Project Work Plan 2023-2025

Lead Organization Name	Asian Institute of Technology, Thailand
Project Name	Calculating Evapotranspiration using GIS and Remote Sensing Techniques for Calculating Crop Water Productivity in Sindh
Project Start Date:	
Project End Date	
Project Country (ies)	Thailand and Pakistan
Implementing Partners (if applicable):	NA

Outcome Description	Output Description	Activity Description	Timeline (Indicate X to represent the timeline)																Deliverables
			2023		2024													2025	
			NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	
Task 1: Pre-Pilot Preparation / Inception Phase																			
Outcome 1: The outcome of this component will be comprehensive report along with the detailed workplan highlighting each task and sub-task activities in details that will be carried out till during the execution of the project.	**Output 1.1:** The output of pre-pilot preparation phase will be an inception report document that will highlight the specific needs of the proposed project along with purpose, methods, data collection instruments and procedures that will be adopted to analyze the data from the pilot study	Activity 1.1.1: Pre-Pilot Preparation / Inception Phase		X	X														*Project Inception Report*
Task 2: Estimation of Evapotranspiration (ET) using Remote Sensing and GIS																			
Outcome 2: The outcome of this component is a comprehensive estimation of evapotranspiration (ET) achieved through the integration of remote sensing and GIS techniques. Facilitate the calculation of cumulative ETa for different crop development stages, thus yielding valuable insights into water consumption dynamics of key crops during distinct growth phases. This robust methodology generates a comprehensive understanding of ET patterns, enhancing our ability to address water management challenges in Sindh Province's agricultural landscape.	**Output 2.1:** Acquiring high-resolution satellite imagery of Sindh Province's canal command areas, followed by accurate preprocessing to rectify atmospheric interferences, cloud cover, and geometric distortions.	Activity 2.1.1: Remote Sensing and Image Processing			X														
	Output 2.2: The task outcome entails using Landsat images from the EEFlux portal with METRIC in Google Earth Engine for 30m resolution, 16-day temporal processing, applying the Penman-Monteith equation for alfalfa crop ETr, and incorporating NLDAS for reference ET estimation.	Activity 2.2.1: Remotely Sensed Data of ET				X													
	Output 2.3: The output of the task is the evaluation of reference evapotranspiration (ETr) using the Penman-Monteith method, with an assumption of grassland cover, specifically designed for the canal command areas of Sindh Province.	Activity 2.3.1: Reference Evapotranspiration (ETr)				X													
	Output 2.4: The task output includes calibrated EEFlux images providing daily Eta values through ETr multiplication, processed for Rabi and Kharif seasons. Landsat images and crop masks extract ETr for wheat, cotton, and rice, enabling cumulative ETa calculations across different crop development stages.	Activity 2.4.1: Actual Evapotranspiration (ETa)				X	X												
Task 3: Analysis of Spatial and Temporal Variations in ET across Different Crops for Climate-Resilient Agriculture																			
Outcome 3: The outcome of this component will yield a comprehensive understanding of evapotranspiration (ET) dynamics within the canal command areas of Sindh Province, orchestrated through the integration of remote sensing, GIS, and climate-resilient agricultural practices. The interpretation of results will uncover the implications of spatial and temporal ET variations, shaping water resource management and guiding crop planning through nature-based solutions. Conversations surrounding findings will contextualize them within the view of sustainable agricultural practices, potential yield enhancements, and judicious water allocation, echoing a harmonious integration of nature and agriculture. The outcomes of this component will empower stakeholders with knowledge to make informed decisions regarding water resource management, sustainable agricultural practices, and the strategic allocation of resources for a climate-	**Output 3.1:** The analysis reveals temporal trends and generating spatial maps of evapotranspiration fluctuations for different crop types using Nature-based Solutions (NbS).	Activity 3.1.1.: Temporal Analysis and ET Variation for Adaptive Water Management				X	X												
	Output 3.2: The task output entails employing statistical analyses (ANOVA or regression) to assess evapotranspiration rate disparities among crop types, enhancing climate adaptation.	Activity 3.2.1.: Statistical Insights and Environmental Factors for Enhanced Resilience					X												
	Output 3.3: The cumulative evapotranspiration calculations for each crop to assess water-use efficiency, identify regions with high evapotranspiration rates, and highlight the need for efficient water allocation practices.	Activity 3.3.1: Water Demand and Efficiency Assessment for Sustainable Practices					X	X											
	Output 3.4: identification of temporal evapotranspiration patterns for specific crops, and validating remotely sensed ET values with ground-based data through field surveys.	Activity 3.4.1.: Temporal Variation and Ground Truth Validation for Informed Decision-Making						X	X										
Task 4: Assessing Crop Water Productivity and Efficiency through Nature-Based Solutions (NbS)																			
Outcome 4: The outcome of this component will be a comprehensive evaluation of crop water productivity and efficiency across the canal command areas of Sindh Province, achieved through the integration of advanced remote sensing techniques and spatial analysis. By gathering detailed data on crop yields and combining it with the spatially explicit evapotranspiration (ET) maps generated in Objective 1, the study will quantify water consumption for different crop types over the growing season. Additionally, a comparative analysis against established benchmarks will	**Output 4.1:** The outcome yields spatial maps of crop water productivity, identifying areas for enhanced efficiency and prioritizing adaptation efforts and suggesting potential areas for optimized water use and sustainable agronomic practices.	Activity 4.1.1.: Spatial Mapping of Efficiency and Identification of Inefficiencies							X	X									
	Output 4.2: The outcome compares calculated Crop Water Productivity (CWP) values of diverse crops against water-use efficiency benchmarks, and highlighting the nexus between water consumption and crop productivity for climate-resilient practices.	Activity 4.2.1.: Comparative Assessment and Sustainable Performance								X	X								*First Output Report*
Task 5: Identification of Climate-Resilient Water Use Zones																			
Outcome 5: The outcome of this component will yield a strategic delineation of climate-resilient water use zones across Sindh Province. By employing NbS and climate adaptation strategies, the study will identify regions characterized by the simultaneous occurrence of high evapotranspiration and crop productivity, indicating efficient water utilization. Through cluster analysis techniques, these zones will be systematically categorized, forming the basis	**Output 5.1:** The outcome defines zones with efficient water use practices through cluster analysis, serving as a foundation for targeted interventions aligned with mitigation strategies.	Activity 5.1.1.: Categorization and Delineation for Targeted Interventions								X	X								
	Output 5.2: The outcome calculates aggregate statistics for efficient water use zones, comparing crop water productivity and evapotranspiration rates with irrigation methods and soil types.	Activity 5.2.1.: Comparative Analysis and Best Practices									X	X							
Task 6: Recommendations for Sustainable Water Management Practices																			

Outcome 6: The ultimate outcome of this component lies in evidence-based recommendations, informed by the harmonious interplay of ET patterns, crop water productivity insights, and efficient water use zones, thus fostering a climate-resilient agricultural sector in Sindh Province. Certainly, incorporating an IT-based dashboard component can enhance the accessibility and usability of the project's	**Output 6.1:** The outcome recommends capacity building with training programs for farmers and extension workers and explores economic aspects, highlighting potential cost savings and increased crop productivity.	Activity 6.1.1.: Capacity Building and Economic Considerations										X	X						
	Output 6.2: The outcome emphasizes the enduring advantages of sustainable water management, highlighting resilience against climate variability.	Activity 6.2.1.: Long-Term Benefits and Enhanced Resilience report											X	X					
Task 7: Development of Dashboard for Sustainable Water Management																				
Outcome 7: The IT-based dashboard will facilitate the dissemination of research outcomes to a broader audience, including farmers, agricultural extension workers, policymakers, and researchers. It will provide an intuitive platform to understand complex data, make informed decisions, and promote the adoption of NbS and efficient water management practices.	**Output 7.1:** The outcome involves developing an IT-based dashboard with GIS, aligning with nature-based solutions and adaptation strategies.	Activity 7.1.1.: Design and Development of the Dashboard												X	X				
	Output 7.2: The outcome involves utilizing project-generated spatial and statistical data for an interactive dashboard, integrating evapotranspiration maps, crop water productivity distributions, and efficient water use zones.	Activity 7.2.1.: Integration of Spatial and Statistical Analysis Data													X	X			*Second Output Report*
Task 8: Knowledge Dissemination and Future Research																				
Outcome 8: Through the synthesis of research outcomes, dissemination to the scientific community, and the establishment of future research directions, this phase will yield a comprehensive understanding of sustainable water management practices. The outcome emphasis on NbS and climate adaptation strategies will contribute to informed decision-making, policy formulation, and the continuous advancement of water-efficient agriculture in Sindh Province.	**Output 8.1:** The outcome includes disseminating knowledge and guiding future research through an extensive final report, leveraging Nature-based Solutions and climate adaptation.	Activity 8.1.1.: Sharing Insights with the Scientific Community														X	X		
	Output 8.2: The outcome includes sharing research outcomes and methodologies aligned with adaptation and mitigation principles.	Activity 8.2.1.: Fostering Collaborative Learning														X	X		Final Project Report