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GIS and Humanitarian Aid

Natural disasters, climate change, political instability are critical issues facing the developing world every day. Droughts, floods, wars, earthquakes and disease are just some recent examples of catastrophes that have stricken developing countries. The people affected by these tragedies need to be assisted with humanitarian aid to stave off acute hunger and malnutrition as well as water shortages and to assist in recovery efforts. Not only can humanitarian aid be administered in disaster situations it can also be dispense to alleviate long term, chronic problems such as chronic malnutrition. Geographic Information Systems (GIS) and Remote Sensing (RS) have the ability to facilitate, coordinate, and rapidly execute humanitarian aid relief efforts in developing countries.

GIS offers the ability to integrate and analyze data crucial to executing successful distribution of goods and locating the areas with the greatest need. For example, GIS can be used to do a rapid assessment of potential disease outbreak, planning and implementation of health systems and program integration. The maps that GIS makes can be used as an advocacy tool to combine information that may not normally be linked. In a humanitarian emergency GIS can link and overlay critical information pertaining to conflict, food scarcities, displacement and mortality. It also has the ability to do a rapid evaluation of the resources required to combat the crises at hand. GIS cannot only be used in a post-disaster situation but also to do risk assessment of areas that may be in a humanitarian emergency in the future. A risk assessment involves gathering information on probabilities of disasters, population data, infrastructure information, and main settlement features. This would prevent the initial disorganization associated with a humanitarian crisis. The data would already be mapped and integrated into a GIS dataset because of the previous risk assessment.

GIS can be used to map areas of poverty, overlay that with areas most affected by drought and then overlay that with areas most likely to be affected by some sort of natural disaster. This has been done in previous studies where health officials where attempting to mitigate malnutrition. This weighted overlay gave authorities a sense of clinic placement and if clinic placement affected malnutrition. Additionally, areas falling within a buffer region of health clinics do not contribute to overall cases of malnutrition.

GIS is an ideal tool to rank regions of a country to identify where relief efforts should be targeted. Also, if relief programs are already in place GIS can be used to map where certain outposts are setup (i.e. World Food Program distribution points, clinics, etc), and then using Thiessan polygons or a buffer tool it would be possible to illustrate how close they are to areas with the severely affected population, how close they are to each other, if they are inaccessible due to natural barriers or rough topography etc. Lastly, GIS can be essential in mapping the progress of efforts in humanitarian aid and assistance. Using GIS it is possible to create perhaps a dot density map of areas with the highest probability of needing aid and relief and then juxtapose that with rates from 5, 10, 20 years before and it is possible to get a visual image of

how aid efforts and needs have decreased, increased, moved to different regions or stayed the same.

The main infrastructure for GIS and RS technologies in developing countries can vary depending on the amount of funding available to support these technologies. Recent improvements in the Internet have allowed for free shareware, like GoogleEarth. Other Free Open Source Software (FOSS) includes Quantum GIS, gvSIG and MapWindow. Free data sources for humanitarian mapping include ReliefWeb, geo4ngo, GIS Development, Public Health Mapping, and more. Any computer and printer and GPS device can be utilized with capacity building running as much as $100,000 or as little at $2,000. Several global organizations are already implementing GIS to enhance their humanitarian efforts. These include but are not limited to: WHO, UN High Commissioner for Refugees, World Food Program, Organization for Coordination of Humanitarian Affairs, and USAID.

Humanitarian emergencies require effective sharing of geographic information. This sharing of information can be critical in disaster response and correlates directly with how many lives can be saved. GIS and RS have emerged as vital technologies to integrate necessary information to organize the most coordinated humanitarian aid responses. With the ever - growing availability of free and low cost technology and data it will be even easier for developing countries to utilizes GIS and RS.

SOURCES:

GIS Emergency Management in Indian Ocean Earthquake/Tsunami Disaster. White Paper, J-9543. ESRI, 2006.

This paper was published by ESRI, which is a powerhouse in the field of GIS software and its use. I found this paper especially useful because it analyzed a recent humanitarian disaster that received worldwide recognition. ESRI explored how GIS supported rescue and recovery and ongoing recovery efforts. ESRI found that relief work takes place on many devices like laptops, GPS, and cell phones. Also, this research found that hazard mitigation may be the best way to prevent disasters of such magnitude in the future. This would be a model to predict the probability and outcome of a hazard. Hazard mitigation uses GIS by performing land-use analysis and population data and has a goal to reduce people affected by humanitarian disasters by 50% by 2015.

Haslett, SJ, and G. Jones. "Local Estimation of Poverty and Malnutrition in Bangladesh: Some Practical and Statistical Issues." Proc. of International Conference on Official Poverty Statistics: Methodology and Comparability, Phillipines, Manila

This research examined the malnutrition in Bangladesh and how GIS can be used to track and reduce this chronic problem. From this paper I learned that half of the 126 million people of in Bangladesh suffer from chronic malnutrition and are desperately in need of an efficient way to reduce this problem. GIS is a way to track, correlate, and aggregate malnutrition data as well as integrate it with land-use data, health clinic data, and other information. The researchers found it was best to use population census data as well as flash-flood information data along with GIS mapping information to target the areas most likely to be affected by chronic malnutrition.

Kaiser, Reinhard, Paul B. Spiegel, Alden K. Henderson, and Michael L. Gerber. "The Application of Geographic Information Systems and Global Positioning Systems in Humanitarian Emergencies: Lessons Learned, Programme Implications and Future Research." *Disasters* 27.2 (2003): 127-40.

This article contained the most prolific amount of information related to humanitarian aid and GIS. These researchers found that GIS has been a major tool in Kosovo, Sierra Leone and Afghanistan and that GIS can be used in a rapid assessment fashion to quickly implement aid. It can create maps and integrate information that may not be normally linked. It also discussed the multiple agencies that use GIS on a regular basis to supplement their humanitarian efforts as well as the important of hazard assessments and risk assessments. This paper also discussed how GIS can do quick evaluation of a disaster situation to estimate the amount of resources required to help mitigate hunger, disease, etc. GIS can also monitor and evaluate humanitarian programs in the rebuilding and recovery phase after the acute disaster phase has passed.

Krauer, Juerg. "Geoinformatics in Support of Peacebuilding, Humanitarian Assistance and Development Cooperation." Proc. of GIS: A Tool for Humanitarian Action, Centre for Development and Environment, University of Bern, Bern, Switzerland.

This author focuses on the progress that GIS has made in Sudan. He talks about the obstacles that Sudan faces because of political instability, natural disasters, and natural resource depletion. These combined have lead to displaces citizens, droughts, wars, etc that require humanitarian aid. This research focused on the use of free open source GIS because in Sudan there is little cooperation between institutions so GIS information may be limited. The author emphasis institutional integration is needed not only in Sudan but probably in many developing countries for GIS to be universally successful in applying GIS. Even though this paper only applies to Sudan I think it is a good example of how GIS can be used in any humanitarian aid situation in any developing country. Problems are probably universal if not similar across many of these countries and situations.

Morris, Naomi. "Field Guide to Humanitarian Mapping." *MapAction*. Mar. 2009. Web. Nov. 2010. <www.mapaction.org>.

This was a great paper because it was published by MapAction which is a GIS entity focused on humanitarian aid and action. In this paper the author stresses that humanitarian emergencies need fast, efficient response and GIS is the tool to provide it. The speed and effectiveness of response can be directly correlated with how many lives are saved or spared in the wake of a humanitarian disaster. This paper also notes that GIS is crucial not only in post-disaster situations but in preparing for disasters through risk assessment. The author notes that free open source software and the expansion of Google Earth since its launch in 2005 have been invaluable to humanitarian aid because of the lack of funding in these situations. The paper goes on to describe spatial data in humanitarian mapping needs to include the where (a village that needs assessment), a safe route to deliver supplies (that can be plotted), and an area with statistics (what are the boundaries). This paper also goes on in great detail about vector, raster, and other forms of data. It also goes over everything we learn in lab so it is a great paper for anyone unfamiliar with GIS who needs to get a quick background or refresher.

Murni, SU, HB Syahrul, and A. Aflah. *A*. Tech. Risk Mapping of Malnutrition Distribution Using Remote Sensing and Geoinformation System (GIS) in Tumpat, North Kelantan, Malaysia. Malaysian Center for Remote Sensing, 2005.

This is a very technical paper that uses remote sensing as well as GIS to uncover the relationship between environmental factors and malnutrition in a region of Malaysia. The area studied, Tumpat, has the highest occurrence of malnutrition in Malaysia and the researchers wanted to determine why this was the case. They used satellite data, health surveys, and GIS data to create a data set. Using a buffer tool they found that locations of government health centers do not contribute to malnutrition cases and in fact most areas with malnutrition were in the areas with health centers. They then used a weighted overlay function to see if there were topology or other environmental factors that are contributing to malnutrition. The researchers believe that for a better result there needs to be more descriptive health information of inhabitants (cholera, malaria, etc) to create a better risk map for malnutrition.

Umali, Cesario G., and Angelito B. Exconde. *Problems Using Remote Sensing and GIS in the Philippines*. Rep. no. 0261-B1.

This paper was a good divergence from the rest of the papers I have read in regards to this research. This author focused on the shortcomings of using GIS in humanitarian aid situations instead of just how it is positively contributes. This is important because there are several important improvements that need to be made in the field to truly make great strides in improving the aid situation. The author notes that the Philippines face such extreme poverty that when funds do come into the country they go to poverty alleviating causes rather than to further GIS or RS technologies. The paper also makes an important point that in developing countries the political situation is frequently unstable and therefore positions of authority can experience frequent turnover. This negatively affects the ability to have successful interagency collaboration in the attempt to share GIS data. Lastly, the author says that in the universities GIS and RS are not strong courses and are often underfunded and poorly attended.