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Identification and Isolation of Mollisols in Savadkooh region

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ABSTRACT: The present study was carried out in Savadkooh region, Mazandaran province, North of Iran, to evaluate and identify, what kind of soils are in this area. The study area is under landuse of forest, rice fields and city. The results showed, because of high organic matter and presence of other conditions in forest area, Mollisols were dominant soils in Savadkooh region. Although, we detected 40% Inceptisols, but the similarity of these soils to each other, we guess landuse change, is the main cause to lack of mollic epipedon and decrease in organic matter. So probabely, more than half of Inceptisols, were Mollisols and after changing in landuse, they became Inceptisols. Entisols and Alfisols had the minimun area in Savadkooh. The present study provides a general concept of presentation of Mollisols in Savadkooh region. @JASEM

The variability of soil properties within fields is often described by classical statistical methods. Soil properties frequently exhibit spatial dependency. Generally, samples collected close to one another are more similar than samples collected at greater distances (Ayoubi *et al*.,2007).

An understanding of the distributions of soil properties at the field scale is important for refining agricultural management practicies and assesing the effects of agriculture on environmental quality (Cambardella et al.,1994). Natural variability of soil, results from complex interactions between geology, topography, climate as well as soil use (Quine and zahng, 2002).

Isolation of Mollisols in the Savadkooh region was the main aim in this study. The main landuse in this area of North of Iran is forest. Although some forests was changed to city and fields(special rice fields). Mollisols represent dark coloured, base-rich(mollic epipedon) soils of the stepps and cover extensive subhumid to semi-arid areas of North and South America, Europe and Asia(Bhattacharyya *et al*.,2006). Large Mollisols occur in landscapes covered by grasslands but they also occur in forested areas. In this study, we detected some Mollisols in Polesefid region and some different soils with distinguished characteristics in another orders of soil taxonomy.

MATERIALS AND METHODS

Study area, sampling and laboratory analysis: The study was conducted on Savadkooh region, about 40 Km Qaemshahr, in Mazandaran province, Iran. 15 points were detected and described following the methods laid down in soil survey manual(Soil survey division staff, 1995) and keys to soil taxonomy(Soil survey staff, 2010) was done. 15 profiles were studied from surface to bed. For each profile, epipedon and diagnostic subsurface horizons were identified. Soil moisture and temperature regims of study area (from soil moisture and temperature regims survey of Iran, Soil and water institute, 2006) were detected. With these four information, soil taxonomy of profiles were done(Soil survey staff, 2010). From each horizon, soil sampling was done. Each sample was taken to the soil laboratory of Islamic Azad University- Savadkooh branch and air dried over night and passed through a 2-mm sieve. Particle size analysis was performed using hydrometer method after removing carbonates, organic matter and oxides of Fe & Al(Jackson, 1979); Organic matter content was determined using Walkley- Black, 1934; pH was measured in a 0.01 mol KCl- solution; EC was measured with Electroconductometer; cation exchange capacity were determined using extraction with sodium acetate(Page et al., 1987); alkaline- earth carbonate was measured by acid neutralization(Salinity laboratory staff, 1954) and presence of gypsum was determined. The coefficient of linear extensibility (COLE) was determined following the method of Schafer and Singer(1976).

RESULTS AND DISCUSSION

The summary of soil parameters are shown in Table 1. After evaluation the results of field study and laboratory analysis, the detected soils are Mollisols, Inceptisols, Entisols and Alfisols. Mollisols are 37.5% of total soils in study area. With accuracy on the map, we could understand all of Mollisols, were formed under forests. We detected 5 suborders udolls and 1 xerolls. The summary of soil orders are shown in Table 2.

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Table 1. Four samples of properties of soil orders

Parameters / Profiles	Depth (cm)	pH -log[H^+]	EC (dSm^{-1})	CEC (cmol+Kg^{-1})	Clay (%)	Silt (%)	Sand (%)	O.M. (%)	$CaCo_3$ (%)
Pedon1: Aquic									
Calciudoll	0-21	8.2	0.74	18.88	28	50	22	1.85	30
A	21-51	8.3	0.57	18.53	12	62	26	-	51.75
Bk1	51-69	8.3	0.85	19.2	2	76	22	-	30.5
Bk2	69-110	8.3	0.74	18.46	2	76	22	-	48.5
Bk3	>110	8.4	0.8	19.12	2	74	24	-	55.5
Bk4									
Pedon2:Typic									
Dystrudept	-	-	-	-	-	-	-	-	-
A	0-90	8.5	1.03	16.53	8	55.5	36.5	-	24
Bk1	90-160	8.5	1.47	18.08	2	67.5	30.5	-	15
Bk2									
Pedon7: Calcic									
Haploxeralf	0-22	8.5	0.76	18.7	28	50	22	2.35	16
Btk	22-45	8.7	0.91	18.5	16	66	18	-	2.75
Bw	45-61	8.6	0.87	18.15	4	19.5	16.5	-	15
Bk1									
Bk2	61-95	8.9	0.84	18.14	2	83.5	14.5	-	15
Bw1	95-127	8.7	0.99	18.41	2	80	18	-	18.75
Bw2	>127	8.6	0.87	19.18	2	83.5	14.5	-	15.5
Pedon33: Aquic									
Xerorthent	0-30	8.4	1.28	17.31	12	56	32	2.08	46.75
A	30-55	8.3	1.87	16.59	2	60	38	-	40
Bw1	55-65	8.6	2.23	15.32	2	36	62	-	52.25
Bw2	65-80								
Lithologic	80-100	8.6	2.64	16.9	2	56	42	-	36.5
discountinuity	100-105								
2Bk									
Lithologic	>105	8.8	6.2	16.83	2	66	32	-	18
discountinuity									
3Bw									

Table2. Summary of soil orders

Pedon	Soil taxonomy(great group)
P1	Aquic Calciudoll
P2	Typic Dystrudept
P3	Typic Calciudoll
P4	Entic ultic Haploxeroll
P5	Humic Haploxerept
P6	Typic Calcixerept
P7	Calcic Haploxeralf
P8	Aquic Haploxerept
P9	Aquic Xerorthent
P10	Typic Hapludoll
P11	Typic Eutrudept
P12	Ruptic-Alfic Dystrudept
P13	Abruptic Argiudoll
P14	Typic Dystrudept
P15	Oxic Argiudoll

Mollisols represent dark coloured, base-rich(mollic epipedon) soils of the stepps and cover extensive subhumid to semi-arid areas. Most of these soils have a grass vegetation after they were defrosted. By and large Mollisols occur in landscapes covered by grassland but they also occur in forested areas. In high altitudes(such as study area, Savadkooh), Mollisols have formed in late Pleistocene or Holocene deposits(Bhattacharyya *et al*.,2006). Beyond the limits of glaciation, Mollisols may be in older deposits or on older surfaces dating back, perhaps to mid- pleistocene or earlier(soil survey staff,1999).

They occur in a wide range of landscapes ranging from flat alluvial plains to undulating plains and mountains(Fenton,1983). Alkaline Mollisols, occurence of acidic Mollisols under forest associated with Alfisols and Vertisols in the humid tropics of central and western India are common(Bhattacharyya *et al*.,2006).

However, in this study, we didn't see acidic Mollisols. Mollisols are formed abundantly in temperate humid climate, which is conductive for the formation and retention of high organic matter since mollic epipedon represents soils containing high organic matter contents, it is expected that formation of Mollisols should be possible in forest areas with high rainfall and cool climate such as Savadkooh region.

Fortythree(43) percentage of all samples that we studied, were Inceptisols. We had 2 suborders of Inceptisols in this area. Inceptisols includes those soils from ustic and udic regions that have altered horizons resulting from translocation of loss of iron, aluminum or bases(Soil survey staff, 1999). These are the middle soils within Mollisols and Entisols. Most of them, have cambic horizons and are eluvial soils. The reduction in soil depth (in epipedon horizon) and decrease in level of soil organic matter, in most cases through a conversion of natural ecosystems to agriculture as well as through on increase in the intensity of tillage.

More than half of Inceptisols in study area were under condition changing landuse(forest to field). Lack of epipedon and decrease in oaganic matter were the main cause of transformation of these soils to Inceptisol instead of Mollisol.

Twelve and half(12.5) percentage of soils, are Entisols. In Savadkooh, the main case of agriculture is rice. Rice in Savadkooh is grown on most aquent, the hydrological requirement being that the surface layers dry periodically to a sufficient degree, so that oxidation can take place(Moormann and Breemen, 1978).

Seven percentage of soils, are Alfisols. We have one suborder of Alfisols in this area. Alfisols are widely used for agriculture because of natural fertility, located in humid and subhumid regions, they occur under wide range of environmental conditions. The central concept of Alfisols is that of forest soils. That occupy relatively stable landscapes positious and thus have a subsurface zone of clay accumulation(Soil genesis & classification, 2003).

Conclusions:The present study provides a general concept of presentation of Mollisols in Savadkooh region. The Mollisols have been formed due to more organic matter in the soil system under forest. According to the conditions in study area, Inceptisols in Savadkooh are under condition changing landuse. Lack of epipedon and decrease in oaganic matter were the main cause of transformation of these soils to Inceptisol instead of Mollisol. Presence of Entisols in Savadkooh, because of rice fields, is acceptable. The minimum percentage was belonged to Alfisols. We detected them with argilic horizon and upper base saturation.

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