# Remote visual evidence of displacement

Susan Wolfinbarger and Jessica Wyndham

**Geospatial technologies such as satellite imagery provide a means of 'reaching' a conflict zone when on-the-ground reporting may be too dangerous, a region too remote, or access denied.**

The visual evidence provided by satellite images and geovisualisation techniques can serve to corroborate and strengthen local reports of conflict, destruction and displacement. Geospatial technologies and techniques – which include a range of modern tools, such as satellite imagery, Geographic Information Systems (GIS) and Global Positioning Systems (GPS) that allow for mapping and analysis – offer valuable tools for identifying, measuring, monitoring and documenting large-scale displacement, whether displacement caused by conflict, housing demolitions, natural disasters or development projects.

## Geospatial image analysis

In 2006, while preparing the indictment of Sudanese President Omar Bashir for war crimes and crimes against humanity, the International Criminal Court reviewed commercial high-resolution satellite imagery analysis of the Darfur region. For the purposes of identifying and measuring the impact of conflict and the scale of displacement, the most common approach is to analyse 'before' and 'after' image pairs. The American Association for the Advancement of Science's (AAAS) Geospatial Technologies for Human Rights Project[1] had documented the destruction of villages in Darfur; in coordination with organisations conducting on-the-ground reporting, AAAS collected pairs of images for 28 locations with dates ranging from 2003 to 2007. Through a careful analysis of each image, it was evident that in 75% of cases villages had been destroyed or new IDP camps had been constructed. Furthermore, the analysis revealed that the villages had been destroyed specifically by burning, corroborating on-the-ground reports.

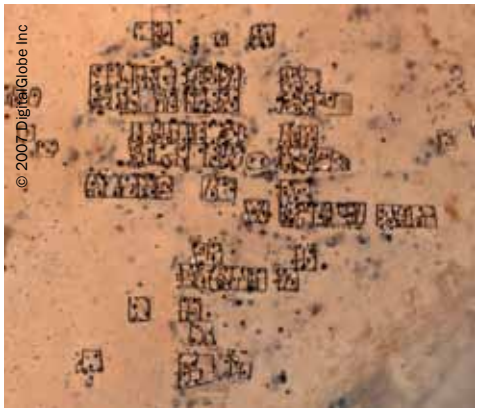
This analysis led to the development of 'Eyes on Darfur',[2] an interactive online site which included images identifying the location and extent of destruction in several villages, and was used by human rights organisations as evidence to support claims of genocide and to advocate for greater international government commitment to addressing the situation on the ground.

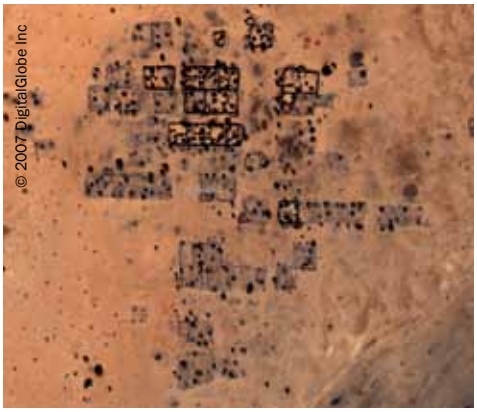
The creation of Eyes on Darfur was an early example of interactive data exploration, combining multiple layers of data (e.g. imagery, text and other multimedia elements) and presenting them in a mapped form. The ability to quickly manipulate large amounts of data and create displays in this way has only recently evolved with advances in GIS software and computing capacity.

In 2009, AAAS teamed with Amnesty International and Human Rights Watch to identify the locations and extent of damage to IDP shelters in Sri Lanka following reports that IDP camps were being targeted. As no outsiders were allowed access to the area during the timeframe in question, commercial high-resolution satellite imagery was one of the few options available for gathering information. They found that thousands of IDP shelters had been removed, and also that there was evidence of shelling in the vicinity of and intermingling with IDP settlements. This analysis informed the US government's 2009 report on war crimes in Sri Lanka.[3]

In 2011, AAAS again linked up with Amnesty International to construct a detailed map identifying numerous human rights-related events occurring throughout Nigeria, from armed conflict, ethnic violence and forced displacement, to the harmful effects of industrial gas flares on local populations and the environment. 'Eyes on Nigeria'[4] revealed the value of using geovisualisation techniques to communicate to the public complex human rights information gathered from a breadth of sources in a way that could not be achieved as effectively by a simple narrative. Among the sources used were remote sensing methods, on-the-ground photos (whose location could be specified through the use of GPS-enabled cameras) and interviews.

Reflecting on the value of these collaborative projects for Amnesty International, Crisis Prevention and Response Campaigner, Christoph Koettl says, "Having been a rather 'exotic' new tool a few years ago, geospatial technologies now belong in the standard tool box for human rights advocates – especially those who work on armed conflict situations. A good example




The 'before' image of Shangil Tobay (left), in North Darfur, was taken 10 March 2003. The 'after' image (right) was taken 18 December 2006. During the intervening period, 75% of the village was identified as having been destroyed.

was our work during the final stage of Sri Lanka's civil war. While the conflict area in northeastern Sri Lanka was completely sealed off by the government, we were able to give virtual access to our activists and the public, thus supporting our campaigning for accountability for alleged war crimes. This would have been hardly imaginable without geospatial tools."

And the European Human Rights Advocacy Centre, in partnership with the Georgian Young Lawyers Association, relied on geospatial image analysis to document the destruction caused during the conflict between Russia and Georgia in August 2009. This information was presented to the European Court of Human Rights in a case arising from the conflict in South Ossetia.

Governments and humanitarian aid organisations are increasingly using satellite images to determine the scope of natural and man-made disasters, and to locate populations displaced by those disasters. Following both the earthquake in Haiti on 12 January 2010, and the earthquake and tsunami that hit Japan on 11 March 2011, high-resolution satellite imagery was used to create large area assessments of damage and to locate populations displaced by the disasters through rapid mapping of the situations and the distribution of this information to disaster response teams.

"Freely available satellite information after the January earthquake in Haiti was invaluable," says Kate Chapman of Humanitarian Open Street Map. "Without having imagery it would have been impossible for OpenStreetMap to create the very detailed basemap used both by traditional responding agencies such as the UN as well as other technology communities."

### Limitations and prospects

High-resolution imagery ranges in price from US$10 to US$25 per km², depending on how recently the image was acquired and whether the image is in colour or black and white. Minimum order sizes can even lead to single images costing up to US$400. Even when cloud cover, for example, does not stop satellite imagery being available for a region, imagery for a specific date or series of dates in close succession may not be available. And government restrictions may mean that non-governmental actors cannot acquire the images.

Finally a human rights or humanitarian organisation wishing to use these tools must be prepared and able to work with technical experts who can analyse geospatial images for them when the requisite expertise is not available in-house.

A number of organisations are beginning to couple geospatial technologies with crowd-sourced information. Crowd-sourcing relies on the ability to call on networks of people, located around the world, and is greatly facilitated by the increasing availability of mobile phone and other wireless technology. Continued growth in mobile phone access, social networking and mapping technologies allows a comprehensive overview of a situation based on an aggregation of a large number of on-the-ground reports to be created. That information can then be combined with other data and mapped to build a holistic picture of what is occurring in a given location.

Providing tools of increasing utility not only to human rights organisations but also to courts and humanitarian response agencies, geospatial technology allows for unprecedented visual access to remote and dangerous locations, enables experts to analyse and quantify levels of destruction, and provides the means to communicate otherwise complex and/or abstract information in a way that can prove powerful whether in advocacy campaigns, policy debates or litigation.

With the increasing availability of satellite imagery and innovative approaches to the collection, analysis and display of information, it will be vital for the community of scholars, organisations and advocates concerned with displacement to come together with the technology community to identify areas of current need for which geospatial technologies and techniques can provide increasingly vital input.

Susan Wolfinbarger (swolfinb@aaas.org) is Senior Programme Associate of the Geospatial Technologies and Human Rights Project of the AAAS Scientific Responsibility, Human Rights and Law Program (http://srhrl.aaas.org/geotech/). Jessica Wyndham (jwyndham@aaas.org) is Associate Director of the AAAS Scientific Responsibility, Human Rights and Law Program (http://srhrl.aaas.org/). She is also an Adjunct Professor at the George Washington University.

This article was written in a personal capacity and does not reflect the views of the American Association for the Advancement of Science.

See also 'Satellite imagery in use' by Einar Bjorgo, Francesco Pisano, Joshua Lyons and Holger Heisig (UNOSAT) in FMR31 www.fmreview.org/FMRpdfs/FMR31/72-73.pdf

1. http://srhrl.aaas.org/geotech/
2. www.EyesOnDarfur.org
3. www.state.gov/documents/organization/131025.pdf
4. www.EyesOnNigeria.org



This pair of images, taken on 19 February 2008 and 7 February 2010, reveals the location and extent of housing demolitions that took place along the waterfront in Port Harcourt, Nigeria, in 2009. The demolitions led to the almost total destruction of the Njamenze slum which was estimated to house over 13,000 people.