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Livelihood Sustainability and Land Degradation in Central Pakhtunkhwa of Pakistan

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Abstract Land Degradation (LD) is a universal problem influencing all areas of human prosperity all over the world. The aim of this research is to study the farming household livelihoods sustainability and land degradation, in Mardan district of Khyber Pakhtunkhwa Pakistan. By using Slovin's "formula", 90 farmers were "randomly" selected through a total of 857 registered farmers. Primary data were collected through structure questionnaire face to face interview from the farming households (HH) and was analysed by using descriptive statistics and Chi-square test. It was found that as a result of the LD farmers land size (44.44%) was decreased but not significant as of the chi-value. Also decline in crop yield (42.22%) was reported. The tillage degradation of the land increased the eroadibility of soil (24.44%) and decreased its yield (36.67%) with a significant association of the perceptions of the farmers. The overgrazing has also affect on the LD by decreasing the plant density (16.67%), increased the soil compaction and trampling by cattle. The soil structure LD having also consequences for the farmer's livelihoods like decreased the food production and increased the chances of droughts. Salinization degradation decreased the productivity of land, income and increased the water scarcity, affect the plant vegetative growth and also results low rain fall which alternatively affect the sustainability of the farmer's livelihoods. It was concluded that LD is an enormous threat to the future sustainability and food security of the farmers. The study recommends for a long- term financial commitment and improved coordination of investments, coupled by allowing the family unit to make the right choices about their livelihoods and family planning to reduce the pressure on limited resources by fostering diversifications of income sources for the households for their future livelihoods sustainability and food security.

Keywords: *farming households, land degradation, farmer's socio-economic conjectures*

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1. Introduction

Land degradation (LD) in most developed and developing countries is whirling into a remarkable constraint to future development and progress towards the rural and urban livelihoods sustainability [1], as approximately 40-75% of the world's agricultural land's output is reduced due to LD [2,3] coupled by 30% of woodlands and 10% of grasslands experiencing degradation [4]. LD is widespread and is lowering the productive capacity of the land in these countries [5]. In current decades, many of the world nations are worried by the changes that anthropological activities have shaped in Earth's life support system [6] as the human population has doubled in the past 40 years and hence quickened the pace of LD [7]. The most common attributes to the LD is the pressure of population on resources and growth in numbers will cause land to be used more heavily, and that as the per capita area of arable and grazing land grows smaller, the sheer necessity of production will force farmers to use land in disregard of the long-term consequences and resulted very severe degradation of land [8]. It is assessed that around 2.6 billion individuals globally are affected by LD in more than a hundred countries, affecting over 33% of the earth's land outward [9,10].

LD is on a very basic level the exhaustion, expulsion and loss of biodiversity that happens because of human movement and cataclysmic events, for example, fire, deforestation, poor harvest, creature farming works on, quarrying, human settlement designs and physical topography and climatic changes, especially dry spell [6,11]. A global survey suggests that 40% of agricultural land is already degraded to the point that yields are greatly reduced, and a further 9% is degraded to the point that it cannot be cultivated for productive use by farm level measures. Soil erosion, nutrient depletion and other forms of LD reduce water productivity and affect water availability, quality, and storage. Reversing these trends entails tackling the underlying social, economic, political and institutional drivers of unsustainable land use [8].

LD shows itself from various perspectives, likewise vegetation may give fuel and fodder, turns out to be increasingly rare, water passages disappear, soils turn out to be thin and stony and prickly weeds prevail in once-rich fields. These indications have conceivably extreme effects for land users and for individuals who depend for their living on the results of a health land. These impression of LD are the typical perspectives of observers worried about a decaying situation and the declining livelihoods of land farmers [5]. Often LD is perceived as having only negative effects for farmers and society alike. These effects are far-reaching with off-site costs extending well beyond the site where LD has occurred. The effects of LD may be experienced by future generations, affecting how they can use the land.

There is an increasing concern over rural livelihoods and the food security of poor communities in developing countries and for this it is vital that land quality is maintained [5]. From the above background it is cleared LD is a worldwide natural and development issue. Cutting-edge quantitative data is expected to help policy and action for nourishment and water security, financial advancement, natural uprightness and quality conservation. Tragically on account of Mardan District of Khyber Pakhtunkhwa-Pakistan, a significant part of the investigation work done as such far ashore LD evaluation has been founded on utilization of Remote detecting/demonstrating, without approval of a similar utilizing real field assessment approaches. This examination was along these lines structured and completed utilizing the farmers land degradation evaluation system with the perspectives of the farmers for the future sustainability of the livelihood. This study aims to evaluate the land degradation and livelihood assessment for the future sustainability if the area with the specific objectives to study the the LD of the farmers and its effect on the livelihoods and to establish the links between LD and impacts on farmer's future livelihoods.

2. Materials and Methods

2.1. Selection of Study Area

One district, Mardan of the central Pakhtunkhwaof Pakistan, was the research area. The district comprises of three Tehsils, i.e. Mardan, Takhtbai and Katlang, having 74 Union Councils (UCs). It is one of the best agriculture areas due to its agro-climatological suitability for cultivation of food and economic crops. This study was conducted in the four purposively selected UCs (Figure 1), i.e. Toru (UC-I), Garhi Kapoora (UC-II), Lund Khwar (UC-III), Katlang-1 (UC-IV). The reason of purposive sampling was the maximum numbers of registered farmers with the agriculture extension of the district.

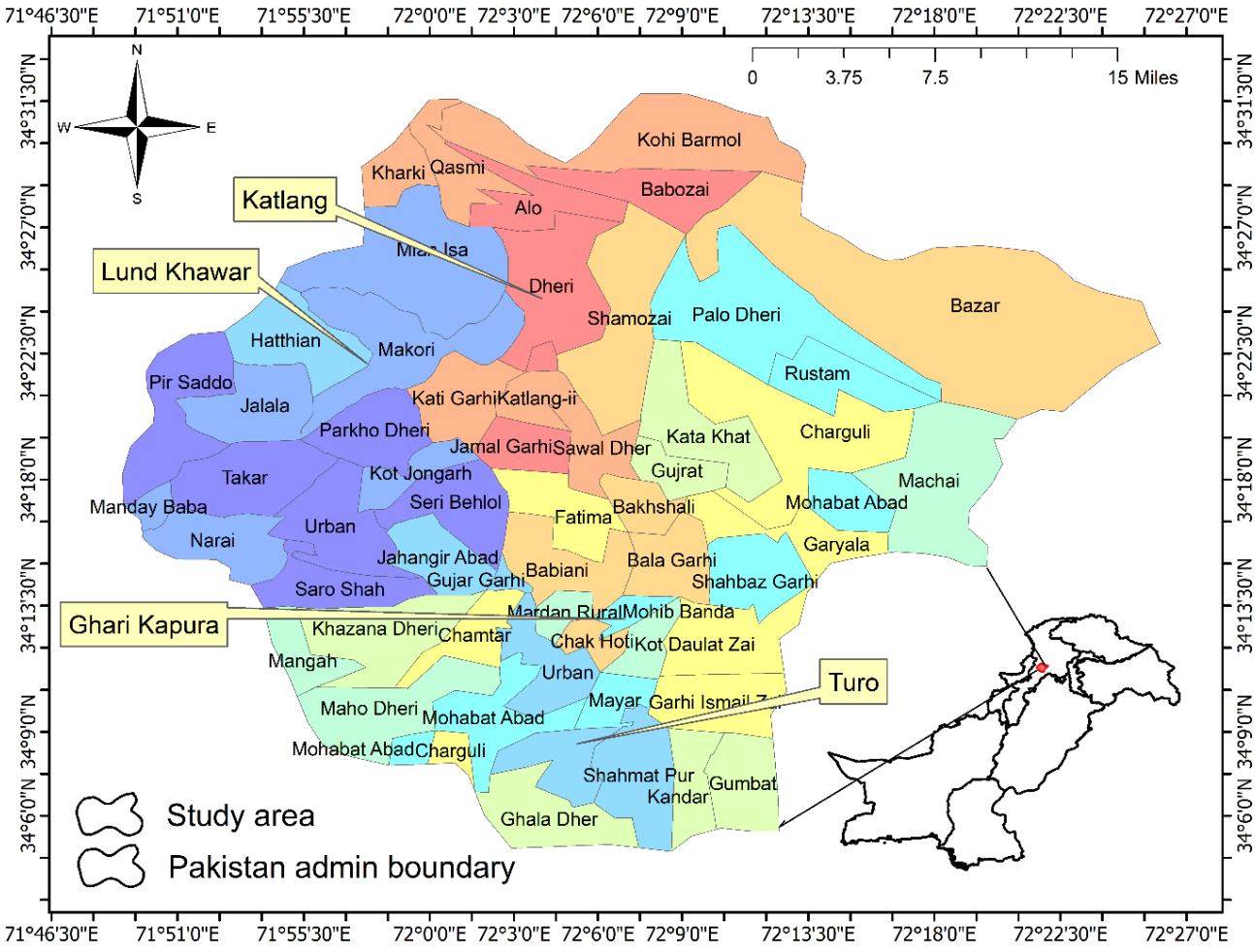

Figure 1. Pakistan Map (small) showing the study district the selected union councils

Purposive sampling and proportionate random sampling was done to obtain the desired sample from the list of register farmers. The total numbers of registered farmers in the selected UCs were 857. Proportionate random sampling was done to obtain representative farmers for the sample size by the use of Slovin's (1960) formula of sample size determination for the simple random sample and thus a total of 90 farmers were selected as a sample size that distributes proportionately among the UCs. Data were collected through a pretested semi-structured questionnaire from the farm households. For data analysis, Statistical Package for Social Sciences (SPSS) software version 22 was used for descriptive statistics and percentages.

3. Results and Discussion

3.1. Land Degradation Effect on Farmer's Land Size

From all over the world, over 20% of cultivated areas, 30% of forests and 10% of grasslands are suffered from degradation and one half billion people are affected [12]. In Ethiopia during 1977, 1989/92 and 2001/02, there were changes in farm size which were one, 0.5 and 0.75 hectares, respectively [13]. Similarly, Kebede [14] reported that the land holding per household was 0.55 ha. This pointed that the farm size had changed up and down through the advancements of years, which brings in farming practices shift based on the available land resource in hand. The data in Table 1, showed that most (44.44%) of the farmers indicated that there was decline in their land size, however, (34.44%) and (21.12%) reported no change and increase respectively. The main reason for the declining was sharing of land with new household formations. Another reason for declining their land size according to the respondents is that government was taken their land for development of infrastructure which negatively affected their livelihood. Those people who indicated that their land holding sizes had increased because of some land inheritance from parents was the major source of the land which was positively affected their livelihood.

Table 1. Distribution of farmers on the basis of land degradation effect on land size

Effect on Land size	UC-I	UC-II	UC-III	UC-IV	Total
No change	7(33.33)	14(33.33)	4(33.33)	6(40)	31(34.44)
Decreased	9(42.86)	20(47.62)	5(41.67)	6(40)	40(44.44)
Increased	5(23.81)	8(19.05)	3(25)	3(20)	19(21.12)
Chi-square= 7.0907, p-value=0.312543 as p < .05(not significant)					

*Frequency (percentage)
Source: Field survey data, 2017.

3.2. Land Degradation Effect on Crop Yield of the Farmer's

More than 99% of human food comes from the land [15], thus establishing a relationship between LD and yield loss is not an easy task in various reasons [16]. The data regarding land degradation effecting on crop yield of the farmers are presented in Table 2, which showed that 42.22% was decreasing in crop yields, while, (32.22%) and (25.56%) indicated no change and increase trend respectively. According to the farmers, the factors which are resulting in increasing in crop yield are better application of chemical fertilizer, better farming practice, applications of improved seed, compost applications and better weather conditions because these factors improved their livelihood. On the other side, those who are reporting a decline trend in crop yield mentioned that the reason were the increasing cost of chemical fertilizer and frequent cultivation of land which affected their livelihood negatively.

Table 2. Distribution of farmers on the basis of land degradation effect on crop yield

Effect in crop yield	UC-I	UC-II	UC-III	UC-IV	Total
No change	6(28.57)	14(33.33)	3(25)	5(33.33)	29(32.22)
Decreased	10(47.62)	16(38.10)	6(50)	6(40)	38(42.22)
Increased	5(23.81)	12(28.57)	3(25)	4(26.67)	23(25.56)
Chi-square = 0.9157, p-value=0.988605, not significant at p < .05.					

*Frequency (percentage)
Source: Field survey data, 2017.

3.3. Water Degradation Effects on Farmer's Livelihood

Water erosion not only effects the soil, plants and wildlife, but the water supplying itself. When the rainwater erodes the soil, it can lead to diminished water quality problems. After the eroded topsoil reaches the water sources, it increases the presence of nitrogen and phosphorous in the water. This results in reducing water oxygen levels and diminishing water quality [17]. The extensive occurrence of water degradation combined with the severity of off-site and on-site effects have made water degradation in Ontario because of soil conservation efforts. Water degradation rate and magnitude is controlled by slope gradient, soil erodibility, rainfall and runoff, cropping and vegetation [18]. The data in Table 3, shows that 32.22% of farmers indicated increasing land fragmentation, while 22.22%, 21.11%, 14.45% and 10% of farmers indicated crop growth, vegetation loss, land management and soil respectively, are the effects of water degradation and seriously effected on farmers livelihood.

Table 3. Distribution of farmer's on the basis of water degradation effects on livelihood

Effect in crop yield	UC-I	UC-II	UC-III	UC-IV	Total
No change	6(28.57)	14(33.33)	3(25)	5(33.33)	29(32.22)
Decreased	10(47.62)	16(38.10)	6(50)	6(40)	38(42.22)
Increased	5(23.81)	12(28.57)	3(25)	4(26.67)	23(25.56)
Chi-square = 0.9157, p-value=0.988605, not significant at p < .05.					

*Frequency (percentage)
Source: Field survey data, 2017.

3.4. Tillage Degradation Effects on Farmer's Livelihood

Tillage erosion has been identified as an important global soil degradation process that has to be accounted for when assessing the erosional impacts on soil productivity, environmental quality or landscape evolution

[19]. Tillage erosion had been identified as a major process of soil redistribution on sloping arable land [20]. The data in Table 4, shows that 36.67% of the farmers pointed the decline in yield is the effect of tillage degradation while 24.44% pointed the increase erodibility of soil. The data also showed that 17.78%, 12.22% and 8.89% of the farmers indicated land management, organic matter decline and poor cultivation respectively, which were the effects of tillage degradation.

Table 4. Distribution of farmer's on the basis of tillage degradation effects on livelihood

Effects of tillage degradation	UC-I	UC-II	UC-III	UC-IV	Total
Increased erodibility of soil	4(19.05)	10(23.81)	3(25)	5(33.33)	22(24.44)
Decreased in yield	7(33.33)	16(38.09)	4(33.33)	6(40)	33(36.67)
Problem in terracing	5(23.81)	8(19.05)	2(16.67)	1(6.67)	16(17.78)
Poor cultivation	3(14.29)	4(9.52)	1(8.33)	0(00)	8(8.89)
Organic matter decline	2(9.52)	4(9.52)	2(16.67)	3(20)	11(12.22)
	Chi-square=3.5683, p-value=0.990029, p < .05.				

*Frequency (percentage)
Source: Field survey data, 2017.

3.5. Overgrazing Effects on Farmer's Livelihood

Worldwide soil degradation caused by overgrazing is a problem. High grazing pressure reduces plant density which ends in changes of the botanical composition of a pasture. The effect that grazing has on a plant depends on the timing, frequency, intensity of grazing and its opportunity to re-grow. Overgrazing adversely effects soil properties, which leads to reducing infiltration, speeding up runoff and soil erosion [21]. The data in Table 5, showed that 32.22% of the farmers pointed trampling by cattle is one of the effects of overgrazing, while 20% of the farmers indicated that overgrazing reduced usefulness of land. The data also showed that 17.78% of farmers indicated that due to overgrazing there is an increase in soil compaction while 16.67% of the farmers indicated decreasing plant density is one of the effects of overgrazing.

Table 5. Distribution of farmer's on the basis of overgrazing effects on livelihood

Overgrazing effects	UC-I	UC-II	UC-III	UC-IV	Total
Reduced usefulness of land	6(28.57)	7(16.67)	2(16.67)	3(20)	18(20)
Trampling by cattle	5(23.81)	16(38.09)	3(25)	5(33.33)	29(32.22)
Decreases plant density	4(19.05)	7(16.67)	2(16.67)	2(13.33)	15(16.67)
Soil nutrients quality decrease	2(9.52)	5(11.90)	2(16.67)	3(20)	12(13.33)
Increase soil compaction	4 (19.04)	7(16.67)	3(25)	2(13.33)	16(17.78)
Chi-square = 3.8135. The p-value is .986571. p < .05.					

*Frequency (percentage)
Source: Field survey data, 2017.

3.6. Soil Structure Degradation Effects on Farmer's Livelihood

Soil structure is one of the most important properties affecting crop production as it determines the depth that roots will penetrate, the quantity of water that may be hold on within the soil and also the movement of air, water and soil fauna [22,23]. Soil quality is strictly associated with soil structure and much of the environmental damage in intensive cultivable lands like erosion, desertification and susceptibility to compaction, as well as originate from soil structure degradation. Moreover, soil functions powerfully depend upon the standard of soil structure, with optimum structure defined as soil having the widest range of possible uses [24]. The data regarding soil structure degradation effects on farmers are presented in Table 6, which showed that 40% of the farmers indicate the loss of fertile land is by soil structure degradation, while 20% indicated that soil structure degradation can restrict seedling germination. The data also showed that 18.89% of the farmers point that decreased food production is one of the effects of soil structure degradation, while 14.44% and 6.67% pointed droughts and ecological are imbalanced respectively. Chi-square test was used to check the relations and the p-value means the significance.

Table 6. Distribution of farmer's on the basis of soil structure degradation effects

Effects of soil structure degradation	UC-I	UC-II	UC-III	UC-IV	Total
Decreased food production	5(23.81)	7(16.676)	3(25)	2(13.33)	17(18.89)
Droughts	4(19.05)	6(14.29)	1(8.33)	2(13.33)	13(14.44)
Ecological imbalance	1(4.76)	5(11.90)	0(00)	0(00)	6(6.67)
Restrict seedling germination	3(14.28)	8(19.05)	3(25)	4(26.67)	18(20)
Loss of fertile land	8(38.10)	16(38.10)	5(41.67)	7(46.67)	36(40)
	Chi-square = 2.8771, p-value is .996351, p < .05.				

*Frequency (percentage)
Source: Field survey data, 2017.

3.7. Salinization Effects on Farmer's Livelihood

One of the most severe ecological problems is that warning agricultural production of crops is salinization. Most of the crops are delicate to salinization caused by high concentrations of salts in the soil. It is estimated that the cost of salinization to agriculture is about $US 12 billion a year, and is expected to increase as soils [25]. Salinization can not only reduce the crops production, but also effects soil physical properties, chemical properties, and ecological balance of the area. The impacts of salinization includes decline in agricultural production, low economic returns and soil erosions, [26]. The data in Table 7, showed that 31.11% of farmers indicated decrease productivity of land is the effect of salinization, while 21.11% indicated that income decrease is the effect of salinization. The data also showed that 20% of farmers indicate that plant vegetative growth is effected

by salinization, while 16.67% and 11.11% of farmers pointed low rainfall and increasing water scarcity are the main reasons respectively. The data as a whole revealed that the salinization degradation effect the productivity of the farmers filed and hence there livelihoods.

Table 7. Distribution of farmers on the basis of salinization effects on livelihood

Effects of Salinization degradation	UC-I	UC-II	UC-III	UC-IV	Total
Decrease productivity of land	6(28.57)	12(28.57)	4(33.33)	6(40)	28(31.11)
Income decrease	5(23.81)	8(19.05)	2(16.67)	4(26.67)	19(21.11)
Increase water scarcity	2(9.52)	5(11.90)	1(8.33)	2(13.33)	10(11.11)
Plant vegetative growth effect	4(19.05)	10(23.81)	3(25)	1(6.67)	18(20)
Low rainfall	4(19.05)	7(16.67)	2(16.67)	2(13.33)	15(16.67)
	Chi-square = 3.2098, p-value = 0.993873, p < .05.				

*Frequency (percentage)
Source: Field survey data, 2017.

4. Conclusion and Recommendations

From all over the world, land degradation is an enormous threat to the future sustainability and food security. Findings of the study concluded that farmers land size were decreased as a result of different types of land degradation. The size of land decline having a drastic affect on the crop yields and hence livelihoods. Also increased land fragmentation is the effect of water and tillage degradation. Most of the farmer's livelihoods is negatively affected by land degradation from land size, crop yields and overall agricultural productivity which having a great threat to the future sustainability of the farmer's livelihoods.

Farmers livelihood were affected by the land degradation in the area and to addressing future livelihood sustainability this requires long- term financial commitment and improved coordination of investments, household member's family unit needs to make the right choices about their livelihoods and family planning to reduce the pressure on limited resources by fostering diversifications of income sources for the households. This may also be accompanied by sustainable environmental training, capacity building, agricultural extension for land, livestock, water management, consider new methods of ecosystem services to help communities for their future livelihoods sustainability and security.

References

[1] Deresa, F., and Legesse, T. (2015). Cause of Land Degradation and Its Impacts on Livelihoods of the Population in Toke Kutaye Woreda, Ethiopia. International Journal of Scientific and Research Publications, 5, 5.

[2] Jolejole-Foreman, M. C., Baylis, K., and Lipper, L. (2012, August). Land Degradation's Implications on Agricultural Value of Production in Ethiopia: A look inside the bowl. In International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguacu, Brazil. http://ageconsearch. Umn edu/bitstream/126251/2/IAAE2012_JForemanBaylisLipper. pdf.

[3] United Nations Convection to Combat Desertification [UNCCD]. (2013). Economic Assessment of Desertification, Sustainable Land Management and Resilience of Arid, Semi-arid and Dry Sub-humid Area. In Westerberg, V., Olsen, N., Stoeckli, V., Jaquet, S., Roth, A., David, E., Baker, L., Castillo, V. and Shim, K. (Eds.), 2nd Scientific Conference of United Nations Convention to Combat Desertification and Global Risk Forum Davos, ISBN 978-92-95043-65-7, Bonn, Germany.

[4] Raven, P. H. (2012). Restoring natural capital: science, business, and practice. Island press.

[5] Stocking, M., Murnaghan, N. (2013). A Handbook for the Field Assessment of Land Degradation. London: Routledge.

[6] Goudie, A. S. (2018). Human impact on the natural environment. John Wiley & Sons.

[7] Hooke, R. L., Martín-Duque, J. F., and Pedraza, J. (2012). Land transformation by humans: a review. GSA today, 22(12), 4-10.

[8] Blaikie, P. (Ed.), Brookfield, H. (Ed.). (2015). Land Degradation and Society. London: Routledge.

[9] Sassen, S. (2014). Expulsions: Brutality and complexity in the global economy. Harvard University Press.

[10] Brevik, E. C., Cerdà, A., Mataix-Solera, J., Pereg, L., Quinton, J. N., Six, J., and Van Oost, K. (2015). The interdisciplinary nature of SOIL. Soil, 1(1), 117-129.

[11] Goudie, A. S., & Viles, H. A. (2013). The earth transformed: an introduction to human impacts on the environment. John Wiley & Sons.

[12] Bai, Z.G., D.L. Dent, L. Olsson and M. E. Schaepman. 2008. Global assessment of land degradation and improvement 1: Identification by remote sensing. Report 2008/01, FAO/ISRIC - Rome/Wageningen.

[13] Wiggins, S. 2003. "Farm Size Dynamics" Overseas Development Institute (ODI).

[14] Kebede, B. 2006. "Land reform, distribution of land and in- situations in Rural Ethiopia: Analysis of inequality with dirty data. School of Development Studies, Centre for the Study of African Economies, University of Oxford.

[15] Pimentel, D., and M. Pimentel. 2000. Feeding the world's population. J. Bioscience 50(5), 387.

[16] Vieira, R. M., S. P. Tomasella, J. Alvalá, R. C. S. Sestini, M. F. Affonso, A. G. Rodriguez, D.A. Barbosa, A. A. Cunha, A. P. M. A. Valles, G. F. Crepani, E. de Oliveira, S. B. P. de Souza, M. S. B. Calil, P. M. de Carvalho, M. A. Valeriano, D. M. Campello and M. O. Santana. 2015. Identifying areas susceptible to desertification in the Brazilian north-east. J. of Solid Earth. 6, 347-360.

[17] Christensen, D. 2011. Negative effects of water erosion. Retrieved from: https://www.hunker.com/13427911/negative-effects-of-water-erosion.

[18] Ritter, J. 2015. Soil erosion - causes and effects, Order No. 87-040. Replaces OMAFRA Factsheet. ISSN 1198-712X.

[19] Oost, K. V., G. Govers, D. Alba and T. A. Quine. 2006. Tillage erosion: a review of controlling factors and implications for soil quality. Volume: 30 issue: 4, p. 443-466.

[20] Heckrath G., J. Djurhuus, T. A. Quine, K.V. Oost, G. Govers and Y. Zhang. 2005.Tillage erosion and its effect on soil properties and crop yield in Denmark. J. Environ. Qual. 34, 312-324.

[21] Radacsi, A., and Czegledi, L. 2005. Overutilization of pastures by livestock. University of Debrecen, Centre of agricultural sciences, faculty of agronomy, Department of animal breeding and nutrition, Debrecen.

[22] Hermavan, B., and K.C. Cameron. 1993. Structural changes in a silt loam under long-term conventional or minimum tillage. J. Soil Till. Res. 26, 139-150.

[23] Langmaack, M. 1999. Earthworm communities in arable land influenced by tillage, compaction, and soil. Z. O ¨kol. Natursch 8, 11-21.

[24] Dexter, A.R. 2002. Soil structure: the key to soil function. Adv. GeoEcology 35, 57-69.

[25] Ghassemi, F., A.J. Jakeman and H.A. Nix. 1995. Salinization of land and water resources. Univ. of New South Wales Press, Ltd., Canberra, Australia.

[26] Hu, Y., and U. Schmidhalter. 2002. Limitation of salt stress to plant growth. p. 91-224. In: Hock B., Elstner C.F., editors. Plant Toxicology. CRC Press, 2004 Publisher, 4rt edn. New York.