

Environmental Monitoring Technology Transfer in Bicol, Luzon

*A sharing of experiences between China and Philippines
on geohazard early warning system (EWS) and mitigation*

Mission Report

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to

United Nations Development Programme
Oxfam – Great Britain
Local Government Units of Albay, Sorsogon and Infanta, Quezon
Philippines

June 8, 2007

1. Introduction

From 24 May – 1 June 2007, three scientists from the Chinese Academy of Sciences (CAS) in Beijing, China, conducted a field mission to the regions of Bicol and Infanta, Quezon, the Philippines to explore the possibility of technology transfer between China and the Philippines in environmental monitoring for geohazards at the local community level. This report documents the mission activities and findings, as well as the recommendations of the international and national consultants.

2. Background

With more than 270 volcanoes, of which 22 are active, the rugged topography of the Philippines has frequent earthquakes and heavy rainstorms, where annual precipitation totals 1000-4000 mm, of which 38% result from tropical cyclones / typhoons. These natural events, made increasingly severe by climate change, cause the Philippines to be particularly prone to catastrophic geohazards, including flooding, debris/mud flows and landslides. In February 2006, a disastrous rockslide-debris avalanche occurred in tropical mountain terrain on Leyte Island. Over 1100 people perished when the village of Guinsaigon was overwhelmed directly in the path of the landslide.

The Bicol region of the Philippines is struck each year by several different geologic hazards. In the last quarter of 2006, the region was hit by four super typhoons, causing major destruction particularly in the Bicol provinces of Albay and Sorsogon. The arrival of Super Typhoon Reming (Durian) to Bicol on November 30, 2006, resulted in 466 mm of rainfall within a 12-hour period over Mayon Volcano, whose soils were already saturated from the rains of earlier typhoons. What then resulted were major lahars and floods in river channels that devastated downstream communities with burial and washout, taking the lives of some 1200 people.

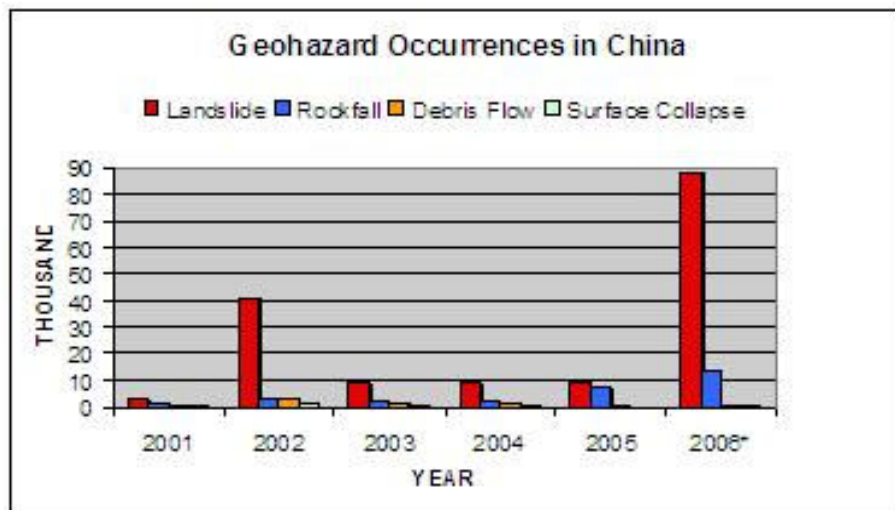
Local communities in the Bicol region have expressed real concern that loss of life will again occur this year, as the torrential rains trigger the geohazards so prevalent in the region around the active volcanoes of Mt. Mayon in Albay and Mt. Bulusan in Sorsogon.

In China, the Ministry of Land and Resources (similar to the Mines and Geosciences Bureau, MGB/DENR in the Philippines) takes the responsibility of mitigation of geologic hazards. As China has a vast territory with numerous geologic hazards, including landslides, rock falls and debris flows that occur every year, it is not possible to adopt engineering solutions or professional instrumental monitoring for each landslide or debris flow, as professional human and financial resources are limited. In 1999, China began an open mitigation policy that engaged participants from the grassroots communities to monitor their own local geohazards. This approach has produced positive results over the last 8 years with a reduction in loss of life.

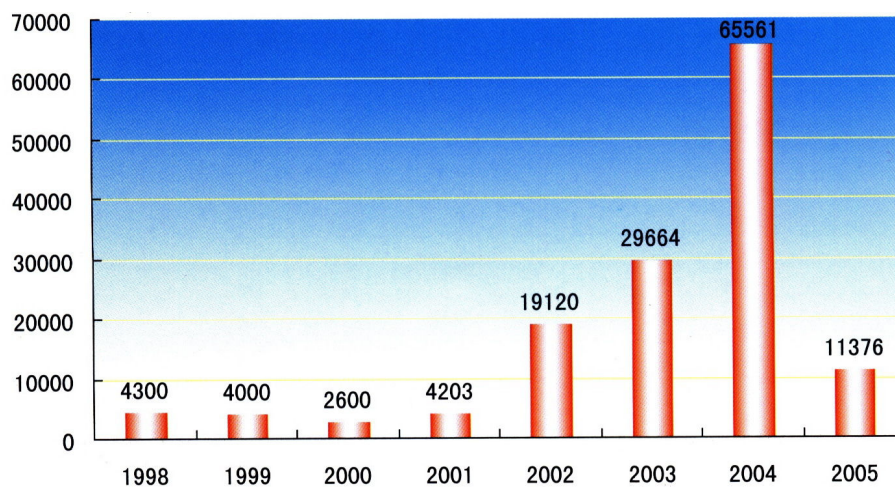
Graphs 1-3 (below) present the geohazards record for China over the last 5-7 years. Considering the frequency of these hazards every year, the loss of life from geohazards is

remarkably low. China began its national recording of occurrences of geohazards in 1999. It took several years before the government systematized their recording of these occurrences, as statistics for geohazards involved the training over the years of a large number of grassroots observers.

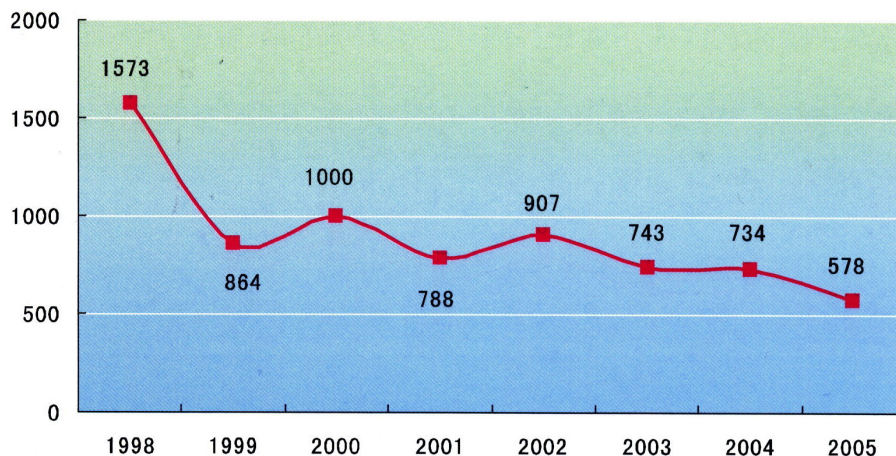
The Chinese experience with geohazards mitigation has shown that engaging local community participation in monitoring environmental changes related to geohazards effectively contributes to reducing the impact of these hazards.



Graph 1 shows the occurrences of geohazards in China. Note that the devastating weather events of 2006 caused a sharp increase in the number of landslides.



Graph 2 shows the total number of persons evacuated each year in China due to the imminent danger of geohazards.



Graph 3 gives the annual loss of life in China from geohazards. For the last two years of 2005 and 2006, the number of deaths fell below 700, despite the sharp rise in 2006 where over 88,520 landslides occurred.

Due to the positive experience of China in dealing with geologic hazards, UNDP-Philippines, in partnership with Oxfam – Great Britain and the Provincial Government of Albay, invited Chinese scientists from the Chinese Academy of Sciences (CAS) in Beijing, to conduct a mission / field visit to the Bicol Region and Infanta, Quezon, the Philippines from May 24 to June 2, 2007. Specific outputs of the CAS team visit were:

- (a) On-site sharing of Chinese experiences with Local Governmental (LGU) officials regarding Early Warning System (EWS) and mitigation of geologic hazards;
- (b) Briefings by the Chinese scientists on their findings and recommendations to all concerned stakeholders, both at the local and national levels;
- (c) Preparation of a report on field observations based on the areas visited, with appropriate recommendations in the context of the Philippines setting.

3. Mission Itinerary and Activities

This mission / field visit to the Philippines covered the following itinerary and activities:

ITINERARY

DATE	ACTIVITY	LOCATION	OUTCOME
May 24, 2007, Thursday	•Arrival of Chinese CAS scientists from Beijing	Manila	- CAS experts briefed on the history and geohazards of the Philippines
May 25, 2007, Friday	•Air travel to Legaspi City •(am) Meeting with LGU representatives (Albay's	(am) Albay's Provincial Disaster	- (am) CAS team briefed on Mt. Mayon lahar flow & flood disaster of Nov. 30, 2006 + future hazards

	<p>PDCC Cedric and Mayor of Sorsogon City) (am); briefed by Mines and Geosciences Bureau staff Arlene Dayao</p> <ul style="list-style-type: none"> •(pm) Drive to Sorsogon to meet with PHIVOLCS scientists and visit PNOC's Geothermal site 	<p>Operation Center in Legaspi City and (pm) in Sorsogon</p>	<ul style="list-style-type: none"> - (pm) Visited Sorsogon's PHIVOLCS monitoring station and briefed there on Mt. Bulusan's eruptive activity - Drove to the BacMan Geothermal Production Field near Mt. Bulusan to share power point presentations (PPTs) and visit boiling hot springs
<p>May 26, 2007, Saturday</p>	<ul style="list-style-type: none"> •Continuation of area visit around Mt. Bulusan, including lahar/debris flow within the 4 km danger zone. Hot, warm and cold springs also visited, within 4-6 km of the volcanic cone. •Drive from Sorsogon City to Legaspi at 8:30 pm 	<p>Area around Mt. Bulusan: Puping Sapa - Gupan, Cogon-Irosin lahar flow, San Benon (Phivolcs) –Irosin hot springs, Masacrot & Palagtoc springs, Bulusan Lake; Legaspi City</p>	<ul style="list-style-type: none"> - Interaction with local community residents in and around hazard areas in vicinity of Mt. Bulusan - Assessed hazards around Mt. Bulusan and discussed sociotechnical methods to monitor these hazards - At the lahar flow site, an on-site exchange on early warning system was made regarding mitigation of the future possible lahar flow hazards in that area - Discussed possible relationship between the temperature of hot springs and eruption of the Bulusan Volcano
<p>May 27, 2007, Sunday</p>	<ul style="list-style-type: none"> •Rick Mendoza of Albay's PDCC office lead CAS team to survey areas devastated by lahar flows of 30 Nov 2006 	<p>Albay's Mt. Mayon Volcano</p>	<ul style="list-style-type: none"> - CAS team gain first-hand experience of debris and damage left by lahars flows and floodwaters. Team gains sense of interplay of volcanic activity and typhoon / heavy rains
<p>May 28, 2007, Monday</p>	<ul style="list-style-type: none"> •Continuation of visit to lahar flows and to closest point to view Mt. Mayon • (PM) visit to Travesia Holding Center in Guinobatan 	<p>Albay's Mt. Mayon Volcano: Barangay Maipon, Guinobatan</p>	<ul style="list-style-type: none"> - Visit survivors of the most deadly lahar flows; interview holding center residents regarding their 30 November 2006 experiences and level of alertness prior to flood

May 29, 2007, Tuesday	<ul style="list-style-type: none"> • Visit to MMDA Village, a temporary resettlement in Legaspi City; interview teachers who survived the lahar flows, and 8 MMDA Village block leaders • Meeting at Albay's PDCC Center for presentation of findings by CAS team to various stakeholders 	Legaspi City	<ul style="list-style-type: none"> - Block leaders shared invaluable information on environmental precursors to lahar flows - DPWH staff present 2 plans to resolve crisis in Legaspi City for this year's flood. CAS team listened and discussed at length. - Minutes taken on CAS team and stakeholders discussions by Lt. Colonel Romeo P. Esplana (see Minutes attached to this report)
May 30, 2007, Wednesday	<ul style="list-style-type: none"> • Fly PAL to Manila and then travel by FX to Infanta • Meeting with Mayor Filipina Grace America and Infanta's Municipal Disaster Coordinating Council (MDCC) from 2-7 pm 	Manila to Infanta, Quezon	<ul style="list-style-type: none"> - CAS team briefed on details of 29 Nov 2004 landslide & flood disaster for Infanta, General Nakar and Real, caused by Typhoon Winnie - Lively and keen sharing of info and views between LGU officials and CAS team on landslides and debris flows / dam building in China and in the REINA region
May 31, 2007, Thursday	<ul style="list-style-type: none"> • (am) Drove to areas in Infanta, General Nakar and Real devastated by the 29 Nov. 2004 flooding & landslides • (pm) Back to Manila by FX 	Infanta, General Nakar & Real, and then Manila	<ul style="list-style-type: none"> - Survey damage from 29 Nov 2004 debris flow & landslides in Infanta, Nakar & Real (REINA) - Survivor of Real landslide interviewed & trained (Mr. Faustino M. Bungag of Brgy. Tignoan in Real, Quezon)
June 1, 2007, Friday	<ul style="list-style-type: none"> • Met with UNDP at 10 am in Makati • Traveled to Oxfam-GB office in Quezon City (pm) 	Metro-Manila: Makati and Quezon City	<ul style="list-style-type: none"> - CAS scientists present their findings based on their field visits to Bicol and Infanta, and propose time-sensitive recommendations

4. Findings and Recommendations – by region

4.1 Lahar flow hazard around Bulusan Volcano, Sorsogon

4.1(a) Findings for Mt. Bulusan region

- (i) Crustal stress data is not being used to monitor volcanic activity;
- (ii) Regular measurements of hot spring's temperature taken by PHIVOLCS staff
- (iii) Lahar flow was triggered by Super Typhoon Reming (Durian);
- (iv) Lahar flow resulted fortunately in zero deaths;
- (v) Before the occurrence of the lahar flow, a local resident heard some unusual sounds and then the lahar flow occurred; the unusual sounds were probably caused by initial failure of edifice collapse;
- (vi) Intense erosion occurred in the upper and middle reaches of the channel and deposited lateral levees on both banks of the channel in the middle reaches; deposition also occurred in the lower reaches of the channel.

4.1(b) Recommendations for Mt. Bulusan region

- (i) A systematic survey should be carried out along the channel and cross-profiles to evaluate the volume changes along the travel path. This can provide some basic input for numerical modeling of lahar flow hazards and for back analysis of some important parameters inherent in lahar flow modeling;
- (ii) The timing of lahar flow occurrence in the past and rainfall records should be analyzed together in detail so that rainfall threshold for the occurrence of lahar flows can be established. Knowledge of the rainfall threshold is essential in developing an early warning system;
- (iii) For the local communities located in the lower or middle reaches of the lahar flow channels, ultrasonic monitoring instruments can be installed in the channel's upper reaches, with the monitoring signals being transmitted in real-time to the local communities so that they can evacuate just before the arrival of the destructive lahar flows;
- (iv) Crustal stress readings can clarify the relationship between changes in stress and volcanic activity in the region; local LGU staff and PHIVOLCS volcanologist(s) would benefit from future trainings on the crustal stress method;
- (v) Develop closer ties with Albay's Provincial Disaster Operation Center, so that the strengths and weaknesses of Sorsogon and Albay can complement each other to enhance the disaster resilience of both volcanic regions;
- (vi) Set up community-managed local networks to monitor for changes in the environment related to volcanic activity and debris/lahar flows:
 - Additional sites for crustal stress and geomagnetic monitoring would strengthen the LGU's ability to prepare for geohazards, especially volcanic activity;

- Grassroots monitoring of hot, warm and cold spring changes in temperature, water flow, water quality, etc., is useful, especially when these changes are networked and related to the volcanic and seismic activity in the region; note also environmental changes in the area of Bulusan Lake;
- (vii) Conduct public education campaigns to raise people's awareness on environmental changes and hazard risk reduction/preparedness measures.

4.2 Lahar flow and flooding hazards around Mayon Volcano, Albay

4.2(a) Findings for Mt. Mayon region

- (i) Sorsogon's crustal stress data is not being used in monitoring for volcanic activity
- (ii) Three days prior to the deadly lahar flow and floodwaters, residents of Barangay Maipon in Guinobatan heard rumblings of Mt. Mayon;
- (iii) Lahar flows in the upper reaches and floods in the middle and lower reaches of the channels were triggered by Super Typhoon Reming (Durian);
- (iv) Intense erosion occurred in the upper and middle reaches of the channel and deposited lateral levees on both banks of the channel in the middle reaches; deposition also occurred in the low reaches of the channel;
- (v) The bridges along main roads do not have enough space for flood waters to pass through smoothly, thus resulting in overflow of the floodwaters;
- (vi) The Albay Provincial Disaster Operation Center was not able to receive real-time rainfall data recorded by the local weather station;
- (vii) People knew that a super typhoon was coming, but they did not know of the possibility of floods; the PDCC expected and warned of flooding, but not of the magnitude that resulted;
- (viii) Brown out of electrical power from damage by previous typhoon(s) prevented many from access to TV and radio news on incoming Super Typhoon Reming and on possibility of floods; the PDCC is now encouraging use of battery-powered radios for hazard preparedness;

4.2(b) Recommendations for Mt. Mayon region

- (i) At present, the most important task is to prepare a detailed plan and map of emergency response and evacuation paths so that local government agencies can minimize the possible hazards in case of emergency, since the rainy season is coming soon;
- (ii) A systematic survey should be carried out along all dangerous channels and across-profiles to evaluate the volume changes along the travel path of the lahar

flow or floodwater. This survey can provide some basic input for numerical modeling of lahar flow and flood hazards that will provide spatial and temporal distribution of flow velocity and flow depth;

- (iii) The time of occurrence of past lahar flows and floods and rainfall records should be analyzed in detail, so that rainfall threshold for the occurrence of lahar flows and floods can be established;
- (iv) A detailed study should be carried out to assess the possible hazardous area with various return periods, for example, 20-, 50- and 100-years. This study would delineate the possible extent of area affected by geohazards over the different time periods, and would provide very useful input for land use planning and development;
- (v) The possible maximum discharge of flood water encountered with various return periods should be estimated so that the channels can be deepened and widened accordingly to contain the maximum discharge of future lahars and floods. Normal maintenance of channels, such as clearance of deposits in the channels, should be carried out whenever a lahar flow or flood occurs.
- (vi) Since the low-lying areas are active or potentially active for hazards, heavy rains, channel blockages, and/or bank failures can result in avulsions (new and unwelcome channeling of waters) and/or debris torrent or floods into these areas. Lands, infrastructure, and people occupying these areas are at risk during extreme events. The governmental agencies should map these areas in detail so that local communities can be aware of these risks when planning development. A procedure for assessing the risk from lahar flows and floods should be proposed by the responsible agencies (Mines and Geosciences Bureau (MGB) and PHIVOLCS?) and implemented by Planning and Water Conservancy agencies;
- (vii) The Albay Provincial Disaster Operation Center should develop a preliminary early warning system, in collaboration with local weather stations and other related governmental agencies. Rainfall data should be shared in real-time within inter-governmental agencies. Rainfall threshold for the early warning system should be refined after a major lahar flow or flood hazard occurs;
- (viii) Develop closer ties with the LGU of Sorsogon, so that the strengths and weaknesses of Albay and Sorsogon can complement each other to enhance the disaster resilience of both volcanic regions; included is regular access to Sorsogon's crustal stress data for monitoring the activity of Mt. Mayon;
- (ix) Set up community-managed local networks to monitor for changes in the environment related to volcanic activity and debris/lahar flows. Additional sites for crustal stress and geomagnetic monitoring would strengthen the LGU's ability to prepare for geohazards, especially volcanic activity;

- (x) Make use of your invaluable pool of experiential knowledge: the survivors of the November 30, 2006, lahar flows and floods have precious first-hand observations on precursory signals to the floods, as well as know-how on ways to survive such events (see section 6 below);
- (xi) Consider the proposal put forth at the stakeholders meeting in Legaspi City on May 29, 2007 (see attached Minutes), which suggests a plan to harness the energy and labor of the flood survivors and others in Legaspi City;
- (xii) Conduct public education campaigns that include the survivors of the November 30, 2006, disaster to raise people's awareness on environmental changes and hazard risk reduction/preparedness measures.

4.3 Landslide hazards in Infanta, Quezon

4.3(a) Findings for Infanta region

- (i) Some time (days to 1-2 weeks) prior to November 29, 2004, the crustal stress instrument located in the ground level of Infanta's Municipal Hall recorded an unusually large signal, indicating stress changes in the earth's crust;
- (ii) During the night of November 29th, prior to the landslides occurring, local residents observed animals behaving abnormally;
- (iii) Typhoon Winnie dropped about 370 mm of rainfall on Infanta during November 29, 2004, causing numerous landslides, predominantly natural terrain landslides;
- (iv) The river upstream was dammed briefly, which then broke causing devastating floodwaters downstream;
- (v) About 1000 lives were lost due to the landslides and flooding from the heavy rains;
- (vi) Most of the landslides were of small size in volume, ranging from several m³ to hundreds m³, and had a shallow failure depth varying from less than 1 m to 3 m;
- (vii) The most deadly landslide had a failure volume of some 2×10⁴m³, and traveled a long distance, resulting in 111 deaths;
- (viii) Many years ago, cracks were observed at the crown of this deadly landslide, and no simple measurements were made by local communities to monitor the development of these cracks;
- (ix) A basic early warning system has since been setup, which includes river level measuring points and an automatic rain gauge powered by solar panels;
- (x) LGU officials are concerned about possible dam-building activities in their region that might cause an increase in risks from geohazards.

4.3(b) Recommendations for Infanta region

- (i) Landslide susceptibility mapping should be carried out based on landslide inventory map; and this landslide inventory map can be produced by aerial photograph or high-resolution satellite image, such as QuickBird or IKONOS, interpretation;
- (ii) The timing of landslide occurrence and rainfall data should be analyzed in detail to derive rainfall threshold for landslide occurrence. On this basis, a local landslide early warning system can be developed;
- (iii) Local communities located at the toe of a slope should be requested to screen if there are any cracks at the crown of and on the slope. Simple monitoring of these cracks and other changes in the slope characteristics could be carried out by local residents to have them know of possible future development of a landslide. If the slope is considered to be highly susceptible to landsliding, then the local communities below should be evacuated during and shortly after heavy rainstorms;
- (iv) On additional activities that local communities can engage in:
 - (a) Hold regular tests/drills of contingency plans at the community level;
 - (b) Encourage community-managed environmental monitoring using simple approaches, tools and easy-to-operate instruments, e.g., crustal stress;
 - (c) Interview/canvas the elderly and farmer/fisherfolk for old sayings/tales and document the experiences of those who have survived landslides/floods;
 - (d) Increase peoples coping capacity by appropriately training them for their survivability and readiness; standard operating procedures must be known by the people and implemented appropriately by local officials, e.g., run sideways from the direction of an oncoming landslide to escape burial.
- (v) On municipal/city construction and planning - One of the most effective measures for hazard reduction is to build hazard-resistant structures in appropriately safe and secure locations.
- (vi) With regard to dam building, any faulting present must be assessed as to the date that the fault last moved. In China, dams can be built on inactive faults, i.e., faults that have had no earthquake activity for the last 180,000 years. However, if a fault is active, i.e., has experienced displacement in the last 10,000 years, then this fault must be examined/studied in great detail before any construction is permitted on it.
- (vii) On hydroelectric power plants – Building such a plant can be an effective measure to mitigate flood hazards if considerable research and geological exploration work are carried out to determine the appropriate location of such a plant. Chinese scientists and engineers have extensive experience on building

hydroelectric power plants in seismically active areas.

5. **Additional Recommendations** – by topic, for areas with active volcanoes

5.1 On early warning systems (EWS)

- (a) Make a special topographical map on mudflow area (1:2000)
- (b) Design and set up monitoring system
- (c) Set up early warning systems

5.2 On mitigating hazards

- (a) Formulate regulations on mitigating hazards - Mitigating hazards is one of the most important factors in developing a city plan. Evaluating hazards before the construction of buildings is necessary.
- (b) Make a land use plan for the city.
- (c) Conduct research to develop the best structures to withstand the destructive force of geohazards that are also reasonably priced.
- (d) Strengthen collaboration among key players in geohazard mitigation, i.e., public administrators, scientists and local communities. Each player should understand each other in their respective roles in mitigating hazards and providing support to each other:
 - (i) *Administrators* - make decisions and organize the mitigation of hazards;
 - (ii) *Scientists* - conduct professional monitoring, scientific analysis and provide recommendations to help administrators make their decisions. Scientists also teach local communities basic knowledge on hazard recognition/mitigation;
 - (iii) *Local communities* – play a major role in helping administrators mitigate hazards and can support scientific research by monitoring the local environment. Communities can create local solutions for hazards with the help of scientists.
- (e) Every key player (i)-(iii) has their limitations, and by complementing each other's roles, the individual players are strengthened and thus the entire team becomes stronger. The following are the identified limitations:
 - (i) *Administrators* have limited time to analyze data and do not know how to forecast hazards. They typically work far away from the hazard site areas;
 - (ii) *Scientists* have advanced techniques and scientific theories to correctly assess a developing hazard. However, they lack information specific to the hazard site;

- (iii) *Local communities* have limited knowledge/theory on forecasting hazards, but they are in proximity to the hazard site(s) and have more information about their area than either scientists or administrators.

5.3 On excavating channels for lahar flow and floodwater control

- (a) Harness the physical attributes of volcanoes as resources -

Volcanic debris consists of fine material, e.g., ashes, as well as coarse material, e.g., rocks/stones/boulders. During the rainy season, the finer materials will be washed away by the floodwaters. So, the main excavation effort before the rains begin should be focused on simply removing the rocks/stones/boulders. By so doing, we pave the way for the finer debris material to be transported by natural water forces down slope to low-lying areas/sea. Also, the rock boulders of volcano can be used to build dikes along the river.

- (b) The stone basket wall/dike is a good choice of river dike structure -

This structure is widely used for construction of river dikes in Europe and in China. It has several advantages:

- (i) The stone basket wall design is easy to make as it does not require engineering skills. Thus, a community can be mobilized to build this kind of dike;
 - (ii) This structure is very stable, permanent and economical;
 - (iii) It is environmentally friendly because it encourages the growth of vegetation.
- (c) This structure can be used as a demonstration engineering design model in the context of a volcano, which can then be replicated elsewhere;
 - (d) Important details for implementation of these recommendations are contained in the attached minutes for the stakeholders meeting in Legaspi City on May 29, 2007.

5.4 On harnessing hazards for eco-tourism and city development

Harnessing hazards to develop the eco-tourism industry should be an important development direction in areas with active volcanoes.

- (a) The combination of a volcano, typhoons and lahar/debris flows provide a special kind of tourist attraction rarely available in the world.
- (b) Use this resource to attract curious tourists and scientists from all over the world, especially from China.
- (c) Note, however, that to attract tourists, the area must first have a way to mitigate these hazards. Thus, mitigating hazards is essential to developing a viable eco-tourism industry in the Bicol region.

- (d) Land use planning and the sound construction of city buildings are very important factors in mitigating hazards and therefore are also fundamental to developing the eco-tourism industry.

6. Survivor Accounts / Observations and Recommendations

6.1 Environmental Changes

On Tuesday, 29 May 2007, we visited the MMDA Village, a temporary resettlement village in Legaspi City built by Bayani Fernando and MMDA employees for the survivors of the November 30, 2006, catastrophic lahar flow and flooding in Legaspi City. We were able to talk with two teachers and with eight of the 38 block leaders of this resettlement village. All had survived the disaster not because they had evacuated in time, but because they saw and noted environmental signs alerting them to something unusual in the imminent future. All 8 block leaders had this information to share:

- A very distinct rainbow pattern encircled the sun weeks before the typhoon. In fact, this circular rainbow pattern persisted during the daytime from 1-30 November 2006, and during the nighttime the block leaders saw it around the moon. The eight block leaders all noticed this phenomenon, and they said that Super-Typhoon Reming (Durian) was the only typhoon they noticed that had this precursor!
- 1-2 weeks before the catastrophic lahar flows and flooding occurred, people were crying and dogs were howling. The old folk in their community have a saying that when people cry and dogs howl, a typhoon and /or floods will happen;
- 1 week before the super typhoon, the leaves of the coconut trees were bending towards the ground;
- Chickens were quiet and hiding under the houses;
- One week before the super typhoon triggered the lahar flows and flooding, agricultural crops in their flowering stage were breaking, e.g., for coconut trees and vegetable crops, the leaves did not drop, they just broke. Bamboo shoots were breaking without any presence of wind!
- The pattern and shape of the clouds were unusual; the local people have noted that when clouds move towards Mt. Mayon, volcanic activity is going to occur, while if the clouds move away from Mt. Mayon, another type of calamity is about to occur...
- Just minutes before the floodwaters arrived, several different families noted the strong and unusual smell of sulphur in their area of Padang;

One of the 8 block leaders, Mrs. Adelfa Arquero of Caloocan Street in MMDA Village, is a two-time survivor of catastrophic flooding. Her first disaster was on December 20, 1993, when floodwaters from heavy rainfall drowned her home. Mrs. Arquero is sure that she has survived

up to now because she knows the signals of the earth alerting her to imminent disaster.

6.2 Local Community Monitoring of the Environment

Recommendations

(1) Encourage/organize/empower the survivors at the holding centers and resettlement villages to canvass/interview each other, so that environmental signals observed prior to the November 30, 2006, lahar flow and floods are documented. The schoolchildren there could help to put these phenomena into visual/picture form. Such documentation would recover/discover valuable disaster-related information that would otherwise be lost to humanity. For those indicators that the survivors feel were observed by many people, sharing these indicators with others may actually make difference for future victims of geohazards.

(2) There were survivors who did not heed Albay PDCC's call to evacuate before Super Typhoon Reming, as they had weathered through the other two previous Category 5 super typhoons. None of them had the faintest idea of the complete destruction and death that Typhoon Reming would cause, and certainly no sense of the cumulative danger caused by the heavy rains over time that had saturated their soils. Such basic knowledge on the role of water seeping into the ground is now being given to large numbers of China's grassroots living in geohazard-prone areas. The well-developed Chinese geohazards education program provides interested and concerned local people with the knowledge and techniques to monitor for geohazards. *A timely visit to China is important to learn and experience what has proved very successful for local communities there in geohazard risk reduction.*

7. **Acknowledgements**

This mission would not have been possible had it not been for the vision and commitment of the following individuals: Kyo Naka and Amelia D. Supetran of UNDP-Philippines, John Ievers of Oxfam-GB, Governor Sally A. Lee of Sorsogon Province, Mayor Filipina Grace R. America of Infanta, Quezon, Cedric D. Daep of Albay's Provincial Disaster Operation Center and Rusty Binas of CORDAID-Netherlands. Their support, enthusiasm and focused attention to advancing community-managed disaster risk reduction (CMDRR) were pivotal in creating this successful mission.

The spirit of volunteerism was evident throughout this mission, as exemplified by our consultant Rusty Binas and our local Pilipino hosts. On China's part, the pro-bono expertise provided by the CAS geohazards team during this ten-day mission could not have come about without the generous support of our institutes at the Chinese Academy of Sciences in Beijing, China. The real goal of this mission is to generate south-south CMDRR projects in the near future that cause a reduction in loss of life from geohazards ***this year*** in the Philippines. Welcome are you to join us in forwarding this mission!

Minutes

Topic: Findings of UNDP Mission Experts from China on Geohazards in the Bicol Region of Albay, Philippines

Venue: Conference/Briefing Room, Provincial Disaster Coordinating Council Legazpi City, Albay, Philippines

Date/Time: Tuesday, 29 May 2007, from 3:00 to 5:00 PM

I. ATTENDANCE

A total of eleven (11) people attended this dialogue/briefing, with 6 persons from the local region and 5 from outside Bicol affiliated with international agencies.

Meeting Participants:

Rick Mendoza, PDCC, Albay

Efren Mendoza, Head of PDD's Hydrology Section, DPWH - Regional Office No. 5 (RO#5)

Feliciano Medina, Chief, Mechanical Section, Planning & Design Division, DPWH – RO#5

Lt Colonel Romeo P. Esplana, PA Res, MNSA GSC (Meeting Rapporteur)

Anthony Montenegro, Social Action Center (SAC) of the Catholic Church in Albay

John Abejuro, Social Action Center (SAC) of the Catholic Church in Albay

Lyra U. Magalang, Programme Officer, Humanitarian Program, Oxfam – Great Britain

Rusty Binas, Advisor, CORDAID – Netherlands

Dr. Fuchu Dai, Institute of Geology and Geophysics, Chinese Academy of Sciences

Dr. Shihai Li, Institute of Mechanics, Chinese Academy of Sciences, Beijing, China

Jean J. Chu, Institute of Geology and Geophysics, Chinese Academy of Sciences

II. PROCEEDINGS

1. Rick Mendoza of PDCC for Albay introduced the international mission team members and then briefed all of the meeting participants on the existing plan to change or short-cut the course of the Yawa River Channel. This plan intends to straighten the Yawa river course from Barangay Busay in Daraga town, to pass through the southern portion of Barangay Alcala (also in Daraga Town), the southern part of Barangay Pawa and directly alongside the Chinese Cemetery at Barangay Bogtong in Legazpi City. The plan was made to save Daraga Poblacion from future

mudflows. However, if this plan pushes through, some 15,000 residents will have to be relocated to allow for the conversion of 70 - 100 hectares of residential and farmland area into a new river channel.

2. The three Chinese scientists from the Chinese Academy of Sciences in Beijing, China, presented some lessons learned on geohazard occurrences in China. Powerpoint presentations were made as follows:

2.a. Professor Fuchu Dai, a landslide and debris flow expert and Research Professor in Engineering Geology at the Institute of Geology and Geophysics, Chinese Academy of Sciences, discussed the "Landslide Hazards and Their Mitigation in China". Slide photos of landslide incidents in China were shown including the mitigation measures made.

2.b. Professors Shihai Li and Jean J. Chu, both of the Chinese Academy of Sciences, discussed the "System of Monitoring, Warning and Decision-Making for Mitigating Landslides (MEWS)". The lively discussion which ensued from Dr. Li's power point presentation centered on re-contextualizing hazard areas as regions for eco-tourism industry, where tourists come specifically to Albay so as to view Mt. Mayon and the hazards this majestic volcano presents. By successfully joining our efforts to strengthen Albay's mitigation of geohazards, investors will come, attracted to invest in Albay rather than run away to safer places. China has made major strides in mitigating the risks from geohazards, such that they no longer affect people and communities as severely as in the past.

3. Efren Mendoza, Head of the PDD Hydrology Section, DPWH - Regional Office No. 5, explained that the DPWH is presently doing dredging operations at the various river channels around Mayon Volcano. The Yawa River, a major channel at the southern quadrants of the volcano, overflowed during Typhoon Reming with flood waters that caused the death of so many people and buried in mudflows hundreds of houses. Engr. Mendoza stated that the DPWH is doing the following activities at Yawa River:

3.a. Dredging operations are being conducted at the 11 km length of the Yawa River from the Albay Gulf delta to Barangay Salvacion in Daraga;

3.b. In two (2) week's time, bidding for the various river-control projects will be completed, and contractors will commence works as projects are awarded to them.

3.c. Mega-dikes will not be built because they are very expensive and the government does not have the needed funds.

3.d. Steel-sheet piles will be pile-driven in at critical river bank sections of the Yawa river to protect residential houses / communities from mudflows.

4. Comments were made on other alternative means by which dredging of the Yawa River can be done in a more economical way, engaging the community people as direct participants to the project via a labor-intensive method. In this case, Lt Col Romeo Esplana, who was on observer status at this meeting, raised his hand and said that he had a project proposal for a

labor-intensive method. The international team was interested in his plan and requested that he explain his proposal to them.

5. Lt. Col. Esplana presented the main points of his project proposal on the “Dredging / Deepening of the Yawa River Through Labor Intensive Method “:

5.a. Daraga town, Legazpi City poblacion and their suburban areas and barangays will be buried by about 25-30 million cubic meters of mudflow pyroclastics from the Mayon Volcano, in the event that the Typhoon Reming situation is repeated. With climate change now accepted globally, Super-Typhoons will very likely hit the Bicol Region again in the near future, so the above scenario is likely.

5.b. If and when this happens, a total of about 2,225 hectares (or 22.25 square kilometers) of critical flatlands within the Daraga and Legazpi City poblacions will be buried by mudflow pyroclastics to about 20 feet in depth at Daraga Town side and about 30 feet in depth at Legazpi City side, resulting in major death and destruction. These flatlands are presently thickly populated, and form the hub of investments for trade and commerce in Albay Province.

5.c. Opined that hazards and imminent dangers from the Yawa River be immediately addressed by the Philippine Government through a strong unified political will of the top leadership, the stakeholders and other players at the LGUs level by taking decisive action on the following:

5.c.1. Take out about 83.66 million cubic meters of debris deposits along the 11 kilometers of the Yawa River channel, by utilizing the Philippine Army Albay Ready Reserve Battalion of the 504 Community Defense Center, augmented by the labor effort of community people who are survivors and whose families were victims of the Super-Typhoons Milenyo and Reming;

5.c.2. Convert the Yawa River for Open Quarrying, where the government shall cancel all exclusive rights of private permittees to quarry along the entire stretch of the river. The local community people should be declared as collective or common owners of the Yawa River resources, hence, they are mandated to dredge and deepen the river and all aggregates to be removed can be sold by them as one of their means of livelihood, subject however to liberalized government control, regulations and supervision.

5.c.3. Some 50 million cubic meters of these aggregates, comprised of sand, gravel, and boulders can be sold to investors and business people at very low prices, whereby about 2.9 to 3 billion pesos in aggregate incomes can be derived therefrom. The national government and LGUs of Albay will thereby generate revenues of no less than 25 million pesos in 12 months. If another mudflow occurs, it will create more aggregates to be sold by the people and the government will additionally generate added revenues.

Note that Mt. Mayon aggregates, especially washed sand, are considered some of the best quality in the world for the construction industry!

5.c.4. The labor-intensive plan of Lt. Col. Esplana will transform the typhoon victims from a relief driven status to one of work driven, which will empower the victims and strengthen the moral

and social fabric of the people of Albay.

5.c.5. This plan will make Daraga and Legazpi City attractive to investors, as opposed to the present trend, where investors are slowly leaving these areas.

5.c.6. Daraga and Legazpi City can, through this plan, become quickly an eco-tourism center for Albay. By empowering local communities to engage in disaster reduction, the region will become safer and eco-tourism will be attracted to Albay's role-model in hazard mitigation. Foreign tourists, students and researchers will come from China and from around the world to study and model Albay's actions.

5.c.7. Lt Col Esplana, in his 9-paged proposal, suggested that he be assigned as the Project Manager, to best operationalize this labor intensive method of three components, namely:

- Dredging / Deepening of the Yawa River through labor intensive method.
- Fabrication of high quality concrete hollow blocks for the distribution at subsidized prizes to no less than 25,000 families who are typhoon victims, with the excess for sale. Fabrication of reinforced concrete piles (RCPs or CSPs) for pile driving, for use at the critical sections of banks of the Yawa River, with the excess being utilized by the government for river bank protection, as foundation for sea walls, piers, ports, stabilizers at road banks and to protect the road sides, embankments and critical cuts at mountainsides from landslides; can be used also as foundation walls in reclamation projects at shallow reefs of the coastal zones and are applicable for sale in the Philippines and among its neighbors such as China, Singapore and Japan.
- Establish a Marketing Center for the fabricated construction materials and sale of Mayon Volcano aggregates to any buyer within the Bicol Region, other parts of the Philippines and in neighboring countries. Meeting participants suggested marketing these materials to China, Japan and Singapore, due to the present booms of the construction industries in these countries.

5.c.8. Funds required for labor intensive method is P/ 110 million, with itemized expenditures as follows:

- a. P/ 20 million as food for work and basic allowances of workers
- b. P/ 80 million as cost for fabricating 3,500 pcs of reinforced concrete piles
- c. P/ 10 million for procurement of hand tools and light /portable equipments and for administrative expenses.

5.c.9. Lt. Col. Esplana requests if UNDP and China can provide funds of P/ 110 million, and for China to provide technical and scientific assistance in terms of:

- a. Trainings to contain and address hazards and disasters.
- b. Donation of tools and instruments for early warnings in floods.

5.c.10. The Yawa River should be widened to an average of 180 to 200 meters, and to an

average depth of 5 -15 meters, to totally absorb some 16,800 cubic meters per second or more of mudflow and flashflood (of typhoon Reming flood volume), with a velocity of 10 meters per second. With this planned widening, the Yawa river will then be able to flush out mudflow and flashfloods from Barangay Salvacion to Albay Gulf in 18 minutes, unlike during typhoon Reming when the river channel absorbed only about 5,000 cubic meters per second, with velocity of 6 meters per second and flushing time of 30 to 35 minutes to the Albay Gulf. Due to these factors, during the Super-Typhoon Reming last November 30, 2006, some 70.23 % of the total floodwater volume spilled over to the Tagas and Dona Maria Subdivision in Daraga and the rest went to Legazpi City poblacion, with the result that the suburban areas experienced an average mudflow height of 7 feet! The widening and deepening of the present Yawa river cancels the need to create a short-cut channel route for this river.

5.c.11. The development of Albay and Legazpi City was set back by about 20 years, to the 1980s. With this labor intensive plan put forth by Lt. Col. Esplana, which includes viable components for livelihood projects, the economic set back of Albay can be recouped in 3 years!

III. COMMENTS, SUGGESTIONS and RECOMMENDATIONS:

1. The UNDP mission experts expressed their appreciation of Lt. Col. Esplana's plan for its technical soundness and social viability. Meeting participants discussed the possibility of a Bicol region delegation visiting China to observe how people there implement measures on disaster mitigation.
2. The present dredging by DPWH, which moves the Yawa river aggregates to the left and right sides of the river gully does not address the very real danger. The millions of tons of volcanic materials that presently exist along and in the Yawa River must be quickly removed away from the actual river gully. If this gully clearing does not happen now, e.g., through the labor-intensive plan, then Daraga and Legazpi City will have to evacuate very quickly every time flooding occurs and during typhoons, which will be very costly and hazardous.
3. Rusty Binas, Global Advisor on Disaster Risk Reduction, suggested that investments for Daraga and Legazpi City should be strengthened and livelihoods for the typhoon / calamity victims be enhanced as soon as possible. Deepening of the Yawa River through the labor-intensive method is the best short and long-term alternative to beat poverty in Albay and thus hasten the rehabilitation of Albay province. The labor-intensive plan greatly enhances sustainable development in the Bicol region.
 - 3.a. Promote bilateral cooperation of the Philippines and China through the auspices of the United Nations, through which China can buy Mayon volcano aggregates in exchange for some assistance to be given by the Chinese Government to Mayon volcano victims and/or for the region's early warning system for geohazards.

3.b. Other investors will be attracted to come to Legazpi City and Daraga Town when Yawa River hazards are, indeed, mitigated to the fullest. Dr. Li and all the others present in the briefing agreed.

4. Rick Mendoza of Albay PDCC and the OXFAM representative opined that the community people must be mobilized quickly and public dialogues be conducted to discuss the labor-intensive method as proposed by Lt. Col. Esplana, in contrast to the present dredging and rehabilitation efforts of the DPWH at Yawa River.
5. Anthony Montenegro and John Abejuro, two representatives of the Social Action Center (SAC) of the Catholic Church of Albay, commented that they are in favor of the Labor-Intensive Method wherein all the typhoon victims within Daraga and Legazpi City will be benefited. These victims will be hired as workers in the dredging and also as enterprising entrepreneurs by selling volcanic aggregates.
6. Majority of those present in this briefing suggested that **there is a need to immediately call for series of public dialogues and consultations among the local community people to be affected by the threats of mudflows, before the DPWH can proceed with the bidding.**
7. All those present in this briefing/dialogue requested that Lt. Col. Esplana be the meeting's rapporteur to prepare its Minutes, which the latter accepted.

MAIN DISCUSSION POINTS of the MINUTES

a.1. All participants agreed that present mudflow deposits at YAWA River bed, with estimated volume of 83.66 million cubic meters, should be removed out of the river very quickly in time for the coming rainy season.

a.2. DPWH plans to use bulldozers and other heavy equipments to push to the left and right sides of the floodway less than 200,000 cubic meters of aggregates in total. This method will not deepen the river gully, and if Typhoon Reming flood volume and intensity should be repeated, the DPWH work plan may result in thick debris/mudflow inundations of Daraga and Legazpi City poblacions and their suburban areas, burying people and homes with 20-30 feet of pyroclastic material.

a.3. The labor-intensive method, as proposed by Lt. Col. Esplana, includes a component on livelihood-income for the people and workers of the plan. This method is a very attractive alternative proposal to the present DPWH plan, because it is economical, generating millions in revenue for the government and almost 3 billion in income for the poor people of Albay. The Esplana plan will result in bigger investments in the province, with full transparency, honesty and "Zero Corruption" in all aspects of implementation.

a.4. The community residents will be organized into cooperatives, People's Organizations

(POs) and Non-Government Organizations (NGOs) will market Mayon raw aggregates and fabricate high-quality hollow blocks and reinforced concrete piles for sale at the lowest prices to market outlets in Albay, the Bicol Region, other areas in the Philippines and in other countries such as China, Singapore and Japan.

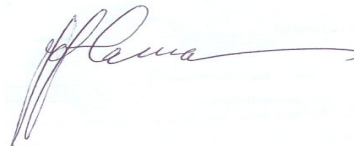
a.5 Millions of tons of Mayon Volcano aggregates are worth billions of dollars in market value if marketed to supply the construction industry boom in China, Singapore and Japan. Marketing in this way will give the poor people of Albay enough income to focus on more expansive business enterprises and livelihood ventures, without their having to leave their families to go abroad. These are wealth that can and should be tapped now!

a.6. Under labor intensive method, as proposed by Lt Col Esplana , there will no longer be the need to short-cut the Yawa River route, which is a very expensive plan and will relocate no less than 15,000 people to a permanent relocation site. The LGU of Legazpi City has neither the space nor the funds to create such a site.

a.7. As the rainy season is beginning, the decision must be made now as to whether the labor-intensive method of Lt. Col. Esplana or the present mechanized dredging and construction works done by the DPWH is the best choice. The DPWH will bid in 2 weeks time to qualified contractors for the various multi-million projects to rehabilitate Yawa River. The Esplana plan is much more cost-effective, with a comparative ratio of 1:117.46, wherein for every P/ 1.00 fund to be required for labor intensive method, the equivalent amount needed by the DPWH for the same work scope would require P/ 117.46.

IV. Date Prepared: June 1, 2007.

Minutes Prepared / Summarized By :



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