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## CLIMATE RISK ANALYSIS ON THE FOOD SECURITY IN SAGUDAY, QUIRINO PROVINCE

### POLICY SITUATION

Saguday is a 5th class municipality of Quirino Province. The 9 barangays of Saguday namely – La Paz, Cardenas, Salvacion, Santo Tomas, Rizal, Tres Reyes, Dibul, Cardenas and Gamis – are all vulnerable to climate change and calamities, not only because of the scarce resources of the municipality, but also due to the geographical and climatological condition of the area. Rainfall rates are projected to increase due to climate change and there will also be some likely increase in mean maximum tropical cyclone wind speed due to the projected 21st century warming (Knutson et al., 2010). Its location in Quirino Province places Saguday within the biggest watershed area in the region. Both observational data and modelling projections show that with climate change, wet regions will generally (but not universally) become wetter. Crop production in Saguday may also be affected biophysically by meteorological variables including rising temperatures, changing precipitation regimes, and increased atmospheric carbon dioxide levels. As socio-economic factors influence responses to changes in crop productivity with price changes and shifts in comparative advantage, a 5th class municipality with scarce resources can be very vulnerable to the effects of climate change. This present study identifies the climatological problems and difficulties confronting the municipality.

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A policy framework has been formulated to help address the projected impacts of climate change faced by the citizens of Saguday and other stakeholders including the effect on food production. This study is valuable and beneficial not only to the policy-making bodies/institutions, but also to other communities which are vulnerable to climate change.

## 1. TO WHAT CLIMATE RISKS, HAZARDS, AND VULNERABILITIES WILL THE MUNICIPALITY OF SAGUDAY BECOME EXPOSED?

Both the probabilistic and deterministic simulation models were used in determining risk parameters such as hazard, vulnerability, and exposure. The indicators (tropical cyclone, drought, and flood for hazard; human development index for vulnerability; and population for exposure) were the inputs both in the probabilistic and controllable models. Data and other information used in this study were provided by the United Nations International Strategy for Disaster Reduction, Institute of Social Order, Ateneo De Manila University, Manila Observatory, and Municipality of Saguday in Quirino.

For the hazard studies, 1000 simulation experiments (applying the Monte Carlo Method using the MATLAB software) were performed. The results suggest an increase in the number of tropical cyclones that would enter the Philippine Area of Responsibility (PAR) and would stay here for five (5) days. These tropical cyclones would place the nine (9) barangays of the Municipality of Saguday at a vulnerable situation. It is projected that an average of  $32.63 \approx 33$  tropical cyclones will enter the PAR within the year: 6 Tropical Depressions (TD); 10 Tropical Storms; 14 Typhoons; and 6 Super Typhoons. There would be 20 floodings and each would last for 3 days. And for the droughts, 5 events are projected, and each would last for 3 days.

To calculate the optimum number of people who would be exposed to the hazards, another 1000 simulations were performed. The population of Saguday as of 2009 was 15,392. Results of the simulation indicate an exposure value for 17,023 individuals, meaning that

all the residents of Saguday would be exposed.

For estimates of the vulnerability of Saguday to hazards, the simulated Human Development Index value was 0.77, which suggests that the municipality of Saguday is at the medium level (0.500-0.799) in terms of growth and progress (Virola & Martinez, 2007). This result indicates that in general, Saguday seems to have enough resources and capabilities to withstand a natural calamity.

## 2. WHAT ARE THE PROJECTED COSTS OF THESE HAZARDS IN TERMS OF CASUALTIES AND MONEY?

Kingsbury (2008) found that most private and government-run health insurance plans worldwide use an international standard equating human life to \$50,000.00 (around PhP 2,100,000.00 at 1 USD = PhP 42). The equation is normally applied only in instances resulting to a fatal outcome.

In 2009, the Comprehensive Land Use Plan (CLUP) of the Province of Quirino registered a total collection of PhP 31,575,441.91 for the Municipality of Saguday. Applying the 1991 Local Government Code stipulation of utilizing 5% of the total revenue for calamity fund translates to PhP 1,577,782 or less than PhP 19.00 per capita allotment for worst-case scenarios.

## 3. WHAT AREAS IN SAGUDAY ARE MOST SENSITIVE TO THE HAZARDS?

Extant data collected indicate that Saguday has been experiencing disasters (e.g. Tropical Cyclones, floods, droughts) for the last ten years. This scenario is also reflected in the hazard modelling data and later confirmed by the records of the

National Disaster Risk Reduction and Management Council (NDRRMC).

Using the Geographic Information System (GIS) Modelling, the three parameters of risk (hazard, exposure and vulnerability) were mapped to identify the most vulnerable areas of Saguday during climate change events. The risk rank system was utilized to determine the barangay with the highest risk by providing the order of the most susceptible areas during extreme perils. This information is vital in planning appropriate responses to calamities and the maximum use of meagre resources.

Results of the exposure modelling exercises show how differently each barangay of Saguday is exposed to hazards. La Paz, Rizal and Magsaysay are the 3 barangays projected to be the most exposed to hazards while Cardenas, Gamis and Tres Reyes are the least exposed. The intensity of exposure to hazards of the different barangays follows this sequence:

La Paz = Rizal = Magsaysay > Salvacion = Santo Tomas = Dibul > Cardenas = Gamis = Tres Reyes.

Based on the vulnerability simulation exercises, Tres Reyes is the most vulnerable to hazards because it has the lowest capacity amongst the 9 barangays to respond to the projected hazards. Rizal, Gamis, Dibul and Cardenas are the most capable of the 9 to respond to hazards and thus the least vulnerable. The sequence of vulnerability of the 9 barangays is as follows: Tres Reyes > La Paz > Magsaysay = Santo Tomas > Salvacion > Rizal = Gamis = Dibul = Cardenas.

This risk model is the outcome of the integration of hazard, exposure and vulnerability models. Based on the modelling results, the barangay most at risk or the “hotspots” during disaster and climate change modulations are the barangays of La Paz, Magsaysay and Rizal. The projected risks involve life, property, and livelihood and food security of the residents of Saguday. The barangay with the highest risk factor is listed in a decreasing sequence:

La Paz = Magsaysay = Rizal > Dibul = Salvacion = Santo Tomas > Cardenas = Gamis = Tres Reyes.

Data shows that although Rizal, Magsaysay and La Paz have the argest population among the barangays of Saguday, they also have the least capacity to respond to climate hazards. These combined put them at a higher risk than the other barangays

#### 4. WHAT APPROACH IS MOST APPROPRIATE FOR SAGUDAY IN ORDER TO MITIGATE THE IMPACTS OF CLIMATE CHANGE?

As a response to climate change and the extreme events observed in Saguday, a municipal disaster preparedness plan was developed. This plan focused on how stakeholders would play strategic roles during disasters. The Municipal Disaster Coordinating Council also prepared a contingency plan for typhoons to help the entire community strengthen their disaster control capability. Nevertheless, climate change is predicted to increase not only in frequency but also in the intensity of hazards. It is timely that the municipality of Saguday update their disaster risk management program to compensate for the effects of climate change.

The outputs from the Risk Assessment were further evaluated for policy formulation and evaluation through consultations in the form of interviews with local heads and focus group discussions with the officials of each barangay. The existing disaster management strategy essential to a community was checked for conformity with local and international laws. Based on the results of consultations with the community leaders, the following are recommendations on policy formation:

**Table 1. Proposed Disaster Risk Management Program Policy Recommendations for the Municipality of Saguday.**

POLICY ISSUES	RECOMMENDATIONS
Lack of Infrastructure	Improve flood control system; construct food storage facilities; install weather monitoring facilities.
Capacity Building	Improve environmental education; build staff capacity and infrastructure to implement flood warning system; build capacity in weather forecasting; install hydro-climatic network monitoring; strengthen commodity value chains and find new markets; build knowledge and capacity in adaptation to climate change impacts.
Policy Development and Implementation	Design and implement zoning regulations and building codes; inter-sectoral allocation; facilitate access to credit; water conservation and demand management (including metering and price structure); compensation for flood damages; develop coastal resource management plans at the barangay levels.
Adaptation of Best Practices	Incorporate risk assessment and mitigation information system into micro-watershed management plans; implement rainwater harvesting.

#### POLICY RECOMMENDATION

The results of the present study indicate the vulnerability of the municipality of Saguday in Quirino province to climate hazards, i.e. typhoons, flooding, and drought. The forecast in this study derived through modelling and simulations are comparable with those reported by the National Disaster Risk Reduction and Management Council (NDRRMC). It was projected at the time of the study that Saguday will experience 33 typhoons with 20 flooding that would stay 3 days per flooding. Five drought occurrences with duration of 2 days each have also been projected. When the projected disasters occur, food production, which is the main source of livelihood of the province,

will be affected. To decrease the vulnerability of Saguday to the effects of climate change, it is recommended that infrastructure support to coastal resource management be improved, and technical capacity building be conducted to improve weather surveillance, disaster preparedness and environmental infrastructure. Environmental policy implementation should be enhanced, and best practices to alleviate the impacts of climate change should be incorporated into the governance and management of Saguday.

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