

# **Satellites Assist in the Fight to Preserve Biodiversity of the Cahaba River in Central Alabama**

## **Presentation Video Transcript**

### **Title Slide**

Hello. This is the NASA DEVELOP Team located Marshall Space Flight Center and the University of Alabama at Birmingham. This is the first part of a two part project in which we are the investigating the relationship between land use and land cover change and how it affects water quality. We are currently using Earth Observing Systems to investigate the changes in the Cahaba River's mussel and macro-invertebrate populations due to changes in the watershed's landscape to assist in local water and land management decision making.

### **Community Concerns Slide**

Each DEVELOP project is a created with a specific goal of addressing a community concern through the use of NASA satellite observations to enhance decision support to help solve issues important to local communities. In this case, we are looking at the Cahaba River watershed. The Cahaba River is among the most biologically diverse rivers of North America. In fact, it supports over 130 species of fish, more than any other river its size in North America. The river also hosts more than 100 species of snails, mussels, and fish that are considered rare or imperiled. Part of the Greater Birmingham Metropolitan Area, the largest metropolitan area in Alabama, is found in the Upper Cahaba River basin. And the Cahaba River supplies 20% of the water to Alabama residents. More than half of Alabama residents live within 100 miles of the Cahaba River. Despite its rich biodiversity and the importance of being a water source, there have been few landscape studies done on the Cahaba watershed, making development of conservation management initiatives difficult.

### **Partners and Applications Slide**

Our current science advisors are Dr. Jeffrey Luvall from the Marshall Space Flight Center and Dr. Donna Burnett from Montevallo University. Our main collaborator is Dr. Randy Haddock, who is the field director from the Cahaba River Society, and it is the Cahaba River Society who is our main project partner. The Cahaba River Society works closely with the EPA and ADEM, which is the Alabama Department of Environmental Management, to identify areas of concern on the Cahaba River and implement solutions strategies. Currently the Cahaba River Society needs updated data and maps of the Cahaba River watershed. DEVELOP is providing satellite imagery of the watershed with related biological and environmental data. Every project that DEVELOP conducts addresses one or more applications of national priority as outlined by NASA's Applied Science Program. In this particular project, the application areas addressed include Public Health, Ecological Forecasting, and Water Resources.

## **Study Area and Objectives Slide**

Our study area is the Cahaba River watershed, which is located in central Alabama. The area approximately covers close to 1900 square miles, and the length of the river is close to 200 miles long. Our project objectives include: To investigate the changes of the landscape in the Cahaba Watershed and how these changes affect water quality and consequently how it affects benthic macro-invertebrate and mussel biodiversity and species distribution. We also plan to work with local conservation groups by using remote sensing to aid in making critical environmental decisions.

## **Methodology Slide**

Our team used satellite imagery from Landsat 5 TM corresponding with the years 2000 and 2004. We acquired our imagery through USGS GloVis and acquired the watershed shapefiles, which are geo-referenced polygons, from Alabama View. We used the shapefiles to isolate the satellite data within the different subwatersheds. There were a total of 33. We calculated the NDVI values for each pixel of each subwatershed. We added *in-situ* data and classified imagery into ArcGIS and then ran an Ordinary Krig to determine the spatial relationships of the collected data.

## **Normalized Difference Vegetation Index (NDVI) Maps Slide**

Normalized Difference Vegetation Index, or NDVI, is an analytical technique that compares the Near Infrared and Red bands from multispectral satellite imagery in order to measure vegetation vigor. NDVI results in a ratio between negative one and one, where negative values are associated with areas that have no vegetation, and positive values are associated with areas with vegetation. And, as values increase, so does the density of the vegetation.

These maps show the vegetation distribution of the Cahaba River watershed. A temporal comparison between the vegetation in 2000 and 2004 was inconclusive since the seasonal variation between the two years heavily affected the NDVI values.

## **Geospatial Analysis - Ordinary Kriging Slide**

Geospatial Analysis in the form of Ordinary Kriging was performed on the *in-situ* data. These are two examples of maps that are being provided to the Cahaba River Society. The map on the left looks at the mussel species distribution. The map on the right shows the EPT index, which is an index of pollution sensitive insects. Results shown through Ordinary Kriging reveal that areas with low biodiversity are associated with areas of development, in particular the Greater Birmingham Metropolitan Area. Results also show that areas of stream confluences are associated with higher levels of biodiversity, possibly caused by a combination of species from separate tributaries.

### **Discussion Slide**

Our initial findings are showing that areas with low biodiversity are associated with areas of development in the watershed. At the same time, areas of stream confluences are associated with higher levels of biodiversity. Our NDVI results did not allow for temporal comparison of vegetation between 2000 and 2004. We need to explore other remote sensing techniques that will allow us to track changes in vegetation throughout the years.

This project could benefit from additional Landsat 5 TM imagery to create a more thorough historic study. Higher resolution imagery like ASTER could allow more in-depth remote sensing analysis. By incorporating fish data, we will be looking at a more complete food web of the ecosystem of the Cahaba River. The Cahaba River Society is also interested in the current status of hardwoods distribution within the Cahaba Watershed. The hardwoods have different water retention properties and affect the water cycle differently than soft woods, such as pines. All of these points will be addressed on the next term of the Marshall Space Flight Center DEVELOP team.

### **Spring 2011 MSFC/UAB DEVELOP Team Slide**

The Spring 2011 Marshall Space Flight Center and UAB DEVELOP Team is comprised of Steve Padgett-Vasquez, Joseph Olson, Jin Huang, Danielle Keyes, Myles McManus, Katharine Campbell, Michelle Foreman, and Connor Whitley.

### **Last Slide**

This concludes our presentation. Thank you for your attention.