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ACCESSIBLE DECISION SUPPORT SYSTEMS UTILIZING THE ENVIRONMENT-VULNERABILITY-DECISION-TECHNOLOGY MODELING FRAMEWORK

Abstract

The Environment-Vulnerability-Decision-Technology (EVDT) integrated modeling framework considers the interactions between the environment, societal impact, human decision-making, and technology design to support decision-making. Local leaders in coastal communities in Indonesia and the Yurok tribal community in California face societal challenges and related decisions regarding the planting of mangroves to improve coastal resilience versus other man-made techniques to mitigate flooding, and the monitoring and protection of indigenous natural resources. The EVDT framework is being applied to develop accessible, web-based Decision Support Systems (DSS) utilizing integrated modeling and Earth Observation (EO) satellite data to support decision-makers seeking to address complex societal challenges at the intersection of environmental factors, socioeconomic factors, and technology investments. These DSS can provide a value added product to aid leaders in addressing these decisions by helping them understand complex relationships between these factors, adapt to changes within the community, and address the needs of multiple stakeholders. For both coastal communities in Indonesia and the Yurok tribe in California, the EVDT framework is being utilized to develop DSS that output descriptive and predictive models for decision-makers. These models allow decision-makers to examine historical data from environmental and socioeconomic domains and explore the relationships between these factors under different simulated conditions to evaluate potential policies or technological investments. These DSS make extensive use of EO observation data as inputs to environmental and socioeconomic models that employ cloud computing and use machine learning algorithms to classify features of interest in the satellite data. These models can be employed by local leaders to analyze societal challenges at the intersection of environmental and socioeconomic domains such as where to plant mangroves to mitigate the economic impacts of flooding in Pekalongan, Indonesia, or quantifying the carbon sequestration potential of forests on Yurok tribal land for participation in the environmental policies of the California state government. This work details the EVDT framework and provides an overview of applications of EVDT to the development of DSS for use in sustainable development situations at the intersection of multiple domains. Prototype versions of DSS employing cloud computing and machine learning techniques in remote sensing analyses and integrated models are presented. Efforts to integrate local collaborators in coastal and indigenous communities into the DSS development process to improve DSS utility and value are also discussed. Planned efforts for quantitative assessment of DSS by relevant end-users are also touched upon.