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Effects of Land Use Change on Acidity soil and Phosphorus and Calcium of Soil

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ABSTRACT: The land use change is one of the important interferences of human in natural ecosystems which affect the ecosystem processes and specially the soil. Soil samples were taken using random systematic method from depth of 0 to 30 centimeters. Totally 60 soil samples (20 samples for each region) were delivered to the soil lab. The data analysis was implemented using SPSS 18 Software and in order to study and compare the data average, the one way variance analysis test and Duncan's multivariate test were used. Amount of calcium and electrical conductivity in 3 usages had no significant differences. Amount of soil acidity in forest, garden and tea garden usage have no significant differences but they had a significant difference in 95 percent significance level with pasture usage. Therefore, it can be said that land use change can affect the soil characteristics and lead to soil destruction and decline in soil nutrients.

Key Terms: Land Use Change, Soil, Shenroud of Siahkal

INTRODUCTION

The land use change from forest to agricultural land specially in steep and erodible loess lands is one of the problems that by affecting directly on soil quality parameters, in addition to harming and reduction of soil potential talent , gives irreparable damages through increasing the soil erodibility (Marinari 2006, *et al*.) results of the use change effect on amount of soil organic materials and physical characteristics in 3 usages of forest, pasture and agricultural lands showed that the measured organic material percentage of soil in agricultural lands has decreased 44 and 48 percents in 0-10 centimeters layer and 48 and 50 percents in 0-20 centimeters soil layer compared to forest and pasture usage (Celik, 2005). Forest land soils have always been given attention due to having abundant organic materials and proper constructions but changes in their management and use and tillage practices usually have a major effect on amount of the organic material and other physical and chemical characteristics of the soil (Li *et al*., 2007. Yimer *et al*., 2007). Therefore, change in forest usage into agricultural lands cause reduction of soil organic material percentage and in contrary to that, changing the agricultural lands into natural vegetation, can cause increase in soil organic material (Dawson, Smith, 2007. Stoate *et al.,* 2001). The study of use changes in loess and steep lands in east of Golestan Province, located in Aghsoo drainage basin, it was determined that long term agricultural operations on steep lands of the area which had previously been under forest natural cover, has turned the soil texture from loam lay silty class into light clay silt texture which is highly susceptible to erosion. This change has a severe indirect effect on other parameters of soil quality like the organic material. Destruction of forest natural cover and loss of soil aggregates have led to reduction of organic carbon and soil total nitrogen amounts, up to more than 70 percents (Ajami *et al.* 1387). The results of forest land use on some physical and chemical characteristics of the soil in a part of Berenjestanak drainage basin, in 3 fields of forest, rain fed agriculture (wheat) and garden showed that the amount of organic material in agricultural lands and gardens has been less than forest lands respectively 44.24 and 45.45 in 0-10 centimeters layer and 42-69 and 43 percents in 10-20 centimeters layer. The maximum total nitrogen in 0-10 centimeters layer in forest usage has been observed up to 30 percents and its maximum in 10-20 centimeters layer in garden lands is up to 19 percents (Soleimani and Azmoude, 1389). Considering the importance of land use change for soil characteristics, present research studies forest use change into pasture and tea garden in Shenroud of Siahkal region in Guilan province.

MATERIALS AND METHODS

The Study Area: Series 7 of Shenroud, is the western part of Mianbod Forests of 25 drainage basin of Iranian north forests in Siahkal county of Guilan Province. Its average annual precipitation is 1264.5 millimeters and the average annual temperature is 16 centigrade degrees (Binam, 2006). The samples were taken from soil of 3 regions by random systematic method.

Fig. 1. Geographical Location of the Study Area in Guilan Province.

After designing the 50×50 network, 30 points were selected for each region which after visiting the study fields, the soil samples were taken from 20 points in each region from depth of 0 to 30 centimeters. The soil samples (totally 60 samples) were transferred to the soil lab and the organic carbon was calculated using Method, absorbable phosphorus by Flame Photometery method, calcium by Spectrophotometery of Atomic Absorption, electrical conductivity by EC Meter Device and PH of the samples was calculated using PD Meter Device (Zinkafsh, 2000. Sadroddini, 2004). The results from physical and chemical soil parameters were organized using Excell and SPSS Softwares and they were normalized using Kolmogorov-smirnov Method.

In order to study and compare the date averages related to soil characteristics in 3 fields of forest (control), pasture and tea garden, one way variance analysis test (Anova) and Duncan's multivariate test were applied.

RESULTS

Soil Phosphorus: The results from variance analysis and comparison of data average, using Duncan's test showed that soil phosphorus (milligrams on kilograms) in 3 fields of forest (control), pasture and tea garden show a significant difference in 95 percents probability level. Average of this amount in forest (control) was the highest and in pasture it was the lowest (Table 1 and Fig. 1).

Table 1. Results of Soil Phosphorus Variance Analysis in 3 Fields of Forest (Control), Pasture and Tea Garden.

Change Source	Sum of Squares	Freedom Degree	Mean-square	F	Significance
Treatment	41.295	2	19.148	16.869	0.001**
Errors	37.207	57	1.027		
Total	78.502	59			

**Significance in 99 percents confidence level

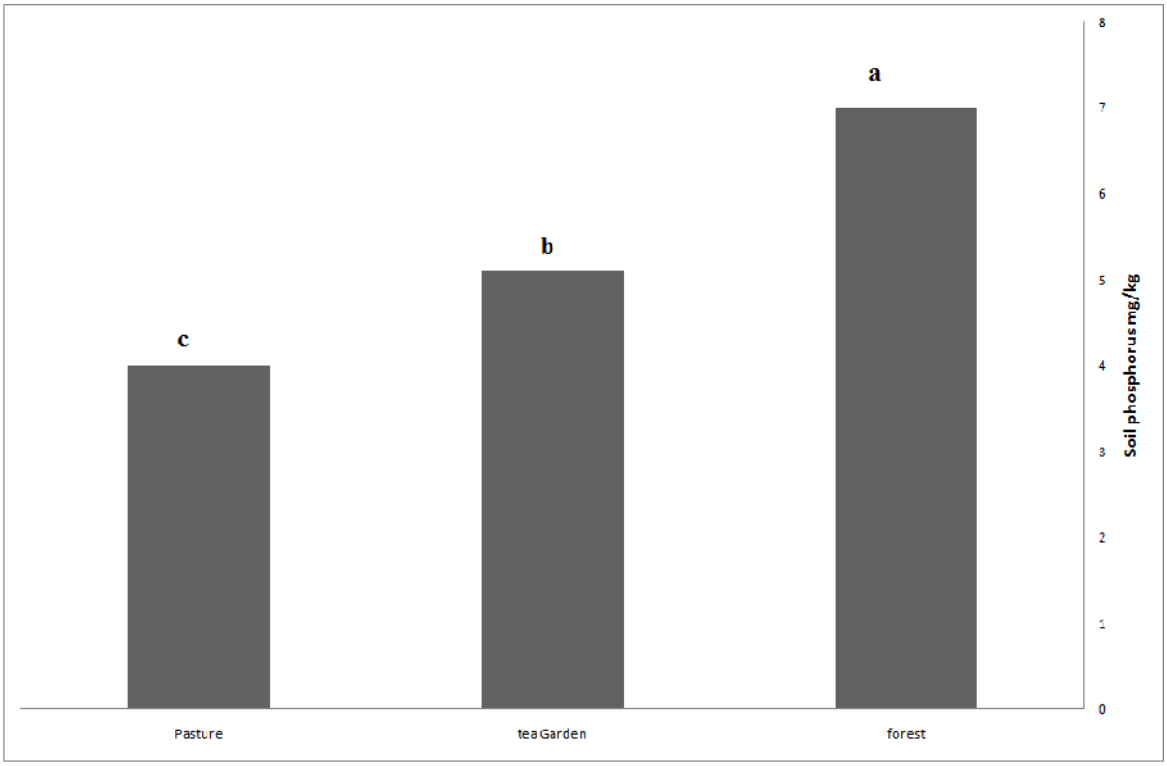

Fig. 1. Soil Phosphorus in Masses of 3 Fields of Forest (Control), Pasture and Tea Garden.

Soil Calcium: The results from variance analysis and comparison of the average data, using Duncan's test showed that there is no significant difference in 95 percents probability level between calcium averages (milligrams on kilograms) in soil of 3 fields of forest (control), pasture and tea garden (Table 2).

Table 2. Results of Soil Calcium Variance Analysis in 3 Fields of Forest (Control), Pasture and Tea Garden.

Change sources	sum of Squares	Freedom Degree	Mean-square	F	Significance
Treatments	2.115	2	1.018	1.125	$0.125^{n.s}$
Errors	15.654	57	0.404		
Total	18.760	59			

n.s: No Significant Difference

Soil Acidity: The results from variance analysis and comparison of the average data, using Duncan's test showed that soil acidity amount in field of forest and tea garden shows a significant difference in 95 percents confidence level with pasture field. Average of this amount in forest mass (control) was the highest and in pasture it was the lowest (Table 3 and Fig. 2).

Table 3. Results of Soil Acidity Variance Analysis in 3 Fields of Forest (Control), Pasture and Tea Garden.

Change Source	Sum of Squares	Freedom Degree	Mean Square	F	Significance
Treatments	11.015	2	4.057	17.739	0.000**
Error	7.913	57	0.467		
Total	18.927	59			

**Significance in 99 percents Confidence Level

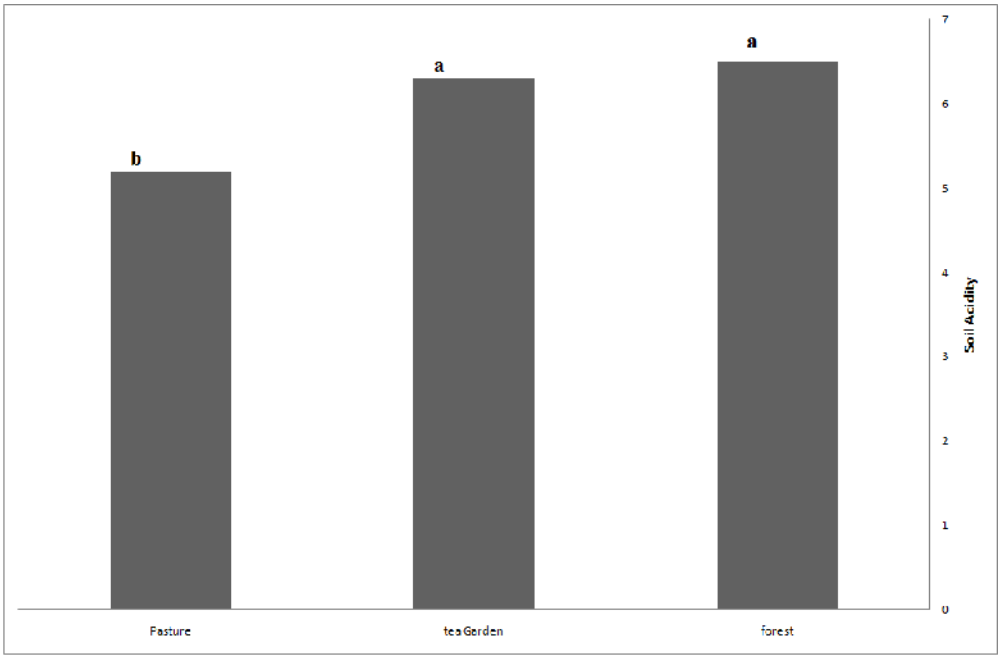

Fig. 2. Soil Acidity in 3 Fields of Forest (Control), pasture and Tea Garden.

Soil Electrical Conductivity: The results from variance analysis and comparison of average data, using Duncan's test showed that there is no significant difference in 95 percents significance level between average of electrical conductivity (microorganisms) in soil in 3 fields of forest (control), pasture and tea garden (Table 4).

Table 4. Soil Electrical Conductivity Variance Analysis in 3 Fields of Forest (Control), Pasture and Tea Garden.

Change Source	Sum of Squares	Freedom Degree	Mean-square	F	Significance
Treatments	0.179	2	0.029	2.221	0.149
Error	0.514	57	0.029		
Total	0.693	59			

n.s: No Significant Difference

DISCUSSION

Amount of absorbable phosphorus in three fields of forest, pasture and tea garden showed a significant difference in 95 percents probability level. Its amount in forest field mass is also more than two other fields. Phosphorus in organic form is not absorbable for the plants and its mineral form with interference of the microorganisms can become absorbable and be available for the plant. The high activity of microorganisms in forest field compared to two other fields has caused this difference. There is limited and little information about the effect of different trees on soil phosphorus amount and inconsistent results have been also mentioned in the studies (Hagen, 2004). It seems that habitat conditions specially the soil biological conditions affect this issue (Fakhari, 2004). Probably, different coverage will have various and sometimes opposite effects on phosphorus combinations and the cycle and phosphorus storage in soil (Hagen, 2004). Habib Kaseb (1999) mentions that mineralization of organic phosphorus in the soil containing humus Moore which is usually formed in presence of softwoods and their leaf litters and has weak biological activity, is done slowly and in contrary, this consolidation and mineralization takes place faster in soils with strong biological activity and humuses like Mull.

The soil acidity in this study was obtained 6.48 in forest field, 5.2 in pasture field and 6.05 in tea garden field which pasture field showed a significant difference in 95 percents probability level with forest and tea garden fields. In terms of the high effect that the soil acidity directly or indirectly has on amount of nutrients available for the plants, lots of scientists have studied about the effect of tree species on soil acidity and their findings were different based on age, species and condition of the study area (August, Ranger, 2001). It seems that the proper climatic conditions of Shenroud of Siahkal region which include growth period around 7 months of the year, due to proper temperature and abundant rainfall have caused the leaf litters of these fields to have a good decomposition rate. Also, it can be emphasized that simultaneous effect of proper climatic conditions and presence of broadleaf species together with their leaf litters have managed to increase decomposition and degradation of leaf litters (Salehi, 2000).

CONCLUSION

The results of this research show a significant difference in amount of nitrogen, organic carbon, carbon to nitrogen ratio, acidity and phosphorus during the forest use change into pasture and garden. According to the results, forest use change caused reduction in percentage of organic carbon, nitrogen and phosphorus and incensement of acidity in forest and carbon to nitrogen ratio in garden. Therefore, considering the ecological importance of Iranian northern forests, results of this research require more attention to studying the modification and land use change in this area.

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