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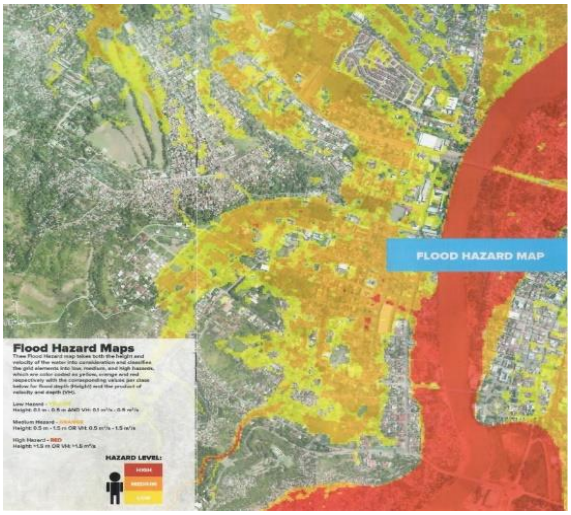
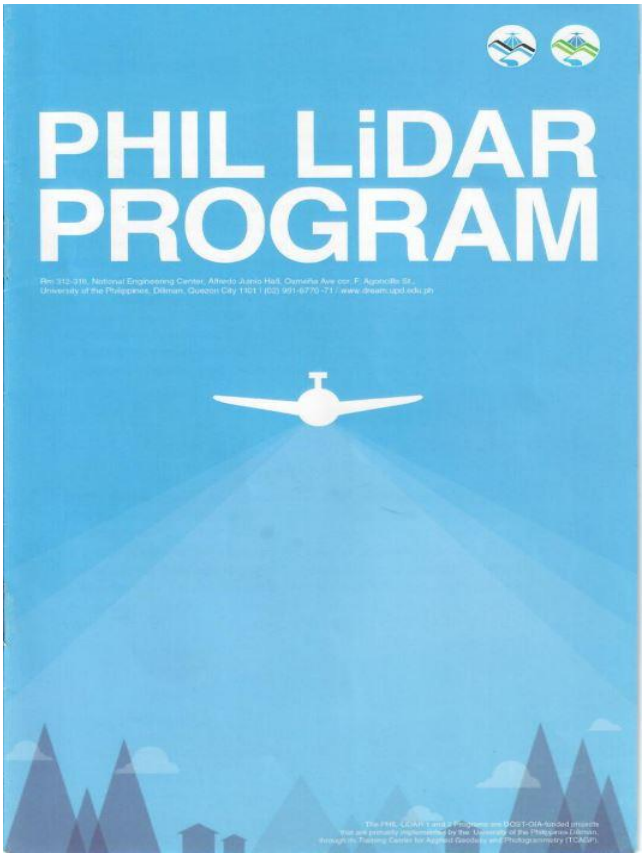
LiDAR AT THE FOREFRONT OF THE DISASTER RISK REDUCTION AND MANAGEMENT IN THE PHILIPPINES: LESSONS AND CHALLENGES





The Philippines ranks as the third most disaster-prone country in the world according to the 2017 World Risk Report of the United Nations University Institute for Environment and Humanity Security (UNU-EHS). Over the past decade, a number of major disasters took the stage in the country, prompting high economic damage and losses, casualties, and social disruptions. Worse, they are expected to further rise as a result of increased anthropogenic activities if no appropriate measures are put in place.

Flooding is the most common and most costly natural hazard globally [United Nations, 2015b]. It causes extensive damages on infrastructure, human life, and the environment which are amplified by poor infrastructure, limited coping mechanisms, inadequate flood hazard mapping and monitoring, and lack of early warning system. The recent upsurge in the intensity and recurrence of disasters present several key challenges and underscores the need for the improvement of our disaster risk reduction and management (DRRM). DRRM is a difficult task made more so by a lack of more accurate data to allow for better planning and preparations.

A variety of strategies can be designed to curtail the impacts of flooding, including early warning systems, flood hazard mapping, structural flood protection, ecosystem restoration to repair natural buffers, building code permits that limit property damage, and land use policies that steer development towards safe areas [IPCC, 2014].

World Risk Index 2017

Rank	Country	Risk (%)
1	Vanuatu	36.28
2	Tonga	29.33
3	Philippines	26.70
4	Guatemala	19.88
5	Bangladesh	19.17
6	Solomon Islands	19.14
7	Brunei Darussalam	17.00
8	Costa Rica	17.00
9	Cambodia	16.58
10	Papua New Guinea	16.43

The Philippines has gone a long way in addressing disaster risk through policies and strategies. The paradigm shift towards proactive and preventive approaches to disasters is underlined in the Republic Act No. 10121 or the Philippine Disaster Risk Reduction and Management Act of 2010. From disaster preparedness and response in the 1970s, the country has shifted its approach to disaster management in the 1980s, disaster risk management in the 1990s, and eventually disaster risk reduction and management in 2005 up to the present. [SEPO, 2017]

The Republic Act No. 10121 provides the legal basis for policies, plans, and programs to deal with disasters and reconstituted the National Disaster Coordinating Council (NDCC) to National Disaster Risk Reduction and Management Council (NDRRMC).

In 2011, NDRRMC adopted the National Disaster Risk Reduction and Management Framework (NDRRMF) which is the principal guide to the country's DRRM efforts. This was followed by NDRRMC's approval of the National Disaster Risk Reduction and Management Plan

(NDRRMP) in 2012, which highlights the need for institutionalizing DRRM policies, structures, coordination mechanisms and programs with continuing budget appropriation on DRR from national down to local levels. Under the plan, the Department of Science and Technology (DOST) is responsible for the prevention of hazards and mitigate their potential impacts by reducing vulnerabilities and exposure; and enhancing capacities of communities.

Phil-LiDAR 1 Program

To complement other DRRM initiatives by the government, the DOST funded the Phil-LiDAR 1 Program or the Hazard Mapping of the Philippines using LiDAR in 2014. The program serves as an urgent response to the pressing need for effective and efficient disaster risk reduction and management strategies particularly for flooding. It was spearheaded by University of the Philippines Diliman (UPD) and co-implemented by fourteen (14) Higher Education Institutions (HEIs) and State Universities and Colleges (SUCs).

An expansion of the Disaster Risk Exposure Assessment for Mitigation (DREAM) Program, Phil-LiDAR 1 produced up-to-date, detailed, and high-resolution three-dimensional (3-D) flood hazard maps and water level forecast system for two-thirds of the Philippine river systems or 257 flood plains or 262 minor river basins prone to flooding nationwide using Light Detection and Ranging (LiDAR) and other remote sensing and geographic information system (GIS) technologies.

LiDAR based digital elevation models (DEMs) generated by the PHIL LIDAR program provided a highly accurate representation of the flood plains to as much as 1-meter spatial resolution. Having a very high resolution can provide accurate estimation of the volume of the floodwaters that may affect the urban areas all over the country.

By the end of the program, flood hazard maps were turned over to 734 municipalities, LiDAR derived datasets were provided to 821 LGUs, and LiDAR maps were handed over to concerned NGAs and LGUs. A LiPAD or the LiDAR Portal for Archiving and Distribution system is available to facilitate the exchange of communication across all components of the Phil LiDAR Program. The products developed out of the program aimed to cater to the Disaster Risk Reduction and Management needs of the NGAs and LGUs particularly in improving the identification of areas at risk of flooding, flood risk management, flood preparedness, and policy interventions.

The Case of Cebu

The Phil-LiDAR 1 Project 1.B.8 LIDAR Data Processing and Validation in Visayas: Central Visayas (Region 7) is devoted to cover twenty-one (21) river basins in Central Visayas with the following objectives:

1. To process data (LIDAR, bathy, SAR) of selected rivers in the Central Visayas (Region 7) from the Phil-LIDAR 1 of UPDiliman for processing using various software.
2. To gather field data for purposes of calibration and validation of hydrologic models
3. To generate and calibrate hydrologic and flood models for each river basin
4. To produce and validate flood hazard maps

The project was housed at the University of San Carlos (USC) Phil-LiDAR Research Center. It was able to generate and calibrate hydrologic flood models and produce and validate flood hazard maps for the 21 river basins in Central Visayas through simulations using the calibrated and validated flood model.

In the case of Cebu province, the project was able to cover 11 out of 51 LGUs. As of March 2018, 94% of the total land area of Cebu has been covered. Last May 2018, the whole Cebu province has been covered.

Issues and Challenges

Notwithstanding the efforts to reduce the risks and vulnerability to natural hazards facing the country, problems still exists impeding government's effort to achieve effective and efficient disaster risk reduction and management strategies.

In the case of the Phil-LiDAR project implemented by University of San Carlos, among the common problems encountered by the project leader and project beneficiaries are as follow:

1. **Inadequate Capacity of the LGUs to Absorb the Technology**
   Some LGUs do not have enough manpower, technical capacity and resources to absorb the LiDAR technology. For instance, some LGUs are not equipped to store and access the data provided by the program. This lack of capacity prevents the maximum utilization of the products of the program.

2. **Institutionalization of Disaster Risk Reduction and Management Offices (DRRMO)**
   The DRRMOs at the barangay, municipal, city, and provincial levels still lack the manpower, technical and administrative capacity to carry their respective mandates. This hinders them to properly implement DRMM strategies and policies.

3. **Phil-LiDAR 1 Area Coverage**
   As R&D project, Phil-LiDAR 1 has specified areas to be covered, which is two-thirds of the Philippine river systems or 257 minor river basins nationwide. Arguably, one setback of the program is that it was not able to cover the whole country. For instance, there are LGUs who have requested for their respective jurisdictions to be covered. In Cebu, Phil-LiDAR 1 was able to cover 11 out the 51 LGUs. To cover the whole province of Cebu, its Provincial Government has shelled out PhP 5,000,000 for the completion of the data acquisition for all of its LGUs.

4. **Delineation of Research and Development (R&D) Projects from NGAs Mandated Functions**
   DOST programs and projects, such as Phil-LiDAR 1, are considered R&D projects. R&D project's objectives are basically the innovation, introduction, and improvement of products and procedures. In the case of Phil-LiDAR 1, its main objective is essentially, to develop, calibrate, and validate flood models and generate flood hazard maps. The National Mapping and Resource Information Authority (NAMRIA) is mandated to act as the central mapping agency in the country. Meanwhile, one of Mines and Geosciences Bureau (MGB) functions is to conduct geohazard assessment and produce geohazard maps. Collaboration among the involved agencies should be relentlessly pursued to realize the objectives of the project and to prevent overlapping of functions if not competing.

5. **Intellectual Property**
   The products of Phil-LiDAR 1 are considered public goods except for case involving its commercial use. LiDAR Portal for Archiving and Distribution or LiPAD serves as the primary data access and distribution center of the Phil-LiDAR 1 Program. The datasets are available for download for use by LGUs, NGAs, members of the academe, and researchers, among others. There are concerns on the improper use of the open-access data and the enforceability of the LiPAD End-User License Agreement (EULA). In addition, the data being provided to the LGU is protected by the EULA. The LGU signed it, on the contrary, the data provided to the consultants commissioned by the LGU can manipulate the data and would be able to generate income from supposedly public goods.

Policy Recommendations

With the aim to serve as an urgent response to the pressing need for effective and efficient DRRM strategy, for flooding, the Phil-LiDAR 1 program was successful in improving the early flood warning system and enhancing the flood hazard maps in the country. These are valuable tools in improving the country's resilience to disasters. Phil-LiDAR 1 attests that science-based approach to disasters are essential for effective and efficient DRRM efforts. But programs such as the Phil-LiDAR 1 are just part and parcel of the whole DRRM efforts of the country.

Building the capacity of LGUs and solidifying the local and national political commitments to institutionalize DRRM are key to sustaining our resiliency efforts. LGUs do not have sufficient capacity to deal with natural hazards. They lack the technical expertise, management capacity, and funds to plan and implement well-targeted disaster risk reduction measures. As highlighted in the NDRRMP, there is a need to further strengthen the mainstreaming of DRRM down to the barangay and individual level. To strengthen the DRRM efforts of the country, the DRRMO's institutional capacities, both administrative and technical, should be fortified. General trainings, as well as technical trainings, are very much needed both by the Provincial/City/Municipal DRRMOs and the LGUs. The case of Cebu province demonstrated that it is possible to equip LGUs with the operational tool for DRRM.

To ensure the effective utilization of the products produced in the program, it is imperative that the beneficiaries are well-equipped to absorb the technology and products being introduced to them. Equivalently, there is a need to localize the outputs so that it can be used effectively by them. As such, it is crucial to actively link the projects to the stakeholders. LGUs, NGAs, as well as the private sector, should have an active involvement in the whole duration of the project through consultative meetings and among others.

In the case of the Phil-LiDAR 1, NGAs and LGUs may provide the additional resources to fully maximize the coverage and applications of the technology. Aside from DRRM, LGUs can use the LiDAR maps and data for generating Comprehensive Land Use Plans (CLUPs), for resource inventory and assessment, for infrastructure planning and monitoring, for the implementation of the Local Climate Change Action Plan (LCCAP) and for governance. NGAs and LGUs need to make sure that these technologies are integrated into their operation. Collaboration among the NGAs should be viewed as a significant move to strengthen their technical and administrative capacities. As for NAMRIA, the flood model developed in the program can help improve the ones used by the agency. This is in support of NAMRIA's vision to build a geospatially-empowered Philippines by 2020 and its mission to provide accurate, timely and accessible topographic maps, nautical charts and other geospatial products and services. Mandated agencies could tap the assistance of the DOST in improving their operations through its Research and Development (R&D) funded projects and activities. Collaboration with the DOST in research undertakings should also be considered and its being a research arm of all government agencies should be emphasized.

Information dissemination, capacity building, and stakeholder engagement also play a vital role in the process. Without these, DRRM efforts will lose their effectiveness.

Lastly, DRRM is a collaborative effort. It takes all the stakeholders to ensure the success towards disaster resiliency. Through permanent mechanisms and science-based and participatory approach, mitigating the effects of natural and human-induced disasters can be done. Unless appropriate measures are implemented, enormous social and economic losses associated with disasters will persist.

References

(1) United Nations University Institute of Environment and Human Security. (2017). 2017 World Risk Report. Retrieved from https://reliefweb.int/sites/reliefweb.int/files/resources/WRR_2017_E2.pdf

(2) Intergovernmental Panel on Climate Change. (2014). IPCC Fifth Assessment Report. Retrieved from http://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf

(3) Senate Economic Planning Office. (2017). Examining the Philippines' Disaster Risk Reduction and Management System. Retrieved from: https://www.senate.gov.ph/publications/SEPO/PB_Examining%20PH%20DRRM%20System_Revised_27June2017.pdf

(4) National Disaster Risk Reduction and Management Council. (2011). National Disaster Risk Reduction and Management Plan (2011-2028). Retrieved from http://www.ndrrmc.gov.ph/attachments/article/41/NDRRM_Plan_2011-2028.pdf

(5) Disaster Risk Reduction and Management Framework. Retrieved from http://www.adrc.asia/documents/dm_information/Philippines_NDRRM_Framework.pdf

(6) UP DREAM (Disaster Risk and Exposure Assessment for Mitigation) Program. Retrieved from https://dream.upd.edu.ph/

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POLICY BRIEF highlights PCIEERD's stance on policy issues related to industry, energy and emerging technology sectors through the coordination of the Policy Unit and the PCIEERD Technical Working Group for Policy Review and Development

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