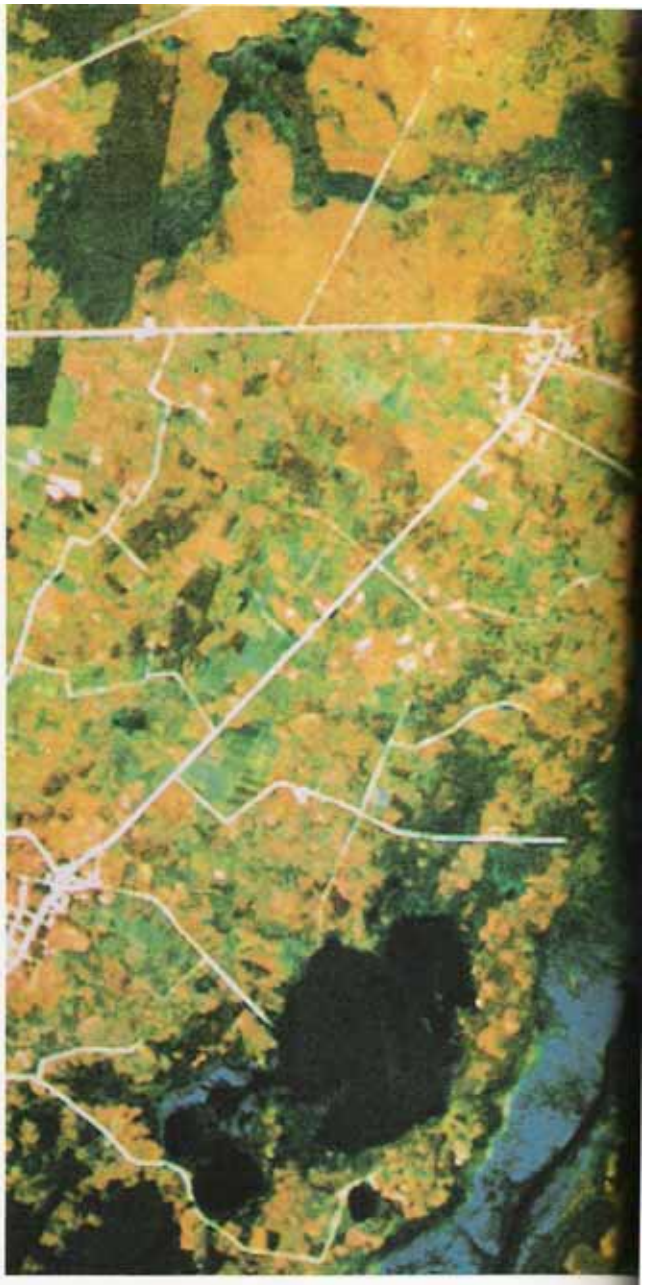
Archeological/Environmental Research



Archeologists have been probing the jungles of Mexico's Yucatan Peninsula for 150 years, seeking knowledge of the Maya, a great civilization that flourished in the region from about 2000 B.C. until the Spanish conquest of the 16th century.

As part of a NASA program to demonstrate the broad utility of satellite remote sensing, Ames Research Center has — since 1984 — been engaged in Maya research that employs imagery from NASA's Landsat and Seasat satellites. Satellite remote sensing has often been used in archeological research, but the Ames project takes a novel approach: it seeks to understand the environmental setting of the ancient culture and whether the decline of the Mayan civilization was influenced by environmental change.

Was the decline of the Mayan civilization influenced by environmental change?

The effort is headed by project chief Charles E. Duller of Ames' Earth System Science Division. Dr. Kevin Pope, formerly an Ames National Research Council Fellow, and more recently with Stanford University; and Dr. Edward Kurjack of Western Illinois University, are principal archeological collaborators. Ten other U.S. and Mexican institutions are represented by collaborative researchers.

More than 35 archeological sites have been imaged. Archeologists have employed the Landsat/Seasat imagery in three extensive site survey expeditions and a large number of individual site mapping projects. Twelve previously unknown sites have been located and mapped by project imagery. This work contributed to development of remote sensing image processing capabilities at three of the collaborating institutions — Western Illinois, Boston and Tulane Universities.

The goal of the project is to reconstruct the environmental history of Yucatan's northern plains, with emphasis on the Mayan period. Satellite imagery has provided new discoveries about Maya settlement patterns, environmental settings and the Mayan's use of natural resources. The imagery found additional

Courtesy Dr. Edward Kurjack, Western Illinois University

Satellite imagery shows evidence of ancient coastlines, indications of past changes in sea level, and an ancient river plain extending across lowland Guatemala

utility: it was used by the Government of Mexico and Mexican ecological science officials for developing coastal management plans, establishing two large Biosphere Reserves, and assessing the damage caused by the 1988 Hurricane Gilbert.

The Ames project has focused on the distribution of water resources. Satellite imagery shows evidence of ancient coastlines, indications of past changes in sea level, and an ancient river plain extending across lowland Guatemala. The Yucatan imagery also shows canal systems built by the Maya for agricultural drainage and irrigation. **Above** is a satellite image of canals along Rio Hondo in Belize.

At left is an aerial photo of the ancient Mayan city known as Uxmal (Oosh-mahl), dominated by the Temple of the Magician (pyramid in center photo) and the adjacent quadrangular Nunnery. Archeologists wondered how the large population that must have lived in Uxmal subsisted with so little *known* water availability.

Satellite imagery provided an answer. **At top** is a computer-enhanced Landsat image showing Uxmal structures (yellow) and a number of natural depressions (blue) that became water-filled in seasonal rainfall. The Maya lined these *aguadas* with rock and mortar for year-round water storage.

A rainy season photo flight verified the Landsat imagery. **Shown above** is an aerial view of one of the *aguadas* hidden in the jungle near Uxmal; it proved to be a Maya reservoir and several more were found nearby.

"By studying the Maya," says project chief Duller, "we can better understand human interaction with the Earth system: how they adapted to the environment and its changes, and what changes they may have caused. This project is a pioneering effort combining remote sensing, environmental studies and archeology."