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A GIS ASSESSMENT OF NONPOINT SOURCE POLLUTION IN THE SAN ANTONIO-NUECES COASTAL BASIN

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ABSTRACT

An Arc/Info Geographic Information System (GIS) method has been developed for the assessment of nonpoint source pollution in a watershed. This method makes use of publicly available elevation, stream network, rainfall, discharge, and land use data sets and uses a digital discretization, or grid representation, of a watershed for the approximation of average annual pollutant loads and concentrations.
The San Antonio-Nueces Coastal Basin in south Texas is identified as the test site for execution of the method.

A digital grid replica of the basin stream network is first created, employing a "burn-in" process to affix the USGS Digital Line Graph stream network to the Digital Elevation Model of the basin. Precipitation is then compared with historical discharge at five gauge locations in the basin and a mathematical relationship between rainfall and runoff is established, using a regression analysis. Literature-based Expected Mean Concentrations (EMC's) of pollutant constituents are associated with land uses in the watershed. The products of these spatially distributed EMC's and the runoff in each digital basin grid cell are calculated and then summed in the downstream direction to establish spatially distributed grids of average annual pollutant loads in the basin. Finally, grids of nonpoint source pollutant concentrations are created by dividing the average annual pollutant load grids by a grid of total annual cumulative runoff.

In an effort to refine the process, a method of simulating suspected nutrient point sources in the basin is investigated and an optimization routine is used with pollutant measurement data at four major sampling points to adjust the literature-based Expected Mean Concentration values for phosphorus.

The GIS nonpoint source pollution assessment method is performed for four pollutant constituents: phosphorus, nitrogen, cadmium, and Fecal Coliform. Predicted concentrations for phosphorus and nitrogen, when determined with the simulated point sources, match closely with average observed concentrations in the basin. Predicted Fecal Coliform concentrations did not match well with average observed values, but Expected Mean Concentration values for the pollutant were highly variable between land uses and should be investigated further. Insufficient heavy metal measurement data exist to make conclusive assessments of predicted cadmium concentrations.

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