**NASA DEVELOP National Program**

University of Georgia

**Summer 2015**

**Short Title: Georgia Disasters & Water Resources**

**Subtitle:** Utilizing NASA Earth Observations to Monitor Sinkhole Development and Identify Risk Areas

**VPS Title:** When the Truth Sinks In: Assessing Sinkhole Development in Georgia

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Adam Milewski, Assistant Professor, Department of Geology, University of Georgia

**Past or Other Contributors:**

Not Applicable

**Partner Organizations**

City of Albany and Dougherty County Planning and Development Services, End-User/Partner,

POC: Randy Weathersby

Southwest Georgia Water Resources Task Force, End-User, POC: Randy Weathersby

**Project Details**

**Applied Sciences National Applications Addressed:**

Disasters, Water Resources

**Study Area:** Dougherty County, GA

**Study Period:** January 1999 - December 2011

**Earth Observations & Parameters**

Terra, ASTER- Elevation data

SRTM- Elevation data

European Remote-Sensing, ERS- 1/2 - Elevation data

Landsat 5 & 7, TM and ETM+ - Land cover and land use

**Ancillary Datasets Utilized**

* USGS National Water Information System- groundwater and surface water measurements
* PRISM- gridded, interpolated precipitation
* USGS National Land Cover Datasets (NLCD) from 2001, 2006, and 2011- land cover
* USGS National Hydrography Dataset (NHD)- linear hydrography
* USFWS National Wetlands Inventory (NWI)- local wetlands extent
* U.S. Census Bureau- Dougherty County roads layout
* Brook and Allison, 1983- fracture traces/lineaments
* USGS borehole log data and cross-sections- bedrock depth/overburden thickness

**Models Utilized**

* ArcGIS ModelBuilder
* PRISM Climate Group Precipitation Interpolation model

**Software Utilized**

ArcGIS – raster and shapefile manipulation/analysis, map creation, and spatial statistical

modeling

ENVI – geospatial analysis and spectral image processing for Landsat TM and ETM+ data

ENVI SARscape – advanced processing of radar images for elevation data acquisition

**Project Overview**

**80-100 Word Objectives Overview**

Sinkholes are a risk to human safety, environmental health, and infrastructure in the coastal plain of the Southeastern United States. The overall objective of this research was to develop sinkhole inventories between 1999 and 2011 using a time-series of digital elevation models (DEM’s) to determine environmental risk to human health, infrastructure, and water supply. Additionally, this research improved the understanding of and predictive capabilities for sinkhole development. Specifically, this research identified and mapped sinkholes, analyzed the factors influencing the development of newly formed sinkholes, and produced a sinkhole susceptibility map for Dougherty County, Georgia.

**Abstract**

Located in southwest Georgia, Dougherty County has a growing populace in an agricultural region that relies heavily on groundwater resources. Partly due to increased groundwater extraction, this area has experienced an increase in sinkhole development over the last decade. Sinkholes pose a threat to infrastructure and groundwater pollution. The NASA DEVELOP Georgia Disasters and Water Resources team partnered with the City of Albany and Dougherty County Planning and Development Services (PDS) and the Southwest Georgia Water Resources Task Force (SGWRTF) to assess past sinkhole development and identify areas susceptible to future sinkhole formation. Sinkhole mapping was completed utilizing a time-series of elevation data (1999 – 2011) from NASA’s SRTM mission and ASTER sensor, as well as European Remote-Sensing (ERS) satellite-derived elevation data. The sinkhole inventory maps and spatial statistical techniques were employed to quantify the factors most influential in sinkhole development. These products identified areas susceptible to future sinkhole formation within Dougherty County. The results of this applied science project will enable the PDS and SGWRTF to make informed decisions on current and future land use, safe infrastructure development, and sustainable water resource management.

**Community Concerns**

* Sinkholes are a risk to human safety, environmental health, and infrastructure (i.e., roads and buildings) in the coastal plain of the Southeastern United States.
* Sinkholes pose a threat to groundwater pollution, as they quickly introduce contaminants into karst aquifer systems with high transmissivity, or ability to disperse contaminants through advection processes.

**Current Management Practices & Policies**

The City of Albany and Dougherty County Planning and Development Services (PDS) is responsible for governing land use and development and ensuring the built environment is safe. The PDS has recognized that to successfully fulfill their responsibilities, risks associated with sinkholes must be considered. However, the PDS does not actively maintain a sinkhole inventory for Dougherty County. Thus, utilizing NASA Earth observations will enable the production of spatial data on sinkhole density and occurrence to manage land use and infrastructure development in identified high-risk areas. Further, the Southwest Georgia Water Resources Task Force strives to provide a guide to the sustainable management of water resources within the framework of existing laws and protect public health and natural systems. The sinkhole susceptibility map will allow for sustainable management of water resources with respect to water quality, for sinkholes can quickly introduce contaminants into the local aquifer system.

**Decision Support Tools & Benefits**

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| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Sinkhole Inventory Map | 2000 SRTM DEM, 2011 ASTER DEM, satellite-derived (ERS) DEM’s | Current and future land use decisions, water resource management, and infrastructure development to reduce risks associated with sinkholes. |
| Sinkhole Susceptibility Map | 2000 SRTM DEM, 2011 ASTER DEM, satellite-derived (ERS) DEM’s | How the city and county governments manage current and future land use and infrastructure development; sustainable management of groundwater by reducing contamination risk. |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)