JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Physico Chemical Analysis of Soils of Forest of Shahapur Taluk, Yadgir District, Karnataka - India

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Abstract

Studies on the nature and properties of soil of forest ecosystems are important for proper management of the environment and utilization of resources. The present study objectively conducted to analyse the physio-chemical properties of soils of forest Shahpur taluka of Karnataka. The study of soil is based on various parameters like texture, temperature, moisture content, water holding capacity, pH, Soil organic carbon, potassium, phosphorus and nitrogen and micro nutrients such as Zinc (Zn), Cobalt (Co), Manganese (Mn) and Iron (Fe).

The soil of Shahapur forest was less acidic. Nearly alkaline. The average Soil Organic Carbon in was 1.03%, Nitrogen 381.93, phosphorus 38.9, exchangeable potassium was 108.64 kg $ha^{-1.}$Zn 0.75, Co 0.41, Mn 11.04 & Fe 32.04 ppm.

Soil nutrient status may help for the Environmentalist and agencies involved in the processes of reafforestation.

Key Words : Physico-chemical analysis, Shahpur taluka, forest soil

INTRODUCTION:

Soil is the link between the air, water, rocks, and organisms, and is responsible for many different functions in the natural world that we call ecosystem services. These soil functions include: air quality and composition, temperature regulation, carbon and nutrient cycling, water cycling and quality, natural "waste" (decomposition) treatment and recycling, and habitat for most living things and their food. We could not survive without these soil functions.

Soils are naturally occurring bodies whose origin, classification, and Physico- chemical properties are Valuable for study. Of the six major factors affecting the growth of plants, only light is not supplied by soils. The soil supplies water, air, and mechanical support for plant roots as well as heat to enhance chemical reactions. It also supplies seventeen plant nutrients that are essential for plant growth (Rajesh 2013).

Soil is a vital component of forest ecosystems and is responsible for the processes that support biomass production and carbon sequestration (Moffat 2003). Physico-chemical characteristics of forest soils vary in space and time because variation in topography, climate, weathering processes, vegetation cover, microbial activities (Paudel and Sah, 2003).

The growth and reproduction of forest cannot be understood without the knowledge of soil. The soil and vegetation have a complex interrelation because they develop together over a long period of time. The vegetation influences the chemical properties of soil to a great extent. The selective absorption of nutrient elements by different tree species and their capacity to return them to the soil brings about changes in soil properties (Singh *et al*., 1986).

The composition of forest soil changes constantly by the growth of trees and ground cover vegetation, activity of organisms and effect of climatic agents. Under the influence of these factors, mineral and organic matter undergoes gradual decomposition or disintegration (Sharma *et al.,* 2010). Dry deciduous forests are the most exploited and endangered ecosystems of the biosphere, compared to the other tropical forest types (Murphy and Lugo, 1986; Janzen, 1988; Gentry, 1990; Bahuguna, 1999). Generally, forest soils research has

been focused on temperate forests, but most recently, forest soils have become a truly global research area. (Jennifer D. 2019)

There is an urgent need to assess their extent and condition, as there is also for the underlying ecological , social , economic, factors leading to forest degradation & reafforestation. This will enable the development of appropriate management strategies to maintain the country's environmental health & ecological stability through the reafforestation of degraded lands. (Bhat *et al*., 2001). In addition study of nutrient status and other Physico chemical properties of soil with respect to forest.

Forest soil quality assessment is well established in several developed countries, such as the United States (Doran & Parkin 1996)., New Zealand (Lilburne *et al.*,2002) and numerous European nations, including the United Kingdom (Royal Commission on Environmental Pollution-1996). In India, because the majority of soil quality studies are performed in agricultural and horticultural sectors (Bhardwaj *et al.*, Masto *et al*., 2007) very little data are available on forest soil quality and biota [8].

Considerable research work has been done regarding the study of Nutrients and Physico-Chemical assessment of various types of soil in many parts of India. (A.A.Patil *et,al*.2013), (R.P.Ganorkar *et,al*. 2013), (R.P.Ganorkar et,al.2014), (Tripathi and Aneja, 2019) , (Monika Rawat *et al*., 2020)

Most of the study on forests soil were carried out at various forests type of Karnataka (Pujar *et al.*,2012), (Nagaraja et al 2014), (Raghuvendra & Vijayakumar 2017).Very less work has been carried in Northern parts of Karnataka (Divya & Belagali 2012).

Considering the previous work done and need of present study an attempt was made to investigate physico chemical properites of soils with reference to forests of Shahpur Taluk.

Material Methods

STUDY AREA

Forest cover in Shahapur taluk is 2845 ha. of the total geographical 1706.00 Sq. km area of which 758 ha. is reserve forest and 1806 ha. protected area and 281 ha. unclassified forest, which is found in smaller or tiny patches and is a hilly terrain and major portion of the rainfall flows down without any underground water

recharge due to lack of vegetation, as a result of this the entire experiences drought like conditions in summer (Table-1; Plate-1).

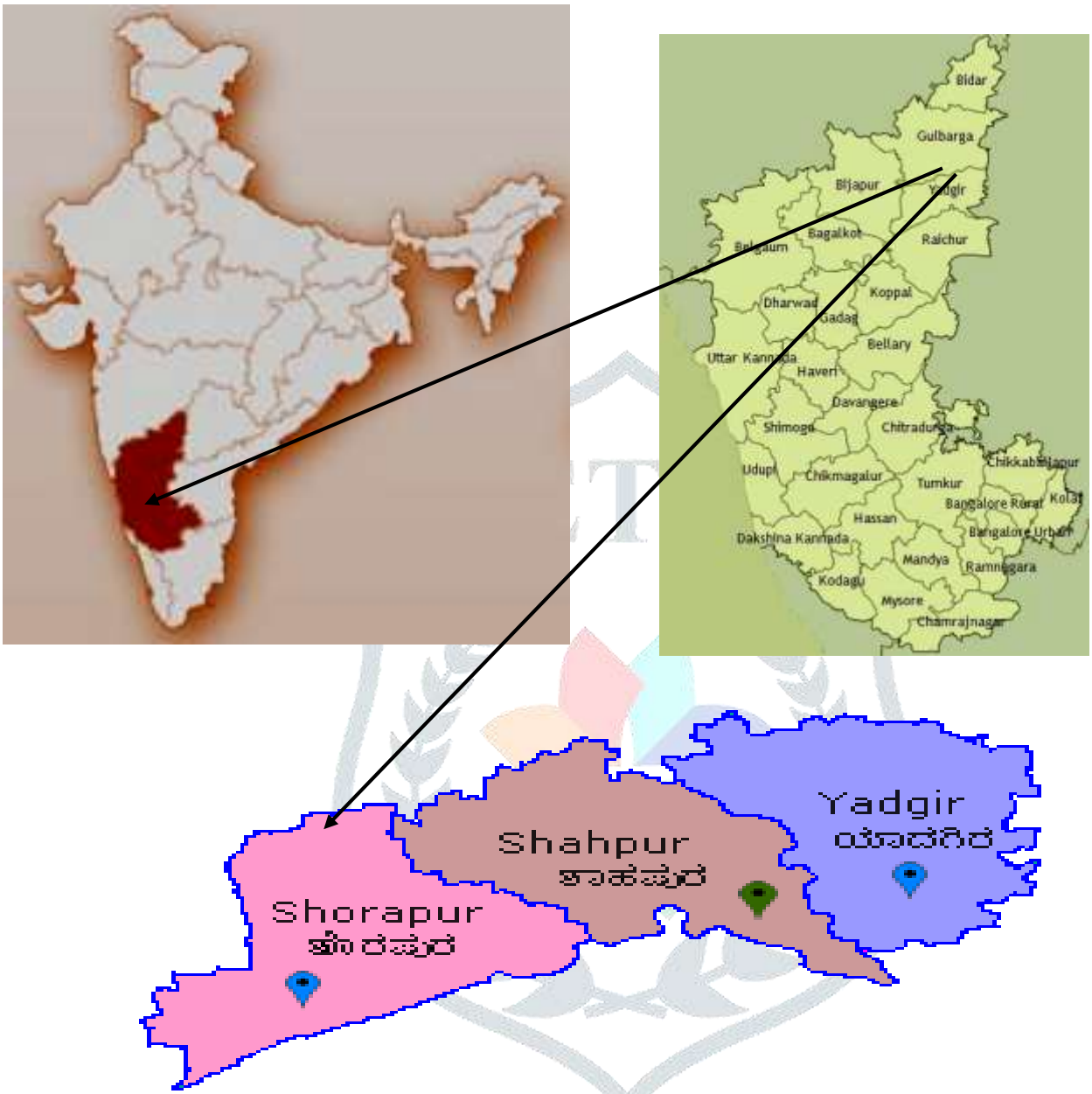
Location and size

Global Positioning System (GPS) device was used to obtain Geographical co-ordinates, elevation, Longitude and Latitude. Slope angle was measured by the clinometers (Suunto Height & Normal slop meter PM-5/1520 PC). The highest point altitude recorded in the forest is 690M and lowest point in the stream level 445M and mean 550M. Latitude 16.79 N Longitude 77.14 E.

Physico-chemical analysis of Soil

The soils forest of Shahpur Taluk were analysed for physico-chemical properties for texture, temperature, moisture content, water holding capacity, pH, Soil organic carbon, potassium, phosphorus and nitrogen and micro nutrients such as Zinc (Zn), Cobalt (Co), Manganese (Mn) and Iron (Fe).

Plate -1



Map of India, Karnataka and Shahapur of Yadgir District

Collection of soil samples

Collection of soil sample was done by random selection in forests of Shahpur taluk. About ½ -1 kg of soil was collected by digging V- shaped forrow and 10-15 soil samples collected at different quadrants, elevations representing different types of vegetation were collected and labeled accordingly then they were shade dried in the laboratory and sent to soil testing laboratories of Agricultural Research Station, Bheemrayan gudi and Agricultural Research Station, Kalaburagi to evaluate the content of macro and micro nutrients. Possible preliminary analysis of the soil is done in the field/ quadrants itself.

Soil pH

1 g of fresh soil sample was dissolved in 100 ml of Distilled Water. Then solution was kept on orbital shaker for 20 min to get homogenized. Further the sample was filtered and filtrate is used for measuring pH of soil using Digital pH meter (Systronic 335).

Soil Temperature

Soil temperature has been noted in the desired area of random selection by digging 1 feet depth and measured by keeping Soil Thermometer for 5 min.

Soil moisture

The moisture content of soil was determined by Gravimetric method/ Oven dry method (Allen *et al*., 1974). Ten gram of freshly collected soil sample was kept in a hot air oven at 105 ^{0}C for 24 hours. The air dried soil was then weighed and recorded.

Soil Texture

The soil texture was determined by Bouyoucos hydrometer method (Allen *et al*., 1974).

Water holding capacity

Water holding capacity of soil was determined by Keen's method by using copper cup of 5.6 cm internal diameter and 1.6 cm height (Piper, 1966).

RESULT AND DISCUSSION

The analysis was aimed to evaluate the micronutrient status of some selected soils of Shahpur. The results of Physico chemical properties of the soil samples are given in Table-1 & Graph-1.

Moisture

The results show that the higher percent of moisture was observed was 3.9% and the lowest was 1.3%, the mean moisture content was 2.25% .

pH

The forest types indicate that the soil of Shahapur forest was less acidic. Nearly alkaline. The highest pH was recorded was 7.1 and lowest was 6.1. The mean pH was 6.52. The PH is very important property of the soil is it determines the capacity. The limit of PH value for Acidic and Alkaline soils are accordance with (Swanti *et al*.) It has been reported that forest soils should be slightly acidic for nutrient supply to be balanced (Leskiw 1998). A fertile soil generally has a pH range between 5.5 and 7.2, which makes the essential elements and nutrients available to the flora.

Organic Carbon

The average Soil Organic Carbon in Shahapur forest was 1.03%. Similar observation have been observed by N. Bassirani1 *et al*. Soil organic carbon (SOC) hold a very important role in global C Cycle as it is largest terrestrial C pool. Soil can be source or sink of green house gases depending on land use and management. Nearly all models of global climate change (Lal 1999).

Available Nitrogen

The highest nitrogen recorded was 509.63 kg/ha^{-} and the lowest was 316.2 kg/ha^{-}. In the soil nitrogen also available as nitrates, nitrites and ammonium salts but nitrates alone can be used by plants. It promotes growth and imparts green colour to the leaves. Over supply of nitrogen encourages excessive vegetation growth, insufficient supply leads to stunted growth. (Raghavendra & Vijayakumara 2017). Soil N is supposed to be the most limiting nutrient in a majority of ecosystems (Fenn *et al*.,1998).

Phosphorous

Soil provides appreciable quantity of phosphorous in the form of phosphates. Phosphorous helps in maturation, flowering, fruiting and lateral and fibrous root development.

The available phosphorus in Shahapur forest was higher (53.7 kg ha^{-1}) and the lowest (16.05 kg ha^{-1}) and the mean was 38.9 kg $ha^{-1.}$ Phosphorus improves root development, rapid growth and encourages blooming (Nagaraja *et al.*,2019)

Potassium

The exchangeable potassium 178.1 kg ha^{-1} and lowest recorded was 60.63 and the mean was 108.64 kg ha^{-1}The potassium content present in the soil depends on favorable soil environment with the presence of organic matter (Chauhan, 2001). The potassium is used to build proteins.Potassium performs very vital processes like regulating transpiration and respiration, influencing enzyme action, and synthesis of carbohydrates and proteins, etc. (Brady 1996).

Micronutrient

The analysis of available micro nutrients in soils of Shorapur forest was carried out for the assessment.

Zinc

The element Zinc (Zn) content in soils of Shahapur highest record was 1.47 ppm and the lowest was 0.42 ppm and mean value was 0.75 ppm.

Cobalt

The highest concentration of Cobalt (Co) reported was 0.9 ppm where as lowest was 0.3 ppm the mean was 0.41

Manganese

In case of concentration o fManganese (Mn) the highest value observed was 52.8 ppm and the lowest was 3.48 ppm and mean reading was 11.04ppm.

Iron

The highest content of Iron (Fe) was 35.80 ppm and lowest recorded was8.30 ppm and the mean reading was 32.04 ppm in the forest of Shahapur taluk (Table-01).

CONCLUSION:

Present study concludes that the all soil parameter were in normal criteria of healthy soil. This is also responsible for excellent reach diversity of flora.

The properties varied, along a gradient of soil development. Nutrient pools are good. Soil physical properties were strongly correlated with soil fertility, with favorable physical properties occurring in highly weathered and nutrient depleted soils. Soil phosphorus concentrations very little varied with the all study area. Phosphorus availability in the younger soils was governed by the weathering of the primary and secondary minerals (particularly apatite) which in turn was controlled by soil pH.

There is a need of conserving this healthy ecosystem gifted by nature as the Forest of Shahpur districts and this may cause harm to this ecosystem in future if proper care is not taken.

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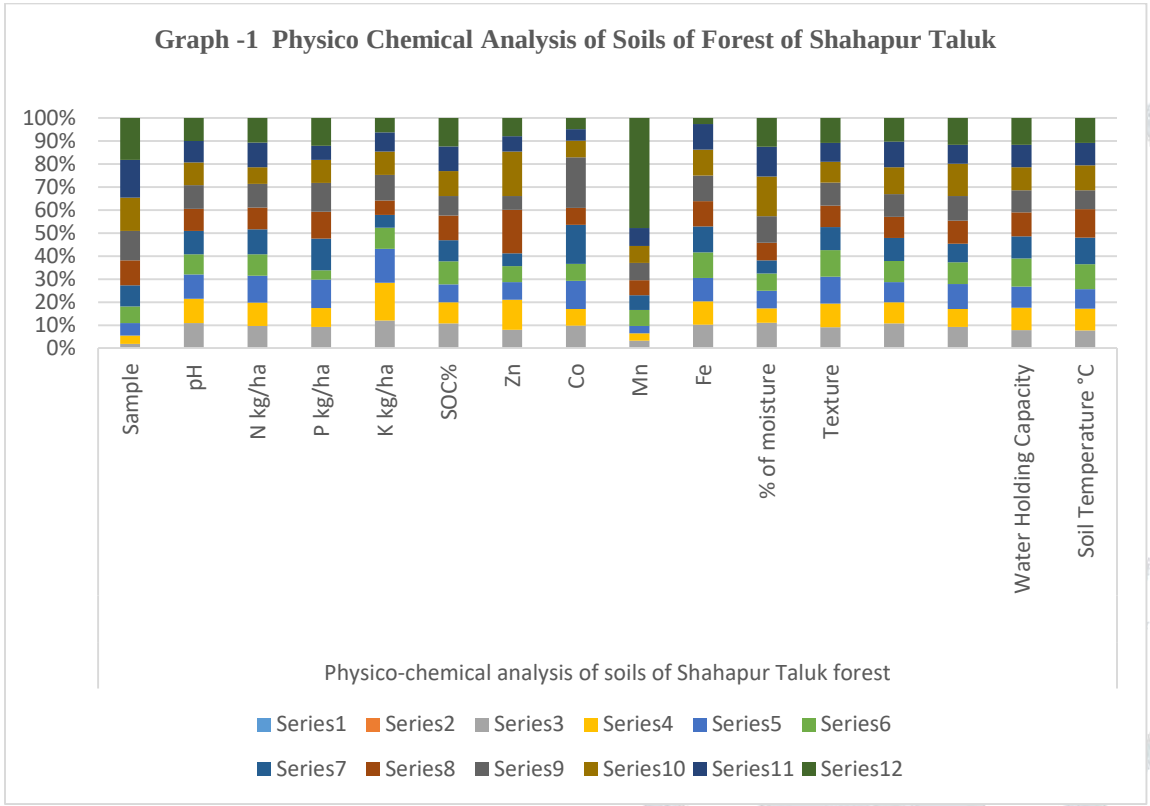
Table-1 . Physico-chemical analysis of soils of Shahapur Taluk forest

Sample	pH	N kg/ha	P kg/ha	K kg/ha	SOC%	Zn ppm	Co Ppm	Mn ppm	Fe ppm	% of moisture	Texture			Water Holding Capacity %	Soil Temperature °C
											Sand %	Clay %	Silt %		
1	7.1	420.2	36.06	130.6	1.4	0.61	0.4	3.66	32.73	2.5	48.8	13.5	21.9	18.2	23.8
2	6.9	433.3	31.89	178.5	1.2	0.99	0.3	3.48	32.60	1.4	55.6	11.5	18.2	22.3	28.9
3	6.9	509.6	48.09	160.1	1.0	0.58	0.5	3.45	32.57	1.7	63.2	10.9	25.6	21.5	26.3
4	5.7	399.9	16.05	99.3	1.3	0.52	0.3	7.73	35.61	1.7	62.1	11.4	22.2	28.1	33.2
5	6.6	470.7	53.7	60.63	1.2	0.42	0.7	7.09	35.81	1.3	54.6	12.6	19.3	22.1	35.3
6	6.3	408.3	45.62	67.3	1.4	1.44	0.3	7.26	35.45	1.7	50.1	11.5	23.6	24.3	38.2
7	6.7	442.2	48.79	121.5	1.1	0.45	0.9	8.20	35.65	2.6	54.2	12.3	25.3	22.2	25.3
8	6.4	316.2	39.07	110.8	1.4	1.47	0.3	8.18	35.68	3.9	48.5	14.6	32.9	23.1	33.1
9	6.1	462.7	23.55	89.9	1.4	0.50	0.2	8.63	35.80	2.9	44.7	13.9	19.6	22.4	29.8
10	6.5	459.9	47.06	67.8	1.6	0.6	0.2	52.8	8.30	2.8	57.9	12.8	27.3	26.9	33.3


Graph -1 Physico Chemical Analysis of Soils of Forest of Shahapur Taluk
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Sample
pH
N kg/ha
P kg/ha
K kg/ha
SOC%
Zn
Co
Mn
Fe
% of moisture
Texture
Water Holding Capacity
Soil Temperature °C
Physico-chemical analysis of soils of Shahapur Taluk forest
Series1 Series2 Series3 Series4 Series5 Series6
Series7 Series8 Series9 Series10 Series11 Series12