World Applied Sciences Journal 20 (2): 205-212, 2012
ISSN 1818-4952
© IDOSI Publications, 2012
DOI: 10.5829/idosi.wasj.2012.20.02.1624

Grazing Effects on Some of the Physical and Chemical Properties of Soil

[1]Sedigheh Zarekia, [2]Mohammad Jafari, [2]Hossein Arzani, [1]Seyyed Akbar Javadi and [3]Ali Ashraf Jafari

[1]Department of Range Management, Science and Research Branch, Islamic Azad University, Tehran, Iran
[2]Faculty of Natural Resources, Tehran University, Tehran, Iran
[3]Gene Bank Research Division, Research Institute of Forests and Rangelands, Tehran, Iran

Abstract: This paper studies short-term effects of grazing management on some of the physical and chemical characteristics of soil in steppe rangelands of Saveh (Markazi Province of Iran). Thus, features such as phosphorus, potassium, nitrogen, organic carbon, electrical conductivity, acidity and soil bulk density have been studied within two projects of range management; the Nemati rangeland with a rest-rotation grazing system for 10 years (moderate grazing intensity) and the Shirali rangeland with continuous grazing during the year (severe grazing intensity). The obtained data was compared with that of a rangeland, which had been excluded for four years. Studies showed that elements such as phosphorus and potassium in the Shirali rangeland are more than the other two regions. However, nitrogen and organic carbon, pH and soil bulk density were not significantly different in these three areas. The results indicate that enclosure and rest-rotation grazing system with moderate grazing intensity leads to small changes in some of the physical and chemical characteristics of soil. Therefore, the effect of management on soil properties requires a longer time in the steppe rangelands.

Key words: Grazing · Soil physical and chemical properties · Steppe rangelands · Iran

INTRODUCTION

Rangelands, as the context for profound economical and social changes in Iranian Nomadic People's lives, have undergone some stress during the past three decades due to excessive grazing (three-time the legal capacity). Destruction of rangelands has faced our country with deep crisis [1]. Soil, one of the most important elements of rangeland ecosystems, is the source of food and moisture content for pasture plants. Excessive grazing is one of the most significant factors causing rangeland degradation and typically, this degradation is effective on vegetation and soil. In general, the effect of grazing on pastures is considered to be in three processes: the loss of plants due to livestock foraging; soil and litter trampling; and deposition of feces and urine. The effects of these processes are hardly distinguishable from each other [2].

Based on studies on rangeland, an important and obvious effect of grazing is the removal of above-ground biomass by livestock and subsequently, a significant impact on the rotation of the nutrients and their absorption [3]. In addition to general effects of grazing on plants, livestock have also other effects on rangeland that subsequently effect on forage production. Generally, nutrients in livestock's feces and urine are useful for forage growth, while trampling and selective grazing can be destructive. Livestock feces and urine are potential sources of nitrogen, phosphorus, potassium, sulfur, magnesium and calcium for plants [4]. Distribution of soil nutrients in a pasture is affected by different factors including parent material, vegetation communities, slope, aspect, kind of livestock, differences in grazing distribution patterns and watering points [5, 6]. Different results have been reported on the effects of different grazing intensities and systems on physical and

Corresponding Author: Sedigheh Zarekia, Department of Range Management, Science and Research Branch, Islamic Azad University, Tehran, Iran.

chemical properties of soil, which can result from the different conditions of the climate, soil, vegetation, rangeland management and kind of livestock. Several studies showed that grazing expedited Nitrogen cycling by stimulating net N mineralization, also by inputting dung and urine to pastures directly. Furthermore, grazing retarded nitrogen cycling by reduction of N-rich and palatable species and by increasing of N-poor species with low litter quality [7]. Most studies showed that exclusion could promote the community productivity, vegetation structure and species diversity [8, 9]. Also intensive livestock grazing leads to the depletion in elemental concentration, resulting in defoliation of vegetation and above and below- ground biomass [10-12]. By contrast, Kohandel *et al*. [13] studied the effect of grazing livestock on nitrogen, phosphorus and potassium in Savojbolagh Rangelands, Iran and concluded that intensive grazing has increased these elements. Steffens *et al*. [14] noticed that the physicochemical properties of soil remained constant after five years of enclosure and that it was improved after 25 years of enclosure in semi-arid steppes of Mongonia. In a study in the steppes of the northern China with different intensities of grazing, Xie and Wittig [15] stated that increasing the grazing intensity reduced organic matter and nitrogen, but the pH- value and potassium were not significantly affected by grazing. In general, they suggested that there is no remarkable difference in the soils of this area in response to grazing intensity. Dormmar *et al*. [16] in southwestern Alberta, after 44 years of grazing, demonstrated that by increasing the grazing intensity, the organic matter, phosphorus and total carbon were reduced, but total nitrogen, acidity and bulk density were increased. In the arid environment of south Tunisia, Tessema *et al*. [17], in a semi-arid savanna of Ethiopia, concluded that the concentration of total nitrogen was higher in sites with light grazing compared with sites exposed to heavy grazing. Similarly, higher concentrations of K, Ca and Na were observed in sites under light grazing.

With investigation of various systems of grazing, Garcia *et al*. [18] stated that the soil organic carbon and total nitrogen were more in rotation grazing treatment than continuous grazing treatment. They concluded that average contents of the other variables except for organic phosphorous (including pH, potassium, organic matter, magnesium, calcium and nitrogen) in the rotation grazing system were more than other grazing systems (controlled and continuous systems). This is because of higher concentration of cattle and higher amount of excreta in rotational grazing compared to the continuous system. Abdel-Magid [19] found that bulk density was not affected by the grazing system (continuous, rotational deferred and short duration rotation) in sandy loam soil. Moradi *et al*. [20] indicated that intensive grazing causes increased bulk density and reduced soil porosity. They stated that not only grazing pressure increases bulk density, but also lack of organic material exacerbates this phenomenon.

Overall, grazing management has different effects on physicochemical properties of soil in distinctive climatic regions. Thus evaluating of effects of livestock grazing is essential to achieve proper management in rangeland ecosystems. This study was conducted to determine the effect of grazing systems on some of the physical and chemical properties of soil in the steppe region of Saveh in Markazi province in Iran.

MATERIALS AND METHODS

The studying area is located at 60 km north-east city of Saveh, Markazi province in Iran (50°35' 49" and 50°49' 11" longitudes, 35°23' 46" and 35°30' 55"altitudes). The average annual precipitation is about 200 mm and the mean annual temperature is 19 °C. The climate is post cold desert arid according to Domartan. The average altitude is 1325 meters above sea level and soil texture is sandy clay loam. This research was done in three areas. Study areas include: 1 - Nemati range: This rangeland is part of winter pastures and for 6 months per year is grazed as rest-rotational with moderate grazing intensity. *Artemisia sieberi –Salsola laricina* is the main type in this rangeland. Mid May is the time of entering of livestock to this area and the time of exiting is early November. This rangeland has been managed for 10 years with this system. 2 - Shirali rangeland: This area is grazed continuously all the year and grazing intensity is heavy. The main vegetation type of this area is *Noaea mucronata- Peganum harmala* 3 - The enclosure area: This area, located within the borders of Nemati rangeland, has been enclosed for 4 years.

To investigate changes in soil parameters in each area, 15 soil samples were taken at the depth of 0-20 cm as random-systematic. In the laboratory, soil samples were dried in an oven at 105°C for 24 hr and then were sieved with a sifter of 2 mm. To measure the organic carbon, Walkly Block method was used. Kjeldahl acid-digestion method and Olsen's method were used to determine total nitrogen and phosphorous respectively. Soil potassium was determined by normal ammonium acetate method. Soil pH and electrical conductivity were determined using pH meter and conductivity meter in saturated mud. Finally, having four samples from each area, the bulk density was determined using paraffin. One way Anova was used to analyze the variance. We used Duncan test to perform comparisons. All the data was run using SAS software statistical program.

RESULTS AND DISCUSSION

Bulk Density: The results demonstrated that grazing management has no significant effect on bulk density (Figure 1a). Although bulk density was highest in Shirali, intermediate in Nemati and lowest in the excluded area, no significant difference was found between the three areas. Abdel-Magid [19] did not find any significant difference in bulk density under continuous grazing, rotationally differed and short-duration rotation grazing system on sandy loam soil. Van Haveren [21] concluded that soil bulk density was not significantly different on sandy loam texture under different grazing intensities. However, its amount was somewhat higher on the grazed pasture. Tate *et al*. [22] in a study in California on sandy loam soil showed that there was no significant statistical difference in bulk density between areas where grazing was excluded for six years and for twenty-six years. In general, many studies cannot find any difference in soil loss, infiltration rate or bulk density of arid and semi-arid rangelands with different grazing intensities [23].

Organic Carbon and Nitrogen: The statistical analysis pointed out that organic carbon and nitrogen means of the three grazing areas were not significantly different (Figure 1b and Figure 1c). However, the amount of organic carbon has been greater in Nemati area than in other areas. It can be concluded that moderate grazing with breaking and transferring plant material and litter to the soil increases the soil organic carbon. Also, the amount of nitrogen in the Shirali area was lower than the other studied areas. There are different results about the effect of grazing on nitrogen, carbon and soil organic matter. As Milchunas and Lauenroth [24] proposed that biogeochemical effects of grazing intensity, especially their influence on C and N, are disputable. Many studies refer to the reverse relationship between grazing intensity and soil nitrogen and organic matter [11, 12, 16, 25, 26]. This can be due to the removal of vegetation by livestock and the deduction of plant covers; and consequently, the decrease of the soil organic matter. However, the effect of grazing on decomposition of soil organic matter is not identical in different rangeland ecosystems. Grazing can increase or decrease organic matter, or have no effect on it. Generally, herbivores may affect the nitrogen and soil organic matter in various ways: 1-They may alter primary production; 2-Livestock can reduce and increase the ground organs of plants and subsequently, reduce and increase the input of nitrogen and carbon from root to soil; 3- Herbivores may alter the litter quality and litter decomposition rates; 4- They can change legumes' frequency and consequently, alter the fixation of nitrogen; 5- Also livestock excreta may increase C and N cycling but reduce nitrogen inputs to soil through evaporation of nitrogen and leaching of urine and feces [27]. However, results showed that the rest- rotation system (for about 10 years) and enclosure for 4 years have increased the amount of the plant cover, especially palatable species, but have minor impact on nitrogen and soil organic carbon. This is strongly consistent with the results of Raiesi Gahrooee [28] which found no difference in grazed and ungrazed areas. They believed that 17 years of enclosure are not sufficient for increasing soil organic matter and nitrogen in semi-arid regions of Iran. Schuman *et al*. [29] believed that Non-breaking of plant residues and mixing them with soil is the main reason for none increasing of organic carbon and nitrogen of the soil during 40 years of enclosure. Also, Liebig *et al*. [30] believed that the effects of grazing management on the amount of total nitrogen in the soil are limited. Similarly, [31-33] found no difference in nitrogen concentration and soil carbon in grazed and ungrazed areas. In a study on an area enclosed for 2 years, where the top vegetation was also created, Al-Seekh *et al*. [34] did not find any significant differences in the amount of organic material. He stated that in the semi-arid regions, about 10 years are required to determine the effects of enclosure on some properties of soil.

Potassium: Based on the results of data analysis, there was a significant difference in K in different areas ($p< 0.01$) (Figure 1d). The highest amount of K was observed in the Shirali rangeland. Due to the presence of livestock throughout the year and higher grazing intensity in Shirali rangeland compared to Nemati rangeland, the amount of soil potassium is higher. The increase in K may have been related to livestock's positive effect on accumulation of K via trampling and their excreta. The results contrast with [13, 18, 35] who estimated that the average content of K was higher in the areas with continuous grazing than in areas with other systems (control and rotational). Though, lower content of soil potassium was reported by Hosseinzadeh *et al*. [11]

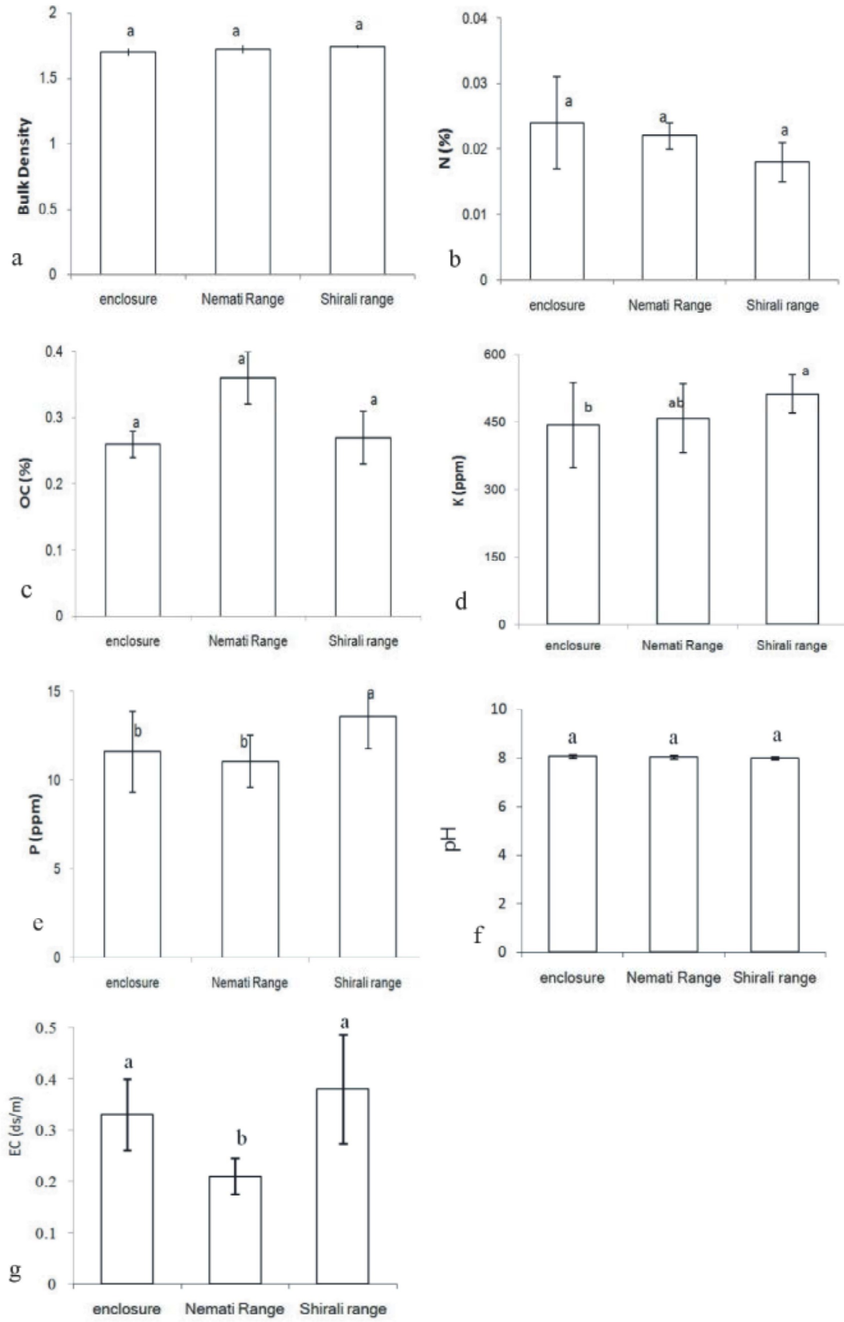

Fig. 1: Different factors in different managements grazing (Enclosure: in 4 years, Nemati Rangeland: rest- rotation system and grazing during six months, Shirali Rangeland: continuous grazing system throughout the year)

in critical area due to soil leaching. On the other hand, Tessema *et al*. [17] demonstrated that the lower content of soil nutrient in the areas with heavy grazing might be related to the lack of animal excreta, used by people for fuel and other purposes. Glaser *et al*. [36] have mentioned the effect of manure on soil nutrient status under heavy grazing in semi-arid areas of northern Tanzania. Haynes and Williams [37] stated consumed potassium (K) by cows is returned to soil but most of this K is from animal urine rather than animal dung.

Phosphorus: The results showed that soil phosphorus was affected by grazing and the value of it in the Shirali rangeland was higher than other areas, but the amount of soil phosphorus in Nemati rangeland and the excluded area showed no variations. The results indicated that heavy grazing intensity increased soil phosphorus levels (Figure 1e) which supports the conclusions by [10, 13, 35, 38]. Increasing of the soil phosphorus level in Shirali rangeland might be related to excreta, litter deposition and more mobility of phosphorus on the surface of the soil due to livestock trampling. Haynes and Williams [37] stated that more than 65% of the phosphorus in the diet consumed by cows is returned as feces to pastures. Soil phosphorus increase has been reported under manure [37, 39]. However, Jeddi and Chaieb [8] found no significant differences between 6- and 12-year exclusions of livestock and continuous grazing in terms of phosphorus. On the contrary Garcia *et al*. [18] in a area with subtropical type climate ascertained that amount of phosphorus in ungrazed area was higher than the grazed area. The increase may have been due to the effect of climate conditions and soil fertility. In this regard, El-Dewiny [40] stated that causing the degradation of organic matter, large amounts of available phosphorus are released. Subsequently, the availability of Phosphorus of the enclosed area is greater than that of the area with higher grazing intensity. In the present study, because of sameness of organic matter and moisture deficiency in soil in all the areas, the animal excreta is the only factor responsible for the increase in phosphorus in the Shirali rangeland.

Soil Acidity: According to data analysis, no significant difference in soil acidity was observed due to the influence of grazing treatments (Figure 1f) Results show that grazing has no effect on the soil acidity. Similarly, no consistent trend was seen for livestock grazing effects on soil acidity in a universal grazing. Similar results were obtained by Xie and Wittig [15] who observed no correlation between soil pH-value and moderate and intensive grazing intensities in the grassland steppes of northern China. Other studies have reported results similar to our findings. As [7, 25] found no significant difference in pH value between the controlled region and regions under different grazing conditions, whereas [11, 35] concluded that pH-value increases with increasing the intensity of grazing. The different climate conditions, plant community and grazing capacity can influence the chemical properties of soil. The relationship between the amount of organic matter and soil acidity is one of the reasons for the reduction of the pH-value in reference area. Also increasing of organic matter in reference area produces carbonic acid. However, the permanent production of it in the soil where root concentration is high leads to the solution of lime and its reduction [35]. According to the results of the present study, the content of organic matter in different areas was approximately equal. In addition, as expected according to the mentioned results, there is no significant difference in pH-value in the studied areas.

Electrical Conductivity: The results presented in this study demonstrated that there was a significant amount of electrical conductivity (EC) in the Shirali rangeland with high grazing intensity compared to Namati area (Figure 1g). It can be related to the inherent differences in different regions or to the conditions that may be imposed on rangeland ecosystems by livestock grazing. Grazing process increases the soil temperature and the soil moisture evapotranspiration [8, 14, 41, 42]. According to these researchers' findings, continuous grazing in the Shirali rangeland has reduced the vegetation and litter cover and consequently soil moisture. Whereupon, soil temperature and evapotranspiration and subsequently, soil salinity and salt increase, which finally leads to an increase in electrical conductivity. This result is in accordance with findings of [25, 43, 44], but it is inconsistent with findings of [9, 30]. They found no difference between the values of electrical conductivity in different grazing treatments. Whereas, there is some salt in cattle excreta contributing to the increase in soil salinity [43]. Also results showed that EC soil in enclosed area was higher than that in the Nemati rangeland. It is possibly due to the presence of *Salsola laricina* whose canopy cover in excluded area is approximately two times more than Nemati rangeland and all productions of *Salsola laricina* fall on the ground. According to Ghorbanian and Jafari [45] the concentration of Na+ in *Salsola rigida* is greater than other elements. Also Ghorbanian and Jafari [45] estimated that the concentration of Na+ under shrub is more than that between shrubs. Parallel to this result, Henteh *et al*. [46] found that different species of *Atriplex sp.* cause soil salination. *Salsola laricina* is a member of chenopodiacea family and can lead to an increase in electrical conductivity in enclosed area. However, this increase does not restrict the plant growth as Ghorbanian and Jafari [45] stated that an amount of eight ds/m is the factor limiting the growth of *Salsola rigida*. Therefore, data showed that the EC values are located in the optimal range of plant growth.

CONCLUSION

- Continuous grazing with severe intensity throughout the year tended to increase the amount of P and K in the soil because of livestock feces.
- The highest amounts of Nitrogen and organic matter were observed in Nemati area with moderate grazing intensity and rotation system but the differences were not significant.
- The effect of soil and water management in arid and semi-arid regions requires a long time and can be seen slowly.

ACKNOWLEDGEMENTS

The Research Institute of Forests and Rangelands financially supported this work. We also thank Farhang Jafari and others for assistance with the fieldwork.

REFERENCES

1. Mesdaghi, M., 1998. Range management in Iran. University of Mashhad Ferdosi Press, pp: 250.
2. Hiernaux, P., C.L. Bielders, C. Valentin, A. Bationo and S. Fernandez-Rivera, 1999. Effects of livestock grazing on physical and chemical properties of sandy soils in Sahelian rangelands. Journal of Arid Environments, 41(3): 231-245.
3. Shariff, A.R., M.E. Biondini and C.E. Grygiel, 1994. Grazing intensity effects on litter decomposition and soil nitrogen mineralization. Journal of range Management, 47: 444-449.
4. Nicol, A., 1987. Feeding livestock on pasture. Occasional Publication, New Zealand Society of Animal Production, (10): 145.
5. Barrow, N., 1967. Some aspects of the effects of grazing on the nutrition of pastures. Journal of the Australian Institute of Agricultural Science, 33(4): 254-262.
6. Wedin, W., C. West, D. Marx and A. Mallarino, 1989. Spatial variability of soil chemical properties in grazed pastures. Soil Science Society of America Journal, 53(3): 784-789.
7. Shan, Y., D. Chen, X. Guan, S. Zheng, H. Chen, M. Wang and Y. Bai, 2011. Seasonally dependent impacts of grazing on soil nitrogen mineralization and linkages to ecosystem functioning in Inner Mongolia grassland. Soil Biology & Biochemistry, 43: 1943-1954.
8. Jeddi, K. and M. Chaieb, 2010. Changes in soil properties and vegetation following livestock grazing exclusion in degraded arid environments of South Tunisia. Flora-Morphology, Distribution, Functional Ecology of Plants, 205(3): 184-189.
9. Huang, W.H.Z., Z. Zhang and G. Wu, 2011. Effects of grazing on the soil properties and C and N storage in relation to biomass allocation in an alpine meadow. Journal of Soil Science and Plant Nutrition, 11(4): 27-39.
10. Dormaar, J.F., B.W. Adans and W.D. Willms, 1997. Impacts of rotational grazing in mixed prairie soils and vegetation. Range Management, 50: 647-651.
11. Hosseinzadeh, G., H. Jalilvand and R. Tamartash, 2010. Short Time Impact of Enclosure on Vegetation Cover, Productivity and some Physical and Chemical Soil Properties. Journal of Applied Sciences, 10: 2001-2009.
12. Pei, S., H. Fu and C. Wan, 2008. Changes in soil properties and vegetation following exclosure and grazing in degraded Alxa desert steppe of Inner Mongolia, China. Agriculture, Ecosystems & Environment, 124(1): 33-39.
13. Kohandel, A., Arzani H. and M. Hosseini Tavassol, 2006. Effect of grazing intensity on N. P. K of soil. Iran-Watershed management Science and Engineering, 3(6): 59-65.
14. Steffens, M., A. Kolbl, K.U. Totsche and I. Kogel-Knabner, 2008. Grazing effects on soil chemical and physical properties in a semiarid steppe of Inner Mongolia (PR China). Geoderma, 143(1-2): 63-72.
15. Xie, Y. and R. Wittig, 2004. The impact of grazing intensity on soil characteristics of Stipa grandis and Stipa bungeana steppe in northern China (autonomous region of Ningxia). Acta Oecologica, 25(3): 197-204.
16. Dormaar, J.F., S. Smoliak and W.D. Willms, 1989. Vegetation and Soil Responses to Short Duration Grazing on Fescue Grasslands. range management, 42(3): 252-256.
17. Tessema, Z., W. De Boer, R. Baars and H. Prins, 2011. Changes in soil nutrients, vegetation structure and herbaceous biomass in response to grazing in a semi-arid savanna of Ethiopia. Journal of Arid Environments, 75: 662-670.
18. Garcia, M.R.L., A.A.M. Sampaio and E. Nahas, 2011. Impact of different grazing systems for bovine cattle on the soil microbiological and chemical characteristics. Revista Brasileira de Zootecnia, 40(7): 1568-1575.

19. Abdel-Magid, A.H., G.E. Schuman and R.H. Hart, 1987. Soil bulk density and water infiltration as affected by grazing systems. Journal of range Management, 40: 307-309.
20. Moradi, H.R., S. Mirnia and S. Lahourpour, 2008. Effect of grazing intensities on the soil physical properties and Vegetation cover of Charandoo summer rangelands in Kurdistan Province. Iranian journal of Range and Desert Reseach, 15(3): 369-378.
21. Van Haveren, B.P., 1983. Soil bulk density as influenced by grazing intensity and soil type on a shortgrass prairie site. Journal of Range Management, 36: 586-588.
22. Tate, K.W., D.M. Dudley, N.K. McDougald and M.R. George, 2004. Effect of canopy and grazing on soil bulk density. Rangeland Ecology & Management, 57(4): 411-417.
23. Vallentine, J.F., 1989. Range development and improvements: Academic Press, Inc.
24. Milchunas, D.G. and W.K. Lauenroth, 1993. Quantitative effects of grazing on vegetation and soils over a global range of environments. Ecological Monographs, 63(4): 327-366.
25. Bagheri, R., S.M. Mohseni and M. Chaeichi, 2009. Effect of grazing intensity on some soil chemical properties in a semi-arid region Study case: Khabr National Park News and near rangeland. Rangeland, 3(3): 395-412.
26. Kumbasli, M., E. Makineci, M. Cakir and M. Ozturk, 2010. Long term effects of red deer (Cervus elaphus) grazing on soil in a breeding area. Journal of Environmental Biology, 31(1-2): 185-188.
27. Pin˜eiro, G., J.M. Paruelo, E.G. Jobba´gy, R.B. Jackson and M. Oesterheld, 2009. Grazing effects on belowground C and N stocks along a network of cattle exclosures in temperate and subtropical grasslands of South America. Global Biogeochemical Cycles, 23(2): GB2003.
28. Raiesi Gahrooee, F., E. Asadi and J. Mohammadi, 2005. Effects of Long-term Grazing on the Dynamics of Litter Carbon in Natural Rangelands of Sabzkou of Chaharmahal Va Bakhtiary. JWSS-Isfahan University of Technology, 9(3): 81-92.
29. Schuman, G., J. Reeder, J. Manley, R. Hart and W. Manley, 1999. Impact of grazing management on the carbon and nitrogen balance of a mixed-grass rangeland. Ecological Applications, 9(1): 65-71.
30. Liebig, M., J. Gross, S. Kronberg, J. Hanson, A. Frank and R. Phillips, 2006. Soil response to long-term grazing in the northern Great Plains of North America. Agriculture, Ecosystems & Environment, 115(1): 270-276.
31. Binkley, D., F. Singer, M. Kaye and R. Rochelle, 2003. Influence of elk grazing on soil properties in Rocky Mountain National Park. Forest Ecology and Management, 185(3): 239-247.
32. Dahlgren, R., M. Singer and X. Huang, 1997. Oak tree and grazing impacts on soil properties and nutrients in a California oak woodland. Biogeochemistry, 39(1): 45-64.
33. Zaady, E., P. Groffman and M. Shachak, 1998. Nitrogen fixation in macro-and microphytic patches in the Negev desert. Soil Biology and Biochemistry, 30(4): 449-454.
34. Al-Seekh, S.H., A.G. Mohammad and Y.A. Amro, 2009. Effect of Grazing on Soil Properties at Southern Part of West Bank Rangeland. Hebron University Research Journal, 4(1): 35-53.
35. Javadi, S., M. Jafari, H. Azarnivand and G. Zahedi, 2006. Investigation on grazing upon soil parameters at Lar summer rangeland. Journal of Agricultural Sciences, 11(4): 71-78.
36. Glaser, B., J. Lehmann, M. Fuhrboter, D. Solomon and W. Zech, 2001. Carbon and nitrogen mineralization in cultivated and natural savanna soils of Northern Tanzania. Biology and fertility of soils, 33(4): 301-309.
37. Haynes, R. and P. Williams, 1993. Nutrient cycling and soil fertility in the grazed pasture ecosystem. Advances in Agronomy, 49(1): 19-199.
38. Jusoff, K., 1988. Influence of sheep grazing on soil chemical properties and growth of rubber (Hevea brasiliensis) in Malaysia. Agroforestry Systems, 7(2): 115-120.
39. During, C. and W. Weeda, 1973. Some effects of cattle dung on soil properties, pasture production and nutrient uptake. New Zealand Journal of Agricultural Research, 16: 423-430.
40. El-Dewiny, C., K. Moursy and H. El-Aila, 2006. Effect of organic matter on the release and availability of phosphorus and their effects on spinach and radish plants. Research Journal of Agriculture and Biological Sciences, 2(3): 103-108.
41. Shaltout, K., E. El-Halawany and H. El-Kady, 1996. Consequences of protection from grazing on diversity and abundance of the coastal lowland vegetation in Eastern Saudi Arabia. Biodiversity and Conservation, 5(1): 27-36.
42. Yates, C.J., D.A. Norton and R.J. Hobbs, 2000. Grazing effects on plant cover, soil and microclimate in fragmented woodlands in south western Australia: implications for restoration. Austral Ecology, 25(1): 36-47.

43. Ajorlo, M., R. Abdullah, A.H.M. Hanif, R.A. Halim and M.K. Yusoff, 2011. Impacts of livestock grazing on selected soil chemical properties in intensively managed pastures of Peninsular Malaysia. Journal of Tropical Agricultural Science, 34: 109-121.
44. Chaneton, E.J. and R.S. Lavado, 1996. Soil nutrients and salinity after long-term grazing exclusion in a Flooding Pampa grassland. Journal of Range Management, 49: 182-187.
45. Ghorbanian, D. and M. Jafari, 2007. Study of soil and plant characteristics interaction in *Salsola rigida* in desert lands. Iranian Journal of Range and Desert Research, 14(1): 1-7.
46. Henteh, A., M. Jafari, N. Zargham and C.M.A. Zare, 2005. Effects of Atriplex canescens on some soil characteristics Case study: Zarand, Saveh. Pajouhesh & Sazandegi, 68: 15-21.