Ecologies of Harm: Mapping Contexts of Vulnerability in the Time of COVID-19

Background

We, Maya Daurio and Stephen Chignell, are doctoral students in Anthropology and the Institute for Resources, Environment, and Sustainability, respectively. We both have significant graduate-level training in Geographic Information Science and regularly use Esri software in our research and professional lives.

We are part of a research collaboration with Dr. Leslie Robertson, Associate Professor in the Department of Anthropology, which emerged in response to the pandemic in March 2020, to collect spatial narratives of harm related to exacerbated vulnerabilities exposed by COVID-19. We used Esri's ArcGIS Web AppBuilder and Survey123 to create an interactive online interface for mapping and analyzing narrative information submitted by witnesses across the world.

Introduction

Many are by now familiar with the John Hopkins [COVID-19 Dashboard](#), a powerful visual illustration of COVID-19 cases and deaths across the globe. This dashboard is typical of how most of us interact with information about COVID-19, through quantitative representations of harm. While critically important, consistent exposure to such statistics can create what researcher Paul Slovic calls "psychic numbing", an emotional disconnect that impacts our actions and decision making (see NPR's "[Why 500,000 COVID-19 Deaths May Not Feel Any Different](#)").

Our project, *[Ecologies of Harm: Mapping Contexts of Vulnerability in the Time of COVID-19](#)*, acts as a complement to statistical renderings of COVID-19, encouraging us to reflect on the lives beneath the numbers. In line with principles of counter-mapping, our research illustrates how harms caused by the pandemic intersect with other injustices and with specific geographies to exacerbate vulnerabilities of marginalized populations.

Drawing on survey responses submitted by community-based researchers or local witnesses, *Ecologies of Harm* is creating a collaborative spatial archive to document locally defined conditions of vulnerability in order to generate opportunities for knowledge-sharing, dialogues, and solutions-based engagements.

Project Design

There are two ways for researchers/witnesses or the public to interact with the Esri products we used in the creation of this project. Researchers/witnesses may submit information through a browser-based survey of nineteen questions. Any member of the public may view these responses in a map which opens to a bird's eye view of every continent, dotted with points representing survey responses.

To start, using Survey123 Connect, we created a highly customized survey comprising questions eliciting text responses, multiple choice selections, and a map of the world where respondents could plot their location. Survey123 creates a hosted feature layer of the survey responses in ArcGIS Online, and the location information is used to plot point locations of survey responses on a global map. When a new survey is submitted, the map is automatically updated. Because we are interested in how the pandemic changes in relation to time and space, we enabled time settings on the hosted feature layer in order to view these submissions over time.

Using the Arcade language to create our own expressions, we configured customized pop-ups for the survey responses in a web map in ArcGIS Online. Some of the pop-ups contain images or links to websites. We used this web map to create a web application using the Web AppBuilder.

Although our research project collects primarily qualitative data, we were able to configure a number of widgets to allow map users to interact with the survey responses in multiple ways. In addition to standard navigation widgets enabling the user to change the extent, zoom in and out, and go to the user's location, we also added widgets with more functionality. For example, the user is able to turn layers on and off, change the basemap, add data to the map, download survey responses, print, and measure distances and areas.

Widgets

The Query widget enables users to filter, select, and download features which intersect with a user-defined shape on the map. Users can also view summaries of survey results via a link, which include word clouds, column charts, and photos submitted by respondents.

One of the most powerful widgets is the Filter widget, which we configured to enable users to filter data by twelve overlapping harms exacerbated by the pandemic, such as *armed conflict*, *loss of subsistence*, and *gender violence*. These can be summarized using the Chart widget, which generates pie and graph charts of overlapping harms across all, or a selection of, the locations on the map. The Time Slider widget interactively shows a chronology of survey submissions from April 2020 to the present. The Information Summary widget offers a way for the user to view the main narrative summarizing harms, with the ability to click on the text to generate a pop-up for that entry at the corresponding location on the map.

We also included the Share widget to provide an easy way for the map user to generate a short URL to share the Web App with others and an HTML iframe tag to embed the Web App on a website.

Insights

With contributions from fourteen countries and six continents, this project has mobilized knowledge about vulnerabilities ranging from lack of access to adequate housing and sanitation among residents of Vancouver's Downtown Eastside, to overcrowding and lack of mobility among refugees in a camp in Chios, Greece. The narratives collected also highlight positive solidarities which have formed during the pandemic, such as the creation of local fishing cooperatives in the Andaman and Nicobar Islands.

Our Web App provides a level of analysis across all survey entries. For example, the Chart widget reveals that the greatest markers of intersecting harms due to the pandemic are stigmatization and loss of subsistence. The Filter widget shows that armed conflict is reported as an overlapping harm in five different locations spanning four continents, while gender violence is pervasive across all continents.

Esri's suite of tools, from Survey123 to the customizable functions within web maps and Web AppBuilder, are typically used for collecting and analyzing highly structured, quantitative geographic data. We effectively adapted these tools to compile and visualize qualitative data about the complexities of intersecting inequities exposed and made worse by the ongoing COVID-19 crisis. ArcGIS Online provided a collaborative platform for multiple people within our network of field-based partners to work on different products at the same time, and we were able to take advantage of sophisticated tools like Arcade expressions and the various functionalities with Web AppBuilder to facilitate the sharing and analysis of important and timely narrative-based information.

Graphics

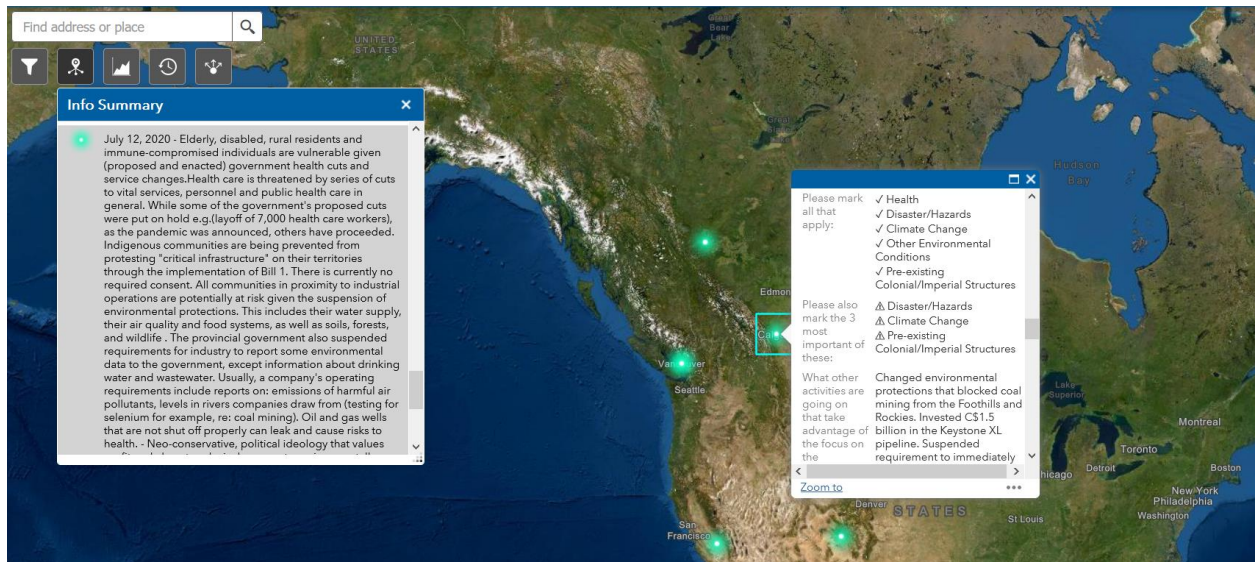**Figure 1.** Filtering the data by overlapping harms.

Figure 2. Exploring narrative information from Calgary using the Info Summary widget and pop-up.
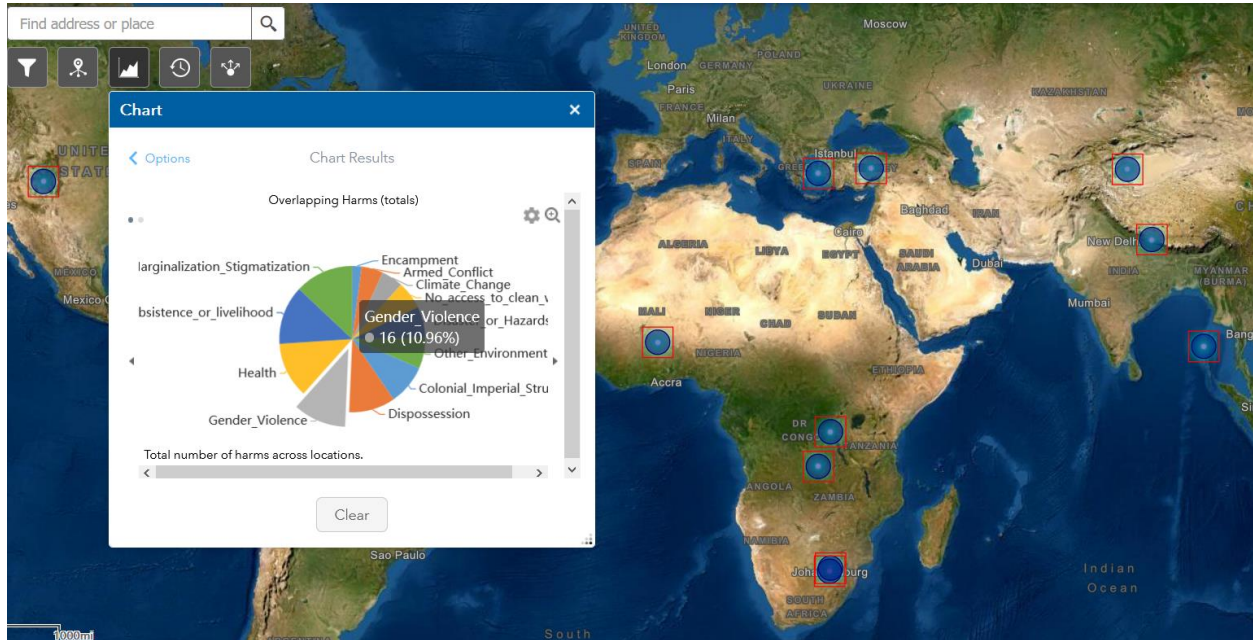
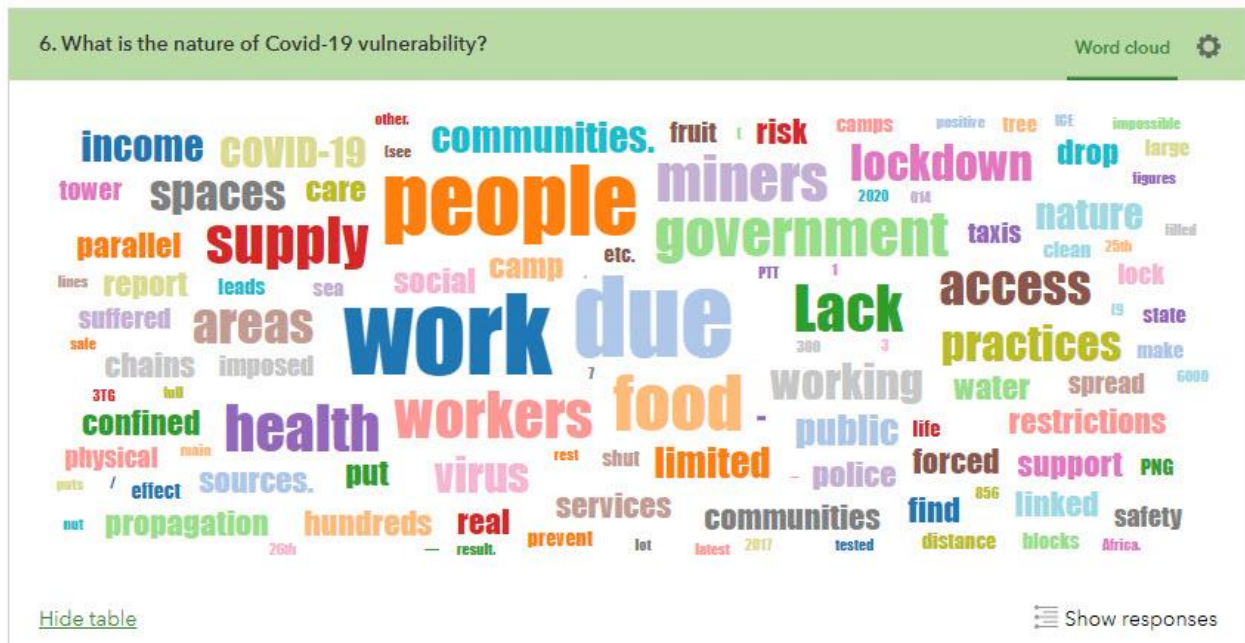**Figure 3.** Summarizing overlapping harms using the Chart widget.

Figure 4. Example word cloud created from survey responses, available to users via link in the Web App.