of Agriculture, Siirt University, Siirt, Turkey.
[2]Department of Biosystems Engineering, Faculty of Agriculture, Mustafa Kemal University, Hatay, Turkey.

Authors' contributions

This work was carried out in collaboration between all authors. Author BS designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors ZG and YA managed the data synthesis of the study. Author MS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

In this study, current conditions of cattle manure, manure storage units, problems of manure storage and interaction with the water resources around Siirt Province were examined. For this purpose, 133 livestock enterprises were chosen. 92 percent of these enterprises did not have manure storage and uncontrolled manure accumulations were observed. These manure accumulations were limiting animal movement and they posed a risk to the animal health. In Siirt province, livestock enterprises can be grouped as the number of cattle they have: 35 percent of the businesses had 1-7 cattle and 36 percent of the businesses had 8-14 cattle, 19 percent of the businesses had 15-21 and 10 percent of the businesses had >21 cattle. To determine the environmental pollution caused by livestock barns and their possible solutions in Siirt province, a survey was conducted. The results were compared with the literature and suggestions were made. In this study, we have examined the present conditions of solid and liquid manure storages found in the barns of stockbreeding

**Corresponding author: E-mail: yusufaydin@siirt.edu.tr;*

companies, storage problems, utilization of manure and environmental pollution. According to the questionnaire results obtained from the study area, 92% of the companies do not have manure storage and the present manure storages are not sufficient for the companies.

Keywords: Livestock; manure storage; environmental pollution; Siirt.

1. INTRODUCTION

Despite the developing technology and industrialization policies in the world, the livestock industry maintains its essential importance within the national economy. However, while the supply and demand relationship regarding the animal food production rapidly increases in favor of the demand on the Earth, same speed cannot be reached regarding the production. Sufficient production is required and its effect on environmental pollution is required to be minimum. Starting from this, the animal food production damages the environment, especially the water resources when being performed in an uncontrolled way as well as providing many benefits for the human life. It is a fact that the controlled production techniques carried out for reducing the damage to water and water resources have gained importance around the world.

The demand created by the increased population in Turkey and the increased socioeconomic wealth necessitate the increase of animal production. Furthermore, our country's potential for export raises the importance of livestock production even more.

However, the livestock production is performed in rural areas with completely extensive agricultural techniques, and in recent years, it has begun to encourage export with both the increase of the inputs for production purposes and the decrease of the labor force in the agriculture. The region's location, which is potentially suitable for the livestock production, does not the production alone; besides, the current supply and demand in meat and milk prices determine the market.

In this study, in which the livestock potential of Siirt province and its environmental impacts were examined, the structural features and status of livestock enterprises present in the districts and villages affiliated with the center were analyzed. Dairy farming constitutes one part of the livestock businesses analyzed, feeder farming constitutes another part of it. Within the structural status of the enterprises in question and layout planning principles, the negative environmental impacts of the solid and liquid manure formed in the existing facilities on water and water resources were aimed to be analyzed by both the questionnaire study conducted and the visual determinations made on site.

The economy of Siirt province is based on the agriculture, livestock production, handcrafts and parts industry. Barns are the structures built with basic or modern projects, in which animals are raised, their needs for nutrition and life are met. Whether the barn system is a modern or simple family business, there will always be certain wastes in the barn. In other words, barns are the structures in which various harmful gasses and dust, solid and liquid wastes are produced and emitted to the environment and atmosphere.

The wastes and gas produced in barns are of various forms and at varied harm levels. Their harms and impacts on the environment, animals and humans should be known and their impacts should be minimized by the necessary best project designing and application. In this case, the compliance with the best project designing standards is ensured. Otherwise, barns operate as contaminate sources [1].

The manure features obtained from barns differ from farm to farm. The age, breed, feed ration of the animal, production system and other factors can be shown as the factors affecting the content of the manure features. The design of the production units and the manner of application affect whether the manure produced in barns is solid, semi-solid or liquid. For example, manure collecting and cleaning by using the pressure water system cause the manure to be more diluted, namely, liquid weighted. On the other hand, manure will be more solid if many bedplates are used. If the solid component in the manure is 20-25% or more, it is called solid manure; if it is 10-20%, it is called semi-solid manner; if it is 0-10%, it is called liquid manure [2]. The manure obtained from barns is stored in solid, semi-solid, slurry and liquid forms [3].

The most hazardous environmental impact caused by animal wastes is sourcing infectious disease factors. Transmission ways of these

factors are in the making of direct and indirect throw. Storage pits of barn wastes embodies a great deal of hazard on human and animal health. Zoonotic disease vectors keep their vitality between 1 week and 3 years in nature which is significant from the aspect of indicating environmental pollution could be active for a long period of time [4].

When the manure obtained from animal barns is not stored properly, it may cause surface water and groundwater pollution because of the nutritional elements and microorganisms in it. The storage of the manure provides the producers with the best nutritional source for plant production. However, if the manure to be accumulated somewhere is not stored properly, it can create an environmental pollution risk for the animal and human health. For this reason, the wastes (solid and liquid manure) produced in barns should be protected in a way that they will not cause any environmental pollution until they are applied to the land [5].

Microorganisms' getting at crops, water, animal and human may pose a risk of health. Waste management, reclamation and refining structures built in an unsuitable manner around water reserves and residential areas are known to be causing health problems [6,7].

The methods to be used in collecting, transferring and storage of the manure and wastewater (wastewater of the milking unit, wash water, surface runoff, leakage, etc.) vary depending on the type of breeding, climate, topographic features of the land, soil texture, geological structure and the cost. Along with these factors, the discomfort the odor will cause to the farm residents and neighboring settlement units should also be taken into consideration. In the determination of the structural features of the manure and wastewater storage facility, the preservation of the quality of the underground and aboveground water resources and reduction of the odor impact should be aimed, and the waste utilization facility should be built considering these factors [8].

Stockbreeding has the second greatest share after agriculture sector in Turkey. In recent years, overgrowing capacity of enterprises cause increasing amounts of manure which is causing manure based environmental problems [9].

This study contains 128 cattle breeding business in 14 villages bounded to Siirt Province and Kurtalan, Şirvan, Baykan districts. Identifying impacts of potential pollution these enterprises may cause on environment and water resources and taking precautions could be taken in research field. Also, this aims to identify hazards of randomly dropped out cattle wastes on human and animal health and attract notice.

2. MATERIALS AND METHODS

The data obtained from the businesses, in which cattle breeding, production is performed intensively in Siirt province and its districts, via questionnaire formed the material of the study. Along with these data, similar studies conducted on the subject by various people and organizations were benefited from. Town centers and villages affiliated to them, in which livestock production is intensive, constituted the study field. For this reason, the livestock production data for 2015 of the Turkish Statistical Institute were used (Table 1) [10].

Table 1. Data of cattle entities in Siirt province and its districts for 2015 [10]

Districts	Animal breed	Cattle (Heads)	Calf-heifer (Heads)	Total (Heads)	Dairy (Heads)
Central	Cattle (Culture)	1.245	155	1.400	770
	Cattle (Hybrid)	1.570	167	1.737	808
	Cattle (Local)	2.724	333	3.057	1.292
Baykan	Cattle (Culture)	202	8	210	93
	Cattle (Hybrid)	580	1	581	341
	Cattle (Local)	3.490	2	3.492	2.379
Kurtalan	Cattle (Culture)	843	384	1.227	451
	Cattle (Hybrid)	2.220	259	2.479	1.359
	Cattle (Local)	1.162	480	1.642	808
Şirvan	Cattle (Culture)	543	180	723	333
	Cattle (Hybrid)	485	250	735	238
	Cattle (Local)	1.832	310	2.142	1.235

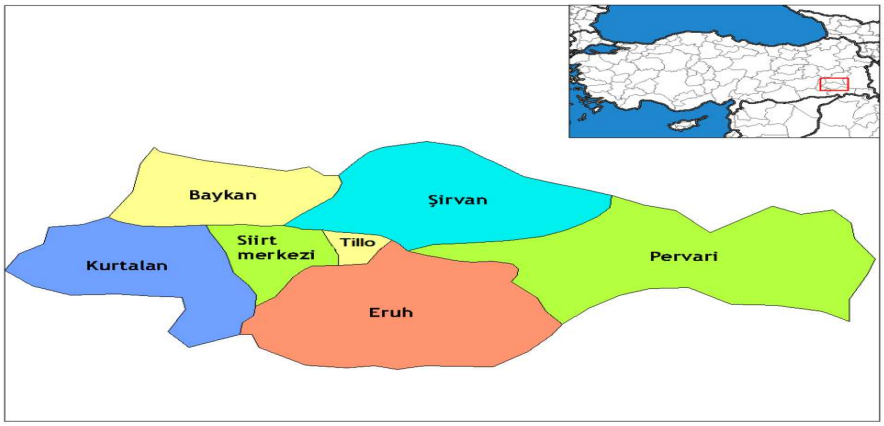

Fig. 1. Map of the study area

To determine the study field correctly, 133 businesses in 14 villages affiliated to the Central, Kurtalan, Şirvan and Baykan town centers, where the cattle breeding is performed intensely, were chosen deliberately by getting in contact with the authorities of the Provincial Directorate of Agriculture. The businesses, which fit the purpose of the study, among the ones in these districts and affiliated neighborhoods, formed the main population of the study (Fig. 1).

It was attempted to determine the status of the cattle breeding businesses operating within the study field by giving questionnaire forms to the agriculture consultants working in the Provincial Directorate of Agriculture as well as going to the businesses in person. Furthermore, the conditions regarding the potential damages of the wastes that emerge from the businesses examined to the environment and these wastes were photographed and visual awareness was tried to be provided and the attention was tried to be drawn to the issue. As materials, necessary data regarding the determined businesses were provided with the questionnaire, observation, and photographs. According to the basic data, the number of enterprises to which questionnaire would be applied in the districts and villages where stock breeding is performed in the region was calculated using the following formula by the Simple Random Sampling method [11].

$$n = \frac{N * S^2 * t^2}{(N-1) * d^2 + t^2 * S^2}$$

$$n = \frac{1097 * 23,57^2 * 1,65^2}{1096 * 3,157^2 + 23,57^2 * 1,65^2} = 133$$

N : the number of enterprises where questionnaires would be made,
N : the number of enterprises in the population (1097 enterprises),
S^2 : the variance according to the animal population where livestock is cultivated owned by the enterprises constituting the population,
t^2 : table value, 10%
d^2 : the amount of error allowed by sample mean, 10*% X
X : Average number of animals 3.157 animal/livestock

In the study, 10% margin of error and 95% confidence limits were used in the determination of the number of the enterprises where questionnaire would be applied

The determinative information on the status of the solid and liquid animal manure storages of the selected 133 businesses was provided by using the questionnaire forms prepared at Siirt University, Faculty of Agriculture, Department of Biosystems Engineering. The questionnaire forms consist of 53 questions and they are in a manner which enables questioning all the data about the business.

3. RESULTS AND DISCUSSION

In this section, the general features of the selected cattle breeding businesses in Siirt province and its districts, current structures in the business, the features of the waste storage structures and the negative impacts that the animal wastes produced in the businesses may create are discussed.

It was observed that the cattle production facilities in the region were not located separately, feeder and dairy cattle breeding were performed together, and animals were kept in the same area in the form of mixed production. Due to the traditional production techniques used, the amount of production declines, unsanitary animal products are obtained and there are only local buyers in the marketing of these products; thus, their selling to the nearby provinces gets harder. The businesses need to sustain their production activities within an environmental regulation plan as well as the quality of the project designing of the barns. The storage of the solid and liquid manure produced in barns at the production stage in a manner that it will not harm the environment and the positioning of the businesses in compliance with the standards of the layout plans are addressed as an important subject for the study. The current capacities of the businesses examined in the region are determined to be 12 heads on average. The business capacities differ depending on the financial status of the proprietors, agricultural supports, and livestock policies. The capacities and percentages of the businesses are shown in (Table 2).

Table 2. Business capacities and percentages

Animal number (Heads)	Business number (Number)	Percentage
1 – 7	47	35
8 – 14	48	36
15-21	25	19
21<	13	10
Total	133	100

Especially the structures, in which the solid and liquid manure are stored, are neglected to a significant extent. The fact that only animal barn was planned, and its construction was considered during the establishment of the business shows that the application consciousness of the layout plans has not been adopted by the producers yet The livestock breeding in the region is performed especially as sheep and goat breeding and migratory livestock breeding is preferred among it. The producers express the opinion that the construction of barns and corrals increases the cost. In the examinations made on the foundation plans of the businesses, it was determined that 10 businesses (8%) were constructed according to a certain project principle, 110 businesses (92%) were constructed without any project. It was revealed that the owners of the businesses constructed with a plan benefited from the agricultural investment support program and they ran their businesses thanks to this. Only 10 (8%) of the businesses studied, which include the ones constructed with a project by receiving a certain financial support, have the structures, in which solid and liquid animal wastes are stored. Solid and liquid animal wastes called manure are accumulated in the open and in bulk in 92% of the businesses studied. According to the answers given to the questionnaire, it is notified that manure heaps are utilized for increasing the organic matter content of the soil in the areas where plant production is performed in cultivated areas. However, while storing the manure in question, the measures for the manure to mature and get beneficial for the cultivated areas are not taken. It was observed that this situation brings along environmental problems such as the odor and visual pollution as well as decreases the quality of the manure. It was observed that the businesses studied in the Center of Siirt and Baykan district are generally built close to one another and neighbor businesses accumulate their wastes in an area that is close to the both businesses. As consequence of this, intensive waste accumulation, odor, and visual pollution emerge within the same region. Depending on the climate which is dry and hot especially in summer in the region, the intensive odor formation is reported. Moreover, it was concluded that the main reasons for animal deaths in the businesses studied, being infections and the environmental conditions inside the barn, may be insufficient. It was observed that the businesses studied in the region did not have cleaning activities inside the barns and the necessary hygienic environment for animals. The facts that the solid and liquid animal manure produced in the barn is not removed from the inner environment, the existing removal systems in the barn are insufficient and, the manure removed somehow from the inner environment is not stored properly in the business are determined to be the biggest problems (Fig. 2.) It was observed that there were solid and liquid manure accumulations from place to place since the manure was accumulated in the yard of the business or in close areas and it was concluded that these wastes may affect both human and animal health negatively. Another important issue in the businesses is odor pollution. The impact of this adverse environmental factor occurs since along with the predominant wind direction, there is no

Fig. 2. An example of the random solid and liquid animal wastes causing pollution and hazard for environment, people and animals

present height difference between the structures of the businesses and other neighbor businesses (Fig. 2.). The necessary precautions was not taken in the place selection and positioning of the barns in most of the businesses studied in the region. Most of the barns were built within the settlement areas, generally next to the housings in rural areas. It was determined that the solid and liquid animal wastes have an adverse effect on the environmental health because they are stored in piles in the open around the barn and in the business yard.

4. CONCLUSION

In research field, barns and haylofts are positioned under the houses. Families getting by stockbreeding are mostly from low income and education groups, causing them to fail proper take care of animals, productivity drops and polluting environment with animal wastes especially in Şirvan county and in its villages, stockbreeding activities cause a great deal of pollution because of liquid and solid animal wastes are dropped out to environment randomly. In this survey, it is stated by farmers that increased amounts of diseases are present in summer which is caused by animal manure dropped out randomly to the streams, aqueducts that people interact with these interactions causing humans to be infected with bacteria and parasites carried with animal wastes.

The absolute distance that should exist between the business and the common use areas of the businesses studied varies depending on a few

criteria. These criteria can be named as the type of the rural area, farm operation type and waste system type, and adjacent areas of usage.

The solid and liquid manure produced in livestock facilities should be stored properly in order not to affect the environment adversely.

Because for the wastes and manure produced in the businesses not to harm the animals as well as the workers performing daily care activities in the businesses in terms of hygiene an environmental planning, the waste storage structures should be considered within the auxiliary equipment unit at the barn planning stage. various measures should be taken, and the determined criteria should be followed meticulously in order not to allow the adverse consequences and to take the adverse effects to the possible lowest level. These criteria are as follows;

Upon calculating the distances of the animal barns to be built in any region to settlement units, water resources such as lakes, etc., the values given in the Water Pollution Control Regulations in the Environmental Legislation should be taken into consideration [12].

If there is manure storage in the business, the ground should be controlled frequently, and ground water pollution should be prevented by eliminating cracks and leaks. The capacity of manure storage facilities should be in a manner that it can prevent the direct discharge or surface flow and water pollution by mixing with the soil [13].

The manure in animal barns should be kept in a closed storehouse to be utilized in the future. When the manure is accumulated randomly in the open, in the business, it creates both environmental pollution and air pollution due to the chemicals in it. For this reason, manure pits, which can properly store the manure produced for certain periods, should be planned in every business [14]. Accordingly, minimum distances provided below should be taken into consideration while choosing the area in which the construction site of the solid and liquid manure storage buildings and facilities will be positioned in a region; [3,4,14,15].

- 50 m away from every kind of surface water,
- 1600 m away from the area where cattle barns and hencoops are located, people and other neighbors live; also, livestock breeding businesses should be at least 300 m away from the water resources such as lakes, etc.,
- Minimum 100 m from the irrigation and drainage canals,
- At least 30 m away from the sanitary systems supplying water,
- 15 m away from all inner farm canals

If the manure and wastes produced in animal barns during breeding are not stored and processed properly, the animal and human health are significantly affected and performing breeding rationally is prevented. To perform a rational production without damaging the environment; feeding areas should be dry. The top of the manure obtained from the barns should be covered and anaerobic decomposition should be prevented. Manure storehouses should be built in accordance with the construction techniques. Manure storage areas should be designed compacted and by sloping towards the manure storehouse. Cleaning the manure in the barn should be done frequently and the manure should not smudge onto the animals' bodies. Otherwise, when there is manure on the body, it causes bacteria to settle onto the skin surface and the odor to be emitted from the animal. Furthermore, predominant wind direction should not be in a way of transferring the odor in barns to the residential area. In respect to this, as stated in the Turkish Environmental Legislation, the solid and liquid animal wastes should be properly accumulated in a storehouse and odor excretion should be tried to be reduced. Farmers should be trained on fertilization, spraying and practices should prevent environmental hazards. Wastes should be dealt properly; some waste drop and storage structures should be built by legal authorities. This will make way to biogas production. Besides, modernization should be implemented to stockbreeding sectors in mentioned areas to prevent hazardous results. Co-operative activities should be supported instead of personal business models, so workforce and productivity could be enhanced.

As a result, to remove these adverse conditions in the study field, if the sufficiency of the laws, regulations, and legislations could be a subject of evaluation, the manure produced in animal barns can be utilized more rationally; besides, it may be possible to eliminate its adverse effects on the environment.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Alagoz T, Kumova Y, Akyüz A, Atilgan A. A study on the hazardous wastes produced in the livestock facilities and environmental pollution they create (In Turkish) symposium of agriculture and environment relations, 13 May 1996; Mersin University Engineering Faculty Mersin /Turkey 32:448-441.
2. Manure Storages Regulations; 2017. Avaliable:https://elibrary.asabe.org/abstract.asp?aid=44187&t=3&redir=aid=44187&redir=[confid=s2000]&redirType=standards.asp&redirType=standards.asp (Accessed 29 September 2017)
3. Manure Storage Regulations. United States Environmental Protection Agency; 2017. Available: http://www.epa.gov/seahome/manure/src/char.htm (Accessed 23 September 2017)
4. Ergül M. Livestock production and environmental pollution. (In Turkish) Yem Sanayi Dergisi. 1989;64:20-25. Turkish
5. Harris BL, Hoffman DW, Mazac FJ. Reducing contamination by improving livestock manure storage and treatment facilities. Natural Resources Conservation Service Office, Texas; 2001.
6. Gilchrist MJ, Greko C, Wallinga DB, Beran GW, Riley DG, Thorne PS. The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance. Environmental Health Perspectives. 2007;115(2):313-316.
7. Pell AN. Manure and microbes: Public and animal health problem? Journal of Dairy Science. 1997;80:2673-2681.
8. Chastain JP, Jacobson LD. Site selection for animal housing and waste storage facilities; 1996. Available:http://www.prairieswine.com/site-selection-for-animal-housing-and-waste-storage-facilities/ (Accessed 12 September 2011)
9. İnan İ. Comparison of the efficiencies of composting and anaerobic digestion processes used for the stabilization of sewage sludges and animal wastes (In Turkish) Graduate School of Natural and Applied Sciences Department of Environmental Engineering Master Thesis; 2012.
10. Statistical Institute, Livestock Statistics 2017 (In Turkish). Available:http://rapor.tuik.gov.tr/1710201608:49:581552374417140253034920617404 8.html (Accessed 22 September 2017)
11. Çiçek A, Erkan O. Sampling and research methods in agriculture economics (In Turkish) Gaziosmanpasa Agriculture Faculty Journal. 1996;12:6. Turkish.
12. Water Pollution Control Regulations; 2004. (In Turkish) Available:http://www.resmigazete.gov.tr/eskiler/2004/12/20041231.htm Turkish (Accessed 13 September 2017)
13. Özturk T. Agricultural buildings (In Turkish) Ondokuz Mayıs, University Faculty of Agriculture. Lecture Book. 2003;49:34-54. Samsun.
14. Cayley J, Johnson J, Ward D. Nutrient management act - Siting regulations for manure storage structures; 2004. Available:http://www.gov.on.ca/OMAFRA/english/engineer/facts/04-11.htm (Accessed 29 September 2017)
15. Mutlu A. A study on environmental pollution created by the wastes produced in the livestock facilities in Adana province and its surroundings (In Turkish) Çukurova Master Thesis, Cukurova Institute of Science, Adana; 1999.

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