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 Saving the Elephants with GIS and GPS

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Saving the Elephants with GIS and GPS

Imagine taking a safari to far-off Africa, where exotic animals roam the grassy plains. Ahead you see many forms taking shape on the horizon. As you get closer, you find you are looking at herds of wildebeests, rhinoceroses, giraffes, zebras, and Cape buffalo, but you have yet to see the one majestic animal that you really came to see?an elephant! Now, imagine what it would be like to visit Africa if elephants were extinct. It would hardly be the same trip, would it?

Fortunately, there is an organization dedicated to the elephant's survival. Save the Elephants (STE) was established in 1993 in response to mounting threats to the elephant population, which come in many forms. Poachers, looking to cash in on the ivory trade, kill these majestic animals with brutal efficiency. As long as there is a worldwide market for ivory, every elephant is at risk. Habitat loss due to human pressure also limits the elephants' range and places added stress on the remaining herds. If their ecosystem is reduced to the point that the animals can no longer find sustainable food sources, then the population will crash and the elephant will cease to wander the African plain. Likewise, as their habitat continues to be reduced, the elephant must compete with other wildlife as well as humans and their livestock.

Save the Elephants is working to secure the future and sustainability of elephants in Africa. They do this in three ways. First, they assist wildlife departments in their fight against ivory poachers and traders. Next, they disseminate information through a variety of media to educate as many people as possible, both locally and internationally, to boost knowledge of the species. Last, they research elephant behavior to provide fresh insights into the elephants' way of life. Prior to this research, the behavior of elephants, their patterns and habits, was not very well known.

Methodology and Role of GIS/GPS in the Project

STE uses global positioning systems to track the movements of elephants, which is the basis of their research. Special GPS tracking collars were designed by Lotek Engineering for this project. "We first used GPS to track the flight paths of the aircraft we used in elephant counts, and also to record simple waypoint locations of each elephant herd," says Dr. Ian Douglas?Hamilton, OBE, chairman and founder of Save the Elephants. "Our first prototype GPS elephant collar was deployed in 1995. It gave such promising results that I was encouraged to

 This map depicts the flight paths taken during a recent elephant survey

continue development."

An elephant's position is recorded every hour by the GPS for the first month the collar is deployed on the elephant. After the first month, the GPS is reset to record a position once every three hours. The chip in the GPS unit can store up to 3,640 positions, so even recording at a frequency of 24 times per day necessitates downloading only once every five or six months. The data from the chips inside the collars is downloaded using software called GPSHost, which is also provided by Lotek Engineering.

To solve the problem of how to get close enough to the elephants to download data from the collars without disturbing them, downloading sessions are conducted using a laptop computer operated remotely from an airplane flown over the herd. The same software, GPSHost, then converts the digital GPS data into spreadsheet format. Spreadsheets that are saved in either a text (.txt) or database (.DBF) format can then be imported into ArcView GIS software.

Dr. Douglas?Hamilton uses the ArcView Tracking Analyst extension to take a "first look" at the data and create maps representing the movement of the elephants. ArcView Tracking Analyst can take input from a data source that has x- and y-coordinates (which is why GPS data is a perfect fit) and display the data in ArcView GIS as a shapefile. The benefit to using Tracking Analyst is not only to be able to see where the elephants were, but where they were at a particular time. This unique information provides insights into elephant behavior and can lead to knowledge of not only the daily routine of a herd, but also to long-range habits over time.

"ESRI software has been invaluable in creating fine, detailed maps for lecture or fund-raising presentations," says Dr. Douglas?Hamilton. "Using these ESRI-generated maps, I have been able to raise people's consciousness about elephant issues by showing them what terrain looks like from an elephant's point of view."

Results

According to Dr. Douglas?Hamilton, "Before we began using GPS, very little was known about the movement of elephants on a fine scale. Using GPS technology, we have been able to record elephant movements in such fine detail that we can begin to analyze how they make decisions in relation to their needs for food and water, safety from human predators, and the company of other elephants. By understanding their needs we can plan to safeguard their future, for example, by preserving the precise corridors we have defined that they use to travel from one safe area to another."

STE's research on the movement of elephants aids in understanding their needs and what motivates them. This information can then be used to find out how various human and ecological factors influence their movement and also to reduce conflicts between humans and elephants.
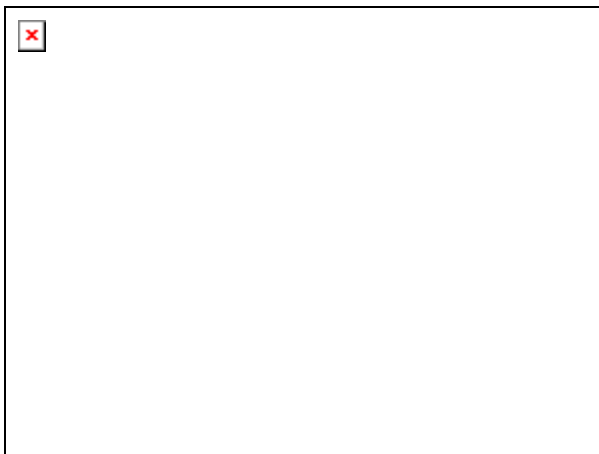
The GPS positions for two bulls have been connected by time to indicate each elephant's track. Bull M169 wandered out of

> *the protected area of the national park, into the controlled
> game area.*

In one instance, two bulls were collared and their whereabouts tracked. These males were suspected of raiding the crops of a nearby village. From the tracking study it was learned that one bull traveled only limited distances, and, as a result, depended on the crops of neighboring villagers for a food source. The other bull not only traveled greater distances in search of food but also left the relative safety of Amboseli National Park in Kenya, a protected area. The GPS and GIS showed that this bull was foraging into the Longido Controlled game area, where he could potentially be killed by hunters or poachers. About the same time, the Tanzanian National Government made the decision to close elephant hunting in the game area because hunting was an incompatible activity with the objectives of the neighboring Amboseli National Park. STE's research provided scientific proof of these cross-border movements, which had previously been denied by the hunting community.

Looking Forward

The primary benefit for Save the Elephants has been increased recognition of their work, and as a result, the growth of the project itself. Over time, the collar design has been refined (it takes a special kind of collar to withstand the daily weight of an elephant!), and their use in tracking elephants all across Africa has increased tremendously. Since the project began, Save the Elephants has over 40 active GPS collars deployed across many regions of Africa. In addition, STE works with scientists and conservationists all over the world, providing research support and technical expertise.

One of STE's primary sponsors, Computer Associates, is currently researching a new elephant collar design that will be able to download real-time maps of elephant movements directly to the Internet.

For more information, contact Dr. Ian Douglas?Hamilton, Save the Elephants founder and chairman, and Clair Geddes, GIS specialist, P.O. Box 54667, Nairobi, Kenya (Web: www.save-the-elephants.org, e-mail: save-eleph@net2000ke.com).

This article was adapted from *Integrating GIS with the Global Positioning System* by Karen Steede?Terry, now available from ESRI Press. *Integrating GIS with the Global Positioning System* is available at better bookstores, online at www.esri.com/esripress or www.esri.com/gisstore, or by calling 1-800-447-9778 (ISBN 1-879102-81-1, PN 84165, $19.95).

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