

## Mapping Disaster Risk Reduction (MapDRR)

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### Abstract

Significant number of disaster risk reduction projects is implemented around the world. Each of these projects can provide guidelines for future projects and can be adopted by other communities if their information is properly shared. These projects can also become a good source of knowledge for teaching and training of future disaster risk reduction professionals. This paper describes a disaster risk reduction mapping project called MapDRR that aims to use Google Fusion Table and Google Map to map disaster risk reduction projects around the world. This system uses advances in cloud database management systems (Google Fusion Table) and Crowd Mapping (Google Map) to add more values to the existing online information about the Disaster Risk Reduction Projects. The paper describes the first phase of this project that currently includes more than 650 disaster risk reduction projects. These projects have been carried out in many different countries to reduce the risk of various natural, technological, and human made disasters. MapDRR not only enables users to map the overall distribution of the disaster risk reduction projects, but also it helps them to get detail textual and visual information by zooming into google satellite and google street view of each project. In addition, MapDRR will allow the users to add new disaster risk reduction projects and provide comments about the existing recorded projects. MapDRR is an ongoing project that is being developed and enhanced continuously.

**Keywords:** *MapDRR, Disaster Risk Reduction; Fusion Table, Google Map Mashup; Hazard Mitigation*

## 1 Introduction

A large number of disaster risk reduction projects (DRRPs) are being undertaken by different governmental and non-governmental agencies around the world. Transfer of knowledge that are generated by these projects to other communities and generations is very important for DRR programs internationally (Cadag and Gaillard, 2012). Each of these projects is a unique symbol of disaster risk reduction knowledge and action and as such it can provide ideas and transfer knowledge to other agencies in other communities who are seeking to implement particular disaster risk reduction projects. In some cases valuable information about these DRRPs are available online, but it is very scattered and not easily accessible or identifiable. Currently there is not a dedicated online tool or system that can provide Disaster Risk Reduction (DRR) experts, practitioners, planners, researchers and students with an easy access to these projects.

Since most of the DRRPs are taking place in a particular location, they have a location or spatial attribute such as an address or latitude and longitude. This provides an opportunity to map these projects. Existence of easy to develop and easy to use cloud database and mapping systems combined with their interactive and participatory capabilities enables us to design and create DRRPs databases to better introduce these projects to interested individuals and organizations.

Efforts have been made to create databases and online portals of Disaster Risk Reductions. One example of such efforts is the Disaster Risk Reduction Project Portal for Asia and the Pacific ([www.drrprojects.net](http://www.drrprojects.net)) that has been developed by the ISDR Asia Partnership on Disaster Reduction (IAP) with the funding support of the Asian Development Bank (ADB) and executed by the Asian Disaster Preparedness Center (ADPC). This online system provides information on all DRR projects in Asia and the Pacific region in order to increase collaboration and cooperation on conceptualisation, planning and programming on DRR among different stakeholders. The DRR Project Portal provides users with customizable tables, graphs, and maps of DRR projects. Data is provided by registered organisations that have implement the DRR projects. The DRR Project Portal was developed using the Sahana Eden Open Source Disaster Management Platform (<http://sahanafoundation.org/>). This portal has been used in disaster risk reduction analysis (ISDR, 2011).

While portals like Disaster Risk Reduction Project Portal for Asia and the Pacific provide a good database with search, analysis, and mapping tools for the Asia and Pacific Region, the main goal of the MapDRR is to develop an alternative approach in mapping, visualising, and reporting DRR projects using the power of Google map and Google fusion table technologies. As such we cover those DRR projects that have spatial attributes (i.e. latitude and longitude). The key advantages of this approach are: 1) Based on Google Map, MapDRR provides more mapping contexts where users can zoom in and change map styles (satellite, terrain, and street view) and see where exactly the DRR projects are being implemented relative to the hazards; 2) Using google map API, spatial analysis tools can be added to the maps that will allow users to apply some basic mapping analysis; 3) Being in the cloud, there is no cost for these services; 4) the database can be easily shared and integrated in other applications.

This paper describes the first phase of this educational and research initiative that has been started at York University to map world's DRRPs. Mapping these projects and making them more accessible can be a useful source for DRR professionals who are trying to find such measures and apply them in their own contexts. It also enables students to learn about different types of hazard and risk mitigation measures and their management processes.

The rest of this paper is organized as follows: Section two explains the methodology, technology and research design used to carry out this research. Section three introduces some of the preliminary

outcomes of the project, followed by some discussions in section four. Section five concludes the paper with some recommendations.

## **2 Research design**

The following steps have been taken in developing the MapDRR.

1. Identifying DRRPs and data Collection
2. Developing the Online Database of DRRPs Using Google Fusion Table
3. Mapping DRRPs with Google Map

This section briefly explains each of the above steps.

### **2.1. Identifying DRRPs**

We used the internet as the main source to identify potential DRRPs. We applied a number of general (such as disaster risk reduction project, hazard mitigation project, etc.) and specific (flood disaster reduction project, earthquake risk reduction project, etc.) keywords to achieve this goal. Considering the resources and time that we had to spend on the first phase of this project, we identified more than 630 projects. Our goal was to have a diverse sample of different types of DRRPs for different countries in the first phase. We then identified a list of key attributes for the projects that need to be added as fields to the database. The following attributes were finally selected, considering the availability of information and their usefulness for the end users:

- Name of the Project
- Type of the DRR or Mitigation
- Hazard Category(s)
- Type of Hazard
- Country, Continent, City
- Short Description
- Reference/Website
- Image

“Name of the project“ represents the official name given to the project.” In most cases each project has its unique name. Examples include: Dust Storm mitigation Project; Gretna Flood control; Padiyapelella town Landslide Mitigation; Mexico’s Battle Against Desertification; and Anti-Hail Cannon. Using the project description and available information, “Type of the DRR or Mitigation” classifies the type of mitigation or risk reduction measures. Using the structural and nonstructural mitigation measures we have tried to classify the DRRPs using this attribute. This field is very important when users need to classify and query the DRRPs in terms of different types of structural and non-structural measures. “Hazard Category” identifies the projects in terms of overall hazard categories: natural; technological; and intentional/civic. “Type of the Hazard(s)” shows the type of hazard that the project has been targeting. In most cases DRRPs target single hazards, but when multiple hazards have been mentioned, the word “multi-hazard” has been used. A number of geographical fields (city/province, country, and continent) have been added to identify the overall location of the projects which will be useful for creating charts and thematic maps. This will enable the users to find and classify the DRRPs based on their geographic locations.

Since we were interested in mapping the exact location of the DRRPs projects, we needed to have either the latitude and longitude or the full address of the projects. A “Location” field has been added to the database that contains the latitude and longitude of each project separated by comma in one

field (for example: ‘29.295916, -94.804541’). Having the exact location of DRRPs enables us to map and visualize the exact location of the projects (by zooming in). This will provide the users with the opportunity to find out more local information about the projects. For example, some of the structural risk mitigation projects are visible in satellite or street views in google map. In such cases, users can see where and what has been done in that location.

“Short Description” is a text field that provides a summary of the project based on the information that could be found through online sources. A short description of the project is provided to the users when they click the project icon on the MapDRR page. The next field “Reference”, takes the users to the original source for the project information when available. Finally, an image field has been added to the database that stores and displays an image of the project if available.

## **2.2. Developing the Online Database of DRRPs Using Google Fusion Table**

MapDRR uses Google Fusion Table (GFT) as its database management system. We chose this for several reasons: First, introduced in 2009, GFT is a freely available cloud-based service for database management, visualization, and integration. MapDRR is not currently funded and thus GFT is probably the most feasible and powerful option. Second, GFT is designed for communities of users that need to collaborate on data management across multiple enterprises and organizations (Gonzalez et al., 2010). Since, MapDRR intends to engage the organizations from around the world to add and share their DRRPs and best practices to the database, GFT seems to be an ideal solution for it. Interested governmental and non-governmental agencies can collaborate in database development by inputting their data into the database. Third, GFT supports a number of data formats that most users are familiar with and most of the digital information are prepared using one of them. GFT can be easily generated through uploading files at <http://tables.googlelabs.com/>; CSV, XLS (X), KML, and Google spreadsheet data formats. Fourth, although GFT generated database is meant to be public, it can be protected by setting its visibility as Unlisted or Private with sign-in required. Fifth, fusion tables can be shared with others as collaborators (who may edit data), or owners (can invite others to view or collaborate). Finally, GFT has many data visualizations and web publishing options (Bradley et al., 2011), particularly with google map and google earth. Sixth, Fusion Tables are normally used in Google Maps when a large number of markers (data records) is used. We are anticipating that this database will become a large database over the time and thus a combination of google map and google fusion table seems to be very helpful. Finally, GFT can be exported as KML and viewed on Google Earth.

## **2.3. Mapping DRRPs with Google Map**

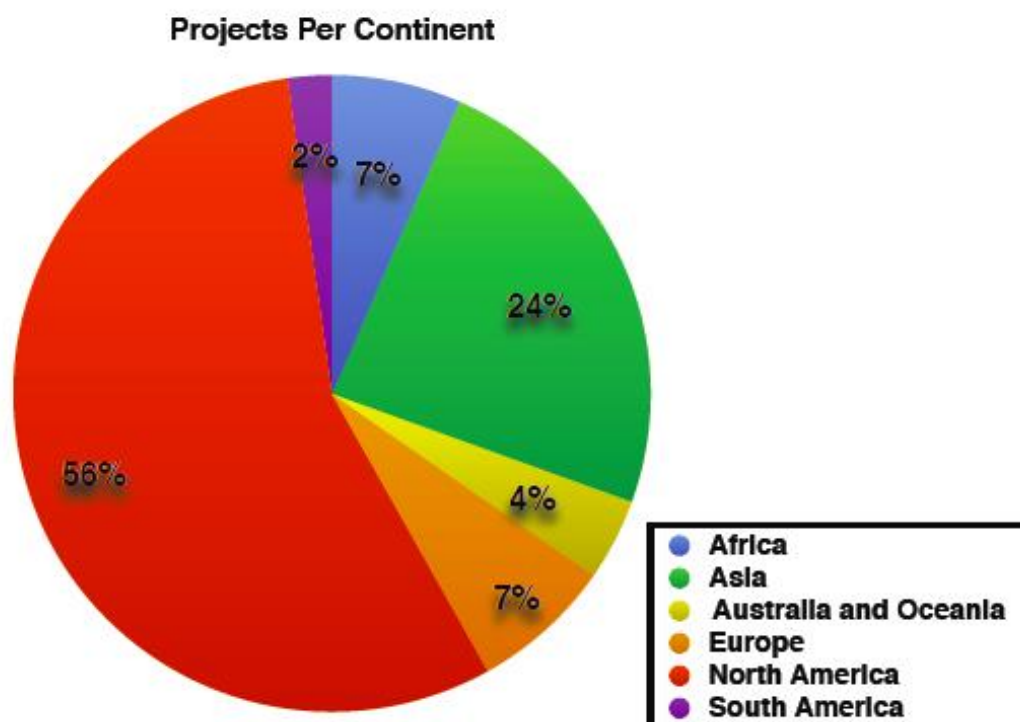
After developing the database in the GFT, we created a webpage that uploads the DRRPs from the MapDRR fusion table into a the google map. Currently the webpage can be accessed at: [www.yorku.ca/asgary/MapDRR.html](http://www.yorku.ca/asgary/MapDRR.html). In the near future it will be transferred to its own website. This website will remain as simple and at the same time as informative as possible.

# **3 Findings**

This section provides more detail information about the contents of the MapDRR database and the features and components of MapDRR webpage.

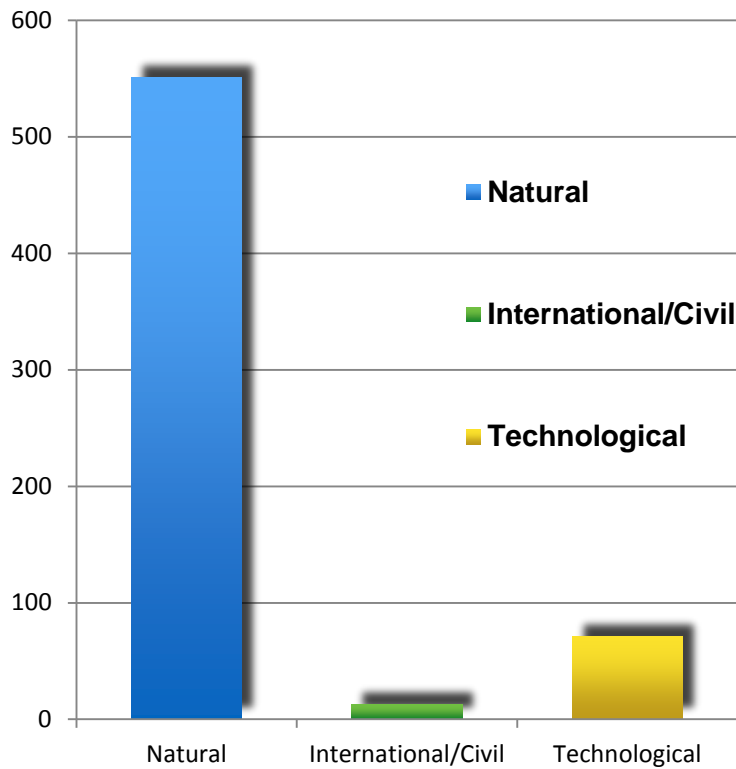
## **3.1. Disaster Risk Reduction Projects in the MapDRR Database**

Currently, the database includes about 650 DRRPs. Although more than half of the records are from the North America (56%), there are considerable numbers of projects from other continents in the database and we are aiming to increase this number in the future. Graph 1 shows the current distribution of DRRPs in the MapDRR database.

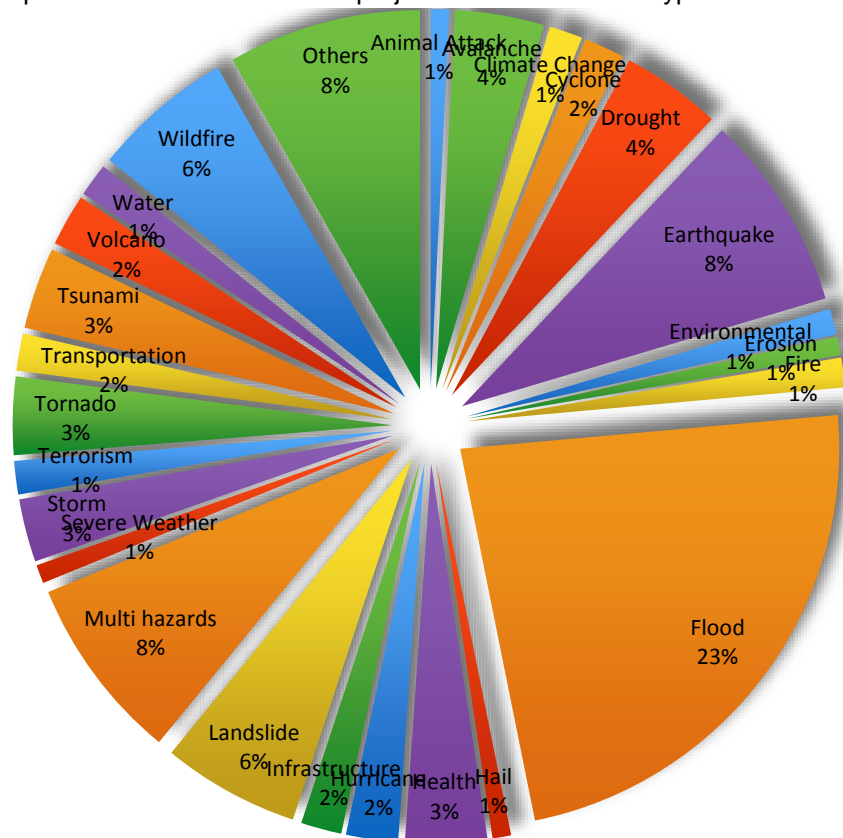


Graph 1. Distribution of DRRPs in the MapDRR database as of May 2014.

Majority of the MapDRRPs database records are related to the natural hazard category (87%). Only 11% of the records are technological and 2% are intentional/civil disaster risk reduction projects (Graph 2).



Graph 2. Distribution of DRRPs project in term of Hazard type



Graph 3. Distribution of DRRPs project in term of hazard type



Graph 3 provides some detail information about the DRRPs in terms of the type of hazards that they are dealing with. The current version of database covers a large number of different hazards. However, as expected significant number of the projects are flood related projects (23%).

### 3.1. MapDRR Website

MapDRR is a currently a webpage that has two main components: 1) MapDRR Google Map; and 2) MapDRR Menu. By entering the MapDRR website, users will see all of the existing DRRPs in a world map (zoom level 2 in google map) (Image 1). To make the records more visible the map type has been set to “Road”.

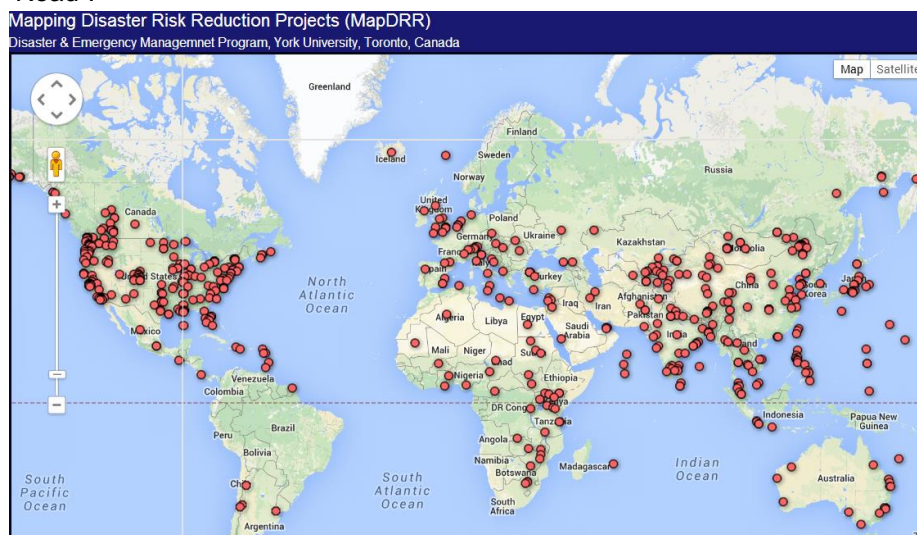


Image 1: The MapDRR map Component.

Users can select each of the DRRPs by clicking on their marker. When a project is selected, detail information is provided to the user in the information window and the zoom level and the map type are changed to present more local and visual information about the project location. Depending on the availability of information map type is changed either to satellite or street view (Image 2). In this example street view of the project site is also available (Image 3).

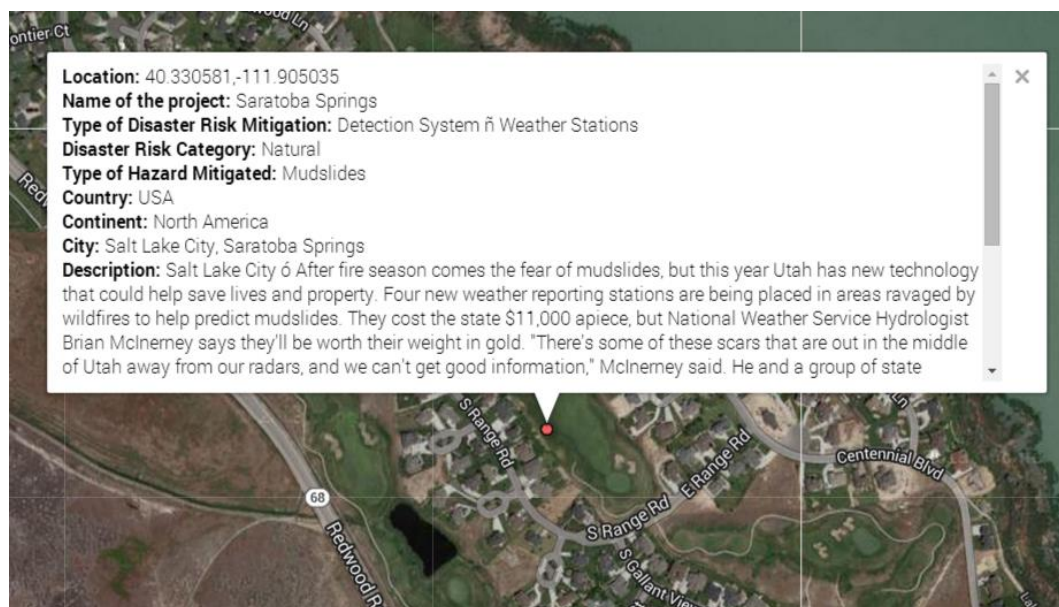


Image 2. Google map satellite view of the selected DRR project.



Image 3. The street view image of the DRR project site.

Users can also filter the DRRPs using the provided menu on the right hand side of the website (image 4). Currently DRRPs can be filtered by hazard category and hazard type. More filters such as DRR type and continent and country filters will be added in the near future.

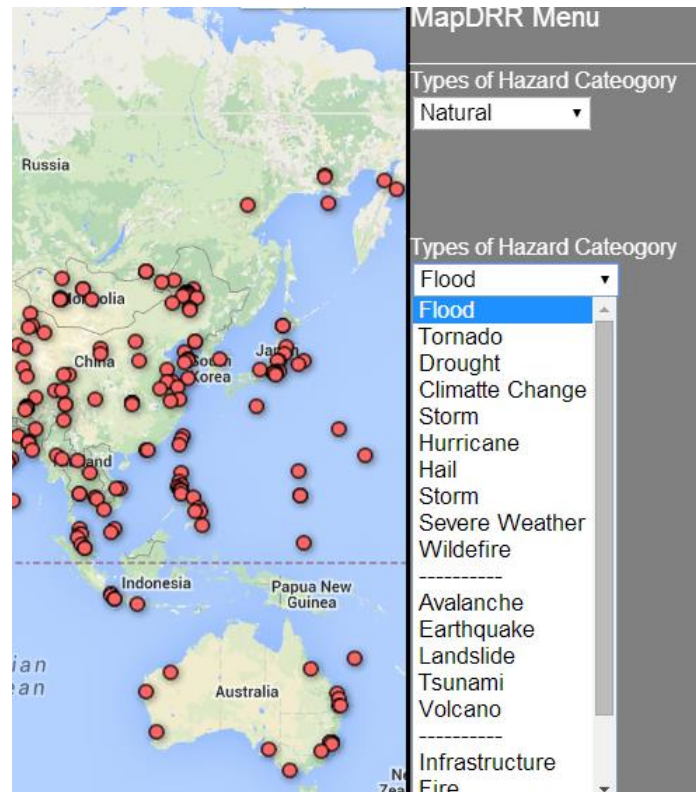


Image 4: MapDRR Menu



Finally, users can extract graph and tabular data for preferred hazard and or DRR projects. This will enable researchers and policy makers to benefit from the database using aggregated data (Image 5).

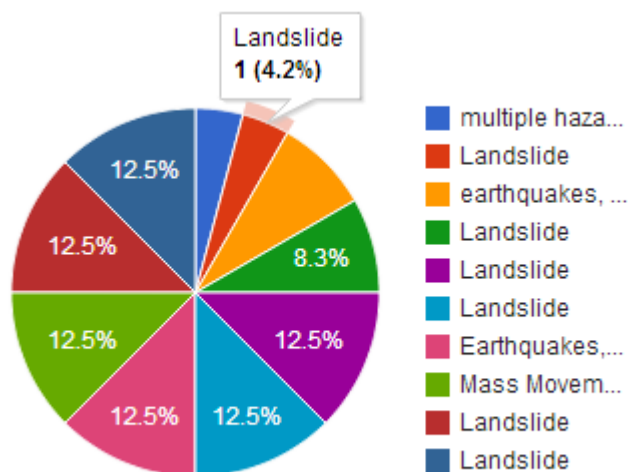


Image 5: DRR Projects by type of hazards (graph generated by Google Fusion Table )

## 4 Discussion

The MapDRR as explained here is a Google Map application initiative that uses Google Fusion Table Technology to map disaster risk reduction projects around the world. This is a project that is in progress both in terms of its database and in terms of its google map interface. We believe that such mapping tool can be very helpful for students, researchers, practitioners, and policy makers who are interested in learning about different types of disaster risk reduction projects that are being undertaken around the world. It not only maps the DRRPs, but also it provides useful textual and visual information to the users by bringing together the information that is publicly available in an easy to understand and navigate approach. However, creating a comprehensive and complete DRRPs mapping system is a daunting task and faces many challenges. Some of these challenges and key areas of improvements are discussed here.

First, many DRRPs especially those that have been implemented in the past or are being implemented by many local governments today are either not reported online (the main source for the MapDRR ) or if they are reported, they are not eported in English, the current language of MapDRR.

Second, although we intentionally limited the number of fields in our database to make it easier for the information providers and the end users, it is possible to add more fields to the database as required. However, adding more fields requires more database management system capacities. This might become a challenging task as the number of records in the database increases.

Third, the “Project Description” field in the MapDRR database contains significant textual information about each project. Being able to add queries that can filter projects based on the information provided in this field could be very valuable. We aim to add this functionality to the MapDRR so that users can find projects that have certain types of information in their descriptions.

Fourth, to receive the maximum benefits from creating the MapDRR database in the Google Fusion Table, we will add more features to MapDRR website. These features will allow the users to generate and view thematic maps, graphs and charts for their selected DRRPs.

Fifth, to make MapDRR a participatory mapping tool, we will allow users to submit their DRR projects to be added to the database after verification. In addition MapDRR can add a section on the database that collects and publishes users' comments about the viewed DRRPs. We are hoping that the participatory and crowd sourcing attributes of the MapDRR encourages more practitioners and DRR experts to provide DRR records and input to the database as highlighted by Doge and Kitchin (2013). This of course has its own challenges as discussed and argued by several other authors (Carr, 2007; Crutcher and Zook, 2009).

Finally, we are developing specific symbols for each DRRP types to be replaced with the default google symbols. This will help users to visually identify the DRRPs on the google map window much faster and easier.

## 5 Conclusions

MapDRR adds many additional benefits to the existing information that are available about DRRPs on the cloud. It provides DRR experts and researchers additional tool to easily find, analyse, and map DRRPs that have been implemented or are being implemented around the world. It will allow the users to compare different projects in different locations and learn from them using this interactive database and mapping tool.

There are many obvious improvements that need to be made to MapDRR, starting from adding more DRR records, structuring the database and adding more fields to the MapDRR Fusion Table, providing spatial analysis functionalities, query options, and users input to the google map component of the MapDRR. However, our plan is to provide useful, reliable, and added value information to the users and prioritize future extensions of MapDRR.

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