# USING PARTICIPATORY MAPPING TO HARNESS LOCAL KNOWLEDGE AND INCREASE COMMUNITY CONNECTEDNESS IN BUSHFIRE PREPARATION

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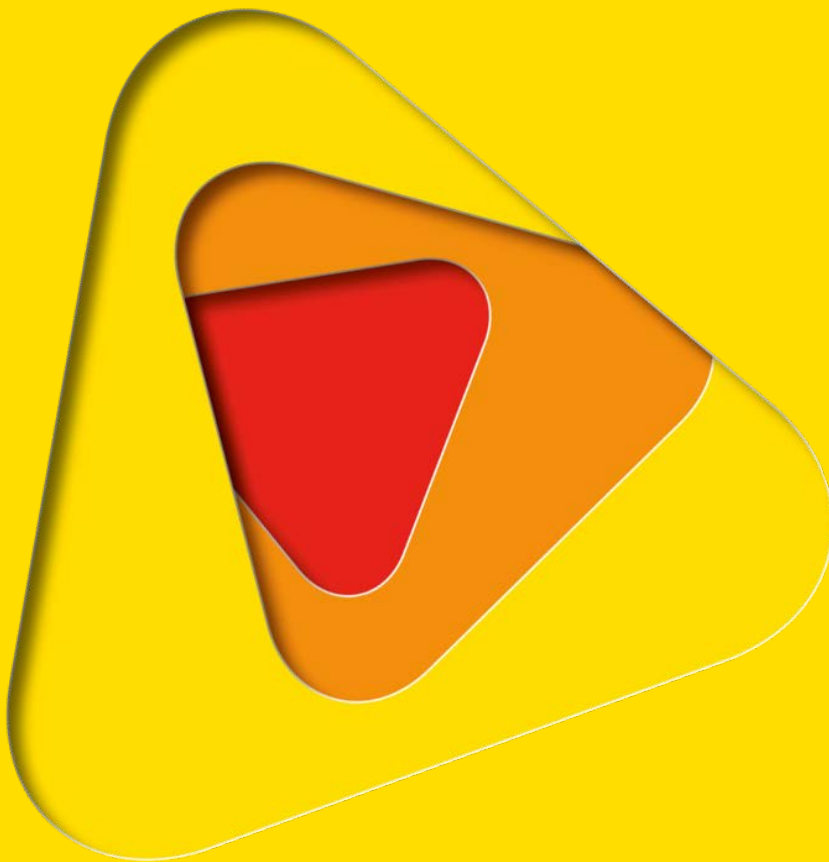
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ABSTRACT

The increased ease of individuals to create, share and map geographic information combined with the need for timely, relevant and diverse information has resulted in a new disaster management context. Volunteered geographic information (VGI), or geographic information created by private citizens enabled through technologies like social media and web-based mapping, has changed the ways people create and use information for crisis events. Literature in this field has focused on disaster response while largely ignoring prevention and preparedness. Preparing for disasters reduces the likelihood of negative impacts on life and property, but despite strategies to educate communities, preparation remains low and increased preparation engagement is required. This study assesses the application and value of VGI in bushfire risk reduction. It examines VGI as a social practice and not simply a data source by considering the user experience of contributing VGI and the potential for these social activities to increase community connectedness for building disaster resilience. Participatory mapping workshops were held in four bushfire-risk communities in Tasmania. Workshops included a paper-mapping activity and web-based digital mapping. Survey results from 31 participants confirm the process of mapping and contributing local information for bushfire preparation with other community members can contribute to increased social connectedness, understanding of local bushfire risk, and engagement in risk reduction. The social aspect of VGI was engaging for participants and contributed to improved community connectedness. The social quality appeared even more engaging than the specific information shared, and this should be considered in future disaster risk reduction initiatives. Participants reported collaborative maps as effective for collating and sharing community bushfire information with a preference for digital mapping over paper-based methods. Local knowledge and shared information were seen as valuable, but further work is needed to extrapolate findings from the study sample to the broader population.

EXTENDED ABSTRACT

Background

The increased ease that individuals have to create, share and map geographic information combined with the need for timely, relevant and diverse information for emergencies has resulted in a new disaster management context (1; 2; 3). Social media and web-based mapping platforms have changed the ways people create and use information for crisis events (4; 5). This includes basic use of sites like Facebook to share text, images and videos (6; 7) as well as more complex activities such as data mining or crowdmapping (8; 9) (3). Through rapid exchange of geographic information between authorities and citizens for disaster response, and promoting connectedness and community engagement in disaster preparation practices, VGI contributes to all phases of disaster management, including prevention, preparedness, response, and recovery (PPRR) (2).

The majority of academic work in this field has tended to focus on disaster response while largely ignoring prevention and preparedness (2). Preparing for disasters dramatically reduces the likelihood of negative impacts on life and property, but, despite the impacts of past events, education and strategies to provide communities with relevant information, active preparation remains low (10; 11). This study differs to others in that it focuses on assessing the application and value of VGI in bushfire risk reduction. A recent study did focus on the potential use of VGI in bushfire preparation by considering technology uptake, community interest, and limitations to use (12). But the study was limited in that it did not address how VGI might be effectively utilised in bushfire preparation. Other studies have also tended to focus on VGI-enabling technologies and VGI data. This study considers VGI as a social practice and not simply a data source in disaster management. It examines the user experience of contributing VGI and the potential to increase community connectedness by working together in building disaster resilience. It does this through participatory mapping.

Involving local communities is a prerequisite to sustainable disaster risk reduction (13). Gaillard and Maceda (13) note that community-based disaster risk reduction fosters participation by involving communities in the identification of risk (including hazards, vulnerabilities, and capacities) and ways to reduce it. Although official and traditional information is critical, such participation can provide more up-to-date and useful risk information (14). One approach to involving communities in risk reduction is through participatory mapping, or public participation geographic information systems (PPGIS).

PPGIS methods incorporate end users, research subjects, and researchers into a collaborative environment (15), with an intended result being increased empowerment for communities involved (16). For reducing disaster risk, participatory mapping enables communities to delineate areas they perceive as vulnerable and prone to hazards, and to plot desired and useful risk reduction measures (13). Jing, Liu and Gang (15) describe a community-based system which allows local residents to report risk information for disaster mitigation which is both accessible to the community and useful for decision-makers. In the specific case of fire, public participation science research may lead to more effective bushfire management by increasing knowledge and prominence of bushfire issues in communities and providing opportunities for forest professionals to work with community members (17). Ferster and Coops (17) evaluated the quality of data collected via

participatory mapping by tasking a group of volunteers in a local community to contribute VGI on forest fuel loading using a smartphone application. Conclusions of the study suggest approaches using smartphones and participatory mapping show considerable promise and warrant further investigation and development (17).

Study aims

The overall aim of this paper is to explore the notion that the process of mapping and contributing local information for bushfire preparation with other community members can contribute to increasing an individual's awareness and understanding of local bushfire risk, social connectedness, and engagement in risk reduction. More specifically, we ask:

1) Does the social practice of contributing and reviewing VGI increase engagement in bushfire preparation?

2) Does the activity of mapping together increase community connectedness?

3) Is the local knowledge and understanding gained from the mapping valuable to communities?

4) Is the map itself an effective medium for collating and sharing community bushfire information?

Methods

Workshops on participatory mapping for community bushfire preparation were held in four communities at bushfire risk in Tasmania: Kettering, St Marys, St Helens, and Tolmans Hill.

In Tasmania, bushfires are the most economically disastrous of all natural hazards and the impacts on communities are long-lasting (18). The 2015–16 Tasmania bushfire season exhibited above-normal risk conditions as a result of recent warm years and low rainfall (19). Thus Tasmania is ideal for studies concerning community bushfire safety.

Workshop participants were recruited in various ways, which included engaging known local contacts and community fire groups, sending invitations to local businesses, community organisations and other local services, local council advertising, residential mail-outs, letterbox flyer drops, sharing on social media sites and other relevant websites, and targeted promotion on Facebook.

Workshops included a paper mapping activity and a digital mapping activity before participants completed an evaluation questionnaire to capture their views on the experience of mapping, mapping methods, the value of local knowledge in bushfire preparation, and VGI and community connectedness. Paper mapping saw participants in groups of two to five marking-up paper maps and satellite images with any information they felt relevant to bushfire preparation in their community. The second activity involved collating the information from each group into a combined web map (though its GIS functionality is limited, the Zeemaps platform was used for its simplicity and accessibility). Participants were given a URL to the map and asked to contribute on laptop computers, smartphones and tablets live in the workshop.

Results

In total 31 people participated in the study workshops and completed a questionnaire. An even distribution of male and female participants attended. The age distribution of participants was skewed towards those over 35.

Workshop observations

During the workshops, researchers observed the participants' interactions with each other and with the activities. Participants appeared interested and motivated to learn and contribute to bushfire preparation in their community. In particular, the paper mapping activity yielded a high level of participant interaction. Some described working with others, the discussions had between community members, and the increased community connections generated through the mapping activities as the most valuable aspects of the workshop.

Main workshop discussion points included what content to map (content focused on services and community assets, potential hazards, areas of increased risk, neighbourhood bushfire groups, 'safer' places and potential evacuation routes), differences between mapping methods, and how a VGI map may be useful and applied in their broader community outside of the workshop setting. Participants described a preference for digital mapping, in contrast to the observations described above. Paper mapping was recognised as useful for community discussions and valuable for its low-tech simplicity for older people and those without internet or computer access. But participants also described difficulty in keeping a paper map up-to-date, sharing it with their broader community, and the challenge of getting the information 'out' of the paper map so it can be used in other ways, e.g. for the fire service.

Participants discussed the portability and currency of a web map. They discussed how online mapping would be useful for vulnerable groups such as travellers, people new to the area, and those who speak languages other than English. The web map was seen as better for examining finer detail information at 'micro' scales (e.g. who has a chainsaw on their street), sharing the map more widely and easily, maintaining information relevance, the convenience of contributing, the ability to include more detailed comments and photos, and the potential for greater data use (e.g. GIS analyses). Despite concerns such as power outages and computer access, map ownership and administration, privacy, and the risk of malicious intent, overall discussions on the potential use of web mapping and VGI for community bushfire preparation were positive.

Questionnaire responses

Broadly, participants described the experience of mapping their own information for their local community as positive. 97 per cent of respondents said the activities were useful for their bushfire preparation, 97 per cent thought maps were an effective way to present and share their information, and 76 per cent learnt something new about bushfire preparation in their community through mapping VGI. Further, undertaking the activities with other community members was seen as highly positive, with all participants reporting working with others was a positive experience, and 93 per cent confirming working with others helped them understand the broader bushfire risk and preparation activities in their wider community.

Some points raised by participants to consider in sharing information to a public community map included the accuracy of information and how it can be verified, privacy and awareness of who can access and use the information, and security

concerns. Despite these concerns, 86 per cent of participants stated they would contribute to community maps like those used in the workshop in the future.

Participants were asked to comment on the differences between the paper mapping method for sharing community VGI and the digital mapping. They described an array of benefits and limitations of both. Strong preferences for digital mapping over paper for individual use and broader community application were reported.

Participants also described favourably the mapped-information itself. 83 per cent of participants felt the information was personally relevant and 73 per cent felt it increased their understanding of community bushfire preparation. 93 per cent believed VGI increased their awareness of other community members and their preparedness, and all participants reported the information would be useful to other members of their community. 93 per cent felt VGI would be useful to emergency management authorities.

Brief discussion

Results of the participatory mapping workshops provide strong evidence for the application and value of VGI in community bushfire preparation. The process of mapping and contributing local information for bushfire preparation with other community members can contribute to increased social connectedness, understanding of local bushfire risk, and individual engagement in risk reduction, but with considerations for implementation, such as map ownership and security.

The social practice of contributing VGI was engaging for participants. There was an understanding from participants that different people had different knowledge to contribute and also that bushfire is something that can potentially affect all members of the community and managing it should be a shared experience. The social quality of VGI appeared even more engaging than the specific information mapped and shared, and this should be considered in future efforts to engage communities in disaster risk reduction.

Further, the act of mapping together was revealed to increase community connectedness. Community connectedness and social capital (social networks and community norms; see 20) are important elements of disaster resilience in addition to the value they add in terms of social engagement in preparation activities. However, longitudinal studies are required to determine if participatory mapping and VGI enable ongoing community connectedness. Our study involved once-occurring workshops and we cannot comment on long-term outcomes.

The local knowledge shared and the information mapped was also of value to participants. A significant majority reported the VGI was personally relevant information and that it helped with their understanding of community bushfire preparation. A particularly meaningful finding was the 93 per cent who reported VGI increased their awareness of other community members and their preparedness. If bushfire resilience and disaster risk reduction is a shared experience and a shared responsibility, it is important that those involved have a common understanding of the risk, responsibilities and actions of those they share with, and thus the contribution of VGI reported here is significant. Given the limited and skewed sample size it is not possible to extrapolate findings to the broader population. The information mapped in the workshops may have been highly useful to those present, but the same information may or may not be useful to the groups of people not

represented in the study sample, for example people under 35, people experiencing greater levels of social disadvantage, or visitors to the area.

However, community mapping was perceived as potentially being effective for capturing knowledge from the broader population and the map itself viewed as an effective medium for collating and sharing community bushfire information, especially in digital form. Given the study sample age bias towards older people, the engagement with the technological solution over offline methods is an encouraging result. The preferences for digital mapping and web technologies expressed in this study by a demographic not commonly associated with those technologies highlights the value and potential seen by participants for VGI to increase bushfire preparation on a broader community scale beyond individual concerns such as computer illiteracy. In addition, some initially hesitant to use the technology saw benefit after trying it themselves, which further illustrates the engaging nature of VGI and digital mapping in bushfire management.

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