Florida Aquifer Vulnerability Assessment Phase II
Wakulla County, Floridan Aquifer System

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INTRODUCTION

All of Wakulla County's nearly 30,000 residents (U.S. Census Bureau) rely to some degree on the Floridan aquifer system, which is the most important and prolific source of fresh water in the county. Wakulla County lies mainly within the Woodville Karst Region and is underlain by thick and highly permeable carbonate rocks that comprise the Floridan aquifer system (Pratt et al., 1996). Karst features characterize the area and include sinkholes, swallets (swallow holes), river rises, and springs and their springsheds. These features all represent surface connections or interactions with the underlying aquifer system and include Wakulla Spring, Spring Creek, Sheppard Spring, Newport Spring, Indian Spring, Sally Ward Spring and many others (Scott et al., 2004). This complex and highly integrated surface and groundwater environment can be very sensitive to activities occurring at land surface.

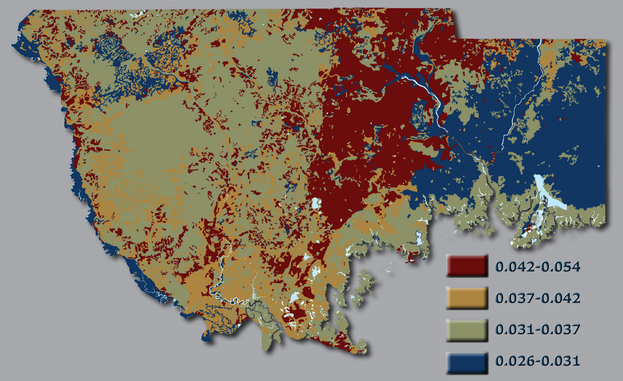
Identifying areas of Wakulla County where the Floridan aquifer system is more vulnerable to contamination from these activities is a critical component of a comprehensive groundwater management program. Protection of the Floridan aquifer system is an important measure to take in helping ensure viable, fresh water is available for continued future use. Aquifer vulnerability modeling allows for a pro-active approach to achieve such protection, and can save significant time and increase the value of protection efforts. Maps of three types of data were used to determine aquifer vulnerability in Wakulla County; soil pedality, karst features and aquifer overburden thickness . Maps showing these data are displayed below.

APPROACH TO MODEL DEVELOPMENT

The primary purpose of the Wakulla County Aquifer Vulnerability Assessment, or WCAVA, is to provide a science-based, water-resource management tool that can be used to help minimize adverse impacts on groundwater quality, including focused protection of sensitive areas such as springsheds and groundwater recharge areas. The modeling process used for the WCAVA project is "weights of evidence," and is based in a geographic information system (GIS). The approach used in the project is a modification of the technique used in Phase I of the Florida Aquifer Vulnerability Assessment project (Arthur et al., 2007). One of the main benefits of applying this technique to the WCAVA project is that it is data-driven, rather than expert-driven, and model output is dependent upon a training site dataset, which produces self-validated model output. For WCAVA, training sites are groundwater wells with water quality indicative of a good connection between the aquifer and land surface, or simply, aquifer vulnerability.

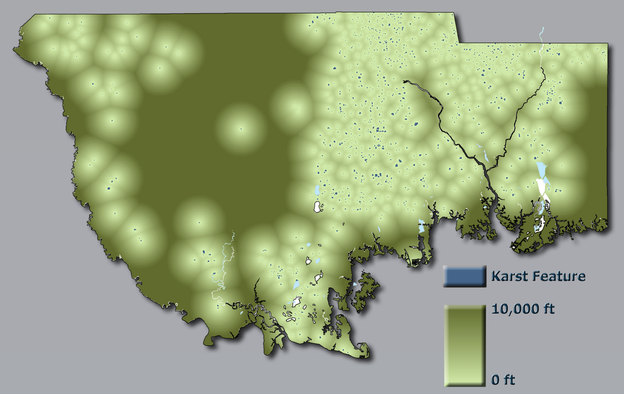
Model generation is accomplished by associating training site locations with data layers representing natural conditions which control aquifer vulnerability. Data layers used for the WCAVA project are described on the lower and left side of this poster and include karst features, aquifer overburden thickness and soil pedality. The model helps determine which areas of each data layer share a greater association with aquifer vulnerability based on the location of the training sites, and then combine the results in a map as shown here. The model results are an estimate of the natural vulnerability of the aquifer system; land use types and or human activities are not used as input. The WCAVA model output map indicates that the areas of highest vulnerability are associated with thin to absent aquifer overburden thickness, dense karst-feature distribution and higher soil pedality values. This modeling procedure is described more completely in Arthur et al. (2007) and the Wakulla County Aquifer Vulnerability Assessment.

Soil Pedality Theme



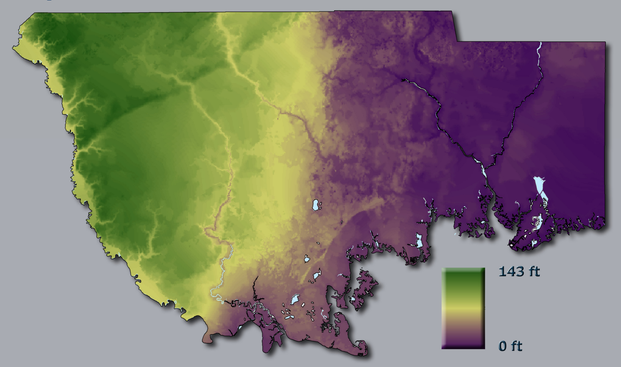
Soil pedality is a relatively new concept used to estimate how water moves through soil (Lin et al. 1999). The rate that water moves through soil is a critical component of any aquifer vulnerability analysis, as soil is an aquifer system's first line of defense against potential contamination. Soil pedality values, which are calculated based on soil type, soil grade, and soil structure, are unitless, and higher values correspond to higher flow rates and therefore higher aquifer vulnerability. In 2006, Wakulla County soils data were refined for the study area by the Natural Resources Conservation Service. As a result, more detailed information is available for soils analysis for the WCAVA project than during previous projects.

Potential Karst Feature Theme



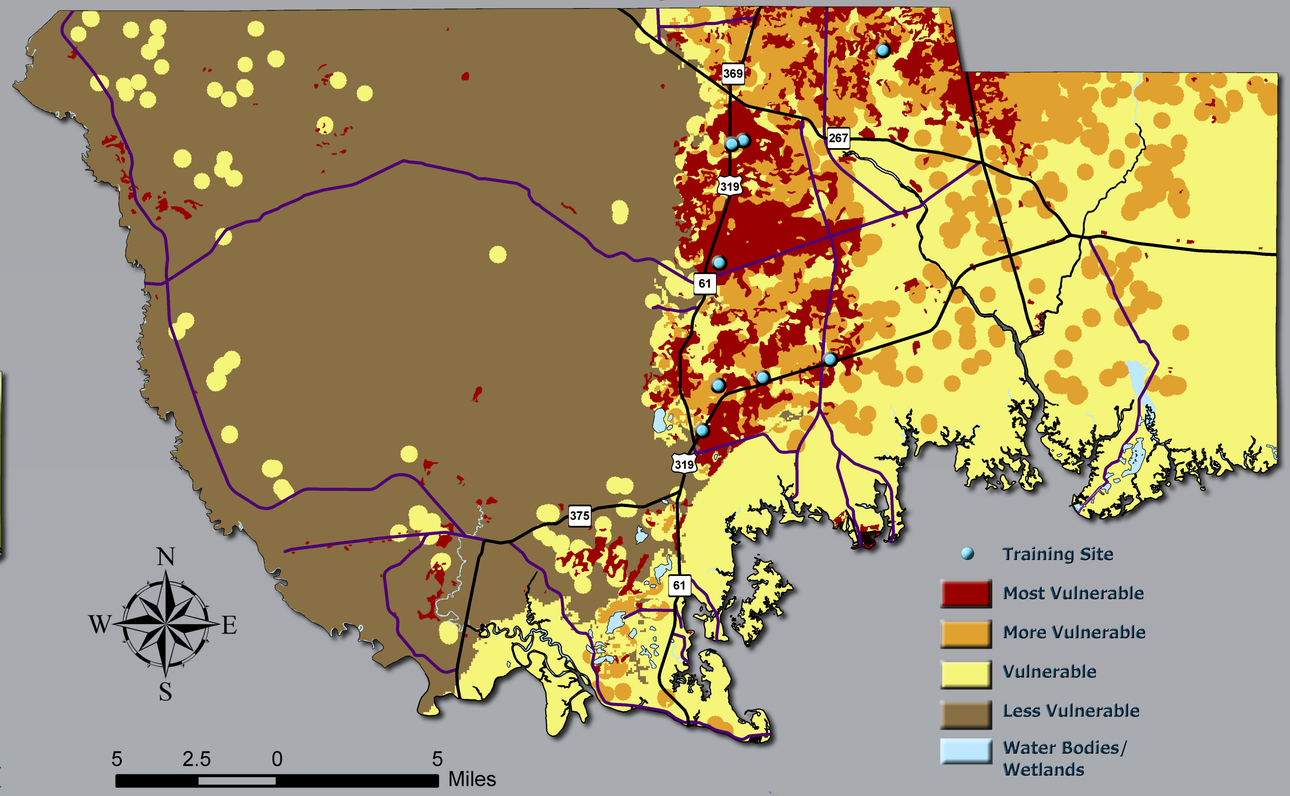
Karst features, or sinkholes and depressions, can provide preferential pathways for movement of surface water into the underlying Floridan aquifer system and increase an area's aquifer vulnerability where present. The closer an area is to a karst feature, the more vulnerable it may be considered. Karst features tend to be generally circular in nature (in contrast to non-karstic depressional features which may not be circular) and can be identified and extracted from a digital elevation model based on this characteristic. These resulting potential karst features can be buffered into zones as shown here to allow for a relative distance analysis.

Aquifer Overburden Thickness Theme



Aquifer overburden thickness refers to the degree that an aquifer system is buried or 'covered'. Where this overburden is thick and continuous and the Floridan aquifer system is deeply buried, as in the western part of Wakulla County, aquifer vulnerability is generally lower. On the other hand, in areas of the county where overburden is thin to absent or breached by sinkholes, the vulnerability of the underlying aquifer system is generally higher, primarily because it is present at or near the land surface. Little or no overburden generally occurs in the eastern half of the county. The aquifer overburden thickness layer used in the WCAVA project represents the thickness of all the sediments overlying the Floridan aquifer system.

VULNERABILITY OF THE FLORIDAN AQUIFER SYSTEM, WAKULLA COUNTY



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