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Engaging global youth in participatory spatial data creation for the UN sustainable development goals: The case of open mapping for malaria prevention

Patricia Solís[a,*], Brent McCusker[b], Nwasinachi Menkiti[c], Nuala Cowan[d], Chad Blevins[e]

[a] Center for Geospatial Technology, Department of Geosciences, Texas Tech University and Knowledge Exchange for Resilience, Arizona State University, Tempe, AZ 85287, USA
[b] Department of Geology and Geography, West Virginia University, Morgantown, WV 26506, USA
[c] Texas Tech University, Lubbock, TX 79409, USA
[d] Department of Geography, George Washington University, and Open Data for Resilience Initiative, Global Facility for Disaster Reduction and Recovery, World Bank, Washington, DC 20433, USA
[e] GeoCenter, United States Agency for International Development, Washington, DC 20004, USA

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ABSTRACT

Practitioners bemoan lack of data as one of the biggest obstacles to progress towards global sustainable development goals. This paper explores a scaled-up participatory method developed by YouthMappers, for creating missing geospatial data derived from remotely sensed imagery in order to contribute to persistent data needs in the context of the United Nations Sustainable Development Goals (SDGs). We explore the application of this method to a case related to SDG 3 on Health. We document how our approach centered on creating a global academic network designed to engage and empower university students and their faculty mentors to participate in broader efforts to create open, free spatial data on open platforms to inform humanitarian and development objectives outlined by the funding agency, the United States Agency for International Development (USAID). This approach expressly links supply and demand for geospatial knowledge by connecting specific needs for geographic information to specific development objectives in targeted places where USAID works to end extreme poverty. We discuss the rationale and context for the methodology as it draws from and builds upon prominent literature of participatory GIS (PGIS) and volunteered geographic information (VGI). We demonstrate how the mapping of building and road infrastructure in Mozambique and Kenya was carried out in order to provide information for an insecticide spray campaign to prevent malaria and protect public health. Throughout these efforts, steps are taken to ensure spatial data quality and to offer opportunities for youth volunteer embeddedness in mapping tasks and themes in places where students otherwise would not engage with real world data or connect with peers from different countries. We reflect on the opportunities and challenges for how this scaled-up "remote participatory sensing" approach to spatial data creation can inform development projects in the context of the SDGs.

1. Introduction

Vast amounts of new geospatial data are created and shared daily through online open platforms by volunteer, humanitarian or crisis mapping actors around the world. Typically, these data are created ad-hoc or for immediate use in response to urgent crises or extreme events. Such information contains geographic features and attributes that are critical to building resilient communities and infrastructure over the long term. Meanwhile, advances in research on resilience and vulnerability are hampered by access to reliable data (Barrett & Headey, 2014) and practitioners often bemoan lack of data as one of the biggest obstacles to progress towards development goals (United Nations Independent Expert Advisory Group, 2014; Stuart, Samman, Avis, & Berliner, 2015, p. 51). This situation presents an opportunity to apply open, online, crowd-engaging geospatial tools in relation to producing missing data that can explicitly address locally relevant longer-term development needs. In addition, these data-generating processes may also support research needs in the context of regions and countries challenged by chronic environmental and economic vulnerability.

Indeed the potential for participatory GIS (PGIS) and volunteered

* Corresponding author.
E-mail address: patricia.solis@asu.edu (P. Solís).

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geographic information (VGI) to inform development goals such as the United Nations Sustainable Development Goals (SDGs) may be something that geospatial practitioners are increasingly aware of, yet represents a novelty within the development community at large. In this article, we document our experience with the creation of an academic network designed to engage and empower students and their faculty mentors, especially in developing regions, to participate in broader efforts to create open, free spatial data on open platforms for humanitarian and development efforts in ways that directly contribute to sustainable development objectives outlined by the funding agency, the United States Agency for International Development (USAID). For the first time, YouthMappers merges the capacity for data and knowledge production in the academic sector with the development and humanitarian actors responsible for implementing tactical interventions, focused on open spatial data creation and engaging students in majoritarian nations.

This research is situated in a long tradition of investigating people's participation in data creation with the goals of empowerment and engagement through geographic technologies (Harris & Weiner, 1998). Studies on Participatory GIS, as it became in the 1990s, focused on the democratization of geospatial technologies and inclusion of the people who were often simply regarded as the objects of study. With continuously expanding access and affordability of the internet in the early-to mid-2000s, people were able to generate data themselves, participate in far-flung communication, and create databases as a collective. Now commonly called "Volunteered Geographic Information", this movement overcame some of the earlier technical obstacles to participation in GIS, but also raised new thorny ethical and data quality issues (Haklay, 2013). Our research in this paper is informed by these debates, and extends them to understanding the purposeful work of scaled up collectives relates to addressing global development objectives.

We describe our methods for the participatory use of remotely sensed imagery to create geographic data that feeds directly into development interventions. In doing so, we consider how the participatory character of these methods relate to the UN's goals because the SDGs currently serve as the dominant development framework. The SDGs are often conceptualized in the context of national level policy-making and international aid discussions while simultaneously attempting to promote local stakeholder engagement. The cross-scalar nature of abstract SDGs justifies the need for a methodological, micro-scale participatory approach that is expressly linked to a particular SDG, yet can directly speak to the broader global framework in question.

In the next section, we explore the potential of PGIS and VGI to inform development framed under the UN's Sustainable Development Goals (SDGs) and we ground this work in the relevant literature. The next section discusses the overall approach of creating a global youth program focused on the fusion of technology and international development. As one example of how this network functions, we introduce a case study of applied mapping related to malaria prevention in East Africa, framed by SDG 3 on Health, to illustrate the results of the data production effort in our first year. We conclude with a reflection on our methodology, suggesting a number of lessons and recommendations for future applications as well as future research on participatory spatial data creation.

1.1. Positioning participatory geographic technologies in the academic literature

Open geospatial technologies, and internet mapping in particular, play a role in enabling digital humanitarianism and represent a novel medium for citizen participation in a digital era (Meier, 2015). This field draws upon a long tradition in geography and related disciplines that integrates public participation with geographic information systems (GIS). This work originated in the early 1990s and coalesced around a few key events, for instance, the National Center for Geographic Information Analysis (NCGIA) Initiative 19 meeting in Friday Harbor, Washington in November 1993. A small group of scholars met to respond to growing critiques of the use of GIS, and to map out a more participatory future (Harris & Weiner, 1998). Obermeyer (1998, p. 65) traced the phrase "public participation GIS" to a workshop organized by planners, but cites the NCGIA meeting as the "first formal gathering of scholars to discuss the topic." Brown and Donovan (2014) and Brown, Kelly, and Whitall (2014) further elaborated the concept of PGIS that emerged from NCGIA as a field that necessarily fosters the empowerment of non-governmental organizations, grassroots groups and local communities. The idea of participation leading to empowerment has been advanced by Ardissono, Lucenteforte, Savoca, and Voghera (2014, p. 3) whereby "participatory processes are related to empowerment [because] they are based on a bottom-up decision-making model."

As far back as a decade ago, Dunn (2007, p. 2) characterized the empowering nature of PGIS with respect to the "control and ownership of geographical information, representing local and indigenous spatial knowledge, the democratization of GIS and sustainability." Mukherjee (2015) emphasized marginality and equity while Chingombe, PedzisaiManatsa, Mukwada, and Taru (2015) emphasized local knowledge integration. Other scholars posited a strand of research under the banner of critical GIScience, which initiated a focus "on the social implications of and social biases inherent in the science, technology, and their deployments" of Geographic Information Science fields (Schuurman, 2017). Critical Cartography researchers, along with feminist GIS scholars, continue to actively challenge the limitations of geospatial technology and its multiple uses, and continue to question and redefine its relationship to empowerment.

When geospatial technologies went online through the introduction of open mapping on the web, the nature of access to these tools changed dramatically (Elwood, Goodchild, & Sui, 2010), representing "a paradigmatic shift in how geographic information is created and shared and by whom, as well as its content and characteristics," including, we assert, a concomitant shift in how to understand its potential to engage volunteer mappers. Calafiore, Borges, Moura and Boella (2016, p. 3) recognized VGI as "systems [that] allow collection of data produced by the engagement of large numbers of private citizens without any pre-required Geographic Information Systems," enabling participation of non experts in ways that challenge how knowledge is created. In return, this new way of creating knowledge has been challenged by concerns regarding the quality, reliability, veracity, completeness, metadata, and bias of VGI (Heipke, 2010; Jackson et al., 2013; Elwood, Goodchild, & Sui, 2013; Flanagin & Metzger, 2008; Neis & Zipf, 2012; Goodchild & Li, 2012). As a result of this tension, the subsequent body of scholarship unfortunately tends to construct "the spatial data production activities of states in opposition to bottom-up, amateur, asserted" mapping (Cinnamon, 2015). For efforts like the SDGs that seek to bridge local change and global indicators, this juxtaposition is problematic.

Alternatively, we respond to Cinnamon's call to more accurately depict what is "in actuality a vast, shifting, and heterogeneous landscape of spatial data production approaches." Recent literature has begun to demonstrate the complex and nuanced ways that VGI is produced during natural hazard events (Burns, 2018; Haworth, 2018). Our work seeks to develop and improve a conceptualization of Cinnamon's (2015) "continuum [that] could encourage the development of hybridities that harness the benefits of different approaches—including the oversight and quality control of conventional methods, with the speed, low cost, and distributed nature of citizen-based spatial data production." We are doing this through the design and implementation of a method of collaborative action in the applied domain that operates at a global scale: YouthMappers' participatory spatial data creation. This is an important stance if the public in general, and youth in particular, can become important actors and partners to their governments in meeting the SDGs, especially in developing regions of the world.