Satellites assist in the fight to preserve the biodiversity of the Cahaba River
in Central Alabama
NASA Marshall Space Flight Center
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Video Transcript

Slide 1: Introduction/Title Slide

"Greetings, this is the Marshall Space Flight Center DEVELOP team**.** This summer our project was an Estimation of Urban Growth Impact on Fish Habitats Using Spatial Analysis Techniques: A Case Study of the Cahaba Watershed Area. This is a continuation of our spring term project."

Slide 2: Community Concern and Potential Partners

"DEVELOP is a NASA Science Mission Directorate Applied Sciences training and development program in which students and young professionals conduct Earth science applications projects and are mentored by science advisers from NASA and partner agencies."

"Each DEVELOP project is created with a specific goal of addressing a community concern through the use of NASA satellite observations to enhance decision support and to help solve issues important to local communities. The Cahaba River is one of the most important rivers in Alabama. The entire watershed covers 1,870 square miles with 200 miles of headwaters. This vast watershed is the primary drinking water source for the greater metropolitan Birmingham area."

"The Cahaba River is one of the most biologically diverse rivers in North America. It is home to many endangered species that cannot be found elsewhere. The river is also used for recreational activities, such as canoeing and fishing. Urbanization and industrial development in the watershed have begun to adversely affect the river, degrading the quality of the water and destroying species' habitats. Our main partner for this project is the Cahaba River Society. Our potential partners include the Fresh Water Land Trust and the Alabama Department of Environmental Management."

Slide 3: Decision Support Tools

"The Cahaba River Society's mission is to restore and protect the Cahaba River watershed and its rich biodiversity. We have worked closely with Dr. Randy Haddock, Ph.D., field director of the Cahaba River Society, throughout this project, learning from him the priorities of the Society and how our research can help them better preserve the Cahaba River. The Fresh Water Land Trust is concerned with acquiring land along the riverbanks that can be used to help guard the health of the river by acting as a screen against sediment runoff from developed areas. ADEM attempts to protect and improve the quality of Alabama's environment and the health of its citizens. All of these organizations could benefit from our findings through the course of this project. Our results could be used to identify areas of concern within the watershed, which in turn could allow the maximum amount of resources and restoration efforts to be concentrated on the areas that need them the most."

Slide 4: Methodology

"We utilized satellite imagery obtained from the Landsat 5 TM and Terra's ASTER sensors to analyze the study area of the watershed. The images were all obtained from the USGS GloVis website. Once acquired, we used remote sensing programs such as ENVI, ER Mapper 7.1, and ERDAS Imagine 9.3 to analyze and process the images. First, we clipped each image down to the size of the Cahaba Watershed itself in order to focus on the study area. Then, we applied a Normalized Difference Vegetation Index (NDVI) to each image, which displays in black and white the reflectance of the vegetation acquired in the visible (red) and near-infrared regions of the image. We then applied a classification scheme to each NDVI image in order to assign colors and descriptions to each of the NDVI classes, visually portraying levels of vegetation within the Cahaba watershed. After this process was completed, we imported these images into ArcMap 9.3 in order to analyze them in relation to historical biodiversity data we had collected. We applied the spatial analysis of Ordinary Kriging in order to show ranges of biodiversity within the watershed."

Slide 5: Results

"These two images are examples of the classifications used to identify different levels of vegetation in the Cahaba River. The first map, made from a Landsat 5 image from June 2006, shows the range of vegetation over the entire watershed. The second map was created using two ASTER images, both dating from September 2004, focusing on the Upper Cahaba River, home to the greater Birmingham area. The same classification scheme was applied to these images, showing vegetation in a smaller area of the watershed but at a much higher resolution."

Slide 6: Results

"These two images display two different types of change detection analyses within the Cahaba River watershed from 2001 to 2006, created using Landsat 5 imagery in ENVI EX and ArcGIS. The first map displays change detection of the original NDVI images, meaning that the areas represented show any change in vegetation over the course of the five years. The second map displays only changes in non-vegetative areas from 2001-2006, meaning that the areas represented can show urban development, new roads, or changes in water area."

Slide 7: Results

"This map shows a spatial analysis in the form of Ordinary Kriging of fish data collected by Morse by recording the Index of Biotic Integrity (IBI) at several points along the Cahaba River in 2002. The Krig analysis shows the distribution of fish species and habitat health and creates a contour map of the area based on these IBI levels, which can range from 12 to 60, visually displaying changes in biodiversity in the watershed."

Slide 8: Conclusion and Transition to Partner

"In conclusion, our acquisition of Landsat imagery proved to be very effective in monitoring vegetation across the Cahaba River over a broad period of time (ten years). Landsat imagery is

generally available for the same location each month of the year. ASTER imagery, on the other hand, offers a greater resolution but provides less consistent data and a more limited coverage area. However, if a specific problem area is identified within the watershed, it would be beneficial to try to obtain an ASTER imagery of the area since it will be higher resolution than a Landsat image and therefore would offer more detail."

"Our spatial analysis of biodiversity data shows that lower levels of biodiversity are found around the I-65 and I-459 junction in the Birmingham area. Spatial analyses and change detection analyses of the study area can reveal areas of concern due to rapid change in land cover, development, and vegetation. Restoration efforts can be focused on interest areas identified in this study, as well as any further areas identified by continuation of this methodology in the future. In the fall we will present our findings and data to the Cahaba River Society, giving them and their partners, such as the Fresh Water Land Trust and ADEM, valuable information for identifying areas of concern within the Cahaba Watershed and helping them devise restoration strategies and plans to conserve the health of this very important river."

Slide 9: Team Members

"This Summer's team had help from Dr. Jeff Luvall our science advisor, Dr. Donna Burnett our research advisor, and Steve Padgett the center lead. The team members were Katherine Campbell, Michelle Foreman, Semiha Caliskan, Danielle Keyes, and Kevin Cowart."

"This concludes our presentation, thank you for your attention."