Effect of Land Use on Soil Quality in a Small Arid Catchment of Upper Yangtze River Valley

Shiliang Liu
Beijing Normal University, China

B. J. Fu
Chinese Academy of Sciences, China

G. H. Liu
Chinese Academy of Sciences, China

M. K. Ma
Chinese Academy of Sciences, China

T. Lu
Northwest Sci-Tech University of Agriculture and Forestry, China

See next page for additional authors

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Shiliang Liu, B. J. Fu, G. H. Liu, M. K. Ma, T. Lu, and J. Y. Zhou

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S.L. Liu[1*], B.J. Fu[2], G.H. Liu[2], M.K. Ma[2], T. Lu[3], J.Y. Zhou[3]
[1] School of Environment, Beijing Normal University, Beijing 100875, China, E-mail: shiliangliu@163.com; [2] Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China; [3] Northwest Sci-Tech University of Agriculture and Forestry, Yangling, Shanxi 712100, China

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Introduction Vegetation recovery, such as reforestation, and natural succession may also change soil quality. Degradation of land is among the most serious environmental problems in Southwest China. There is a need for research to be conducted to determine the effects of land cover change. Taking the Dagou catchment with a reforestation history in the Upper Minjiang River as an example, a study was initiated to characterize ecological effects in reforested and adjacent cultivated or shrub sites. The objectives were to (1) investigate soil propertie changes associated with different land use types, and (2) to identify changes on soil properties and plant diversity brought about by the reforestation.

Methods and materials The conditions of the study area are now better than the dry valley adjacent to the study area which has very high evaporation and very limited precipitation. The annual rainfall is 900 mm while evaporation is 795 mm, and the mean monthly temperature is approximately 8.9℃. Soil types are mainly mountainous umber and brown soils. The landscape of the catchment still exhibits large heterogeneity. Land use types were identified into four categories including shrub, cropland, potatoes, reforested land, and woods planted with Chinese pine for periods of 5 years to 30 years (orchard land). In total twenty-nine plots were investigated. At each site all individual trees were identified and diameter measured at breast height, layer coverage, stem height (height of the first major branch) and total height. Shrubs were identified and measured for diameter, layer coverage and total height, while herbaceous vegetation were identified and counted. Soil samples were collected to assess effects of land use change on soil properties. The number for orchard land, shrub land, cultivated land and reforested land was 4, 8, 4, and 13, respectively. The *QI* was calculated by soil quality factor membership values and their weight as following *equation*.

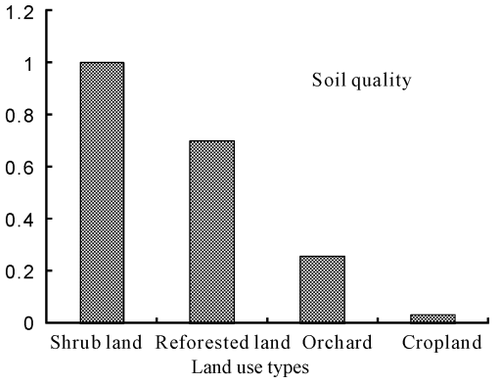

Figure 1 *Soil quality of different land uses in the Dagou catchment.*

Results The results showed that OM, TN, AK, SW had statistically significant differences between the four land use types. The values presented that OM and TN of cultivated land were dramatically lower than shrub and reforested land. Figure 1 showed that the land use changes had resulted in very different soil quality levels. The *QI* values for shrub land, cropland, orchard and reforested land were 1, 0.03, 0.25, and 0.70 respectively. Figure 2 showed that reforestation could greatly change soil properties. The OM, TN, AK and SW had good relationship with reforested years. The results showed the *QI* values increased with the reforested years, from 0.08 to 0.89.

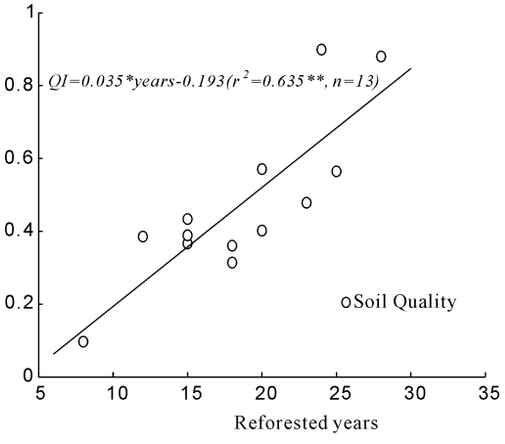

Figure 2 *Positive linear relationship between soil quality and years since reforestation.*

Conclusions The study assessed the effects of land use and forest recovery on the soil properties. The results showed that cropland had the lowest soil quality level and the shrub land had the highest level. The soil quality index increased with vegetation recovery. The study suggested that in the dry valleys shrubs had a good capacity for soil improvement and reforestation, if well restored, could also improve soil quality and biodiversity. The project was supported by National Natural Sciences Foundation of China (No.40501067).

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