

# Landscape Modeling for Estimation of Environmental Impacts on Estuaries: with an Application for the Patuxent Estuary of the Chesapeake Bay

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Much environmental degradation to our coastal seas and estuaries results from pollution released from human modified landscapes in their watersheds. We are developing a landscape modeling system designed to assess environmental impacts for various watershed land use patterns and practices. We are developing an application of this system, the Patuxent Landscape Model (PLM), for the Patuxent River Watershed, Maryland, USA. We are using the Spatial Modeling Workstation (SMW), which combines several software programs and data bases including: the General Ecological Model (GEM), Graphic Information Systems (GIS) data bases, and the Spatial Modeling Program (SMP). We simulate the PLM on a desktop computing environment consisting of Macintosh computers with transputers installed. GEM is a 21 state-variable ecosystem model written in STELLA™ designed for simulating natural and managed ecosystems in a variety of climates. GEM is a process-based model that simulates flows and storages of water, nitrogen, phosphorus, salt, dissolved oxygen, inorganic soil particles and carbon through ecosystems. The GIS data base was developed in MAP II™ and data were obtained from four GIS data bases in other formats. GIS files of land use, soils, slopes, weather and elevation serve as inputs to the PLM. The SMP was written in C and links translated replicates of GEM in a spatial cellular grid. The 2,400 km<sup>2</sup> watershed is divided into 5896 0.405 km<sup>2</sup> cells. The PLM calculates exchange flows among adjacent cells and to the estuary and atmosphere. Preliminary hydrologic simulation results that show general agreement with field data are presented. The model is being used to explore potentials for changes in estuary nutrient and sediment loadings resulting from changes in land use patterns. Directions of further work are discussed.