CASE STUDY

HEXAGON GEOSPATIAL

Conservationists Collaborate to Save Giant Pandas

Smithsonian National Zoological Park

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In July 2005, many Americans were delighted by new reports about the birth and early development of Tai Shan, a giant panda, at the National Zoo in Washington, DC. This was a momentous event bought about by years of collaborative effort from reproductive biologists and veterinarians from the U.S. and China. Now, almost 2, Tai Shan was the fourth cub born in the U.S. and the first from the National Zoo's resident pair of giant pandas, Mei Xiang and Tian Tian.

Only four zoos in the U.S. have giant panda pairs: Atlanta, San Diego, Memphis, and the National Zoo. These pandas are on loan from China for 10 years. Giant pandas are one of the world's most endangered mammals and those kept in captivity, including nine in the U.S., serve as an "insurance policy" against extinction. They are managed cooperatively across zoos worldwide, in an effort to maintain the maximum genetic diversity possible for the captive population.

Although much excitement accompanies every zoo birth of a giant panda, the ultimate survival of the species depends on having a self-sustaining population in China. Thus, the National Zoo puts a lot of effort and funding towards research in China and capacity building for panda reserves.

Tai Shan's parents were both born at the China Research and Conservation Center for the Giant Panda at Wolong Nature Reserve in Sichuan Province. This is one of nearly 50 protected areas in China, some of which are linked by wildlife corridors designed to facilitate movement and interbreeding between the separated wild panda populations. Currently pandas are separated into 24 different populations which are dispersed across six mountain ranges.

There are an estimated 1,600 pandas remaining in the wild according to results of China's national panda survey published in 2004. Pandas rely almost entirely on bamboo for their nutrition and therefore have very specific habitat requirements. Through the years, climate change and human activities have severely reduced the amount of panda habitat remaining. Just during the last 30 years, panda habitat decreased by almost 25 percent – estimated to be 29,500 km2 (11,390 square miles) during the first national survey in 1974, but down to 23,000 km2 (8,800 square miles) in a 2004 survey.

These remaining areas are made up of deciduous and coniferous forests, interspersed with dense patches of bamboo forests and covering high mountains (panda habitat ranges from 4,000 to 11,000 feet in elevation).

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In many of these areas, the pandas are in close proximity to farmers who plant crops in the river valleys and the lower mountain slopes. The panda's existence in these areas may not be sustainable — bamboo harvesting, bamboo shoot collection, land cover conversion, and mining have depleted the habitat they need. As bamboo forests are converted for other uses, it is critical to protect the remaining habitat and monitor the wild populations.

TRAVELING WITH TECHNOLOGY TO CHINA

When the National Zoo received Mei Xiang and Tian Tian from China in 2000, they became ambassadors for a much larger mission. Beyond the excitement and educational opportunities provided by their arrival, a primary objective for the National Zoo was to work to improve the giant panda's chances for long-term survival through research and capacity building. Soon after the arrival of the pandas, the National Zoo began to hold workshops with our Chinese colleagues to collaborate on research projects and to support their panda conservation efforts. Training with geospatial technology was identified early on as one of their top priorities –they recognized that imagery would be critical for wildlife management and research analysis projects.

At the Zoo's Conservation GIS Laboratory, we began working with our Chinese colleagues to adapt our applied GIS training course, "GIS and Remote Sensing for Wildlife Managers," for use in China. Even though this course is taught every year at the Zoo's Conservation and Research Center in Front Royal, Virginia, we were able to take the basics and create applications that were relevant for panda reserve staff.

Modules are based on data that's specific to local panda research and all training materials have been translated into Chinese. The training is led by U.S. and Chinese instructors,

Dr. Liu Xuehua and Jin Xuelin demonstrate GIS techniques for students.

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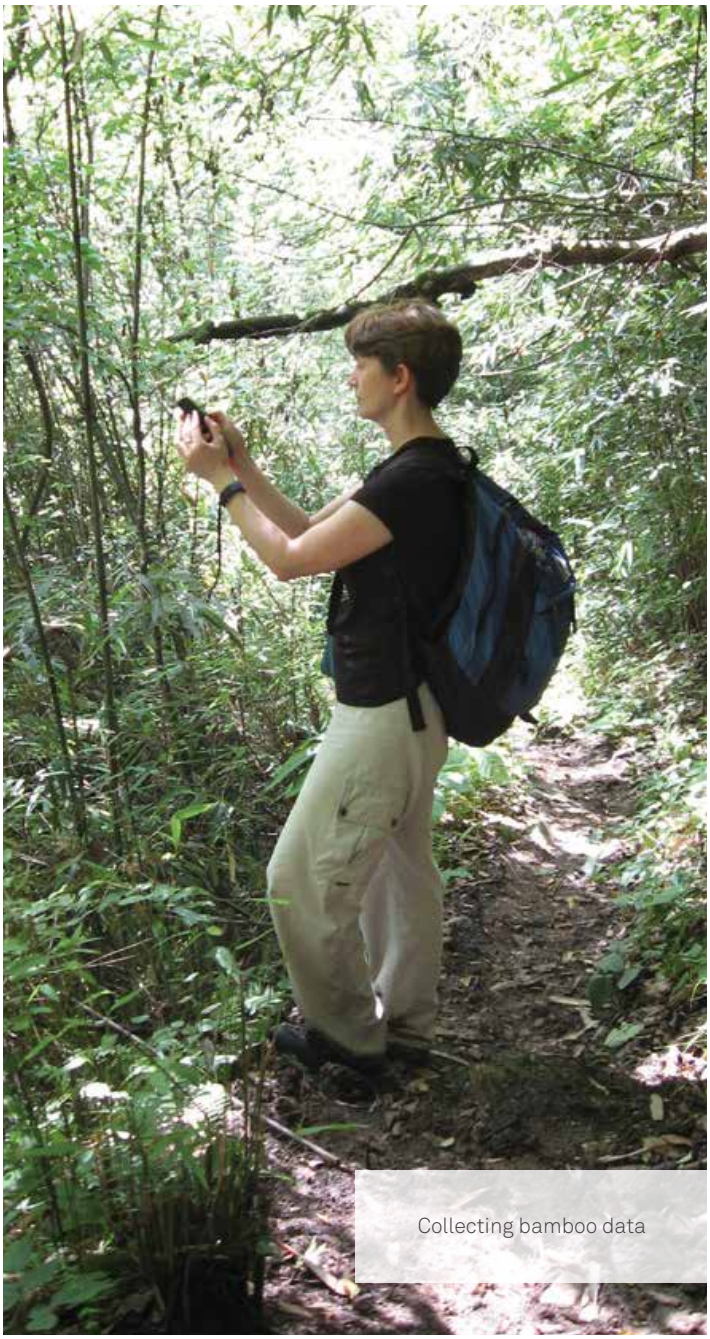

Collecting bamboo data

and throughout the training courses, there is always a bilingual instructor present to help with communication.

For the past five years, we have traveled to China to present the course in panda reserves for staff working in the reserves and forestry departments, as well as researchers from science academies and universities. The course provides step-by-step instructions for using Global Positioning System (GPS) units to collect data on the ground, the ERDAS IMAGINE® software suite (Hexagon Geospatial, Norcross, GA) to rectify, view, and mosaic imagery, and GIS software for analysis and data presentation.

Many reserves do not have the hardware to run GIS and to help bridge the technology gap, the National Zoo provides PCs, a GPS, and other essentials to several participating reserves each year.

When we began teaching the course in 2001, it was very hard to get enough computers to teach the course; we often had several students gathered around one machine.

> He may only be one small bear, but Tai Shan is a symbol for the future, illustrating how we can work together, using geospatial technologies as our communication medium to improve cooperation and understanding and help save the giant panda.

Through the years, we have seen quite a change – now many students arrive with laptops and we can more easily pull together enough workstations to cover our participants. It has also been encouraging to see students who already have some experience using geospatial systems in their work.

This year's course was held during summer 2006 at the Tangiahe Nature Reserve, an official conservation partner of the National Zoo. We expected 25 students, but nearly 40 panda researchers and reserve staff arrived for the training course.

Each year, we see rising interest in protecting China's pandas and using technology to speed and improve conservation efforts.

GEOSPATIAL TRAINING

During the course, we try to make our case studies as realistic as possible, using examples from different reserves to give the students a good sense of what we do in assessing a protected area. About 130 "graduates" of this course have a basic understanding of how to store and analyze spatial data, how to use satellite imagery and GIS to map and monitor remaining habitat, and how geospatial analysis may be used as a management tool to assess how changes to a reserve may impact wildlife.

For example, one module is designed to illustrate how panda survey data can be used to assess habitat selection. Prior to habitat analysis, the students start by learning how to extract areas of interest from a satellite image. After they have extracted the data, they learn how to perform an unsupervised land cover classification using ERDAS IMAGINE. Once they have the basics of image classification, they move to the next module for habitat analysis.

The habitat selection analysis is based on data collected during surveys of pandas dung and recorded via GPS in Wanglang Nature Reserve, Sichuan Province. Other data layers included are habitat, elevation, roads, and streams. By combining databases using spatial joins, querying attributes, buffering features, and searching databases, the students identify what habitat characteristics are most important to pandas. Next, they use these characteristics to map suitable habitat.

These modules teach students important operations, as well as encourage them to think about the possibilities of using remote sensing and GIS in their own reserves.

One of the objectives of our training is to build the capacity of the trainers as well as the students. As we build the capacity of trainers in China, we anticipate some sites will be able to hold their own geospatial training courses. At that point, we hope to become a supplemental resource brought in when needed.

We have also been contacted by people who want more advanced training. To meet their needs, we have created an advanced Chinese manual based on our "Land Cover Change and Endangered Species" conservation course. In the future, we are hoping to start a mini-grant program for the reserves so they can fund their geospatial programs.

WORKING TOGETHER

We hope that a side benefit of this training will be increased collaboration among the reserves to share data and findings. Staff members from most of the reserves have attended our training and are familiar with geospatial concepts and potential for their projects.

As their connections build, both in technologyand trained personnel, we would anticipate greater levels of cooperation and information exchanges. This would bring a wider understanding of panda conservation and challenges in terms of habitat loss and infringement.

As geospatial technology becomes an ingrained part of research programs in China, it can be used to examine living conditions and challenges of other endangered species. Other species of concern that share giant panda habitat are takin, golden monkeys, and even red pandas.

Students and instructors of the GIS and Remote Sensing for Wildlife Managers training course held at Wolong Nature Reserve, Sichuan Province, China

Once the skills are achieved, it would only be a matter of introducing the new data layers and using the same analytical approach to understanding the data. The birth of Tai Shan is an achievement shared by both National Zoo and Chinese conservationists. It's anticipated when the cub is old enough, he will be returned to China. Due to the great success of captive breeding programs, China is now moving toward releasing captive born pandas into the wild, where we hope they will enhance the sustainability of the wild populations.

He may only be one small bear, but Tai Shan is a symbol for the future, illustrating how we can work together, using geospatial technologies as our communication medium to improve cooperation and understanding and help save the giant panda.

Melissa Songer, Ph.D., is the manager of the Conservation GIS Lab for the Smithsonian National Zoological Park (the National Zoo) in Washington, DC. She can be reached at songerm@si.edu.

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