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## UP NOAH in Building Resilient Philippines; Multi-hazard and Risk Mapping for the Future

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### Abstract

University of the Philippines' Nationwide Operational Assessment of Hazards (UP NOAH) Center is a nationwide disaster management program that aims to improve the government and the Filipino people's capacity to respond against the impact and effect of extreme weather conditions. NOAH is undertaking advanced disaster science research, comprehensive and multidisciplinary assessment of hazards while also developing accessible tools that enable local government units, community leaders, policy makers, planners, families, and individuals to prevent and mitigate disasters.

UP NOAH's initiatives on disaster risk reduction and management (DRRM) have continually built individual and institutional capacities and resilience using multidisciplinary research and risk assessment. With the completion of its three component projects (flood, landslide, and storm surge hazards mapping) last December 2015, UP NOAH proceeded to its next step in innovation: From hazard mapping to risk mapping. This is to even more enhance the disaster mitigation plans of communities in the Philippines.

Embracing and taking advantage of information communication technology, the content of this user-generated mapping data are indeed vital in DRRM.

Using the existing tools, techniques, and innovations of UP NOAH, a community-based adaptation fit for all levels of practitioners was introduced through Integrated Scenario-based Assessments of Impacts and Hazards (ISIAIH). The project helped enhance the knowledge of policymakers on areas that are safe for habitation as well as those that are suitable for long-term development.

ISIAIH highlighted the emphasis of DRRM on strengthening preparedness and building stronger community resilience through

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persistent and constant information, education, and communication campaign using the internet and social media, as well as continuous personal visits to local communities where mapping workshops were conducted.

This is essential as it recognized the actions needed to address the underlying reasons of disaster risk: poor urban planning among other man-made factors. In this way, adapting to the challenges of climate change in addition to DRR is given emphasis to help prevent significant loss of lives wrought by future disasters.

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## 1. Main text

University of the Philippines' Nationwide Operational Assessment of Hazards (UP NOAH Center), formerly known as the Philippine's Department of Science and Technology's Nationwide Operational Assessment of Hazards (DOST- Project NOAH), is a nationwide disaster management program that aims to improve the government and the Filipino people's capacity to respond against the impact and effect of extreme weather conditions. NOAH is undertaking advanced disaster science research, comprehensive and multidisciplinary assessment of hazards while also developing accessible tools that enable local government units, community leaders, policy makers, planners, families, and individuals to prevent and mitigate disasters.

Just this February, the University of the Philippine's (UP) Board of Regents approved the establishment of NOAH Center for climate actions and DRRM, thus the institution is now known as UP NOAH.

UP NOAH's initiatives on disaster risk reduction and management (DRRM) have continually built individual and institutional capacities and resilience using multidisciplinary research and risk assessment. With the completion of its three component projects (flood, landslide, and storm surge hazards mapping) last December 2015, UP NOAH proceeded to its next step in innovation: From hazard mapping to risk mapping. This is to even more enhance the disaster mitigation plans of communities in the Philippines. (See Figure 1).

Risk mapping is emerging as a dynamic way to visualize the impacts of hazard events. Through crowdsourced mapping, individuals and organizations can readily help to prevent, prepare for, and respond to disasters.

Embracing and taking advantage of information communication technology, the content of this user-generated mapping data are indeed vital in DRRM.

As it continues to strengthen the capabilities of local government unit officials, members of non-government agencies, community leaders, policy makers, and planners in the field of disaster risk reduction (DRR), UP NOAH announced the inception of a new component last March 2016: the Integrated Scenario-based Assessments of Impacts and Hazards (ISAIHA) which ended a year after, completely mapping 15 provinces.

Even if the project ended, NOAH scientists and researchers are continually developing multi-hazard maps of the future for early warning, incorporating possible scenarios predicted as consequence of climate change (Lagmay, 2016).

According to UP NOAH's Executive Director, Dr. Alfredo Mahar Lagmay:

Using frontier science and cutting edge-technology, scientists from Project NOAH generate at least 1:10,000 scale hazard maps to empower communities in their efforts to reduce the adverse consequences of climate change as well as harness any of its beneficial aspects. Project NOAH scientists understand and map natural hazards to meet their real objective, which is to identify suitable areas for the development of communities adapted to climate change and provide locations of the safest sites for evacuation and placement of critical facilities. They understand that knowing the hazards without identifying suitable areas to avoid disasters will not help communities adapt to climate change.

For five years now, UP NOAH yields extensive use of science and technology as it continues to bring considerable efforts in averting the effects of natural hazards, thus minimizing the likelihood of disasters.

### *1.1. Structure*

#### **UP NOAH – ISIAIH OBJECTIVES**

Continuing with UP NOAH's response to a call for a proactive disaster prevention and mitigation program, NOAH added up-to-date reliable data sources in ISIAIH. The objectives of ISIAIH are to:

1. Create a municipal level risk assessment, incident reporting, and visualization tool.
2. Map exposure elements, such as population, buildings, and critical facilities.
3. Assess vulnerability to hydro meteorological hazards based on available datasets.
4. Evaluate the Disaster Risk Reduction and Management capacities of local government units.
5. Train and communicate end-users in the use of the NOAH website and its allied tools.
6. Provide data and risk information required by National Disaster Risk Reduction Management Council (NDRRMC) during extreme weather events through the Pre-Disaster Risk Assessment (PDRA) system.

#### **RISK MAPPING EFFORTS**

Scientists and researchers for ISIAIH implemented range of capacity building activities including Information, Education, and Communication (IEC) campaigns to different regions in the country, training workshops to the members of local government units and national government agencies, and even conferences with the help of DRR advocacy organizations and institutions along with a unique opportunity for learning and training.

ISIAIH also highlighted the emphasis of DRRM on strengthening preparedness and building stronger community resilience through persistent and constant information drive using the internet and social media, as well as continuous personal visits to local communities where mapping workshops were conducted. (See Figure 2).

Using the existing tools, techniques, and innovations of UP NOAH, a community-based adaptation fit for all levels of practitioners was introduced. The project helped enhance the knowledge of policymakers on areas that are safe for habitation as well as those that are suitable for long-term development. ISIAIH placed a very high priority on risk mapping and the community leaders were able to point out appropriate areas that are most likely safe for the rehabilitation of civic buildings like hospitals, schools, and more importantly, evacuation centers.

This is essential as it recognized the actions needed to address the underlying reasons of disaster risk: poor urban planning among other man-made factors. In this way, adapting to the challenges of climate change in addition to DRR is given emphasis to help prevent significant loss of lives wrought by future disasters. (See Figure 3).

Through these developments, UP NOAH continues to keep key stakeholders informed with progress, issues, and solutions in its disaster risk reduction efforts through advanced science and technology.

#### **OSM PARTNERSHIP**

NOAH has a sustained partnership with the OpenStreetMap (OSM) community. OSM is a tool that is an integral part in creating a disaster resilient environment. By identifying points of interest, critical facilities (e.g. health centers, schools, town halls), buildings, and other infrastructures in the community, areas vulnerable to disasters can be easily identified, and risk and exposure details (number of affected houses, commercial buildings, evacuation centers) would be readily estimated.

The information from UP NOAH website tools and OpenStreetMap data is practically designed for the benefit of LGU officials in the Philippines. This is because the website information can serve as strategic guide to emergency response and disaster mitigation planning. (See Figure 4).

This low cost innovation creates fast dissemination of specific geo-information onto the OSM base map. The collections of data are directed towards a smaller dedicated audience who is “on the ground” and are readily available to support rapid humanitarian mapping services.

## **THE PERENNIAL DILEMMA**

Disaster risk communication is actually a perennial dilemma. In the Philippines alone, there are so many efforts to reach the grassroots level but emergency and disaster preparedness messages inevitably fall short.

It is indeed hard to motivate the public to be proactive. The Philippines is very vulnerable to hazards risk and disasters but social media posts and communication efforts mostly go unnoticed, if not argued upon. It tends to be a unified dispute to other (and older) people.

The problem persists when there is a great danger of disaster-causing hazards. Older people seem to dwell on the idea that everything in the Philippines is a development failure, which is a sad premise just because the Philippines is a third-world country. The increasing frequency and even severity of both natural and technological disasters often yield scientific and political debates.

It is still hard to disseminate information about emergency and disaster preparedness because people think scientific terms are too technical; still harder to reach out to the greater number when there is a threat of clouded judgment of political aims.

This kind of habit is a multiplier of our country’s risk and insecurity. Sometimes the efforts in urging the public to take action seem useless because the challenge lies on how to achieve social, economic, and political unity.

## **SCIENTIFIC KNOWLEDGE IN DRRM POLICY AND PRACTICE**

NOAH has long embraced public participation to improve emergency response and disaster mitigation throughout the country. Through this crowdsourced method of generating geospatial data through the internet, solving spatial problems with the help of satellite applications and mapping technology was even made possible and readily available.

End-users, especially the officials of local government units and members of civic groups, can better rely on the information translated to the website tools. This data from thematic OSM mapping can be a solution to the heavily involved damage assessment and analysis activities before, during, and after large-scale emergencies.

The collaborative efforts of national government agencies pave way to a more relevant and vital execution of WebSAFE, an impact assessment tool that can be accessed through UP NOAH’s website. (See Figure 5).

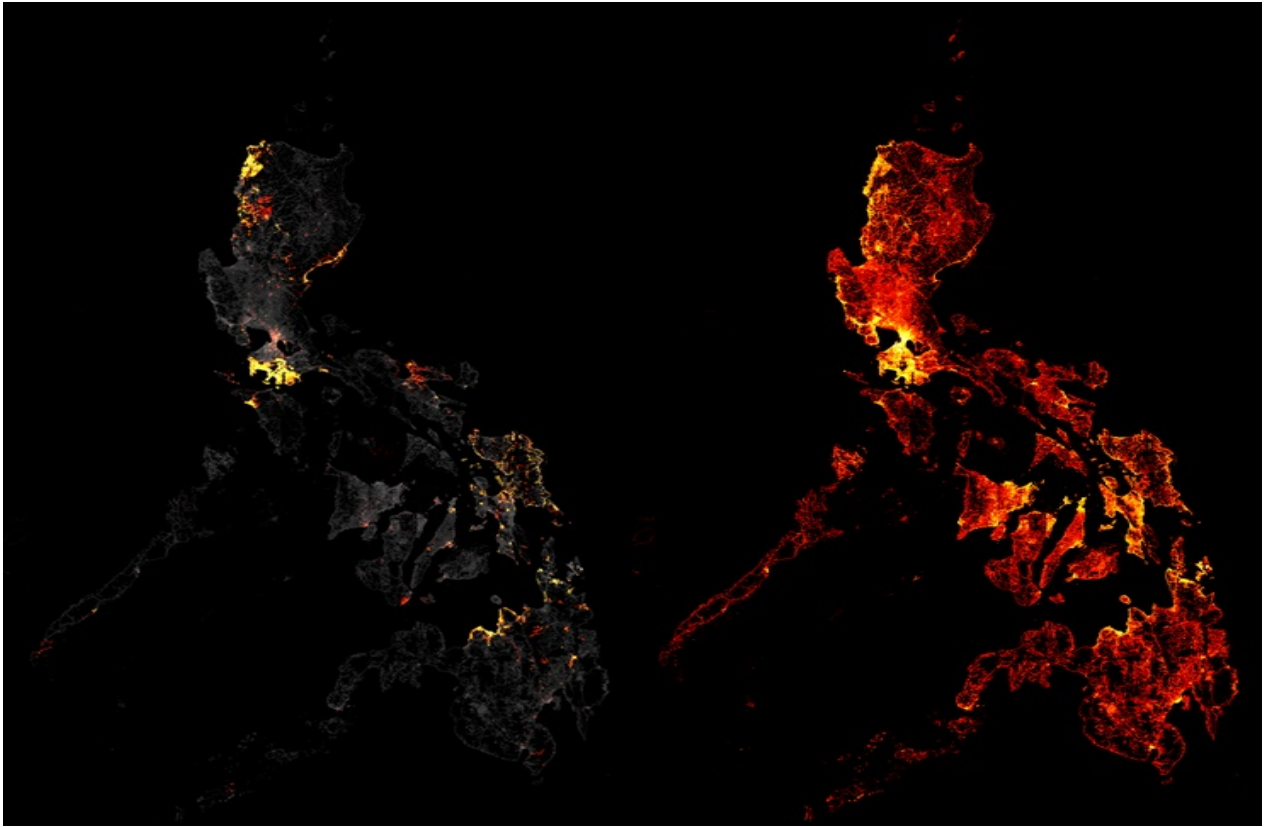
The building footprints obtained from the OSM community is translated through the OSM data. The information from these data is automatically integrated to the website tools of UP NOAH, specifically in the WebSAFE application.

UP NOAH believes that if citizens map their own communities, and they are educated with sufficient scientific knowledge, disaster preparedness measures will be more engaged and effective, especially in identifying hazards and risk exposure in the community.

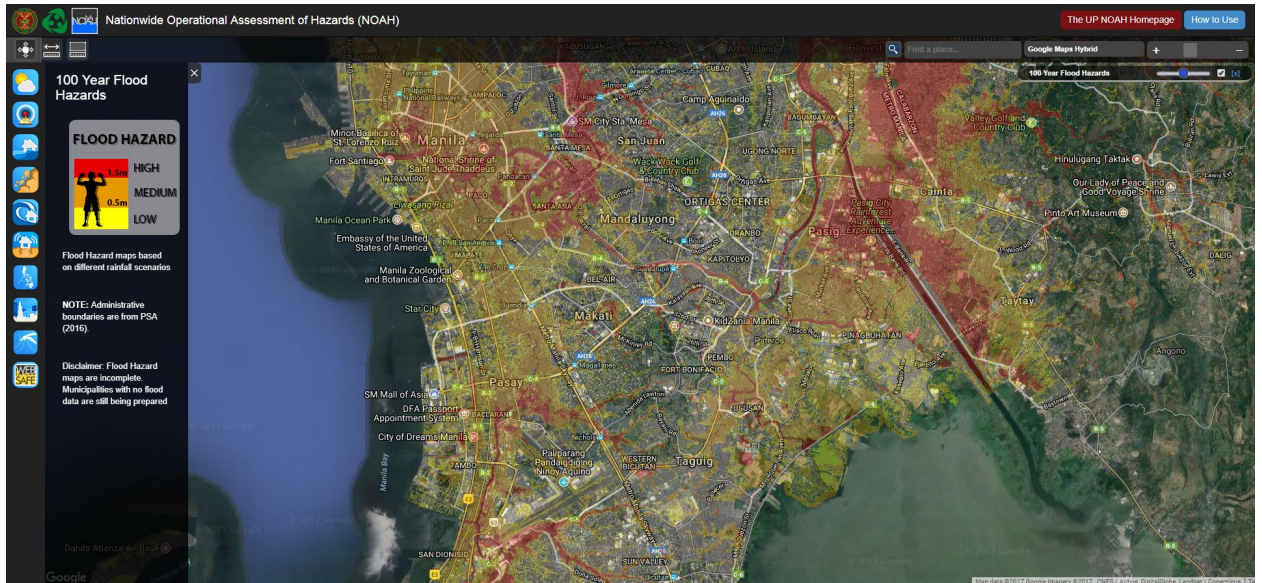
This way, UP NOAH’s call to Open Government Data will lead off substantive support to DRRM using effective public participation.

## **2. Illustrations**

These illustrations show the efforts of UP NOAH in mapping the whole Philippines. Images show the progress of the initiative of making the public participate in mapping the critical facilities in their respective areas.



**Fig. 1 - Node density (colored) shows the progress of points (building footprints, road works, and other edits) mapped in a given city and municipality. Photo from UP NOAH website and articles.**



**Fig. 2 - Looking at the map generated by UP NOAH, colored areas show the level of inundation people might experience in case of a 100 year rain return rate flooding. Areas with no colors show places safe habitation**



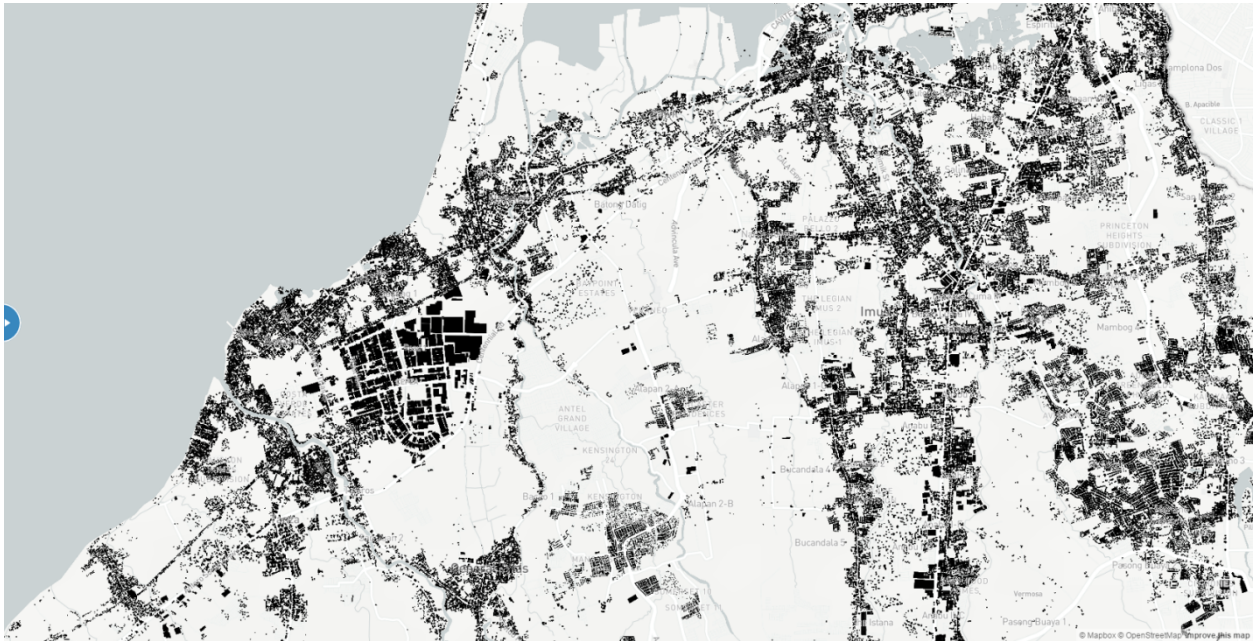


Fig. 3 – Black outline shows the points mapped through OpenStreetMap

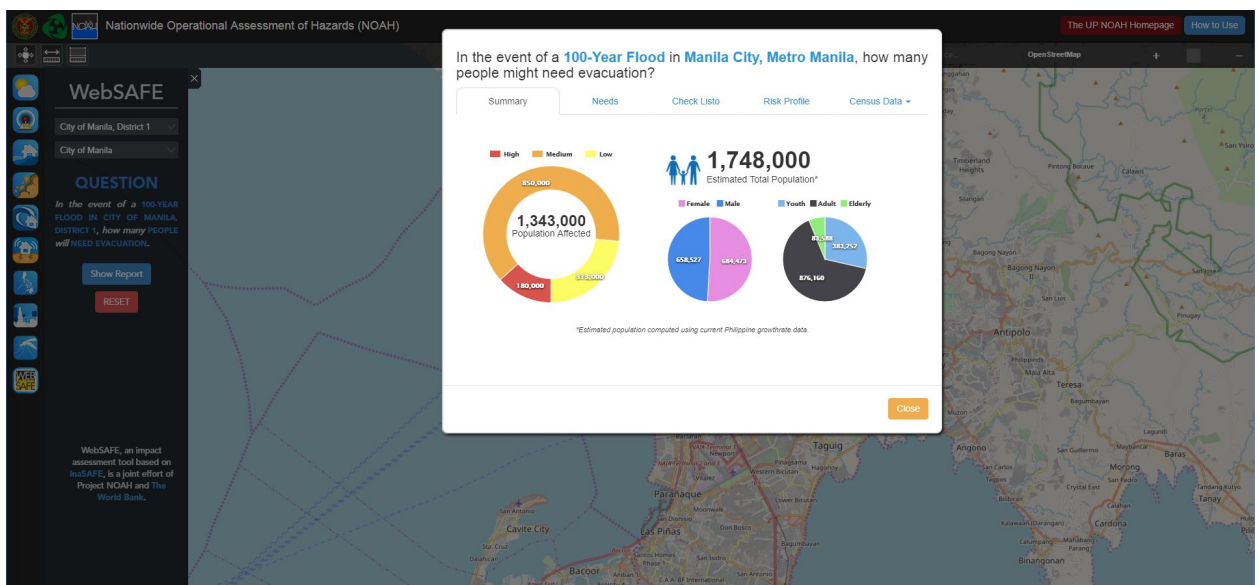
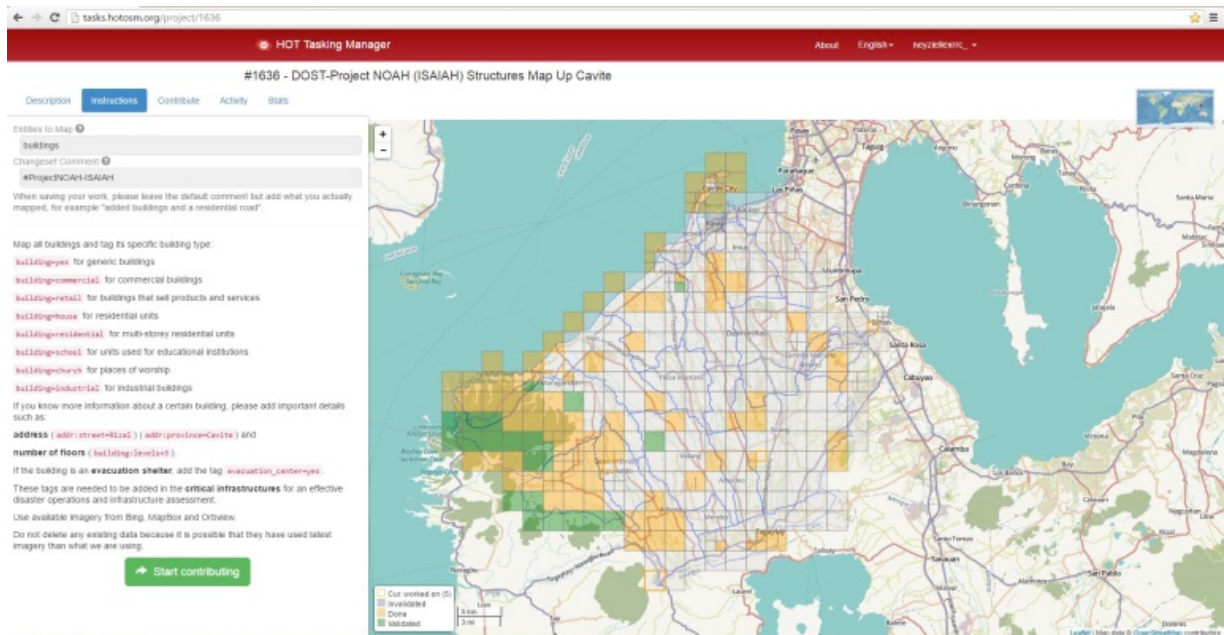


Fig. 4 - WebSAFE is software that analyses disaster impacts based on available hazards and infrastructure maps. It is adapted from Indonesia's software INASAFE and was a part of collaboration with World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR). Can be accessed through <http://noah.up.edu.ph>

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### 3. Equations

Disaster risk reduction is the concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the causal factors of disasters. Reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness and early warning for adverse events are all examples of disaster risk reduction (UNISDR).



$$\text{Disaster Risk} = \frac{\text{Hazard} \times \text{Vulnerability} \times \text{Exposure}}{\text{Capacity}}$$

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