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Multi-Hazard Response Plan for Volcanic Eruption, Typhoon, And Dengue Outbreak in Sto. Domingo, Albay

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Abstract:

This paper presents a Multi-Hazard Response Plan for Sto. Domingo, Albay, a municipality exposed to overlapping threats from volcanic eruptions, typhoons, and dengue outbreaks. Using a risk-informed, locally grounded approach, the plan integrates strategies across the four thematic areas of Disaster Risk Reduction and Management (DRRM). The plan was developed through community surveys, interviews with local government staff, and review of historical climate and health data. Key interventions include legislative development, localized early warning systems, dengue prevention campaigns, community training, emergency deployment of health and response services, and livelihood rehabilitation through microfinance and skills training. This integrated plan underscores the importance of adaptive, multi-sectoral, and community-led disaster strategies in reducing vulnerabilities and enhancing local resilience to compounding hazards in disaster-prone areas.

Keywords — **Put your keywords here, keywords are separated by comma.**

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I. INTRODUCTION

The intersection of natural and biological hazards has increasingly threatened communities in disaster-prone regions such as Sto. Domingo, Albay. Located within the 6-kilometer permanent danger zone of Mayon Volcano and exposed to annual typhoons due to its location along the Pacific, Sto. Domingo also faces heightened vulnerability to disease outbreaks, particularly dengue, which often emerges as a secondary hazard. Prolonged evacuation and displacement following typhoons and volcanic eruptions can lead to overcrowded shelters and poor sanitation, while stagnant water from flooding or ashfall provides breeding grounds for disease-carrying mosquitoes.

While the Philippine government has established frameworks for DRRM, most local government units (LGUs) continue to adopt siloed response strategies for each hazard. The COVID-19 pandemic and the 2018 Mayon eruption underscored the urgent need for integrated, multi-hazard approaches. This study aims to develop a strategic plan that bridges response protocols across volcanic, meteorological, and epidemiological threats.

II. SCOPE AND LIMITATIONS

This plan adopts a worst-case scenario approach based on qualitative local evidence from LGU Contingency Plans, CDRAs, and LCCAPs. It focuses on four high-risk barangays: Fidel Surtida, Lidong, San Fernando, and Sta. Misericordia, all located within the 8-kilometer Permanent Danger Zone (PDZ) of Mayon Volcano. These communities are directly exposed to pyroclastic flows, ashfall, lahar, and are also vulnerable to typhoon-induced flooding and landslides. While other barangays in Sto. Domingo faces similar hazards; this plan prioritizes those within the PDZ where evacuation and disaster response are most urgent.

III. SITUATIONAL ANALYSIS

Volcanic Hazard Context

Mayon Volcano, one of the most active volcanoes in the Philippines, presents threats of pyroclastic flows, ashfall, and lava fountaining. During the 2018 eruption, over 75,000 people were displaced. Ashfall from eruptions frequently contaminates water sources and damages infrastructure, indirectly affecting health and mobility.

Typhoon and Flooding Risk

As part of Typhoon Alley, Sto. Domingo experiences multiple typhoons annually. Super Typhoon Rolly (2020) and Typhoon Tisoy (2019) both caused major flooding, crop damage, and forced evacuations. Many barangays lack permanent flood defenses or resilient shelters.

Dengue Outbreak Risk

Dengue outbreaks in Sto. Domingo follows seasonal rainfall. Water-logged areas post-typhoon and post-eruption (when clean-up efforts stall) serve as breeding sites for mosquitoes. The local Rural Health Unit (RHU) reported a rise in dengue cases in 2021 and 2022, mainly in barangays with limited vector control.

Intersecting Vulnerabilities

What distinguishes Sto. Domingo's risk profile is the cascading nature of its hazards. For instance, a volcanic eruption may trigger displacement, which crowds evacuation centers, setting up conditions for disease transmission. Similarly, typhoons may follow eruptions, washing ash into communities and overwhelming drainage systems.

IV. RESEARCH DESIGN

A descriptive approach was used to assess community awareness and understanding of disaster risks while evaluating the effectiveness of existing disaster prevention and mitigation efforts implemented by the LGUs. To establish a data-driven foundation, historical records from PAGASA and PHIVOLCS on rainfall and volcanic activity were analyzed to identify trends in heavy rainfall events and lahar flooding frequency. Additionally, dengue incidence reports from local health offices and the Department of Health (DOH) were examined to detect seasonal patterns, peaks, and fluctuations in dengue cases.

The data-gathering process involved crafting and implementing a random survey that aimed to collect relevant information on community experience perception. Data extracted from this survey formed part of the action plan's approach to addressing the impact of typhoons, volcanic events and dengue outbreak.

V. RESULTS OF THE SURVEY

Table 1.
RESPONDENTS REPRESENTATION
PER BARANGAY

BARANGAY	NUMBER	PERCENTAGE
Lidong	10	33%
Fidel Surtida	10	33%
San Fernando	5	17%
Sta. Misericordia	5	17%
TOTAL	30	100%

The respondents consisted of 30 residents representing the four barangays highly to moderately susceptible to lahar flows: Lidong, Barangays Fidel Surtida, Lidong, San Fernando, and Sta. Misericordia. These barangays, located within the 6–8-kilometer Permanent Danger Zone (PDZ) of Mayon Volcano, are frequently evacuated due to the risk of lahar flows.

Table II
STATEMENTS ON AWARENESS OF
EARLY WARNING SIGNALS

STATEMENTS	AVERAGE	INTERPRETATION
I know the different Alert Levels of Mayon Volcano.	4.5	Strongly Agree
I know the different warnings on public storm signals	4.57	Strongly Agree
I am aware of the current measures for the prevention and control of dengue in our barangay.	4.6	Strongly Agree

Legend: 5 - Strongly Agree; 4 – Agree; 3 – Neither agree nor disagree, 2 – Disagree; 1 – Strongly Disagree

The respondents expressed confidence in understanding Alert levels for volcanic activities as well as public storm signal warning for hydro-meteorological hazards.

TABLE III
RESPONSES TO QUESTION #8 ON INFORMATION
SOURCE ON EARLY WARNING

Question: I receive notifications or warnings about volcanic activity through:	Frequency
Text Messages (SMS)	10
Social Media	10
TV/Radio	14
Local leaders	11

For this question, most respondents strongly agreed (with a weighted mean score of 4.8) that they received advisories regarding ongoing volcanic activity. When asked about the platforms or channels through which they received these advisories, TV and radio announcements emerged as the primary sources of information. Information relayed by local leaders ranked second, while social media and text blasts were tied, with 10 respondents each citing them as sources.

TABLE IV
RESPONSES TO QUESTION #14 ON WHERE
ALERTS ARE RECEIVED.

Question: "I receive storm warnings or alerts through:	Frequency
Notice from Barangay leaders	10
NDRRMC Alert (SMS)	3
Alerts from neighbors	1

Question#14 explores how community members receive alerts related to typhoon alerts, the most common response is the advisories from barangay leaders followed by NDRRMC SMS blasts as their main source of early warning alerts.

Overall, there is high awareness of Mayon's alert levels and typhoon warnings.

TABLE V
STATEMENTS RELATED TO DENGUE

Statements	Weighted Mean Score
I am aware of the current measures in dengue prevention and control in our barangay.	4.6
Every time there is a Dengue outbreak, I see materials (e.g. posters, announcements, seminars) from the municipality regarding what to do to prevent Dengue. (Dissemination of information/awareness raising)	4.2
Our barangay/municipality is conducting fumigation and other measures against mosquitoes.	4.3

Legend: 5 - Strongly Agree; 4 – Agree; 3 – Neither agree nor disagree, 2 – Disagree; 1 – Strongly Disagree

TABLE VI
RESPONSES TO QUESTION #24
ON DENGUE PREVENTION

Statement	Frequency
Information drive / Avoid misinformation	2
Clean up drive	11
Eliminate sources of stagnant water	8
Disinfection/fumigation	2
Prevention (before dengue season)	2

This response underscores the community's awareness that while fumigation is an immediate solution, long-term dengue prevention requires proactive measures such as proper waste disposal, water drainage management, and maintaining clean surroundings. The emphasis on clean-up drives suggests that residents recognize the role of collective action in reducing mosquito populations and minimizing the risk of dengue outbreaks.

VI. SWOC ANALYSIS

Strengths

Utilization of CDRA, CLUP, and LCCAP for risk-informed, sustainable development planning.

DRRM Fund integrated in the AIP; PHP 8.4M allocated in 2024.

Prepositioned supplies for 1,000 households; reliable communication and designated evacuation centers.

Weaknesses

Health Human Resource - One doctor for 30,000 residents; limited capacity during multi-hazard events.

Inadequate and outdated response tools despite some new vehicle provisions.

Lack of BDRRM plans and insufficient training at the barangay level.

VII. PESTEL ANALYSIS

Political

Sto. Domingo's local government demonstrates continuity in disaster risk governance, with leadership from the Mayor, Vice Mayor, and DRRM Officer committed to strengthening preparedness. Proposed ordinances such as preemptive evacuation laws reflect alignment with provincial goals for zero casualties.

Economic

Upgraded to a second-class municipality, Sto. Domingo's economic base includes agriculture, fishing, trade, tourism, and quarrying. However, recurring disasters disrupt livelihoods, underlining the need for resilient income-generating programs and infrastructure investments.

Social

While there is active participation from women and barangay leaders in disaster preparedness, awareness levels vary among vulnerable groups. Displaced populations face increased risks during compound hazards due to overcrowding and limited access to basic services.sensitive and include spiritual leaders to ensure effectiveness.

Technological

Technological gaps include limited internet connectivity and absence of localized weather monitoring tools. National dengue vaccination campaigns have previously faced backlash, contributing to vaccine hesitancy that complicates public health preparedness.

Environmental

The absence of a comprehensive waste management plan presents a persistent challenge for Sto. Domingo. While the LGU promotes the establishment of Material Recovery Facilities (MRFs) and stricter waste segregation at the source, enforcement remains weak and community participation is inconsistent.

Legal

Sto. Domingo complies with national disaster and climate change laws (RA 10121, RA 9729). However, land-use conflicts and absence of local ordinances addressing multi-hazard scenarios indicate the need for more robust local policy frameworks.

VIII. ACTION PLAN

TABLE VII
ACTION PLAN FOR GOAL 1 OBJECTIVE 1.1

Goal 1	Build resilient communities through proactive measures to minimize the impact of volcanic eruptions, typhoons, and dengue outbreaks.
Objective 1.1	To enact a municipal ordinance strengthening multi-hazard risk assessment and early warning systems, including health-related risks.
Outcome	The communities are better protected from multi-hazard events, including health-related risks, as demonstrated by their increased awareness of risks, improved access to timely early warnings, and effective participation in risk reduction and response activities, facilitated by the strengthened municipal ordinance.
Programs, Projects, and Activities (PPA)	**1.1.1** Formulation of municipal ordinance to institutionalize multi-hazard risk assessment and early warning systems. **1.1.2** Stakeholder Commitment Signing to Support the Passage of the Multi-hazard Risk Assessment and Early Warning Systems Ordinance

In support of long-term disaster preparedness and risk reduction in Sto. Domingo, Albay, two complementary activities were developed that focused on the formulation of a municipal ordinance institutionalizing multi-hazard risk assessment and early warning systems. This legal measure aims to establish a structured framework for proactive disaster governance, directly benefiting the general population, particularly the 10,330 residents of the four high-risk barangays; Lidong, Fidel Surtida, Sta. Misericordia, and San Fernando.

To ensure broader support and sustainability, PPA 1.1.2 involves a stakeholder commitment-signing activity that engages members of the LDRRMC, civil society organizations, and sectoral representatives. This participatory process is designed to promote inclusive risk governance, foster a sense of shared ownership, and strengthen multi-sectoral accountability in the implementation of the ordinance.

TABLE VIII
ACTION PLAN FOR GOAL 1 OBJECTIVE 1.2

Goal 1	Build resilient communities through proactive measures to minimize the impact of volcanic eruptions, typhoons, and dengue outbreaks.
Objective 1.2	To enhance community engagement in regular preventive actions aimed at identifying and eliminating mosquito breeding sites to reduce the risk of dengue outbreaks.
Outcome	Fewer mosquitoes and decreased dengue fever cases in the target communities.
Programs, Projects, and Activities (PPA)	**1.2.1** Launch Social Behavior Communication Change Campaign on dengue prevention and source reduction strategies. **1.2.2** Community clean-up drive for mosquito-borne disease prevention

To strengthen community participation in monthly preventive measures to eliminate mosquito breeding hotspots.PPA 1.2.1 focuses on launching Social Behavior Communication Change Campaign. This campaign will roll out Knowledge, Attitudes, and Practices (KAP) surveys to the four target barangays and synthesize its results for the campaign development. PPA 1.2.2 facilitates monthly community-led clean-up drives targeting mosquito breeding sites, with at least 100 households per barangay participating.

TABLE IX
ACTION PLAN FOR GOAL 1 OBJECTIVE 1.3

Goal 1	Build resilient communities through proactive measures to minimize the impact of volcanic eruptions, typhoons, and dengue outbreaks.
Objective 1.3	To promote community-based recycling and waste management initiatives in high-risk barangays.
Outcome	Enhanced community participation in sustainable recycling and waste management practices in high-risk barangays, leading to improved environmental health and reduced waste-related risks.
Programs, Projects, and Activities (PPA)	**1.3.1** Stakeholder forum on recycling and waste management solutions **1.3.2** Enhancement of community- based recycling and waste management initiatives.

To promote community-based recycling and waste management initiatives in high-risk barangays. To support this objective, PPA 1.3.1 involves the conduct of a stakeholder forum that brings together members of the Barangay Disaster Risk Reduction and Management Committees (BDRRMCs), youth groups, and micro, small, and medium enterprises (MSMEs). PPA 1.3.2 focuses on conducting an audit of existing Material Recovery Facilities (MRFs) and barangay-led recycling efforts in the same target areas.

TABLE X
ACTION PLAN FOR GOAL 2 OBJECTIVE 2.1

Goal 2	Enhance community resilience by strengthening local capacities in disaster preparedness, response, and recovery to minimize the impact of volcanic eruptions, typhoons, and dengue outbreaks.
Objective 2.1	To reduce the community's vulnerabilities on volcanic hazards, typhoon and dengue outbreak through enhanced community based DRRM intervention
Outcome	Enhanced community based DRRM interventions have resulted in increased community capacity to prepare for, respond to, and recover from volcanic hazards, typhoons, and dengue outbreaks, leading to reduced vulnerabilities..
Programs, Projects, and Activities (PPA)	**2.1.1** Strengthening BDRRM Councils through Comprehensive DRRM Training **2.1.2** Strengthening Local Preparedness through CP formulation and simulation drills **2.1.3** Training of Trainers for BHWs on health promotion and education. **2.1.4** Proposal development of mobile health unit

PPA 2.1.1 focuses on strengthening BDRRM Councils by providing comprehensive DRRM training to 23 barangays. PPA 2.1.2 complements this by engaging the same BDRRM Committees in participatory contingency planning, resulting in locally tailored plans. PPA 2.1.3 ensures these plans are tested through barangay-level simulation drills, In PPA 2.1.4, barangay health workers receive training on health promotion and education to address health-related risks during emergencies. Lastly, PPA 2.1.5 involves the development of a proposal for a mobile health unit. This unit will be crucial in supporting the efficient movement of the lone medical doctor between evacuation centers, thereby enabling the rapid detection of dengue-like symptoms among the displaced population in a timely manner.

TABLE XI
ACTION PLAN FOR GOAL 2 OBJECTIVE 2.2

Goal 2	Enhance community resilience by strengthening local capacities in disaster preparedness, response, and recovery to minimize the impact of volcanic eruptions, typhoons, and dengue outbreaks.
Objective 2.2	To enhance the capacity of LDRRMO to support and provide quick and timely response to affected population
Outcome	LDRRMO effectively and efficiently delivers immediate relief and assistance to affected populations within 24 hours of a declared emergency
Programs, Projects, and Activities (PPA)	**2.2.1** Creation of an information management database indicating a multi-phase plan for timely and effective delivery of life-saving assistance. **2.2.2** Procurement of Tools and Equipment for Disaster Response 2.2.3 Forging Public-Private Partnerships with Aggregate Industries for Disaster Clearing Operation.

To ensure the timely delivery of life-saving assistance, PPA 2.2.1 details the creation of an information management database with a multi-phase plan that facilitates smooth coordination among local responders, national agencies, and humanitarian actors, ensuring that decisions are based on accurate and updated data. PPA 2.2.2 involves the procurement of essential tools and equipment, will be prepositioned and maintained for immediate deployment during debris clearing and rescue operations. Meanwhile, to ensure sustained efforts, this goal engages the Private Sector through MOU's to activate their support and involvement during large-scale clearing operations.

TABLE XII
ACTION PLAN FOR GOAL 3 OBJECTIVE 3.1

Goal 3	Foster a culture of disaster preparedness and health resilience through risk communication and public education.
Objective 3.1	To intensify community engagement in Climate Adaptation Strategies using online and traditional media channels for IEC campaigns.
Outcome	Strengthened risk communication efforts have resulted in increased public awareness and understanding of volcanic hazards, typhoons, and dengue outbreaks.
Programs, Projects, and Activities (PPA)	**3.1.1** Design and Production of Print and Digital IEC Materials on volcanic hazards, typhoons, and dengue outbreaks. **3.1.2** Establishment of an online community radio program to broadcast disaster preparedness and health promotion key messages.

To foster a culture of disaster preparedness, these initiatives focus on strengthening risk communications to ensure that communities, particularly those in high-risk areas, are well-informed and empowered to take proactive measures before, during, and after emergencies.PPA 3.1.1 targets the design and production of both print and digital Information, Education, and Communication (IEC) materials in key conspicuous areas. an online community radio will also be initiated to share relevant content on disaster preparedness.

TABLE XIII
ACTION PLAN FOR GOAL 4 OBJECTIVE 4.1

Goal 4	Provide swift and effective emergency response based on national standards to support affected populations.
Objective 4.1	To deliver quick and timely life-saving assistance including provision of prepositioned supplies to the affected population within 24 hours of the disaster response.
Outcome	100% of affected populations receive life-saving assistance within 24 hours of a disaster, resulting in minimized immediate suffering

Programs, Projects, and Activities (PPA)	**4.1.1** Deployment of Emergency Medical Tent Facility **4.1.2** Emergency Cash-for-Work Program for Debris Clearing and Evacuation Center Support.

To ensure that LDRRMO delivers swift and effective life-saving assistance to affected populations, this goal includes deployment of an Emergency Medical Tent Facility to serve as a temporary medical station in evacuation centers. To address the economic impact of the disaster, PPA 4.1.2, involves the implementation of an Emergency Cash-for-Work Program, aimed at providing immediate short-term income to at least 80 disaster-affected heads of households.

TABLE XIV
ACTION PLAN FOR GOAL 5 OBJECTIVE 5.1

Goal 5	Promote Sustainable Recovery and Livelihood Rehabilitation by restoring economic activities, supporting displaced families, and fostering long-term resilience through livelihood programs.
Objective 5.1	To implement income-generating programs, skills training, and financial assistance initiatives to help affected families regain economic stability.
Outcome	At risk families have established sustainable livelihoods through participation in income-generating programs, skills training, and financial assistance initiatives, resulting in long-term economic stability and reduced reliance on external aid.
Programs, Projects, and Activities (PPA)	**5.1.1** Provision of Cash Grants and Formation of Community-Based Savings Cooperatives. **5.1.2** Formation and Capacity Building of Local Savings and Loan Associations **5.1.3** Implementation of Barangay-Based Income-Generating Projects (e.g. soap making, food processing, hydroponic farming)

To promote sustainable recovery and livelihood rehabilitation. This intervention focuses on the formation and capacity building of local savings and loan associations for women. There will also be barangay-based income generating projects that do not just aid economic support needed by the affected population but also addresses their water, sanitation and health needs as well as nutrition efforts.

IX. CONCLUSION

This action plan presented a localized Multi-Hazard Response Plan for Sto. Domingo, Albay, addressing the municipality's vulnerability to volcanic eruptions, typhoons, and dengue outbreaks. The plan is structured around the four thematic areas of disaster risk reduction and management: prevention and mitigation, preparedness, response, and rehabilitation and recovery. It integrates risk assessments, stakeholder consultations, and community-driven recommendations to create an actionable framework. Key interventions include legislative reforms, community-based dengue prevention strategies, risk communication campaigns, and livelihood support programs. Each intervention is supported by a results-oriented Monitoring and Evaluation (M&E) framework to ensure accountability and measurable outcomes. The plan ultimately aims to strengthen local capacities and reduce vulnerabilities through coordinated, evidence-based, and inclusive disaster risk reduction strategies.

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