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Archaeology from Space



New technology, such as this color infrared photo, reveals archaeological treasures. (All photos courtesy of Thomas Sever)

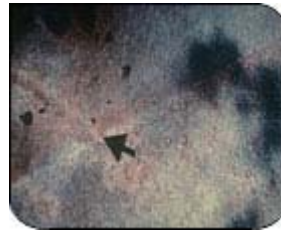
By Laura DAmelio, May 30, 2002

Long ago covered with sediment and vegetation, ancient villages and roadways are not visible to the human eye but they are secretly giving off signals to their location. Researchers just have to go thousands of kilometres above the earth to find them.

Remote sensing is a method of gathering information from afar, usually by means of radar. This is especially useful to archaeologists who can get a better idea of where to dig, sometimes as close as a few metres to the actual site, without having to disturb fragile

environments or upset local residents.

The technology can involve aerial photography, infrared technology and multispectral sensors that can "see" light that the average eye cannot, the electromagnetic spectrum of light. Satellite and aircraft-mounted sensors including the Landsat Thematic Mapper and TIMS, a Thermal Infrared Multispectral Scanner, measure the thermal radiation given off by the ground to accuracy of 0.1 degree centigrade.



An arrow on an infrared photo points out a suspect road in Costa Rica

It's Hot or It's Not

Able to penetrate cloud cover, vegetation and soil, TIMS creates images based on the temperature being emitted by objects on the ground. The heat is from sunlight, absorbed and then reflected back out into the atmosphere at varying degrees depending on the substance. For example, we know that when we wear a black T-shirt on a sunny day we will get hotter than if we were wearing a white T-shirt. That black T-shirt is absorbing more solar radiation than a white T-shirt and will therefore have more heat to radiate back out into the atmosphere. The same theory applies for objects in nature. Vegetation absorbs a lot of sunlight necessary for its growth and will therefore emit more radiation than a rock.



The heat from the Arenal volcano in Costa Rica would appear red on a thermal image, the water would be black.

In thermal photos, warmer objects or areas appear red on the satellite images, cold areas such oceans and lakes appear black. The newest technology can scan the earth to the nearest few metres, able to sense slight differences in objects or materials like the difference between sand and soil. For archaeologists, the images can reveal differences in soil texture by minor temperature variations, setting apart areas that have been cultivated in the past from those which are untouched. These slight differences in soil texture or vegetation are invisible to the human eye. More importantly, these differences can indicate something hidden. A slightly hotter piece of land may indicate a buried stone wall or building because stone

absorbs more heat than soil.

Being able to see more before they dig is exactly what archaeologists want to make their job easier and safer. A conference in the early 1980s on remote sensing in archaeology brought the technology forward. It has since been an integral part of

uncovering roadways in New Mexico, ancient Mayan pyramids in Guatemala and sites in Israel and various parts of the United States. One of the most widely known projects was a joint effort between the University of Colorado and NASA in Costa Rica.

What Costa Rica was hiding

A fierce volcano casts a menacing shadow over the Arenal region of Costa Rica. Below its violent peak, lush 150-foot forests grow on top of the volcanic ash, deposited 10 times over the past 4000 years. Underneath, preserved villages and artifacts are hiding secrets of an old civilization.



Beneath the lush forests in Costa Rica lies newly discovered footpaths.

Payson Sheets, an archaeologist from the University of Colorado, and his team first surveyed the Arenal region in 1984 and were interested in seeing more than they could. Sheets had already uncovered some areas in Costa Rica when NASA set up flights with a Learjet over the area. In 1985 a second series of flights were completed adding colour, infrared photographs and thermal data from TIMS to their bank of knowledge.



Archaeologists Tom Sever and Payson Sheets stand on an ancient footpath.

The images revealed linear features over much of the region, what Tom Sever, NASA's archaeologist, and Sheets first thought were roadways several feet wide. As the team excavated through almost six feet of volcanic ash a V shaped pattern appeared, indicating erosion by constant wear. The base of this area of erosion was only one or two feet wide suggesting the roadways were actually footpaths. The buried footpaths seem to have more vegetation growing over them so the infrared instruments mapped their heat emission as thin red lines.

One of the greatest discoveries was one of the lines appeared to run out from a high-ground cemetery already under excavation and led to other excavation sites nearby. The team has since dug several sites for the footpaths and dated them during two time frames, the earliest being 500 BC. Combining their knowledge of the ancient peoples of Costa Rica and following the footpaths, the archaeologists have located other settlements and sites.

With the wealth of information provided by remote sensing, the Costa Rica project is moving ahead. The team is set to continue their research in Costa Rica this summer.