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Taking Stock of Our Earth's Resources Is Crucial for Effective Integrated Watershed Care

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Abstract

Soil degradation, water shortages, falling efficiency, rising temperatures, and societal decline are some of the issues that land, the most essential natural resource, faces today. Since rainfed regions in India are so pervasive and have so much promise for increasing agricultural yields via improved utilization of resources, they must be developed as quickly as possible. Adopting a comprehensive watershed management plan that integrates human involvement in diversifying natural assets to support overall societal growth is the most effective method for handling these rainfed regions. Conducting a complete land resource survey is the first and most important stage in establishing a watershed control program, which is then followed by careful planning, efficient execution, careful monitoring, and exhaustive assessment. Our study included a comprehensive LRI at a scale of 1:3960 of the Dwarkeswar Micro-Watershed in the Puruliya region of West Bengal. Soil type, underlying land use, topography, climate, and vegetation were all considered in this exhaustive survey. We identified and mapped ten physiographic units and nine different soil series over the examined region. We created an organizational unit map that serves as a powerful tool for efficient land use development by using these criteria and considering the current socio-economic situation and requirements. This map may effectively drive the watershed management strategy.

***Keywords**: fear indicator, rising temperatures, climate anxiety, environmental action, environmentally responsible eating habits, environmental advocacy, preservation of resources, financial support*

INTRODUCTION

Society's resource management practices can be evaluated using various indicators, including economic growth, technological progress, resilience, and personal responsibility. Among these, the most valuable resource is the land, encompassing the ecosystem comprising groundwater, soil, and indigenous flora and fauna. Given the increasing scarcity and declining farmland productivity, rainfed regions have more potential to attract aid and political attention. With over sixty percent of India's rainfed land, reliance on rainwater for irrigation becomes crucial in agricultural practices. However, rainfed agriculture faces challenges such as low resource efficiency, deteriorating soil quality, water scarcity, and land degradation. Yet, these areas hold untapped potential to increase agricultural production by optimizing available resources. Addressing the various difficulties related to the environment, ecosystems, farming, geography, and other natural resources requires context-specific guidance and information. The absence of farm-level soil and land data and recommendations within national development programs may have contributed to this delay. Conducting a comprehensive and large-scale land resource inventory coupled with geographic visualization could have partially bridged this gapThe watershed concept was widely heralded as a game-changer for rural revitalization and agricultural advancement. Climate-resilient farming practices contributing to economic growth can bring rainfed areas to the forefront through integrated watershed management initiatives. These initiatives involve human intervention in resource management within the boundaries of a watershed. Environmentally friendly integrated watershed governance relies on three pillars: resource assessment, land use planning and implementation, and policy monitoring and evaluation. However, all these efforts would be futile without an initial step of conducting a thorough land resource inventory (LRI). An extensive LRI is necessary to identify soil and land information for strategic crop cultivation at the watershed level. Simultaneously, a comprehensive survey of natural resources is required to map land components and gather descriptive data on attributes such as soil, weather, slope, landform, vegetation, and socio-economic status. This inventory serves as a foundation for determining the feasibility of land development for profitable purposes.

A comprehensive soil assessment at the cadastral layer is essential to ensure effective land use management in agriculture within a watershed.

1. Comprehending the relationship between land-use changes and soil type modifications in different biomes is vital. Identifying soil succession, delineating soil boundaries, and recording soil characteristics are all necessary steps in assessing soils for increased and lucrative agricultural production.

2. The classification of rocks influences soil composition, surface equilibrium, and potential land uses. Studying the current stone type is essential to assess soil substrate, origin, and characteristics. Additionally, identifying and outlining lineaments can help locate subsurface water sources.

3. Climate plays a significant role in determining potential land usage. Considering climatic factors such as average and extreme temperatures, rainfall, and water loss is essential when surveying an environmentally friendly land use plan. This terrain is suitable for farming, horticulture, equestrian crops, forestry, and plantation usage based on climate data. Soil activities and surface destruction, indicators of the system's nutrition and efficiency, are directly impacted by climate.

4. Physiography, including elevation, slope variations, aspect, and erosional and depositional stages, forms the basis for soil assessment and subsequent land use decisions. DEM analysis on a GIS platform provides measurements, which are then verified through field research and ground verification.

5. Vegetation is a valuable source of information for soil-based development models and future land use planning. Assessing current land utilization and vegetation through field surveys and satellite data helps identify changes in land usage over time. Combining information from soil surveys with maps of the area's current vegetation and land use leads to sustainable land use plans.

6. Incorporating the social status, conventions, religions, and needs of the villages is crucial for an adequate water supply governance strategy. Conducting an in-depth survey of the social and economic conditions of the villagers, their anticipated needs, and their attitudes toward accepting changes is essential for revenue generation and job creation.

In conclusion, land evaluation techniques within a watershed border involve gathering thematically related information to assess the land comprehensively. This method provides a logical strategy for planning, protecting, and conserving soil, water, and other natural resources to address societal deterioration and climate change.

CASE REPORT: INVENTORYING LAND RESOURCES

Based on the information above, the Dwarkeswar Micro-Watershed in the Hura alleviate of Puruliya district, West Bengal, consists of three towns: Parasibona, Batabathan, and Kalaboni. A study was conducted to assess the agricultural resource assets in these towns (Bhattacharya et al., 1985). The Micro-Watershed experiences variable temperatures and monsoon rains. Physical resource enumeration was performed, considering environmental variables such as rainfall, probable evapo-transpiration, and highest and lowest temperatures.

Specific patterns characterize the climate in this region of arid sub-humid eastern India. Compared to the average monthly precipitation of 12.5 centimetres over the previous thirty years leading up to 2011, the probability of evapotranspiration was found to be 17.6 percent higher. The aridity coefficient calculated was 1.15. Both high and low temperatures in May exceeded the annual averages (Figure 1), with the former reaching 38 degrees Celsius and the latter dropping below 26 degrees Celsius.

The primary livelihood in this area relies on mono-crop barley cultivation, with yields ranging from 1.5 to 2.1 tons per hectare. A detailed soil survey was conducted at 1:3960, encompassing thorough analyses of shapes and land use patterns as part of the comprehensive natural resource inventory. A granite-gneissic substrate (Figure 2) identified and mapped eight distinct soil types within 14 physiographic subdivisions.

To maximize benefits for farmers through ecologically sound development, evaluations of land capability and crop compatibility were carried out for crops such as maize, wheat, rice, mustard sauce, groundnut cultivation, cowpea, bird pea, and sabai vegetation. Resource information from the Micro-Watershed was utilized to create a management unit map (Figure 3).

In-depth studies were conducted in the Micro-Watershed, including assessing water flow from Tilaboni Hill through lineaments and the existing water infrastructure for irrigation purposes. A thorough inventory of the river's land resources is crucial for the effective execution, monitoring, and evaluation the watercourse administrative program. This stock is a vital resource for defining areas of management and making an evidence-based land utilization proposal.

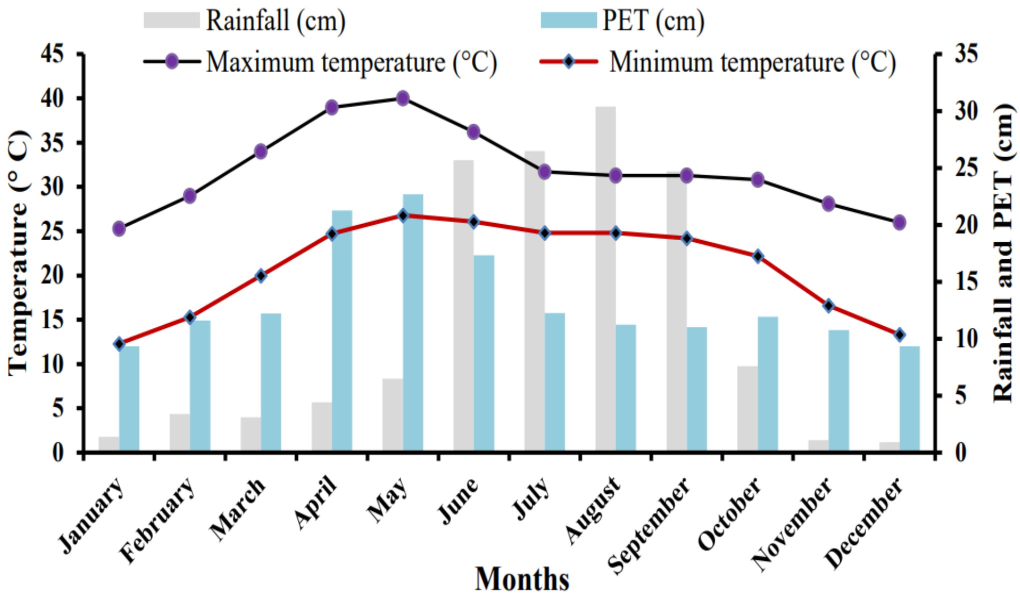

FIGURE 1: Monthly averages of temperature, precipitation, and evaporated water capability at the location

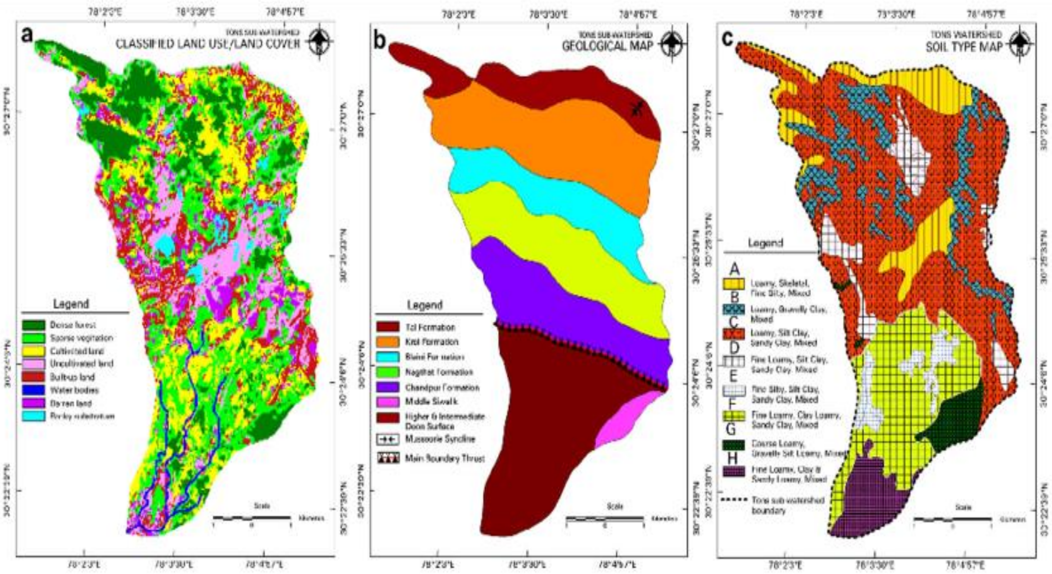

Figure 2: physiography and land use maps

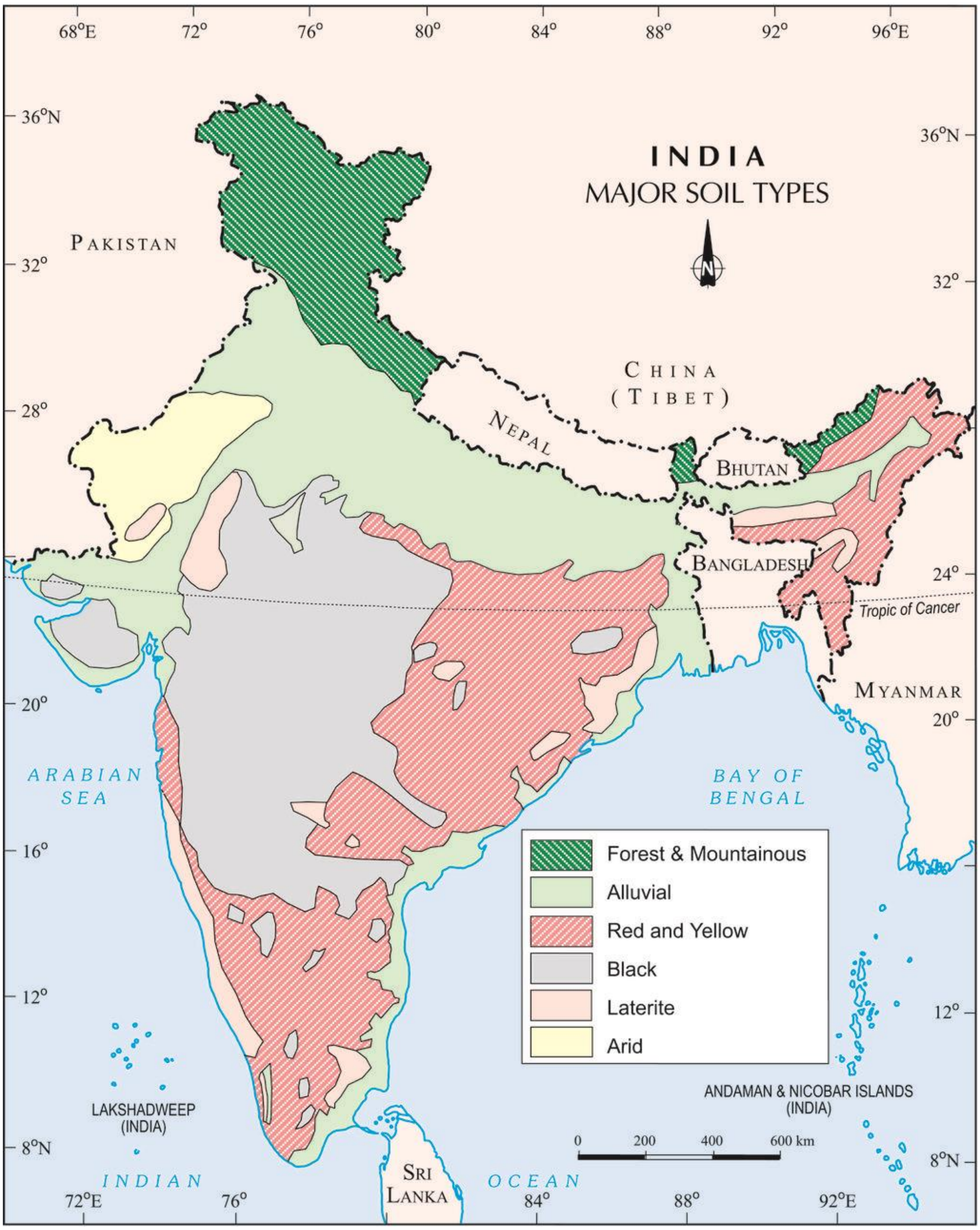

Figure 3: Maps of India's Soils and Irrigation Districts

The management of watersheds has a long history and has evolved through various stages of development. Initially, the focus was solely on forestry-related hydrology, without involving human participation. However, over time, the emphasis shifted towards managing land assets, encompassing various activities to maximize financial returns for all stakeholders. Wösten et al. (1985) transformed detailed soil maps into "functional units" with unique electrical conductivity and water retention properties to achieve this. Additionally, Bouma et al. (2002) conducted simulations on nitrogen conversions and pesticide absorption for specific data points, establishing "leadership units" for precise agriculture, which were then interpolated. Understanding the variance among these "leadership units," it becomes possible to estimate the variability resulting from their simulation runs.

Consequently, a practical, functional unit that considers hydrodynamic characteristics is essential for realizing sustainable agriculture goals. This new approach emphasizes community involvement and holistic drainage planning to cater to local needs better. Given that watershed management directly impacts farmers' livelihoods and social progress and their reliance on thorough research, planning, execution, monitoring, and collaboration with knowledgeable land-use inventory experts, it is crucial to proceed with clarity and organization.

CONCLUSION

The current Micro-Watershed strategy integrates the deliberate and efficient utilization of Earth's resources through collaborative endeavours among local end-users. In contrast to the dominant approach of solely focusing on infrastructure enhancements to alleviate poverty, an alternative income source has emerged by safeguarding local resources. The authors have dedicated their efforts to elaborating on this concept, recognizing it as the sole means to reconcile human civilization and Earth's resources while preventing resource depletion. By embracing this new paradigm, which holds particular value in rainfed farming regions, the land and human society can be better safeguarded.

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