Impact of Different Land-use / Land Cover Types on Soil Quality in Alandan Forest, Sari

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Received: 21/05/2012 Accepted: 16/10/2013

Extended Abstract

Introduction

Soil is the main source for human basic needs and land utilization. It makes a linkage between climatic and biogeochemical systems and meets a variety of human requirements (Young et al., 2004). An unsuitable land- use change may lead to a decrease in areas of pastures and forests, soil and water pollution, soil quality reduction and lossing land productivity (Islam *et al*., 1999). Forest destruction and its conversion into agricultural lands and reforestation by broad-leaved and coniferous species are the common forms of forest land-uses in the mountainous Hyrcanian forests in north of Iran. Soil quality as the combination of physical, chemical and biological properties of soil may be altered by changing in soil conditions affected by land use type (Brejda et al., 2000). Impact of different land – uses on soil quality was evaluated by measuring several soil properties. The present study aimed to investigate the effect of land use change on soil physical, chemical and biological properties and soil quality index in managed Beech stand, destructed forest stand, Pine plantation, Ash plantation, and agriculture land in Alandan forests.

Methodology

Our study was conducted in Alandan forest, a part of Hyrcanian region in the north of Iran

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(latitude, 36° 13′ N; longitude, 36° 10′ E). The experimental area was situated in 1000 m above sea level and average annual rainfall and temperature were 858 mm and 11.9 °C, respectively. Soil type is Brown forest soil. Five land-use types, here, are including managed Beech stand (*Fagus orientalis* Lipsky.), destructed forest stand (*Carpinus betulus L., Parrotia persica C. A. Meyer*) Pine plantation (*Pinuse nigra* Arnold.), Ash plantation (*Fraxinus excelsior* L.) and agriculture land (as rainfed farming with wheat and barley). Soil samples were taken in all sites in August 2010 using 8 cm core based on systematic random sampling design (n=6 in each land – use). The soil samples were transported to laboratory and their physical and chemical properties were measured. Calculation of soil quality index involves three main steps:

1) definition of a Minimum Data Set (MDS) by expert opinion method,
2) score assignation to each indicator by liner mathematical functions,
3) data integration in an index.

The data were analyzed using one-way analysis of variance (ANOVA) after checking the assumption for parametric test in SPSS v.16 software.

Results and Discussion

Results showed that soil moisture were significantly ($P<0.05$) higher in managed Beech stand and destructed stand than other sites. Adding organic matter to soil may lead to increase in conservation of water in soil via reduction of evaporation and transpiration and increase in water infiltration rate. Ash plantation showed significantly greater pH compared with managed Beech stand. Ash litter has been shown to be easily decomposable and rich in nutrients and cause high base cation return to the soil (Norden, 1994b). The lower pH in beech forest compared with other land uses can be explained by slower litter decomposition of this species, which leads to production of organic acids and also delays the return of base cations to the soil (Hagen–Thorn et al., 2004a). The highest total nitrogen was found in Ash plantation and its lowest amount was observed in Pine plantation. The easily decomposable and nutrient-rich litter of ash may support large population of micro-organisms, which could contribute to an increase in soil N (Fried et al., 1989). The low amount of total nitrogen in pine monoculture may be related to slow litter decomposition in pine species (Neirynck, 2000). Agriculture land showed significantly greater K compared with other sites. The fertilizer application may result in increasing of K concentration in arable soil. The highest Ca concentration was observed in Ash plantation. A high content of base cations in the Ash foliage and its high susceptibility to leaching led to increased base cation input through fall to the soil (Hagen-Thorn *et al.*, 2004b). Beech stand and destructed stand showed significantly higher ammonium concentrations compared with other land uses. The higher ammonium concentrations may be related to higher rates of Net N mineralization (Garten, 1993). Increasing N mineralization rates and microbial activity have been reported as an effect of transient increase in temperature, water content, pH, and labile sources of C and N for microbes (Rutigliano et al., 2007). The highest soil quality was found in Ash plantation and destructed stand and its lowest amount were observed in pine plantation. The lower value of nutrient and organic C, total nitrogen and soil moisture caused reduction of soil

quality in Pine plantation (Zhao*et al*., 2005). In Ash plantation, the presence of herbaceous vegetation may be one of the reasons for better soil quality.

Conclusion

Results of our study showed that different land – uses can significantly affect soil quality. Soil quality in Ash plantation and destructed forest were the best whereas in Pine plantation was the worst. According to our findings it can be suggested that Ash trees should be admixed within Pine monocultures in order to cause an appropriate soil quality. In that destructed forest showed the highest soil quality compared with other sites. Thus, those areas should be fenced because they are capable to regeneration and forest reconstruction.

Keywords: Alandan, Land – use Change, Physical and Chemical Properties of Soil, Soil Quality.