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Design Methodology for the Identification of Critical Stream Sampling Points in Upland Watersheds

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From a world-wide perspective, the degradation of water resources continues to be a critical environmental problem. To reduce, control, and manage the pollution disrupting the natural equilibrium of water bodies, there is a need to qualitatively and quantitatively determine the existing conditions and changes in water quality. The principle scientific instrument to temporally and spatially manage water resources is a water quality monitoring network. The principal instrument to temporally and spatially manage water resources is the establishment of a water quality monitoring network. However, to date there is a definite absence of a concise strategy or methodology for designing monitoring networks. Since water quality monitoring networks can be quite cost-intensive, it is very important to properly design the monitoring network so that maximum information extraction can be accomplished. A methodology for identifying the critical sampling locations within a watershed has been developed and embodies the spatial component in the design of a water quality monitoring network by designating the critical stream locations that should ideally be sampled. For development purposes, the methodology focuses on a single contaminant, namely total phosphorus, and is applicable to small, upland, predominantly agricultural-forested watersheds. It takes a number of hydrologic, topographic, soils, vegetative, and land use factors into account. In addition, it includes an economic as well as logistical component. The methodology incorporates a geographic information system (GIS) for spatial analysis and data manipulation purposes, a hydrologic simulation model for estimating the total loads, and an artificial intelligence technology, known as fuzzy logic, for improved input data representation.