Seasonal Distribution of Physical Parameters of Soil in Catchment Area of Pandoga Sub Watershed in Shivalik Foothills of Una, India

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Abstract

Watershed projects in India are implemented with the twin objectives of soil and water conservation. Present study area falls in fragile and degraded foothills of Shivalik ranges. Aim of this study was to determine the physical parameters of soil in pandoga sub watershed catchment area for two seasons. Three–stage systematic sampling design was followed for soil sampling. Total twenty seven soil samples were collected from a depth of 0-20 cm. The collected soil sample was air dried, ground, sieved with 2 mm sieve, tagged, and stored for laboratory analysis. Physical parameters were analyzed using standard methodology. Soilcolour, soil texture changed within the sites but remain almost static with the season. ***.*** *Sand particles show dominance of over silt and clay in each site of study area. Bulk density, moisture content was higher in site 3 and show high mean value in post monsoon season against the pre monsoon season.*

Key Words

Physical parameters, sub watershed, water availability

I. INTRODUCTION

Soil is a natural body of mineral and organic material, which differs among themselves as well as from underlying materials in their morphology, physical make up, chemical composition and biological characteristics (Solanki and Chavda, 2012). Large proportion of earth terrestrial surface has converted from natural ecosystems to human dominated system. These land uses changes affect the ecosystem soil properties (Paz-Kagan, *et al.*, 2014).

Soil fertility varies spatially from field to larger region scale, and is influenced by both land use and soil management practices (Sun *et al.*, 2003). Revealing spatial variability of soil fertility and its influencing factors are important to improve sustainable land use strategies (Qi *et al*., 2009).

A watershed is a catchment area from which all water drains into a common point, for technical efforts to conserve soil and maximize the utilization of surface water and subsurface water for crop production (Kerr *et al*., 2000). The government of India adopted watershed management on a large scale as a strategy to conserve rainwater and soil for increasing production of rain fed systems (Wani and Ramakrishna, 2005; Wani*et al.*, 2008) and to enhance the livelihoods of the rural poor (Sharma and Scott, 2005).

The present study was conducted (July 2013 - June 2014) in pandoga sub watershed catchment area which is located in rainfed agricultural area of Shivalik foot hills which is fragile and young. Therefore study is important to assess the physical parameters of soil in changed scenario after the sub watershed implementation in area.

II. MATERIALS AND METHODS

Pandoga sub watershed is one of the 22 sub watersheds implemented in SRIWMP (SWAN RIVER INTEGRATED WATERSHED MANAGEMENT PROJECT). SRIWMP was launched to convert flood and hazards region of rainfed agricultural area into natural gift. The Pandoga sub watershed was located at 31^0 30’25.30”N Latitude and 76^0 82’ 02.24” E longitudes.Elevation of area is 350 to 600 m above mean sea level. Topography of the area is gentle to moderately sloping. Mean annual rainfall is approximately 1155mm with extreme variation in rainy and post rainy season. Temperatures also vary from high in summer season (May to June) to low in winter season. Agro climatic zone is Shivalik foot hills of Western Himalayan zoneThree–stage systematic sampling design was followed where watershed’s catchment area was divided into three sites; second one was division of each site into three wards; third is triplicate soil sampling was done from each ward for two seasons (post monsoon and pre monsoon season) from a depth of 0-20 cm and then data was analyzed by following standard methodology; colour(Rice et al., 1941);texture(International pipette method (Piper, 1966));moisture content(Dry oven method),bulk density (core method.

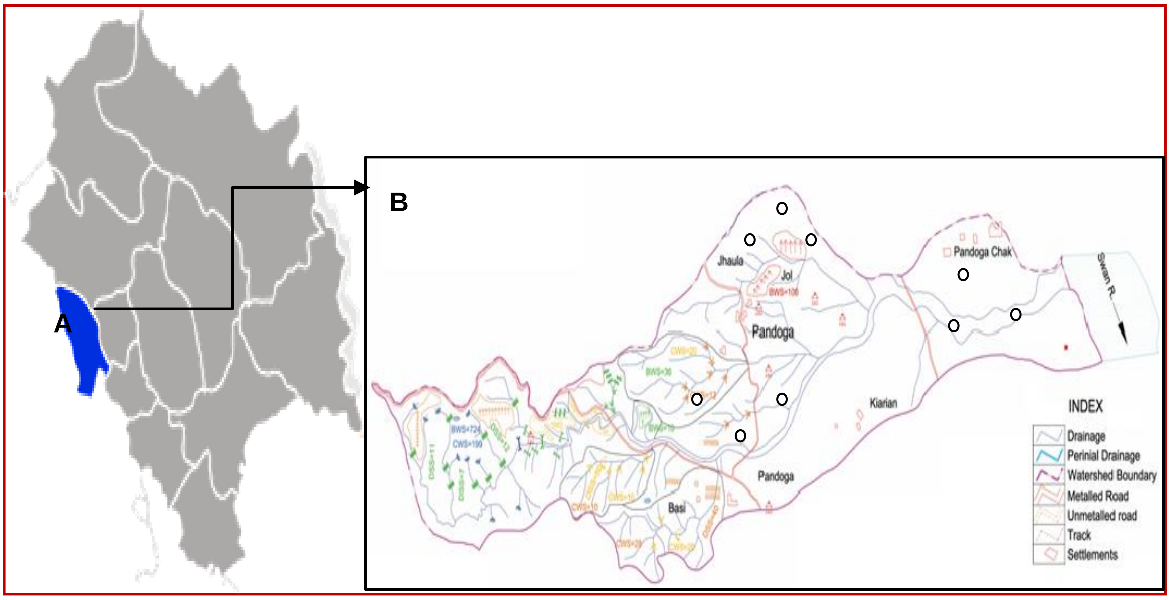

Figure 1: Location map A. Distt. Una in Himachal Pradesh; B. Pandoga sub-watershed catchment area

III. RESULT AND DISCUSSION

A) Physical Analysis

[**SOIL COLOUR, SOIL TEXTURE, SOIL BULK DENSITY,SOIL MOISTURE CONTENT**]

Results of present study revealed that soil colour varied from site to sites as: pale yellow to brownish gray or yellow in site 1, light gray to brownish gray in site 2, while pale yellow or dull yellow to brownish gray in site 3(Table1) . Woldeamlak and Stroosnijder, (2003) found the grayish soil colour in flood plain area where alluvial deposited during flooding. Soil texture controls the infiltration, water holding capacity, soil porosity, adsorption of nutrients, microbial activities, tillage and irrigation practices (Gupta, 2004). Results revealed that maximum mean sand percentage (75%) was found in ward 10 of site 2 and minimum mean sand percentage (64.33%) in ward 9 of site 1. Maximum mean silt was (23.33%) in wards of 4 of site 3 and minimum mean (17.33%) in ward 7 of site 3. Maximum mean clay was observed (15.66%) in ward 9 of site 1 and minimum mean in ward 10 of site 2 (Fig.2A). Sand particles dominate over silt and clay in all sites of study area. According to (Mortimore, 1989) sand particle dominate in arid and semi-arid climate. (Adamu, 1997) indicated that sandy textured soil are prone to erosion due to poor binding between the soils particles and create unstable structures. Differential particle size distribution in sites might be the result of differential soil conservation measures adopted. The soil at Pandoga sub watershed catchment area was sandy loam type of soil, same type of soil texture was observed from various altitudes of some western Himalayan regions (Jina*et al*., 2011; Gupta and Sharma, 2016). During post monsoon season, maximum mean bulk density 1.54 gm/cm^3 was in ward 7 of site 3 and minimum mean bulk density1.37 gm/cm^{3}in ward 8 of site 1. However, during pre monsoon season maximum bulk density 1.50 gm/cm^3 was in ward 7 of site 3 and minimum 1.27 gm/cm^3 in ward 8 of site 1(Fig.2B). Results revealed that bulk density of post monsoon was higher than the pre monsoon seasons. Same trend was observed in the study of (Patel *et al.*, 2015). Higher bulk density in site 3 may be due higher percentage of sand, trampling effect of live-stock population. Sandy soils had relatively high bulk density since total pore space in sand was less than the silt and clay soil. Maximum mean moisture content was recorded by 17.58% and 17.14% was in ward 7 of site 3 in post and pre monsoon season respectively whereas minimum mean moisture content was recorded by 12.73% in ward 2 of site 2 during post monsoon season. Minimum mean moisture was 11.15% in ward 1 of site 2 during pre monsoon season. Soil moisture was increased by rainfall during rainy season (Fig.2C). The amount of water in the soil was mostly influenced by the quantity of precipitation occurred in that particular area (Fauzie*et al.*, 2015) while (Jina*et al.*, 2011) indicated that soil moisture shows a fixed seasonal trend i.e., it was higher during rainy season and decrease gradually in winters and summers. Higher moisture content in site 3 may be due to meeting point of Pandoga River with the Swan river and ground water recharging in site 3 through gravity gradient flow of water to underground region of pandoga.

Site 1			
Ward	**8**	**9**	**11**
Colour	Pale Yellow to Yellow	Brownish Gray to Dull Yellow	Pale Yellow
Site 2			
Ward	**1**	**2**	**10**
Colour	Light Gray	Light Gray to Brownish Gray	Light Gray
Site 3			
Ward	**3**	**4**	**7**
Colour	Pale Yellow to Grayish Yellow	Dull Yellow to Brownish Gray	Brownish Gray

Table 1: Variation in soil colour at Pandoga sub watershed catchment area at different sites (nine wards)for post monsoon season.

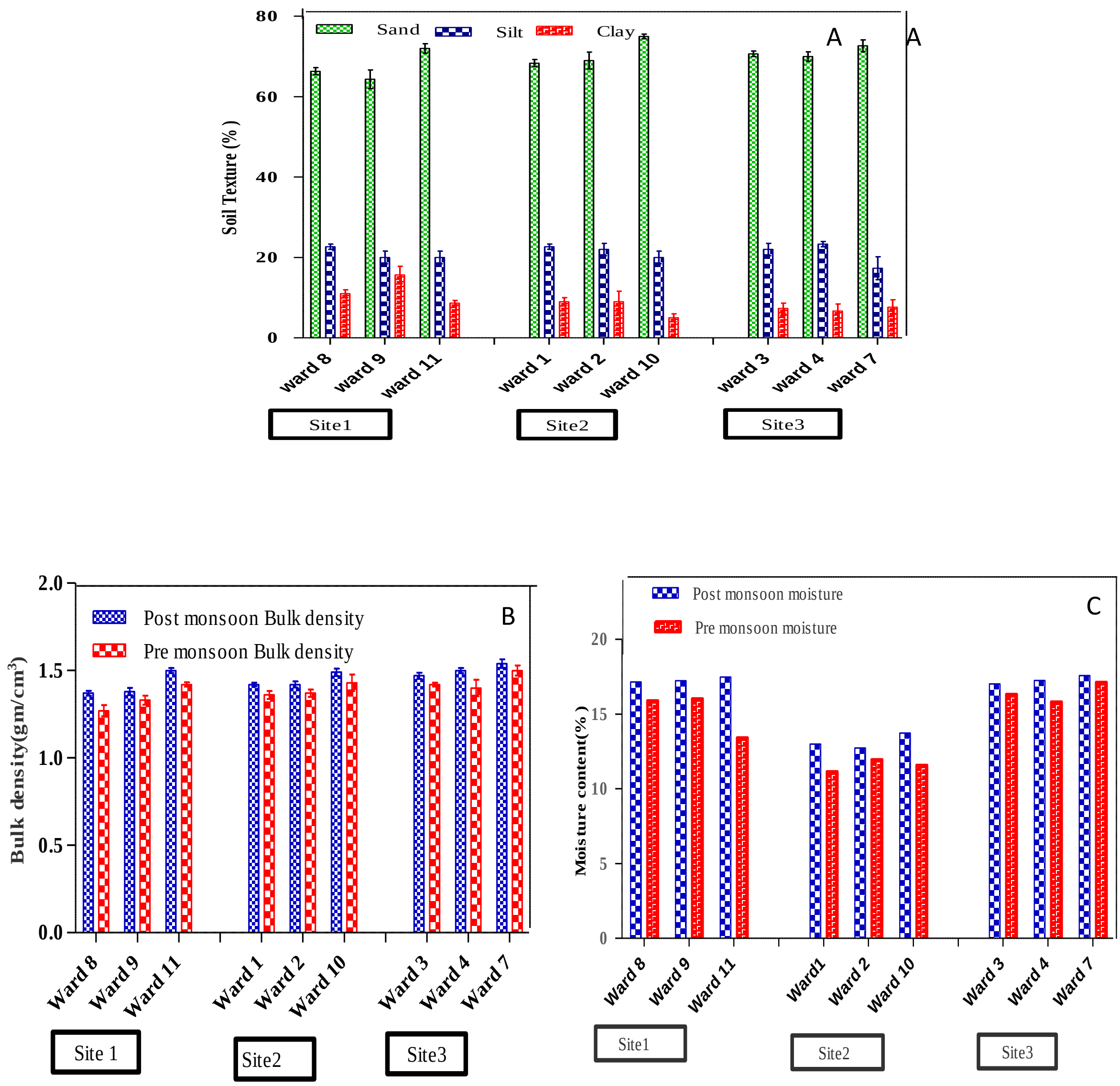

Fig.2: Variation in physical parameters of soil at Pandoga sub watershed catchment area at different sites (nine wards) during two different seasons. Values are ± S. E. n=3. [A: Textural distribution; B: Bulk Density; C: Moisture content]

IV. CONCLUSION

Pandoga sub watershed catchment area had influence on the soil physical parameter as study area experienced changed ecology (rainfed agro ecological region) by recharging ground water. Soil conservation measures (wire check dams, crate wire check dams, vegetation) affect the rate of erosion which ultimately affects the texture, bulk density and moisture holding of soil in different sites of study area. Fluctuations of Physical parameter results season wise as well as site wise indicated changing characters with the changed conservation measures.

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