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Research Brief

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GEO-TEMPORAL ESTIMATION AND VISUALIZATION OF NITROGEN IN A MIXED-USE WATERSHED

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Increasing nutrient concentrations have recently been reported in groundwater, spring water and drinking water wells in the Suwannee River Basin. Unpolluted groundwater is important for healthy natural ecosystems in the Suwannee Basin since it makes a significant contribution to lakes and streams. It is also the source of drinking water and most agricultural and industrial water in the district.

Figure 1. The Santa Fe River Watershed (in green).

In particular, elevated nitrate-nitrogen has been reported within the Santa Fe River Watershed (part of the Suwannee River Basin). Nitrate-nitrogen is the most common groundwater contaminant and can be harmful to humans. Major sources of nitrate-nitrogen are believed to be human activities such as agriculture and silviculture and urban point sources. The surficial aquifer in most of the watershed is unconfined or semi-confined and is thus vulnerable to soluble contaminants, such as nitrate-nitrogen.

This brief outlines a recently initiated project examining nitrate-nitrogen in the Santa Fe River Watershed. The aim of this work is to evaluate relationships between topography, land use, management practices and soil type and nitrate-nitrogen concentrations in both soil and water. Soil nitrate will be predicted at all locations within the watershed, from soil samples collected at sites representative of the major different combinations of soil and land uses (Potential Factor Combinations – PFCs) found in the basin. Geographic Information System (GIS) data layers, such as those in Figure 2, will be used to identify PFCs. Much of this information is readily available.

Sampling intensively throughout the watershed would be an extremely time-consuming and costly exercise. By using newly-developed techniques which allow prediction from data that is already available, it is possible to save time and money and still obtain a good representation of nitrate-nitrogen concentrations over large areas.

Prediction of soil nitrate will be achieved using two methods: (1) measured nitrate-nitrogen values will be transferred to similar PCFs within the watershed and (2) at

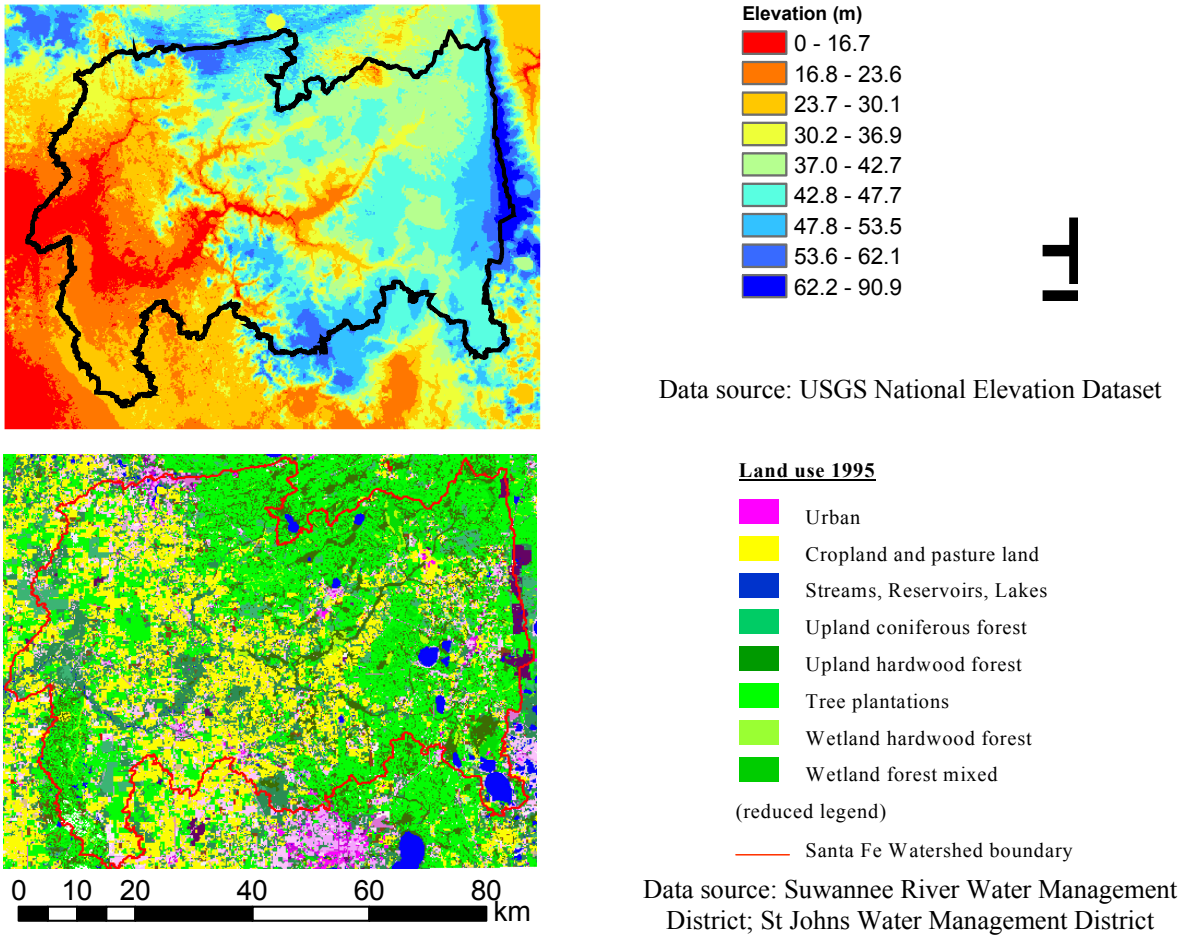

Figure 2. GIS data layers currently available include elevation (top) and land use (bottom).

other unsampled locations stochastic simulation will be used to predict soil nitrate-nitrogen concentrations.

Stochastic spatial simulation is a geostatistical technique which predicts possible data values at each unsampled location. The technique uses collected data to calculate the most likely nitrate-nitrogen concentrations at unsampled locations.

A single prediction at each location within the watershed is called a realization. Multiple realizations will be generated to provide a better representation of possible nitrate-nitrogen concentrations within the watershed than those derived from more commonly used prediction techniques.

2D and 3D visualization tools will be used to describe and display the spatial and temporal distribution of nitrate-nitrogen at all locations within the Santa Fe River Watershed, to a depth of 240 cm.

We will be able to identify land uses and management practices responsible for elevated nitrogen in surrounding soil and water. Analysis of interactions between land use and management practices will provide a better understanding of the nitrogen dynamics within this watershed.

Ultimately, this work should help protect human health and water resources within and around the Santa Fe River Watershed at minimal cost.

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