Program Profile		
Program	Program name	Rainfall-Runoff Modelling of the Teesta River Basin, Bangladesh Using SWAT Model
	Category	A8: SDG-Based Responses to Global Challenge

Summary of Program	
Program Name	Rainfall-Runoff Modelling of the Teesta River Basin, Bangladesh Using SWAT Model
Category	A8
Abstract of Program	The program "Rainfall-Runoff Modelling of the Teesta River Basin, Bangladesh Using SWAT Model" addresses the pressing challenges of water resource management in one of Bangladesh's most climate-vulnerable regions. The Teesta River, shared by India and Bangladesh, is vital for irrigation, agriculture, and domestic use. However, its flow is highly variable due to monsoon rainfall and upstream regulation, creating uncertainties in flood management, irrigation scheduling, and transboundary negotiations. To tackle these challenges, the program employs the Soil and Water Assessment Tool (SWAT), a robust hydrological model that integrates spatial and climatic datasets. High-resolution Digital Elevation Models (DEMs), land use/land cover maps, and soil data are combined with daily climate inputs to delineate watersheds and define Hydrologic Response Units (HRUs). Runoff simulations are conducted for selected years, followed by calibration and validation against observed streamflow data from the Bangladesh Water Development Board. Performance is evaluated using statistical measures such as Nash-Sutcliffe Efficiency (NSE) and R^2. The study generates runoff distribution maps, highlights the impacts of land use and soil variability, and identifies spatial and temporal patterns of hydrological response. These findings contribute actionable insights for improving flood forecasting, irrigation planning, and sustainable water resource management in northern Bangladesh. Beyond technical outcomes, the program strengthens academic capacity at the World University of Bangladesh by embedding advanced hydrological modeling in research and teaching. It enhances students' skills, supports faculty-led innovation, and fosters collaboration with government and industry stakeholders. By aligning with SDG targets such as Climate Action, Zero Hunger, and Life on Land, the project not only advances scientific knowledge but also promotes policy integration and resilience in national water governance.

Details of Program		
Planning		
Objectives	Long-term Goals	• Establish a scientific foundation for climate-resilient water resource management in northern Bangladesh.

		• Provide data-driven insights for transboundary water-sharing negotiations with India. • Strengthen flood forecasting and irrigation planning for sustainable agriculture. • Institutionalize hydrological modeling as part of academic and policy practices in Bangladesh.
	Short-term Targets	• Complete watershed delineation and HRU classification within the first year. • Collect and preprocess required datasets from BMD, BWDB, and remote sensing sources. • Conduct calibration and validation of the SWAT model with observed streamflow data. • Produce runoff maps and reports to support immediate decision-making for irrigation and flood management
	Rationale	The Teesta Basin faces high variability due to monsoon rainfall and upstream flow regulation. Limited understanding of spatial and temporal runoff distribution restricts effective flood management and irrigation planning. A scientifically grounded hydrological model is urgently needed to guide policymakers, improve water-sharing strategies, and safeguard livelihoods dependent on agriculture and river resources.
Subject (Leader)	Initiator(s)	NASHIB MD NUR AL
	Champion(s)	NASHIB, MD NUR AL
	Major team member(s)	
Environment	Nature/Society	Seasonal flooding, soil variability, and climate change impacts pose challenges. Local communities depend heavily on the Teesta River for agriculture and domestic water, making sustainable management crucial.
	Industry/Market	Agriculture is the dominant economic sector in the basin. Poor water planning reduces productivity and increases vulnerability to floods and droughts. Market demand for reliable irrigation strengthens the need for this program.
	Citizen/Government	Citizens demand better flood protection and water security. The government seeks scientific input for transboundary water-sharing negotiations and national water policy, making the program's outputs highly relevant.
Resources	Human resources	The program leverages faculty expertise, student researchers, and institutional collaboration with BMD and BWDB. While sufficient for research, scaling up may require more specialized staff.
	Financial resources	Currently limited to academic and institutional support. Additional funding is needed for extended field studies, workshops, and advanced computational resources.
	Technological resources	Adequate access to GIS, ArcSWAT, remote sensing tools, and statistical software supports the program, though expanded cloud-computing

		resources would improve efficiency.
Mechanism	Strategy (Weight/Sequence)	Building a robust hydrological model using SWAT
	Organization	he World University of Bangladesh provides institutional support, enabling faculty and students to engage in applied research. This aligns with the program's strategic direction of integrating academic innovation with national challenges.
	Culture	The university fosters research in climate resilience, civil engineering, and sustainability, which strongly supports the program. Its emphasis on applied learning and student engagement ensures continuity and scalability.
Doing		
Launch date		November, 2025
Responsible organization		Department of Civil Engineering, World University of Bangladesh
Program content and process		The program "Rainfall-Runoff Modelling of the Teesta River Basin, Bangladesh Using SWAT Model" is designed to simulate rainfall-runoff processes in a transboundary river critical for irrigation and agriculture in northern Bangladesh. Its content and process include systematic phases of data collection, model setup, calibration, and validation. The first step involves watershed delineation using a high-resolution Digital Elevation Model (DEM), followed by classification of land use/land cover and soil types. Climatic data, including daily rainfall, temperature, humidity, solar radiation, and wind speed, are collected from the Bangladesh Meteorological Department (BMD). Streamflow data for calibration and validation are obtained from the Bangladesh Water Development Board (BWDB). These datasets are integrated into ArcSWAT to establish Hydrologic Response Units (HRUs). Simulations are conducted to generate daily and monthly runoff estimates across different sub-watersheds. Calibration ensures that the simulated runoff matches observed data, while validation confirms the reliability of the model using statistical measures such as Nash-Sutcliffe Efficiency (NSE) and R^2.
Key highlights of the content/process		• Use of advanced hydrological modeling with SWAT in a transboundary river basin. • Integration of multi-source datasets (DEM, remote sensing, climate data, streamflow records). • Production of runoff distribution maps and actionable insights for water management
Differences from traditional approaches		Traditional water resource studies in Bangladesh rely on historical flow data and empirical estimates, often without spatially distributed modeling. This program introduces a process-based, GIS-integrated hydrological model, allowing finer resolution of runoff variability across sub-watersheds. It shifts from reactive flood management to predictive, data-driven planning.
Progress as of today		• Watershed delineation and HRU setup completed. • Data collection from BMD, BWDB, and remote sensing sources underway. • Preliminary runoff simulations conducted; calibration phase ongoing.

Problems in implementation	• Limited availability of long-term, high-quality hydrological and climatic data. • Resource constraints for field validation and extended monitoring.
Approaches to solve the problems	Statistical interpolation and bias correction techniques applied to incomplete climate records.
Completion date, if completed	Within 6 month
Seeing	
Impacts on students	Students gain practical skills in hydrological modeling, GIS, and EIA, enhancing research capacity and employability.
Impacts on professors	Professors integrate SWAT-based modeling into teaching and research, enriching curriculum.
Impacts on university administration	Administration is satisfied as the program boosts institutional reputation in sustainability research.
Responses from industry/market	Industry values program outputs for flood risk assessment, irrigation planning, and sustainable land use.
Responses from citizen/government	Citizens benefit from improved flood and irrigation strategies, strengthening local resilience.
Measurable output (revenues)	Outputs include student training, research publications, and potential consultancy projects
Measurable input (expenses)	Costs cover software, data acquisition, and research resources; supported mainly by the university
Cost-benefit analysis for effectiveness	Modest costs yield high academic, societal, and policy benefits.
Future Planning	
Where does the project go from here?	Achieve sustainability through policy integration, funding, or community adoption
Addendum	
Exhibits, pictures, diagrams, etc.	
Reports, mimeos, monographs, books, etc.	
Others which may help explain the program (including website links)	