GIM INTERNATIONAL INTERVIEWS LILIAN PINTEA

Conservation: A Birdâ€™s-eye View

GIS technology is an effective tool for analysing and mapping wildlife data such as population size and distribution, habitat change, use and preference, and regional biodiversity. The ability to overlay this data makes GIS helpful in outlining relationships between wildlife and people, and it has become a crucial element in monitoring threatened animals and their habitat to help prevent further loss or even extinction. At the Jane Goodall Institute (JGI) GIS is enhancing nearly half a century of wild chimpanzee research. Lilian Pintea, director of conservation science at the institute, integrates chimpanzee data with habitat-change and human land-use information from satellite imagery to understand the needs and threats inherent in chimpanzee conservation and support the development of African conservation strategies. We spoke to him about the value of geospatial information in species preservation.<P>

You recently returned from the Republic of Congo. What are you working on there?
I'm involved in a project funded by the US Fish and Wildlife Service, conducting biological and socio-economic surveys to identify a potential reintroduction site for about a hundred orphan chimpanzees currently living at our Tchimpounga Chimpanzee Sanctuary. Their mothers were killed for bush meat, but because these infants had too little flesh on them they were sold into the pet trade. We have been working with the government and other partners to confiscate the chimps and bring them to the sanctuary, where we can care for them and integrate them into social groups. Chimpanzees live for a long time, and reintroducing them into the wild requires long-term commitment. We have been conducting field surveys and ground-truthing to identify a feasible reintroduction site by mapping forests and human land use using ASTER, Landsat and PALSAR satellite imagery.

How can GIS contribute to nature conservancy now and in the future?
For any conservation effort to be effective you need to understand the distribution of species, their habitats and threats. An increasingly used approach is 'conservation action planning': an adaptive cycle for planning, implementing and measuring conservation success for each project. This begins with identifying what you are trying to conserve, and key species or ecosystem processes that reflect it. The idea is to ensure that biodiversity in an area is conserved by selecting six to eight key species. Next you identify the most critical threats and decide which to focus on to yield best results. The design of any conservation strategy calls for the initial elimination of these risks. The best conservation action plan can only be undertaken once the role of social, economic, political and cultural factors has been acknowledged.
Conservation often involves many people with diverse interests. Once the strategies have been implemented, outcomes must be monitored and this information used to continually adapt and learn throughout the life of the project. Because conservation is about species and their habitats, it's inherently spatial. Satellite imagery and GIS are the tools that help us map chimpanzee habitats so that we can monitor their distribution and threats to them.

What are the challenges which need to be overcome?
We need better geospatial data for Africa. For example, Dimonika Biosphere Reserve in the Republic of Congo happens to have very mountainous terrain, and smaller but still very steep mountains are not captured by 90-metre SRTM elevation models. Here GIS did not help us in the field as we could not avoid complex and steep terrain; one day we moved only 1.4 km in five hours. A good digital terrain model would improve this situation. Another major factor is cost. Geospatial technology can be expensive and we cannot afford to fly planes to collect Lidar data over central Africa, thus in many remote areas we rely solely on satellite-derived data.
Training remains an ongoing challenge. While it's great to see how many more African students are using GIS, there is still a serious lack of adequately trained people to recruit for projects. We believe that long-term conservation depends on the involvement of people from local communities and government structures.

Africa remains largely unexplored from a GIS perspective, and the best maps available today are from satellite imagery. We are keen to

develop partnerships with high-resolution image providers. Lack of geospatial infrastructure on the continent greatly impacts our work; it would be helpful if the geospatial community could join forces and help co-ordinate efforts to bring it in line with Europe and the US. It would also be useful to have a standardised data model designed with conservation applications in mind. This could be used for many different conservation projects involving diverse species and habitats. For example, we know that conservation programmes targeting elephants in the regions where we work all look at habitat; it would be great to share information, but we can't because of the lack of standards and co-ordination.

How is GIS helping in Gombe National Park?
We use GIS to analyse chimpanzee behaviour and habitat-use data, and monitor conservation efforts. Dr Jane Goodall began her research on chimpanzees in Gombe in the 1960s, making this one of the longest field studies of any animal species in their natural surroundings. Using aerial photography from the '60s and '70s and satellite imagery we have been able to recreate an impression of how forests were then and narrate how they have changed. Today field assistants continue to follow the Gombe chimpanzees and record data every fifteen minutes. This is entered into the database at JGI's Center for Primate Studies at the University of Minnesota, enabling students to analyse long-term behaviour.

In 2000 we started using GIS to integrate more than 400,000 chimpanzee observations with other GIS layers so that we could see how the habitat was changing over time and how the chimpanzees use their home range. Also, land tenure in this part of the world is not always clear, but land-use plans cost local communities money. We are making GIS available to facilitate the development of these plans for the benefit of the population and the park.

How have local communities reacted to the use of geospatial science?
Bordering on Gombe National Park are villages, which means you have to involve the people who live there. We try to engage local communities directly in all aspects of conservation. This means talking to them, finding out what they want and need, and listening to them. We try to involve them in conservation efforts and share what collected data reveals about their area. For example, we explain how cutting down trees on steep slopes is not good for the environment, as it leads to severe soil erosion.

What has been really interesting for me, personally, is to see how even those local people who are illiterate and unable to read maps can recognise, on very high-resolution images, their homes, churches, schools and the places where they go to collect firewood and water. But there are many difficulties too. Most of these communities are without electricity, and it's challenging to bring in technology as sophisticated as GIS. We are addressing these problems by supporting community forest monitors and training them to use GPS first. They monitor the vegetation and report to us any activities, such as tree felling. This information is then downloaded onto our GIS database and mapped. The idea is that these maps can be used to provide information for village and local government, conservationists and the local communities themselves, so that everyone has up-to-date information on what is happening in these areas.

Does Gombe work with Remote Sensing?
Remote sensing is used extensively and is integral to the application of GIS to conservation. The JGI has adopted a multi-sensor approach. To map chimpanzee habitats and human land-use patterns in Gombe we use 60-cm QuickBird, AWiFS, Landsat TM/ETM+ and other satellite sensors, along with ArcGIS, Feature Analyst and Imagine software. Also mapped is Masito-Ugalla and the larger Greater Mahale Ecosystem, which covers an area of more than 20,000km2. The value of the imagery lies in the fact that it helps us to understand what happens to the forests over time. It also reveals human land-use patterns; to view some of these, such as banana and cassava patches measuring less than 30 metres, we had to start using high-resolution imagery. Partnership has enabled us to map every house, structure, foot path and vegetation patch, which is crucial for our work. Remote sensing has also been used in western Tanzania to monitor dramatic change in the Miombo woodlands during the dry season.

Cloud cover is so persistent in some regions, like Tchimpounga in the Republic of Congo, that you must use Synthetic Aperture Radar (SAR) technology, which is able to penetrate cloud to obtain images of the land. It's exciting to see how quickly remote sensing is developing in this respect.

What features would make GIS even more helpful and valuable in nature conservation?
I think the main challenge for GIS in this field is to bridge the gap between what the technology can do and what the users need. Standardised data models for specific application in conservation would really help. Web-based GIS is also becoming extremely valuable; it means users do not have to worry about storing high-resolution images using huge amounts of disk space. Although in western and eastern Africa we are restricted by low internet availability, it's heartening to see that accessibility is improving every year.