Nepal(/country/npl)

Mapping for resilience: crowd-sourced mapping in crises

News and Press Release

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by Elizabeth Gilmour

Massive earthquakes have rocked the Nepalese capital Kathmandu throughout its history. In 1934, an earthquake destroyed a quarter of the buildings in the city and killed over 10,000 people across the region. The most recent major event, on 25 April 2015, had its epicentre 80 kilometres from Kathmandu, in Gorkha. Fourteen of Nepal's 75 districts sustained serious damage, including the three districts in the Kathmandu Valley. Nearly 9,000 people were killed and another 17,000 injured. Half a million houses were destroyed.

Concerns about earthquake preparedness had been growing for years before the earthquake. Preparedness is more than building earthquake-resistant buildings and resilient infrastructure: information is also a key element, of which maps are an important part. Maps show road networks and settlements, as well as hospitals and other facilities. They are crucial for directing relief, understanding the risk of secondary disasters and locating resources.

Kathmandu Living Labs (KLL), a Kathmandu-based not-for-profit civic tech company founded in 2013, uses crowd-sourced mapping to improve the information infrastructure in Nepal. KLL helped prepare Nepal before the earthquake using open mapping. After the earthquake, the organisation provided crisis maps to relief actors. KLL's preparation and previous work with crisis mapping meant that it was uniquely placed to provide maps and coordinate crisis mapping after the earthquake.

Capacity-building and preparation

The Open Cities project, an initiative from the Global Facility for Disaster Reduction and Recovery (GFDRR), began in 2012 to collect open-source data about the seismic vulnerability of schools and medical facilities in the Kathmandu Valley. Student groups and citizen volunteers assisted in digitising data about building locations and the road network, as well as structural information about schools and medical facilities.

Open Cities stored the information it gathered on OpenStreetMap, a global online map that anyone can edit and contribute to. OpenStreetMap is a crowd-sourced mapping platform. Local mappers can add places with which they are familiar to the map, while volunteers around the world add features from satellite

imagery. Users map manmade and natural features ranging from highways to temples and sources of water. In addition to drawing objects on the map, users can add information. For a school, for example, users can add the name, the number of students and details about the building.

As part of the Open Cities Project, schools, roads, medical facilities and houses were mapped in OpenStreetMap. In total, the volunteers mapped over 100,000 buildings in the Kathmandu Valley, added structural information about 350 medical facilities and about 2,300 schools and improved and updated the map of the road network on OpenStreetMap. The project meant that crucial information was in place, and many residents of Kathmandu knew how to use OpenStreetMap and could continue to add to it. KLL also began working with other organisations in Nepal to teach open mapping. For example, in 2013 staff of the Nepal Red Cross Society (NRCS) were trained in mapping vulnerabilities and resources in communities. These training sessions taught NRCS staff from several districts how to use open data and open mapping in their day-to-day work, and in case of a disaster.

During crises such as natural disasters the Humanitarian OpenStreetMap Team, or HOT, organises the mapping of affected areas. The area is broken into many smaller mapping tasks. Each task is divided into squares, each of which is mapped by one or more volunteers who work with aerial imagery to trace objects on the map. Just as in the case of the Open Cities project, volunteers use aerial imagery to produce a digital map. In this way, volunteers can efficiently map large areas, and organisers can focus volunteers' efforts on priority areas. KLL also studied how OpenStreetMap contributed to the response to Typhoon Haiyan in the Philippines in 2013. Just as after other natural disasters, maps were important for locating victims, routing aid and assessing damage. The typhoon KLL joined other volunteers from around the world in mapping road networks and damaged buildings. KLL also organised mapping marathons to recruit more volunteers.

Post-earthquake mapping

The day after the earthquake, on 26 April, several members of KLL met to plan a course of action. Although Open Cities Project and KLL had organised a major mapping effort in Kathmandu, the other affected districts had not yet been thoroughly mapped. As the building where KLL worked was one of many damaged in the earthquake, staff set up a table and chairs in the parking lot. For the next few weeks, they would work outdoors.

The lessons KLL learned in the mapping effort after Typhoon Haiyan helped to plan next steps. Mappers had to be alerted to the need, and mapping tasks had to be assigned to direct volunteer efforts. As the available imagery was from before the disaster, it did not show earthquake damage or the camps where internally displaced people were staying. Despite cloudy skies over Nepal, by 1 May, less than a week after the first earthquake, enough satellite imagery was available to create new mapping tasks focused on several districts outside the Kathmandu Valley. The first imagery to arrive was of Gorkha, Nuwakot and Dhading districts; imagery from Sindhupalchok, a heavily damaged district to the north of Kathmandu, arrived later. In addition to HOT, KLL worked with other organisations to understand what maps were needed for earthquake relief.

Maps on the ground

The earthquake drew an unprecedented response from mappers. By 28 April, 2,200 people had contributed to the crisis mapping effort. KLL was still helping to guide the mapping from the parking lot of its former office. At this point, individuals, volunteer groups and humanitarian organisations began to request map data as well as printable maps, for navigation on the ground in places where mobile maps were unreliable.

Four days after the earthquake, on 29 April, KLL began to co-ordinate with the Nepal army, after establishing contact through its GIS division. The army specifically requested information about camps housing earthquake victims, and also used the maps to coordinate relief operations. Working with a non-governmental organisation to plan relief operations was a major change for the military. The information provided by KLL helped the army expand its relief efforts. 'Earlier, we were simply focusing on Bhaktapur but we found out that areas like Ramkot and Balaju were heavily damaged', explained Lieutenant Colonel Sudeep Panta, the head of the army's GIS Department.

The day after coordination with the Nepal army began, KLL held a training session for doctors on how to use its maps to assist in earthquake relief efforts. By this time, five days after the earthquake, 3,300 people had participated in crisis mapping. KLL also began posting printable maps to an online repository. Relief organisations, such as the Canadian Disaster Response Team, had already begun using the printable maps for their relief operations. On 1 May, KLL created the QuakeRelief.info website and consolidated and posted its collection of printable maps.

Mapping only affected districts is not enough for future natural disasters. In a country like Nepal, with such diverse and challenging topography, it is necessary to know where people live and how to reach them in times of crisis, by car, jeep, mule or helicopter. Continuing work on mapping in Nepal and in other developing countries should be considered an essential part of disaster preparedness and mitigation. The role that KLL played before, during and after the crisis caused by the 25 April earthquake shows the value of having an organisation on the ground to direct and organise crisis mapping.

Elizabeth Gilmour is an intern at Kathmandu Living Labs, where her work focuses on GIS, mapping and UAV imagery. She is shortly beginning a Master's degree in geophysics and engineering seismology at the University of Memphis. The views expressed in this article are not necessarily those of KLL.

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