

Chapter 21

Volunteered Geographic Information for Disaster Management

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ABSTRACT

The amount of information generated and provided by citizens via the World Wide Web is constantly growing. Citizens share information, thoughts, and experiences in blogs and contribute information to web-based content sharing platforms, collaboratively created data bases that are freely usable by everybody. Disaster management as one component of urban planning to decrease a society's vulnerability can benefit from information provided by citizens. This chapter gives an overview of the application of information provided by citizens in disaster management. It points out the potential of using such information for the various phases of disaster management. Three main challenges, which affect the usefulness of information supplied by citizens, are presented in more detail: data collection, localization and quality assessment. For each of these challenges, various approaches to address them are discussed.

INTRODUCTION

Internet technology supports citizens not only to access but also to provide information. Information created by citizens, is generally called user-generated content, or - more specifically - volunteered geographic information (VGI) if it is geographic in nature (Goodchild, 2007; Gouveia et

al., 2004). Volunteered geographic information is provided by different media: text, images or video. VGI can be regarded as an extension of public participation geographic information systems (PPGIS) which intend to empower communities by improved information access and participation (Ghose, 2001; Sieber, 2006). In contrast to PPGIS, which facilitates citizens' participation, the VGI approach is predominately self-organized. Extensive research in citizen science and PPGIS

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has proved the usefulness of involving the public in environmental monitoring (e.g. Fore et al., 2001; Engel & Voshell, 2002) and spatial planning (e.g. Weiner & Harris, 2003; Sultana et al., 2008). Recent examples have also shown the usefulness of VGI for disaster management (Goodchild & Glennon, 2010; De Longueville et al., 2010). In order to make VGI a valuable additional information source for disaster management as one component of urban planning to decrease a society's vulnerability its potential has to be examined systematically, and challenges and solutions have to be identified. This chapter gives an overview about the application of VGI in disaster management and presents existing approaches to tackle important challenges related to VGI.

APPLICATION OF VGI IN DISASTER MANAGEMENT

Potential and Challenges of Volunteered Information for Disaster Management

Natural disaster management encompasses all activities before, during and after a hazard event that aim at preventing natural disasters, reducing their impact and recovering from their losses. The disaster management process can be regarded as cycle consisting of four phases: mitigation, preparedness, response and recovery.

Disaster mitigation focuses on reducing or eliminating risk. It includes risk identification, analysis, and appraisal, as well as risk reduction. Preparedness deals with planning how to respond to hazardous events. Emergency planning, training, monitoring, forecasting, and early warning systems are proper means in this phase. In case of a disaster, response measures are necessary which maintain or re-establish public safety and provide the basic humanitarian needs of the affected population. Post-disaster recovery is the process of restoring the living conditions in the

affected areas. It includes damage assessment as well as rehabilitation and reconstruction.

The varying phases of disaster management require different kinds of information which can be volunteered by the public. In the phase of risk mitigation, information about natural hazards and vulnerability parameters are of great importance to assess an area's exposure to one or more kinds of hazards. In areas where few long-term records exist, the local population's knowledge about location and extent, frequency and intensity of past natural disasters can be of high value. Mitigation also includes an open discussion of acceptable risk and mitigation options, in which the public is an important stakeholder. The main contribution the public can make in these phases via VGI is to communicate their views and perceptions about acceptable and unacceptable risk, coping strategies, possible mitigation measures, and their prioritization.

In the preparedness phase, monitoring the drivers of disasters, the hazard itself as well as vulnerability parameters is of great importance. Accurate information about vulnerability parameters, such as type of buildings, land use, or condition of protection measures are a prerequisite for risk assessment and risk reduction. Vulnerability parameters are often subject to fast changes, especially in very dynamic areas such as big cities or regions of transformation. The local public can be involved in monitoring and reporting the changes of local vulnerability parameters. This approach already exists in the context of municipal projects where people can register all kinds of deficiencies (<http://www.mängelmelder.de/>). Mitigation and preparedness are predominately long-term phases that require continuous information about changes in vulnerability and protection measures.

In contrast to mitigation and preparedness, the response and, to some extent, the recovery phase requires highly dynamic data, describing the extent and intensity of the hazardous event as well as resulting impacts and the current status of response activities. Citizens can provide local,

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