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Land Use Change Effect on Physical, Chemical, and Mineralogical Properties of Calcareous Soils in Western Iran

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ABSTRACT

Aims Todays, the change of range land to agricultural uses by unplanned and improper locations of water supply wells would be led to sever reduction of ground water level and subsequently fully land degradation. However, the aim of this study was to investigate the effect of land use change on soil physical, chemical, and mineralogical properties.
Materials & Methods In this study, 9 soil profiles in Kangavar plain with range and different arable land uses were dug and described. Some properties of soil samples were determined, then, pedons classified to Inceptisols, Entisols, and Mollisols orders.
Findings The result showed that with land use change from range land to agriculture, content of soil clay reduces (from average 47.6% to 41.4%). With land use change of range to cropland properties including pH, organic matter and calcium carbonate equivalents contents decreased. The amount of soluble potassium in the surface horizons in range lands was more than arable land. In the cropland pedons, the amount of soluble sodium reduced compared to rangeland pedons. The results showed that land use change had no effect on clay minerals type, but changed those value. According to the results, in range land, illite and vermiculite percentage were greater than crop land soil pedons. The smectite content in arable land use more frequency than range land (data have significant difference at $p < 0.05$ level).
Conclusion It was concluded that long-term agriculture in study area induced to sever reduction of nutrient and consequently caused to soil degradation in whole plain.
Keywords Macro-nutrient; Clay mineral; Soil texture

CITATION LINKS

[1] Global forest resources assessment 2005, Progress toward ... [2] 9th session of the commission for the controlling the desert ... [3] Challenges of a changing ... [4] Land use change prediction using a hybrid ... [5] Land-use planning using a quantitative model and Geographic ... [6] Land-use change and soil degradation: A case ... [7] Assessment the effects of land use changes on ... [8] Effect of land use on physical, chemical and mineralogical ... [9] Impacts of land use change and slope positions on some ... [10] Effect of land use change on soil properties and clay ... [11] Investigating the soil properties affected by land use ... [12] Micromorphology and clay mineralogy of loess-derived ... [13] Effect of land use and land cover change on some soil chemical ... [14] Variation of land use and land cover effects on some soil ... [15] Effects of agroecological land use succession on soil properties ... [16] Soil moisture and temperature regimes map ... [17] Keys to soil taxonomy ... [18] Particle size analysis ... [19] Total carbon, organic carbon and organic ... [20] Iron ... [21] Soil pH and soil acidity ... [22] Salinity: Electrical conductivity and total dissolved ... [23] Cation exchange capacity and exchange ... [24] Estimation of available phosphorus in soils by extraction ... [25] Soluble salts ... [26] Iron oxide removal from soils and clays by a dithionite ... [27] X-ray diffraction and the identification ... [28] Micromorphology and quality attributes of the ... [29] Soil quality information ... [30] Degradation of mollisols in Western Iran as affected by land ... [31] Carbon storage in the soils and vegetation of contrasting ... [32] Soil changes under different land-uses in the ... [33] Soil genesis and classification ... [34] Mineralogy of rhizospheric and non-rhizospheric ... [35] Micromorphological investigation of mollic epipedon porosity ... [36] Environmental effects of land use change on TIC ...

Introduction

Population growth is a reason to enhance the need of food that could impose a pressure on land resources [1]. Land use/cover changes associated with human activities and natural factors jeopardize many ecosystems [1]. Land degradation encompasses the whole environment including individual factors such as soils, water resources, forests, rangelands, croplands, and biodiversity (animals, vegetative cover, and soil) [1].

In Asia, in 1980s about 11% of forest covers were lost that more than of the others point in the world [2]. During the last 4 centuries, around 30% of forests and grasslands in the world have been converted to agricultural lands and animal husbandry raising. Land use change frequently leads to the loss of soil organic carbon (OC), hydraulic conductivity, and soil structure degradation as well as increasing bulk density in soils [3].

Different intensive cultivation practices affected soil physical, chemical, and mineralogical characteristics. Soil degradation, reduction of organic matter, soluble salt leaching, and erosion are the results of intensive agricultural activities [3] in the world. Todays, using the quantitative models and geographic information system to manage land use changes is being developed with tools for predicting land use maps [4, 5]. Numerous studies have been published on land use changes in Iran and other countries following summary present some examples of the studies.

Bahrami *et al.* [6] showed that land use change from forest to tea cultivation in north of Iran caused a decreasing trend in soil cation exchange capacity (CEC), electrical conductivity (EC), organic carbon, total nitrogen, and pH. Deforestation and subsequent tea plantation caused a significant increase of bulk density and a decrease of the soil porosity.

Rafei Sharif Abad *et al.* [7] showed that land use changes from forest to agriculture resulted in significant decreases in silt contents, aggregate stability, N, P, K content, and organic matter and consequently, bulk density, sand content and pH were significantly increased. Vahidi *et al.* [8] in a comparison between orchard (apple) and wheat cultivation revealed that the average clay percentage in wheat cultivation is more than orchard cultivation. Changes of CEC in orchard were higher than crop, while EC and total calcium carbonate percentage increased in crop land use [8].

RahimiAshjerdi and Ayoubi [9] in two land use type comprise pasture land and cultivated land showed that soil organic matter, total nitrogen, available potassium, clay, and sand content were significantly higher in pasture land than cu1tivated land. In addition, some soil properties in surface soils including calcium carbonate, bulk density, and soil acidity showed increasing tendency compared to pasture soils [9].

In addition, physico-chemical properties, changes of land use, and land cover can alter clay minerals in soils. In the Caspian Sea region of Iran, it was revealed that after changing forest (deciduous forest) to tea cultivation (over 3 decades), soil pH, CEC, clay content, and the amount of organic carbon were decreased at $p<0.01$ significance level, but bulk density was increased compared to soils under natural forest.

X-ray diffractograms of clay fractions showed that vermiculite, vermiculite–illite mixed layers, and hydroxyl interlayered clay minerals were the major clay components [10]. The land use change of paddy rice to kiwi plantation in north of Iran leads to decreasing available iron and manganese amounts and increasing phosphorus and potassium contents.

Mineralogical results indicated that smectite was the most dominant mineral in the studied paddy soils while under kiwi fruit land use with moderately drainage condition, smectite content decreased and some vermiculite was formed [11]. Kaviani *et al.* [12] revealed that the conversion of natural land resources in to croplands causes illite and chlorite have transformed to smectite and vermiculite and subsequent serious soil degradation in loess derived soils, as well.

Studies regarding land use change processes on soil properties in other countries have been published. Worku *et al.* [13] revealed that soil available K, total N, OC amounts, soil texture, and color are significantly different comparing the land use and land cover of the entire watershed and within the land use and land cover of sub catchments [13]. A study conducted by Kizilkaya and Dengiz [14] revealed that land use change and subsequent tillage practices resulted in significant decrease in organic matter, total porosity, total nitrogen, and soil aggregates stability. Depending upon the increase of the soil bulk density followed by cultivation, total soil porosity decreased accordingly. Land use types effect on soil physico-chemicals and provide an opportunity to evaluate sustainability of land use systems and, thus, the basic process of soil degradation in relation to land use [15].

Considering, in the study area, land use change from range land to agriculture during 4 decades, excessive use of ground water for agriculture, and subsequently reduction of natural nutrients will led to severe soil degradation. However, the information about the effect of land use changes on soil physicochemical properties is essential for the presentation of recommendations for optimal and sustainable land resources utilizations. Some of soil clay minerals are sources for releasing plant nutrients; for example, clay minerals are involved in the soil potassium reservoir; hence, checking them after land use change is important. Therefore, the aim of this study, in addition to investigation of land use change impacts on soil physico-chemical, is addressing the mineralogical properties after land use change.

Materials and Methods

Site Description: The study region in the Kangavar plain that is located in western Iran with an average of 1450m height above sea level (Figure 1). The area is situated in latitude 47° 45’ 3ʺ to 48° 04’ 41’ E and longitude 34° 02’ 03ʺ to 34° 30ʹ 44’ N. The study area is around to 13000 ha. Physiographic unites in the region including flood plain, piedmont plain, and hill (Table 1). The average annual rainfall and mean annual temperature are 399.1mm and 13.8 °C, respectively. Climate parameters of the study area belong to 1987-2014 collected from Kangavar Synoptic station. Soil moisture and temperature regimes are xeric and mesic, respectively [16].

The land uses include range land, agriculture, and urban land in the research area. Land use change from pasture to agricultural occurred about past 3 to 4 decades to now and piedmont plain was preserves as pastures due to water deficiency and its unavailability. General information of pedons was presented in Table 1.

In this study, 9 soil profiles (Figure 1) in range lands and arable lands with different products were identified to describe soil properties. Soil samples were classified to Entisols, Inceptisols, and Mollisols orders based on their macro-morphological, physical, and chemical characteristics according to Key of Soil Taxonomy [17]. The stage of the works was shown in the flow chart (Figure 2).

Present land use map of study area is shown in Figure 3. The most area located in flood plains that are mainly under crop products and range lands are very low area in map. While during the past 30 years, the range-land was the major land use in the study area. The change of this land use to arable lands has caused a sharp decrease in the rangeland area portion.

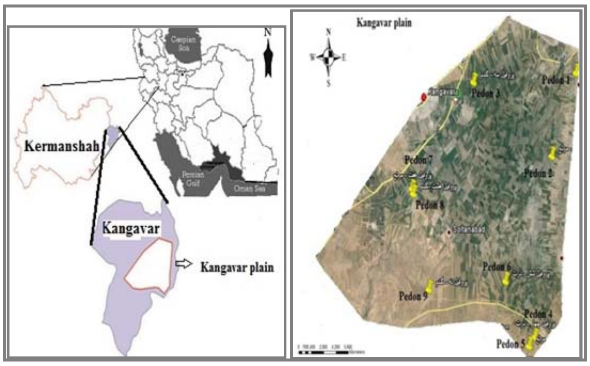

Figure 1) The location of the study area on Iran map and soil sampling point on satellite image

Table 1) General characteristics of study pedons

Pedons USDA (2014)	Physiographic Unit	Land Use	Long-latitude (UTM)
(TypicCalcixerepts)	Flood Plain	Maize	231526 N,3822491 E
(HumicHploxerepts)	Flood Plain	Rangeland	229772N, 3818978 E
(AquicCalcixerepts)	Flood Plain	Wheat	224818N, 3822432 E
(TypicXeropsamments)	Piedmont plain	Maize	228418N, 3811319 E
(TypicXeropsamments)	Hill	Rangeland	228081N, 3810831E
(TypicCalcixerepts)	Flood Plain	Maize	226472N, 3813642 E
(TypicCalcixerolls)	Flood Plain	Rangeland	771446N, 3817576 E
(TypicCalcixerepts)	Flood Plain	Wheat	771559N, 3817341 E
(TypicXeropsamments)	Piedmont plain	Wheat	773633N, 3813251 E

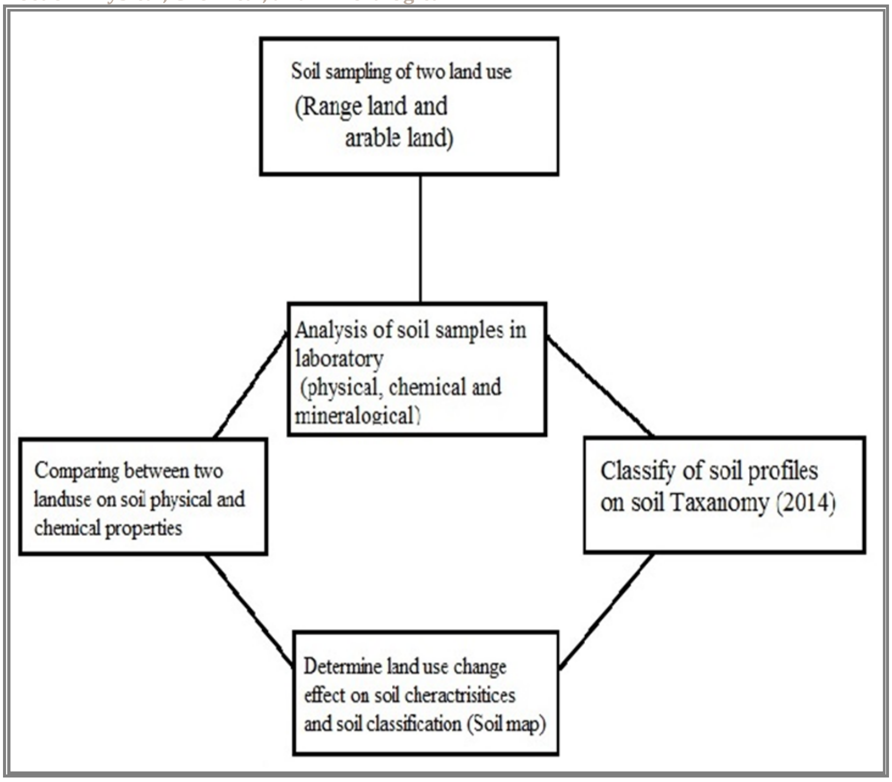

Figure 2) the flow chart of methodology

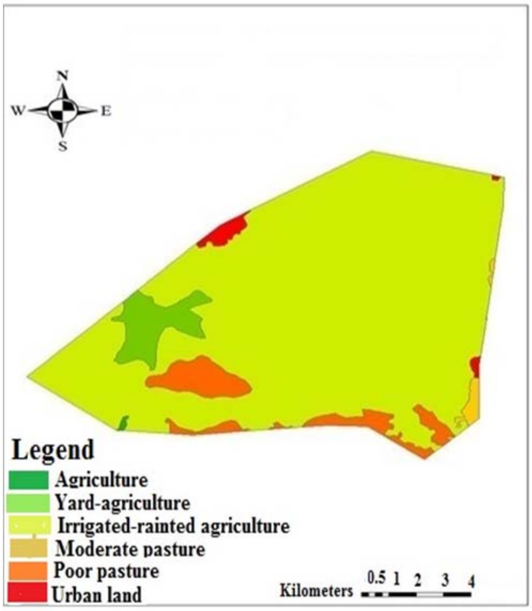

Figure 3) Land use map in the study area

Physical and Chemical Properties: Soil samples were taken from the surface and subsurface horizons. Particle size analyses [18], organic carbon [19], and calcium carbonate equivalent (CCE) [20] were determined for all the samples. Soil pH was measured with a glass electrode in a saturated paste (mixture of water and soil) [21]. EC was determined by method of Rhoades [22]. CEC was measured in the sodium acetate at a pH of 8.2 [23]. Available phosphorous [24], soluble sodium, and potassium [25] were determined, as well. All these analyses were done in soil science laboratory.

Mineralogical Analysis: Mineralogical study was made with the <2 mm soil fraction. After oven dried of soil samples at 100°C for overnight, gypsum was removed by repeated washing with distilled water; calcium carbonate, organic matter, and Fe oxides were also removed, using 1N sodium acetate (pH=4.8-5), 35% H_2O_2, and citrate-bicarbonate-dithionate, respectively [26]. Soil clay fractions were separated by centrifugation for 5 min with the speed of 750 rpm, and the < 2 µm fraction was treated with Mg-K saturation, then, oriented slides were arranged for the following treatments: heating to 550°C; solvation with Glycerol [27]. The prepared samples were analyzed, using X-ray diffractometer (Philips PW-1710 CuKα radiation).

Land use planning was performed by Arc GIS (9.3) software. Statistical analysis of the data was carried out by the SPSS 21.0 for windows and Microsoft Excel program. Analysis of variance (ANOVA) was applied to test the impacts of land use change on some nutrients and clay minerals. Comparison of means was performed, using the Duncan's multiple range tests (p≤0.05).

Findings

Physico-chemical properties in study pedons: The main physico-chemical soil characteristics are presented in Table 2. Particle size distribution results showed that pedon 3 and pedon 5 have the greatest (53.2%) and the lowest (17.67%) average clay percentage within all the pedons, respectively. The mean value of clay is greater in the rangelands (47.6%) compared to crop lands (41.4%). In spite of clay amount, mean value of sand (14.8%) and silt (33.6%) are lower in rangeland than the amount in crop lands with the mean values of 16.5% for sand and 39.2% for silt fractions. Soil pedons that were located in flood plain (pedon 1, 2, 3, 6, 7, and 8) had mean clay percentage greater than pedons, which were located in piedmont plain and hills (4 and 5).

Table 2) Some selected physico-chemical properties in the pedons studied

Pedons N0.	Horizon	Depth (cm)	Sand	Silt (%)	Clay	O.M (%)	$CaCO_3$ (%)	CEC (Cmolc/Kg)	EC (dSm^{-1})	Na	K (meq/l)	P
1	Ap	0-26	28	51	21	1.4	16	17.3	0.23	0.65	0.2	0.16
	Bk1	26-53	22	47	31	0.91	18	18.2	0.3	0.59	0.11	0.04
	Bk2	53-86	17	48	35	0.95	22	18.2	0.62	0.33	0.02	0.01
	Bk3	86-118	12	51	37	0.56	24.5	21.5	0.8	0.33	0.01	0.01
	Bk4	>118	10	52	38	0.44	23.5	19.8	0.83	0.34	0.01	0.03
2	A	0-26	26	36	48	2.98	27	29.7	0.54	0.3	0.52	0.15
	Bw1	26-50	20	35	45	1.01	42	17.3	0.55	0.4	0.23	0.05
	Bwg1	50-94	10	38	52	0.66	52	12.4	0.57	0.8	0.15	0.03
	Bwg2	94-120	10	43	47	0.46	52.5	10.7	0.73	0.9	0.09	0.03
	Bg	120-170	15	45	40	0.4	49	10.9	1	0.93	0.01	0.02
3	Ap	0-30	21	43	36	1.85	28.5	23.1	0.44	0.73	0.1	0.15
	Bk1	30-58	15	37	48	0.85	47	16.5	0.35	0.65	0.02	0.07
	Bk2	58-88	10	29	61	0.58	55.5	13.2	0.39	0.47	0.02	0.15
	Bkg1	88-120	8	32	60	0.37	58.5	11.6	0.4	0.33	0.01	0.15
	Bkg2	120-175	6	33	61	0.26	57	14	0.4	0.22	0.08	0.16
4	Apk	0-33	56	27	17	0.64	23	24.8	0.4	0.39	0.05	0.17
	Ck1	33-80	42	27	31	0.4	46	19.8	0.6	0.39	0.03	0.07
	Ck2	80-115	50	24	26	0.39	46.5	14	0.85	0.35	0.05	0.04
	Ck3	>115	41	32	27	0.3	47.5	8.3	0.97	0.3	0.02	0.05
5	A	0-25	37	48	15	1.69	43	25.6	0.21	0.1	0.05	0.27
	Ck1	25-85	57	26	17	0.56	58	9	0.23	0.2	0.01	0.02
	Ck2	85-180	36	43	21	0.35	59	10.4	0.37	0.22	0.01	0.001
6	Ap	0-30	32	49	19	2.3	23.5	26.4	0.26	0.43	0.54	0.9
	Bk1	30-70	27	40	33	0.8	29	28.9	0.44	0.26	0.08	0.12
	Bk2	70-130	22	40	38	0.62	36.5	24.8	0.49	0.2	0.01	0.05
	Bk3	>130	48	16	36	0.52	36	16	0.49	0.2	0.01	0.01
7	A	0-30	29	35	36	3.58	23.5	23.9	0.8	0.35	0.64	0.2
	Bk1	30-63	19	34	47	1	42	13.2	0.85	0.57	0.26	0.1
	Bk2	63-90	8	37	55	0.7	59	12.2	1.1	0.9	0.02	0.03
	Bk3	90-128	8	36	56	0.72	60	9.9	1.2	0.94	0.01	0.08
	Bk4	128-195	9	37	54	0.74	61	9	1.0	0.91	0.01	0.008
8	Ap	0-20	7	43	50	1.7	31.5	24.8	0.5	0.4	0.1	0.84
	Bwg	20-55	10	44	46	1.2	35.5	22.3	0.5	0.22	0.02	0.16
	Bk1	55-110	12	50	38	0.37	50	12.4	0.3	0.16	0.002	0.09
	Bk2	110-180	14	52	34	0.25	52	2.5	0.3	0.12	0.02	0.08
	Ck	>180	22	56	22	0.27	56	7.4	0.3	0.1	0.02	0.05
9	Ap	0-17	32	40	28	0.76	28.5	19	0.24	0.23	0.02	0.2
	Ck1	17-63	31	46	23	0.58	32.5	15.6	0.25	0.04	0.02	0.1
	Ck2	63-200	19	45	36	0.36	35.5	9.9	0.29	0.06	0.01	0.03

Within pedons with orchard and crop land use, the highest percentage of clay were related to pedon 3 (53.2%) and 8 (44.4%) with wheat cultivation situated in flood plain. Contrasting the particle size distributions between pedon 7 (pasture) and 8 (crop land) is shown in Diagram 1. These results are similar with the study conducted by Khormali and Shamsi [28]. Their research on the loess derived soils were affected by land use change in Ghapan watershed, northern Iran revealed that soil texture changed due to the land use change and more reduction of soil clay versus increasing of silt occurred. The pH value of grassland (pedon 2 and 7) is greater than crop land (Diagram 2). The soil pH influences on nutrient availability, elements movement, and soil micro-organisms activity. Different land management effects on soil acidity [29]. Generally, comparison among pedons showed that electrical conductivity value in range land was greater than cropland (Diagram 3).

Cation exchange capacity changes with soil depth were irregular, but it decreased from soil surface to depth (Diagram 4). The decline of organic carbon and clay content with depth and clay mineral type were generally main reasons affecting on CEC. The CEC varied with soil depth in range-land (Diagram 4). Land use changes and subsequent changes in soil organic carbon had strongly affected other soil properties, which in turn have feedback effects on the soil microbial activity and soil organic carbon dynamics.

As shown in Table 2, the content of soil organic carbon in rhizosphere is higher in rangeland than crop land, because of the root turnover and the absence of tillage practices. Organic carbon changes in two pedons are shown in Diagram 5. Agricultural activities, especially above ground harvest, have caused a decrease in soil organic carbon in crop land. Generally, mean of organic carbon in content rangeland (pedon 2, 5, and 7) was equal to 1.1, 0.86, and 1.34 percentage, respectively.

The average calcium carbonate equivalent was greater in flood plain physiography unit in rangeland (pedon 7) by 49.1% in comparison with physiography unit with maize cultivation (31.25 %). CCE variation in two land uses is shown in Diagram 6. As it has shown, lime percentage was increased with soil depth. The comparison among pedons showed that phosphorous value was higher in the surface horizons in two land uses (Diagram 7). Soluble sodium value for range land (pedon 2, 5, and 7) enhanced with soil depth, while reduced in crop land (other pedons) (Diagram 8). It can be concluded that permanent irrigation may motivate Na leaching in soils under different cultivation practices. In all pedons, soluble potassium content reduced with increasing soil depth (Diagram 9). Transformation of illite to smectite clay mineral is main reason for desorption of K (Section 2. clay mineralogy results). The mean comparison within soil chemical characteristics in range land and crop land were shown in Diagrams 10 and 11. As shown in diagrams, there is a significant difference at p<0.05 level between CEC and O.M content in range land and crop land. The results of macro nutrient demonstrated that there is a significant difference at p<0.05 level among N, P, and K amounts in two land use type.

Clay mineralogy results in study pedons: In order to compare land use types, pedon 2 and 7 as rangeland and pedon 3 and 6 as crop land were selected. Semi-quantitative measurements of different amounts of minerals in the clay fraction samples are given in Table 3. Chlorite, smectite, palygorskite, illite, vermiculite, and kaolinite were identified as the main minerals in the clay fraction (<2 mm) in almost all the profiles. According to the results (Diagram 12), in range land (pedon 2 and 7), illite and vermiculite percentage are greater than crop land. Smectite content was the most dominant mineral in the studied pedons of crop land.

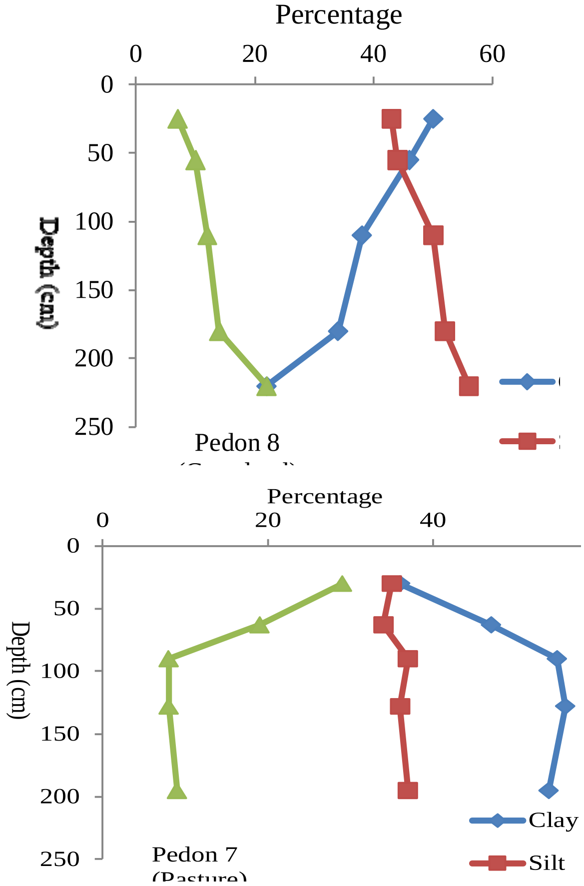

Diagram 1) The comparison of particle size distribution within pedons 7 and 8 with different land use

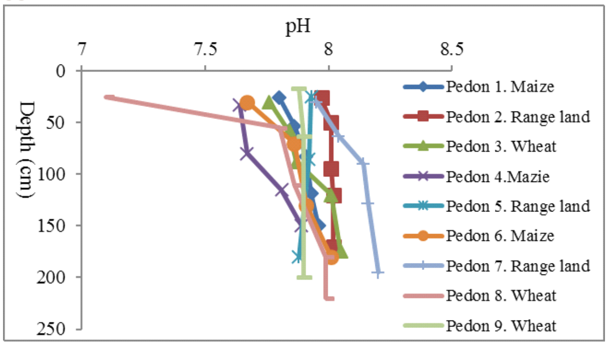

Diagram 2) The variation of pH value with depth in all pedons

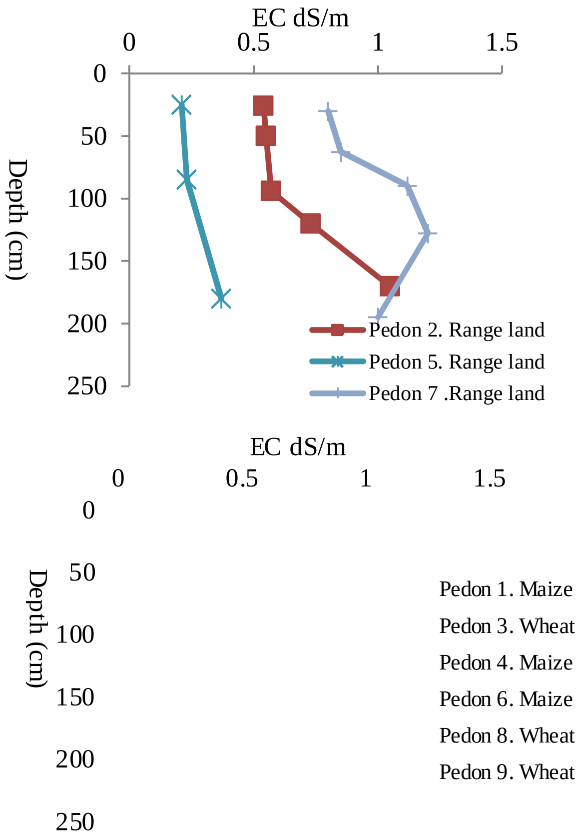

Diagram 3) The variation of EC in range land and crop land pedons with depth

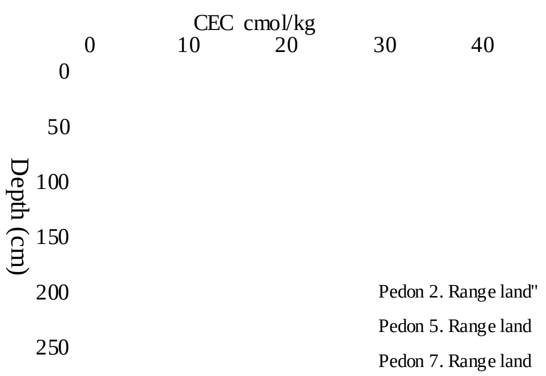

Diagram 4) The variation of CEC with soil depth in range land use

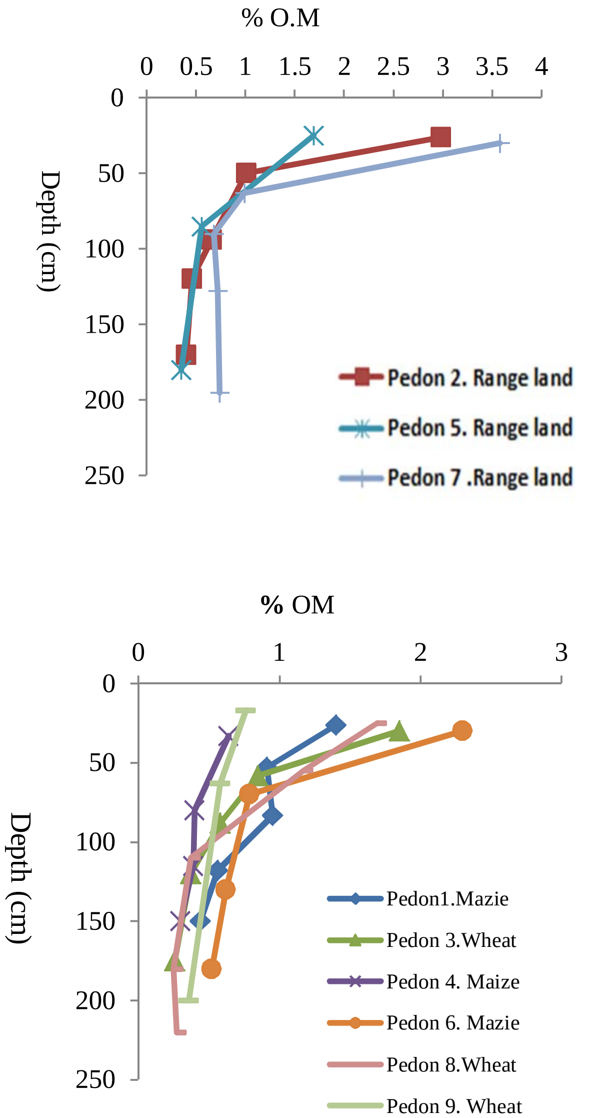

Diagram 5) The variation of organic matter in range land and crop land pedons with depth

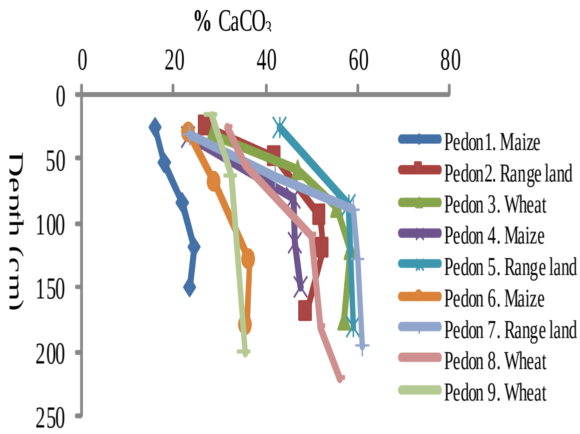

Diagram 6) The variation of $CaCO_3$ with soil depth in studied pedons

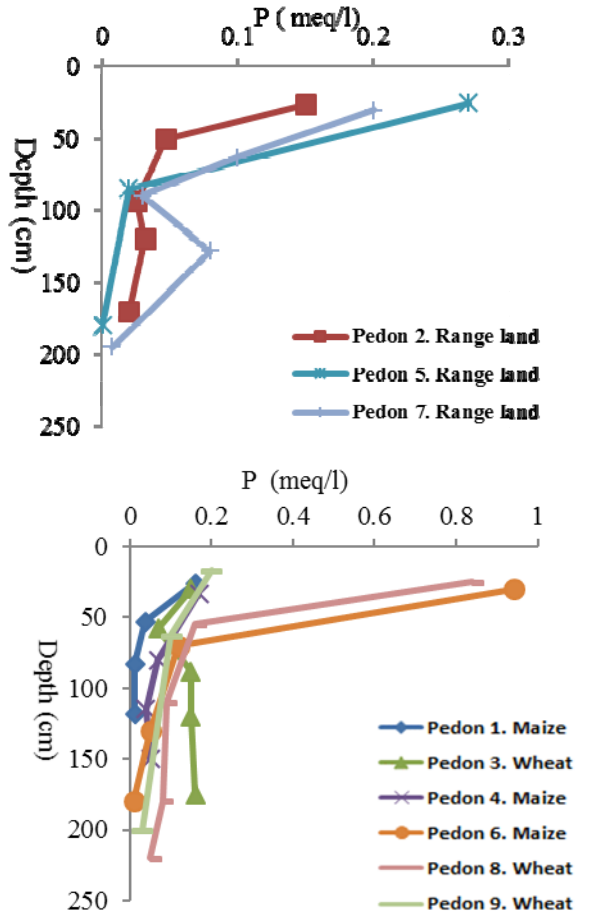

Diagram 7) The variation of phosphorous in range land and crop land pedons with soil depth

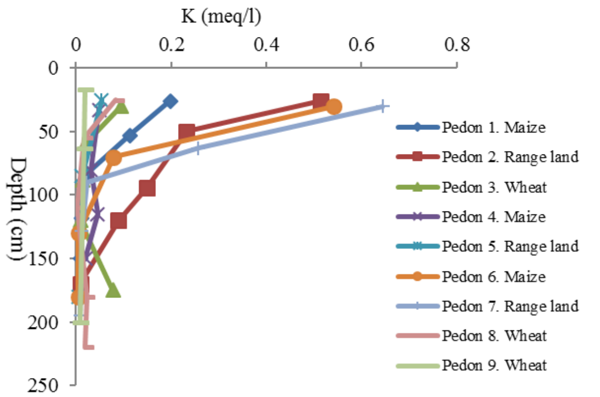

Diagram 9) The variation of K with depth in studied pedons

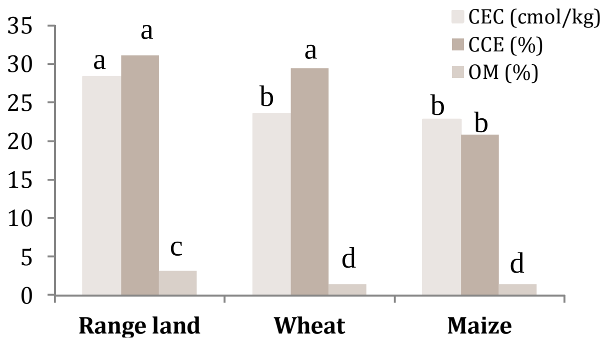

Diagram 10) The mean comparison of some chemical characteristics between range land and crop

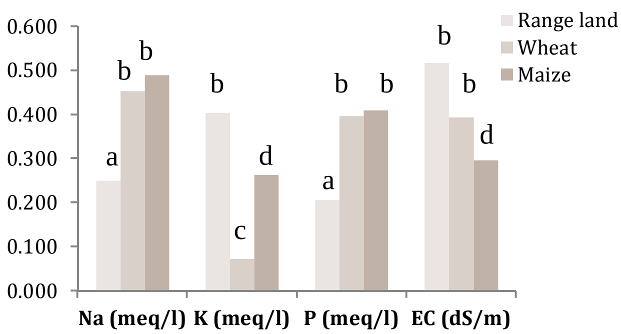

Diagram 11) The mean comparison of some macro-nutrients between range land and crop land

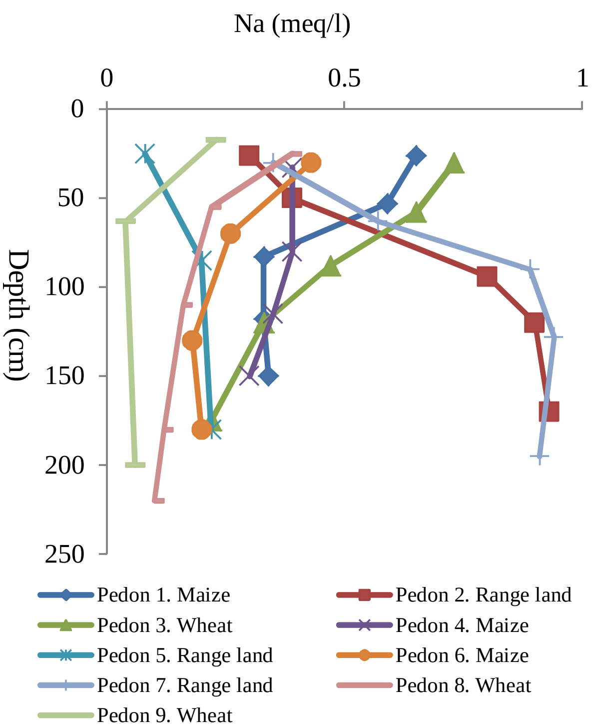

Diagram 8) The variation of soluble Na amount with soil depth in studied pedons

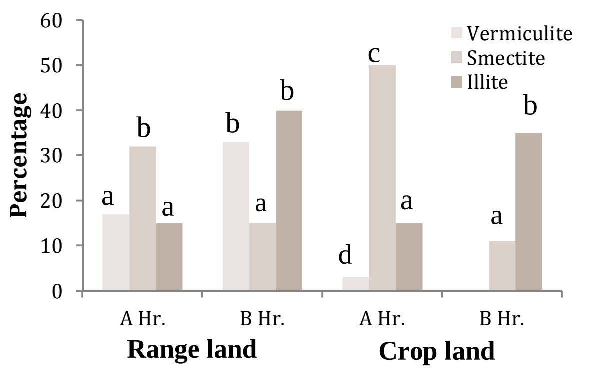

Diagram 12) The mean comparison of clay minerals in two land use

Table 3) Semi-quantitative results of clay minerals in the studied horizons

Pedon	Horizon	Clay minerals							
		Chlorite	Illite	Smectite	Vermiculite	Palygorskite	Kaolinite	Quartz	Mix.
2	Ap	*	**	***	**	**	*	*	**
2	Bwg1	**	***	**	***	***	*	*	**
3	Ap	**	**	****	*	**	Tr	*	*
3	Bkg1	**	***	**	-	***	Tr	*	*
6	Ap	*	**	****	-	**	*	*	*
6	Bk3	**	****	*	Tr	***	*	*	*
7	A	*	**	***	**	**	*	*	**
7	Bk4	**	****	**	***	****	*	*	**

(-) (Not seen); tr (Trace); (5<%); *(10-5%); ** (25-10%)*** (40-25%)*** (60-40%)

Discussion

The results showed that clay content in range land is less than crop land in the soil surface layer (A horizon). These could be a result of two soil properties; first of all, surface horizon in rangeland is a mollic with high moisture content, suitable structure, and deep roots are caused clay transformation from surface layer to soil depth and the next is that tillage practice in crop land accelerating soil weathering and consequently converting silt to clay fraction. Increases of the cultivation year length induce to the increase of clay translocation from the surface horizon or removal of clay from the surface by runoff.

Topography is another soil formation factor that influenced on soil particle size distribution in this area [28]. Rezaei *et al.* [10] revealed that after changing forest to tea cultivation pH, cation exchange capacity, clay content and the amount of organic carbon of the soils were decreased at significance level of $p<0.01$.

The results showed that EC value in range land was higher than cropland. Irrigation operations washed the soluble salts out of soil profile; however, it can be concluded that soil texture change as a result of land use change from rangeland to agriculture and thus lighten of soil texture is reason for leaching of soluble salts and reduction of electrical conductivity.

Bahrami *et al.* [6] showed that deforestation and, then, long-term inappropriate cultivation activities could potentially decrease the soil electrical conductivity as confirmed in our study [6]. The change of soil CEC with depth was revealed in the Diagram 4, showing reducing of it. As suggested by Vahidi *et al.* [8] in comparison of CEC in two different land uses (orchard and crop), changes of cation exchange capacity in orchard could be higher than crop land. They concluded that CEC changes significantly correlated with clay contents in pedons. Investigation of pedon 7 and 8 with rangeland and crop land in similar land type showed that land use change from range land to agriculture have caused to conversion of soil order from mollisols to inceptisols. Reduction of organic carbon in surface horizon (mollic) is reason for this phenomenon. Soil cultivated suppressed organic carbon compared to range-land since cultivation increases soil aeration and consequently accelerates decomposition rate.

Khormali and Nabiollahi [30] studied degradation of mollisols in western Iran as affected by land use change indicated that mollic epipedon transformed to ochric horizon. Soil organic carbon stock is also influenced by land use. Cultivation practices may increase OC mineralization, causing a significant loss of soil organic carbon within 10-15 years [31].

Increase of organic matter in soil surface layer in all pedons caused the increases in available phosphorous. The decline of organic matter levels with depth could be a main reason for decrease in available p value. This trend in range-land is irregular, but it would be regular in crop land (Diagram 7).

Similar to the current study, another research in Brazil indicated that nutrient concentration was high in crop lands and rangeland in the soil surface, but those did not occur at deeper horizons for any land use type. The soybean crop had extremely high extractable P concentration as almost 9 time greater than the natural background values [32]. Potassium value was greater in crop land compared to range land, which could be a result of fertilizer application in crop land. In addition, tillage practice and soil distribution could enhance the weathering of clay minerals, resulting in K desorption in soil solution. Rafisharifabad *et al.* [7] showed that land use change from forest to agriculture can result in the significant decreases in N, P, and K values.

The results of mineralogy study showed that illite and vermiculite are common minerals in range land and smectite is dominant mineral in the crop land. Mineralogy of soils is mainly controlled by parent materials in arid and semi-arid regions [33]. This could be attributed to agricultural practices and subsequent weathering. It could be concluded that transformation from mica (illite) is the main mechanism for the occurrence of smectite in the studied pedons. Smectite amount was high in surface horizons; however, the decreasing trend was observed with soil depth. Regardless of smectite, illite content was enhanced by depth. The comparison mean within minerals has shown significant difference at $p<0.05$ level (Diagram 12).

Kodama *et al.* [34] investigated mineralogy variations around maize root and revealed that root network of maize affected the mineral weathering. Mirkarimi *et al.* [35] showed that the increase of smectite and vermiculite percentage in natural background in forest and rangeland compared to orchard and crop land would enhance the moisture content in natural areas and consequent produce conditions for weathering. Davami and Cholami [36] indicated that degradation of mica minerals is taking place along land use change that leads to transformation of illite to vermiculite.

Conclusion

According to the results, the different land use and land cover in 9 pedons showed that variation in particle size distribution could be due to land use change. The silt, clay, and sand contents were also influenced by land use changes, showing decrease in clay percentage and increases in sand and silt percentage in farm lands. The pH, EC, and CEC value of rangeland were greater than farmland. The presence of vermiculite and chlorite-vermiculite minerals are main factors affected on CEC in surface horizons in rangeland. Results showed that land use change could suppress organic matter levels. Generally, the vegetation cover, tillage operation (type, intensity, and frequency), land use change, and crop type are effective parameters influencing soil organic matter content. Land use change led to a decrease in $CaCO_3$, P, Na^+ contents, and an increase in K^+ amount. Tillage practice and soil distribution caused the weathering of clay minerals (illite) resulting in desorption of K in soil solution. While land use change had no effect on the clay minerals type, it may change the clay percentage. According to the results, illite and vermiculite percentage are greater in rangeland than farm land. Generally, land use change caused significant impacts on soil macro nutrient, physical, and mineralogical properties. Long-term cultivation can effect on nutrient decreasing and released element leaching under minerals weathering, which all items induced to soil degradation that need to protect to reach sustainable management.

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