11-12 December 2006

Dumangas
Iloilo
Philippines

Report on the

Workshop on Climate Forecast Applications for Managing Climate Risks in Agriculture

USAID FROM THE AMERICAN PEOPLE
US Agency for International Development Office of Foreign Disaster Assistance

Provincial Government of Iloilo

Philippine Atmospheric, Geophysical and Astronomical Services Administration

Dumangas Municipal Government

adpc
Asian Disaster Preparedness Center

Asian Disaster Preparedness Center

Asian Disaster Preparedness Center (ADPC). *Report on the Workshop on Climate Forecast Applications for Managing Climate Risks in Agriculture*. Bangkok: ADPC, 2007.

This report has been made possible by the generous support of the American People through the United States Agency for International Development Office of Foreign Disaster Assistance (USAID-OFDA). The contents of this report are the sole responsibility of ADPC and do not necessarily reflect the views of the USAID or the United States Government.

20 years of commitment to safer communities and sustainable development through disaster risk reduction

The Asian Disaster Preparedness Center (ADPC) is an international, non-governmental, non-profit organization based in Bangkok, Thailand. Established in 1986, ADPC is mandated to promote safer communities and sustainable development through the reduction of the impact of disasters in Asia and the Pacific by raising awareness, helping to establish and strengthen sustainable institutional mechanisms, enhancing knowledge and skills, and facilitating the exchange of information, experience and expertise.

ADPC is governed and guided by a Board of Trustees and advised by a Regional Consultative Committee and Advisory Council. In 2005, ADPC was endorsed as an inter-governmental organization, with Bangladesh, Cambodia, China, India, Nepal, Pakistan, the Philippines, Sri Lanka, and Thailand as founding members.

ADPC develops and implements disaster risk management programs and projects by providing technical and professional services in formulating national disaster management policies, facilitating the development of institutional mechanisms to support disaster risk reduction, capacity building of disaster management institutions, program design for comprehensive disaster risk management, post-disaster assessment, public health and emergency management, land-use planning, disaster-resistant construction, and the planning of immediate relief response and subsequent rehabilitation activities.

ADPC provides a wide range of training and learning opportunities through its courses and workshops on a range of topics, such as disaster management fundamentals, urban disaster mitigation, seismic and cyclone hazards mitigation, flood hazards mitigation, technological hazards, public health emergencies, climate forecast applications, crisis management and community-based approaches to disaster management.

Cover Photo: A farmer in Dumangas, Iloilo, Philippines. Dumangas serves as one of the demonstration sites of the Climate Forecast Applications for Disaster Mitigation Program where tools and risk management strategies are tested and refined in order to mitigate the impacts of climate-related risks in agriculture. ADPC, 2006.

Report on the

Workshop on Climate Forecast Applications for Managing Climate Risks in Agriculture

Asian Disaster Preparedness Center, Bangkok, Thailand, 2007

CONTENTS

ACRONYMS

ADPC	Asian Disaster Preparedness Center
APN	Asia Pacific Network for Global Change Research
BMG	Meteorological and Geophysical Agency (Indonesia)
CFS	Climate Field School
CPT	Climate Predictability Tool
CRM	Climate Risk Management
DITLIN	Directorate for Plant Protection, Ministry of Agriculture (Indonesia)
ECE	Extreme Climate Events
ENSO	El Niño Southern Oscillation
HMM	Hidden Markov Model
IPB	Bogor Agriculture University
IRI	International Research Institute for Climate and Society
FAO	Food and Agriculture Organization of the United Nations
MoA	Ministry of Agriculture (Indonesia)
MWSS	Metropolitan Waterworks and Sewerage System (Philippines)
NTT	Nusa Tenggara Timur
OFDA	Office of Foreign Disaster Assistance
PAGASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PAO	Provincial Agriculture Office (Philippines)
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

The Asian Disaster Preparedness Center (ADPC), International Research Institute for Climate and Society (IRI), and national and local partners in Indonesia and the Philippines are implementing the program on "Climate Forecast Applications (CFA) for Disaster Mitigation in Indonesia and the Philippines" to improve the management of climate risks, primarily by using seasonal climate forecasts. Four project sites demonstrate how climate forecasts may be used for managing climate risks in various sectors, namely agriculture (Indramayu, Indonesia and Dumangas, Philippines), water resources (Angat Reservoir, Philippines), and food security (Nusa Tenggara Timur, Indonesia). The CFA program is made possible by the generous support of the American People through the United States Agency for International Development Office of Foreign Disaster Assistance (USAID-OFDA).

The past three years (October 2003-September 2006) of program implementation focused on identifying and addressing specific climate risks in partnership with local and national stakeholders. Specific activities included identification of demonstration sites, identification of climate-related problems and assessment of impacts, institutional analysis, climate diagnostics, and capacity building of meteorological agencies. Several partner-initiated activities towards institutionalizing and replicating climate forecast applications were also implemented.

From 11-12 December 2006, more than 80 representatives of national and local implementing partners from Indonesia and the Philippines, Chief Municipal Agriculturists and Chief Planning Officers from 20 municipalities in Iloilo Province (Philippines) that are most prone to floods, drought and typhoons, provincial agricultural planning officers from Iloilo and Antique Provinces, and representatives of agricultural cooperatives, coalitions, and farmers groups met in the Philippines for the workshop on "Climate Forecast Applications for Managing Climate Risks in Agriculture" hosted by the municipality of Dumangas, Iloilo. The workshop served as a platform for exchanging lessons learned from program implementation and for encouraging the adoption of CFA tools and methodology in the provinces of Iloilo and Antique. This is consistent with the broader program goal of transferring learning for managing climate variability and extremes in locations not directly targeted by the USAID-supported program. The highlights and key outcomes of the workshop are as follows:

I. **Objective 1:** Share experiences between Dumangas and Indramayu for cross-fertilization of lessons and good practices.

   Indramayu, Indonesia:

   - Institutional mechanism for the generation, interpretation, translation, communication and application of seasonal climate forecasts in Indramayu has been improved, and now includes:
     - BMG (generation of localized seasonal climate forecasts)
     - Climate Analysis and Mitigation of the Directorate of Plant Protection (DITLIN) of the Ministry of Agriculture (translation into potential impacts)
     - Indramayu Agriculture Office and Indaramayu Regency (preparation of response options)
     - Indramayu Agriculture Extension workers and pest and diseases observers (communication to farmers)
   - The Climate Field School (CFS), a mechanism for institutionalizing the communication of seasonal climate forecasts, has proved to be an effective mechanism for changing perceptions and practices for reducing climate-related risks amongst farmers. The CFS has been extended to 11 other sub-districts, with District Government and DITLIN investment, now benefiting more than 1,000 farmers.
   - The mass media (local journalists) is engaged as partners in disseminating climate information
   - Indramayu Regency initiated a support mechanism to assist farmers in implementing crop management options in response to a climate forecast:
     - Agreement with agricultural inputs distributors to provide sufficient seed stocks, fertilizers, etc. to support early planting
     - A revolving fund from which farmers can take out a loan, to be repaid in 2-4 seasons. The fund is established from Regency/ District and central government resources.
     - Agreement with Sucofindo to provide market for soybean and maize (crop alternatives to rice)

- Indramayu experience in preparing for the ongoing El Niño, which is expected to last until mid-2007, was shared. Workshop participants gained insights into how forecast and decision options and action plans in anticipation of delayed monsoon rains flowed from BMG to farmers.

Dumangas, Philippines:

- Dumangas highlighted its experiences in using climate forecasts in decision-making (in agriculture, peace and order, infrastructure, and disaster management) and how sustained support for climate forecast application can be ensured through legislation (Dumangas Municipal Ordinance 2005-01 provides an annual budget for climate forecast application).
- The paucity of local rainfall observation data is one of the barriers in providing localized seasonal forecasts with high confidence. The Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) is encouraging municipalities to install rain gauges and assign personnel who will take observations. Local funding sources include the municipal calamity fund, which may be used now for investing in pre-disaster programs, and the municipal and congressional development funds. PAGASA committed to provide technical assistance.

II. **Objective 2:** Broaden program implementation by identifying opportunities and developing plans of action for replication in other locations and for mainstreaming in development planning at municipal and provincial levels.

Indonesia:

- Indramayu Regency plans to broaden climate forecast application to include application in non-farm activities and in other sectors, and develop appropriate training modules
- Indramayu Regency is empowering farmers' groups towards entrepreneurship by building skills in agribusiness, post harvest management and financial management, and assisting in developing the necessary organizational structure within each farmers' group. Demonstration has been initiated in Sleman village.
- The Climate Field School has been adopted by the Ministry of Agriculture as a medium-term strategy in building human resource capabilities and in anticipating the impact of climate extremes

Philippines:

- Participants formulated action plans for replicating CFA methodologies in Iloilo and the neighboring province of Antique. The action plans detail the climate-related problems, proposed solutions, and potential funding sources.
- Recommendations of the workshop will be provided as inputs to the Iloilo provincial comprehensive disaster management (DM) plan. A policy paper for the provincial council to provide support to implement CFA activities within the DM plan will be prepared by the provincial agriculture office.
- Antique Province expressed its interest to implement CFA activities and committed local funding to initiate activities. It also requested support from ADPC, particularly in organizing a start-up workshop for replicating the CFA program in the province.
- PAGASA committed continued technical support and resources to cover its local costs.
- ADPC developed a proposal for the Food and Agriculture Office (FAO) of the UN that aims at equipping farmers to respond to climate forecasts by providing production and market forecast information and financial support through a locally appropriate financial support mechanism. The program will be implemented in Dumangas in partnership with PAGASA, Philippine Bureau of Agricultural Statistics (BAS), and FAO.

III. **Objective 3:** Advocate for the replication of methodology and tools nationally.

Indonesia:

- BMG invested in observing, computing and human resources to provide localized seasonal climate forecasts in other regencies/ districts and provinces. It is currently providing localized forecasts to 30 districts (from one in Indramayu). BMG plans to add 10 more regencies in 2007, bringing to 40 the number of regencies to be covered, which represents 10% of the total number of regencies nationally. It also plans to involve its 10 regional centers in providing localized seasonal climate forecasts.
- DITLIN plans to establish a national network of extension workers who were involved in implementing the Climate Field Schools to adapt CFS for wider implementation nationally, document experiences and good practices in climate forecast applications, and assist local extension workers in preparing forecast response options.

Philippines:

- Gaining confidence from the CFA methodology, PAGASA has developed projects that aim at improving resource management decision systems in the agriculture and water resources sectors through the application of climate forecast products. A project supported by the Australian government looks at the potential economic value of seasonal climate forecasts in corn-based farming systems in Isabela, Leyte, Cebu, and Malaybalay (Bukidnon); a project supported by the Korean government will develop a community-based climate information and early warning system in 3 provinces; and a project locally supported by the Metropolitan Waterworks and Sewerage System will develop a short- and long-range weather/ climate and streamflow forecast model for reservoir management.

I. BACKGROUND

The Asian Disaster Preparedness Center (ADPC), International Research Institute for Climate and Society (IRI), with national and local partners in Indonesia and the Philippines are implementing a program to improve the management of climate risks, primarily by using seasonal climate forecasts. The program, entitled "Climate Forecast Applications (CFA) for Disaster Mitigation in Indonesia and the Philippines," involves identifying and addressing specific climate risks in agriculture and water resources management in demonstration sites in Indonesia (Indramayu and Nusa Tenggara Timur) and the Philippines (Angat Reservoir and Dumangas). This program is funded and supported by the United States Agency for International Development Office of Foreign Disaster Assistance (USAID-OFDA). Annex 1 provides the program overview.

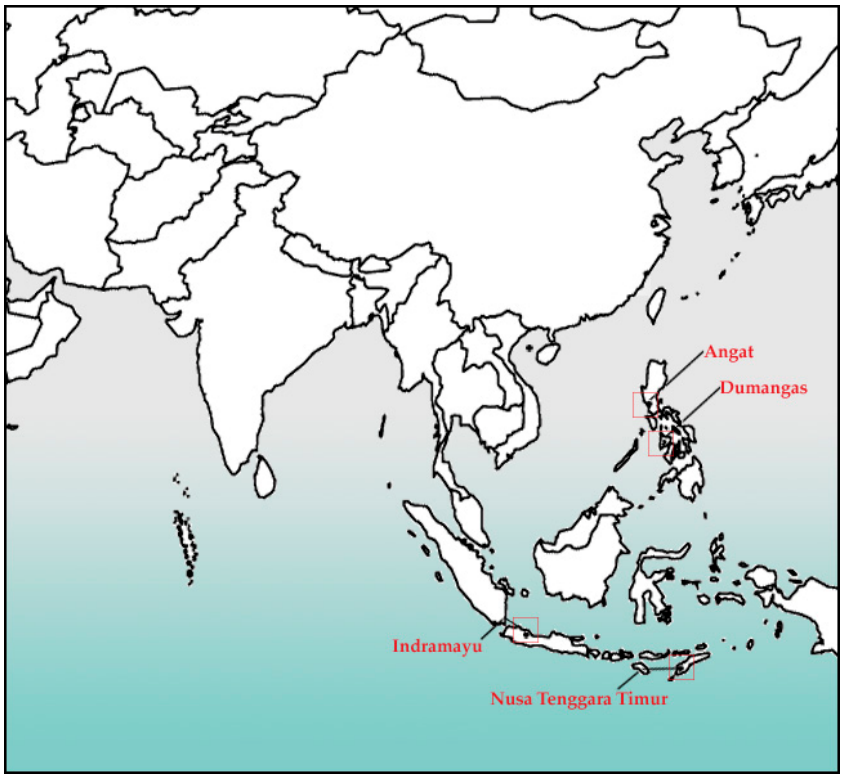
Three years into program implementation, the Municipality of Dumangas in the Philippines hosted a workshop with the theme "Climate Forecast Applications for Managing Climate Risks in Agriculture" from December 11-12, 2006 in order to:

1) Share experiences between the demonstration sites in Dumangas, Philippines and Indramayu, Indonesia, and allow for cross-fertilization of good practices and lessons on reducing climate risks to small-holder agricultural systems;
2) Broaden program implementation by identifying opportunities and developing plans of action to replicate the methodology and tools in other municipalities of Iloilo and Antique provinces and mainstream climate forecast application in development planning at municipal and provincial levels; and
3) Advocate for the replication of methodology and tools nationally.

The workshop brought together 82 participants (Annex 2) consisting of national implementing partners from Indonesia and the Philippines, local partners (Dumangas, Iloilo Province, Philippines and Indramayu, West Java, Indonesia), Chief Municipal Agriculturists and Chief Planning Officers from 20 municipalities in Iloilo Province that are most prone to floods, drought and typhoons, representatives of provincial agricultural planning offices from Iloilo and Antique Provinces, representatives of agricultural cooperatives and coalitions, and farmer representatives. The local delegation was led by Mr. Zafiro Palabrica and Mr. Nicolasito Calawag, Chief Provincial Agriculturists of Iloilo and Antique respectively.

This report summarizes presentations (refer to Annex 3), discussions and outcomes from the workshop. The presentations and discussions during the first part of the workshop focused on the following themes: 1) experiences of Philippines and Indonesia in climate forecast applications for disaster mitigation; 2) ongoing and planned efforts to mainstream climate forecast applications for disaster mitigation in local development planning processes; and 3) ongoing and planned efforts to replicate CFA methodology and tools nationally.

Figure 1: CFA program demonstration sites in Indonesia and the Philippines



The second part of the workshop was devoted to formulation of work plans by participants from the Philippines, detailing how each congressional district (consisting of contiguous municipalities) in Iloilo and Antique plan to address climate risks based on the lessons learned from Dumangas and Indramayu. These work plans constitute a starting point for expanding the spatial coverage of climate forecast applications in the Philippines.

II. OPENING PROGRAM

The workshop program was opened by the host, Mayor Rolando Distura (Mayor, Municipality of Dumangas). Keynote speeches were given by Mr. H. Irianto MS Syafiudin (Bupati, Indramayu District), Mr. Soetarto Alimoeso (Director General, Directorate of Food Crops Protection, Indonesian Ministry of Agriculture), Dr. Prisco D. Nilo (Officer-in-Charge, PAGASA), and Atty. Neil Tupas, Sr. (Governor, Iloilo Province). Mr. A.R. Subbiah (Director, Climate Risk Management Team, ADPC) delivered the inaugural speech.

The speakers noted the importance of the workshop as a platform for exchanging lessons learned from program implementation. They also highlighted the significant milestones achieved so far, specifically the expansion of climate forecast applications to sectors and locations beyond the initial targets of the USAID-funded program.

Noting the similarity of issues faced by Indramayu and Dumangas, the speakers advocated for deepening the collaboration between Indonesia and the Philippines on climate risk management, as well as on broader agriculture and economic development endeavours. The Mayor of Dumangas announced that in order to advance and solidify the cooperation between Dumangas and Indramayu, a cooperative agreement will be signed between the two local government units.[1]

The inaugural speech recognized the invaluable support of program partners in Indonesia and the Philippines, and the generous support of the American People through USAID-OFDA. It noted the success of the Climate Field School in Indonesia, which will be replicated in the Philippines in 2007.

[1] The signing took place at the Dumangas-Indramayu Fellowship Night on 11 December 2006.

III. EXPERIENCES IN CLIMATE FORECAST APPLICATIONS FOR DISASTER MITIGATION

The presentations and discussions on the experiences in climate forecast applications for disaster mitigation were divided into two thematic parts - the experiences of demonstration sites in implementing climate forecast applications and the experiences of national meteorological agencies (BMG and PAGASA) in providing localized forecasts to meet the needs of the demonstration sites.

III.A. PHILIPPINES

Dumangas is exposed to recurring climate risks, namely floods from August to December and drought from March to May. These climate risks have caused infrastructure damage, significant agriculture production losses, and displacement of households. Changes in temperature and water salinity, as well as salt intrusion also produced negative effects on livelihoods. Risks are amplified during El Niño years, which are linked to below normal rainfall in Dumangas. The adverse impacts prompted the Dumangas municipal government to implement mitigating measures.

The primary application of climate forecasts in Dumangas has been in the areas of agriculture, water management, and disaster management. El Niño forecasts are utilized in order to prepare for natural hazards known to accompany El Niño events. Rainfall forecasts issued by PAGASA are used to advise farmers on crops to plant as well as the timing of planting. Advisories regarding potential outbreak of certain types of diseases are also issued. These advisories are communicated to village leaders through the nightly radio meeting program via handheld VHF radio.

Farmers used to rely on an indigenous forecasting method, known locally as "tubong-tubong." Tubong-tubong presupposes that the weather behavior during the first 12 days of the year provides the forecast for corresponding months of the year. For example, if the fifth day of the year (January 5th) is dry, it means that May – the fifth month of the year - will also be dry. The fact that farmers used tubong tubong - despite the absence of scientific evidence establishing its predictive value - indicates that there is a high demand for seasonal climate information to guide farming-related decisions. In order to address the demand of agriculture and other climate-sensitive sectors for climate information, the municipal government established a local agro-meteorological station, which is the only operational agro-meteorological station in the province of Iloilo.

The local agrometeorological station collects observation data, and sends to PAGASA office in Manila for interpretation. In January 2005, the municipal legislature passed an ordinance appropriating an annual budget of 200,000 Philippine pesos (about 4,000 US dollars) for the maintenance and operation of the agro-meteorological station. This ensures that the station will continue to be operational on a sustainable basis.

PAGASA aims to provide timely, accurate and relevant climate information and prediction services for planning and decision-making to various climate-sensitive sectors. At present, PAGASA routinely issues the following agro-meteorological products:

- *Daily farm weather forecast and advisories for agriculture*, which informs farmers and other users on the kind of weather that is expected within 24 hours.
- *Tropical cyclone warning and advisories*, which includes the following information: areas affected by the cyclone, speed, location, and maximum speed. Corresponding advisories for agriculture sector are also issued. This information is valid for six hours.
- *Ten-day regional agri-weather forecast and advisory*, which informs agricultural communities about expected extreme weather events for different regions in the Philippines. Provided with a lead time of 10 days, this product is intended to help farmers plan farm operations over a 10-day period.
- *Philippine agro-climatic review and outlook (ten-days)*, which discusses the results of assessment and validation of crop stages and farm activities.
- *Seasonal forecast and advisories for agriculture*, which shows the six-month condition and corresponding agriculture advisories within the season.
- *Extreme climatic forecast and advisories for agriculture*, which contains El Niño and La Niña forecasts and corresponding advisories for agricultural sector.

PAGASA has been implementing initiatives that are aimed at improving climate forecast generation and dissemination. PAGASA's initiatives include capacity building activities for both providers and users of climate information, understanding the demands of various users in order to provide the appropriate information, establishing effective dissemination system, and intensifying forecast provider-user interaction. Under the CFA program, PAGASA meteorologists were trained by scientists from IRI forecast downscaling techniques, such as Climate Predictability Tool (CPT) and Hidden Markov Model (HMM).

The paucity of long term climate data is the major obstacle in providing seasonal climate forecasts with higher skill. A huge number of rainfall observations is crucial in providing increasingly accurate rainfall forecasts. In Iloilo, it is particularly important to have a dense rainfall monitoring network because there are two major rainfall regimes within the province - in the southwestern parts of Iloilo, November through April is generally dry, while the Southwest monsoon brings rains from May through October. In other areas, there is less of a distinction between the two seasons. At present, PAGASA needs to qualify its seasonal forecasts for the province because the long-term data come from only one synoptic station (Mandurriao airport). The establishment of Dumangas agro-meteorological station in 2003 is a big boost to PAGASA's forecasting activity in the province. Other local government units are encouraged to put up at least one rain gauge, if not a full weather station. They are advised to contact PAGASA if they plan to do so.

The importance of building a dense rainfall observation network was highlighted when a representative from Igbaras municipality reported that farmers in the municipality have observed that the dry season is getting longer for up to six months. PAGASA shared that other parts in the Philippines also reported this trend. However, it is difficult to validate and determine if the trend will persist because observation data are still limited to allow robust analysis.

As regards forecast dissemination, PAGASA has been regularly conducting climate forums at the national level. Under the CFA Program, PAGASA has conducted the first local climate forum in Iloilo Province on 15 November 2006, in collaboration with the Provincial Government of Iloilo through the Office of the Provincial Agriculture Office (PAO). It is envisioned that such fora will be held before the onset of every season in order to provide an opportunity for forecast users and providers to discuss the forecast for the season and evaluate responses to forecasts in the previous season.

III.B. INDONESIA[2]

Two thirds of Indramayu's 1.6 million people are engaged in agriculture. Farmers at the tail-end of the irrigation system, or those who do not receive any irrigation at all, are particularly vulnerable to climate variability and extreme events (i.e. delay of the monsoon, early onset of the dry season, floods, or dry spells). About 86 percent of crop losses in Indramayu from 1997 to 2003 are attributed to climate variability.

In order to manage the impacts of floods and droughts, the district government of Indramayu, in collaboration with ADPC, IRI, Bogor Agriculture University (IPB), Agency for Meteorology and Geophysics (BMG), and the Ministry of Agriculture (MoA) has implemented the following initiatives:

- Refined the institutional system for the generation and communication of climate forecast, impact, and response information;
- Enhancing farmers' understanding of climate variability and building their capacity to analyze climate forecasts, and evaluate response options through the Climate Field School;
- Educating and engaging the mass media in the area of climate communications; and
- Working with a variety of institutions and expanding climate forecast applications to other sectors.

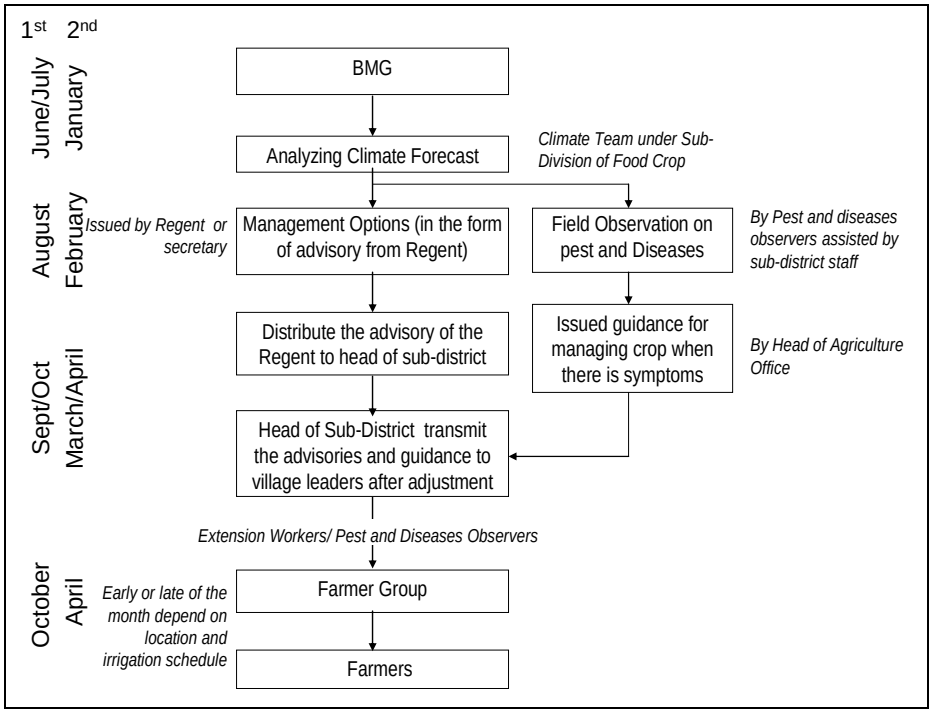
Indramayu is particularly known for pioneering the Climate Field School (CFS), an institutional mechanism for enhancing the capacity of agriculture extension workers and farmers to understand and apply climate information in setting up crop management strategies. From 2003 to the present, 1,000 farmers have already completed the CFS modules, which consists of 12 sessions covering the following topics: 1) basics of climate and weather; climate, plants and soil; 2) rain formation and importance of forests in retaining water; 3) terminology in seasonal climate forecasting by BMG; 4) understanding probabilistic forecasting; forecast skill and utility in decision-making; 5) forecast verification by farmers using rainfall monitoring data; 6) rainfall observation and recording; 7) impacts of severe weather events on cropping systems; 8) developing cropping strategies to minimize impacts of floods and drought; 9) water balance, irrigation water requirement, flood risk; and 9) economic value of climate information.

The CFS in Indonesia started with the training of agricultural extension specialists who are working at the district level. In turn, the extension specialists trained agriculture extension workers who are working at the sub-district level. Finally, the agriculture workers conducted dialogues with farmers to communicate climate information in the farmers' language, disseminate adaptive farming practices, and facilitate farmers' application of seasonal climate forecasts in making farming decisions.

Indramayu's experience demonstrates that cooperation amongst government agencies is indispensable in the identification, assessment, and dissemination of options. If the forecast warns of delayed rainfall onset, farmers must have the knowledge and capacity to choose amongst different options (e.g. planting early-maturing cultivars or not planting at all) in order to mitigate the potential impacts. The process of tailoring crop management strategies and subsequent dissemination to farmers is given in the diagram below:

[2] For more details about Indonesia's experience in climate risk management, see A.R. Subbiah, Lolita Bildan, Kareff Rafisura. "Managing Climate Risks through Climate Information Applications: The Indonesian Experience." in *Real Risk* (August 2006). For further details about the Climate Field School, see ADPC. "Changing perceptions and practices for managing climate-related risks through Climate Field Schools." in *Disaster Reduction in Asia and the Pacific: ISDR Informs* (Issue 2, 2006).

Figure 2: Process of tailoring crop management strategy and dissemination to farmers at the district level

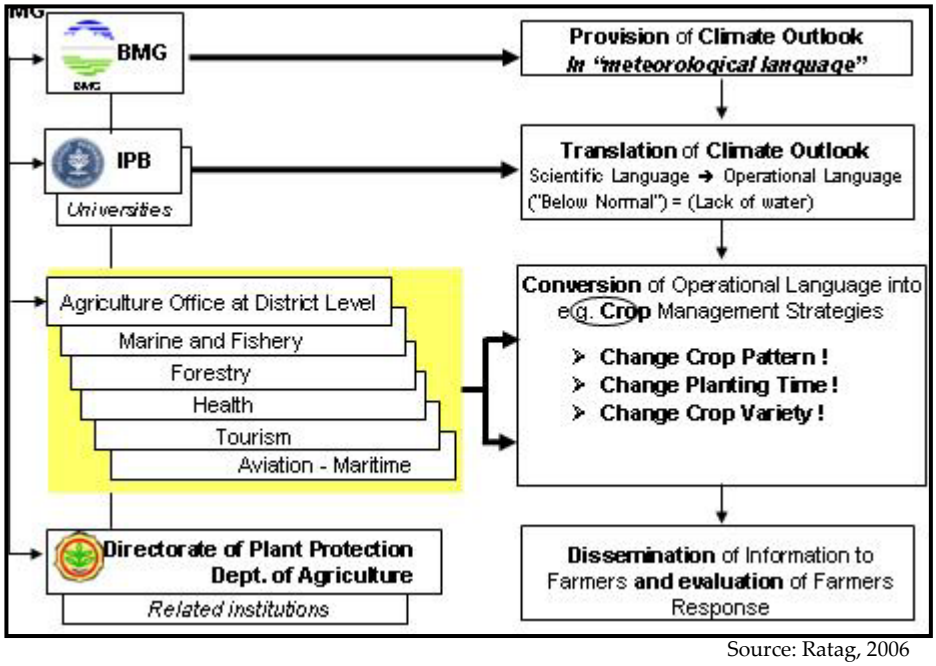


Source: Syafiudin, 2006.

Recognizing that climate risk management is a collective enterprise, the district government is now embarking on new initiatives that are aimed at building the capacity of farmers' cooperatives to manage risks. Within the larger context of establishing an integrated risk information system, the district government plans to implement capacity building activities that will help develop the entrepreneurial skills of farmers. Support will also be extended by the government to enable cooperatives to carry out agri-business activities and to encourage economies of scale in agricultural production. Specifically, the district government is promoting the "farmer corporate" concept. Every village, which covers a minimum farm land of 300-500 hectares, forms a group that is headed by a farmer who has strong leadership and strong entrepreneurship. The group is then divided into a number of sub-units, such as food crops, animal husbandry, banking business, agriculture inputs services, post harvesting business, marketing and other sub-units that may be required by the members. These sub-units should be legal entities themselves (such as registered small and medium enterprise or cooperative). The farmers group is assisted by an expert or a skilled person (*tenaga pendamping*) who can provide assistance and advice to the group in running their business activities. This concept is now being piloted in Sleman village in Indramayu. In the long-term, the government hopes that this initiative will encourage farmers to lead development, with the government playing only a supporting role.

The support of national agencies, most notably the MoA and BMG, is crucial to the operationalization of climate forecast applications system in Indramayu. The district also benefits from its close collaboration with IPB. The national climate forecast applications framework in Indonesia is shown in Figure 3.

Figure 3: National framework of climate forecast applications



Source: Ratag, 2006

BMG has been providing high resolution climate forecast to Indramayu since 2003. BMG has increased the resolution of the forecast from two to six rainfall regions within the district. Through its Research and Development Department, BMG undertook the following steps in order to provide high resolution seasonal climate forecasts to Indramayu: 1) data collection & quality control; 2) data clustering; and 3) rainfall type zonation. BMG found out that statistical downscaling is much more useful for producing climate information for use at district level.

Convinced by the demonstrated relevance of seasonal forecast in mitigating climate risks in agriculture, BMG has built upon its learning experience in Indramayu in order to expand its services to other districts. In 2006, 30 districts receive localized forecasts from BMG. In 2007, this service will be expanded to 10 additional districts, bringing the total number to 40. For 2007, as well as in the succeeding rounds of expansion, BMG's regional centers will begin to play a more important role in operational climate forecasting.

The MoA is also in the process of expanding the Climate Field School to districts where localized forecasts are already available. The MoA and BMG agreed to match the districts that they select because forecasts need to be translated to the language that is most familiar to the users.

BMG led the formation of two fora namely the Science Forum and the Science-Policy Forum. The Science Forum is intended to improve seasonal forecast generation through inter-agency collaboration and research. It consists of scientists from BMG, LAPAN (National Institute of Aeronautics and Space), and the R&D Department of the MoA. The district-level Science and Policy Forum is BMG's major instrument for connecting with the users of climate information. It is initiated primarily to ensure that forecasts are interpreted correctly and to enhance the integration of climate forecasts into district-level decision making by translating climate language into risk management language. The forum consists of BMG representatives and district officials. The IPB is also an active participant in this forum.

The MoA has been advocating the use of climate information in different stages of agricultural activities, from pre-planting (crop selection, planting timing), planting (water management, growth and pest monitoring), and post-planting (harvesting, drying, milling). It recognizes that mainstreaming climate forecast applications is not a stand-alone process; it has to be supported by a host of structural and non-structural programs. Programs in four areas, namely institutional, human resources, methodology and extension activities, are being revitalized. Specific activities include rehabilitation of agricultural infrastructure, application of technologies, land and water conservation, setting up an early warning system for climate-related disasters, recognizing and promoting indigenous practices in agriculture, and extending government assistance (seed, fertilizer, etc.).

Box 1: INDRAMAYU RESPONDS TO 2006/7 EL NIÑO*

Starting April 2006, positive sea surface temperature (SST) anomalies were observed in most of the equatorial Pacific. Several climate models suggested the development of a weak El Niño that may delay the onset of the monsoon in the last half of 2006. Indeed, positive SST anomalies, coupled with atmospheric anomalies, persist and most models predicted that El Niño conditions are likely to continue through March-May 2007. This development raises alarm in the district because crop losses are attributed to El Niño, with more than 90% of drought years linked to El Niño events. Within the Indramayu district, there is slight variation from region to region but, in general, the first rice planting season starts in October while the second planting season starts in April.

BMG issued the El Niño forecast in August 2006. The monthly update issued by BMG in October 2006 was in accord with the August forecast. Upon receipt of this information, the Agriculture Office held meeting with field staff from other related agencies to prepare action plans in order to manage the potential impacts of El Niño, namely delay of monsoon onset in November and delay in second cropping, which starts in April during normal years. These action plans serve as the basis in formulating management options by the district government. These management options are then communicated by the head of the district to heads of sub-districts.

The district government contacted agriculture inputs distributors to provide enough fertilizers and seed stocks in order to avoid delays in planting during the 2006 wet season. Farmers were also encouraged to clean farmlands from rats, pest and disease as well as the irrigation canals before the onset of the monsoon so that rice planting can start as soon as the rains come. This will save time for the second planting season.

As of November, monsoon onset was already delayed and the first rice crop had not yet been planted. The delayed planting would expose the crop to high flood risk during harvest, and delay in the second planting season.

In anticipation of the delay of the second planting season, the Indramayu district government, with the support of the central government, has undertaken the following actions:

- Established a revolving fund (loan without interest and payable for a period of 2-4 seasons) for assisting farmers to implement management options during the dry season 2007 (e.g. planting non-rice crops). Funding for 950 ha crop area (700 ha for soybean and 250 ha for maize) comes from the local government budget while funding for seeds supply (1000 ha for maize and 2150 ha for soybean) comes from the central government budget.

- Forged agreement with Sucofindo to provide market for the farmers' products (soybean and maize)

BMG has been monitoring the situation and will provide 2007 dry season forecast in April 2007. Based on the April 2007 forecast, the district government and farmers will formulate management options. In particular, they will use the forecast to decide whether to plant rice as a second crop or to switch to alternative crops, such as maize and soybeans.

*Based on the presentation of Dr. Rizaldi Boer, December 11, 2006

IV. MAINSTREAMING CLIMATE FORECAST APPLICATIONS FOR DISASTER MITIGATION IN LOCAL DEVELOPMENT PLANNING PROCESSES

IV.A. DUMANGAS

In Dumangas, climate forecast applications is mainstreamed in development planning through the incorporation of activities that make use of climate forecasts in the Municipal Disaster Preparedness Plan and Municipal Development Plan. For example, information on onset of rainfall is used in scheduling infrastructure works, such as road construction and rehabilitation of drainage systems, to avoid the typhoon and flood season; medical missions are arranged to reduce morbidity in anticipation of increased incidence of severe weather events as induced by ENSO; and strengthening of the municipal police force in anticipation of a long dry season when most social gatherings are held at night. Also, as mentioned earlier, the municipality instituted the continuous support for climate forecast applications, with a local legislation that provides annual appropriation for the local agro-meteorological station, which was established by the municipality from its own funds.

At the provincial level, the Provincial Agriculture Office plans to take the recommendations of this workshop as inputs to the Iloilo Provincial Comprehensive Disaster Management Plan. PAO will prepare a policy paper for the provincial council for the provision of continued support for climate forecast applications in the province.

IV.B. INDRAMAYU

The district government of Indramayu has taken a very active role in mainstreaming climate forecast applications into development planning, noting its value to the district's rice-based economy. Indramayu has adopted the Climate Field School, and has replicated it in 11 sub-districts not covered by the CFA program. Indramayu also funded a Climate Field School for the local media, as they are viewed as partners in the dissemination of climate-related information and application experiences.

Recently, Indramayu put in place structural mechanisms to support farmers' decisions to respond to forecasts: agreement with agricultural inputs distributors to provide sufficient seed stocks, fertilizers, etc. to support early planting; a revolving fund for a micro-credit scheme; and agreement with Sucofindo to ensure a market for alternative crops. The district government is also leading efforts to enable farmers' cooperatives play a leading role in climate risk management, entrepreneurship, and in establishing market linkages.

At the national level, BMG and DITLIN have incorporated climate forecast application into their development plans, and invested resources in plan implementation. DITLIN created a Climate Analysis and Mitigation cell within the Directorate to analyze potential impacts of a forecasted event, and accordingly prepare a response plan for mitigation of potential impacts. BMG has invested in observing, computing, and human resources to enable the delivery of localized forecast products in 30 districts in the country. DITLIN is matching BMG's program expansion by replicating Climate Field Schools in these districts. Adaptation of the CFS curriculum to these districts is ongoing. The CFA institutionalization process follows these iterative steps:

1) Mapping of climate risks in districts based on historical data (type of climate hazards, timing, intensity, affected area, economic losses, etc.)
2) Prioritizing districts that will receive special services from BMG in providing climate forecast and refining forecast regions, climate observation networks, forecast models;
3) Providing relevant climate information for the prioritized districts;
4) Developing climate forecast applications tools for managing climate risks;

5) Increasing the understanding and capacity of policy makers as well as other end users in climate risk management for disaster mitigation;
6) Documenting lessons learnt and good practices gained in applying climate information in managing climate risks and mitigating climate related disasters; and
7) Institutionalizing and mainstreaming climate information application in development process in order to increase resilience to current and future climate risks.

DITLIN plans to establish a National Extension Workers Network, with support from the Asia Pacific Network for Global Change Research (APN), IPB, BMG, and Local Governments (through the Pest Disease Observers). The Network will play a leading role in the following activities: documentation of experiences and good practices on climate forecast applications for disaster mitigation, development of national curriculum and modules for Climate Management Field School with assistance from universities and research institutes, providing inputs to DITLIN in setting up national programs and activities for climate risk management, and working with local extension workers for setting up action plans for anticipating extreme climate events, particularly in vulnerable areas.

V. REPLICATION OF CFA METHODOLOGY AND TOOLS

V.A. PHILIPPINES

Gaining confidence from the CFA methodology, PAGASA has developed and is currently implementing a project entitled "Bridging the Gap between Seasonal Climate Forecasts and Decision-makers in Agriculture" in collaboration with the Australian Center for International Agriculture Research (ACIAR), Philippine Institute for Development Studies (PIDS), and Leyte State University (LSU). The project aims to develop and deliver seasonal climate forecasts; identify gaps between actual and potential values of seasonal climate forecasts; estimate the potential economic value of seasonal climate forecasts for select corn-based farming systems in the Philippines; and provide forecasts required by decision makers in the corn sector. The study areas are spread all over the country, namely in the provinces of Isabela (Luzon), Leyte, and Cebu (Visayas), and Bukidnon (Mindanao).

Other projects in the pipeline include the establishment of Early Warning and Monitoring System for Agriculture and Water Resources, which will be funded by the Korea International Cooperation Agency (KOICA). This project will replicate CFA methodologies in three provinces. The project's goal is to improve the productivity of rice and corn and raise the standard of living through a community-based climate information and early warning and monitoring system for agriculture.

Another project in the pipeline is the "Climate-Based Information Support System for Management of the Angat-Umiray Reservoir," which will be funded by the Metropolitan Waterworks and Sewerage System (MWSS). The project will develop a computer-based decision support system for managing water resources in Angat and Umiray Reservoir.

V. B. INDONESIA

As mentioned in section III, BMG aims to provide localized forecasts to a total of 40 regencies in 2007. Five of these regencies benefit from the CAPABLE Program (Scientific Capacity Building/Enhancement for Sustainable Development in Developing Countries) of APN. In response to user requirement, BMG is also working towards providing a package of information to users that integrates both weather and seasonal climate forecasts.

Aside from its continuing work on improving its research and development programs for district scale-climate prediction, BMG is planning to expand its initiatives at the Southeast Asian region level by providing training on establishing Climate Field Schools, with funding from the Indonesian government.

In order to support its initiatives, BMG is undertaking the following activities:

- Improving hardware capability primarily by expanded PC cluster
- Applying new software for prediction
- Training for improving personnel capability in climate prediction at international centers
- Promotion of R&D products to regencies and climatological stations
- Continuous validation of rainfall prediction for district levels
- Improving the skill of prediction
- Improving the capability of station personnel

In the future, BMG is planning to set up an ensemble prediction system which will be derived from both statistical and dynamical approaches. Improvement of hardware and software, as well as capacity building for its meteorologists and researchers are essential in BMG's work. It also plans to continue its close collaboration with national (LAPAN, Bandung Institute of Technology, Bogor Agriculture University, Department of Agriculture, etc) and international prediction centers (International Research Institute for Climate and Society, Bureau of Meteorology Australia, Australia's Commonwealth Scientific and Industrial Research Organization, India Meteorological Department, Japan Meteorological Agency, Korean Meteorological Agency, and others).

V.C. Integration of Climate, Market and Financial Risk Information

For its part, ADPC has conceptualized a project that is aimed at deepening the CFA program through the integration of climate, market, and financial risk information. This project is motivated by the observation that, oftentimes, even if farmers are willing to respond to climate forecasts, they are unable to do so because they either lack financial resources or because of the uncertainty of crop market value during harvest (should they decide to switch crop) or both. This project will be piloted in the Philippines, in partnership with the Food and Agriculture Organization of the United Nations (FAO), PAGASA, and the Bureau of Agricultural Statistics (BAS) in the Philippines.

The proposed project consists of the following components: 1) provision of production and market forecast information to guide crop selection before the cropping season; 2) making available a sustainable financial support mechanism to support farmers' decision, 3) provision of short range (3-5 days initially), medium range (20-25 days); and seasonal rainfall forecasts (1 month); and 4) putting in place low-cost technical drought preparedness and mitigation options.

The provision of production and market information for essential agricultural commodities will build upon the existing tools and methods already developed by BAS. The market information will be province-specific and will include information from trading partners and competing provinces. In order to ensure that the target users know how to use the information, there will be users' training and demonstration of information application.

The project will also assess the existing financial instruments and document the good practices that are already available in the country. It will then facilitate the farmers' evaluation of available options and explore the possibility of providing package for farmers in partnership with existing financial institutions. If the assessment will reveal that a new financial instrument is required, the project will develop the instrument and test its operation.

The capacity building activities, tools and methodologies developed under CFA will be leveraged in order to provide enhanced severe weather forecasts in different timescales. The project proposes the identification, acquisition and verification of prediction models that are appropriate for the country. Agriculture extension workers at provincial and municipal levels will be trained to apply and communicate these products to farmers. This component will build on the partnership with PAGASA, BMG, and regional disaster risk information centers, wherever available.

The final component comprising the proposed project is the identification and evaluation of low-cost but sustainable drought preparedness and mitigation options ranging from rainwater harvesting, water management practices, agronomic drought management practices, preparedness measures (contingency crop planning, fodder management), and alternative livelihood strategies. Given the wide range of possible options, the project proposes that priority measures will be identified and implemented in a participatory manner.

A project proposal has already been developed by ADPC. FAO is mobilizing donor support for the project.

VI. ACTION PLANNING

The participants were asked to form groups and tasked to discuss the profile of their area, identify the climate-risks, formulate ways of addressing them, and identify potential funding sources. The delegates from Iloilo were divided according to the congressional districts they represent. A congressional district consists of contiguous municipalities. There were 6 groups overall, representing districts 1 to 5, and with the delegation from Antique Province, which consists of provincial government officers and representatives from the municipality of Sibalom, forming one group. Group outputs are presented in Annex 4.

It is remarkable that there are already a few local funding sources that may be explored for climate risk management initiatives, such as the Congressional Development Fund. Part of the local government's calamity fund can be used now for investing in disaster mitigation programs (e.g. fabrication/acquisition of rain gauges, flood markers, etc). In-kind contributions may also be sought from private entities. The manager of Zarraga Multi-Purpose Cooperative in Zarraga Municipality announced that a supplier of agricultural inputs donated a rain gauge, which will be installed in the municipality.

ADPC will extend technical assistance to municipalities that are interested in replicating CFA. In particular, ADPC responded to Antique's request for assistance in organizing a workshop in the province as a start up activity for implementing a climate risk management project. PAGASA's initial commitment is in the area of increasing the density of rainfall observation network. PAGASA has a manual for putting together a locally-fabricated rain gauge, which can be made available to local governments upon request. PAGASA will also extend technical assistance in the installation of rain gauges and training for observers, as well as provide the design and specifications of a small weather station.

ANNEX 1. PROGRAM OVERVIEW

The Climate Forecast Applications (CFA) program aims to develop locally-appropriate climate information tools and capacity to apply these in real-time in Indonesia and the Philippines to mitigate the impacts of droughts, floods, and typhoons. It employs a two-level approach: 1) carrying out targeted demonstration projects to explore and refine methods, and 2) identifying and stimulating national capacities to scale up the application of the methods so that they can be applied elsewhere.

Program Goal: ***Sustainable end-to-end institutional systems in Indonesia and the Philippines that demonstrate improvements in the performance of climate sensitive sectors at the community level with the capacity to achieve similar success nationally in other locations.***

Program Objective 1: **Decision support tools and capacities developed and tested for selected locations, showing measurable improvements in performance of climate-sensitive sectors.** ***Focus is on the participatory identification of climate-related problems and development of knowledge and tools in areas and sectors that are vulnerable to climate impacts and where there is interest in learning and demonstration.***

Program Objective 2: *Capacities, tools and information required to operationalize the demonstration project results at national scale identified and transferred.* Focus is on identifying the elements of sustainable end-to-end climate information and applications systems and strengthening the capacities of the local and national institutions needed to generate and effectively apply climate information in Indonesia and the Philippines, based on the results of the demonstration projects.

Key Program Elements and Activities

Objective 1	*Objective 2*
Demonstration projects	
• Selection of pilot sites of high climate predictability, vulnerability and receptivity in a participatory manner • Demonstration of climate information applications	• Transfer of learning for managing climate variability and extremes in locations not directly targeted by the project
Development of tools	
• Create climate information products needed for end-to-end demonstration at pilot sites • Formulation and application of metric to measure enhanced performance due to project products	• Develop and package site selection procedures • Package tools developed for site-specific projects for broader distribution and application
Capacity building	
• Develop network of local-national partnerships in each country for project implementation • Enhanced availability of tailored information on climate variability and impacts at demonstration sites	• Transfer of tools and lessons learned on climate impacts and decision-support systems for application in climate-sensitive sectors in other locations

ANNEX 2. LIST OF PARTICIPATING LOCAL GOVERNMENT UNITS AND GOVERNMENT AGENCIES

I. Local Government Units

I.A. Philippines

Municipalities

1) Carles
2) Balasan
3) Concepcion
4) San Dionisio
5) Ajuy
6) Barotac Viejo
7) Dumangas
8) Barotac Nuevo
9) Pototan
10) Dingle
11) Lambunao
12) Janiuay
13) Maasin
14) Zarraga
15) Leganes
16) Pavia
17) Alimodian
18) Tigbauan
19) Igbaras
20) Miag-ao
21) Sibalom

Provinces

1) Province of Iloilo
2) Province of Antique

I.A. Indonesia

1) Regency of Indramayu

II. Agencies

II.A. Philippines

1) Municipal Agriculture Office (MOA)
2) Municipal Planning and Development Office (MPDO)
3) Provincial Agriculture Office (PAO)
4) Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA)

II.B. Indonesia

1) Agency for Meteorology and Geophysics (BMG)
2) Ministry of Agriculture (MoA)
3) Indramayu District Office of Agriculture

ANNEX 3. LIST OF PRESENTATIONS

This report is based on group discussions and the following presentations:

Experience of Dumangas, Iloilo in using climate forecasts for managing climate risks in the agriculture sector

Hon. Rolando Distura
Mayor, Municipality of Dumangas
Iloilo, Philippines

PAGASA program for improving the skill of climate forecasts for agro-meteorology services (including status of climate science research towards tool development under the CFA program)

Dr. Flaviana Hilario
Chief, Climatology and Agrometeorology Branch
PAGASA

Experience of Indramayu, West Java, in managing climate risks in agriculture

Mr. H. Irianto MS Syafiudin
Bupati, Kabupaten Indramayu
West Java, Indonesia

Experience of BMG in providing localized forecast to West Java districts (including forecasting techniques and resource mobilization)

Dr. Mezak Ratag
Head, Research and Development Department
Agency for Meteorology and Geophysics (BMG), Indonesia

Indonesian national program and policies for managing climate risks in agriculture

Dr. Soetarto Alimoeso
Director General, Directorate for Food Crop Protection
Ministry of Agriculture, Indonesia

Experience of Dumangas, Iloilo in integrating climate information into municipal development planning process

Engr. Saul Deasis
Municipal Planning and Development Officer
Dumangas, Iloilo, Philippines

Mainstreaming climate forecast applications for disaster mitigation in district development planning process

Dr. Rizaldi Boer
Head, Climatology Laboratory
Bogor Agricultural University, Indonesia

Ongoing and planned efforts in providing locally-tailored climate forecast information in other locations in the Philippines

Dr. Prisco D. Nilo
Officer-in-Charge and
Deputy Director for Operations and Services, PAGASA

Ongoing and planned efforts in providing locally-tailored climate forecast information in other locations in Indonesia

Ir. Yunus Swarinoto, MSc.
Head, Climatology & Air Quality Data Management Division
Agency for Meteorology and Geophysics (BMG), Indonesia

Deepening the CFA Program by integrating climate, market and financial risk information into livelihood programs

Ms. Lolita Bildan
Project Manager, Climate Risk Management, ADPC

ANNEX 4. ACTION PLANS

4.1. DISTRICT I – Municipality of Igbaras

1. PROFILE

Igbaras is a third class municipality in the southern part of Iloilo Province with almost 32,000 inhabitants. It is characterized by mountains and rolling hills with a minimum and maximum elevation of 40 feet and 3,239 feet above sea level respectively. There are about 25 rivers and creeks that traverse in the entire municipality and the major river is the Tangyan River, which drains to Guimbal Gulf. This river is a major watershed. There are two pronounced seasons in Igbaras namely rainy season from June to November and dry season from December to May.

2. CLIMATE-RELATED PROBLEMS

In year 2003-2004, a long dry spell was experienced in the locality that damaged agricultural crop production and resulted in 90% rice production losses. Aside from paddy, secondary crops were also affected, such as corn, peanuts and bananas. Pests and other harmful organisms proliferated and negatively affected the yield of farmers. Livestock suffered from the shortage of forage due to the reduction of supply of forage crops. Because of this long dry spell, the area experienced lack of water supply. There was also an outbreak of Hemorrhagic Septecimia disease which resulted in the death of a huge number of livestock. Since then, drought has been experienced regularly and rainfall pattern is now becoming more erratic compared to the past.

Flooding is the worst disaster that occurred in Igbaras. Since 1990, lives were lost due to occurrence of floods. In October 2006, 23 people died and 19 are still missing due to sudden flashflood in Tangyan River. Aside from loss of lives, floods caused damage to agricultural crops. The recent floods created a bigger flood plain especially in the poblacion (town center) area.

Other problems that were identified are:

1. Land mismanagement
2. Illegal cutting of forest trees
3. Encroachment of forest for agricultural activities
4. Quarry operations that resulted in excessive extraction of gravel, sand, stones and boulders
5. Occurrence of natural phenomenon, such as El Niño, La Niña, typhoons
6. Weak data information system
7. Occurrence of floods and droughts

3. PROPOSED SOLUTIONS

1. Capacity building for farmers, stakeholders and other members of civil society for land management
2. Information, & education campaign and advocacy program
3. Regulating quarry operations and conduct monitoring system for their extraction activity
4. Reorganization of the Municipal Disaster Coordinating Council
5. Provision of necessary equipment, tools and materials for disaster preparedness program
6. Encourage organic farming and salt application in some areas of the municipality
7. Establish climate information and monitoring center
8. Formulate Disaster Preparedness Plan
9. Conduct training and seminars relevant climate risk management
10. Organize a databank for ready reference
11. Establish agricultural meteorological station in the municipality and provide rainfall stations in strategic areas
12. Integrate climate information program in the municipal agricultural development plan and ultimately in the municipal development plan as one of the priority programs

4. POTENTIAL FUNDING SOURCES

1. Government funds
    a. Local Internal Revenue Allotment
    b. Provincial Aid
    c. National Aid

2. Private Donors and Benefactors

4.2. DISTRICT 2

1. CLIMATE-RELATED PROBLEMS, SOLUTIONS & POTENTIAL FUNDING SOURCES

1. A. El Niño

Sectors affected	**Problems/Issues**	**Solutions**	**Funding Sources**
Livestock	1) Insufficient supply of drinking water for animals 2) Outbreak of diseases 3) Supply of meat and meat products will be affected 4) Scarcity of feed supply and ingredients	1) Well-drilling 2) Mass vaccination & medication 3) Look for alternative protein substitute 4) Reduce livestock stocking density	
Potable Drinking Water	1) Aquifer affected by excessive heat	1) Explore and establish a centralized potable water source	
Rice Farming	1) Lack of water supply 2) Rice production not possible 3) Shortage on rice supply 4) Price escalation	1) Well drilling (deep and shallow) 2) Crop management; identify crops suited for dry condition 3) Rice importation 4) Activate price control	
Vegetable farming	1) Limited species of vegetables that could adapt to dry climate 2) Lack of vegetable supply	1) Identify vegetables that could grow best in dry season 2) Explore sources of vegetables from other provinces	
Fish farming	1) Slow growth of various brackish water aquaculture species 2) High water salinity 3) Expensive cost of production 4) Fresh water farming is not possible	1) Water management	

1. B. La Niña

Sectors affected	Problems/Issues	Solutions	Funding sources
Livestock	1) Disease outbreak 2) Limited supply of meat	1) Mass vaccination/medication 2) Alternative source of protein	
Portable drinking water	1) Contamination of potable water	1) Sterilize drinking water/water analysis	
Rice farming	1) Farm preparation affected 2) Outbreak of pest and diseases 3) Growth potential and yield of rice affected 4) Harvesting	1) Delay planting/revise cropping pattern 2) Use of resistance varieties, both pest and lodging 3) Modify cropping pattern 4) Provision of mechanical dryers	
Vegetable farming	1) Outbreak of pests and diseases 2) Shortage of supply	1) Revise/modify cropping pattern 2) Use of off-season varieties	
Fish farming	1) Damage of fish ponds/cage/nets 2) Shortage supply of fish	1) Change in production cycle 2) Make use of other protein source	
Salt farming	1) Limited production of salt	1) Adapt mechanical dryer	
OTHERS			
Lowland areas along the riverbanks	1) Flooding	1) Cleaning, desiltation of river bed 2) Construction of flood control dikes	
Coastal areas	1) Soil erosion	1) Reforest denuded mangrove areas along coastal barangay	National

2. GENERAL RECOMMENDATIONS

1) Each municipality should be provided with rain gauges and encourage them to use a weather chart for daily weather monitoring in order to establish a climate pattern in the area.
2) Introduce livelihood training programs as an alternative source of income in case of crop production will be affected by climate.

4.3. DISTRICT III

1. PROFILE

1.1. Location: Central Iloilo

1.2 Topography

- Rugged terrain – almost 50% of the area is mountainous; alimodian clay loam
- Water sources: River-Jalaur, Suague, Tigum
- Presence of springs in mountain areas

1.3 Climate regimes

1) Type 1 - two pronounced seasons
2) Type II - no pronounced seasons

1.4 Economic profile

- Major source of income: agriculture
- Major crops: Rice, corn, banana

2. CLIMATE-RELATED PROBLEMS, PROPOSED SOLUTIONS, and POTENTIAL FUNDING

Sectors affected	Problems/Issues	Strategies/Proposed Solutions	Potential funding
2.1. La Niña			
Rice farming	1) Flash flood occurs along the riverbanks damaging the rice fields and resulting in low production	1) Information Education Campaign 2) Reforestation 3) Minimize quarrying 4) Planting of high resistant varieties	Internal Revenue Allotment (IRA) of the local government units
Vegetable farming	2) Shortage of vegetable in the market	1) Planting of off-season vegetables	
Livestock	3) Outbreak of pest and diseases	1) Mass vaccination/immunization of animals and fowls	
2.2. El Niño			
Rice farming	4) Lack of water supply	1) Installation of shallow tube wells to irrigated rice areas 2) Pumping from river banks	
	5) Shortage/low production	1) Planting of early maturing varieties	
		2) Planting of crops that are resistance to dry season	
Livestock	6) Outbreak of pest and diseases	1) Vaccination of large animals and immunization of	

4.4.DISTRICT IV

1. PROFILE

1.1. Major crops: Rice, sugarcane, corn, livestock
1.2. Population: 250,263

2. CLIMATE-RELATED PROBLEMS, SOLUTIONS, and POTENTIAL FUNDING SOURCES

1) Heavy rains from May to mid-July
2) Month-long dry spell from mid-July to August
3) Heavy rains from mid-August to December
4) Long dry spell and drought from February to early May

Problems	Solutions	Funding sources
A. Flood		
1. Crop/Livestock/Fishery Destruction	1.1) Flood early warning system	Barangay (village) and municipal internal revenue allotment (IRA)
	1.2) Organize and strengthen municipal/barangay disaster management centers	Donations from private sector
	1.3) Activate disaster management center	Grants from local and foreign donors
	1.4) Regular monitoring of the disaster management team to ensure preparedness in disaster situations	
	1.5) Identify safe places for livestock	
	1.6) Use climate information for designing crop patterns	PAGASA and ADPC
2. Food shortage problems	2.1) Allocate portion of the calamity fund for pre-disaster activities	Local IRA

	2.2) Disaster preparedness training	Private sectors/NGO
	2.3) Emergency food stocks	
	2.4) Communication equipment and system	
	2.5) Installation of rain gauge in each municipality within the district or at least in every ecological zone within the municipality	
3. Erosion/Siltation	3.1) Formulate and approved municipal resolution on the protection of erosion-prone areas using different technologies	
3.1. Erosion	3.1.1) Wide advocacy on the use of agriculture technology such as SALT, alley cropping/contour farming, GEO-Textile	Department of Agriculture – Department of Science and Technology (DOST)-Department of Trade and Industry (DTI)-Technical Education and Skills Development Authority (TESDA)
	3.1.2) Dredging and recovery of silt soil from rivers and irrigation system	
3.2. Siltation	3.2.1) Advocate soil harvesting	
	3.2.2) Dredging and recovery of silt soil from rivers and irrigation system	
4. Health-related problems	4.1) Early warning system	Department of Health & nongovernmental organizations
	4.2) Training of paramedics to complement disaster management teams	
	4.3) Stand-by food and medical supplies as in 2.2	
	4.4) Long-term health management programs	
5. Infrastructure problems	5.1) Early warning system	
	5.2) Municipal/barangay infrastructure monitoring teams through the municipal/barangay disaster council	Barangay/municipal IRA
	5.3) Activate fast action repair teams	
	5.4) Ensure fast feedback mechanism to congressional representatives/governor for immediate repair of damages	Congressional Development Fund/Department of Public Works and Highways (DPWH), National Irrigation Administration (NIA), Department of Agriculture (DA)

4.5. DISTRICT V

1. PROFILE

1.1 Geographical location: northeast of Panay Island
1.2 Population: approximately 370,500
1.3 Topography: lowland, upland, coastal
1.4 No. of municipalities: 11 (8 municipalities are coastal)
1.5 Major products: rice, corn, aqua-marine products
1.6 Crop area under irrigation: approximately 3,000 hectares
1.7 Climate characteristics: Dry from January to May and wet from June to December

2. CLIMATE-RELATED PROBLEMS, PROPOSED SOLUTIONS, AND POTENTIAL FUNDING SOURCES

2.1. Major climate risks

a) Drought – February to April
b) Flood – June to August
c) Typhoon – September to November

PROBLEMS	SOLUTION	FUNDING SOURCE
1. Unpredictable climatic changes	Reforestation, ecological, and solid management	Local government unit (LGU)
2. Absence of data/information on weather conditions & no existing weather/climate observation facilities	Installation of equipment	PAGASA/ADPC/LGU
3. Lack of awareness and agriculture extension workers on climate information	Information, dissemination, training, & sustain Farmer Field School	LGU, Department of Agriculture (DA), Bureau of Fisheries and Aquatic Resources (BFAR)
4. No precise cropping/fishery pattern	Information dissemination and planning session with farmers and fisher folks	LGU, BFAR
5. Intrusion of salt water to rice land due to high tide	Installation of sea wall and river control	LGU, National Irrigation Administration (NIA), Department of Public Works and Highways (DPWH)
6. Flood	Construction/rehabilitation of drainage canals, cleaning and rehabilitation of rivers, education of inhabitants on proper care of rivers	NIA, LGU, DA
7. Drought	Crop diversification	LGU, DA

4.6. PROVINCE OF ANTIQUE

1. PROFILE

1.1 Location: The province is located in the Western Part of the Panay Island, bounded by the mountain ranges of Aklan, Capiz and Iloilo in the East and the Cuyo-East Pass in the West.
1.2 Population: 531,536 (2006)
1.3 Area: 252.2 sq. km; majority of land area is lowland
1.4 No. of Municipalities: 18 (14 Coastal, 1 Island & 3 Inland)
1.5 Agro-Ecological Zones:
- 83% upland
- 17% lowland

1.6 Livelihood:
- Agriculture and fisheries are the main industry
- 50,000 Hectares (effective area) is devoted to Agriculture
  - 10,000 Ha. – irrigated
  - Rest of the area is rainfed
- Produce rice two to three times a year in the irrigated area and once in the rainfed areas

1.7 Climate Characteristics:
- Generally wet from May to October and dry from November to April
- However, the Northern part of the province wet season is from May to February (Culasi to Pandan)

1.8 Major Climate Risks
- Southwest monsoon is prevalent in the province from May to mid of September, where heavy rains, floods, strong winds occur unpredictably
- Experiences an average of 2 strong typhoons a year (from June to December)
- Experiences drought during dry season from November to April

1.9 Existing Weather/Climate Observation System

- 1 Rain gauge – Sibalom-San Jose Irrigation System (Tipuluan River)
- 1 Water Level Indicator (Sibalom Bridge)
- Rain Station at Barbaza, Antique
- Observation Station maintained by PHIVOLCS at Anini-y, Antique
- Internet connection to monitor PAGASA Report/Forecast

(Inventory of other weather related facilities to be conducted by the Provincial Planning and Development Office)

2. CLIMATE-RELATED PROBLEMS

- Lack of technical knowledge on climate forecasting and interpretation of existing data collected from the rain gauges, etc.
- An average of 30% loss of the agricultural production due to unpredictable heavy monsoon rains (July to September)
- Irrigation is insufficient during dry season (February to April)
- 50% of the small farmers loss their crop productions due to unpredictable rainfall every year particularly during second and third cropping (November to April)
- PAGASA weather forecast most often does not jibe with the Antique weather condition

3. PROPOSED SOLUTIONS

1. Adopt similar initiatives undertaken by the Dumangas and Indonesia (e.g. Climate Field School)
2. Establishment of Weather Station in the Province of Antique
3. Skills training of personnel on climate forecasting and interpretation
   - Installation of equipments & facilities

4. POTENTIAL FUNDING SOURCES

1. 20% IRA (Development Fund) of the Local Government Units
   - Barangay
   - Municipal
   - Provincial

2. Congressional Development Fund
3. ADPC

5. IMMEDIATE NEXT STEPS

The Province of Antique would like to manifest its desire to pursue the same initiatives of Dumangas and Indonesia on Climate Forecast Applications for Managing Climate Risks in Agriculture.

In this connection, we would like to know what possible assistance could ADPC may support or provide the Province of Antique. Likewise, if we will organize a workshop on climate risk management, what would ADPC expect from us?

ASIAN DISASTER PREPAREDNESS CENTER
P O Box 4, Klong Luang, Pathumthani, Thailand 12120
Tel: (66 2) 516 5900-10
Fax: (66 2) 524 5360
URL: http://www.adpc.net