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Proactive Planning: Using GIS Data and Mapping Parties to Expedite Disaster Relief Response to Vulnerable Places

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Abstract:

Humanitarian mapping activities combine open data and crowdsourcing efforts to support disaster relief response and humanitarian aid to vulnerable populations. During mapping events, participants learn to use basic map editing software and learn how map data and information is collected. Then, they use map data to create tools that humanitarian organizations--like the American Red Cross and Doctors Without Borders--rely on to plan risk reduction and disaster response efforts. Mapping events utilize several information literacy-related competencies in which librarian contribution and instruction is useful, including the collection and organization of data sources, understanding ways data can be used for decision-making, the development of open knowledge and tools, and the provision of remote data access during crises. Libraries, as physical spaces, are ideal for hosting Mapathons and as meeting spaces for uploading data after field mapping activities. This paper will discuss how humanitarian mapping is used to help expedite first responder's response during disaster relief efforts, and will illustrate how libraries are involved in humanitarian mapping efforts

Keywords: Humanitarian Mapping, Map Data, Open Data, Disaster Relief, Active Learning

Introduction:

Humanitarian mapping events like Mapathons or mapping parties are a type of Participatory GIS (PGIS), a participatory approach that combines spatial planning, spatial information, and communications management. PGIS is similar, in concept, to participatory design, participatory management, or participatory democracy. Its basis is community empowerment, and it attempts to engage a multidisciplinary group in making geographic technologies more widely available, particularly amongst disadvantaged groups and vulnerable populations.

Mapathons or mapping parties are a type of PGIS in which participants, called Mappers, meet to help develop tools that humanitarian organizations use to plan risk reduction and disaster response efforts. Mappers are given background information on mapping locations, information about what kind of data is needed, and information on how to differentiate between buildings, types of building, landmarks, and types of landscape. They identify high need projects and help contribute to mapping activities by creating accurate map information that help direct first responders to high-need areas. Because these maps are usually freely available, they might also be used by health organizations to plan public health interventions, or by finance organizations like the World Bank to help plan economic development projects.

Humanitarian mapping illustrates the potential of geographic data and Geographic Information System (GIS) and can help participants build spatial literacy skills, digital literacy skills, and data management skills while engaging with an international community. Because the threshold for technical expertise is low for participation in humanitarian mapping activities, events like mapping parties can serve as an introduction to data-related challenges for audiences who might not otherwise consider themselves technically savvy. Libraries are playing an important role as meeting places for humanitarian mapping events, and librarians--particularly librarians interested in STEM education and active learning--play an important role in helping Mappers make literacy-related connections and build data management skills during humanitarian mapping events.

Humanitarian Mapping

“In the pre-disaster context we would like to map vulnerability and develop baselines for it. The data for these baselines would include scientific hazard data and the outputs from qualitative assessments at community level.”-- Bhupinder Tomar, Senior Officer, Disaster Preparedness, International Federation of Red Cross and Red Crescent Societies.

Maps are a powerful decision-making tool for humanitarian workers seeking to communicate and share complex emergency response information because they provide the ‘Where’ -- they direct first responders to where aid is most likely to be needed. In proactive disaster relief planning and risk assessment, maps can be used to identify a community’s vulnerability to certain natural hazards. Humanitarian mapping, when considered a form of Participatory GIS, is a combination of three factors:

1. The principles of public participation¹:
 - a. Public participation is based on the belief that those who are affected by a decision have a right to be involved in the decision-making process.
 - b. Public participation includes the promise that the public's contribution will influence the decision.
 - c. Public participation promotes sustainable decisions by recognizing and communicating the needs and interests of all participants, including decision makers.
 - d. Public participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision.
 - e. Public participation seeks input from participants in designing how they participate.

¹ Principles of Public Participation. (2008)
https://www.co-intelligence.org/CIPoI_publicparticipation.html. Retrieved 2018-06-05.

- f. Public participation provides participants with the information they need to participate in a meaningful way.
 - g. Public participation communicates to participants how their input affected the decision.
2. Participatory Rural Appraisal (PRA)²: PRA is an approach used in international development in which the knowledge and opinions of local people are included in the planning and management of development projects for their communities.
3. Geographic Information Systems (GIS)³: GIS systems integrate, store, edit, analyze, share, and display geographic information. GIS applications are tools that allow users to create interactive queries, analyze spatial information, edit data in maps, and present the results.

As crowdsourcing became popular, three major technological shifts led to Humanitarian Mapping gaining significant traction⁴:

1. A widespread adaptation of Web 2.0 provided users with more opportunities to contribute to internet content. With the advent of Web 2.0 in around 2004, websites began⁵:
 - a. offering a richer user experience with dynamic, responsive content like videos and interactive images
 - b. encouraging user participation, with online commenting and survey evaluations that allowed for two-way information exchange between site managers and users
 - c. offering software as a service, through the development of APIs and mashups
 - d. using folksonomies or the free classification of information, which allows users to classify and search for information as a collective
 - e. realizing and adjusting for mass participation, from what had been an audience of mostly traditional internet users well-versed in computer literacy to a wider spectrum of users
2. The mass marketing and greater affordability of GPS and locational technology, which allowed users to easily geotag images and content, creating mashups with map data. In the realm of disaster relief, this use of mashup map data was observable in the wake of the 2010 Haiti earthquake, where users utilized the online mapping network Ushahidi.com to report incidents and areas of need.
3. Cloud-based computing, which allowed software to be accessible over the internet, on a server and not solely based on a physical machine.

² Castelleo, P.; Gamble, D. N. (2005). "Participatory methods in community practice: popular education and participatory rural appraisal". In Weil, M.; Reisch, M. *Handbook of community practice*. Thousand Oaks, CA: Sage Publications. pp. 261–275. doi:10.4135/9781452220819.n13. ISBN 076192177X. OCLC 55008364.

³ Maliene, V.; Grigonis, V.; Palevičius, V.; Griffiths, S. (2011). "Geographic information system: Old principles with new capabilities". *Urban Design International*. pp. 1–6. doi:10.1057/udi.2010.25.

⁴ Corbett, J.; Rambaldi, G.; Kyem, K.; Weiner, K.; Olson, R.; Muchemi, J.; McCall, M.; Chambers, R. (2006). "Overview: Mapping for Change: The emergence of a new practice" (PDF). 54:13-19 IIED, London, UK. iapad.org. Archived from the original (PDF) on 16 July 2011. Retrieved 06 June 2018.

⁵ O'Reilly, T. (2005). *What is Web 2.0. Design Patterns and Business Models for the Next Generation of Software*, p. 30

OpenStreetMap (OSM) and the Humanitarian OSM Team (HOT)

OpenStreetMap (OSM) is a humanitarian mapping project created by British entrepreneur Steve Coast in 2004. Coast was inspired by Wikipedia, to create an open source product that created maps based on field map data, GPS coordinates, and satellite imagery. Mappers learn to use map editing software and enter data into the OSM database. Then, locals enter detailed information like street and building names, building types—homes, schools, places of worship, etc. The Humanitarian Open StreetMapTeam (HOT) was formed after the Haiti earthquake in 2010, and has become a leader in the humanitarian mapping arena. HOT aims to provide free, updated maps for relief organizations to use to respond to disasters or political crises.

The HOT Missing Maps Project applies principles of open source and open data sharing to support humanitarian response and economic development in developing nations. Its core objectives include:

- to connect humanitarian actors and open mapping communities
- to provide remote data creation during crises
- to collect and organize existing data sources
- to support deployments to the field
- to be a distribution point for free data
- to develop open knowledge and tools
- to promote crowdsourcing and simple web standards for data sharing
- to develop technical improvements to Open Street Maps and OSGeo in response to field requirements

HOT bridges communication between “the OSM community and humanitarian organizations: distributing data, deploying aid to the field, and developing open knowledge and tools for on-the-ground data collection. Some 45,000 people have contributed their efforts over the past seven years.”⁶ After disaster, HOT gathers volunteers to create or update maps for use by first responders and governments. But, many HOT projects focus on disaster preparedness—working to ensure communities are ready to respond to disasters before they actually occur. These efforts include long-term projects with partners that include USAID and the U.S. State Department Humanitarian Information Unit. Their efforts also include support of community mapping projects that allow people to create their own maps for socio-economic development and disaster preparedness.

Mapathons and Individual Mapping Projects

The Missing Maps project relies on mapping parties of volunteers--events called Mapathons--to trace areas, do data editing, and to upload after field mapping activities. These parties are often organized by volunteers, and the university community has been active in hosting Mapathons. Tailored projects for students and universities, community advocates--interest areas are wide-ranging and include topics like accessibility, special populations, drinking water, food security, etc., and region-specific territory-based projects are available.

During Mapathons, participants learn to use basic map editing software and learn how map data and information is collected. They use the OSM Task Manager to identify high-need areas and contribute to current activities. The Task Manager provides background

⁶ Peet, L. (2017). “Mainland Libraries Aid Maria Victims with Money, Mapathons”. *Library Journal*, 142, 18. pp. 14-15 <https://lj.libraryjournal.com/2017/10/academic-libraries/mainland-libraries-aid-maria-victims-money-mapathons/>

information on mapping locations, information about what kind of data is needed—i.e. road, schools, and places of worship, and instruction on how to differentiate between building types. Because OpenStreetMaps relies on volunteers to provide mapping data, it also includes a validation process to ensure the resulting maps are robust and accurate.

Image 1 provides a comparison of 2 OSM Map types, Carto and Humanitarian to 2 types of Google Maps. OSM map quality continues to improve as Mapper participation increases.

The OSM Task Manager includes project options for individual mapping and numerous WikiProject options exist for individuals interested in volunteering for specific technical projects. For example, WikiProject Semantics focuses on improving the terms, classifications and ontologies used within OpenStreetMap and WikiProject Pictograms focuses on creating and improving the icons used on maps. Additionally, opportunities exist for designers and developers to collaborate with NGOs such as the Peace Corps, USAID, and the World Bank to build and improve applications based on OSM data.

Individuals might also consider attending the HOT Summit, the Humanitarian OpenStreetMap Team’s annual global community meeting where stakeholders, mappers, and organizers meet to showcase projects, share ideas, build international collaborations, and learn what impacts their mapping efforts have made on communities in need.

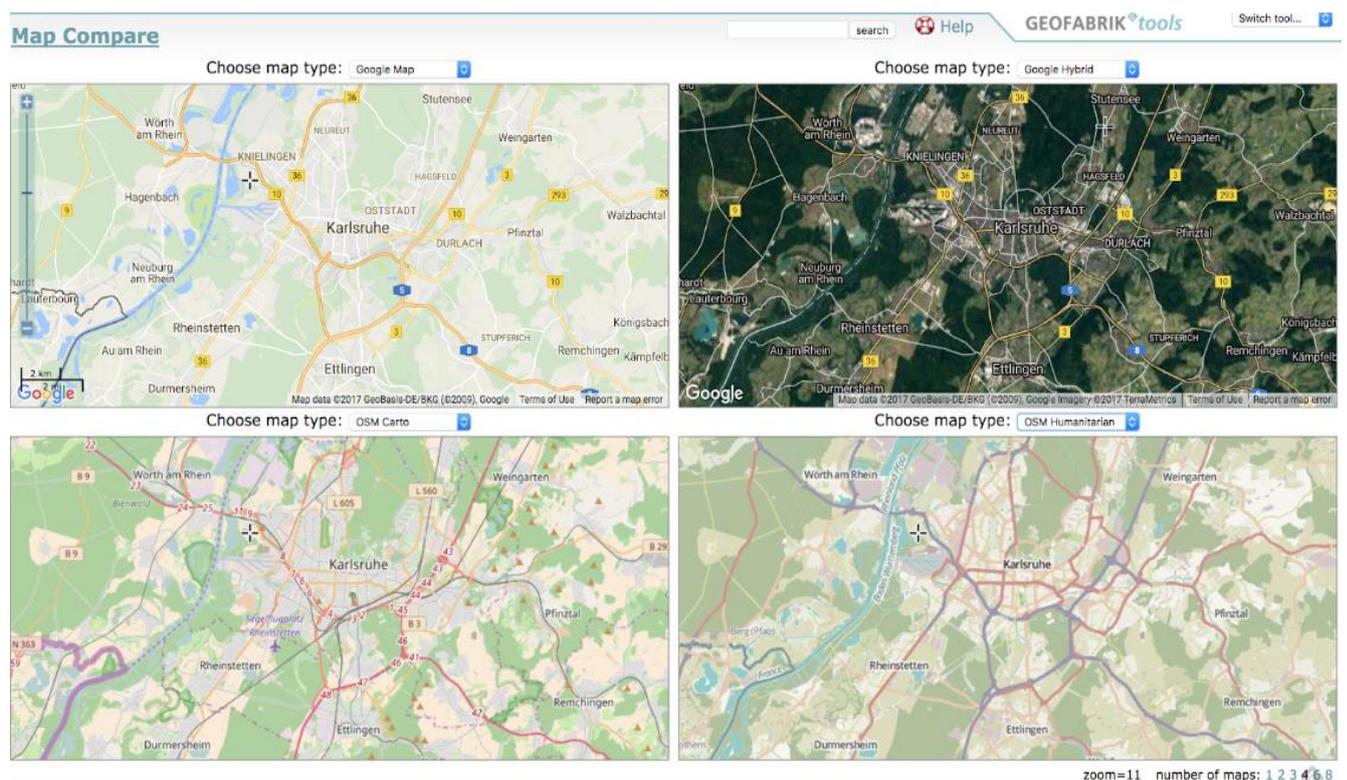


Figure 1. OSM Maps and Google Maps Comparison

How Libraries Support Humanitarian Mapping Initiatives

Libraries are playing an important role as meeting places for humanitarian mapping events and librarians, particularly librarians interested in STEM education or active learning, play an important role in helping Mappers make literacy-related connections and build data management skills during humanitarian mapping events. While the Missing Maps project, www.missingmaps.org, provides comprehensive resources for hosting Mapathons, additional

complimentary resources are available. Librarians at Columbia University, in response to their efforts in hosting mapping events after Hurricane Maria, created the Nimble Tents Toolkit to help librarians quickly and easily plan mapping events. “The nimble tents toolkit provides timelines, instructions and sample materials to help your team and organization be as prepared as you can to address urgent challenges, both individually and as collectives.”⁷

Columbia University’s Butler Library hosted a Mapathon in the aftermath of Hurricane Maria. The maps generated from the Mapathon were used by Red Cross workers and the Federal Emergency Management Agency (FEMA) to locate landmarks and check the condition of bridges and buildings in Puerto Rico⁸. A New York Times article covering the Mapathon explains the importance of open maps: “Maps can show a hidden weakness during natural disasters. In remote areas, where forces often wreak the greatest devastation, entire villages may have never made it onto a map. That could be because private companies, which hold the rights to their maps, have less incentive to include those areas, or because the government does not have the resources for frequent updates to existing maps. Even when a region is mapped, changes in neighbourhoods could alter the landscape drastically in less than a year.”⁹

Results and Conclusion

Mapping events can serve as mediators between information and users, and offer librarians an opportunity to teach spatial literacy, digital literacy, and data management competencies, while proactively supporting a movement that provides disaster teams with map data that inform decision-making. Mapathons and individual mapping projects can be a next step for librarians already experienced in using and developing open data, or can serve as an introduction to librarians just beginning to use data to teach information literacy. Because the required level of technical expertise for these events is low, humanitarian mapping events have the added value of attracting audiences who might normally shy away from traditional data-related challenges--particularly women and members of underrepresented minority groups.

⁷ Taylor, L. N. (2018). Digital Humanities Tools for Disaster Response: Hosting Mapathons and Telling Our Stories.

⁸ Eberhart, G.M. (2018). Hurricane Maria: The Aftermath: Caribbean libraries sustain catastrophic damage. *American Libraries*. pp. 20+ <https://americanlibrariesmagazine.org/2018/01/02/hurricane-maria-aftermath-caribbean-libraries/>

⁹ Yin, A. (2017). A Mapathon to Pinpoint Areas Hardest Hit in Puerto Rico. *The New York Times*.

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