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Determination And Anylisys Of Soil Moisture Content Under Different LandCovers In Panvel, India Region

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ABSTRACT

In the present research an attempt has been made to understand the linkage between land cover and Soil moisture content at the given area and the long-term field experiment. The study area is the part of Panvel, India region. In Panvel we have taken the area nearby Gadeshwar dam. Where we found both forest and deforest. The objectives of the present study were: To understand spatial variability of soil water potential and soil moisture content under different land covers in the humid tropical Panvel, India Region. To evaluate differences if any in spatial patterns of soil moisture content as influenced by nature of land cover. To develop theregression model for Gadeshwar region using software XL-STAT and correlation regression analysis. To this end, experimental watersheds located in the Panvel, Raigad, Maharashtra, India, were established for monitoring of soil moisture. These watersheds possessed homogenous land covers of natural forest and degraded forest. Soil moisture content measurements were made at two locations in each watershed at 25 cm, 50 cm, and 75 cm depths at weekly time intervals during the period of January to February.

Keyword – Soil Moisture, Humid Tropical Forest, land cover changes, spatial variation, hydrological impact.

INTRODUCTION

Water and forests both cover large portions of the earth and both are crucial to sustenance of life and environment. As the world population increases exponentiallywith time, so doesthe pressure on the extent of utilization of these natural resources.Water and forest are twoindependent natural resources; a close linkage exists betweenthe two. Forest ecosystems generate multiple benefits to society through a wide rangeof products for consumption anduse. In addition, forest on account of interaction with the water cycle, also provide hydrological regulation through groundwater recharge,low-flow augmentation, and flood control processes. The rapidly increasing population pressure in many areas of developingcountries has often led to changes in forest, mostly in terms of deforestation aimed at increasing agricultural productionand providing additional land for human activities. It is generally accepted that deforestation can dramatically alter the water regime with respect to its quantity andquality. In India too, significant reduction in all types of forest covers hastaken placeduring the post-independence period. Recently, Bhat et al (2015) assessed landcover by 1.2% considering the period between 2001 to 2011, changes in different categories of forest covers were evaluated and results are shown in table.

From these results is clear that, the coverage of dense forest has marginally increased,whereas a major reduction in the scrub forest cover (-25.5%) has taken place during that decades

OBJECTIVES

1. Accordingly, the present research was taken up with the following specific objectives: To evaluate the controls exercised by climate, physical characteristics, and nature of land cover on soil moisture content at the watershed-scale.

2. To understand the role of the unsaturated soil zone on soil moisture content of watershed through characterization and analysis of observed long-term spatial variation of soil moisturecontent.
3. To develop a modelling strategy for prediction of soil moisture at watershed-scale using routinely available inputs. To simulate the likely impacts of land cover changes on catchmentof soil moisture content

PROBLEM STATEMENT

How does soil moisture content vary under different land covers (agriculture, forest, urban, water bodies) in the Panvel region?

Soil moisture content varies significantly across different land covers due to differences in vegetation type, land use practices, soil properties, and microclimatic conditions. In the Panvel region, which consists of agricultural land, forests, urban areas, and water bodies, these factors influence the soil moisture levels in unique ways:

1. **Agricultural Land:**

Moisture Variability: Soil moisture in agricultural areas tends to be more variable depending on the type of crops, irrigation practices, and seasonal rainfall. Crops with high water requirements may deplete soil moisture more quickly, while areas with irrigation may maintain higher moisture levels, especially in the root zone.

Impact of Agricultural Practices: Intensive farming, plowing, and monoculture farming systems can affect the infiltration and retention capacity of soil. Irrigation practices, such as flood or drip irrigation, also influence the moisture levels. Excessive irrigation can lead to waterlogging, while insufficient irrigation can result in soil desiccation.

2. **Forest Areas:**

Higher Moisture Retention: Forested areas typically have higher soil moisture content due to greater vegetation cover, which reduces evaporation and improves water retention in the soil. The leaf canopy helps to intercept rainfall, reducing the rate of runoff, while the forest floor's organic matter helps increase water infiltration and reduce evaporation.

Seasonal Variability: Forested regions also have a more stable moisture content over time, especially in the root zone, as the dense vegetation provides a natural buffer against both excess and deficit rainfall conditions.

Influence of Tree Canopy: The type of forest (e.g., deciduous vs. evergreen) can influence moisture content, with evergreen forests often retaining higher moisture levels year-round due to continuous canopy cover.

3. **Urban Areas:**

Lower Soil Moisture: Urban areas generally exhibit lower soil moisture content due to impervious surfaces (concrete, asphalt) that limit water infiltration and increase surface runoff. These areas tend to have faster evaporation rates, and the soil is often disturbed or compacted, reducing its ability to retain moisture.

Impact of Urban Heat: The "urban heat island" effect can increase evaporation, further lowering moisture levels in the soil. Additionally, the presence of vegetation in urban green spaces (parks, gardens) can create localized pockets of higher soil moisture, but these are often limited in extent.

4. **Water Bodies (Lakes, Rivers, Wetlands):**

High Moisture Availability: Soil moisture content around water bodies (such as rivers, lakes, or wetlands) is typically very high due to proximity to water. These areas often experience waterlogged soils, especially during the wet season, leading to conditions of reduced oxygenin the soil and unique hydrological processes.

Moisture Redistribution: In the case of riverbanks or wetlands, the fluctuating water levels can create a dynamic range of moisture levels in the surrounding soil. In contrast, in areas like lakes, groundwater seepage might contribute to high moisture retention around the shorelines.

Key Factors Influencing Variation:

Vegetation Cover: Dense vegetation (forests and agricultural crops) typically results in higher moisture retention due to interception and reduced evaporation, while urban areas with minimal vegetation led to moisture depletion.

Soil Type: Sandy soils tend to drain quickly and retain less moisture compared to clayey soils, which have a higher water-holding capacity. The soil texture influences how water is absorbed, retained, and redistributed

in the landscape.

Climatic Conditions: Panvel's tropical climate, with its distinct monsoon season, plays a crucial role in the seasonal variability of soil moisture. Areas with higher rainfall (like forestsor wetlands) are likely to maintain more moisture compared to agricultural or urban areas, especially during dry spells.

Land Use Practices: The way land is used (e.g., farming, urbanization, deforestation) can impact soil structure and moisture retention. For example, deforestation in forests or conversion of land to urban spaces often leads to a decrease in soil moisture retention.

LITERATATURE REVIEW

Jun Wen et al., Year 2003 explained that Land Surface Soil Moisture Is a Combination of Local Precipitation and Surface Evaporation Which Influence the Weather and Climate Variations. Remote Sensors Can Be Used to Analysis the Land Surface from Space. These Observed Data Can Be Used to Correct Atmosphere Effect. Remote Sensing Is Used to Evaluate the Land Cover and Study the Effect of Climate Variation on Land Cover.

B. Venkatesh et al., Year (2010) experimented the "linkage between a region hydrography, ecology and physiology is characterized by an understanding of soil moisture variability at Western Ghat, India. Where deforestation along with afforestation with exotic species is under taken. The urgent need to evaluate the impact on these changes on regional hydrology.

a) To Understand Spatial and Temporal Variability of Soil Moisture Content Under Different Land Cover at Western Ghat Region.
b) To Evaluate the Difference Between Special and Temporal Variability of Soil Moisture Content as The Changes in Nature at Land Cover

Now At Soil Matric Potential Measurement Were Made at Four Location in Each Watershed At 50cm , 100cm , 150cm Depth at Weekly Time Interval During the Period Of2004-2008.At Different Land Cover at Different Distance And change in Temperature Variable the Soil Moisture Content Are Calculated by Potential Measurement .Where There IS No Such Changes with Depth Were Noticed. Under Acacia and Degraded Land Cover were calculated by Correlation and Regression Method. Regression Method May Prove Useful When Surface Soil Moisture Content Calculated by Remote SensingMethod." **Muhammad et al., Year (2010)** experimented to show that a simple approach to Irrigation control problem using Artificial Neural Network Controller. The proposed system is compared with ON/OFF controller and it is shown that ON/OFF Controller based System fails miserably because of its limitations. On the other hand, ANN based approach has resulted in possible implementation of better and more efficient control. These controllers do not require a prior knowledge of system and have inherent ability to adapt to the changing conditions unlike conventional methods. It is noteworthy that ANN based systems can save lot of resources (energy and water)

and can provide optimized results to all type of agriculture areas.

Kalyan et al., Year (2011) is carried out an experiment to show that the need for systems that make agriculture easier and more sustainable has increased within the pastfew years. The ability to conserve two of the most important resources of a farmer, water, and time, has been the latest challenge. A system that provides this ability - using efficient and reliable methods such as wireless sensor networking, sprinkler irrigation, GSM, SMS technologies and readily available mobile phone devices – is certain to help the farmers get a better yield and on a larger scale, help the agricultural and economic growth of the country.

S. Wang et al., Year (2012) showed that "water Is the Main Ecological Constraint for Plant Survival in Arid and Semi-arid Regions, Also Hydrological Angle to Determine the Direction of Ecology and Functioning of Soil Vegetation System. Soil Moisture Dynamics Are Dependent on Hydrology Cycle Which Include Factors Like Infiltration, Penetration, Evaporation, and Root Water Uptake Soil Moisture Content for 5 Types of Land Cover Was Studied Considering Temporal Effect. Grass Had the Highest Temperature Corresponding

To Greater Moisture Whereas Shrub Resulted in Lower Temperature and Less MoistureLoss During Wet Period. Moisture Lost at Forest Region Were Compared to Shrubs."

METHODOLOGY

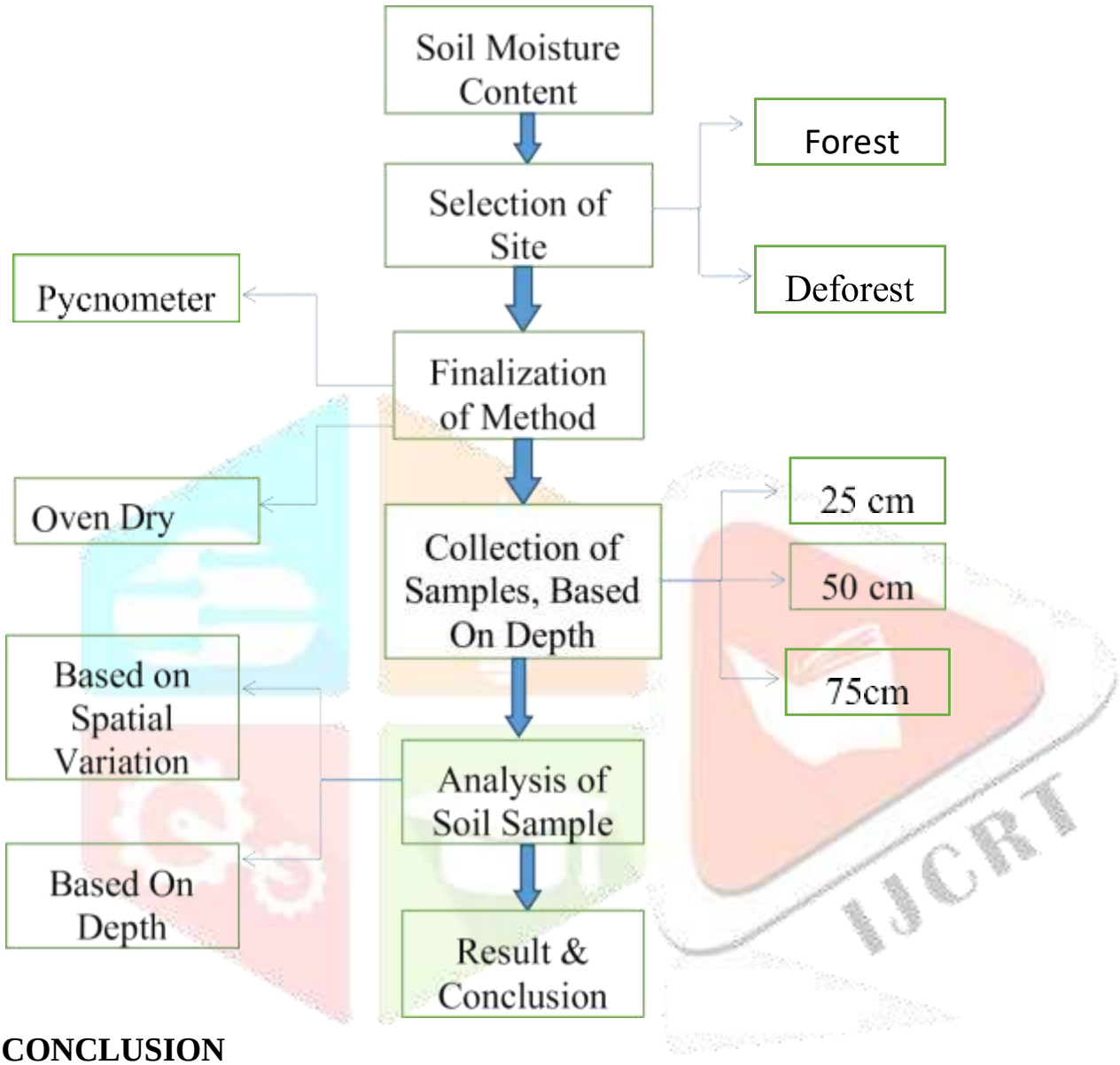
The primary focus of the present research was to characterize the soil moisture content of the small catchments located in the Gadeshwar region of Panvel of Maharashtra through long-term measurement using experimental methods. The intension was to understand the effect of different land cover on soil moisture content and to develop appropriate methodologies to up-scale this knowledge to larger watersheds.

In this chapter, a description of the study area, the characteristics of the selectedcatchment and watershed and monitoring is enumerated

In this project, the soil moisture content for forest and deforest areas located in Gadeshwar region of Panvel. Maharashtra, India was calculated using field experimentation.

The field experiments used for calculating soil moisture content were OVEN DRY TEST & PYCNOMETER TEST.

FOLW CHART



CONCLUSION

Soil moisture content in Panvel varies significantly across different land covers. Forests generally maintain higher and more stable moisture levels, followed by water bodies that keep moisture levels consistently high near their shores. Agricultural areas show more fluctuation depending on crop type and irrigation practices, while urban areas typically experience lower soil moisture due to impervious surfaces and compacted soils. Understanding these variations is crucial for land and water management, especially in termsof agricultural productivity, ecosystem health, and urban planning.

FUTURE SCOPE

1. With further experimentation and environmental condition, the regression model canbe used to find the soil moisture content of the area with more accuracy.
2. Future study may be taken up to evaluate the applicability of physically-basedmechanistic model in similar studies and compare

The present study has shown the benefits obtained in advancing knowledge regarding hydrological processes through intensive long-term the improvement in accuracy of simulations versus the increased data requirement. Measurement and monitoring at small spatial scales. There is an urgent need to establish such experimental watersheds in different hydro geoclimatic regimes to gain an improved understanding of processes and how they are affected by anthropogenic activities.

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