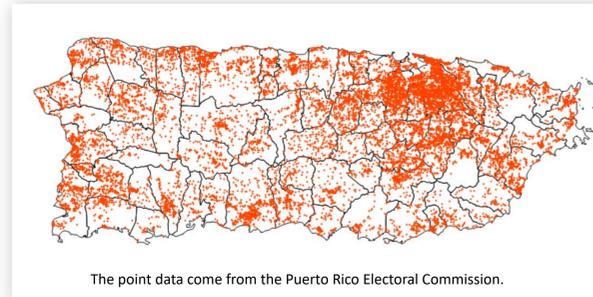


Multiple Criteria Evaluation to Identify Communities at Risk in Puerto Rico

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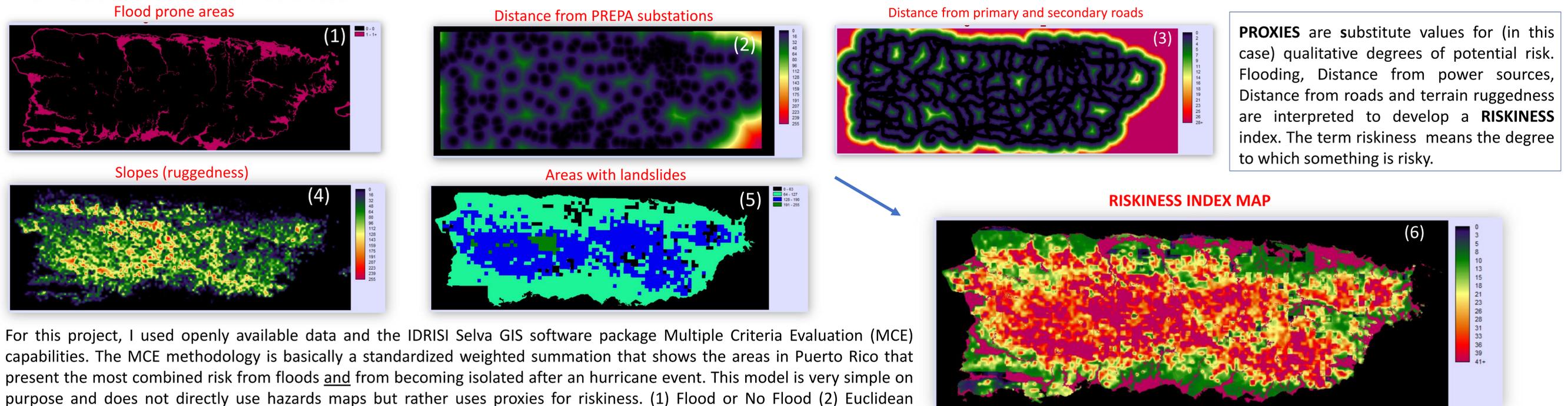
This is a showcase (demo) project of the use of Geographic Information Systems to quickly identify the most at risk communities in Puerto Rico. I use proxy geographic information to represent a qualitative notion of risk. The potential end products are multiple and useful for setting planning priorities and directions for long term recovery projects.

DESCRIPTION



There are over 15,000 points representing individual communities in this map. How would you evaluate each one for its riskiness? Currently the most efficient way to do this is using GIS. There are several, very sophisticated ways to do this such as running FEMA-HAZUS or other modeling environments that require large amounts of specialized and expensive data. We are certainly not intending to compete with these methodologies that have very specific uses. The purpose here is to develop a general idea of about where in Puerto Rico it is necessary to focus initial planning, reconstruction and recovery efforts given a short period of time and lack of available data. The term **“riskiness”** is used in a non academic colloquial form. From our experience, asking municipalities “What communities in your municipality are most at risk, from any hazard?” prompts all kinds of answers that are linked to local knowledge and are perfectly manageable by the local decision makers and emergency managers. The outputs of this exercise are useful only to start a conversation about risk and local communities and are not designed to fashion external technical solutions to local problems nor to diagnose more technical hazard specific related recommendations.

METHODS & PROXIES FOR RISKINESS



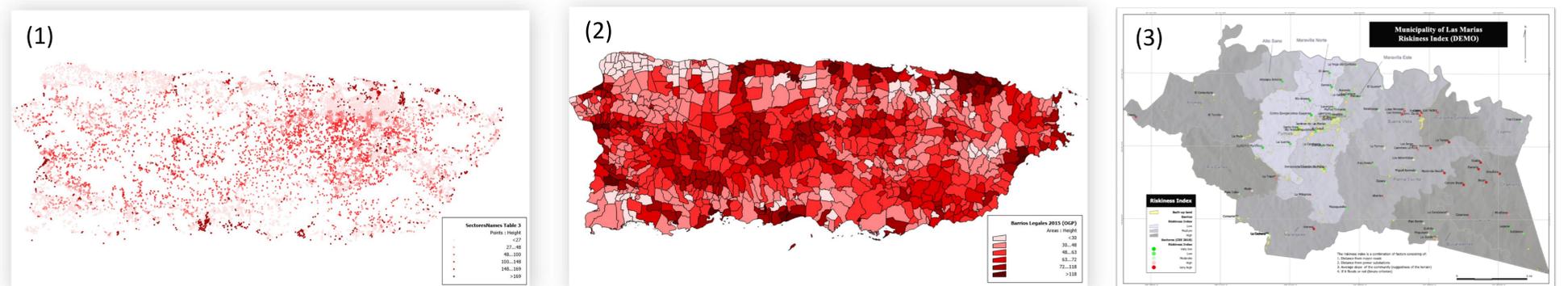
For this project, I used openly available data and the IDRISI Selva GIS software package Multiple Criteria Evaluation (MCE) capabilities. The MCE methodology is basically a standardized weighted summation that shows the areas in Puerto Rico that present the most combined risk from floods and from becoming isolated after an hurricane event. This model is very simple on purpose and does not directly use hazards maps but rather uses proxies for riskiness. (1) Flood or No Flood (2) Euclidean distance from PREPA power substations (3) Euclidian distance from Primary and Secondary Roads (4) Slopes (5) Landslides from Maria. Each raster map is standardized to values 1-256 weighted equally and summed to produce a “RISKINESS INDEX MAP” See Map (6) Looking at the map, it should be clear that flood zones and mountainous areas in Puerto Rico are most at risk, which is obvious. What the product also allows for, is to select or extract those areas in Puerto Rico that are at most risk based on other criteria. For example: Excluding flood prone areas, what locations are most at risk from becoming isolated in the island? Or within a particular municipality; what areas are most at risk from becoming too isolated after an event?

It is important to stress that there are other methodologies designed to address specific hazards and particular planning needs. This particular effort is aimed at presenting a first view at general risk issues and to aid in the development of regional planning priorities that would need to be validated with local knowledge.

Sources: US Geological Survey, PREPA (OPG DATA), Puerto Rico Electoral Commission

POTENTIAL PRODUCTS

There are a variety of potential products that can be developed from this process (1) a list of communities with riskiness indices that could be used for planning purposes (2) a map that show the barrios that are most at risk (3) an individual municipality map that presents various levels of risk at different geographic scales. These ideal products can be combined with other datasets to create more substantial and meaningful recovery strategies.



CAVEAT EMPTOR

The showcase methodology and products are presented as a methodological exercise and have not been validated in the field. In practice the weights applied to each proxy layer should be discussed with experts or community members to create a more “realistic” output. The proxy GIS layers in this exercise come from various sources and for the most part did not have proper metadata. This presents the challenge which is very common about whether to use the data or to discard them.

Acknowledgments: I prepared this showcase demo in my own time with my own resources. Even though I work for FEMA it must be clear that this is NOT a FEMA product nor does it represent the views, opinions or position of FEMA. Should you have any questions please contact me at my personal email Antonio.gonzo@gmail.com I would like to thank my wife Dr Tania Lopez for the encouragement and my kids Diego and Camilo for allowing me to use their computer.