

Esri News

for Health & Human Services

Spring 2013

Saving Sight Beyond the End of the Road

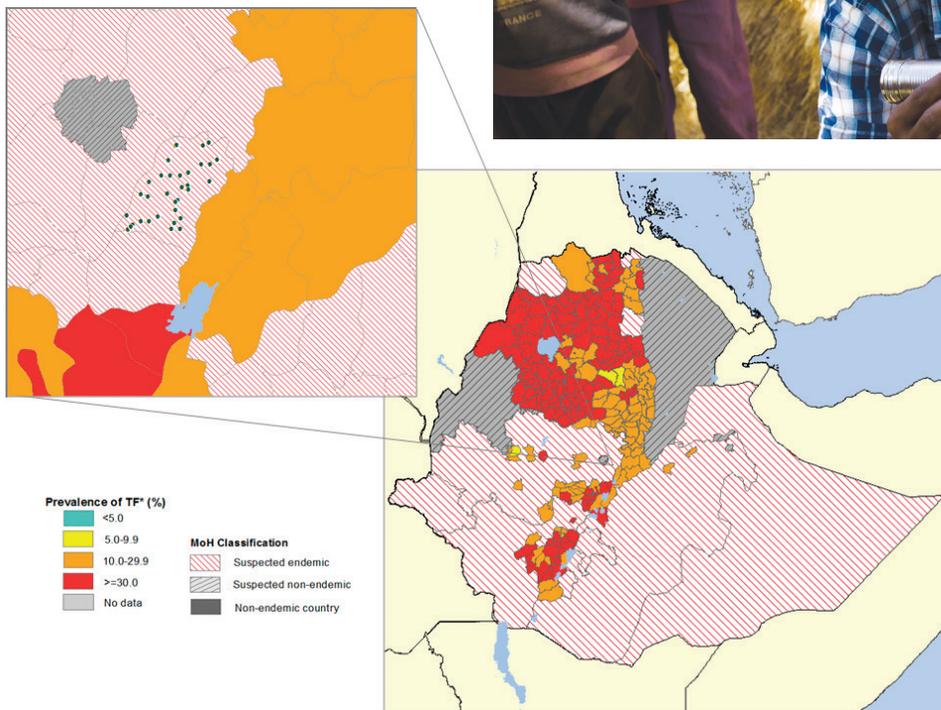
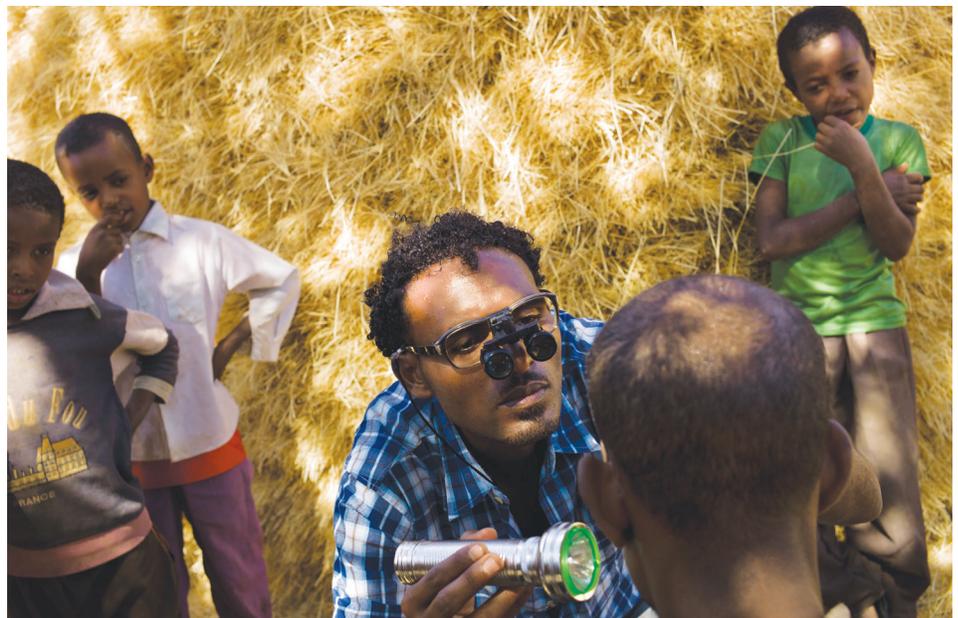
ArcGIS Helps Fight World's Leading Cause of Preventable Blindness

By Mike Schwartz, Esri Writer

It feels like thorns scraping your eyes each time you blink.

Repeated infections during your childhood lead to scarring of the conjunctiva, or inner mucous membrane of the upper eyelid. Your eyelashes turn inward and scratch the cornea. Slowly, painfully, you may go totally blind.

The affliction is called trachoma, and it affects the poorest of the poor—mostly women and children—especially in regions that have limited access to sanitation and water. More people suffer from trachoma in Africa than on any other continent. And because this bacterial disease is transmitted via close personal



↑ Genemo Abdela is one of many surveyors examining almost 600,000 people in Ethiopia. The team is identifying areas where people are at risk from trachoma and hence where treatment programs are needed. (Credit: Dominic Nahr/Magnum/Sightsavers.)

contact, it tends to occur in clusters—often affecting entire families and communities.

Approximately 110 million people worldwide live in endemic areas and require treatment, with 210 million more living where trachoma is suspected of being endemic, according to the International Trachoma Initiative (ITI) at the Task Force for Global Health based in Decatur, Georgia.

“Affected people are said to be living beyond the end of the road,” said Dr. Danny Haddad, director of the ITI. “In some instances, you need to walk half a day to get to some of these villages.”

↑ The point features generated by the Esri software can be aggregated to the health district, turning the health district classification from “suspected endemic” to a prevalence value. This knowledge drives health interventions.

Neglected No Longer

Until recently, a better ability to identify enclaves of so-called neglected tropical diseases—such as leprosy, river blindness, lymphatic filariasis (elephantiasis), African sleeping sickness, and trachoma—has proved elusive.

Fortunately, researchers combining Android and Esri software have figured out a quick way to visually assess the prevalence of trachoma in remote regions and to pinpoint gaps in prevention and treatment services, said Haddad.

A trachoma developmental study of the latest data collection, transfer, and visual display process using ArcGIS was launched in mid-October 2012 in the Oromia region of Ethiopia. It is part of a global survey funded by the UK government and led by the international nongovernmental organization Sightsavers, which aims to examine a sample of four million people across more than 30 countries by March 2015 to identify where people are living at risk of contracting trachoma and where treatment programs are needed.

In Ethiopia, several layers of smartphone and Esri technology enabled the immediate transfer of vast amounts of collected data to distant hardware and software platforms for display, analysis, and sharing.

Esri products were chosen because of their dynamic capabilities, said epidemiologist Alex Pavluck, a senior manager of research information technology at International Trachoma Initiative. ArcGIS maps are not only useful as visual tools but also offer real-time transfer of data and automated updates that provide much-needed efficiencies, Pavluck said.

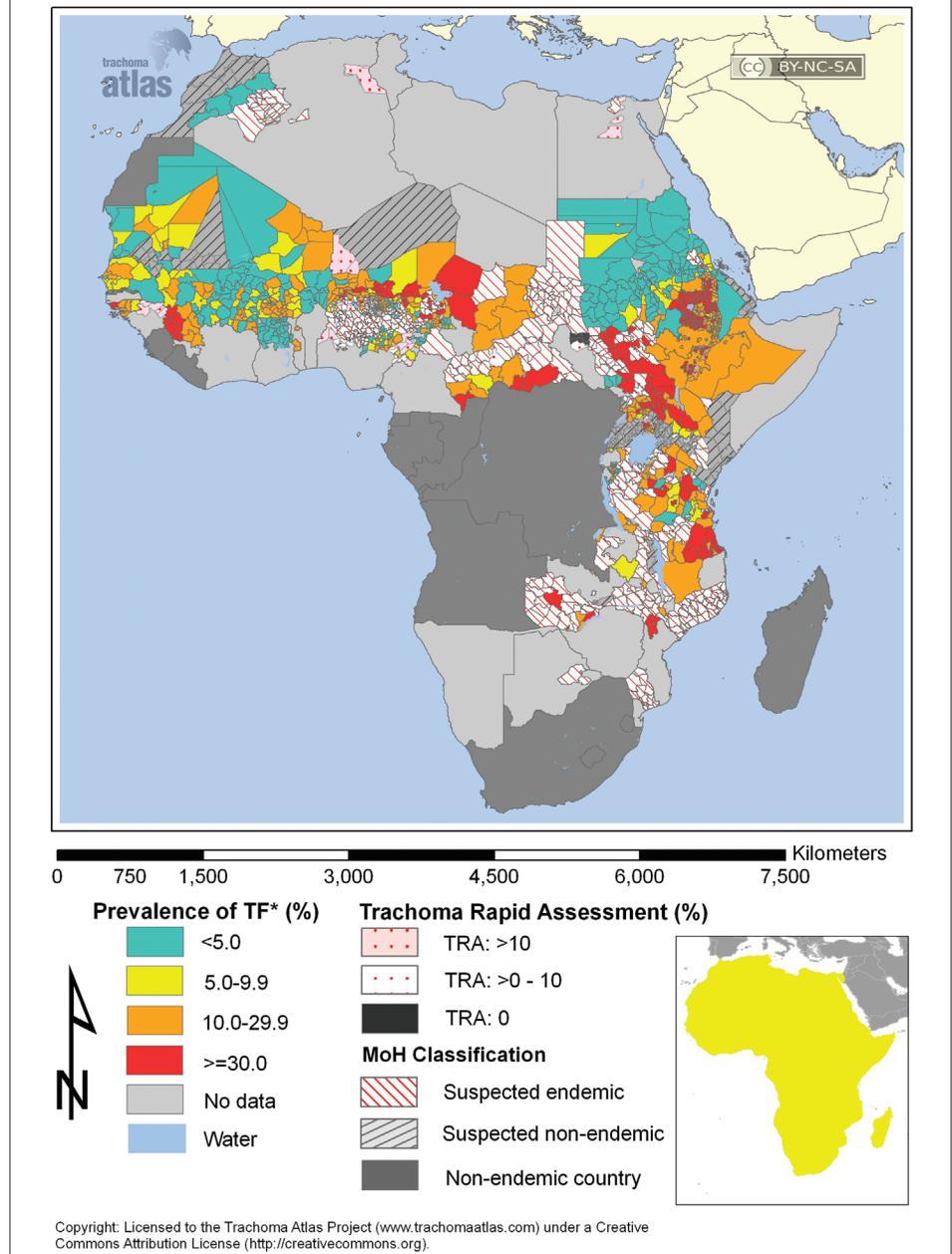
“One thing we wanted was the ability to produce layered maps,” he said. “These are really the key here—to show prevalence overlaid with areas currently receiving treatments such as donated drugs.”

The goal was to help realize an ambitious plan endorsed by the World Health Organization (WHO)—a dream, if you will, of endemic countries with organized national trachoma control programs—called Global Elimination of Trachoma by the year 2020, or GET2020.

According to Haddad, the Esri technology-enhanced system was built on one already developed for a variety of neglected tropical diseases, including trachoma. It relied on Android devices, which made it easy for field-workers to use. A robust reporting back end allowed data to be sent via cellular network or Wi-Fi to a web-based system at Task Force headquarters. It didn't take long for this approach to achieve surprising results, transmitting data on lymphatic filariasis from 18 countries.

“Before we used the Android tools, we had piles of paper that had to be manually entered after a survey,” recalled Haddad. Initial success

Prevalence of active trachoma in Africa



encouraged public health workers in endemic countries to realize that a system such as this—but one that was even more capable—was needed to reach WHO's ambitious GET2020.

Global Atlas of Trachoma—developed in 2011 by the International Trachoma Initiative with the support of partners such as the London School of Hygiene & Tropical Medicine, the Carter Center, and the Bill & Melinda Gates Foundation—provided up-to-date regional maps of trachoma's geographic distribution. Health workers now could reach more people with preventive hygiene; corrective surgery; and the antibiotic azythromycin (Zithromax), donated by pharmaceutical manufacturer Pfizer Inc.

Nevertheless, researchers discovered that the database supporting the atlas identified

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Dr. Danny Haddad, Director of International Trachoma Initiative



← The teams responsible for surveying people in Ethiopia for trachoma meet early in the morning before heading out to their assigned communities. Sixteen teams work to identify the disease in Ethiopia. (Credit: Dominic Nahr/Magnum/Sightsavers.)

more than 1,200 health districts that still lacked the data needed to guide interventions.

"We still didn't have the entire picture," said Rebecca Mann, geographic information systems data manager at International Trachoma Initiative.

Heart of the System

The latest Esri-enhanced system is designed to correct that. Here's how it works: Trained field-workers initially collect data on smartphones and tablets using Android technology.

"That's the beauty of it," said Mann. "The app can go on any device running Android."

Then the devices quickly transfer data to a website on a server housed in Decatur where it is summarized, checked for errors, and mapped. Using a 3G connection, the data can be transmitted to the server in real time.

Next, the data moves to a central MySQL server linked to an ArcGIS mapping server. A Python script automatically converts tabular data into feature points that link to ArcGIS map templates embedded in a project website on arcgis.com. These points accumulate on the web maps as data is collected, illustrating the distribution of surveyed clusters and ensuring that selected samples spatially represent the entire survey area.

The server makes the data accessible worldwide so researchers and managers can review the accumulating information in real time, then approve it for wider dissemination such as within the trachoma atlas, said Danny Hatcher, an applications developer with Esri Professional Services in Atlanta, Georgia.

ArcGIS for Server pushes the data onto more detailed maps that show the entire survey area, providing visual displays that aid health

workers in more quickly identifying areas and people needing treatment.

"It was nice that we didn't have to reinvent the wheel," said Hatcher, who set up the servers and wrote the Python script. "We could fit hand in glove with ITI's existing process and turn it into a map it could use."

Proof of Concept

Mann recalled her excitement when the Ethiopian pilot project began. Pavluck needed just half a day to train a team of local field-workers how to use the smartphones.

"Because the system is so simple, it isn't necessary to train a highly specialized team," Mann said.

When the field-workers in Ethiopia started collecting data, Mann and her colleagues in Decatur could actually see it flow from the phones to their server.

"Python script converted the data into feature points, which I personally added to the first mapping template," she said. As more data came in, the system automatically updated the website.

The researchers plan to add features if the system runs smoothly. "As we get into the rhythm of things, I'm sure we'll want to tweak our system," Mann said. "But right now, we're trying to keep it as simple and straightforward as possible."

Haddad said researchers now are looking at other neglected tropical diseases and, thanks to ArcGIS, can more clearly see gaps in defenses against them. "This system is making a huge impact on how we run our programs," he said. "It allows us to make much faster decisions on what we need to do."

For more information, contact Rebecca Mann at rmann@taskforce.org or visit www.taskforce.org, www.trachoma.org, www.trachomaatlas.org, and www.trachomacoalition.org.



380 New York Street
Redlands, California
92373-8100

1 800 GIS XPRT (1 800 447 9778)
T 909 793 2853
F 909 793 5953
info@esri.com
esri.com

Offices worldwide
esri.com/locations

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