

ABSTRACT

The Teesta River, which is regarded as a source of sustenance in the landscape, is situated in the Himalayan and Sub-Himalayan region and has hydrological characteristics that are frequently significantly altering. In this regard, morphometric analysis has been created for the Teesta River basin area, and different morphometric data have been produced utilizing topographical maps released by the Survey of India as well as Remote Sensing and GIS platforms. The examination of physical characteristics and human interference allows for the identification of numerous hydrological changes. Anthropogenic activities have created adjustments along the Teesta, which change the hydro-morphological properties across the basin area. These changes are manifested in a variety of dangerous circumstances, primarily flooding across the concerned river's flood plain, while concurrently, for most portions of the basin, agriculture denotes a leading role in this regard. Agriculture in the study area has advanced significantly in recent years. But lately, it has been struggling with issues including tiny land holdings, traditional agriculture with poor infrastructure, a lack of surface water, and rising climatic and hydrological variability. The River Teesta's flood plain is a significant source of natural resources that provide high economic and livelihood values to the locals who live along the river's banks in the study region. Local rural residents are currently dealing with a different kind of issue as a result of hydrological and hydro-morphological changes. Due to the high demand for agricultural products, smart agriculture and appropriate adaptation strategies are required to ensure agricultural output. As a result, this is a reform of the agricultural system to increase productivity and reduce its impact on the environment. An effort has been made to uncover some little-known information about the restoration, conservation, and management of the floodplain through sustainable agricultural adaptation practices that closely resemble hydrological changes, which are more beneficial to socioeconomic development as well as serve to lower the risk of human habitation and promote sustainable use of the land in the nearby riparian areas. The current research aims to conduct an in-depth analysis of the Teesta River's hydrological processes, including any changes or issues they may have, and to add value to assessments of the socioeconomic resilience of the areas around the channels by offering some suggestions for long-term adaptation and management and The supposition of this research is that the adoption of climate-smart agriculture results in increased agricultural output as well as field-level water and energy savings. Smart agriculture is one example of an adaptation practice that can lessen many of the negative effects of hydrological variability and hydrological change. These practices can also improve socioeconomic situations and many other advantages. The peasants are less vulnerable due to inadequate infrastructure, scarce economic resources, insufficient water supply, and traditional agriculture. However, adaptation

techniques like mulching, zero tillage, solar-powered irrigation pumps (SPIP), etc. tend to benefit the villages on several levels, including energy and water savings, as well as production increases. Our research demonstrates that smart agriculture is a framework to integrate its use at the national, state, and local level strategies for wide-scale and long-term support of it in developing nations, such as India. Overall, adaptation practices such as smart agriculture play a key role in preserving agricultural sustainability in the face of increasing hydrological risk and variability. The methods employed in this study are to evaluate a conceptual framework of vulnerability and adaptability in agriculture using various indicators related to the study's central issue. It is based on the integration of numerous climate risks and hazards, environmental elements, and socioeconomic aspects that generate evaluations using the multi-criteria decision-making technique and the association between hydrological, socioeconomic, economic governance, biophysical, and coping mechanisms of locals in the research area was examined using the binary logistic regression model. Consequently, it suggests that policymakers incorporate smart agriculture into their development planning which is essential for lowering agricultural susceptibility to the hydrological risk and flood occurrences that have a devastating impact.