Asia-Pacific Network for Global Change Research

Linking Climate Change Adaptation to Sustainable Development in Southeast Asia

Final report for APN project: ARCP2007-05CMY

The following collaborators worked on this project:

Dr. Rodel Lasco, ICRAF-Philippines, Philippines, r.lasco@cgiar.org

Dr. Florencia Pulhin, FDC-UPLB, Philippines, yaybpulhin@yahoo.com

Dr. Rizaldi Boer, Institute Pertanian Bogor, Indonesia, rboer@fmipa.ipb.ac.id

Mr. Perdinan, Bogor Agricultural University, perdinan@gmail.com

Ms. Kiki Kartikasari Bogor Agricultural University, kkartikasari@gmail.com

Dr. Nguyen Thi Hien Thuan, IMH-MONRE, Vietnam,thuan_sihymete@yahoo.com

Linking Climate Change Adaptation to Sustainable Development in Southeast Asia

Project Reference Number: ARCP2007-05CMY

Final Report submitted to APN

Overview of project work and outcomes

Non-technical summary

Climate change is one of the primary concerns of humanity today. The most recent IPCC Fourth Assessment Report (IPCC AR4) states that climate is indeed changing and that human activities largely contribute to this change. Indeed climate change will exacerbate current stresses on the natural and social systems (Adger et al., 2003). As the climate changes, increasing attention is given to how societies and natural systems can adapt to a new climate regime.

Recently, it is being recognized that the way to address climate change is to integrate adaptation policies into the sustainable development programs of the country (Huq *et al*.,2003). By mainstreaming climate change adaptation into the sustainable development and poverty reduction strategies, the most vulnerable sectors (the poor people) will become more resilient to climate change (Sperling, 2003). However, the link between climate change adaptation and sustainable development is not explicitly recognized for a number of reasons. In many cases, the climate change community has little interaction with national development planners. As a result, mainstreaming of climate change adaptation in development efforts is making little headway. This project aimed to help clarify the links between climate change adaptation and sustainable development. By engaging the policy maker community and other relevant stakeholders, the project hoped to contribute to the mainstreaming of climate change adaptation to the sustainable development agenda of SE Asian countries.

Objectives

The main objectives of the project were:

1. Synthesize research on adaptation strategies for climate change and climate variability in SE Asian countries;
2. Analyze the links of adaptation strategies to the sustainable development goals of the respective countries;
3. Hold a science-policy workshop to disseminate results and solicit recommendations; and
4. Publish the results of the study in a format that is useful to policy makers and other stakeholders.

Amount received and number years supported

2007/08: USD 35,000.00

Activities undertaken

1. Synthesis Meeting

   On September 26-27, 2008, a synthesis workshop was held at Khush Hall, IRRI, Los Banos, Laguna. The primary objective of the meeting was to identify the sector to focus on and the methodology to be used. To provide a spring board for discussion, Dr. Rodel Lasco, Project Leader, presented a general framework of analysis that will be used by the country collaborators from Vietnam, Indonesia, Laos and the Philippines. During the meeting, it was agreed that the following activities be undertaken by each country collaborator: (1) review and analyze existing national/regional/sectoral development plans, programs, strategies and activities, and identify whether climate change have been integrated; (2) review and synthesize past and present climate change, climate risks and

climate-related researches/studies to identify the most appropriate adaptation strategies/measures and analyze its links to sustainable development; and (3) conduct consultation and key informant interviews with stakeholders to identify the extent of integration of climate change into policies and the adaptation measures that needs to be mainstreamed.

2. Synthesis of climate change adaptation and related research in the SE Asian region

   Each collaborator conducted an inventory of researches on climate change adaptation and related researches undertaken in their respective countries. Results from such researches were synthesized to identify the most promising adaptation strategies.

3. Analysis of links to sustainable development

   For each participating country, the link of the most promising adaptation strategies identified above to sustainable development was analysed. For instance, the consistency of climate change adaptation strategies to national policies and development plans (eg Millennium Development Goals, national Agenda 21; medium term plans) was analyzed. Scientists and policy makers of the countries involved were interviewed and consulted on various issues related to climate change adaptation, environmental protection and socio-economic development to identify the appropriate links between climate issues and national development plans. Scientists from international organisations and institutions, whose works focused on the SE Asian region, were also consulted.

4. Science-Policy Workshop to disseminate results and solicit recommendations

   A year after the synthesis meeting, a science-policy workshop was held to disseminate results of the findings of each country collaborator. The workshop brought together the policy makers of each collaborating country, the climate change community and other relevant stakeholders in the Philippines.

   After the paper presentation, an open forum was held to solicit recommendations and comments on the synthesis papers presented by each collaborator. The workshop immediately followed to determine potential points of entry where climate change adaptation can be mainstreamed, strategies/approaches to be undertaken and responsible agencies. The participants were divided into three groups to discuss the following sectors: (1) agriculture and natural resources; (2) policy; and (3) infrastructure.

Results

Relevance to APN's Science Agenda and objectives

The project is highly relevant to the APN's current Science Agenda with focus on climate change adaptation and sustainable development. There is limited information on how developing countries in the region adapt to climate change. The project's activities helped identify the most appropriate climate change adaptation strategies for the natural resources and agriculture sector as well as rural communities. More importantly, the link of these adaptation strategies to the sustainable development agenda of each country was analyzed.

The project synthesized recent climate change adaptation and related research in the region (e.g. the recently completed AIACC research involving the PI and other collaborators). The results were used to build the capacity of national decision makers

through a science-policy workshop. The workshop sought to promote dialogue between the science and policy communities in the SE Asian region.

Self evaluation

1. Synthesize research on adaptation strategies for climate change and climate variability in SE Asian countries
   Each country collaborator made an inventory of climate change researches conducted in his/her respective country
2. Analyze the links of adaptation strategies to the sustainable development goals of the respective countries
   The country collaborators identified the link of adaptation strategies in the sector chosen to the sustainable development goals of his/her country. For instance in the Philippines, it was discussed that the adaptation strategy "protection of the watersheds" would ensure steady water supply and ensure production of food to meet growing demand. Inability to secure the food requirement will result to inability to engage in economic activities resulting to greater poverty. Likewise, limited agricultural products available due to insufficient water supply will bring the prices for such products into a remarkably high mark making them unaffordable for the majority of the country's population. Also, declining water supply will cause farmers especially the small ones not to produce any crops. To cope with the adverse impacts of drought, some farmers engage themselves to charcoal making or fuelwood production or other economic activities that are harmful to the environment. As a result of the destruction of the environment, the local community becomes more vulnerable to extreme climatic events since their livelihoods are natural resource based.

   In the same manner, ensuring that watersheds are protected would prevent pollution of the water resources downstream. Accordingly, water pollution costs the economy an estimated P67 billion annually (NWRB, 2003).

   The industrial sector also requires water for its activities. Without enough water for its use, there will be limited growth for the industry sector. This will in turn limit available jobs for many people and advancement of the country's economy.

3. Hold a science-policy workshop to disseminate results and solicit recommendations

   A science-policy workshop was conducted on September 24, 2008 to disseminate results of the project and solicit recommendations on the potential points of entry, strategies to be undertaken and responsible agencies. It brought together the science community and policy makers.

4. Publish the results of the study in a format that is useful to policy makers and other stakeholders.

   A paper "Mainstreaming Climate Change in Developing Countries: The Case of the Philippines " which was conceived due to this project was accepted for publication and is currently in press.

Potential for further work

In the future, it is valuable that implementation of the sustainable development initiatives integrating climate change adaptation be assessed. Barriers to its implementation should also be identified.

Publications

Lasco, R. D. R. J. Delfino, F. B. Pulhin and M. Rangasa. 2008. The Role of Local Government Units in Mainstreaming Climate Change Adaptation in the Philippines. AdaptNet Policy Forum 08-09-P-Ad, 30 September 2008.

References

Adger, WN., S Huq, K Brown, D Conway, and M Hulme. 2003. Adaptation to climate change n the developing world. *Progress in Development Studies* 3: 179-195.

Huq, S., A. Rahman, M. Konate, Y. Sokona and H. Reid. 2003. Mainstreaming Adaptation to Climate Change in Least Developed Countries (LDCs). International Institute for Environment and Development, London, UK, 40 pp.

Sperling, F. (ed.) 2003. Poverty and Climate Change—Reducing the Vulnerability of the Poor through Adaptation. AfDB, ADB, DFID, EC DG Development, BMZ, DGIS, OECD, UNDP, UNEP and the World Bank, Washington, DC, USA, xii+43 pp.

NWRB, 2003 National Water Resources Board (NWRB). 2003. National Water Resources Board Strategic Planning and Management of Integrated Water Resources Management in the Philippines.

IPCC 2007. Fourth Assessment Report. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland.

Acknowledgments

The implementation of this project would not be possible without the financial support given by the Asia Pacific Network.

The research team is grateful to the stakeholders who participated and provided valuable inputs.

Technical Report

Preface

The Southeast Asia (SEA) countries are very vulnerable to the impacts of climate change because of the very limited resources they have. Currently, attention is given as to how societies and natural systems can adapt to a new climate regime. As a result, it is expected that the SEA countries will have a hard time to attain sustainable development. However, this can be dealt with if climate change adaptation strategies are mainstreamed in sustainable development plans.

This project was undertaken to stir up interest in mainstreaming climate change adaptation to the sustainable development agenda of SEA countries.

Table of Contents

1.0 Introduction

The most recent IPCC Assessment Report (IPCC, 2007) states that climate is indeed changing and that human activities largely contribute to this change. Impacts of climate change are projected to be disastrous. Among the countries in the world, the developing nations are among those which will be hardly hit by climate change. With very limited resources, the developing countries will not be able to cope with the impacts of climate change.

Currently, the natural and social systems are already experiencing a lot of stresses which include the impacts of climate variability and extremes. These stresses will intensify as frequency and intensity of such climate variability and extremes increase with climate change (Adger et al., 2003). Thus, measures on how societies and natural systems can adapt to a new climate regime must be put together. These adaptation strategies will enable natural or human systems to make adjustments in response to observed or expected changes in climate stimuli, or their effects in order to alleviate adverse impacts or take advantage of opportunities (Adger et al., 2005; IPCC, 2001; McCarthy et al., 2001).

Climate change and sustainable development are closely linked with each other. The adverse impacts of climate change are among the contributory factors why sustainable development efforts of the developing countries will not be achieved. This, however, can be addressed if climate change adaptation strategies are mainstreamed in sustainable development plans of the country (Huq et al., 2003). At present, efforts to mainstream climate change adaptation in development works are making little headway. This is attributed to the very little interaction of the climate change community with the national development planners.

This project was undertaken to help clarify the links between climate change adaptation and sustainable development. By engaging the policy maker community and other relevant stakeholders, the project aimed to contribute to the mainstreaming of climate change adaptation to the sustainable development agenda of SE Asian countries.

2.0 Methodology

2.1 Synthesis of climate change adaptation and related research in the SE Asian region

In Southeast Asia (SEA), researches were conducted in the last few years to assess the adaptation strategies undertaken by the natural resources and agriculture sectors to cope with the impacts of climate variability and extremes (e g El Nino, La Nina, tropical storms) and climate change. These studies were compiled and synthesized by the research team members of the three SEA countries: Indonesia, Vietnam and the Philippines. In-depth review on issues of socio-economic development, policies on environmental protection and climate change adaptation were conducted with focus on the use of natural resources and agricultural practices. Vulnerable areas were identified alongside with their existing challenges caused by climatic and institutional changes. Common problems in coping with climate impacts of the region were likewise addressed and examined.

2.2 Analysis of links to sustainable development.

For each participating country, the link of the most promising adaptation strategies identified above to sustainable development was analysed. Also, the consistency of climate change adaptation strategies to national policies and development plans (e g Millennium Development Goals, National Agenda 21; medium term plans) was analyzed as well. Scientists and policy makers of the countries involved were interviewed and consulted on various issues related to climate change adaptation, environmental protection and socio-economic development to identify the appropriate links between climate issues and national development plans. Scientists from international organisations and institutions, whose works focused on the SE Asian region, were also consulted.

2.3 Synthesis meeting

The synthesis meeting was held at Khush Hall, International Rice Research Institute (IRRI), Los Banos, Laguna, Philippines on September 25 – 26, 2007. The synthesis meeting brought together the project partners from the four collaborating countries: Indonesia, Laos, Vietnam and the Philippines. The meeting served as a venue to level-off expectations of the team members.

During the meeting, Dr. Rodel D. Lasco, the Project Leader, presented the framework of the project (Figure 1). The framework is based on the discussion of the IPCC AR 4 on the relationship between climate change and sustainable development. According to such report, "*Sustainable development can reduce vulnerability to climate change, and climate change could impede nations' abilities to achieve sustainable development pathways*" (IPCC WG II, 2007). Thus, adaptation to climate change could promote sustainable development. In the same manner, promoting sustainable development could enhance adaptation to climate change.

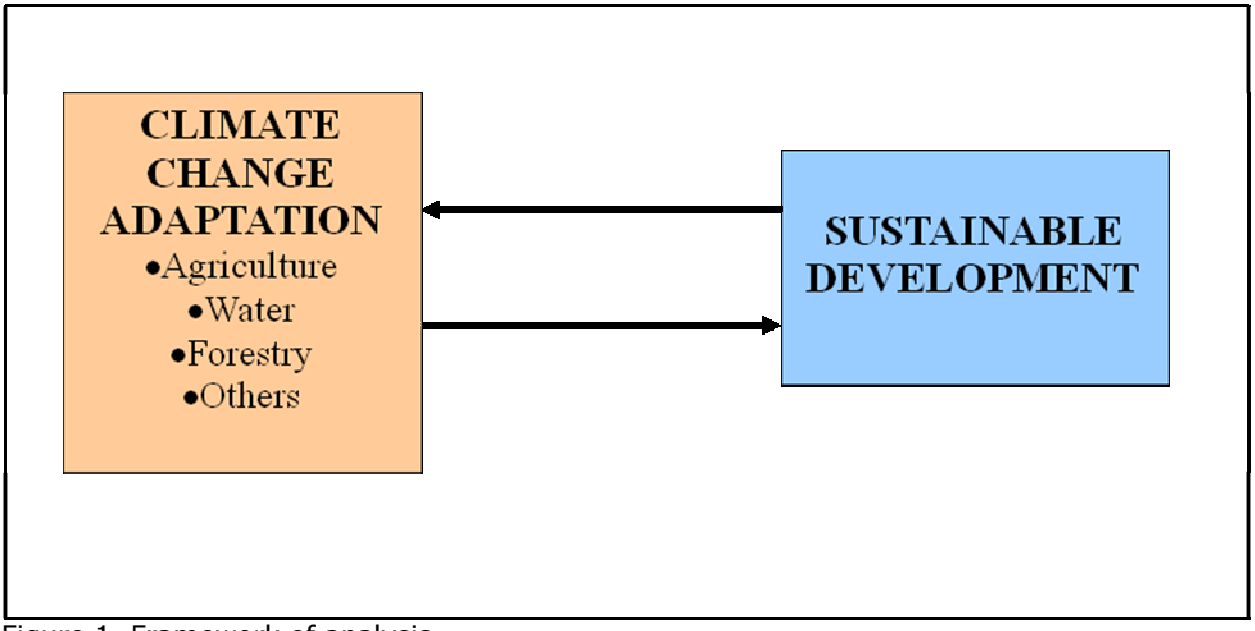

Figure 1. Framework of analysis

Using the framework in Figure 1, each team member from the collaborating countries developed expanded outlines of the synthesis report which were presented for

comments. Each team member chose the sector (water, agriculture, etc) which they wanted to focus their paper on. The synthesis report for Vietnam had a focus on agriculture and livelihood security in the Mekong Delta River in Vietnam while that for Indonesia dealt on Agriculture and Food Security with particular emphasis on rice production. The Laos paper centered on the energy while the synthesis paper of the Philippines focused on the water sector.

All the synthesis reports used a combination of primary data and secondary data. Primary data was gathered through conduct of interview with key informants. Secondary data collected included the sustainable development plans of each collaborating country, policies, researches on adaptation to climate change *etc.*

Details of the synthesis meeting are in Appendix 1.

2.4 Science-policy workshop

A year after the synthesis meeting, a science-policy workshop was held on September 24, 2008 at Sulo Hotel, Quezon City, Philippines. This workshop brought together the policy community and the science community in the participating countries. Also, local participants from government ministries (environment, agriculture, planning, meteorology), NGOs, and research agencies were invited to participate in the meeting.

The main purpose of the workshop is to present the synthesis papers prepared by the project collaborators from Indonesia, Vietnam and the Philippines. A workshop was also held to discuss the points of entry where climate change can be mainstreamed, strategies to facilitate mainstreaming of climate change adaptation to sustainable development planning and responsible agencies.

Details of the science-policy workshop are in Appendix 2.

3.0 Results & Discussion

3.1 Evidences of climate change in SEA

Similar to the global trend, evidences that climate is changing are observed in Indonesia, Vietnam and the Philippines over the past few years. For instance in Vietnam, the annual average temperature has increased by 0.7^0C while sea level rose by about 20 cm. Number of strong typhoons has also increased which damaged infrastructures and claimed lives.

In Indonesia, the onset of wet and dry season was observed to change in a number of regions of Sumatra and Java islands (GOI, 2007) during the period 1961-1990, 1991 and 2003. In most areas in Sumatra region, the onset of the wet season advanced between 1 and 2 dekads while the onset of dry season advanced between 3 and 4 dekads. On the other hand, most of the regions in Java, except in the eastern part, the onset of the wet season delayed between 1 and 2 *dekads*, and this onset delay will cover more regions during the dry season.

In the Philippines, records show that temperature in the country had increased from 1951 to 2006. Similar to most countries in the world, the year 1998 was observed to be the warmest year. Aside from rising temperatures, it has been observed that amount of precipitation decreased by 6% during the turn of the century.

In the same manner, occurrence of ENSO events was observed to become more frequent since 1980. For instance from 1982 onwards, strong El Nino event occurred every five years (1982-1983, 1987-1988, 1992-1993, 1997-1998). Of these ENSO events, strongest were those that happened in 1982-1983 and 1997-1998.

Number of strong typhoons (> 185 kph wind speed) hitting the Philippines from 1980 to 2006 also follow an increasing trend. From 1990-1998, a total of seven strong typhoons have crossed the country affecting thousands of families and damaging agriculture, livestock, fisheries and infrastructure. Based on estimates by the National Disaster Coordinating Council, total damage of these typhoons totaled to P46.279B. These typhoons also caused the death of more than 10,000 people. (NDCC, 2000 and Typhoon 2000.com).

Rising sea levels, one of the indicators that climate change is occurring, have been observed to happen from five major stations (Manila, Legazpi, Cebu, Davao and Jolo). Annual mean sea level is observed to increase in Manila since 1960s while for the rest of the stations, sea level rise occurred in 1970s. In the Manila, Legazpi and Davao stations, an increase of almost 15 cm was observed from 1980-1989. This value is the lowest expected sea level rise set by the IPCC (Perez, 1998).

At current climate variability and extremes, such as flooding, drought, delay and early onset of rainy season mentioned previously, the poor sectors are already vulnerable because most often, sources of their livelihood are limited and are mostly based on natural resources. During floods or drought, their sources of livelihood fail to provide them with crops to eat and cash to meet the needs of their families. To cope with such adverse impacts, they resort to selling of their farm animals, mortgaging or renting out of their farmlands. While this measure gives immediate solution to the poor people's problem, over the long term, such action make their livelihoods unsustainable. These people will only have food for a short time as proceeds from the sale of assets or mortgage/rent of farmlands are not really much. For the rest of the time, the poor people will have very limited food intake resulting to malnourishment. As a consequence, their capacities to do manual labor are reduced.

With climate change, these traditional coping mechanisms will become less effective as climate will become more harsh making the poor people poorer. According to Huq and Reid (2004) climate change is highly recognized as a significant factor that can influence sustainable development. To attain sustainable development amidst the climate change regime, development activities to be undertaken must contribute to the country's overall efforts of poverty reduction among the rural poor. This would mean decreasing their powerlessness and vulnerability by strengthening the five capital assets *i.e*. natural, social, human, physical and financial. In the same manner, increasing resiliency to climate change can be attained if such adaptation strategies are linked with sustainable development plans of the country (Huq *et al*., 2003).

3.2 Climate Change and Sustainable Development

3.1.1 Water sector: the case of the Philippines

Results of the analysis made by the collaborator from the Philippines show that in the water sector, climate change is not mainstreamed in the policies and development plans. Currently, there are a number of policies that pertain to water resources in the Philippines. These include: (1) Presidential Decree (PD) No 1067; (2) Republic Act (RA) No. 8041; (3) RA 198; (4) PD 1586; (5) PD 424; (6) RA 7160; (7) PD 1151; (8) RA 9275; (9) Commonwealth Act (CA) 383; (10) PD 984; (11) RA 9003; (12) RA 6969; (13) RA 4850; (14) RA 6234; (15) PD 281; (16) DENR Administrative Order (DAO) No.

90-34; (17) DAO 90-35; (18) DAO 94-26A; (19) PD 856; (20) DAO 97-39; (21) DAO 2000-18; and (22) DAO 98-58.

PD 1067 issued in 1976 is also known as the National Water Code of the Philippines. This decree provides the framework as regards water appropriation, control, conservation and protection of water resources. Aimed to attain optimum development and efficient use to meet present and future needs, PD 1067 describes the rights and obligations of the water users.

RA 8041 or the National Water Crisis Act of 1995 takes into consideration the issues of water supply, privatization of state-run water facilities, protection and conservation of watersheds and the waste and pilferage of water.

RA 198 was issued in 1973 to create the provincial water utilities. Through this Republic Act, the local water districts are authorized to operate and administer water supply and waste water disposal systems in the provinces.

PD 1586 requires that an environmental impact assessment (EIA) be undertaken prior to the implementation of any project regardless of who will implement such project. Issued in 1978, PD 1586 institutionalizes the Environmental Impact Statement System (EIS) in the country.

To ensure that a body will look into the problems of water resources, a National Water Resource Council was created through PD 424.

RA 7160 or the Local Government Code provides power to the local government units (LGUs) to enforce laws on water sanitation and to provide basic services such as water supply, sanitation and flood control.

PD 1151 better known as the Philippine Environment Code defines the necessary components of a regulatory program along with its functions.

RA 9275 provides a program and regulations for the abatement and management of water pollution from point and non-point sources. Also called the Clean Water Act, RA 9275 promotes the use of market based instrument in imposing fees on polluters of water.

Commonwealth Act 383 or the Anti-Dumping Law prohibits dumping of waste and other substances into rivers. This Act was issued as early as 1938.

PD 984 issued in 1976 promotes control of water pollution as it provides guidelines for the control of water pollution from industrial sources through imposition of penalties or charges to violators.

RA 9003 also called the Ecological Solid Waste Management Act of 2000 institutionalize a national program that will manage the transfer, transport, processing and disposal of solid waste. This law would like to ensure that landfills to be established would not affect the water quality of the water resources.

RA 6969 (Toxic Subtances and Hazardous and Nuclear Wastes Control Act) was issued to control and manage the import, manufacturing, processing, distribution, use, transport, storage, treatment and disposal of toxic substances and hazardous and nuclear wastes.

To regulate pollution in Laguna de Bay Region, RA 4850 was issued in 1966. This Act was amended by PD 813 to address growing problem of water pollution in Laguna Lake which includes sewage works and industrial waste disposal system.

RA 6234 was issued in 1971 to create the Metro Waterworks and Sewerage System (MWSS). MWSS constructs, operates and maintains water systems, sewerage and sanitation facilities in the Metro Manila area.

In 1973, PD 281 was issued that led to the Creation of the Pasig River Development Council. This Council regulates and controls pollution of the Pasig River.

DAO 90-34 or the Revised Water Usage and Classification/Water Quality Criteria classified the water bodies according to their best usage. Likewise, different parameters and criteria for water quality required for each type of classification were identified.

DAO 90-35 of 1990 provided revision of the effluent regulations. This administrative order prescribes the standards for discharge of effluents to the different classifications of water bodies.

DAO 94-26A or the Philippine National Standards for Drinking Water provides the different parameters and value for drinking water quality. Also it defines guidelines for assessing water quality for drinking water.

PD 856 also known as the Sanitation Code of the Philippines prescribes standards for sewage collection and refuse and excreta disposal. It also assigns to cities and municipalities the responsibilities to provide for efficient and proper disposal and to handle nuisance and offensive trades and occupations.

DAO 97-39 or the Chemical Control Order for Mercury and Mercury Compounds regulates the importation, manufacture, distribution and use of mercury and mercury compounds and the storage, transport, and disposal of their wastes.

To identify requirements and procedures pertaining to the importation, manufacture, distribution, and use of cyanide and cyanide compounds and the storage, transport and disposal of their wastes DAO 2000-18 or the Chemical Control Order for Cyanide and Cyanide Compounds was issued.

DAO 98-58 or the Priority Chemical List identifies existing and new chemicals that can potentially pose unreasonable risk to public health, workplace, and the environment. This same DAO requires all manufacturers, distributors, users, and importers of chemicals included in the PCL to submit bi-annual reports.

Although these policies already deal with the regulation of water quantity and quality, there was no mention of the issue of climate change.

In the same manner, climate change adaptation has not been mainstreamed in the sustainable development plans and programs of the Philippines. These documents include the Medium Term Development Plan (MTDP) for 2004-2010, Philippines Millenium Development Goals (MDGs) Progress Report and the Philippine Agenda 21 (PA 21). For instance in the MTDP, Lasco *et al* (2007) mentioned that while there are adaptation measures being mentioned in the document, all pertain to cope with natural disasters such as typhoons, flooding and landslides and not to foreseen climate change.

Similar to the MTDP, the Philippines MDG progress report did not make any mention about climate change adaptation. However, the document indicated the need to

address the increasing trend of carbon dioxide emissions. Likewise, the document also emphasized the need to improve flood control and drainage facilities to cope with the damage caused by flooding and typhoons in the urban areas (Lasco et al, 2007).

Unlike the MTDP and MDG, PA 21 mentioned about climate change. However, this was cited only once and refers only to water resources. According to the document, there is a need to promote and adopt methods for impact assessment of climate change on water resources. Similar to MTDP and MDG, PA 21 also emphasized the need to adapt to problems posed by climate related events such as flooding and drought. The document recommends that flood monitoring and forecasting be undertaken (Lasco et al 2007).

To determine the perspective of the stakeholders on mainstreaming climate change adaptation in the sustainable development plans and programs, one on one interview was undertaken. All the respondents believe that mainstreaming climate change in policies, plans and programs of the water sector is important. Results indicate that there is already a recognition among the stakeholders that mainstreaming climate change adaptation is important in attaining the sustainable development goals of the Philippines.

Numerous reasons were cited by the respondents when asked why mainstreaming climate change adaptation in sustainable development plans is important (Table 1). Some 37 respondents mentioned that by doing such, formulation of adaptation measures/programs (e.g. water use efficiency/water regulation, proper water allocation, water conservation, improve water management that will ensure continuous water supply to the different water users, proper waste disposal, protection of the remaining forests and rehabilitation of degraded watersheds) that will reduce the impacts of climate change on water will be fast tracked. Others however believe that mainstreaming climate change in sustainable development plans will increase awareness of the different sectors on climate change and its impacts. A mere 11% mentioned that funding for climate change adaptation will be ensured once it is integrated in sustainable development plans of the Philippines.

Table 1. Reasons why mainstreaming climate change adaptation in policies, plans and programs of the water sector is important.

REASON WHY IMPORTANT	FREQUENCY	PERCENT
Will speed up the formulation of adaptation measures/programs that will reduce the impacts of climate change on water quality and quantity	37	59.68
Will increase awareness of the different sectors on climate change and its impacts	10	16.13
Will ensure funding for climate change adaptation activities	7	11.29
Will promote more integrated efforts to address climate change	4	6.45
Will encourage participation of all sectors of society	2	3.23
Will help in proper land use planning	1	1.61
Will support sustainable development	1	1.61
TOTAL	**62**	**100.00**

When asked whether climate change adaptation has already been mainstreamed in the policies, plans and programs of the water sector, conflicting views were collected. For instance, some 33% of the respondents believe that climate change adaptation has

already been mainstreamed in policies, plans and programs. They emphasized that climate change is not explicitly stated in the policies, plans and programs but somehow there are sections that indirectly address climate change. This is consistent with the findings of Lasco et al (2007) wherein climate change was not at all mentioned in the sustainable development documents of the Philippines but there are sections that discuss on natural disasters such as typhoons, flooding etc that the country has been facing for ages.

Majority of the respondents (67%), however, claimed that climate change has not been mainstreamed because of numerous reasons (Figure 2). The most popular reason mentioned is the lack of information on the impacts of climate change among the policy makers and heads of agencies. Thus, they are not doing anything to help address climate change. It is worthy to note though that in the Philippines, capacity building activities on climate change already started as early as the late 1990's. These capacity building activities were undertaken by some academic institutions such as the Ateneo de Manila University particularly the Manila Observatory (MO) and the Climate Change Center or KLIMA, the Environmental Forestry Programme (ENFOR) of the College of Forestry and Natural Resources (CFNR), University of the Philippines Los Banos (UPLB), and the Inter-Agency Committee on Climate Change (IACCC), a multi-agency committee compose of the Department of Environment and Natural Resources (DENR), Department of Science and Technology (DOST), Philippine Atmospheric Geophysical and Astronomical Services Administration (PAG-ASA), Department of Energy (DOE), Philippine Rural Reconstruction Movement (PRRM) and many others. However, very few people were interested that time to attend to climate change activities. Interest on climate change just started to gain its momentum in 2007.

About nine respondents said that climate change is just an emerging issue while another nine respondents claimed that climate change is not a priority program of the government. These reasons can be attributed as well to the lack of awareness among the policy makers.

Some five respondents said that there is no single agency that consolidates the plans and programs and issue policies on water thus, mainstreaming climate change in the water sector can be a difficult thing to do. This problem has been pointed out earlier in this paper. As mentioned earlier, management of water resources is fragmented because there are around 30 government institutions that concern with water resources of the country.

Four respondents claimed that the heads of agencies have reactive attitudes, thus they are not lifting a finger to address projected climate change. The "wait and see" attitude is very common among Filipinos. Filipino people want to observe first and try to sense what that other people are doing. Once they prove that what has been undertaken by those people who took the first steps are beneficial, then that's the time when they will take a step. The disadvantage however of such attitude is that most of the time the actions are already late to solve the problem because not much preparations have been undertaken.

Two responses each were received by the following reasons: (1) matters regarding climate change are the concern of PAG-ASA only; and (2) no ensured funds to implement programs related to climate change. Since PAG-ASA is the agency issuing climate related data, many people think that PAG-ASA will take care of everything that concerns climate change. Also, some people do not realize that climate change will have impacts on the different sectors and combating it requires the cooperation of everyone.

One respondent said that direct relationship between climate change and water sector has not been fully established thus, climate change has not been integrated in the mentioned sector.

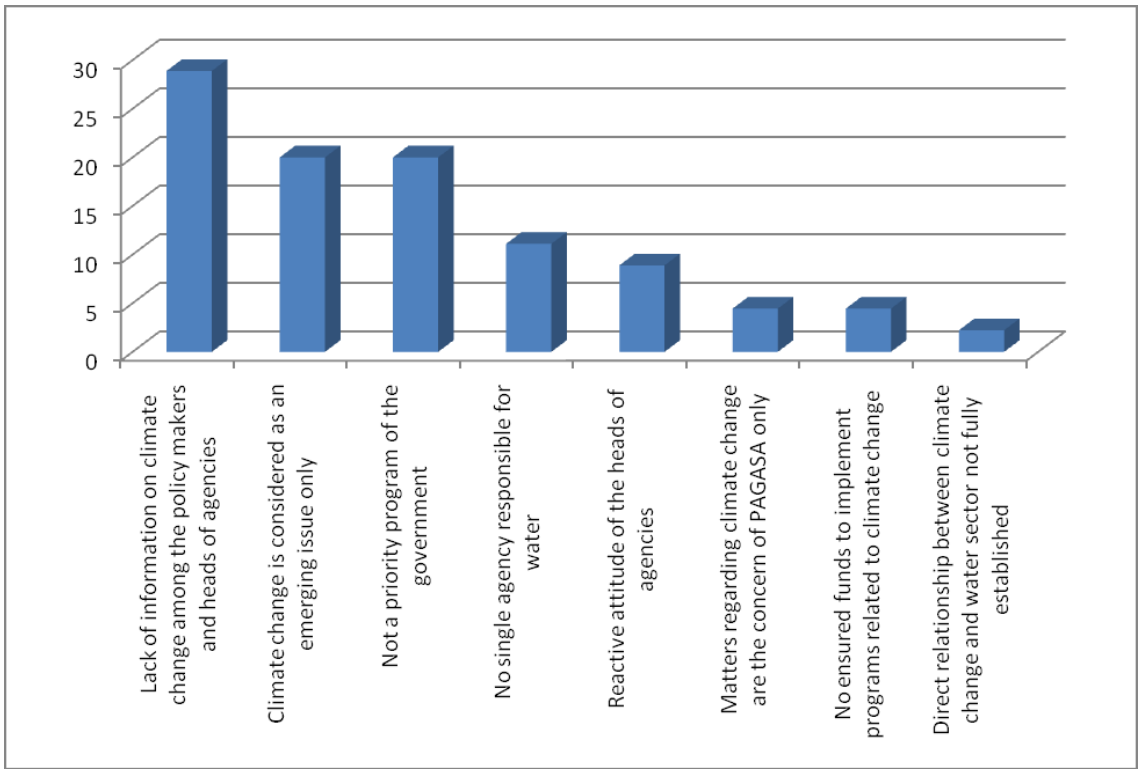

Figure 2. Reasons why climate change adaptation has not been mainstreamed

With regards to the potential points of entry where climate change can be mainstreamed, majority of the respondents emphasized that all policies, plans and programs of all agencies concerned with water need to integrate climate change. Among those mentioned by the respondents include (1) water resource management plan; (2) water conservation strategies; (3) watershed rehabilitation, management and protection; (4) energy independence e.g. shift of power source from diesel/coal to hydropower/renewable cleaner energy; (5) construction of reservoir; (6) promotion of organic farming; (7) drainage facilities; (8) programs on water production; (10) reforestation; and (11) collection of funds for the preservation of watershed.

About 23% believe that climate change should be integrated in capacity building activities of all stakeholders and agencies. Every agency conducts continuous training to keep its personnel updated with emerging issues. By doing such, appreciation on climate change of the personnel is created which will contribute to more effective implementation of climate change programs.

Around 11% believed that climate change should be integrated in national policies such as the Sustainable Forest Management Act (SFMA), Land Use Act and Agriculture and Fisheries Modernization Act (AFMA).

Some respondents believe that by increasing the level of awareness of each sector, participation on climate change activities such as planting of trees, conservation of water, waste management, etc even among the youth will be increased. To increase the

level of awareness even among students, about 4% of the total respondents believe that climate change should be integrated in the curriculum.

Two respondents mentioned that climate change should be integrated in the Millenium Development Goals of the Philippines while another two respondents said that it can be mainstreamed in the barangay and municipal resolutions.

Factors that can enhance mainstreaming climate change adaptation include: (1) building the capacity of all sectors (2) providing funds for climate change programs; (3) creation of a single body that will coordinate climate change activities; (4) presence of a strong political will; (5) uplifting the socio-economic conditions of the poor; (6) presence of strong commitment of all sectors and (7) coordination among institutions concerned with water resources (Figure 3). Among these factors, building the capacity of concerned sectors is the most popular factor cited by the respondents. Results indicate that respondents fully believe that by making the sectors aware, integration of climate change will be a lot easier.

Six respondents are convinced that by providing 'ensured funding' for climate change programs, it is very certain that climate change will be integrated in the various activities undertaken. Four respondents however mentioned that the presence of strong political will is very important in seeing climate change programs on the ground.

Two persons said a climate change commission similar to the one being espoused by Sen Legarda should be created. By doing this, climate change efforts will be more coordinated and will prevent overlapping of activities.

Another two respondents said that the way to move programs forward is to address the basic needs of the poor who compose the majority of the population. Most often, programs being undertaken are in the disguise of reducing poverty but in reality, those programs do not alleviate the socio-economic conditions of the poor. As a consequence, support from this sector is not gained because these people are busy engaging themselves in livelihood opportunities. Showing to them that the programs being conducted will benefit them the most will ensure support and participation for the poor sectors.

One person mentioned that coordination among institutions engaged in water resources will enhance integration of climate change in policies, plans and programs while another person said that there is strong commitment of all sectors to combat climate change.

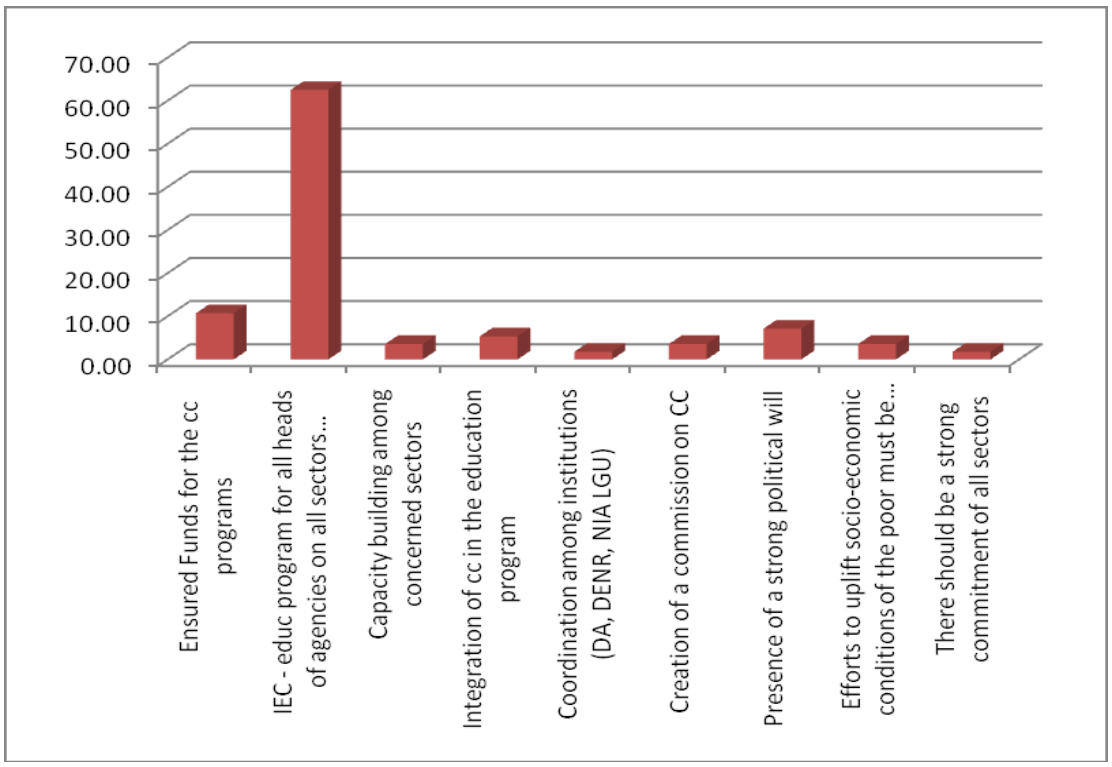

Figure 3. Factors that can enhance mainstreaming of climate change adaptation

3.2.2 Agriculture / rice production: the case of Indonesia

Indonesian rice production is highly influenced by the extreme climate events such as El Nino Southern Oscillation (ENSO). In the future as a consequence of global climate change, the frequency of the events may increase. Understanding such situation and considering the negative impacts which will be faced, Indonesia needs to set up an appropriate adaptation strategy to cope with the future climate condition. Immediate implementation of such adaptation strategy will be beneficial to Indonesia not only to combat the impacts of future climate change but also that of current climate variability and extreme.

Realizing the benefit of implementing adaptation options, the Indonesian government through ministry of environment proposed that adaptation to climate change should be performed through a number of ways (SME 2007)., namely:

1. Integrate the climate change adaptation agenda into national development plans such as Medium and Long Term Development Plans;
2. Review and adjust the existing initiatives or programs, so they will be resilient to climate change;
3. Institutionalize the use of climate information in order to have capability to manage climate risk;
4. Encourage local autonomy to integrate consideration of climate risk into local development plans;
5. Strengthen the information and knowledge to reduce present and future climate risk
6. Ensure the availability of domestic resources and funding for adaptation activity and maximize the use, probably with the international support;
7. Choose no regret option, which is conducting adaptation action with or without climate change so the benefit received could be used to reduce the vulnerability to climate change, but also could be used for national development benefit;

8. Encourage a national dialogue to accelerate implementation process of adaptation agenda to climate change in Indonesia

In addition to the proposed action to design and implement the adaptations, the focus areas of the climate change adaptation are 1) the effort to address poverty; 2) social and economic development; 3) investment; and 4) spatial planning (SME 2007).

For rice production, Boer (2007) proposed a strategy of changing cropping pattern for cultivating rice in a region where the rainfall pattern is changing. For example, the region whose wet season is shorter should change from cropping pattern of rice-rice to rice-non rice. Because under a changing climate, the occurrence of extreme climate event associated with drought will be more frequent than the current climate and there is a possibility that the dry season will persist for longer periods so that keeping the cropping pattern of rice-rice may expose Indonesian farmers to more frequent crop failures (GOI 2007). If the rice-rice pattern wants to be maintained, the development or improvement of water storage and irrigation facilities is required for supplying water during the dry season. Furthermore, huge efforts are also required for searching new short maturing rice variety to anticipate the shorter period of wet season

Moreover, (GOI 2007) developed the list of climate change adaptation for various sectors in Indonesia. The list categorized the adaptation options into two: short-term and long-term. The short term plan focuses on cropping calendar, efficiency of water use, rain fed rice development, pest and diseases control, and searching for new variety which is tolerant to high temperature, while the long-term is addressed to develop early warning system to flood and drought and integrated management of water uses.

The RAN-MAPI (Rencana Aksi Nasional Menghadapi Perubahan Iklim - National Action Plan to Cope with Climate Change) clarified more detailed programs on climate change adaptation for various sectors including the agriculture sector (SME 2007). The report emphasized that the objective of devising climate change adaptation programs is mainly to support the vision of agriculture sector "Actualization of Competitive Sustainable Industrial Agriculture System that Could Ensure the Food Security and Farmer Welfare". Thus, the national development agenda 2005-2009 have prioritized 'Agriculture Revitalization" in order to achieve the Indonesian agriculture vision. For this agricultural development, three major programs are formulated: (1) Program to increase food security; (2) Program to develop agro business; and (3) Program to increase farmers' welfare.

In other words the three major programs are directed to be focused on food supply, agribusiness development and farmers' income. Thus, in the context of climate change adaptation for rice production, the proposed adaptations should be directed not only to increase the production but also to increase the farmers' income and agribusiness development. Achievement to these three focused programs will lead to improved economy of livelihoods in the rural region in Indonesia.

Table 2. Climate Change Adaptation Options for Agricultural Sector

Problems / Impacts	**Proposed General Adaptation Program**	
Drought	**Short term**	**Long term**
• Limited irrigation water • Reduced planting areas • Loss of crops yield • Failure to harvest	• Water conservation • Water harvesting • Controlled groundwater exploitation	• Early warning system to drought hazard • Integrated irrigation water management for

• Reduced of farmers' income	• Efficient water use • Prioritization of water use • Introduction of drought tolerant varieties • Introduction of early maturing crops varieties • Crop calendar • Rainfed rice development • Farmers' capacity in understanding drought behavior	food crops
Flood/standing water		
• Damaged crops • Loss of crop yield • Failure to harvest • Reduction of farmers' income	• Flood mitigation • Drainage improvement • Raise bed system • Introduction of crops tolerant to high water level • Crop calendar	• Early warning system to flood hazard • Integrated drainage water management for farming system
Increase of humidity during La-Niña		
• Pest and diseases outbreaks	• Crops environment improvement • Pest and diseases control • Introduction of crop tolerant varieties to pest and diseases • Jointly planting time	• Integrated crops pest and diseases control
Increase of temperature		
• Increase of transpiration and respiration • Crops early mature with low yield	• Breeding of tolerant crop varieties to high temperature	

Source: (GOI 2007)

Furthermore, the RANMAPI documented by (SME 2007) devised the climate change adaptation programs with the corresponding responsible institutions who will implement the proposed adaptation strategies. This will strengthen the institutional linkage among Indonesian government department and agencies. Likewise, it will result to reduced cost for implementation of the strategies since there will be no redundancy when conducting the proposed programs and the real problems faced by many stakeholders can be addressed well.

Table 3. Climate Change Adaptation Options from 2007 to 2050 for Agricultural Sector

Responsible Institutions	Proposed adaptations 2007-2009
Department. of Marine Affairs and Fisheries, State Ministry of Environment, Dept. of Public Works and Local	1. Increase the utilization of drought prone map. 2. Conduct water saving agriculture

Government	activities. 3. Implement good agriculture practices. 4. Implement the acceleration planting with appropriate technology. 5. Rehabilitate and increase irrigation network. 6. Optimize alternate system in water irrigation distribution. 7. Form working group on climate anomaly and climate change in Department of Agriculture. 8. Form commanding post to control flood and drought in the Department of Agriculture. 9. Advocate and socialize the right understanding of climate change and its impact to the agriculture sector as well as government policy in mitigation and adaptation effort.
	Proposed adaptations 2009-2012
State Ministry of Environment, Department of Public Works and Local Government	1. Develop drought early warning system. 2. Increase the utilization of alternative water resource potential. 3. Empower the P3A institution. 4. Strengthen the institution of water use farmer. 5. Empower the farmer group to arrange the planting schedule and decide the beginning of planting season. 6. Develop food diversification policy 7. Develop agriculture climate information system and network in various level and region including the development of Agriculture Field School as a development of SLPHT and SLI (Climate Field School)
	Proposed adaptations 2012-2025
Ministry of Environment, Department of Public Works and Local Government	1. Conduct climate anomaly impact analysis toward seasonal shift to decide the beginning of planting season 2. Conduct research on superior seeds that are resistant to climate change. 3. Development of adaptive track husbandry. 4. Research program on government strategy and policy to address climate change in agriculture sector. 5. Formulate detail planning regarding agriculture development policy. 6. Development program to increase farmer's income.

	Proposed adaptations 2025-2050
Department of Agriculture, KMNRT, State Ministry of Environment, Dept. of Public Works and Local Government	1. Improve various existing step and strategy based on evaluation to various concepts, strategy, efforts and technology that had been implemented in previous period. 2. Develop various innovative technology, particularly for superior adaptive variation and technology for management of land and water that have been produced in the previous period. 3. Continue the food diversification policy that has been evaluated. 4. Increase the minimum income of farmer equivalent to average income of worker in Indonesia through various implementation of innovative technology and institution and development of various commercial commodities

Source: (SME 2007)

Furthermore, it can be seen from Table 3 that the RAN-MAPI devised the climate change adaptation programs into four time periods. The first period is mainly directed to implement better farming strategy and institutional development as part of the commitment process in implementing the adaptation strategies. The second period is devoted to strengthen the farmers' institution to utilize climate information to support their farming system. Establishment of climate school programs in 25 provinces (150 districts/cities) to increase farmers' understanding of climate information and its application is proposed to achieve the focused target for this period. The pilot project of climate field school has been established in Indramayu since 2003 (ADPC 2003). The third and final periods are focused on research and development on climate anomaly. Researches will include determination of the right planting season, search for new superior variety and innovative technology of farming system to increase the farmers' income. Even though, the proposed climate change adaptations documented in the RAN-MAPI is for agriculture in general, almost all strategies are applicable for rice production except the food diversification policy. The policy to diversify crops is issued to offset the foreseen deficit of rice production in the country which may occur when quantity of rice produced does not increase even with increasing trend of population.

Rice production development does not at all compete with the food diversification policy. Ensuring that demand for rice is met is highly necessary to support the Indonesian food security. This means that implementation of the adaptation strategies to minimize the future climate change risks on rice production is essential. With this, it would be beneficial to see which adaptation strategies are in line with the rice production strategies in Indonesia

The strategies mentioned hoped to increase the Indonesian rice production. Increasing the rice production is likely to bring the domestic price for rice while decreasing its production will lead to increase in the price. Moreover, implementing such strategies to secure the rice production and meet its demand is important as it will give multiplier effects on the Indonesian economy with regards to the position of rice as a strategic commodity. Furthermore, the low production will impose the Indonesian government to

import rice to meet its demand and stabilize the domestic rice price. This will in turn result to reduction of welfare among the rice farmers since they will not be able to get higher price for rice due to imported rice flooding the Indonesian market (Darwanto, 2005). Thus, future programs on the national food supply especially the rice supply should not only address the rice productivity improvement but also the price of the rice.

Utilization of climate information is important in attaining the two major goals: rice production and price stabilization. If the rice production is increased to meet the demand, the volume of rice to be imported can be reduced. Furthermore, if rice produced is more than what the Indonesian people require, there is a chance that rice can be exported. However, the government must ensure that the price of rice will be competitive in the world market.

Oxfam (2007) has determined the potential impacts of climate change on the eight key goals of the MDGs. In the case of the achievement of MDG 1 "Eradicate extreme poverty and hunger" associated with the crop land, climate change is expected to degrade the crop land that many poor families depend on for their food and livelihoods. In addition, UNDP (2007) reported that some regions in Indonesia are extremely vulnerable to climatic variations. For instance, crop failure as a consequence of long drought in the province of Nusa Tenggara Timur caused serious problems on food supply leading to acute malnutrition. This indicates that securing food supply i. e. rice supply is highly important and has direct relation to the MDG 1. Indirectly, failure to do so may have influence on the other goals. However, for the purpose of this paper, only the direct relation will be discussed in detail.

SME (2007) argued that the future climate change risks will impede the Indonesian MDGs related to poverty, hunger and health. Thus, implementation of adaptation activity should be parallel with poverty alleviation efforts and economic development targets for poor communities as they are the most vulnerable group in terms of the impact of climate change. In line with this, Indonesian President, Dr. H. Susilo Bambang Yudhoyono, in his foreword for the RANMAPI, stated that "*efforts to control climate change cannot be separated from economic development and poverty alleviation*". To achieve this goal, the development strategy must be devised by considering the four pillars of sustainable development in Indonesia, namely economic growth (*pro-growth*), poverty alleviation (*pro-poor*), employment opportunities (*pro-job*), and environmental protection (*pro-environment*). The Indonesian government has recognized that in climate change issues both the mitigation and adaptation must be incorporated into the Long Term Development Action Plan 2005-2025 and the Medium Term Development Action Plan (SME 2007).

Understanding the climate change issues should be tackled by coordinating those institutions that are responsible for climate change mitigation and adaptation. The State Ministry for National Development Planning has documented a guideline to integrate both mitigation and adaptation to climate change into national development planning (SMNDP 2007). It is expected that the document will be used as an initial input for preparing the Medium Term Development Action Plan 2010-2014. The document proposed the mitigation and adaptation programs for eleven key sectors in Indonesia including agriculture. Below is the list of adaptation options for rice production.

Table 4. Long-term 2005-2025 and Medium-term 2004-2009 National Development Planning Climate Change Mitigation and Adaptation Programs

Priority Target Long term Development Plan 2005-2025-	**Medium-term Development Planning 2004-2009**	
	Development Priority and Sector	**Climate Change Mitigation and Adaptation Programs**
Realization of Beautiful and Everlasting Indonesia	**Agriculture revitalization**	
	1. *Agriculture*	1. Food security improvement program 2. Agribusiness Development Program 3. Improvement of farmer welfare program

It can be seen from Table 4 that the development priority in the agriculture sector particularly the crop production is in line with the development strategy for agriculture. To give details on the programs for adaptation especially on crop production, the document proposed activities which focus on the effort of matching cropping calendar and cropping pattern, application of new variety of rice resistant to high temperature, drought, salinity, flood, and socialization of village water storage as well as efficient use of ground water for irrigation particularly in drought area. That means the proposed climate change adaptation programs for rice production in Indonesia has been acknowledged to be included in the National Development Planning. Therefore, in this context it would be beneficial to look at the possibility of implementing such actions to cope with climate change using the current knowledge in coping with climate variability.

Table 5 shows the programs for the rice development strategy and the climate change adaptations. It can be observed that the climate change adaptation supports the rice development strategy by adding the programs "Change Cropping pattern/Modified Planting Season". To increase the capacity of farmers, the two strategies are in agreement as regards increasing the farmers' knowledge on using the new farming system or technology. This includes the utilization of climate information, where the adaptation adds programs for mapping vulnerable areas to drought and flood. For the economic aspects, the two strategies did not propose any incentive system such as insurance to secure the rice yield or farmers' income to cope with the climate risks. Finally, climate change adaptation also enhanced the implementation of the rice production strategies by inducing the important programs for land conversion, conservation and institutional development i.e. institutionalizing climate forecast information so that the information can be used by the farmers. The programs for land conversion and conservation are suggested by considering the problem on achieving the projected rice demand.

Table 5. Matrix of programs for rice strategy and climate change adaptation and climate research in Indonesia

Focused Programs	Rice Strategies			Climate Change Adaptation						Climate Research
				Country Report		RAN-MAPI				
	09	15	25	15	30	09	12	25	50	
A. Intensification										
•New Variety		√	√	√				√	√	TM
•Technology Invention	√		√			√			√	TM
•Farming System/Management	√	√	√	√		√		√	√	TM/R/M
• Water Management		√	√	√	√	√	√		√	TM/R/M
• Planting Index	√	√	√		√					TM/R
B. Pest and Diseases Control				√	√					TM/M
C. Change Cropping pattern / Modified Planting Season				√			√	√		TM
D. Creating new rice field areas	√	√	√	√						TM/R/M
E. Infrastructure / Irrigation*	√	√	√	√	√	√				TM/M
F. Capacity Building / Awareness Increasing	√	√	√	√		√	√			
G. Community / Research /		√				√	√	√		CB
H. Institutional Network										CB
I. Drought and Flood Map Capacity						√				TM/R
J. Dissemination Information / Early Warning System	√	√					√			TM/CB
K. Alternative Activities				√						TM/R/M
L. Farmers' income								√	√	TM/R/M
M. Incentive System										
• Credit scheme programs*	√	√	√							TM/R
• Insurance										TM/R/M

16. Land Conversion Policy				√						TM/M
17. Conservation Program Policy				√						TM/M
18. Institutional Development/ Empowerment						√	√			TM

Note: * Strategy proposed by (Swastika et al. 2007); Rice Strategies: Section D.2; Country Report (GOI 2007) and RAN-MAPI (SME 2007): Section E; Climate Research: Section C.2;
Values in the headings refer to the final year of implementing the programs

Furthermore, the matrix also shows that current capacity of Indonesia to implement the inclusion of the adaptations strategies to the rice development strategies is more than enough since the climate research showed that they have attempted to deal with similar issue proposed by the adaptation strategies. Also, the extension of utilizing the tools and model (TM) developed or used by the climate research as well as the approach on assessing the climate risks (R) and managing it (M) would offer a great benefit when conducting the focused programs. Specific approach associated with the climate research that can be used to support the implementation of each focused program is listed in that table.

The developed matrix specifically shows the additional key aspects of the climate change adaptation programs that would be useful to stabilize and increase the rice production in Indonesia as well as to cope with climate change risks, namely: mapping vulnerable regions to drought/flood, modified cropping pattern and institutional development. In addition to this, the insurance system is worthy to be considered as well to ensure income from rice farming. To come up with the real action, **a *Rice Information and Distribution Centre*** must be established. This will institutionalize the implementation of the additional strategies such as utilization of the climate information, insurance system, etc. The prototype system of integrating the climate forecast and planting calendar to address the drought stresses, which have been developed by research project collaboration among BMG, Bogor Agricultural University and Department of Agriculture (ADPC 2003), could be considered as an initial point to be expanded for developing the Rice Information and Distribution Centre.

To implement climate change adaptation options to support the activities aimed to increase rice production on the ground is another question since there are gaps in present data sets resulting from: (1) the climate models work at large scale which cannot be used to study the impact of climate change at local scale, (2) the direction of climate change cannot be always predicted, different models give different predictions, (3) the more plausible climate models for impact assessment, regional climate models are not fully developed, and (4) the availability of long historical climate data required for validating the climate models is very low except in Java (GOI 2007). Aside from the idea of establishing the Rice Information and Distribution Centre and the problems on climate models, the above findings reveal that climate change adaptations for rice production have strong linkage with the Indonesian sustainable development goals. The inclusion of the adaptation strategies to rice development strategies will secure and enhance the implementation of the rice strategies. This will increase the rice production in Indonesia, meet its rice demand and could possibly export rice when production is way above the demand. If this will happen, it will lead directly to economic development in the rural regions and alleviate the poverty which is related to the MDG 1 "Eradicate Extreme Poverty and Hunger". Also, the two major programs, "Intensification" and

"Extensification", devoted to increase the rice production, have been addressed well by the inclusion of the climate change adaptation strategies. The climate information can be employed to search for the new appropriate areas for cultivating rice and suitable planting time. Current and future climate risks can be managed when climate information is utilized in the implementation of new farming system and technology. Therefore, such application of climate information will provide a great contribution to manage the rice stock-flow in Indonesia since the domestic rice production can be estimated by employing the climate information and the simulation models for agricultural production.

The Intensification and Extensification programs listed in Table 5 have been given equal emphasis to increase the farmers' income and create job opportunity. In addition, the classical approach of production function where the programs are more focused on labour intensive than capital intensive as there is no specific program proposed on the use of machinery intensively for increasing the rice production will be promoted. The presence of capacity building programs also clarified clearly that the programs are labour intensive which is suitable with the Indonesian condition whose population is relatively high. That means the two programs have been highly directed to increase economic growth and to alleviate poverty especially in the rural regions. Thus, with regards to the strategic position of rice commodity and the large population depending such commodity, the determined MDG 1 "Eradicate Extreme Poverty and Hunger" can be achieved successfully.

3.2.3. Agriculture: the case of Vietnam

Until recently, most Vietnam national policies, programs and development plans focus on poverty reduction and environment protection. With climate related issues, more attention has been put on natural disasters, climate change mitigation rather than climate change adaptation. In Vietnam Agenda 21, climate change is not directly mentioned. It however mentioned the following:

- Alleviate climate changes and restrict the detrimental impacts of climate changes, prevent and combat natural disasters.
- Implement measures for mitigating climate change, limiting its negative impacts, preventing and controlling natural disasters.

Using the Vietnam Agenda 21, provinces also prepare their own Sustainable Development Strategy. An example is for Ben Tre Province (in Mekong River Delta): Sustainable Development Strategy 2006-2010 and vision for 2020 (Mar 2006): for the whole document, the word "climate" is mentioned twice as climate change & climate variability (as adverse factors influencing the development). Vietnam Five Year Socio-Economic Development Strategy 2006-2010 states overall objectives, main targets, major tasks and resolutions set out in Vietnam's five year socio-economic development plan for 2006-2010: it mentioned the word 'environment' 9 times, 'poverty', 4 times, 'natural resources', 2 times, "sustainable development', 2 times, "climate change" only 1 time and this mentioned in terms of "restricting negative impacts of climate change".

In the 5-year Plan for the Agricultural and Rural Development (2006 – 2010), 16 national and ministerial programs are to be implemented in which only 1 is related to climate (natural disaster control and mitigation) but with emphasis on strengthening dyke systems and improving dyke management and protection, setting up early disaster warning system; relocating people in high-risk areas and preparing emergency relief system. Special attention is given to the Mekong river delta where the following activities will be carried out: program of flood control, strengthening existing

embankments and sea dykes. These activities are carried in the assumption that the people will live together with floods and ensure the safety of lives and assets. Overall, there has been inadequate attention to climate change adaptation until recent release of the IPCC Fourth Assessment Report (IPCC, 2007) and the World Bank Report on the consequences of climate change and sea level rise to the Asian countries. To date, Vietnam government has mainly focused on inventories and the reduction of greenhouse gas emissions. The Initial National Communication (INC) to the UNFCCC (MONRE 2003) only explored climate change impacts and necessary adaptation measures in a preliminary and qualitative way. A series of sector assessments were made and adaptation options were identified. These however, did not include socio-economic analysis, and they have not yet been followed by specific programmes. More in depth vulnerability and adaptation assessments and the preparation of a policy framework for implementing adaptation measures are currently being undertaken for the Second National Communication (SNC) to the UNFCCC, which should be completed by 2010. The Second National Strategy is still, however, designed principally to address the short term climate extremes rather than to respond to future climate change, and focuses on emergency response and reconstruction, rather than risk prevention and adaptation. There is also a marked lack of integration between disaster risk reduction policies and wider policies for rural development and poverty reduction, with little cross sectoral integration or coordination, either in policy, or practice. There is limited government ownership yet of an adaptive approach to future climate related risks, and limited financing available for climate change adaptation.

In Dec 2007, MONRE has been assigned to set up the National Target Program (NTP) to cope with climate change and sea level rise. Several consultation workshops have been organized throughout the country to gather participants' recommendations and contributions from other ministries and sectors. Strategic objectives of the NTP are to enhance the country's capacity and efficiency in response to climate change in specific periods to ensure sustainable development of Viet Nam, protect people from harmful impacts of climate change, and prevent, mitigate and minimize risks posed by climate change; join international community's effort to mitigate climate change impacts and protect global climatic system. The NTP of Vietnam is a combination of the nation's efforts in the implementation of various commitments as stipulated in regulation of the Convention, at the same time as a request of enjoying various financial support and technology transfer to carry out proper measures to deal with climate change. Adaptation to climate change has now become the first and immediate as well as long term issue. The NTP for coping with climate change should be considered as a priority program to achieve sustainable development goals of the country. After the approval of the government, it will be the basic orientation and strategies of the state to respond to climate change. Being aware that agriculture is the most affected by climate change, the Ministry of Agriculture and Rural Development (MARD) was prompted to set up an action plan for adaptation to climate change for the period 2008-2020. A program for water resource management in the Mekong River Delta to cope with climate change and sea level rise is also proposed. Given the linkages between climate change and development, adaptive policies can only be effective if they are integrated into the wider development agenda. With potential increases in the magnitude and frequency of natural hazards because of climate change, creating closer links between the governance of climate adaptation and the governance of disasters is crucial. The climate adaptation community can also learn from the recent experiences of mainstreaming disaster risk reduction, and may be able to take advantage of existing initiatives in this field.

As in other developing countries, the mainstreaming process in Vietnam is also in its early stages. In the past, many solutions responded to climate variability with a range of isolated structural and non-structural responses. Often these ignored the most

vulnerable – for example, engineered flood control measures, drought early-warning systems and flood wall construction. More generally, government actions and plans which have the potential to reduce climate vulnerability are either restricted to a single ministry with few resources or fragmented across sectors with no coordinating mechanism, and as a result have not been fully implemented.

With the experience of the 2000 floods, Government departments in the MRD and mass organisations mobilised staff, distributed literature, organised meetings, visited households and warned people of rising flood waters. Awareness raising after the 2000 floods concentrated on schools to reduce child fatalities, but many of the poorest children could not attend school as they had to work (in fishing & agriculture) and thus remained extremely vulnerable during floods. Women volunteers through the Women's Union were key in staffing these centres, with several reporting that their prestige increased as a result. Safe water campaigns were launched, and people were also mobilised to clean up their local environments once the flood waters receded, in order to avoid epidemics. Also, during the 2000 floods, several aid organisations distributed boats, which are used as a means of transport and for fishing during floods and in normal times (IFRC 2002). Such programmes also happened after the 2001 floods, with a focus on the poorest people. The policy slogan during and after this time was 'living with the floods', which reflects a realisation that ever higher dykes in the Mekong Delta are not the answer to seasonal floods, that fields and forests must store flood water instead, and that people's livelihoods must adapt. Government has subsequently launched a programme of safe settlement areas for home relocation and the raising of homes above flood levels so that evacuation will no longer be necessary (IFRC 2002).

The risk of Mekong Delta floods and droughts will increase with expected higher intensity rains in the rainy season and intensified dry spells. Vulnerability of rice crops and therefore farmers' livelihoods are expected to be serious, but many mitigation measures are also already known and being tried, at the farm level (e.g. changing seed varieties and crops, diversifying to non farm techniques and seasonal migration), community level (e.g. enhancing, protecting common resources such as fish ponds, developing village funds and shared processing facilities) and national level (e.g. infrastructure investments, research & development, strengthened information systems) (Chinvanno et al. 2006). Until recently, the concept of climate change, its potential impacts and the need for adaptation are not yet well known in Viet Nam. Only a small community of experts and development workers, some concerned state management agencies, and some localities (which have benefited from climate change related projects) know about climate change. To improve the current situation, a strengthened communication, and comprehensive research on the possible impacts of climate change on the Vietnamese economy and key development goals, particularly poverty reduction are needed. And little is known yet on the potential social and economic implications of climate change and sea level. Research is needed on the most effective long-term adaptation measures and strategies to ensure human well being and continued economic growth and poverty reduction.

According to the United Nations Development Program (UNDP, 2007), Vietnam has made a remarkable progress in human development. Poverty levels have fallen and social indicators have improved, putting the country ahead of schedule on almost all of the Millennium Development Goals. Climate change poses a real and imminent danger to these achievements – and nowhere more so than in the Mekong Delta. Around 4 million people living in poverty in the Delta. Many of these people lack basic health. For this group, even a small decline in income or loss of employment opportunities linked to flooding would have adverse consequences for nutrition, health and education. The poor face a double risk. They are far more likely to live in areas vulnerable to flooding, and they are less likely to live in "more robust permanent homes".

There are main approaches which need to be adopted for considering adaptation to climate change in development policies, plans and programs: (1) addressing adaptation challenges for climate change within various stages of preparing the development plans, programs or policies; and (2) incorporating climate change adaptation into assessment tools. With regards to entry points to mainstream climate change, NTP workshops and consultations revealed the following:

- The policy framework
- Institutional arrangements
- Consultation and coordination processes
- Financing and budgeting
- Tools and methods for adaptation
- Awareness raising

Results show that in the three countries (Vietnam, Indonesia and the Philippines) there is high recognition that linking climate change adaptation in sustainable development is important. However, climate change adaptation is yet to be mainstreamed to current sustainable development programs of each country. Integration of climate change adaptation into development and poverty reduction programs and policies will enable to take actions that are consistent with the goals of development (Huq *et al* ,2006). Benefits foreseen when climate change is mainstreamed to programs and policies include (1) reduction of the sensitivity of development activities to likely impacts of future climate change; (2) more efficient use of financial and human resources; and (3) future projects and strategies will reduce vulnerability. Thus, Klein *et al*., (2007b); Huq *et al*., (2006); Sperling, (2003) emphasized that the most effective way to address climate change impacts on the poor is by incorporating adaptation measures into sustainable development and poverty reduction strategies.

4.0 Conclusions

The project hoped to identify the link between climate change adaptation and sustainable development. Results show that in the three countries (Vietnam, Indonesia and the Philippines) it is recognized that integration of climate change adaptation into sustainable development programs is highly important. The adverse impacts of climate change are among the contributory factors why sustainable development efforts of the three countries will not be achieved. However, this can be addressed if climate change adaptation strategies are mainstreamed in the respective sustainable development plans of each country. Currently, sustainable development plans/programs in Vietnam, Indonesia and the Philippines do not integrate yet climate change. However, there are on-going discussions on how climate change adaptation can be mainstreamed. While there is no clear evidence that the project contributed to the mainstreaming of climate change adaptation to the sustainable development agenda of Vietnam, Indonesia and the Philippines, engagement of the stakeholders during the conduct of the research and the science-policy workshop triggered the stakeholders to support the integration of climate change adaptation in the sustainable development plans/programs of their respective countries.

5.0 Future Directions

In the future, it is valuable that implementation of the sustainable development initiatives integrating climate change adaptation be assessed. Barriers to its implementation should also be identified.

6.0 References

Adger, WN., S Huq, K Brown, D Conway, and M Hulme. 2003. Adaptation to climate change n the developing world. *Progress in Development Studies* 3: 179-195.

Adger, W.N., N.W. Arnell, and E.L. Tompkins. 2005. Successful adaptation to climate change across scales. *Global Environmental Change* (in press).

ADPC 2003. Climate Forecast Information Application: Case Study at Indramayu District.

Boer, R., et al. 2007. Deteksi perubahan iklim dan dampak sosio-ekonominya. Laporan Proyek Kerjasama BMG dan IPB. Bogor: BMG dan IPB.

Darwanto, 2005 Darwanto, Dwidjono H. 2005. Ketahanan Pangan Berbasis Produksi dan Kesejahteraan Petani. *Ilmu Pertanian* 12 (2):152 - 164.

GOI. 2007. Climate Variability and Climate Change, and their implication. In *Indonesia*

Country Report. Jakarta: Goverment Republic of Indonesia.

Huq *et al*., (2006) Huq, S, H. Reid and L.A. Murray. 2006. Climate change and development links. International Institute for Environment and Development. London, UK. 24 pp.

Huq, S., A. Rahman, M. Konate, Y. Sokona and H. Reid. 2003. Mainstreaming Adaptation to Climate Change in Least Developed Countries (LDCs). International Institute for Environment and Development, London, UK, 40 pp.

IPCC TAR Climate Change 2001: Synthesis Report. Summary for Policymakers. An assessment of the Intergovernmental Panel on Climate Change. p.25.

IPCC Working Group I. 2007. Summary for Policy Makers. Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. *In press.*

Klein, R.J.T., S.H.E. Eriksen, L.O. Naess, A. Hammill, T.M. Tanner, C. Robledo and K.L. O'Brien. 2007. Portfolio screening to support the mainstreaming of adaptation to climate change into development assistance. Tyndall Centre Working Paper No. 102. Tyndall Centre, Norwich, UK.

Lasco, R. D., F. B. Pulhin, P. A Jaranilla-Sanchez, R. J. P. Delfino and K. B. Garcia. 2008. Mainstreaming climate change in developing countries: The Case of the Philippines. AdaptNet (in press)

National Disaster Coordinating Council, 2000. NDCC Website. http://www.ndcc.gov.ph and http://baseportal.com/cgi-bin/baseportal.pl?htx=/miso/typhoons. Retrieved January 18, 2008.

Oxfam. 2007. Adapting to climate change. What's needed in poor countries, and who should pay.

Perez, R. T. 1998. Adaptation and Mitigation Measures for Climate Change Impacts on the Coastal Resources. In *F. B. Pulhin and R. D. Lasco (eds) Consultation Meeting for the International Conference on Tropical Forests and Climate Change: Status, Issues and Challenges*. Environmental Forestry Programme. College of Forestry and Natural Resources. University of the Philippines Los Banos. College, Laguna. pp 27-52.

SME. 2007. National Action Plan Addressing Climate Change. Jakarta: State Ministry of Environment,Republic of Indonesia.

SMNDP. 2007. National Development Planning Response to Climate Change State Ministry for National Development Planning.

Sperling, F. (ed.) 2003. Poverty and Climate Change—Reducing the Vulnerability of the Poor through Adaptation. AfDB, ADB, DFID, EC DG Development, BMZ, DGIS, OECD, UNDP, UNEP and the World Bank, Washington, DC, USA, xii+43 pp.

Chinvanno S., S. Souvannalath, B. Lersupavithnapa, V. Kerdsuk, and Nguyen T. H. Thuan, 2006: Climate risks and rice farming in the lower Mekong River countries. AIACC Working Paper No. 40. http://www.start.or.th/ , accessed on 15 Jul, 2008

UNDP. 2007. The other half of climate change: Why Indonesia must adapt to protect its poorest people. Jakarta: United Nations Development Programme Indonesia.

7.0 Appendices

7.1 Synthesis Reports

7.1.1 Linking Adaptation Strategies for Water Resources to Sustainable Development in the Philippines

Florencia B. Pulhin and Rodel D. Lasco

Abstract

Climate change is one of the pressing issues of our day. The IPCC (2007) report states that climate is indeed changing and human activities largely contribute to this change. In the Philippines, warming is also happening. Based on historical records, temperature is increasing in the country. Similar to most countries in the world, the year 1998 was observed to be the warmest year this century. Impacts of climate change are predicted to be disastrous both to human and the environment. Being an archipelagic country, the Philippines is highly vulnerable to climate change. Currently, there are numerous strategies being undertaken by the various sectors concerned to adapt to climate variability and extremes such as El Nino, La Nina, typhoons etc). Such adaptation approaches could form part of the strategies that can be developed to address climate change in the country. According to Huq *et al*., 2003, increasing resiliency to climate change can be attained if such adaptation strategies are linked with sustainable development plans of the country. Currently, very limited study is available in the Philippines related to climate change adaptation and sustainable development. Thus, this study was undertaken to fill such gap.

To determine whether climate change adaptations had been mainstreamed to the sustainable development plans and programs in the Philippines, documents discussing sustainable development agenda were reviewed. Key informant interviews were conducted to assess potential points of entry where climate change can be mainstreamed and the factors that can enhance integration of climate change.

Results showed that potential points of entry include: (1) all policies, plans and programs of every agency, (2) capacity building activities of all stakeholders and agencies; (3) national policies such as the Sustainable Forest Management Act, Land Use Act and Agriculture and Fisheries Modernization Act; (4) curriculum; (5) Philippines' MDG; and local government's resolutions ad ordinances.

Climate change adaptation can be enhanced through: (1) building the capacity of all sectors (2) providing funds for climate change programs; (3) creation of a single body that will coordinate climate change activities; (4) presence of a strong political will; (5) uplifting the socio-economic conditions of the poor; (6) presence of strong commitment of all sectors and (7) coordination among institutions concerned with water resources.

Introduction

Climate change is one of the pressing issues of our day. Based on the IPCC 4th Assessment Report (FAR), there is very clear evidence that climate is indeed changing and that human activities largely contribute to this change. In the Philippines, warming is also observed to happen. For instance from 1951 to 2006, records show that temperature in the country had increased (Figure 1). Similar to most countries in the world, the year 1998 was observed to be the warmest year. Aside from rising

temperatures, it has been observed that amount of precipitation decreased by 6% during the turn of the century.

In the same manner, occurrence of ENSO events was observed to become more frequent since 1980. For instance from 1982 onwards, strong El Nino event occurred every five years (1982-1983, 1987-1988, 1992-1993, 1997-1998). Of these ENSO events, strongest were those that happened in 1982-1983 and 1997-1998.

The extreme drought that is associated with occurrence of El Nino episode placed the agricultural sector at risk. Since crop production is highly dependent on water, limited availability or unavailability of water greatly affects the yield of most crops. Evidence to this is the sharp decline in the volume of production of palay, corn, coconut and sugarcane during the two worst El Nino events in 1982-1983 and 1997-1998 (Amadore, 2005). The effect of ENSO episode on crop production does not end once the event is over rather it still linger even the following year (Canlas and Cruz, 2004).

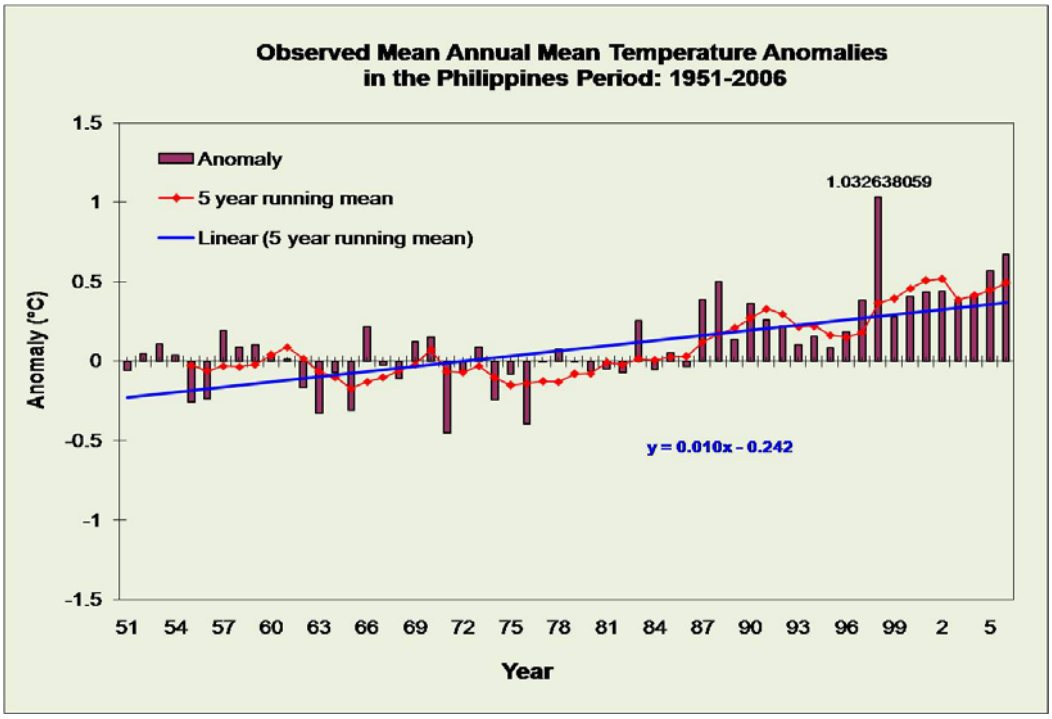

Figure 1. Observed mean annual temperature anomalies in the Philippines (1951-2006).

Aside from ENSO, the Philippines is frequently visited by typhoons because of its geographical location. Based on the 59 year period (1948-2006), annual average number of typhoons occurring within the Philippine Area of Responsibility (PAR) is around 19 to 20 (PAGASA, 2007). From 1980 to 2006, an increasing trend on the number of strong typhoons (> 185 kph wind speed) hitting the Philippines has been observed. From 1990-1998, a total of seven strong typhoons have crossed the country affecting thousands of families and damaging agriculture, livestock, fisheries and infrastructure. Based on estimates by the National Disaster Coordinating Council, total damage of these typhoons totaled to P46.279B. These typhoons also caused the death of more than 10,000 people. (NDCC, 2000 and Typhoon 2000.com).

Rising sea levels, one of the indicators that climate change is occurring, have been observed to happen from five major stations (Manila, Legazpi, Cebu, Davao and Jolo). Annual mean sea level is observed to increase in Manila since 1960s while for the rest of the stations, sea level rise occurred in 1970s. In the Manila, Legazpi and Davao stations, an increase of almost 15 cm was observed from 1980-1989 (Figure 3). This value is the lowest expected sea level rise set by the IPCC (Perez, 1998).

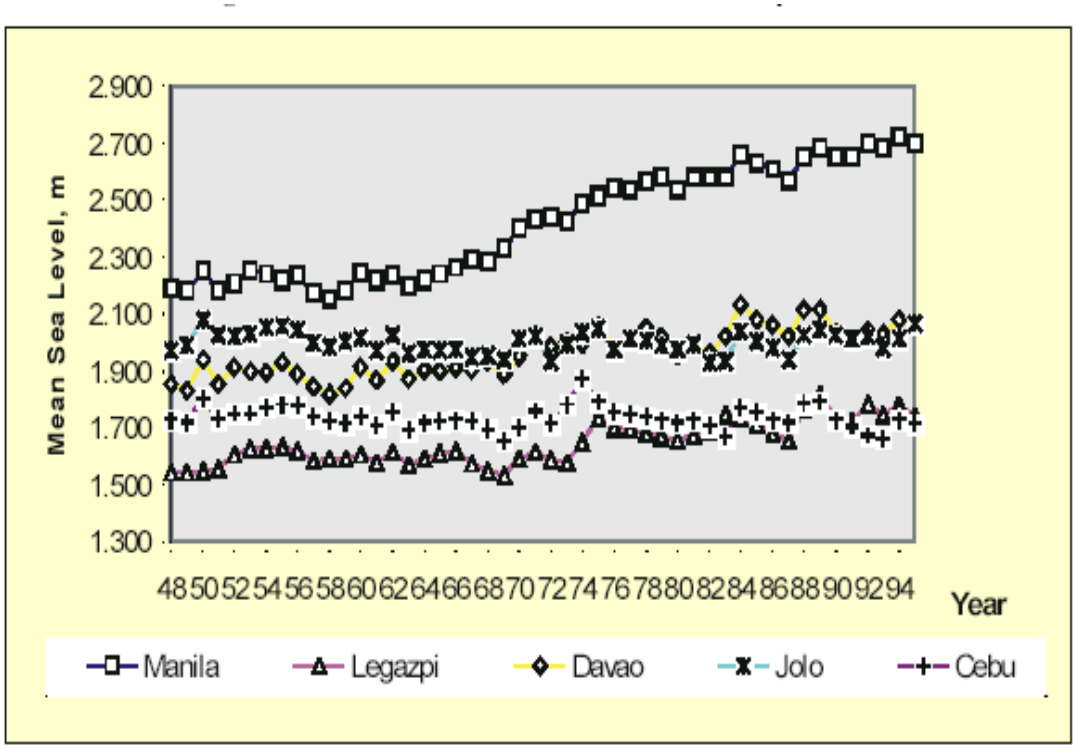

Figure 2. Annual mean sea level for five primary stations
Source: Philippines' Initial National Communication (1999)

In the future, temperature in the Philippines is projected to increase continually. Based on the results of the Canadian Climate Center (CCC) Model using a double CO_2 scenario, most regions of the country will have a 2-3^{0}C increase in temperature. In terms of rainfall, there will be an increase from 50% - 100% in most regions of the country while Northern and Eastern Mindanao will experience a reduction by up to 50%.

While currently there are adaptation strategies that are being undertaken to cope with climate variability and extremes, such measures may not be enough with climate change. It is expected that the current climate variability and extremes will worsen when climate change occur (Philippines Initial National Communication, 1999). However, resiliency to climate change can be increased if adaptation strategies are linked with sustainable development plans of the country (Huq *et al*., 2003). Currently, very limited study is available in the Philippines related to climate change adaptation and sustainable development. Thus, this study was undertaken to fill such gap.

Review of adaptation researches on the water sector and climate change

Jose and Cruz (1999) assessed the impacts of climate change on water resources using hydrological model. Results showed that changes in rainfall and temperature in the

future will be critical to future inflow in the Angat reservoir and Lake Lanao with rainfall variability having a greater impact than temperature variability.

Acosta-Michlick (2005) assessed vulnerability of the farmers to globalization and climate change using the agent based model. Results showed that only an optimal mix of adaptation options could help reduce the vulnerability of the farmers. Likewise, she found out that social network plays an important role in reducing their vulnerabilities irrespective of the type of adaptation measures. Results of the study showed that agent-based model is a useful and flexible tool for evaluating scenarios of environmental change and adaptation options.

Lasco *et al* (2006) conducted the first integrated assessment of climate change impacts, vulnerability and adaptation in watershed areas and communities in the Pantabangan-Carranglan watershed (PCW). Results of the study indicated that there will be about 17% increase in wet season streamflow and a decrease of around 35% in dry season streamflow of PCW. Assessment of vulnerability of the watershed by land use with the aid of GIS revealed that more than 65% of the entire PCW is moderately vulnerable to climate extremes and change while more than 25% is highly vulnerable. Most of the areas that are highly vulnerable are forests, grasslands and brushlands while grasslands, brushlands and forests are moderately vulnerable. Vulnerable places in PCW include low lying flood prone settlement areas, agricultural areas prone to floods and droughts, dying streams/rivers, farmlands at the tail end of irrigation canal, highly erodible areas along riverbanks, unstable areas with steep slope that support infrastructure, and grasslands and forested areas/plantations near roads and settlements susceptible to fire.

Methodology

The study used a combination of primary and secondary data. Primary data was gathered through conduct of interview with key informants. Secondary data collected include the sustainable development plans of the country such as the Philippine Agenda 21 (PA 21), Millenium Development Goals (MDG), Medium Term Development Plan (MTDP), water policies, researches on adaptation to climate change *etc.* These data were collected from the National Development Economic Authority (NEDA), Department of Environment and Natural Resources (DENR) and other relevant agencies.

To determine the perceptions of the different stakeholders as regards mainstreaming climate change adaptation in policies, plans and programs of the water sector, key informant interview was conducted. The key informants were asked about the importance of mainstreaming climate change adaptation in policies, plans and programs, what specific policy, plan or program where climate change has been mainstreamed, possible reasons why climate change has not been mainstreamed and necessary factors that will enhance mainstreaming of climate change adaptation.

Key informants include the key staff of the different divisions of the DENR and its attached bureaus such as the Forest Management Bureau (FMB) and Environmental Management Bureau (EMB), River Basin Office, National Irrigation Administration (NIA), National Power Corporation (NPC), National Water Resources Development Board, PAG-ASA, Manila Water, Manila Water System Services (MWSS), Bureau of Soil and Water Conservation (BSWM), Maynilad, House of Representatives, Senate, Bukidnon Environment and Natural Resource Office (BENRO), Provincial Agriculture Office of Bukidnon, Community Environment and Natural Resource Office (CENRO), Provincial Environment and Natural Office (PENRO), National Irrigation Administration-Provincial Irrigation Office (NIA-PIO), Provincial Office of PAG-ASA in Malaybalay, Bukidnon.

Sustainable Development

Most often, development is equated to advancement of an economy at the expense of the environment especially in cases when extraction of resources is not properly undertaken. While over the short-term, development may create jobs, bring access roads, health and other essential services to the local communities currently residing in the area where development is occurring, over the long-term, development practically leaves little or even nothing for the future. It is in this premise that countries around the world agree to push for development programs that would cater to the needs of the people while preserving the health of the environment and alleviating hunger and poverty (ICSU, 2002 as cited by IPCC, 2007). Such type of development is commonly termed as sustainable development. The 1987 Brundtland Commission Report defines sustainable development as the "development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs".

There are three pillars of sustainable development: ecology, economy and social. The environment pillar acknowledges that activities undertaken must not be able to cause damage to the environment to a point where the latter ceases its capacity to supply the goods and services it used to offer. For instance, harvesting trees from a forest area using the high impact logging reduces the ability of the forests to deliver the goods and services they used to offer such as biodiversity, carbon, water, aesthetic value, food etc. A study by Lasco *et al* (2000) showed that carbon stored in a virgin forest in Mindanao is reduced by 50% when logging was undertaken. Even if the area is allowed to rest for 35 years, the usual cyclic cut under the Philippine Selective Logging System (PSLS), the amount of carbon stored in forest is a lot less than the amount of carbon stored in the original or virgin forest.

The economic pillar of sustainable development on the other hand identifies that the economy should be strong to generate resources needed for sustainable development. This means that benefits derived from a growing economy should be put into other investments that will benefit the present and future generations. It is in this essence that sustainable development is said to be attained because the needs of the poor population are met and their living conditions are improved.

The social pillar of sustainable development is concerned with building up the economy and at the same time strengthening the capacities of the people. This is a departure from the old concept of development where the only focus is on the economy. In sustainable development, the focus is on reducing powerlessness of the people and building the social asset through attainment of individual and group aspirations (Munasinghe and Swart, 2000) and at the same time creating greater environmental awareness among the people (O'Riordan, 2004).

Climate Change and Sustainable Development

Sustainable development and climate change are closely linked with each other. According to Huq and Reid (2004) climate change is highly recognized as a significant factor that can influence sustainable development. At current extreme climate events such as flooding and drought, the poor sectors are already vulnerable because most often, sources of their livelihood are limited and are mostly based on natural resources. During floods or drought, their sources of livelihood fail to provide them with crops to eat and cash to meet the needs of their families. To cope with such adverse impacts, they resort to selling of their farm animals, mortgaging or renting out of their farmlands. While this measure gives immediate solution to the poor people's problem, over the long term, such action make their livelihoods unsustainable. These people will only have

food for a short time as proceeds from the sale of assets or mortgage/rent of farmlands are not really much. For the rest of the time, the poor people will have very limited food intake resulting to malnourishment. As a consequence, their capacities to do manual labor are reduced.

With climate change, these traditional coping mechanisms will become less effective as climate will become more harsh making the poor people poorer. To attain sustainable development amidst the climate change regime, development activities to be undertaken must contribute to the country's overall efforts of poverty reduction among the rural poor. This would mean decreasing their powerlessness and vulnerability by strengthening the five capital assets *i.e*. natural, social, human, physical and financial. Pretty and Hines (2000) as cited by Pulhin (2001) defined these five assets as follows:

Natural capital – nature's goods and services such as natural forests, planted trees, water, wildlife including their habitats, biodiversity areas, non-timber forest products, upland farms, sacred groves, and others. Also included are the various natural and biological processes such as nutrient cycling and fixation, soil formation, biological control of pests, climate regulation, and the other protective and aesthetic values of the forests.

Social capital – the social bonds that facilitate cooperation among members of upland communities; the bundles of common rules, norms and sanctions for behavior; reciprocity and exchanges; connectedness and social institutions.

Human capital – the status of community members that comprises their stock of health, nutrition, education, skills and knowledge; access to services that provides these, such as schools, medical services, extension services; the ways community members and their knowledge interact with productive technologies; and the leadership quality of community members.

Physical capital – local infrastructure, and comprises housing and other buildings; roads and bridges that links communities to markets and other support services; energy supplies; transportation and communication facilities.

Financial capital – stocks of money, and comprises savings; access to affordable credit; remittances from family members and relatives; pensions; welfare payments; grants and subsidies; and other forms of financial support.

Reducing vulnerability of the poor people can be achieved through protecting the forests from further degradation, helping them to establish linkages that will help them find good market for their products, capacitating the local community, providing support services, and ensuring that their financial resources are able to meet the needs of their families.

Water Resources in the Philippines

Sources of water

The Philippines is endowed with rich water resources. Rainfall, one of the major sources of water in the country, ranges from 1000 to 4000 mm annually. Of this, about 1000 to 2000 mm are collected as runoff by about 421 principal river basins, 59 natural lakes and a number of streams. Aside from rainfall, the Philippines gets its water supply from rivers, lakes, and reservoirs, and groundwater resources. In terms of total annual available freshwater supply, the country has around 145,900 million cu. m. and groundwater recharge of 20,000 million cu. m. (NWRB, 2003).

Reasons for declining water quantity and quality

While in general, the Philippines has abundant water resources, problem on water supply still exist in the country. A number of reasons are noted to have caused such shortage (NWRB, 2003). Firstly, there is difference between the supply of and demand for water. The amount of rainfall received by an area is dependent on its geographical location. Different parts of the country do not receive the same amount of rainfall. Some parts of the country receive very little rainfall each year while some parts receive a lot of rainfall. As a result, areas with limited rainfall and are thickly populated suffer water shortage especially during the dry season:

Secondly, there is lack of water allocation formula in the Philippines. While a national policy exists where domestic water supply is the priority over all other uses, big companies such as MWSS sometimes draws more water from the reservoir than its allocation.

Thirdly, there is existing competition between corporations and people for the control and use of available freshwater resources. Mineral water companies hold permits over many of the creeks, springs and rivers of the country. As a result, the local communities who rely on such natural sources for their water supply experience substantial reduction of their water supply.

Fourthly, there is weak water use regulation and enforcement in the Philippines. The NWRB is not properly equipped in regulating the water resources of the country because they lack both the manpower and the resources needed to effectively manage such resource.

Fifthly, there is inefficient water use existing in the country. Water is wasted in distribution lines, irrigation canals, homes, offices etc. Many people regard water as an inexhaustible resource so it will always be available anytime, anywhere. It is a common attitude among many people not to care about open or leaking faucets or pipes because they are not the ones who will pay for the wasted water anyway. Very few people would care to close open faucets and report leaking pipes. Rarely would people realize that the water that they may be saving today could be the water they might be needing in the future. Most often, people would be able realize the importance of conserving water only when they experience to have very low supply of water.

The sixth reason for water scarcity in the Philippines is depletion of groundwater resources caused by establishment of too many groundwater wells. There is no law that regulates the establishment of groundwater wells thus, many residential and industrial establishments that are not reached by water services use such wells to draw water.

The last reason why water is scarce in the country is that management of water resources is fragmented. Currently, there are around 30 government institutions that deal with water *i. e* supply, hydropower, irrigation, flood control, pollution, watershed management. For instance, the NWRB is responsible for policy formulation, administration and enforcement of the Water Code of the Philippines; the National Economic Development Authority (NEDA) is engaged in planning and policy formulation; the Metro Manila Development Authority (MMDA) for flood control and drainage; the Department of Health (DOH) for sanitation; the DENR for watershed protection and water quality; the Department of Interior and Local Government (DILG) for LGU-managed water supply, and sewerage and sanitation systems and capability building; the National Power Corporation (NPC) for hydropower development; the National Irrigation Administration (NIA) and the Bureau of Soils and Water Management

(BSWM) for irrigation development; the Metropolitan Waterworks and Sewerage System (MWSS) for water supply, sewerage, and sanitation in Metro Manila and, partially, in its neighboring provinces; and Local Water Utilities Administration (LWUA) for the Water Districts which manage water supply and sewerage systems. Each of these agencies have independent strategies and programs on water resources. This resulted to conflicts among the agencies concerned, uncoordinated efforts in implementing regulatory policies and addressing water issues and confusion (Madrazo, 2002).

On top of the reasons mentioned above, supply of water is affected by the deterioration of watersheds, the primary sources of freshwater. In the past, watersheds in the Philippines had been subjected to excessive logging and land use conversion. Much of the forests covering the watersheds were converted into agricultural areas. Aside from the reduction on water quantity, watershed degradation has also caused occurrence of excessive soil erosion and siltation of rivers, lakes and reservoirs which resulted to reduction of water quality.

Sectors using water

Water is a very important resource as it is being used by a number of sectors: agriculture, industries, hydropower and the domestic consumers. Of these, the agricultural sector uses about 85% of the total water supply while the industrial sector and domestic users almost equally share in the remaining 15% of the total water supply. The hydropower on the other hand is considered as non-consumptive (PEM, 2003; 2004).

Water and sustainable development

Water plays a key role in the attainment of sustainable development. Insufficient water supply, low water quality and degradation of watersheds decrease productivity of the poor people. For instance poor water quality or unsafe drinking water puts the poor population at risk. This sector is more exposed to water-related diseases because they do not have the resources to buy purified drinking water. Once they become sick, their capacity to earn is reduced or at times the affected population is unable to work and become unproductive. As a result, poverty is not reduced rather these poor people even become poorer. Poor water quality also results to reduced urban productivity, increased cost of manufacturing and a lower quality of life. Eventually, this weakens the sustained economic growth and social development of the affected area.

Water pollution causing poor water quality has also adverse impact on the country's economy. Accordingly, water pollution costs the economy an estimated P67 billion annually (NWRB, 2003).

Declining water supply will also affect the production of food for a growing population. As the population grows, more agricultural crops, livestock and fishery products have to be produced. Thus, the agriculture sector will require more water to produce such products. Without sufficient supply of water however, agricultural production will not be at all possible. Inability to secure the food requirement of the growing population will result to malnourishment which may lead to weakling or sickly society. As a consequence, the people will not be able to engage in economic activities resulting to greater poverty.

Moreover, limited agricultural products available due to insufficient water supply will bring the prices for such products into a remarkably high mark. This will make such products unaffordable for the majority of the country's population since they have very

limited money to buy food. Similarly, this will result to malnourishment of most of the country's population.

Farmers especially the small ones will be badly affected by the declining water supply. Studies undertaken in the Philippines assessing the vulnerability of the farmers to drought show that most farmers experience substantial reduction in their crop yield. Some farmers even claimed that they are unable to harvest any crops because of very limited or unavailable water supply. To cope with the adverse impacts of drought, some farmers engage themselves to charcoal making or fuelwood production or other economic activities that are harmful to the environment. As a result of the destruction of the environment, the local community becomes more vulnerable to extreme climatic events since their livelihoods are natural resource based.

The industrial sector also requires water for its activities. Without enough water for its use, there will be limited growth for the industry sector. This will in turn limit available jobs for many people and advancement of the country's economy.

Review of Policies, Plans and Programs for the Water Sector

Policies

Currently, there are a number of policies that pertain to water resources. These include: (1) Presidential Decree (PD) No 1067; (2) Republic Act (RA) No. 8041; (3) RA 198; (4) PD 1586; (5) PD 424; (6) RA 7160; (7) PD 1151; (8) RA 9275; (9) Commonwealth Act 383; (10) PD 984; (11) RA 9003; (12) RA 6969; (13) RA 4850; (14) RA 6234; (15) PD 281; (16) DENR Administrative Order (DAO) No. 90-34; (17) DAO 90-35; (18) DAO 94-26A; (19) PD 856; (20) DAO 97-39; (21) DAO 2000-18; and (22) DAO 98-58.

PD 1067 issued in 1976 is also known as the National Water Code of the Philippines. This decree provides the framework as regards water appropriation, control, conservation and protection of water resources. Aimed to attain optimum development and efficient use to meet present and future needs, PD 1067 describes the rights and obligations of the water users.

RA 8041 or the National Water Crisis Act of 1995 takes into consideration the issues of water supply, privatization of state-run water facilities, protection and conservation of watersheds and the waste and pilferage of water.

RA 198 was issued in 1973 to create the provincial water utilities. Through this Republic Act, the local water districts are authorized to operate and administer water supply and waste water disposal systems in the provinces.

PD 1586 requires that an environmental impact assessment (EIA) be undertaken prior to the implementation of any project regardless of who will implement such project. Issued in 1978, PD 1586 institutionalizes the Environmental Impact Statement System (EIS) in the country.

To ensure that a body will look into the problems of water resources, a National Water Resource Council was created through PD 424.

RA 7160 or the Local Government Code provides power to the local government units (LGUs) to enforce laws on water sanitation and to provide basic services such as water supply, sanitation and flood control.

PD 1151 better known as the Philippine Environment Code defines the necessary components of a regulatory program along with its functions.

RA 9275 provides a program and regulations for the abatement and management of water pollution from point and non-point sources. Also called the Clean Water Act, RA 9275 promotes the use of market based instrument in imposing fees on polluters of water.

Commonwealth Act 383 or the Anti-Dumping Law prohibits dumping of waste and other substances into rivers. This Act was issued as early as 1938.

PD 984 issued in 1976 promotes control of water pollution as it provides guidelines for the control of water pollution from industrial sources through imposition of penalties or charges to violators.

RA 9003 also called the Ecological Solid Waste Management Act of 2000 institutionalize a national program that will manage the transfer, transport, processing and disposal of solid waste. This law would like to ensure that landfills to be established would not affect the water quality of the water resources.

RA 6969 (Toxic Subtances and Hazardous and Nuclear Wastes Control Act) was issued to control and manage the import, manufacturing, processing, distribution, use, transport, storage, treatment and disposal of toxic substances and hazardous and nuclear wastes.

To regulate pollution in Laguna de Bay Region, RA 4850 was issued in 1966. This Act was amended by PD 813 to address growing problem of water pollution in Laguna Lake which includes sewage works and industrial waste disposal system.

RA 6234 was issued in 1971 to create the Metro Waterworks and Sewerage System (MWSS). MWSS constructs, operates and maintains water systems, sewerage and sanitation facilities in the Metro Manila area.

In 1973, PD 281 was issued that led to the Creation of the Pasig River Development Council. This Council regulates and controls pollution of the Pasig River.

DAO 90-34 or the Revised Water Usage and Classification/Water Quality Criteria classified the water bodies according to their best usage. Likewise, different parameters and criteria for water quality required for each type of classification were identified.

DAO 90-35 of 1990 provided revision of the effluent regulations. This administrative order prescribes the standards for discharge of effluents to the different classifications of water bodies.

DAO 94-26A or the Philippine National Standards for Drinking Water provides the different parameters and value for drinking water quality. Also it defines guidelines for assessing water quality for drinking water.

PD 856 also known as the Sanitation Code of the Philippines prescribes standards for sewage collection and refuse and excreta disposal. It also assigns to cities and municipalities the responsibilities to provide for efficient and proper disposal and to handle nuisance and offensive trades and occupations.

DAO 97-39 or the Chemical Control Order for Mercury and Mercury Compounds

regulates the importation, manufacture, distribution and use of mercury and mercury compounds and the storage, transport, and disposal of their wastes.

To identify requirements and procedures pertaining to the importation, manufacture, distribution, and use of cyanide and cyanide compounds and the storage, transport and disposal of their wastes DAO 2000-18 or the Chemical Control Order for Cyanide and Cyanide Compounds was issued.

DAO 98-58 or the Priority Chemical List identifies existing and new chemicals that can potentially pose unreasonable risk to public health, workplace, and the environment. This same DAO requires all manufacturers, distributors, users, and importers of chemicals included in the PCL to submit bi-annual reports.

Although these policies already deals with the regulation of water quantity and quality, there was no mention of the issue of climate change.

Plans and programs

Sustainable development programs in the Philippines are described in the following documents: (1) Medium Term Development Plan (MTDP) for 2004-2010; (2) Philippines Millenium Development Goals (MDGs) Progress Report; and (3) Philippine Agenda 21.

The MTDP contains the ten point agenda of the administration of the current President Gloria Macapagal-Arroyo. The primary mission of the MTDP is to alleviate poverty among the Filipino people through creation of jobs and opening up of economic opportunities,

The Philippines' Millenium Development Goals (MDGs) Progress Report is being prepared by the National Economic Development Authority (NEDA) to describe the efforts being undertaken by the Philippine government in attaining poverty reduction targets. The Philippines is dedicated in achieving the MDGs as part of its commitment during the 2000 Millenium Summit.

The Philippine Agenda (PA) 21 was crafted in response to the Philippines' commitment in the Earth Summit in 1992. *PA 21 envisions a better quality of life for all Filipinos through the development of a just, moral and creative, spiritual, economically vibrant, caring, diverse yet cohesive society characterized by appropriate productivity, participatory and democratic processes, and living in harmony and within the limits of the carrying capacity of nature and the integrity of creation.* This can be achieved by undertaking interventions in various ecosystems (forest/upland, coastal and marine, urban, freshwater and lowland/agricultural) and critical resources (minerals and biodiversity).

In all these sustainable development plans climate change adaptation has not been mainstreamed (Lasco *et al*. 2007). For instance in the MTDP, Lasco *et al* (2007) mentioned that while there are adaptation measures being mentioned in the document, all pertain to cope with natural disasters such as typhoons, flooding and landslides and not to foreseen climate change.

Similar to the MTDP, the Philippines MDG progress report did not make any mention about climate change adaptation. However, the document indicated the need to address the increasing trend of carbon dioxide emissions. Likewise, the document also emphasized the need to improve flood control and drainage facilities to cope with the damage caused by flooding and typhoons in the urban areas (Lasco et al, 2007).

Unlike the MTDP and MDG, PA 21 mentioned about climate change. However, this was cited only once and refers only to water resources. According to the document, there is a need to promote and adopt methods for impact assessment of climate change on water resources. Similar to MTDP and MDG, PA 21 also emphasized the need to adapt to problems posed by climate related events such as flooding and drought. The document recommends that flood monitoring and forecasting be undertaken (Lasco et al 2007).

Mainstreaming Climate Change Adaptation in Sustainable Development Agenda of the Water Resources as Viewed by the Stakeholders

This section is based on the interview conducted with the key informants from the various agencies mentioned elsewhere in this paper.

Table 1 shows the profile of the respondents. The ages of the respondents range from 29 to 69 years old. About half of the respondents are in the age range of 45-55 years old while around 40% are in the age range of 25-34 (12.82%), 35-44 (10.26%), and ≥ 55 years old. Around four respondents failed to mention their ages. Results indicate that most of the respondents are already in their middle ages and beyond. This is expected as most of the respondents hold key positions in their respective institutions.

There are more male respondents than females. Twenty five respondents or 64% are males while 14 respondents or 36% are females.

In terms of the civil status of the respondents, results show that almost all of the respondents are already married. About 32 respondents are married representing around 82% of the total respondents. The remaining 18% do not have families of their own yet.

Table 1. Profile of respondents

CHARACTERISTIC	FREQUENCY	PERCENT
Age		
25-34	5	12.82
35-44	4	10.26
45-54	19	48.72
≥ 55	7	17.95
No answer	4	10.26
TOTAL	**39**	**100.00**
Sex		
Male	25	64.10
Female	14	35.90
TOTAL	**39**	**100.00**
Civil Status		
Single	7	17.95
Married	32	82.05
TOTAL	**39**	100.00

When whether mainstreaming climate change is important, all the 39 respondents believe that it is important to integrate climate change adaptation in policies, plans and programs of the water sector. There are various reasons cited for this. These include: (1) will speed up the formulation of measures/programs that will reduce the impacts of climate change on water quality and quantity (60%). These measures include water use efficiency/water regulation, proper water allocation, water conservation, improve water management that will ensure continuous water supply to the different water users, proper waste disposal, protection of the remaining forests and rehabilitation of degraded watersheds; (2) will increase awareness of the different sectors on climate change and its impacts (16%); (3) will ensure funding for adaptation activities and hence will help reduce climate change impacts (11%); (4) will promote more integrated efforts to address climate change (6%); (5) will encourage participation of all sectors of society (3%); (6) will help in proper land use planning (2%); and (7) will support sustainable development (2%) (Table 2).

Table 2. Reasons why mainstreaming climate change adaptation in policies, plans and programs of the water sector is important.

REASON WHY IMPORTANT	FREQUENCY	PERCENT
Will speed up the formulation of adaptation measures/programs that will reduce the impacts of climate change on water quality and quantity	37	59.68
Will increase awareness of the different sectors on climate change and its impacts	10	16.13
Will ensure funding for climate change adaptation activities	7	11.29
Will promote more integrated efforts to address climate change	4	6.45
Will encourage participation of all sectors of society	2	3.23
Will help in proper land use planning	1	1.61
Will support sustainable development	1	1.61
TOTAL	**62**	**100.00**

When asked if climate change adaptation has already been mainstreamed in policies, plans and programs, respondents have differing views on the matter. For instance, about 64% of the total respondents believe that climate change has not yet been integrated while some 33% of the total respondents think that it has been mainstreamed. However, one respondent said that he/she is not yet sure whether it has been integrated or not (Table 3). Respondents who mentioned that climate change is already integrated in the policies, plans and programs however qualified their claims. They emphasized that climate change is not explicitly stated in the policies, plans and programs but somehow there are sections that indirectly address climate change. This is consistent with the findings of Lasco et al (2007) wherein climate change was not at all mentioned in the sustainable development documents of the Philippines but there are sections that discuss on natural disasters such as typhoons, flooding etc that the country has been facing for ages.

According to the 13 respondents, policies where climate change has already been integrated include: (1) regulation on utilization of the river basin/watershed; (2) establishment and protection of coastal areas; (3) creation of Presidential Task Force on Climate Change; (4) policies in agriculture such as no burning of rice straw, application of soil and water conservation technologies and use of low water consuming crops; (5) policies on water such as rotation of water use, water rights permit from NIA, water use

efficiency, regulation of ground water extraction etc (6) Water Code of the Philippines; (7) Proposed urban forestry policy; and (8) Clean Water Act and RA 9003.

As regards the plans, the 13 respondents mentioned that the following sectoral plans already integrate climate change: (1) watershed management plans; (2) river bank rehabilitation and management especially the establishment of bank allowance; (3) establishment of buffer, setback zones and mangrove plantation; (4) agricultural plans such as conversion from chemical to organic farming and promotion of soil and water conservation measures; (5) water resources management plan such as storing of raw water through water impounding dams/reservoirs, use of water saving farming system; (6) framework for clean water; (7) formulation of guidelines on groundwater extraction; (8) Integrated Water Resources Management (IWRM) Plan Framework; (9) delination of forest areas; and (10) deputization of LGUs as water police.

Programs mentioned where climate change has already been mainstreamed include: (1) relocation program of informal settlers along riverbanks; (2) development of Integrated Riverbasin Information Management System; (3) forest/watershed management, rehabilitation and protection program such as installation of forest guards other than those from the DENR in watershed areas; (4) soil and water conservation programs; (5) development of hazard maps for vulnerable and flood prone areas; (6) IEC on water conservation and management; (7) organic farming; (8) water watch programs; (9) waste water treatment; (10) cropping calendar due to pronouncement of El Nino and La Nina; (11) development of decision support tool; (12) raw water pricing; and (13) forging of MOAs with LGUs in the protection of watershed

Table 3. Perception of respondents whether climate change been mainstreamed?

RESPONSE	FREQUENCY	PERCENT
Yes	13	33.33
No	25	64.10
Could be Yes and No	1	2.56
TOTAL	**39.00**	**100.00**

The respondents who answered that climate change has not been mainstreamed stated numerous reasons for such (Table 4). All of the respondents mentioned that there is lack of information on the impacts of climate change among the policy makers and heads of agencies. Thus, they are not doing anything to help address climate change. It is worthy to note though that in the Philippines, capacity building activities on climate change already started as early as the late 1990's. These capacity building activities were undertaken by some academic institutions such as the Ateneo de Manila University particularly the Manila Observatory and the Climate Change Center or KLIMA, the Environmental Forestry Programme of the College of Forestry and Natural Resources, University of the Philippines Los Banos, and the Inter-Agency Committee on Climate Change, a multi-agency committee compose of the DENR, DOST, PAG-ASA, DOE, PRRM and many others. However, very few people were interested that time to attend to climate change activities. Interest on climate change just started to gain its momentum in 2007.

About nine respondents said that climate change is just an emerging issue while another nine respondents claimed that climate change is not a priority program of the government. These reasons can be attributed as well to the lack of awareness among the policy makers.

Some five respondents said that there is no single agency that consolidates the plans and programs and issue policies on water thus, mainstreaming climate change in the water sector can be a difficult thing to do. This problem has been pointed out earlier in this paper. As mentioned earlier, management of water resources is fragmented because there are around 30 government institutions that concern with water resources of the country.

Four respondents claimed that the heads of agencies have reactive attitudes, thus they are not lifting a finger to address projected climate change. The "wait and see" attitude is very common among Filipinos. Filipino people want to observe first and try to sense what that other people are doing. Once they prove that what has been undertaken by those people who took the first steps are beneficial, then that's the time when they will take a step. The disadvantage however of such attitude is that most of the time the actions are already late to solve the problem because not much preparations have been undertaken.

Two responses each were received by the following reasons: (1) matters regarding climate change are the concern of PAG-ASA only; and (2) no ensured funds to implement programs related to climate change. Since PAG-ASA is the agency issuing climate related data, many people think that PAG-ASA will take care of everything that concerns climate change. Also, some people do not realize that climate change will have impacts on the different sectors and combating it requires the cooperation of everyone.

One respondent said that direct relationship between climate change and water sector has not been fully established thus, climate change has not been integrated in the mentioned sector.

Table 4. Reasons why climate change has not been mainstreamed in the water sector

RESPONSE	FREQUENCY	PERCENT
Lack of information on climate change among the policy makers and heads of agencies	13	28.89
Climate change is considered as an emerging issue only	9	20.00
Not a priority program of the government	9	20.00
No single agency responsible for water	5	11.11
Reactive attitude of the heads of agencies	4	8.89
Matters regarding climate change are the concern of PAGASA only	2	4.44
No ensured funds to implement programs related to climate change	2	4.44
Direct relationship between climate change and water sector not fully established	1	2.22
TOTAL	**45**	**100.00**

With regards to the potential points of entry where climate change can be mainstreamed, majority of the respondents emphasized that all policies, plans and programs of all agencies concerned with water need to integrate climate change. Among those mentioned by the respondents include (1) water resource management plan; (2) water conservation strategies; (3) watershed rehabilitation, management and protection; (4) energy independence e.g. shift of power source from diesel/coal to

hydropower/renewable cleaner energy; (5) construction of reservoir; (6) promotion of organic farming; (7) drainage facilities; (8) programs on water production; (10) reforestation; and (11) collection of funds for the preservation of watershed.

About 23% believe that climate change should be integrated in capacity building activities of all stakeholders and agencies. Every agency conducts continuous training to keep its personnel updated with emerging issues. By doing such, appreciation on climate change of the personnel is created which will contribute to more effective implementation of climate change programs.

Around 11% believed that climate change should be integrated in national policies such as the Sustainable Forest Management Act, Land Use Act and Agriculture and Fisheries Modernization Act.

Some respondents believe that by increasing the level of awareness of each sector, participation on climate change activities such as planting of trees, conservation of water, waste management, etc even among the youth will be increased. To increase the level of awareness even among students, about 4% of the total respondents believe that climate change should be integrated in the curriculum.

Two respondents mentioned that climate change should be integrated in the Millenium Development Goals of the Philippines while another two respondents said that it can be mainstreamed in the barangay and municipal resolutions.

Table 5. Potential points of entry where climate change can be mainstreamed

RESPONSE	FREQUENCY	PERCENT
All policies, plans and programs of every agency	25	53.19
Capacity building activities of all stakeholders and agencies	11	23.40
Policies - Sustainable Forest Management Act, Land Use Act, Agriculture and Fisheries Modernization Act	5	10.64
Curriculum	2	4.26
Philippine MDG	2	4.26
Climate change can be integrated at the barangay and LGU level by urging the passage of resolutions or ordinances	2	4.26
TOTAL	**47**	**100.00**

According to the respondents, mainstreaming climate change adaptation can be enhanced by (1) building the capacity of all sectors (2) providing funds for climate change programs; (3) creation of a single body that will coordinate climate change activities; (4) presence of a strong political will; (5) uplifting the socio-economic conditions of the poor; (6) presence of strong commitment of all sectors and (7) coordination among institutions concerned with water resources. Among these factors, building the capacity of concerned sectors is the most popular factor cited by the respondents. Results indicate that respondents fully believe that by making the sectors aware, integration of climate change will be a lot easier.

Six respondents are convinced that by providing 'ensured funding' for climate change programs, it is very certain that climate change will be integrated in the various activities undertaken. Four respondents however mentioned that the presence of strong political will is very important in seeing climate change programs on the ground.

Two persons said that creation of a climate change commission similar to the one being espoused by Sen Legarda. By doing this, climate change efforts will be more coordinated and will prevent overlapping of activities.

Another two respondents said that the way to move programs onward is to address the basic needs of the poor who compose the majority of the population. Most often, programs being undertaken are in the disguise of reducing poverty but in reality, those programs do not alleviate the socio-economic conditions of the poor. As a consequence, support from this sector is not gained because these people are busy engaging themselves in livelihood opportunities. Showing to them that the programs being conducted will benefit them the most will ensure support and participation for the poor sectors.

One person mentioned that coordination among institutions engaged in water resources will enhance integration of climate change in policies, plans and programs while another person said that there is strong commitment of all sectors to combat climate change.

Conclusion

Results of the study show that all the stakeholders believe that mainstreaming climate change adaptation in the policies, plans and programs of the water sector are important to cope with the adverse impacts of climate change. Potential points of entry include: (1) all policies, plans and programs of every agency, (2) capacity building activities of all stakeholders and agencies; (3) national policies such as the Sustainable Forest Management Act, Land Use Act and Agriculture and Fisheries Modernization Act; (4) curriculum; (5) Philippines' MDG; and local government's resolutions ad ordinances.

Climate change adaptation can be enhanced through: (1) building the capacity of all sectors (2) providing funds for climate change programs; (3) creation of a single body that will coordinate climate change activities; (4) presence of a strong political will; (5) uplifting the socio-economic conditions of the poor; (6) presence of strong commitment of all sectors and (7) coordination among institutions concerned with water resources.

References

Acosta-Michlik, L. 2005. Intervulnerability Assessment: Shifting Foci from Generic Indices to Adaptive Agents in Assessing Vulnerability to Global Environmental Change (A Pilot Project in the Philippines). Department of Geography, University Catholic of Louvain (UCL), Louvain-la-Neuve, Belgium

Amadore, L.A. 2005. Crisis or Opportunity: Climate Change Impacts and the Philippines. Greenpeace Southeast Asia in the Philippines. Quezon City, Philippines. 58pp. www.greenpeace.org. Retrieved on September 19, 2007.

Canlas, F.M. and C.F. Cruz. 2004. Philippine Agricultural Crop Production Cycle: Evidenced and Determinants. Paper submitted to the University of the Philippines School of Economics in part fulfillment of the requirements for Economics 1999. UPSE Website.http://www.econ.upd.edu.ph/students/sicat_award/2005/2005_sicat_award_1st_best_cruz-canlas.pdf . 95pp. Retrieved on February 22, 2008.

Madrazo, A. 2002. Water Issues in the context of Sustainable Development. Paper presented during the 2nd World Conference on Green Productivity, December 9 – 11, 2002, in EDSA Shangri-La, Mandaluyong City, Philippines.

Lasco, R. D., F. B. Pulhin, P. A. Jaranilla and K. B. Garcia. 2007. Mainstreaming Climate Change in the Philippines. World Agroforestry Centre. 2nd Floor Kush Hall, IRRI, College, Laguna.

National Water Resources Board (NWRB). 2003. National Water Resources Board Strategic Planning and Management of Integrated Water Resources Management in the Philippines.

National Disaster Coordinating Council, 2000. NDCC Website. http://www.ndcc.gov.ph and http://baseportal.com/cgi-bin/baseportal.pl?htx=/miso/typhoons. Retrieved January 18, 2008.

Perez, R. T. 1998. Adaptation and Mitigation Measures for Climate Change Impacts on the Coastal Resources. In *F. B. Pulhin and R. D. Lasco (eds) Consultation Meeting for the International Conference on Tropical Forests and Climate Change: Status, Issues and Challenges*. Environmental Forestry Programme. College of Forestry and Natural Resources. University of the Philippines Los Banos. College, Laguna. pp 27-52.

Perez, R.T. 2007. Philippine Climate: Trends and Projection. Paper presented during the FORESPI National Symposium on Climate Change in November 28, 2007 at Sulo Hotel, Quezon City. FORESPI Website. http://www.forespi.com/events.html. February 1, 2008.

Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) Official Website. http://www.pagasa.dost.gov.ph/cab/statfram.htm . Retrieved on February 5, 2007.

7.1.2 Linking Climate Change Adaptation Options for Rice Production and Sustainable Development Goals in Indonesia

Perdinan, Rizaldi Boer, Kiki Kartikasari

Introduction

Rice is a strategic commodity in Indonesia. The commodity is a staple food for more than 95% of Indonesian inhabitants and offers available job opportunity for about 21 million household farmers (Swastika et al., 2007). That means rice industry played important role as the main source of income in rural regions. Furthermore, the authors also clarified that securing crop supply especially rice to meet the demand is the main goal of agricultural development policy in Indonesia since insufficiency of crop supply will cause national instability on economy, social and politics. Having said this, securing rice production to meet the future consumed demand which lead to secure the reasonable rice price as well is essentially important for Indonesia.

Indonesian rice production is strongly influenced by climate extreme events associated with ENSO, which could cause flood and drought, by which significantly affected the rice productivity leads to rice production in Indonesia (Boer and Subbiah 2005; D'Arrigoa and Wilson 2008; Naylor et al. 2002; Naylor et al. 2001). Data from Ministry of Agriculture 2007 shown that about 546,487 hectares and 1,036,641 hectares of rice field area was inundated by flood in 2004 associated with La Nina and exposed to drought in 2003 associated with El Nino, respectively. Taking an average of rice productivity per hectare of 4 to 6 ton, rice production loss as a consequence of those events would be a serious problem.

Furthermore, understanding to the consequence of climate variability associate with ENSO in Indonesia, the future climate change is expected to influence more on Indonesian rice production since the extreme events will be exacerbated by the climate change (DFID 2005; PEACE 2007; Hansen et al. 2006). In Indonesia, of 46 massive drought events, about 30 events occurred between 1844 and 1960 (within 117 years), and 16 events occurred between 1961 and 2006 (within 46 years). More than 75% of these massive droughts were associated with El-Nino (Boer and Subbiah 2005). Furthermore, (Boer and Perdinan 2008) justified that based on data collected by the OFDA/CRED International Disaster Database[1], from 1907 to 2007 number of natural hazards occurred in Indonesia categorized as global hazards was 345 events in which about 60% were climate-related hazards. The data shown that flood was the most frequent hazard, followed by landslide and water or vector borne diseases, wind storm, forest fire, drought, and high tide/storm surge. The authors stressed that the first climate hazards occurred in 1953 and then hazards occurrence became more frequent after 1980s for which the top 10 natural hazards causing huge economic loss and human impact mostly occurred after 1980s suggesting increasing trend in hazards' intensity. The increase in the frequency of flood and drought will impact significantly on rice production. The flood can force farmer to sow rice twice if the event attacks in emerging period and damage the crop when attacking rice in growth development up to maturity period. Under drought exposure, water supply would not adequate to meet the required water demand which lead to crop failure. This decreasing production, eventually will force rural economy in many regions in Indonesia to be unstable since rice industry is

[1] OFDA and CRED. 2007. EM-DAT: The OFDA/CRED International Disaster Database, www.em-dat.net - Université catholique de Louvain - Brussels - Belgium".

the main source of income in the regions. For example, at Indramayu, the drought occurrence in 2003 El-Nino caused huge rice production loss which caused many of farmers could not get yield from their rice farm and impacted on increasing number of household that could not meet their food basic needs by 14% compare to the normal years (Boer et al. 2004). Expanding the consequences to the off farm activities consisted in rice industry which was discussed by (Perdinan 2006), the reduction in rice production will cause huge impact on the Indonesian economy and in long term could impede the achievements of sustainable development goals in Indonesia. Production loss is shifting the rice price to be higher which can give multiplier effects on the economy. Further research is needed to assess this latter consequence quantitatively since this works is beyond the discussion of this report.

Understanding the future severe calamity as a consequence of climate change, Indonesian government put high attention on developing adaptation strategy to climate change for which the government through Ministry of Environment documented the adaptation strategy for many sectors of Indonesian economy into a National Action Plan called as RAN-MAPI (Rencana Aksi Nasional Menghadapi Perubahan Iklim - National Action Plan to Cope With Climate Change)(SME 2007). This dynamic document offers a foundation to develop further strategy to mainstream climate change adaptation into national development planning. In 2007 Indonesian government through State Ministry of National Development Planning has also developed a document of National Development Planning Response to Climate Change (SMNDP 2007). In addition to these documents country report on status of Climate Variability and Climate Changes, and Their Implications was established as well (GOI 2007). For the rice production, the Indonesian government had also projected the future demand up to 2025 under certain scenarios and the strategies to reach the demand target documented in Prospek dan Arah Pengembangan Agribisnis Padi (Prospect and Direction for Agribusiness Paddy Development (Deptan 2005).

Taking the advantage of those national documents policy on climate change in Indonesia and rice production, further assessment to discover more detail the linkage of climate change adaptation options and sustainable development plan for Indonesian rice production is being an important issue to be discussed further in order to secure the food supply to meet the future consumption demand. Therefore, this paper is addressed to research that linkage and to propose potential adaptation options to be implemented in order to sustain domestic rice production in Indonesia.

The presentation of this report is directed firstly to discuss about the consequence of climate variability associated with the extreme events on rice production in light of seeing possible future climate change impacts in Indonesia. We then present the existence of climate change and synthesize the previous climate change study to clarify information about current knowledge on the impact of climate change in Indonesia with which plausible adaptation strategy can be set up. In addition to shaping the appropriate adaptation strategy which is in line with the rice development planning, documentation of Indonesian rice production strategy as well as list of climate change adaptation options is then discussed. Final presentation is directed to discuss about the linkage of climate change adaptation options for Indonesian rice production and sustainable development in Indonesia from which the plausible adaptations which is in line with the sustainable development can be proposed.

Climate Variability and Rice Production

Invention of farming technology and system offers great benefit to increase rice productivity as well as rice production in Indonesia. (Deptan 2005) reported that during the period of 1970 to 2004 Indonesian rice production was increasing nearly three times

resulted from increasing in cultivation areas (8.3 million ha to 11,6 million ha) and productivity (2.42 ton/ha to 4.54 ton/ha). Detail information about this technology improvement can be seen from historical data of Indonesian paddy production which shows many programs conducted by Indonesian government since 1971 to improve the efficiency of farming system through intensification programs and invention of new variety (Figure 0-1). However, paying attention to the figure, after 1991 the rice production growth is steadily increase which may happen as a result of the impact of frequent climate extreme events associated with drought on rice production. (Deptan 2005) reported that currently the stagnancy of and the decrease in rice production is mostly due to pest/diseases attacks and climate anomaly.

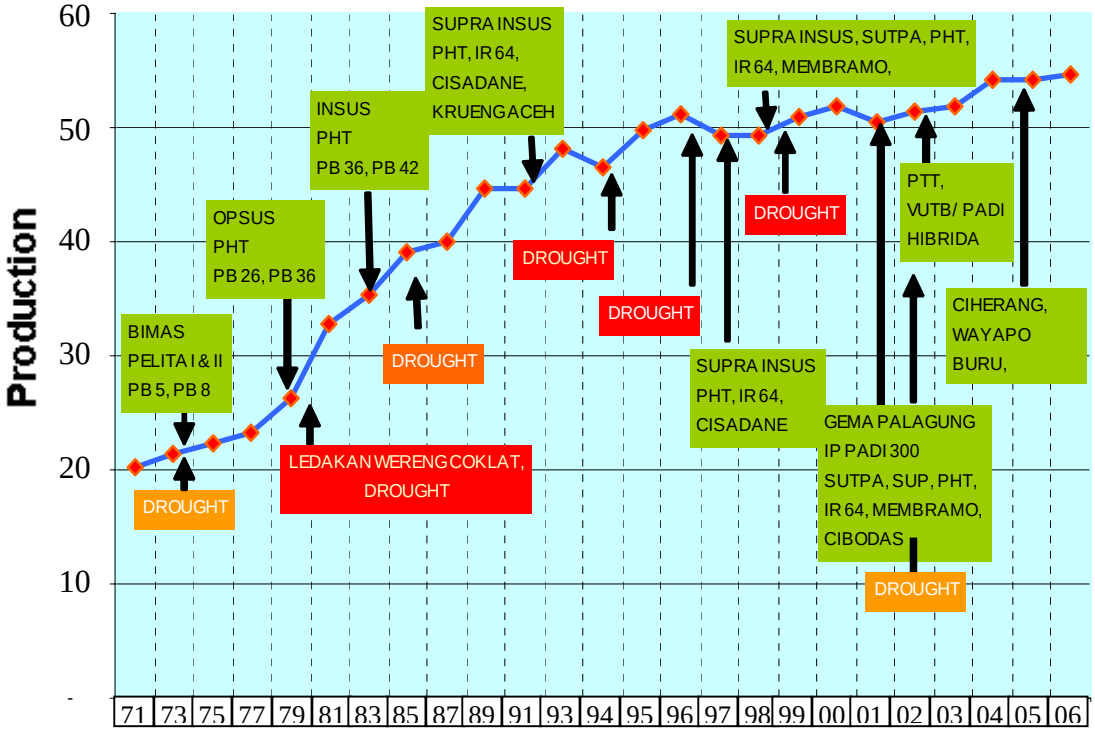

Figure 0-1. Historical Paddy Production in Indonesia (million tons)
Source: (Ditlin 2007)

Furthermore, recent series data on flood impact on rice production from 1996 to 2006 informed that the flood diminished the rice production in Indonesia. The data justifies around 370 thousands hectares of wet rice field equals to 919 ton is damaged by the floods annually (Figure 0-2). The existence of climate extreme events such as La Nina is predicted to have a huge influence of the flood occurrence since La Nina causes long rainy season in Indonesia. Relatively similar to flood, the prolonged drought causes serious problems on rice production as well. The 14-year series data from 1993 to 2006 shows that more than 350 thousands hectares area of wet rice field was damaged by the drought stress annually, which result in production loss of more than 700 thousands tons (Figure 0-3). The climate extreme events-El Nino, caused more severe problems, the loss reached more than 2 million tons.

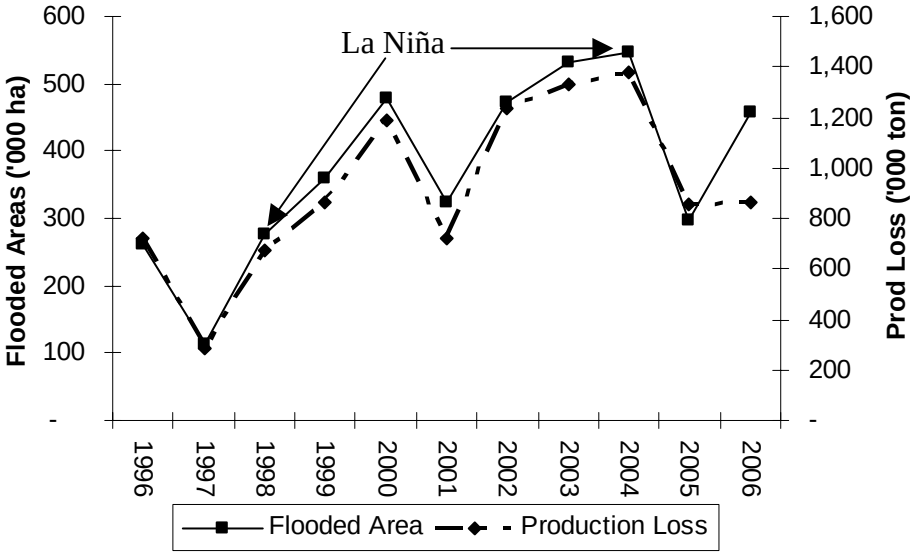

Figure 0-2. Total flooded area of wet rice fields and production loss in Indonesia
Source : Drawn from Department of Agriculture, 2007

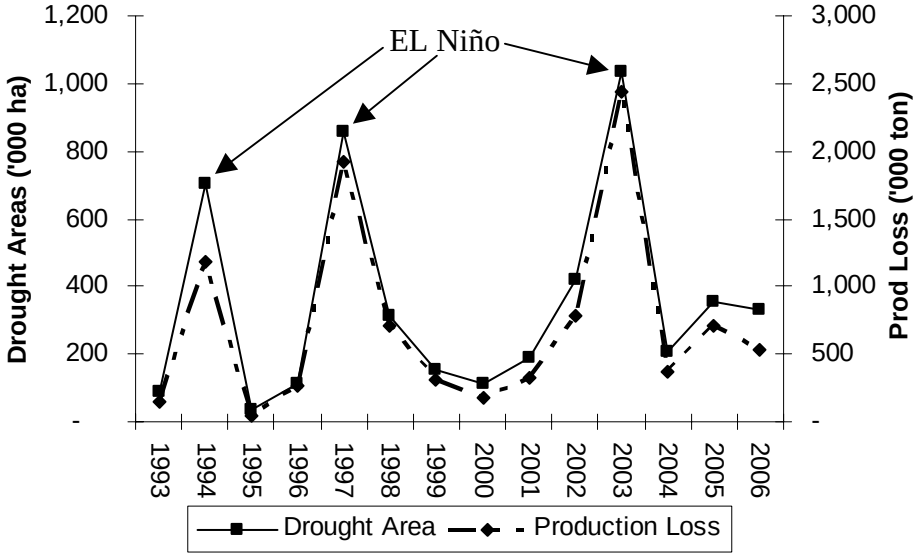

Figure 0-3. Total dried up area of wet rice fields and production loss in Indonesia
Source : Drawn from Department of Agriculture (2007)

Even though, it is clear that the drought events is highly correlated with El Nino event in Indonesia, (Boer et al. 2007) argued that the existence of El Nino event do not always result in dramatically rice production loss. This is because the following factors:

- Calculation for production uses calendar year, while EL Nino does not follow the calendar

- El Nino do not influence strongly on the entire rice production centres in Indonesia
- Farmers decision to alter rice to soybean when El Nino occurs
- Increasing productivity as a consequence of high radiation intensity during El-Nino
- Decreasing rice production caused by lower production inputs for the on farm activities as a consequence of decreasing in farmers' purchasing power after the El Nino

Paying more attention to the above factors, it can be seen that they are intended to clarify some factors that affected the justification of the correlation between rice production and El Nino without having any intention to neglecting the serious impact of the extreme climate events on rice production in Indonesia. In line with this argument, (Boer and Las 2003) argued that Indonesian rice production system becomes more vulnerable to extreme climate events (ECE) since in general current technologies are not directed to cope with the extreme climate events so that the production loss due to the ECE increased from time to time, before 1994 the loss of rice production due to ECE was about 0.2 million ton per event and after 1994 it increased to at least 1.0 million ton per event (1.1 to 1.7 million ton per event).

More over, the ECE affected significantly on a region whose climate type is monsoonal with rainy season and dry season period around November to April and May to October, correspondingly. For example Java Island whose climate type is monsoonal is affected significantly by El Nino (Figure 0-4). Map of production loss under El Nino condition in 1991, 1994 and 1997 shown that almost all of regions within Java island experienced production loss of more than 25 thousands hectares which is classified by using five level of drought index as sensitive areas (Boer et al. 2002; GOI 2007). Understanding the rainy and dry season period of monsoonal climate type, it is understandable that drought and flood is normally developed in June/July and December-February, respectively.

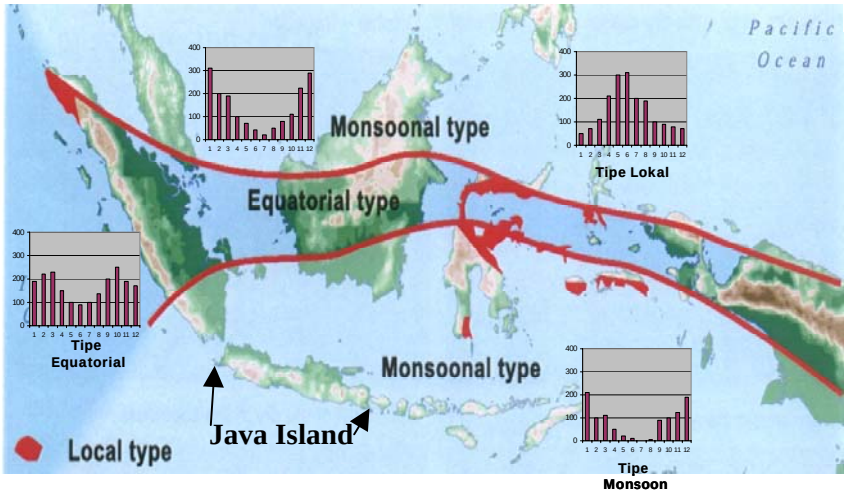

Figure 0-4. Major rainfall type in Indonesia
Source: Modified from DPI-Australia, 2002 (Boer 2002)

Despite the direct effect on crop production, the ENSO has also indirect effects on crop since the phenomenon can increase the pest population. It was indicated that in La-Niña years the brown plant hopper (*'wereng coklat'*) population was increasing significantly, probably as a consequence of higher rainfall amounts. (GOI 2007) used data on variation of wereng attack during the period of 1989 to 2005 in Indonesia collected from Directorate of Plant Protection, Department of Agriculture (2007) reported that Wereng attack in West Java, the main rice growing area of Indonesia, increased significantly in

years when La-Niña occurs in 1995 and 2005. Relating this evidence with Figure 0-1, it is clear that directly and indirectly the extreme climate events impact significantly on rice production in Indonesia. The implementation of farming technology development will not provide significant contribution to increase rice production in Indonesia if the extreme climate events are not considered appropriately since the events has been acknowledged as an important threat that required much attention to be solved. (Boer and Las 2003) stressed that current farming technologies are not directed to cope with the extreme climate events, thus the development of adaptation technology to the extreme climate event should be changed from time to time following the level of exposure to the system.

Realizing on those facts about the consequences of the extreme climate event as a result of the variability of climate condition spatially and temporally, the future climate change will require appropriate adaptation strategy in order to minimize the possible negative impacts. (Amien et al. 1996) reported that simulation model showed under climate change in 2030 the rice productivity in Ngawi and Sukamandi which is located on Java Island would be lower than the current productivity in which the productivity would decrease by about 30% and 20% for the two regions, accordingly. Therefore it is clear that future climate adaptation strategy is necessary to be developed in order to minimize the possible negative effects and previous knowledge on the impact of climate variability gives some initial step on how to deal with the problem. (Jones 2003) stated that an appropriate strategy to deal with climate change can be devised based on previous knowledge on climate variability.

To start developing the appropriate climate change adaptation options for supporting Indonesian rice production so that they can be implemented properly, previous research on securing rice production, climate variability and rice production, the impact of climate change in Indonesia and current strategy to utilize the climate information to minimize the negative effect of climate extreme events would be valuable to be synthesized. The syntheses result can also give an understanding on current capacity of Indonesia to deal with the possible extreme climate event. The next section is addressed to discuss about this subject.

The Existence of Climate Change and Synthesis of Climate Studies in Indonesia

Climate Change in Indonesia

The existence of climate change in Indonesia has been widely clarified by many reports on climate change status in Indonesia such as (BMG 2007; GOI 2007; PEACE 2007) which collected information from many research articles. Those reports reported that there will be shifting in climate pattern in Indonesia. For example, (BMG 2007) reported that most of the wet season rainfall of stations located in the southern part of Indonesia (South Sumatra, Java and Eastern Indonesia) tended to increase, while that of dry season rainfall tended to decrease. On the other hand the stations located in the northern part of Indonesia (e.g. Sumatra), rainfall in both seasons showed a slight increase.

Furthermore, (GOI 2007) based on many research on identifying climate change in Indonesia (Neelin et al. 2006; Naylor et al. 2007; BMG 2007) justified that future wet and dry season rainfall trend follows the past trends. It is very likely that in Java and Bali (southern part) the length of rainy season in the future may shorten and its rainfall depth may be higher than the current climate which results in higher flood risks and drought risks in these regions. Meanwhile, the pattern of change in rainfall pattern for regions in the northern part of equator is likely to be the opposite (Figure 0-1). Thus it

is clear that the southern part of Indonesia such as Java Island will be exposed to frequent climate extreme events in the future that may exacerbate the current stress of the events on affecting the rice production in Indonesia.

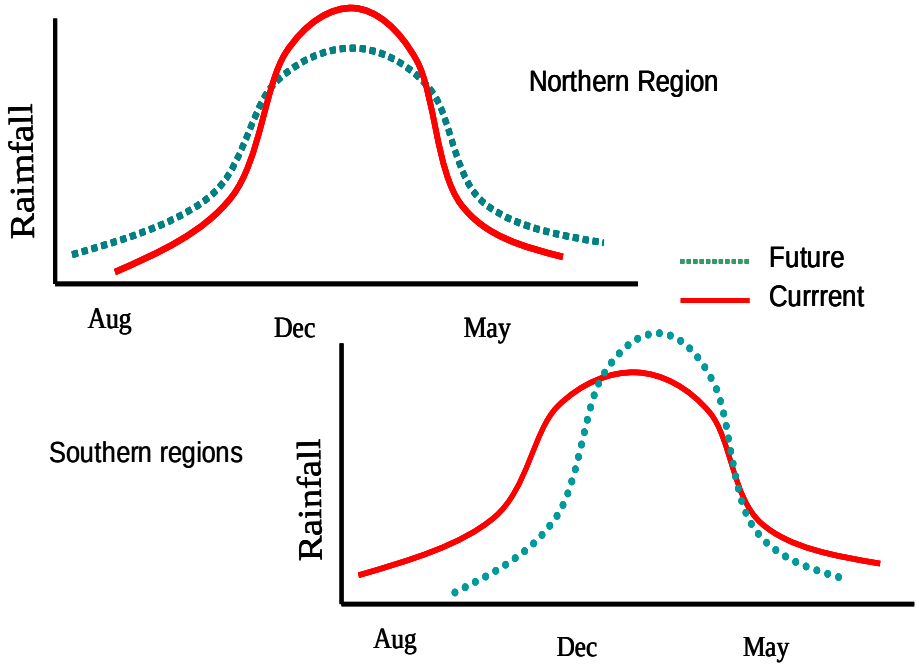

Figure 0-1. Likely rainfall pattern in northern and southern regions in Indonesia
Source: (GOI 2007)

The changing rainfall pattern of wet and dry season will lead to change the onset of seasons. Based on mean data of onset of the rainy and dry season gathered from BMG (2004) in the period of 1961 to 1990 and 1991 and 2003, respectively, the onset of wet and dry season was changing in a number of regions of Sumatra and Java islands (GOI 2007). In most of the Sumatra region, the onset of the wet season advanced between 1 and 2 *dekads*, while the onset of dry seasons advanced between 3 and 4 dekads. On the other hand, most of regions in Java, except the eastern part, the onset of the wet season delayed between 1 and 2 *dekads*, and this onsets delay will cover more regions during the dry season (Figure 0-2). Therefore, it indicates that future adaptation strategy such as changing cropping calendar and cropping pattern following the climate information should be developed in order to minimize the possible negative impacts of the changing climate.

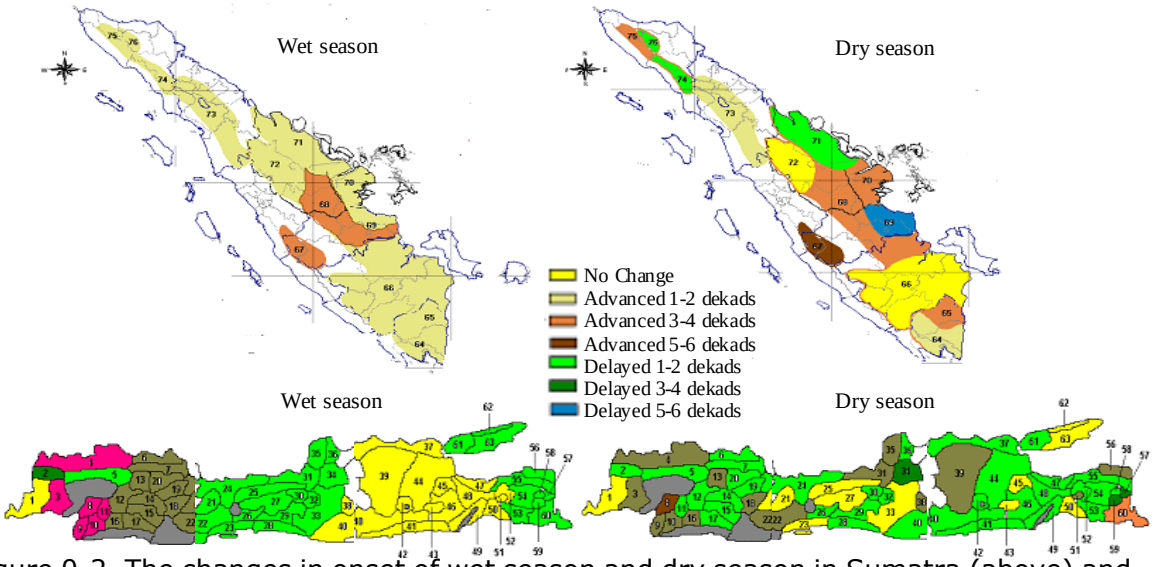

Figure 0-2. The changes in onset of wet season and dry season in Sumatra (above) and Java Island (below). One *dekad* equal to 10 days.
Source: Bureau of Geophysics and Meteorology (2004)

Synthesis of Climate Studies in Indonesia

Recently, research on climate risks and climate change is growing significantly in Indonesia. Many government and non-government agencies in the country focused their research on the issue with specific stress in the topic of climate model, impact studies, mitigation and adaptation (Figure 0-3). The terminology for each topic in here is described as follow:

- climate model: development of climate model to assess the climate change
- impact studies: identifying the existence of climate change and its implication
- mitigation: reduction of atmospheric carbon
- adaptation: adaptation to climate condition by utilizing the climate information

Pay an attention to discuss about the climate change adaptation, actually, there were not many previous research directly addressed to assess the climate change adaptation in Indonesia especially on assessing the climate change adaptation for crop production such as paddy/rice. Most of the research related to this issue is addressed to utilize the climate information in order to alleviate the negative impacts of the extreme climate event (ADPC 2003; Boer 2004; Elsa 2006). Because of that when classifying the agencies focused onto the adaptation category, we clarify based on their role and research project on utilizing climate information. The four agencies classified in the adaptation category are also still conducting research on the climate change adaptation.

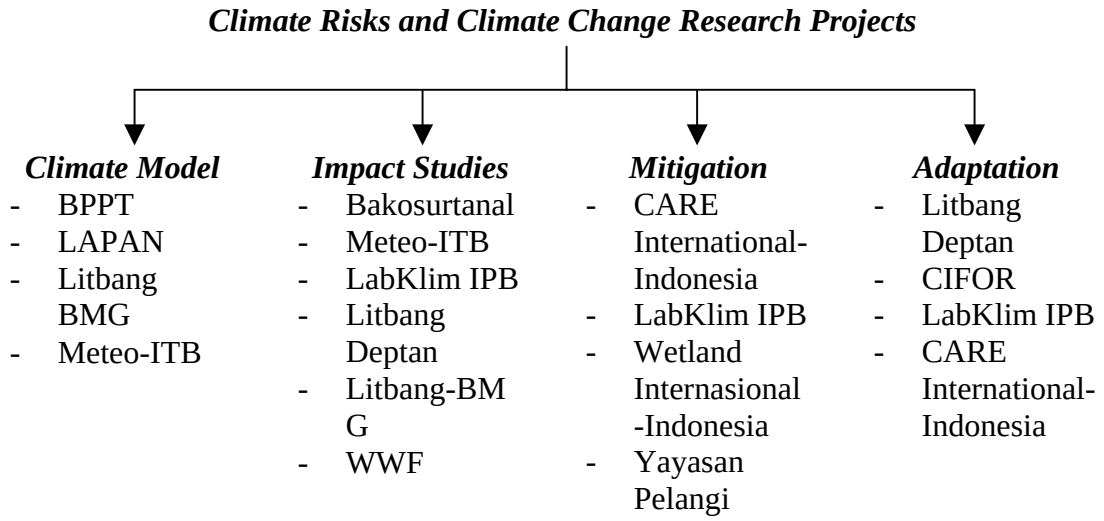

Figure 0-3. Indonesian agencies focused on Climate Risks and Change Research Projects Source: Redrawn from (Boer and Kartikasari 2007)

Technically, the institutions focused on the climate research in Indonesia have used climate model and impacts model intensively. The spatial method dealing with Geographic Information System (GIS), Remote Sensing (RS) and the statistical model have also been utilized. Interestingly, the climate research has also moved towards to use participatory approach and economic valuation model to study the climate risks and climate change in Indonesia (Table 0-1). These finding provide a glimpse about the current capacity of Indonesia to assess the impact of future climate change under different scenarios on certain sector such as crop production and water resources from which early action to alleviate the possible negative impacts can be devised.

Table 0-1. Techniques analysis, model and approach used for studying climate risks and climate change in Indonesia

Tool, Model, Teknique Analysis	ITB	IPB	BKLIM	BMG	LAPAN	BPPT
- Impacts Model (crop simulation, hydrology simulation and etc.)	Yes	Yes	Yes	No	Yes	No
- GIS and Remote Sensing	Yes	Yes	Yes	Yes	Yes	Yes
- Statistical Model for Climate Forecast Application	Yes	Yes	Yes	Yes	Yes	Yes
- Dynamical Model for Climate Forecast Application	Yes	No	No	Yes	Yes	Yes
- Statistical downscaling technique of GCM to analyze climate change	No	Yes	No	Yes	Yes	Yes
- Climate Data Generador	No	Yes	Yes	No	Yes	No
- Participatory Approach	No	Yes	Yes	No	No	No
- Economic and Valuation Model	Yes	Yes	Yes	No	No	No

Note:
BKLIM : Balitklimat, BPPT : UPT Hujan Buatan BPPT, BMG : Litbang BMG, LAPAN : Natural Resources and Environmental Monitoring -LAPAN Pekayon and Climatology Application and Environment and Climate Modelling -LAPAN Bandung. Source: (Boer and Kartikasari 2007)

Having investigated the broad research topic on climate change in Indonesia, now, we turn to clarify more specific research project on climate risks and crop production as well as the relevant climate change studies in order to look at the current stage of factual climate research on this topic. Based on previous project research on climate issues in Indonesia, it can be synthesized that most of the research are dealing with the climate variability and the use of climate forecast information especially on agricultural sector (APN 2003). From these pieces of research, rice was being a focused commodity to be discussed (APN 2003). Furthermore, research on climate change issues are mainly addressed to detect the existence of climate change and asssessing the possible impact of the climate change especially on watershed and agriculture (AIACC 2003). Stands to these points, it seems the strategy to deal with the climate variability such as ENSO events had been addressed well and appropriate strategy to alleviate the possible negative effects, for example: planting strategy, can be devised.

It also can be seen that climate research has moved into practice in Indonesia, for example the implementation of Climate Field School program (ADPC 2003), where under this program farmers was trained to use climate information appropriately. Next, the previous research on detecting the existence of climate change and identifying the possible impact of it on socio-economic sectors (BMG 2007) offers early warning to devise appropriate climate change adaptation strategies as soon as possible in order to minimise the negative effects which may occurs. The research project on development of linkage among Indonesian local scientist, policy makers and community as is shown in Figure 0-4 has also been done (APN 2007). Therefore, climate studies in Indonesia has moved from theoritical framework, use of tool and model, to the application, use of climate information to assess risk and devise better management system for agriculture. In addition to this the projects has also progressed towards the dissemination of utilising the climate information through capacity building (Table 0-2). Realizing the importance issue of climate change to be addressed and climate change adaptation for agricultural sector to be developed, currently in 2008 Ministry of Agriculture Republic of Indonesia (Deptan-RI) formed climate consortium composed on many scientists across institutions to do research on climate change mitigation and adaptation. Specifically for the adaptation, the consortium is expected to identify vulnerable region exposed to climate change and to devise appropriate adaptation strategy. Summary information about the past 5 years reseach in detail is listed in Appendix 1.

Table 0-2. Synthesis of Climate Research on Crop Production as well as Relevant Climate Change Studies in Indonesia

Authors / Research Project	Classification of the Research Project				
	Tool/Model	Risk	Management	Capacity Building	Policy
(APN 2003)	√	√	√		
(AIACC 2003)	√	√			
(ADPC 2003)			√	√	
(Boer 2004)			√		
(Mardawilis 2004)	√	√	√		
(Aser 2004)		√	√		
(Leemhuis 2005)	√	√			
(Elsa 2006)	√	√	√		
(LAPAN 2006)	√	√			
(APN 2007)				√	
(Boer 2007)	√	√			
(LAPAN 2008)	√	√			

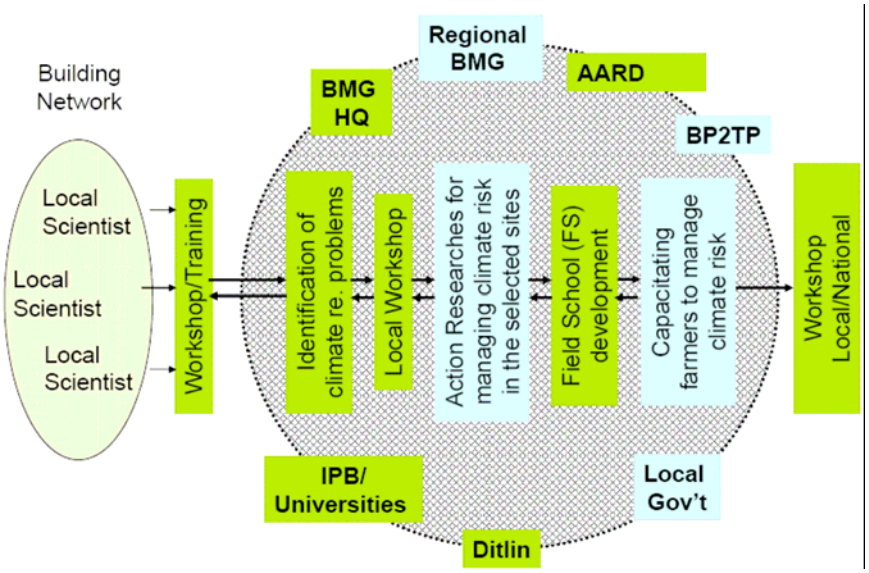

Figure 0-4. The process of APN Capable Research in Indonesia
Source: (APN 2007)

Therefore, to ultimately employ the research on climate variability and rice farming for devising better climate change adaptation strategy to secure rice production, understanding the rice development strategy is important. From which the appropriate plausible climate change adaptation strategy can be selected and implemented smoothly since it has strong correlation with the rice development plan. This essential substance will be discussed in the next section.

Indonesian Rice Demand Projection and Its Development Strategy

Indonesian Rice Demand Projection

The demand for rice is increasing in Indonesia from time to time as a consequence of the population growth and the relatively constant of rice consumption per capita. (Deptan 2005) projected with the population growth of 1.49% annually and the consumption of 105 kg per capita in 2025, the demand for rice in Indonesia in 2025 will be about 41.5 million tons which equals to paddy production of about 65.85 million tons (Table 0-1). The report clarified that the increasing demand for rice from 2010 to 2025 is about 2 million tons per five years which equals to paddy production of about 3.17 million tons using paddy to rice conversion of 63%.

Table 0-1. Regional Demand for Rice in the period of 2010 – 2025 (in thousand tons).

Regions	2010	2015	2020	2025
Sumatera	8,037	8,499	8,987	9,504
Jawa	20,081	21,202	22,386	23,637
Bali and Nusatenggara	2,12	2,242	2,371	2,507
Kalimantan	1,944	2,055	2,173	2,298
Sulawesi	2,556	2,704	2,862	3,028
Maluku and Papua	432	457	484	512
Indonesia	35,170	37,160	39,263	41,487
Paddy Production	55,825	58,984	62,323	65,852

Note: paddy production is paddy produced to meet the rice demand using paddy to rice conversion of 63%

Under this projected demand, Sulawesi and Kalimantan is predicted to have a capacity to reach absolute self sufficiency, while Java will have a problem to meet its demand so that Java have to import rice from other regions. This is reasonable with regard to the demand for rice in Java contributes to about 57% of Indonesian rice demand, while the Java capacity to produce rice domestically can not reach the demand as a consequence of agricultural land conversion. Statistical data of Indonesian Bureau of Statistics from 1995 to 2005 showed the areas of paddy field in Java decreased by about 0,43 percents annually (Swastika et al. 2007). In general, the conversion of irrigated paddy field to non-agricultural uses and wet paddy field with irrigation to non-irrigation about 15,000-20,000 and 10,000-20,000 per year, respectively (Table 0-2).

Table 0-2. Agricultural Land Conversion in Indonesia

Types of Land Conversion	Units	Areas	Source
A. Irrigated paddy field conversion to non-agricultural uses	ha/year	15,000-20,000	1
B. Irrigation channel conversion to other uses	ha/year	15,000	2
C. Conversion of irrigation area to settlement and industry indicated by the expansion of cities' area	ha/year	15,000	3
D. Conversion of wet paddy field with irrigation to non-irrigation	ha/year	10,000-20,000	3

Source:

1) Ministry Of Settlement And Regional Infrastructure, 2003
2) Ditjen SDA, 2003. *Kebijakan Pengembangan dan Konservasi Sumberdaya Air Dalam Rangka Mendukung Program Ketahanan Pangan*. Presentation on *Pertemuan Regional Wilayah Barat Ditjen Bina Produksi Tanaman Pangan*
3) Ditjen SDA, 2003. *Kondisi Sumber Daya Air Nasional*

Furthermore, to meet the projected demand, Indonesian government constructed four scenarios of paddy production. The scenarios considered the harvesting areas and productivity to increase the paddy production. Expanding the harvesting areas is directed to expand the planting areas of paddy called as extensification, while increasing productivity is focussed on improving the farming system and rice variety to reach the higher yield called as intensification. The implication of the first three scenarios needs the construction of new paddy field about **75 thousand hectares in 2010** and increases the expansion by about **75 thousand hectares** every five years up to **2030**. On the other hand, for the same time period, the last scenarios will build the new field about **100 thousand hectares** with the additional expansion about **100 thousand hectares** (Deptan 2005).

Table 0-3. Scenarios of proyected paddy production

Scenarios	Harvesting Areas	Productivity
Scenario 1 (pessimistic)	Increase by 0.4% per year	Increase by 1.0% per year
Scenario 2 (optimistic)	Constant	Increase by 1.5% per year
Scenario 3 (realistic)	Constant	Increase by 1.0% per year
Scenario 4 (resources)	Increase by 0.37% per year	Increase by 0.48% per year

It is important to note that the scenarios only considered the extensificantion and intensification strategy, while climate change adaptations have not been considered well when implementing the strategies. Therefore, the implementation may not reach the goal to meet the demand for rice optimally. The discussion about the inclusion of

climate change adaptations for rice production will be discussed after the discussion on Indonesian rice development strategy.

Indonesian Rice Production Strategy

The high demand for rice as has been discussed previously forced Indonesia to devise appropriate strategy to fulfil the demand. It is expected that at least the domestic production can fulfil about the 95% of the projected demand. To meet with this objective, the rice development strategy is directed into two pathways:

(1) Increase the productivity of about 1-1.5% annually (intensification);
(2) Increase the planting area or planting intensity (extensification)

In general, the intensification is programmed by improving the rice variety which is resilient to the drought condition and farming technology (PTT) as well as the socialization of the programs to farmers. Empirical data of implementation the PTT shows that the program increases the rice productivity by about 37%, 27%, 16% for research, assessment and field experiment, accordingly (Deptan 2005). Meanwhile, the extensification is programmed to expand the rice planting areas in outside of Java particularly in Sumatera and Kalimantan, other land typology namely rain-fed, dry land and tidal swamp areas without omitting the role of irrigated paddy field and to improve the planting intensity (Table 0-4). In addition to this, with regard to the complex system of rice agriculture, the medium and long term strategy is not only directed to the production but also the wide range of rice agriculture system, namely: (1) development of farming facilities, (2) development of seed system in 2025 for domestic use and export, (3) intensification, (3) extensification, (4) development of protecting system, (5) processing and marketing yield, (6) development of institutional linkage, and (7) enhancement of developed management (Deptan 2005). Without neglecting the important aspects of the other strategies to influence the rice production, in the context of this paper, the intensification and extensification strategies will be detailed with regard to their direct impact on rice productivity. In addition to this the climate phenomena described in the section of "Climate Variability and Rice Production" directly influences the two strategies.

Table 0-4. Strategy to increase paddy production on four agro-ecosystems

Agro-eco systems	Expanded Areas	Quality and Yield	Proposed Activities
Irrigated paddy field	**	***	• Increase the planting intensity through pump programs, improvement the irrigation channels, and implementation of superior variety. • Narrow the yield discrepancy through dissemination and technology for specific location. • Improve the yield quality to support the agribusiness.
Rainfed paddy field	**	**	• Increase the planting intensity and yield stability through implementation of superior variety which resilient to pest and diseases as well as drought.
Dry land areas	***	*	• Increase the planting intensity and yield stability through introduction of new superior variety and Improved Agricultural System model called as PTT .
Tidal	***	*	• Attempt to cultivate rice in this area regarded the

swamp areas			problem on water management, soil fertility, water quality, contamination of iron, organic acids and aluminium, even though, water is always available.

Note: Number of stars indicated the priority (Source: Modified from (Deptan 2005))

Turn to discuss about the intensification, Indonesian government has developed short, medium and medium plan. In 2009, programs are mainly addressed to improve the implementation of improved agricultural farming model and adoption of the new farming technology. For the medium term (2015) the programs are expanded to assemble superior variety supported by seed system and to enhance the effectiveness and efficiency of land, water, crop and organism management supported by basic research and technology. Furthermore, the long term program (2025) is directed to improve the cultivation of rice farming in the four agro-ecosystem, irrigated paddy field, rain-fed paddy field, dry land areas and tidal swamp areas (Table 0-5). In addition to this, rehabilitation of degraded land, as a result of erosion, tidal land and lowland swamp, and land conservation are also programmed.

Table 0-5. Intensification programs for increasing rice production in Indonesia

Shortterm plan (2009)
1. Improvement of technology for specific location, improved agricultural system model (PTT) or prescription farming, in particular the use of new superior variety (higher productivity about 5-10% than IR64) which can adapt to a specific environment 2. Acceleration of adoption the technology by improving the dissemination system of the technology (development of pakar system, test kit, website information system and others)
Mediumterm plan (2015)
1. Assembly the superior variety (VUB, VUTB, VUH, VUHTB) supported by well seed system 2. Enhancement of the effectiveness and efficiency of land, water, crop and organism management supported by basic research and technology 3. Development of network system for research and application focussed on paddy commodity 4. Dissemination and promotion of results of research on paddy using information technology
Longterm plan (2025)
1. Irrigated paddy field: improvement of the intensification quality (PMI) in relation to the approach of PTT, application of new superior variety (VUS, VUH and VUTB), appropriate use of fertilisers, and the implementation of cultivated technique for specific location. 2. Rainfed paddy field: improving technology of PTT in particular cropping pattern, controlling interfered plants, VUB and management of nutrients for specific location, and the utilisation of organic compounds. 3. Dry land areas: implementation of PTT with consideration on aspects of land conservation, cropping pattern, and management of nutrients and VUB for specific location. 4. Tidal swamp areas: implementation of PTT and introduction of paddy variety for a specific location, micro water management, land conservation, and management of nutrients for specific location

(Source: Translated from (Deptan 2005))

Implementation of the programmed plans sounds promising with regard to the technology development for increasing paddy productivity (intensification) which is in line with the plans has been started since 2005 (Figure 0-1). Historical data has also shown that the technological development and improved farming system has strong impact on increasing rice production in Indonesia (Section 0, Figure 0-1). In addition to this, (Swastika et al. 2007) clarified that Indonesia has high potency to increase the production with regard to the following factors:

- Technology of cultivating paddy is relatively well establish and understood by farmers
- Superior variety which has high potential yield and tolerates to the worst environmental condition is available
- Technology of fertilization, crop management and controlling interfered plants is understood by farmers generally
- Number of farmers is adequate and available

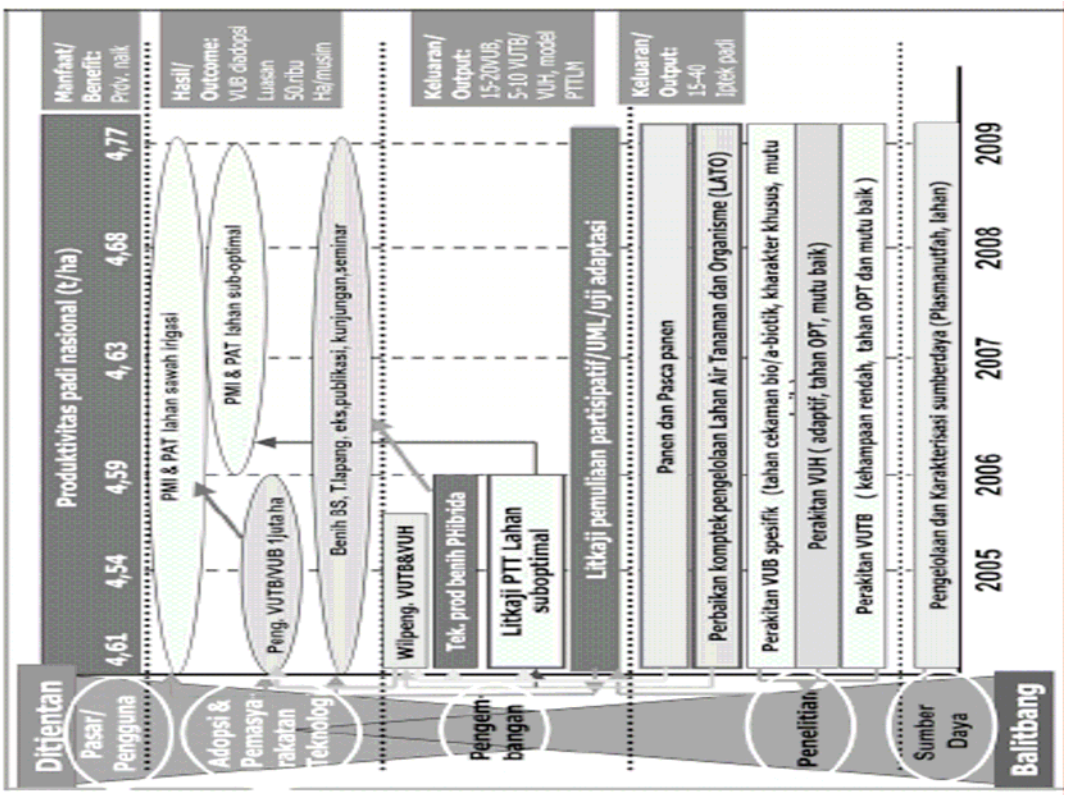

Figure 0-1. Roadmap of paddy commodity in Indonesia
Source: (Deptan 2005)

On the contrary to the promising implementation described above, the Indonesian paddy production is also confronting fives challenges, namely: (1) productivity and production is relatively constant, (2) production factors totally or production efficiency and paddy competitive ability is declining, (3) fertile and intensive land is degraded as well as the availability of water resources and fertile land is being difficult to find, (4) the consumers' preference to rice quality is dynamic, and (5) growth in the number of farmers is relatively constant (Litbangtan 2005). Because of that, to come up with clear understanding on the situation of rice farming in Indonesia and to look at the potential and impeded factors of increasing rice production in Indonesia, SWOT analysis was done

to discover various factors which could influence the performance of Indonesian rice production and measured the contribution of each factor to the improvement of paddy production (Swastika et al. 2007). Referring to the scoring result, the authors argued that biophysical aspect promised significant prospective to improve the performance of Indonesian rice production in Indonesia, while socio-economic aspect was confronting external threats(Table 0-6).

Table 0-6. SWOT analysis for the factors influenced Indonesian rice production

Biophysical Aspects	
Strength (S)	**Opportunity (O)**
1. Potential areas for wet rice field is still large 2. Potential improvement of planting intensity (IP) is still high 3. Production technology is well establish	1. Demand for rice is increasing 2. Extensification is supported by the government 3. Programs for infrastructure is available
Weakness (W)	**Threats (T)**
1. The land conversion is still occurring 2. Productivity is stagnancy 3. Production factors is being limited	1. The environment is being more unfriendly 2. Land value for non-agriculture is higher 3. Other businesses replaces agribusiness paddy

Socio-Economic Aspects	
Strength (S)	**Opportunity (O)**
1. Rice is staple for Indonesian 2. Rice creates big job opportunity 3. Agribusiness rice contributes significantly to income	1. Demand for rice is increasing 2. Marketing rice is efficient 3. Subsidy programs for production factors is available
Weakness (W)	**Threats (T)**
1. Farmers' capital is limited 2. Land owned is relatively small 3. production factors is being more expensive	1. Farmers' bargaining position is weak 2. Price for imported rice is cheaper 3. Investment for building new rice field is expensive

Moreover, the result of SWOT analysis suggested relatively similar result to the government plan which proposed the improvement of cropping index as a strategic policy to compensate land conversion and of intensification applying superior variety in line with integrated crops management (Swastika et al. 2007). In addition to this the implementation of the strategic policies should be supported by development and renovation of infrastructures (Biophysical Aspect) as well as establishment of credit scheme programs (Socio-Economic Aspects) so that farmers will have better capacity to adopt the modern technology. From this point of view it is clear that improving farmers' ability to apply the new farming technology including the application of new variety is a key point to increase rice production in Indonesia. This is reasonable since long historical experience has shown that technological improvement play vital role in the context of rice production growth. In addition to this, classical facts show that the abundance of rice production will result in lower price and cause farmers can not have the benefits of the increasing production. To deal with this situation, stock management of rice production is highly necessary to stabilize domestic price of rice (Deptan 2005).

Having discussed the strategies and programs, it is important to note that the implementation of those programs will be successful, if the surrounding environment is

appropriate for. Historical data has depicted that the existence of climate anomaly such as ENSO will have significant impact on reducing the production as has been discussed in section 'Climate Variability and Rice Production' above. When the programs implemented, the loss could be doubled since investment has been spent for searching and developing the technology, meanwhile the farmers still experience the crop damage. Therefore integrating the climate information to support the farming system in order to minimize the climate risk is an urgent action with regard to the consequence of climate phenomena on rice production. Furthermore, in the future the existence of climate change in Indonesia as has been detailed in section 'Climate Change in Indonesia' could exacerbate the loss if the climate risk management is not well addressed. That means the climate change adaptation options to support the rice farming need to be set up by considering the historical facts and the proposed strategies and programs.

Indonesian Climate Change Adaptation Options for Rice Production

It is known that Indonesian rice production is highly influenced by the extreme climate events such as ENSO (Section 0). In the future as a consequence of global climate change the frequency of the events may increase. Understanding to the situation and considering the negative impacts which may face, Indonesia needs to set up an appropriate adaptation strategy to cope with the future climate condition. Actually, the implementation of the adaptation strategy which is set up from now and implemented immediately will benefit not only for anticipate the future climate condition but also the current climate variability associated with the extreme climate events.

Furthermore, realizing the benefit of implementing such adaptation options, Indonesian government has highlighted some key aspects of designing suitable adaptation strategy to climate change in Indonesia in order to **mainstream the climate change adaptation into** various sector's **policy and program** (with focus on disaster management, water resource, **agriculture**, health and industry). Indonesian government through ministry of environment guided that adaptation to climate change should be performed through a number of ways, namely:

1. Integrate the climate change adaptation agenda into national development plans such as Medium and Long Term Development Plans;
2. Review and adjust the existing initiatives or programs, so they will be resilient to climate change;
3. Institutionalize the use of climate information in order to have capability to manage climate risk;
4. Encourage local autonomy to integrate consideration of climate risk into local development plans;
5. Strengthen the information and knowledge to reduce present and future climate risk
6. Ensure the availability of domestic resources and funding for adaptation activity and maximize the use, probably with the international support;
7. Choose no regret option, which is conducting adaptation action with or without climate change so the benefit receive could be used to reduce the vulnerability to climate change, but also could be used for national development benefit;
8. Encourage a national dialog to accelerate implementation process of adaptation agenda to climate change in Indonesia (SME 2007).

In addition to the proposed action to design and implement the adaptations, the focus areas of the climate change adaptation are 1) the effort to address poverty; 2) social and economic development; 3) investment; and 4) spatial planning (SME 2007).

Turn to discuss about the climate change adaptation options for rice production in Indonesia, the list of proposed adaptations which was developed by considering the

above guidelines for agriculture sectors will be taken into consideration. This is reasonable since rice is a strategic commodity in Indonesia so that the adaptations for agriculture will automatically consider this crop. (Boer 2007) proposed a strategy of changing cropping pattern for cultivating rice in a region where the rainfall pattern is changing, for example the region whose wet season is shorter should change from cropping pattern of rice-rice to rice-non rice. Because under a changing climate, the occurrence of extreme climate event associated with drought will be more frequent than the current climate and there is a possibility that the dry season will persist for longer periods so that keeping the cropping pattern of rice-rice may expose Indonesian farmers to more frequent crop failures (GOI 2007). If the rice-rice pattern wants to be maintained, the development or improvement of water storage and irrigation facilities is required for supplying water during the dry season. Furthermore, huge efforts are also required for searching new short maturing rice variety to anticipate the shorter period of wet season (section 0).

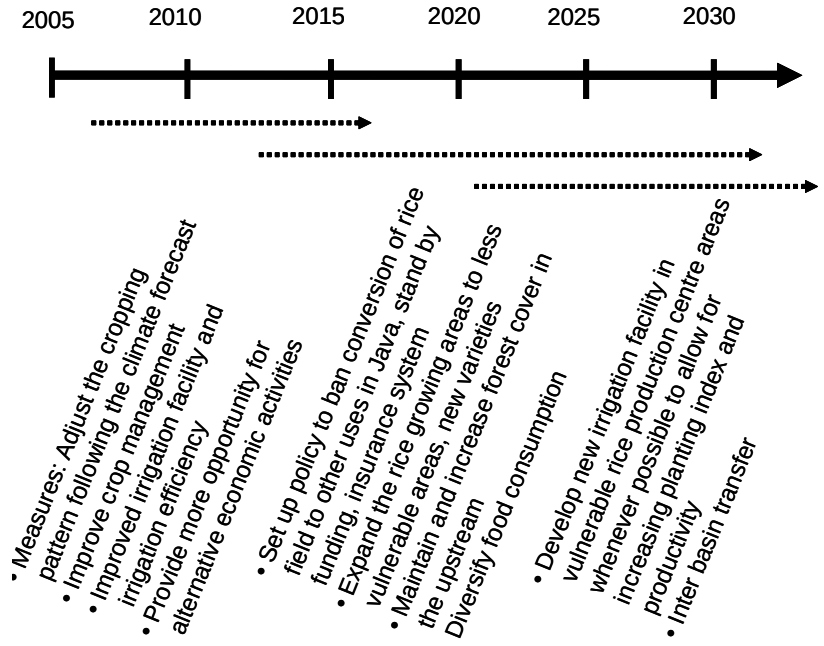

Figure 0-1. Example of long-term plan for adaptation for the agriculture sector
Source: (Boer 2007)

Moreover, (GOI 2007) developed the list of climate change adaptation for various sectors in Indonesia. In the context of this paper, the adaptations for agriculture and its related sectors are selected. Generally, the list of proposed adaptations is derived by considering the associated problems and impacts of future climate change on agriculture sector in Indonesia. The report divided the options into short term and long term adaptation programs. The short plan focuses the program on **cropping calendar**, **efficiency of water use**, **rain fed rice development**, **pest and diseases control**, and **searching for breeding new variety tolerated to high temperature**, while the long one is addressed to develop **early warning system to flood and drought and integrated management of water uses** (Table 0-1).

The other report called as RAN-MAPI (Rencana Aksi Nasional Menghadapi Perubahan Iklim - National Action Plan to Cope with Climate Change) clarified more detail programs on climate change adaptation for various sectors including the agriculture sector (SME 2007). The report emphasized that the objective of devising climate change adaptation

programs is mainly to support the vision of agriculture sector "Actualization of Competitive Sustainable Industrial Agriculture System that Could Ensure the Food Security and Farmer Welfare". For which the national development agenda 2005-2009 have prioritized 'Agriculture Revitalization" in order to achieve the Indonesian agriculture vision. For this agricultural development, the programs area formulated into three major programs:

1) Program to increase food security;
2) Program to develop agro business;
3) Program to increase farmer welfare.

In other words the three major programs are directed to be focused on food supply, agribusiness development and farmers' income. Thus, in the context of climate change adaptations for rice production development, the proposed adaptations should be directed not only to increase the production but also to increase the farmers' income and agribusiness development (Figure 0-2). Achievement to these three focused programs will lead to improve the economy of livelihoods in the rural region in Indonesia.

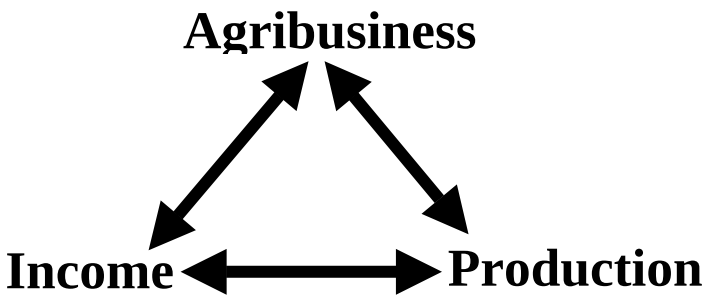

Figure 0-2. Three major goals of the rice production development in Indonesia
Source: own presentation

Table 0-1. Climate Change Adaptation Options for Agricultural Sector

Problems / Impacts	Proposed General Adaptation Program	
	Short term	Long Term
Drought • Limit of irrigation water • Reduce of the planting areas • Lost of crops yield • Felt of harvesting • Reduce of farmers income	• Water conservation • Water harvesting • Controlled groundwater exploitation • Efficient of water uses • Prioritize of water uses • Introducing crops tolerance varieties to drought • Introducing the early mature crops varieties • Crops calendar • Rainfed rice development • Farmers' capacity in understanding drought behavior	• Early warning system to drought hazard • Integrated irrigation water management for food crops

Flood / standing water • Physical damages of crops growth • Lost of crops yield • Felt of harvesting • Reduce of farmers income	• Flood mitigation • Drainage improvement • Raise bed system • Introducing crops tolerance to deep water • Crops calendar	• Early warning system to flood hazard • Integrated drainage water management for farming system
Increase of humidity during La-Niña • Pest and diseases outbreaks	• Crops environment improvement • Pest and diseases control • Introducing the crops tolerance varieties to pest and diseases • Jointly planting time	• Integrated crops pest and diseases control
Increase of temperature • Increase of transpiration and respiration • Crops early mature with low yield	• Breeding of tolerance crops varieties to high temperature	

Source: (GOI 2007)

Discussing about the climate change adaptation programs for agriculture sector, the RAN-MAPI documented by (SME 2007) has moved one step since the document not only devised the climate change adaptation programs but also the responsible institutions for implementing the proposed adaptation strategies (Table 0-2). That clarification will benefit to strengthen the institutional linkage among Indonesian government department and agencies and lead to minimize the cost for implementing the strategies since there will be no redundancy when conducting the proposed programs and the real problems faced by many stakeholders can be addressed well.

Table 0-2. Climate Change Adaptation Options from 2007 to 2050 for Agricultural Sector

Responsible Institutions	Proposed adaptations 2007-2009
Dept. of Marine Affairs and Fisheries, State Ministry of Environment, Dept. of Public Works and Local Government.	1. Increase the utilization of drought prone map. 2. Conduct water saving agriculture activities. 3. Implement good agriculture practices. 4. Implement the acceleration planting with appropriate technology. 5. Rehabilitate and increase irrigation network. 6. Optimize alternate system in water irrigation distribution. 7. Form working group on climate anomaly and climate change in Department of Agriculture. 8. Form commanding post to control flood and drought in Department of Agriculture. 9. Advocate and socialize the right understanding of climate change and its impact to the agriculture sector as well as government policy in mitigation and adaptation effort.
	Proposed adaptations 2009-2012
State Ministry of Environment, Dept.	1. Develop drought early warning system. 2. Increase the utilization of alternative water resource potential. 3. Empowered the P3A institution. 4. Strengthened the institution of water use farmer.

of Public Works and Local Government.	5. Empower the farmer group to arrange the planting schedule and decide the beginning of planting season. 6. Develop food diversification policy. 7. Develop agriculture climate information system and network in various level and region including the development of Agriculture Field School as a development of SLPHT and SLI (Climate Field School)
	Proposed adaptations 2012-2025
Ministry of Environment, Dept. of Public Works and Local Government.	1. Conduct climate anomaly impact analysis toward seasonal shift to decide the beginning of planting season 2. Conduct research on superior seeds that resistance to climate change. 3. Development of adaptive track husbandry. 4. Research program on government strategy and policy to address climate change in agriculture sector. 5. Formulate detail planning regarding agriculture development policy. 6. Development program to increase farmer income.
	Proposed adaptations 2025-2050
Dept. of Agriculture, KMNRT, State Ministry of Environment, Dept. of Public Works and Local Government.	1. Improve various existing step and strategy based on evaluation to various concepts, strategy, efforts and technology that have been implemented in previous period. 2. Develop various innovative technology, particularly for superior adaptive variation and technology for management of land and water that have been produced in previous period. 3. Continue the food diversification policy that has been evaluated. 4. Increase the minimum income of farmer equivalent to average income of worker in Indonesia through various implementation of innovative technology and institution and development of various commercial commodities.

Source: (SME 2007)

Furthermore, it can be seen from Table 0-2, the RAN-MAPI devised the climate change adaptation programs into four time periods. The first period is mainly directed to implement better farming strategy and institutional development as part of the commitment process in implementing the adaptation strategies. The second period is devoted to strengthen the farmers' institution to utilize climate information for supporting their farming system. Establishment of climate school programs in 25 provinces (150 districts/cities) to increase farmers' understanding of climate information and its application is proposed for achieving the focused target of this period. The pilot project of climate field school has been established in Indramayu since 2003 (ADPC 2003). The third and final periods are focused on research and development on climate anomaly in relation to determine the planting season and searching for new superior variety as well as innovative technology of farming system in order to increase the farmers' income.

Even though, the proposed climate change adaptations documented in the RAN-MAPI is for agriculture in general, almost all strategies are applicable for rice production except the food diversification policy. Actually, this policy is offered in regards to cope with the unequal domestic rice production and its demand. Because the stagnancy of domestic rice production will cause serious problem on food security in Indonesia if the food diversification policy is not established, since the total population steadily increase. Therefore, rice production development is not competing with the food diversification

policy, and securing of rice production to meet its demand is highly necessary to support the Indonesian food security. That means implementation of the adaptation strategies to minimize the future climate change risks on rice production are essential actions to be taken for.

Paying attention to the proposed adaptation options; it seems the options are likely to be similar with the Indonesian rice production strategy discussed in section 0. Understanding to the situation, it would be beneficial to discover which adaptation strategies are vastly in line with the rice production strategies in Indonesia so that the selected adaptation strategies can be stressed to be implemented. Furthermore, discovering the linkage of implementing the strategies and sustainable development in Indonesia is an essential issue to be discussed.

Linking Climate Change Adaptations for Rice Production and Indonesian Sustainable Development Goals

Discussion on the previous section about the Indonesian rice strategy and the climate change adaptations has clarified that the ultimate goal of the two is supporting each other, where those strategies are devoted to increase the farmers' welfare. Those strategies emphasized the programs that would be implemented to increase the Indonesian rice production. We understand that increasing in the rice production could have an impact on decreasing the domestic rice price, while decreasing in the production will increase the domestic price. However, without neglecting the important aspects of the domestic price stabilization, implementing those programs to secure the rice production to meet its demand is an essential task as it will give multiplier effects on the Indonesian economy with regard the position of rice as a strategic commodity as has been discussed in Section 0.

Furthermore, the low production will impose the Indonesian government to import rice in order to sufficient the demand and stabilize the domestic rice price. That means the farmers will experience worse condition because they can not obtain higher price as a consequence of lower production which can reduce their welfare. (Darwanto 2005) argued that the increase in contribution of import rice at the expense of domestic rice to national rice supply will lessen our attention to increase the farmer's welfare. Because of that the author stated that future programs on the national food supply especially the rice supply which is focused on increasing the domestic rice supply should address not only the productivity improvement but also price of the product. In the context of this paper, without neglecting the important aspects of many factors which influences the national rice supply (Darwanto 2005), the utilization of climate information is crucial to deal with the two major goals, production and prize stabilization. If the domestic rice production can be secured to fit with the demand, the import can be reduced. In addition to this, if the domestic rice production can be increased, the rice can be exported. Even though, in this case the government is still required to stabilize the domestic price in competition with the world price. Discussion about this issue is beyond the scope of this paper, therefore we can assume that increasing rice production will have positive impacts on increasing the farmers' welfare leaded to improving the rural economy condition. Having said that, next, we will discuss more detail about linking the climate change adaptations for the rice production and Indonesia sustainable development goals.

Knowing the proliferated impacts of climate change on many sectors including the agricultural sectors, the event is believed to influence the achievement of sustainable development which is targeted on Millennium Development Goals (MDGs) of a country. (Oxfam 2007) has determined the potential impacts of climate change on the eight key

goals of the MDGs. In the case of the achievement of MDG 1 "Eradicate extreme poverty and hunger" associated with the crop land, the climate change is expected to degrade the crop land that many poor families depend on for their food and livelihoods. In addition to this (UNDP 2007) reported that some regions in Indonesia are extremely vulnerable to climatic variations, for example crop failure as a consequence of long drought in the province of Nusa Tenggara Timur caused serious problems on food supply leading to acute malnutrition. That means securing food supply in this case is rice supply is highly important and has direct relation to the MDGs 1. Indirectly, the failure to do so may have influence on the other goals. However, to spotlight our discussion, the direct relation will be discussed in detail.

Turn to discuss about linking the climate change adaptations and sustainable development in Indonesia, (SME 2007) argued that the future climate change risks will impede the Indonesian MDGs related to poverty, hunger and health so that the implementation of adaptation activity should be parallel with poverty alleviation efforts and economic development targets for poor communities as the most vulnerable group to the impact of climate change. In line with this, Indonesian President, Dr. H. Susilo Bambang Yudhoyono, in his foreword for the RAN-MAPI, stated that "*efforts to control climate change cannot be separated from economic development and poverty alleviation*". For achieving this goal, the development strategy must be devised by considering the four pillars of sustainable development in Indonesia, namely economic growth (*pro-growth*), poverty alleviation (*pro-poor*), employment opportunities (*pro-job*), and environmental protection (*pro-environment*). Because of that Indonesian government has recognized that climate change issues both mitigation and adaptation must be incorporated into the Long Term Development Action Plan 2005-2025 and the Medium Term Development Action Plan (SME 2007).

Understanding the climate change issues should be tackled by coordinating those institutions that are responsible for climate change mitigation and adaptation rapidly and systematically, the State Ministry for national Development Planning has documented a guideline to integrate both mitigation and adaptation to climate change into national development planning (SMNDP 2007). It is expected that the document will be used as an initial input for preparing the Medium Term Development Action Plan 2010-2014. The document proposed the mitigation and adaptation programs for eleven key sectors in Indonesia including the agriculture. In here, the list adaptations for the sector are described in Table 0-1 as we focus on discussing the adaptations for rice production.

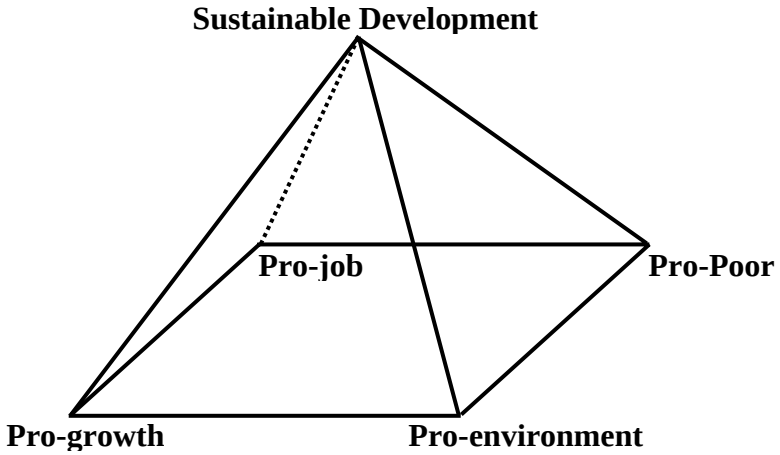

Figure 0-1. The Four Pillars of Sustainable Development in Indonesia

Table 0-1. Long-term 2005-2025 and Medium-term 2004-2009 National Development Planning Climate Change Mitigation and Adaptation Programs

Priority Target Long-term Development Plan 2005-2025	Medium-term Development Planning 2004-2009	
	Development Priority and Sector	Climate Change Mitigation and Adaptation Programs
Realization of Beautiful and Everlasting Indonesia	**Agriculture revitalization** • *Agriculture*	• Food security improvement program • Agribusiness Development Program • Improvement of farmer welfare program

It can be seen from Table 0-1 the development priority agriculture sector related to crop production is in line with development strategy for agriculture which has been discussed in section 0. To detail the programs for adaptation especially on crop production, the document proposed such activities focused on the effort of matching cropping calendar and cropping pattern, application of new variety of rice resistance to high temperature, drought, salinity, flood, and socialization of village water storage as well as efficient use of ground water for irrigation particularly in drought area. That means the proposed climate change adaptation programs for rice production in Indonesia discussed in section 0 has been acknowledged to be included in the National Development Planning. Therefore, in this context it would be beneficial to look at the possibility of implementing such actions to cope with the climate change with regard to the previous and current knowledge to cope with climate variability.

The developed matrix of programs for the rice development strategy (Section 0) and the climate change adaptations (Section 0) discovered that the focused programs for increasing the paddy/rice production through intensification and extensification programs have been addressed well by the two strategies (Table 0-2). The climate change adaptation supports the programs by adding the programs "Change Cropping pattern/Modified Planting Season" which has not been addressed by the rice development strategy. Turn to increase the capacity of farmers, the two strategies is supporting each other since they stressed equally the important aspects of the capacity building to increase farmers' knowledge on using the new farming system or technology which also includes the utilization of climate information, where the adaptation adds programs for mapping vulnerable areas to drought and flood.

For the economic aspects, the two strategies did not propose any incentive system such as insurance to secure the rice yield or farmers' income to cope with the climate risks. Finally, the climate change adaptation also enhanced the implementation of the rice strategies by inducing the important programs for land conversion, conservation and institutional development for institutionalizing climate forecast information so that the information can be used by the farmers. The programs for land conversion and conservation are suggested by considering the problem on achieving the projected rice demand discussed in Section 0.

Table 0-2. Matrix of programs for rice strategy and climate change adaptation and climate research in Indonesia

	Focused Programs	Rice Strategies			Climate Change Adaptation						Climate Research
					Country Report		RAN-MAPI				
		09	15	25	15	30	09	12	25	50	
Extensification-Intensification	**A. Intensification**										
	• New Variety		√	√	√				√	√	TM
	• Technology Invention	√		√			√			√	TM
	• Farming System/ Management	√	√	√	√		√		√	√	TM/R/M
	• Water Management		√	√	√	√	√	√		√	TM/R/M
	• Planting Index	√	√	√		√					TM/R
	B. Pest and Diseases Control				√	√					TM/M
	C. Change Cropping pattern / Modified Planting Season				√			√	√		TM
	D. Creating new rice field areas	√	√	√	√						TM/R/M
	E. Infrastructure / Irrigation*	√	√	√	√	√	√				TM/M
Capacity	**F. Capacity Building / Awareness Increasing**	√	√	√	√		√	√			CB
	G. Community / Research /		√				√	√	√		CB
	H. Institutional Network										
	I. Drought and Flood Map						√				TM/R
	J. Dissemination Information / Early Warning System	√	√					√			TM/CB
Economic	**K. Alternative Activities**				√						TM/R/M
	L. Farmers' income								√	√	TM/R/M
	M. Incentive System										
	• Credit scheme programs*	√	√	√							TM/R
	• Insurance										TM/R/M
Policy	**16. Land Conversion Policy**				√						TM/M
	17. Conservation Program				√						TM/M
	18. Institutional Development / Empowerment						√	√			TM

Note: * Strategy proposed by (Swastika et al. 2007); Rice Strategies: Section 0; Country Report (GOI 2007) and RAN-MAPI (SME 2007): Section 0; Climate Research: Section 0;
Values in the headings is respected to the final year of implementing the programs

Furthermore, the matrix also shows that current capacity of Indonesia to implement the inclusion of the adaptations strategies to the rice development strategies is well enough since the climate research shown that they have attempted to deal with similar issue

proposed by the adaptation strategies. Beside of this the extension of utilizing the tools and model (TM) developed or used by the climate research as well as the approach on assessing the climate risks (R) and managing it (M) would offer a great benefit when conducting the focused programs. Specific approach associated with the climate research that can be used to support the implementation of each focused program is listed in that table.

The developed matrix specifically shows the additional key aspects of the climate change adaptation programs that would be useful to stabilize and increase the rice production in Indonesia as well as to cope with climate change risks, namely: mapping vulnerable regions to drought/flood, modified cropping pattern and institutional development. In addition to this the insurance system is worthy to be considered as well in order to secure the yield or revenue from cultivating rice. To come up with the real action establishing **a *Rice Information and Distribution Centre*** to institutionalize the implementation of those additional strategies to utilize the climate information, including the insurance system, in each rice production centre is also worthy to be considered in order to sustain the achievement of the programs. The prototype system of integration climate forecast and planting calendar to tackle the drought stresses, which have been developed by research project collabotarion among BMG, Bogor Agricultural University and Department of Agriculture (ADPC 2003), could be considered as an initial point to be expanded for developing the Rice Information and Distribution Centre.

However, to employ the climate change adaptation options to support the activities to increase rice production in reality is another question since a serious attemp is needed to fill the gaps in present data sets as a consequence of (1) the climate models work at large scale and can not be used to study the impact of climate change at local scale, (2) the direction of climate change can not be always predicted, different model give different prediction, (3) the more plaussible climate models for impact assessment, regional climate models are not fully developed, and (4) the availability of long historical climate data required for validating the climate models is very low except in Java (GOI 2007).

Apart from the idea to establish the centre and the problems on climate models, the above findings reveal that climate change adaptations for rice production have strongly linkage with the Indonesian sustainable development goals. The inclusion of the adaptation strategies to rice development strategies will secure and enhance the implementation of the rice strategies to increase the rice production to meet its demand and if possible to be exported. This expected achievement will lead directly to economic development in the rural regions and alleviate the poverty which is related to the MDGs 1 "Eradicate Extreme Poverty and Hunger". Beside of that, the two major programs devoted to increase the rice production, namely "Intensification" and "Extensification", have also been addressed well by the inclusion of the climate change adaptation strategies. The climate information can be employed to search for the new appropriate areas for cultivating rice and suitable planting time. The implementation of new farming system and technology which is directed towards specific location will also be helped by the utilization of climate information with which the current and future climate change risks can be managed. Therefore, those utilisations will provide a great contribution to manage the rice stock-flow in Indonesia since the domestic rice production can be estimated by employing the climate information and the simulation models for agricultural production.

The Intensification and Extensification programs listed in Table 0-2 are also been emphasized equally to increase the farmers' income and create job opportunity. In addition to this using the classical approach of production function; the programs are

more focused on labour intensive than capital intensive (Figure 0-2) as there is no specific programs proposed the use of machinery intensively for increasing the rice production. The presence of capacity building programs also clarified clearly that the programs are labour intensive which is suitable with the Indonesian condition whose population is relatively high. That means the two programs have been highly directed to increase economic growth and to alleviate poverty especially in the rural regions. Thus, with regard to the strategic position of rice commodity and the large households depending upon the commodity, the determined MDGs 1 "Eradicate Extreme Poverty and Hunger" can be achieved successfully.

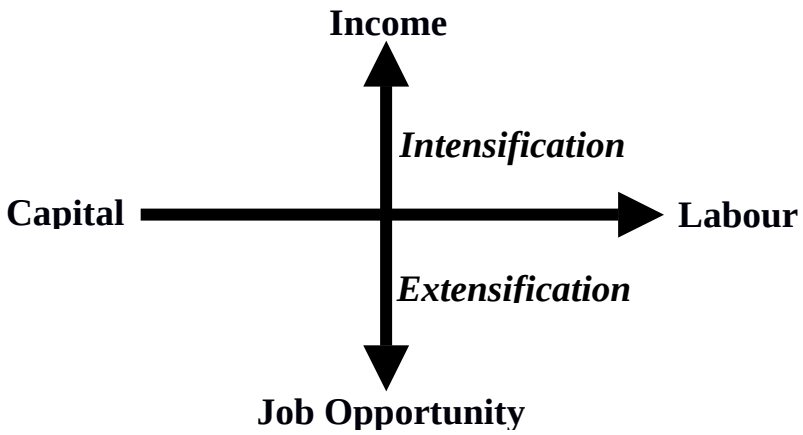

Figure 0-2. Classification of the main programs for increasing rice production in Indonesia using quadrant diagram. Source: own presentation

Conclusion and Recommendation

It is important to note that historical data shows technology invention for farming system and rice variety provided great contribution to increase rice production in Indonesia, while the climate anomaly or the climate extreme events caused stagnancy of and decrease in the Indonesian rice production. Under the future global climate change, the frequency of the extreme events is believed to increase and the Indonesian climate is also changing. The southern part of Indonesia such as Java Island will be exposed to frequent climate extreme events which may exacerbate the current stress of the events on affecting the rice production. The changing rainfall pattern of wet and dry season will also change the onset of the seasons.

Understanding the significant influences of the climate variability on agriculture in particular the rice production, many pieces of research were aimed to utilize the climate information in order to alleviate the negative impacts of the extreme climate event. In addition to this, technically, the institutions focused on the climate research in Indonesia have used as well climate model and impacts model intensively to investigate the impact of climate phenomena including the climate change so that management strategy to deal with the climate risks can be devised. This current capacity will bring significant initial point as a basis to cope with the impact of climate change.

Realising the important point of climate change issue to be addressed, formally, the Indonesian government through the Ministry of Environment had listed the climate change adaptation options within the RAN-MAPI document. In addition to this, the State Ministry of Government Planning attempted to incorporate the climate change issues

including the adaptation options to Medium-term and Long-term National Development Plan. The short plan focuses the program on cropping calendar, efficiency of water use, new areas development, and searching for breeding new variety tolerated to high temperature, while the long one is addressed to develop early warning system to flood and drought and to integrate management of water uses.

In the context of climate change adaptations for rice production development, the proposed adaptations is directed not only to increase the production but also to increase the farmers' income and agribusiness development since the climate change adaptations can support the implementation programs of Indonesian rice development strategy to increase the rice production which lead to increase the farmer's welfare. The climate change adaptation supports the programs by adding the programs "Change Cropping pattern/Modified Planting Season" which has not been addressed by the rice development strategy. In the light of capacity building, the two strategies is supporting each other since they stressed equally the important aspects of the capacity building to increase farmers' knowledge on using the new farming system or technology which also includes the utilization of climate information. However, for the economic aspects, the two strategies did not propose any incentive system such as insurance to secure the rice yield or farmers' income to cope with the climate risks.

The Intensification and Extensification programs as a main program to increase the rice production have been addressed well by the climate change adaptation strategies. In this regards, the climate information can provide a great contribution to manage the rice stock-flow in Indonesia. Using the quadrant diagram, the two major programs have also emphasized equally the final goal of implementing them to increase the farmers' income and create job opportunity. The programs are also directed to be more labour intensive than capital intensive, which is suitable with the Indonesian condition whose population is relatively high. That means the two programs have been highly designed to increase economic growth and to alleviate poverty. Therefore, considering the strategic position of rice commodity and the large households depending upon the commodity, the determined MDGs 1 "Eradicate Extreme Poverty and Hunger" can be achieved successfully.

Finally, discussion from this paper revealed that further research on developing reliable projected climate change data for conducting real assessment of possible impacts of climate change on Indonesian rice production is a key challenge that should be addressed seriously. From which further assessment on economic cost and benefit of implementing such adaptation options can be done so that their contribution to benefit for rice production, which leads to increase farmer's income and the distribution benefits for various stakeholders, can also be estimated. Based on that prioritisation of plausible climate change adaptation options could be ranked as well. These difficult tasks are quite challenging for coming with the real action to manage the future climate change risks.

References

ADPC. 2003. Climate Forecast Information Application: Case Study at Indramayu District.

AIACC. 2003. An Integrated Assessment of Climate Change Impacts, Adaptation and Vulnerability in Watershed Areas and Communities in Southeast Asia (AIACC AS21). Indonesian Components.

Amien, I., P. Rejekiningrum, A. Pramudia, and E. Susanti. 1996. Effects of interannual climate variability and climate change on rice yield in Java, Indonesia. *Water, Air, and Soil Pollution* 92:29-39.

APN. 2003. Applying Climate Information to Enhance the Resilience of Farming System Exposed to Climatic Risk in South and Southeast Asia. Short Report of APN 2002-09: Indonesia Components.

APN, CAPaBLE. 2007. Increasing Adaptive Capacity of Farmers to Extreme Climate Events and Climate Variability through Enhancement of Policy-Science-Community Networking. .

Aser, Rouw. 2004. Tingkat Kerawanan Zona Agroekologi Tanaman Pangan Terhadap Kekeringan dan Banjir: Studi Kasus Kabupaten Merauke Papua, Program Studi Agroklimat, Institut Pertanian Bogor, Bogor.

BMG. 2007. Deteksi perubahan iklim dan dampak sosio-ekonominya. Laporan Proyek Kerjasama BMG dan IPB. Bogor: BMG dan IPB.

Boer. 2004. Reducing Climate Risk for Potato and Chili Production at Pengalengan, Bandung District, West Java.

Boer, R. , and A.R Subbiah. 2005. Agriculture drought in Indonesia. In *Monitoring and predicting agriculture drought: A global study*, edited by V. K. Boken, A. P. Cracknell and R. L. Heathcote. New York: Oxford University Press.

Boer, R., et al. 2007. Deteksi perubahan iklim dan dampak sosio-ekonominya. Laporan Proyek Kerjasama BMG dan IPB. Bogor: BMG dan IPB.

Boer, R., SWG. Gaib, E.T. Purwani, Y. Sugiarto, MK. Rahadiyan, and Suciantini. 2002. Penyebaran daerah rawan kering di wilayah pertanaman padi Indonesia. Jakarta: Direktorat Perlindungan Tanaman Departement Pertanian.

Boer, R., A.R. Subbiah, Kusnomo Tamkani, Hery Hardjanto, and Soetarto Alimoeso. 2004. Institutionalizing Climate Information Applications: Indonesia Case.

Boer, Rizaldi. 2002. Analisis Risiko Iklim untuk Produksi Pertanian. In *Pelatihan Dosen PT Se Sumatera-Kalimantan dalam Bidang Pemodelan dan Simulasi Pertanian dan Lingkungan*. Bogor Departemen Geofisika dan Meteorologi IPB.

Boer, Rizaldi, Agus Buono, Arif Ramadhan, Bambang Dwi Dasanto, Kiki Kartikasari, Adi Rakhman, Rini Hidayati, Yon Sugiarto, Woro Estiningtyas, Hastuadi Harsa, Welly Fitria, Eko Heriyanto, M. Abdullah Arif, Rian Anggraeni, Asmono Haryowidarto, Anggoro Suryorini, Kurnia Endah Komalasari, Wido Hanggoro, and Jimmi Nugraha. 2007. Penyusunan Kalender Pertanian. Jakarta: Pusat Penelitian dan Pengembangan Badan Meteorologi dan Geofisika.

Boer, Rizaldi, and Kiki Kartikasari. 2007. Assessment of Capacity and Needs to Address Vulnerabilities, Adaptations and Resilience to Climate Risks in Indonesia. Bogor: Laboratory of Climatology IPB.

Boer, Rizaldi, and Irsal Las. 2003. Sistem Produksi Padi Nasional Dalam Perspektif Kebijakan Iklim Global In *Kebijakan Perberasan dan Inovasi Teknologi Padi*, edited by B. Suprihatno and A. K. M. e. al. Jakarta: Pusat Penelitian dan Pengembangan Tanaman Pangan, Badan Litbang Pertanian.

Boer, Rizaldi, and Perdinan. 2008. Adaptation to Climate Variability and Climate Change:Its Socio-EconomicAspect. In *EEPSEA Conference on Climate Change*. Bali: EEPSEA.

D'Arrigoa, Rosanne, and Rob Wilson. 2008. El Ni˜no and Indian Ocean influences on Indonesian drought: implications for forecasting rainfall and crop productivity. *International Journal of Climatology*.

Darwanto, Dwidjono H. 2005. Ketahanan Pangan Berbasis Produksi dan Kesejahteraan Petani. *Ilmu Pertanian* 12 (2):152 - 164.

Deptan, Litbang. 2005. Prospek dan Arah Pengembangan Agribisnis Padi. Jakarta: Badan Penelitian dan Pengembangan Pertanian Departemen Pertanian.

DFID. 2005. Growth and poverty reduction: the role of agriculture: Department for International Development.

Ditlin. 2007. Program Pemberdayaan Petani Untuk Mengatasi Permasalahan Iklim Jakarta: Direktorat Perlindungan Tanaman Pangan Direktorat Jenderal Tanaman Pangan Departemen Pertanian.

Elsa, Surmaini. 2006. Optimalisasi Alokasi Lahan Berdasarkan Skenario Iklim di Kabupaten Bandung, Program Studi Agroklimat, Institut Pertanian Bogor.

GOI. 2007. Climate Variability and Climate Change, and their implication. In *Indonesia Country Report*. Jakarta: Goverment Republic of Indonesia.

Hansen, J., M. Sato, R. Ruedy, K. Lo, D.W. Lea, and M. Medina-Elizade. 2006. Global temperature change. *Proceeding of National Academy of Science* 103:14288-14293.

Jones, Roger. 2003. Managing Climate Change Risks. In *OECD Workshop on the Benefits of Climate Policy: Improving Information for Policy Makers*: Organisation for Economic Co-operation and Development.

LAPAN. 2006. Analisis Perubahan Iklim Wilayah Indonesia Berdasarkan Luaran Beberapa Model Iklim.

———. 2008. Laporan Hasil Pemantauan Sumber Daya Alam dan Lingkungan Berdasarkan Data Satelit Penginderaan Jauh: Bulan Maret 2008.

Leemhuis, C. . 2005. The Impact of El Nino Southern Oscillation Events on Water Resources Availability in Central Sulawesi, Indonesia, Faculty of Mathematics and Natural Sciences, University of Gottingen.

Litbangtan. 2005. Rencana Strategis Badan Penelitian dan Pengembangan Pertanian 2005-2009. Jakarta: Departemen Pertanian Badan Penelitian dan Pengembangan Pertanian.

Mardawilis. 2004. Aplikasi Model Simulasi Tanaman untuk Menyusun Teknologi Budidaya Palawija pada Tiga Lokasi Iklim Berbeda, Program Studi Agroklimat, Institut Pertanian Bogor, Bogor.

Naylor, R.L., D.S. Battisti, D.J. Vimont, W.P. Falcon, and M.B. Burke. 2007. Assessing risks of climate variability and climate change for Indonesian rice agriculture. *Proceeding of the National Academic of Science* 114:7752-7757.

Naylor, Rosamond, Walter Falcon, Nikolas Wada, and Daniel Rochberg. 2002. Using El Nino-Southern Oscillation Climate Data to Improve Food Policy Planning in Indonesia. *Bulletin of Indonesian Economic Studies* 38 (1):75-91.

Naylor, Rosamund L., Walter P. Falcon, Daniel Rochberg, and Nikolaswada. 2001. Using El Nino/Southern Oscillation Climate Data to Predict Rice Production in Indonesia. *Climatic Change* 50:255-265.

Neelin, J. D., M. Munnich, H. Su, J. E. Meyerson, and C. E. Holloway. 2006. Tropical drying trends in global warming models and observations. *Proceeding of National Academy of Science* 103:6110-6115.

Oxfam. 2007. Adapting to climate change.What's needed in poor countries, and who should pay.

PEACE. 2007. Indonesia and Climate Charge: Current Status and Policies.

Perdinan. 2006. Indonesian Rice Industry. In *Assignment - Industry Profile*. Brisbane: School of Natural and Rural System Management, The University of Queensland Australia.

SME. 2007. National Action Plan Addressing Climate Change. Jakarta: State Ministry of Environment,Republic of Indonesia.

SMNDP. 2007. National Development Planning Response to Climate Change State Ministry for National Development Planning.

Swastika, Dewa K.S., J. Wargiono, Soejitno, and A. Hasanuddin. 2007. Analisis Kebijakan Peningkatan Produksi Padi Melalui Efisiensi Pemanfaatan Lahan Sawah Di Indonesia. *Analisis Kebijakan Pertanian* 5 (1):36-52.

UNDP. 2007. The other half of climate change: Why Indonesia must adapt to protect its poorest people. Jakarta: United Nations Development Programme Indonesia.

Appendix 1. Summary of Climate Research on Crop Production as well as Climate Change Studies in Indonesia

Authors / Research Project	Summary of the research project
(APN 2003)	- Exploring options for supporting farmers in decision-making on the choice of cropping strategies based on climate forecast - Changing rice to soybean or maize when the El Nino occurs
(AIACC 2003)	- Assessing current and future rainfall in Indonesia and found that under changing climate, rainfall in Indonesia might increase or decrease depends on the region - Clarifying a watershed system taken as a case study of Citarum watershed is very vulnerable to current climate and future climate change - Assessment the impact of land use change and climate change on river flow at citarum upper catchments result in vulnerable map of water deficit and water surplus
(ADPC 2003)	- use of climate (forecast) information for improving farm management system through climate field school (CFS) program develop institutional framework to disseminate the climate forecast information to support farming activities
(Boer 2004)	- Use of ENSO and IOD indicator for potato management practices
(Mardawilis 2004)	- Application of Crop Simulation Model for Developing Palawija Cultivation Technique - Identifying the Impact of SOI to rainfall variability - Optimal Planting Date of Maize and Peanut - Recommendation of Cultivation Technique
(Aser 2004)	- Crop vulnerability to drought and flood - Alternative strategy of rice cultivation in vulnerable area to drought/flood
(Leemhuis 2005)	- Impact of climate variability to water resource management - in general, the scenario simulations of hydrological models show a great potential to critical water resource situations in space and time - regional impact on rice production
(Elsa 2006)	- Analysis of extreme climate impact to rice, maize and soybean production - Land allocation strategy to anticipate extreme climate event - economic valuation of climate information for farming system (gross margin in normal condition, drought, flood)
(LAPAN 2006)	- changing pattern of rainfall in Indonesia as a response to change in CO_2 concentration of the atmosphere varied among location of the project - assessment of suitable statistical downscaling technique among the three options (MARS, PCR, and ANN) to gather data for a specific location in Indonesia
(APN 2007)	- strengthening the capacity of local scientist in Indonesia to conduct research and identify problem related to climate issues - enhancing the policy, science and community networking through scientific discourse (training workshop) for building capacity of the local scientist among Indonesian regions.
(Boer 2007)	- Clarifying Indonesian past climate condition (1900-2000) especially on rainfall - Projecting future climate condition of 2001-2100 using GCM CSIRO - Identification of climate change problems on agriculture, forestry and health in Indonesia
(LAPAN 2008)	- Daily monitoring: cloud cover, rainfall, fire danger rating system, hot spot, potential area to flood, sea level temperature - Fire danger rating system, hot spot, NDVI, flood prediction, food insecurity - Mapping of paddy growth and development

7.1.3 Linking climate change adaptation options for agriculture in the Mekong River Delta to Viet Nam sustainable development

Nguyen Thi Hien Thuan

Introduction

Climate change is considered to be one of the most serious threats to current and future sustainable development, with adverse impacts expected on the environment, human health, food security, economic activity, natural resources and physical infrastructure. Recent studies summarized by International Panel on Climate Change (IPCC) in 2007 indicated that magnitudes of the impacts can now be estimated more systematically for a range of possible increase in global average temperature. Climate change imposes not only on the change in climatic variability, but also the frequency and intensity of extreme events such as storms, floods, droughts... Climate change is hampering efforts to deliver the Millennium development Goals (MDG) promise. Looking to the future, the danger is that it will stall and then reverse progress built-up over generations not just in cutting extreme poverty, but in health, nutrition, education and other areas.

In Viet Nam, over the past 50 years, mean annual temperature has increased by 0.7^{o}C with a sea level rise of about 20 cm. The influence of El-Nino and La-Nina phenomena has increasingly expanded throughout the country. Climate change has intensified natural disasters, particularly storms, floods and droughts. The average temperature in Viet Nam has been estimated to increase by 3^{o}C and sea level rise by 1 m in 2100.

Agriculture plays a dominant role in the Vietnam's economy, contributing 21% to the GDP and 30% of total export earnings. Among cereal crops, rice is the single most important one. Mekong river Delta in Viet Nam is the country's largest rice and agro product producer and exporter. Recently, Mekong river delta provinces contribute 50% of the country's rice output, 90% of rice export value and more than 60% of seafood exports.

Crop production, especially rice cultivation, is most likely to be affected by hydrological change and saline intrusion. Currently grown varieties of rice and other crops may no longer be appropriate given changes in water level and rainfall distribution.

According to a recent World Bank study, Vietnam is one of the few countries to experience potentially catastrophic consequences from sea level rise (Dasgupta et., 2007). The report claims that at 1m sea level rise, over 10% of Vietnam's population, or 8.5 million people, mainly in the Mekong and Red River deltas, will be disrupted; at 5m sea level rise, over 35% of its population will be impacted. Sea level rise will cause extensive saltwater intrusions into the delta areas and eliminates a significant proportions of agricultural land. Given that a large percentage of the population and much of the economic activity are located in the delta, the spill over effects will be even larger.

Being aware of impacts of climate change, the government of Viet Nam has early taken part in and approved the Framework Convention of the United Nation on Climate Change and Kyoto Protocol. A number of ministries, sectors and localities have undertaken programs, and projects researching the progress and impacts of climate change on resources, environment and socio-economic development; recommendations have been proposed and response solutions have been initially taken.

Although the issue of adaptation has been highlighted in the Initial National Communications with adaptation measures considered important in sensitive sectors such as agriculture, energy and coastal zones, sustainable development and integration

of climate change concerns into planning in line with long-term goals are not clearly defined, the government policies and programs are designed principally to address short-term climate extremes rather than to respond to future climate change, and focuses on emergency response and reconstruction, rather than risk prevention and adaptation.

Based on the existing climate change documentation, this study was conducted to identify whether there is the linkage between climate change adaptations and sustainable development plan for Vietnam, especially for agriculture in the Mekong River Delta.

This report presents a brief overview of the development plans, programs of Vietnam's agriculture sector in the Mekong River Delta. It also revises past researches on climate change adaptation and determines whether climate change adaptation is integrated in development plans.

The study was based on a review of secondary information (documents, reports, papers, websites) and subsequent discussions with researchers, individuals from governmental agencies and non-governmental organizations during a numbers of workshop and seminars.

The study used mostly secondary data. These include the development strategies, programs and plans of the country such as: Five Year Socio-Economic Development Strategy 2006-2010, Strategic Orientation for Sustainable Development in Viet Nam (Viet Nam Agenda 21), National Strategy for Environmental Protection until 2010 and vision toward 2020 (NSEP), Second National Strategy and Action Plan for Disaster Mitigation and Management in Viet Nam 2001-2020.

Climate Change in Vietnam

Current Situation and Trend of Climate Change

According to observed data, changes of climate have the following noticeable points:

• *Temperature:* during the last fifty years (1951 - 2000), annual average temperature in Vietnam increased by 0.7^{o}C.

• *Rainfall:* Changes in rainfall patterns are complex and season and region specific. Monthly rainfall is already decreased in most of the country in July and August and increased in September, October and November, and rainfall intensity is increased considerably (Nguyen 2006).

• *Sea level:* In the last 50 years the average sea level rised by about 20 cm.

• *Number of Typhoon:* in the recent years, there were more typhoons with higher intensity affecting Viet Nam, typhoon track has moved towards southern latitudes and typhoon season ends later. In 2006 Vietnam had 10 typhoons – 3 were particularly destructive: 500 people dead; 2,900 injured; sea dykes were broken; 86,000 houses destroyed; 74,000 roofs blown away; 3,300 ships sunk or damaged.

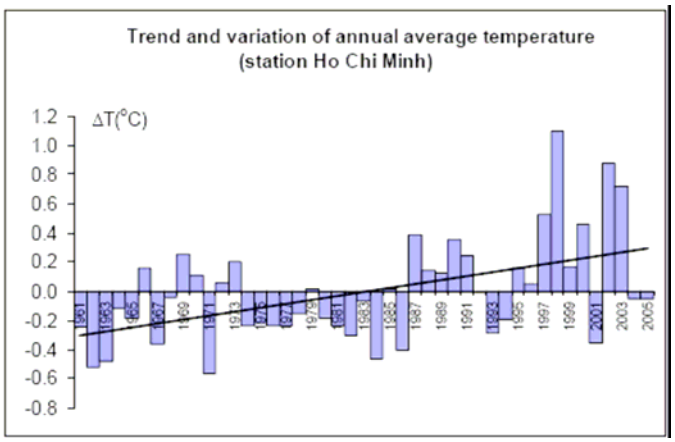

Figure 1. Observed mean annual temperature anomalies in Ho Chi Minh City

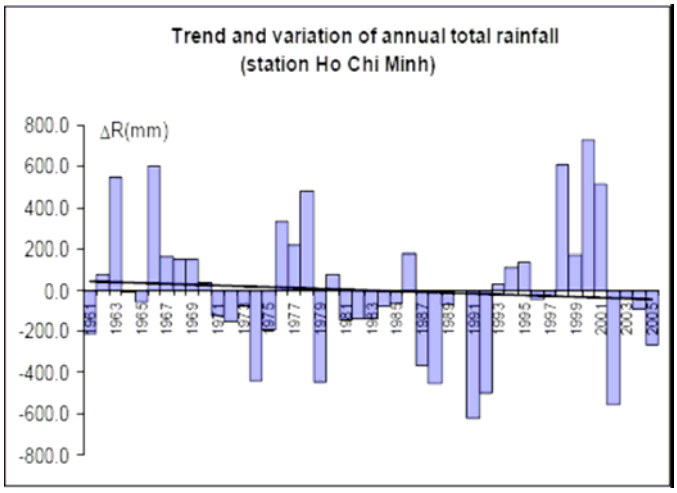

Figure 2. Observed mean annual rainfall anomalies in Ho Chi Minh City

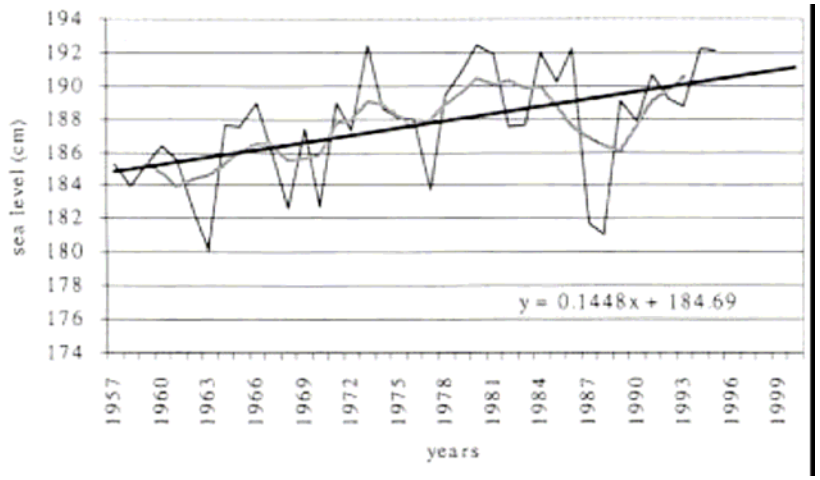

Figure 3. Mean water level at sea station Hon Dau (Lien, 2002)

• *Water related hazards:* Severe floods occur more often in the Central and South Vietnam (Mekong River Delta, historical flood in 1999 and 2000). Adverse droughts happen almost every year in many places, especially in the Highlands and South Vietnam during dry season and early rainy season. ENSO has stronger effects on weather regime, climatic features in various areas of Viet Nam. Historical drought took place during Elnino 1997-1998 in many places in the Central and South Vietnam.

In the last few decades, it is evident that climate change is a likely factor in the increase of the numbers and intensities of weather related disasters, affecting people, livelihood assets, infrastructure and ecosystems (Table 1).

Table 1. Natural Disasters in Vietnam by decades (1901 – 2000) (Source: ADRC 2002)

		Data						
Period	DisTypes	Count of DisNo	Sum of Killed	Sum of Injured	Sum of Homeless	Sum of Affected	Sum of TotAff	Sum of DamageUS$ ('000s)
1951-1960	Wind storm	4	3,356					
1961-1970	Epidemic	1	598			10,848	10,848	
	Flood	3	668		70,361	329,541	399,902	10,000
	Wind storm	1	7,000			700,000	700,000	50,000
1971-1980	Flood	2	168		79,000	4,628,000	4,707,000	
	Insect infestation	1						
	Wind storm	6	520	384	414,500	15,188,000	15,602,884	
1981-1990	Drought	1	0					
	Earthquake	1	0					
	Epidemic	1	200				0	
	Flood	4	373	200	120,000	2,848,000	2,968,200	
	Wind storm	18	3,136	5,731	268,000	9,898,416	10,172,147	21,000
1991-2000	Drought	3	0	0	0	5,700,000	5,700,000	416,770
	Epidemic	3	279			17,706	17,706	
	Flood	16	2,429	605	153,204	15,605,789	15,759,653	1,078,100
	Slide	4	294	73	39,000	0	39,073	2,300
	Wind storm	27	5,299	59,147	913,715	4,220,988	5,193,850	873,275
Grand Total		96	24,320	66,140	2,057,780	59,147,288	61,271,268	2,451,445

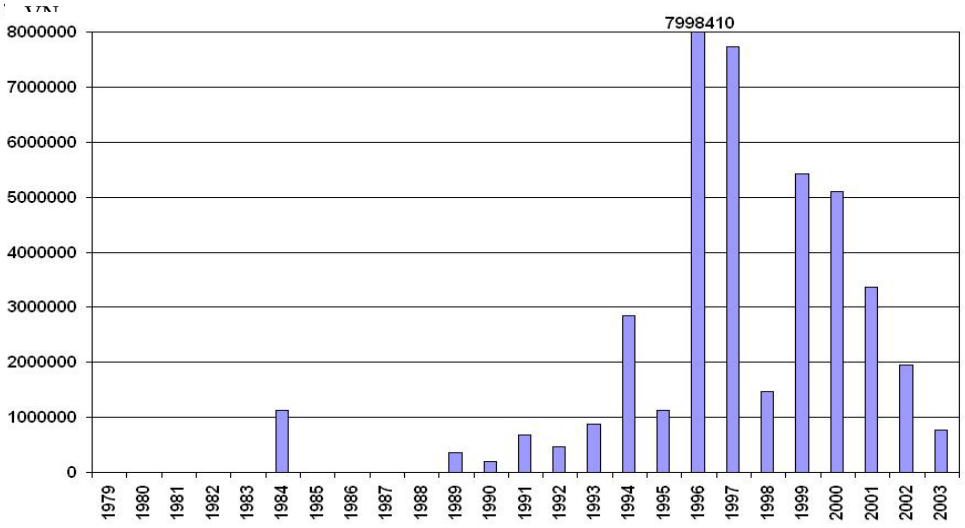

Figure 4. Economic loss by natural disasters (in VND)
(Data from DMC, MARD)

Future climate scenarios

Studies on climate change scenarios by the Institute of Meteorology, Hydrology and Environment (IMHEN, 2007) give the following projections:

• *Temperature:* In all regions of Vietnam, annual average temperature would increase by 2^{o}C in 2050. At 2100, the temperature is projected to rise by 3^{o}C.

• *Rainfall:* Seasonal rainfall in all regions would increase up to 5% in 2050, except Central region, where seasonal rainfall would increase up to 10%. In some areas such as the North-West region, North-East region, Northern Delta, Southern Delta and Southern Central Coast, rainfall in dry season may vary in a range of ±5%. Therefore, in areas suffering from droughts in dry seasons, droughts are likely to increase both in intensity and space.

• *Sea level:* Averaged in the entire coastal areas of Vietnam, see level is estimated to rise by 40 cm in 2050 and by 100 cm in 2100.

2.3 Potential impacts of climate change on specific sectors/regions

a) Impacts of climate change on Water Resources

Water resources are put under additional risks due to ever increasing droughts in some regions and seasons. This will directly affect agriculture, water supply for rural and urban areas as well as electricity generation. In both main rivers, Red and Mekong, due to climate change annual flow and flow in dry season would be decreased, in contrary the flow in flood season increased. This means that flood in rainfall season and drought in dry season is likely to be more severe.

b) Potential Impacts of Climate Change on Agriculture and Food Security

Climate change has significant impacts on growth and productivity of plants, affects cropping seasons, and may induce pestilent insect. Climate change would also affect growth and reproductive of livestock, increase risk of pathogenesis and spread of dangerous diseases. Vietnam's agriculture has great demand for crop variety and livestock development so as to minimize the risks resulted from extreme weather events (those crop variety and livestock that are highly adaptable to severe flood and/or drought).

Due to warming over the country, the adaptable time for tropical plants will be longer while for the sub-tropical plants is shorter. Increased temperature results in northward and upward movement of tropical plants, whereas the area of sub-tropical plants tends to shrink. Climate change is likely to increase the frequency, intensity, oscillation and extreme levels of dangerous weather phenomena such as storms, whirlwinds or temperature and rain induced natural disasters such as dry weather condition, floods, or droughts, damaging cold, salt intrusion, pests, which may all result in decreased livestock and crops productivity. A significant fraction of agricultural land in the coastal plain, the Red River Delta and the Mekong River Delta is exposed to salt water intrusion as a result of rising sea level.

Agriculture in the Mekong River Delta

In the last twenty years, Vietnam's economy grew rapidly with an annual rate of 7%. The agricultural sector experienced an impressive development, changing the country from a food importing position to one of the leading exporters of several agricultural commodities in the world.

Table 2. Some key agricultural indicators 2005 over 1986

	1986	2005	2005 compared to 1986 *(time)*
Average population *(Mil.)*	**61.1**	**83.1**	**1.4**
Urban	11.8	22.3	1.9
Rural	49.3	60.8	1.2
GDP per capita at exchange rate *(USD)*	**86(*)**	**638**	**5.4**
Output value of agriculture, forestry and fishery at constant 1994 prices *(Trill. VND)*	**65.1**	**182.0**	**2.8**
Agriculture	54.2	137.1	2.5
Forestry	4.2	6.3	1.5
Fishery	6.7	38.6	5.8

Source: FAO, 2006

Agriculture plays a dominant role in the Vietnam's economy, contributing 21% to the GDP and 30% of total export earnings in 2006. Rice is the single most important crop. The planted area for rice increased from 5.6 million ha in 1980 to around 7.3 million ha in 2006 (GSO). Major incentives to rice production were provided by the land reforms, the improved infrastructure especially with respect to irrigation, and easier access to inputs like fertilizer and pesticides.

Since 1986, Vietnam has changed the country's policy to market-oriented economy and has got a rapid economic growth, particularly rice production has gained an impressive achievements. Total output increased from 15.1 million tones in 1987 to 35.8 million tones in 2006. There has also been a remarkable growth in rice yield, from 2.70 t/ha in 1987 to 4.9t/ha in 2006. From a food-deficit country, Vietnam becomes the second largest rice exporters in the world (since 1996, over 3 million tons of rice per year has been exported).

The Mekong River Delta in Vietnam (MRD, also called Cuu Long Delta in Vietnam) is the low-level plain in the southern most extent of the Mekong River Basin. The MRD comprises of 13 provinces, 12% of Vietnam's national land area and approximately 18 million inhabitants with an area of approximately 40,000 square kilometres and criss-crossed by a complex system of canals and rivers. Recent estimated data showed an approximate 85% of Mekong River Delta population lives on agricultural activities.

The rapid increase in rice area and the intensity of rice cropping have been possible by heavy investment in flood control, drainage, irrigation that turned the flood prone ecosystem in the MRD into an irrigated ecosystem, and the development of very short duration rice varieties.

The MRD has become the 'rice bowl' of Vietnam. The MRD contributes 50% of the nation's food production, including 90% of rice exports, 60% of fisheries production and 70% of fruit.

Much of the growth came from the expansion of the rice harvested area, as farmers shifted land from a long-duration single-cropped deepwater rice to double- and triple-cropped short-duration, high-yielding modern varieties. The introduction of high-yield varieties with short growing periods brought about a drastic change in cropping patterns. Double cropping of rice, consisting of both traditional and high-yield varieties, is widely applied in the Mekong Delta. Even triple cropping of rice was

established in some areas with favorable water and soil conditions. Not only the improvement of varieties but also the introduction of various technical components, such as chemical fertilizers, pesticides, low-lift pumps, and machinery, play important roles in developing such intensified cropping patterns of rice.

Table 3. Mekong Delta GDP structure

(Source: Tran T. Be, 2007)

GDP %	1995	2000	2004
Agriculture – Fishery – Forestry	60.8	52.8	47.8
Industry – Construction	14.5	18.0	22.0
Services – Trade	24.7	29.2	30.2

Table 4. Rice production in Mekong Delta

Paddy	1995	2000	2004
Area, mil. ha	3.191	3.946	3.813
Spring	1.036	1.521	1.465
Autumn	1.398	1.882	1.958
Monsoon	0.757	0.543	0.390
Yield, T/ha	4.02	4.23	4.87
Spring	5.16	5.26	5.87
Autumn	3.79	3.72	4.38
Monsoon	2.89	3.12	3.56
Production, mil. Tons	12.832	16.703	18.569
Spring	5.348	8.004	8.607
Autumn	5.296	7.005	8.572
Monsoon	2.187	1.694	1.390

Despite those potentials and opportunities, rice production in the Mekong Delta is still experienced natural constraints including floods, acid sulfate soils, droughts, sedimentation and salinity intrusion.

Annual floods affect 1.2 to 1.9 million hectares of the Mekong Delta. Due to the low elevation of the delta plain, floods in the Mekong Delta are typically prolonged and aggravate the problem of poor drainage. Both the degree of severity and the frequency of the floods have increased.

The low rainfall and high evaporation during the annual dry season place constraints on human habitation and activity in the Mekong Delta, that are as equally serious as those arising from the excess of rainfall during the wet season. During the dry season (from December to April), there is a pressure on freshwater supply, especially toward the

latter part of the season, as the freshwater discharge in the main river channels diminishes, surface water storages on the delta become depleted and the ground water table falls. Such conditions bring about other problems such as salinity intrusion in coastal areas and acidification in acid sulfate soils areas.

The increased production of rice and productivity of rice-based farming systems remain the country's primary goals. Studies in the Mekong River Delta have focused on various rice-based farming systems models: rice-fish integrated with fruit trees, rice-shrimp in saline areas, rice-fish in deepwater areas, and rice–cash crops in the remaining small amount of floating-rice area.

Climate Change Impacts on Agriculture in MRD

The threat of climate change poses a serious destabilizing factor to agricultural activities in the Mekong Delta, primarily paddy farming and shrimp farming. The main impacts are inundation that will result from heavily increased rain in inland areas, salinization, and sea level rise.

Impacts on Paddy Farming

Climate studies have estimated that precipitation during the summer monsoon will increase, El Niño and La Niña events may also occur more frequently or intensively. Therefore, the period of inundation will be prolonged during the rainy season, severely impacting the productivity of rice farming. Using a very rough estimate of rainfall effects on inundation area, as much as one million hectares or even more of the Mekong Delta may be inundated in the coming decades. This is equal to 25 % of the total area of the region, reducing production by 3 million tons of rice. In addition, there is the increased possibility of extreme weather such as destructive typhoons, severe droughts/floods in El Niño/La Nina years.

Salinity intrusion in the climate scenarios would be of intense while the wet season would start later, it is likely that the dry seasons will then be prolonged in the Mekong region. Currently, 1.7 million hectares of the delta (42%) is affected by salinity intrusion. Salinity intrusion is the principal limiting factor for agricultural production (particularly for mono-crop rice cultivation), where most of the poor provinces with a high ratio of poor farmers are located. Drinking water shortages are another constraint for local people. In order to prevent further salinity intrusion, it is necessary to keep flows from dropping too low. Tidal movements and river discharges greatly affect the level of salinity.

The intense rainfall concentrated in a narrow window of time would increase run-off, which then leaves less freshwater in the system for the dry season. An expected change in rainfall patterns would both aggravate the concentration of salinity and expand the area affected.

Impacts on Shrimp Farming

Since the late 1980s, a strategy of crop diversifying has been practiced with the introduction of non-rice crops, as well as the large-scale adoption of aquaculture. This strategy, although providing high income, has also rendered the cropping systems vulnerable to periodic floods. Hence, the losses from floods in recent years have increased compared to those in previous decades.

In the coastal areas of the Mekong Delta, many farmers have adopted the practice of rice/shrimp farming. However, the expansion of shrimp farms into mangrove areas and the removal of forests for shrimp cultivation can bring about adverse consequences.

Impacts from climate change with regard to shrimp farming may happen in two ways: 1) the area available for aquaculture will be reduced due to sea level rise, and 2) the farms are exposed to intense storms which had previously been protected by mangrove forests.

Research on climate change impacts

Viet Nam Coastal Zone Vulnerability Assessment project (1994–1996) was the first climate change related study which assessed the vulnerability of the entire coastal zone of Vietnam to the effects of sea-level rise, and developed an approach for integrated coastal zone management in Vietnam. The project was undertaken by the Marine Hydrometeorological Centre of the Hydro-meteorological Center (HMS), with support from a European coastal zone management expert team under the funding of the Dutch Government.

In the last decade, studies on climate change related topics have increased in numbers. Most studies concentrated on identifying climate change in different geographical regions with the indication of temperature rising trend in many places all over the country, the change in rainfall patterns, the abnormal behaviour of tropical storms and their unprecedented consequences.

Recently, climate change impacts have drawn attention of scientists and researchers from different sectors. Climate change impacts have been identified in sectors with high priority such as agriculture, aquaculture, forestry, energy and coastal zones.

Studies of scientists (Viet et al., 2003, Giai et al., 2006) focused on climate change, climate variability and cropping patterns, rice yields in different agro-ecological zones in Vietnam. The reduction of rice yield in Northern Delta under different climate scenarios would be in a range of 10 - 20% compared with base line (Nguyen M. Cuong, 2005).

Studies showed the changes in planting dates, growth durations and crop yields associated with the changes of meteorological elements. Rice yields also change in El Nino/La Nina years (Giai, 2003). In El Nino years, winter-spring rice yields decreased in almost all agro-ecological zones. The most remarkable decrease is in Northern Midlands and Southern Delta. Summer rice crop, in opposite, has higher yields in El Nino years. In La Nina years, both winter-spring rice and summer rice have higher yields in almost all zones though with different amounts. It is found that the effects of climate change, climate variability and ENSO are not the same for different growing zones.

The assessment of climate change impacts on rice production in the Mekong River Delta in different CO_2 emission scenarios compared with the base line scenario of the 1980s (Chinvanno et al., 2006) revealed that although there is some increase in rice yield in 1.5 CO_2 emission scenario (3 - 8%), a noticeable reduction would happen when the concentration of CO_2 is doubled. The reduction is more significant with summer rice crop (reduction of about 20% in normal conditions and of more than 40% in extreme rainfall conditions).

For sustainable agricultural development, a number of measures have been suggested such as to change crop calendars, crop patterns, crop rotations. For each agro-ecological zones, a suitable varieties and hybrids adaptive to the new conditions induced by climate change should be introduced.

By assessing the impacts of sea level rise for all developing countries using a homogeneous set of indicators, and for multiple sea level rise scenarios, Dasgupta et. al. (2007) has revealed that Vietnam is the one of the most affected countries by sea level rise.

Table 5: Significant climate change impacts on agriculture and relevant adaptation mechanisms in Vietnam (Prabhakar, 2007)

Impacts:	Adaptation mechanisms:
• Increasing floods and droughts would impact agriculture • Productivity of agriculture crops such as rice may be affected due to increasing temperatures • Significant areas under cultivation in Mekong delta region may become saline due to saline water intrusion	• Development of sustainable farming techniques • Improving the irrigation and drainage systems for rice crop • Strengthening the capacities of agriculture universities and institutes such that the climate change could be taken into consideration in the existing research programs • Research on improved crop varieties and animal breeds • Diversification of agriculture through rural infrastructure development

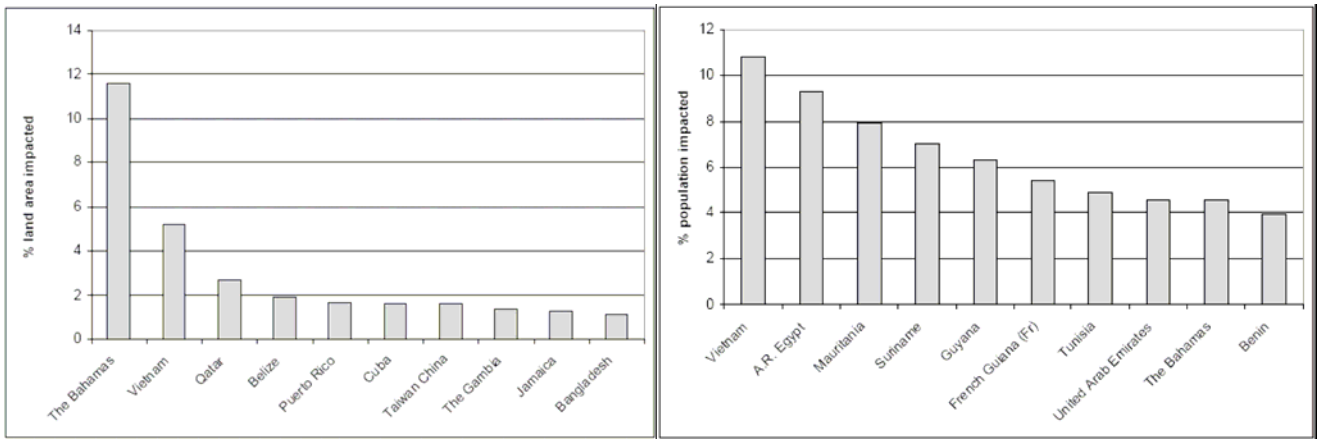

Figure 5. Most impacted countries: Land area (left) and population (right) **(**Dasgupta et. al., 2007)

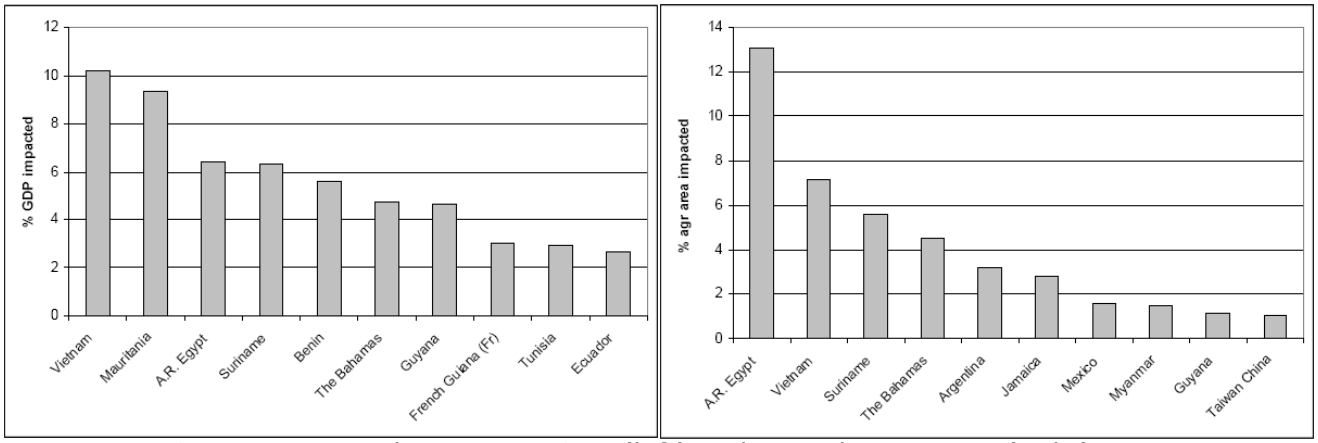

Figure 6. Most impacted countries: GDP (left) and agriculture extent (right) **(**Dasgupta et. al., 2007)

Sustainable Development Framework in Vietnam

Vietnam policy has great concerns to environment protection, sustainable development and raising the people's living standard. Viet Nam has adopted or revised a number of laws, decrees, and strategies to integrate the principles of sustainable development into country policies and programs.

Vietnam National Assembly approved the Environmental Protection Law in 1993. In 2000, Vietnam developed the National Environmental Protection Strategy for the period of 2001 – 2010 with the general objectives to continuously protect and improve environment in order to raise the living standard and health of the people and to ensure the sustainable development of the country.

The main target of community development for remaining sustainable development is to reduce poverty. From this point of view, the environment is known as the land for farming; the water for drinking, living activities and plants; the air for breathing and as the supplier for food and pharmaceutical products. As a result, there is a tight relationship among poverty reduction and hunger elimination, economic growth and natural resources protection for a sustainable development.

National important programs and policies for poverty, environment and sustainable development include:

(1) *National Rural Clean Water Supply and Sanitation Strategy to 2020* (RWSS Strategy, 2000);

(2) Strategic Socio-Economic Development 2001 – 2010 (SSED, 2001);

(3) Vietnam Development Goals (MDG/VDG, 2001);

(4) Strategy and Action Plan for Disaster Mitigation and Management in Viet Nam 2001-2020.

(5) Comprehensive Poverty Reduction and Growth Strategies (CPRGS, 2003);

(6) National Strategy for Environmental Protection until 2010 and vision toward 2020 (NSEP, 2003);

(7) Strategic orientation for sustainable development in Vietnam (Agenda 21 Vietnam, 2004);

(8) 5-year Plan for the Agricultural and Rural Development 2006 -2010 (2004)

(9) Targets of Socio-economic Development 2006-2010 (TSED, 2006);

(10) Five-year plan for natural resources and environment 2006-2010;

The Comprehensive Poverty Reduction and Growth Strategy (CPRGS, 2002), is now used as the overarching framework for addressing several facets of poverty within Vietnam. CPRGS is considered as an integrated part of the 10-year, 5-year, and annual socio-economic development plans at the national, sectoral, and provincial levels. It is meant to build upon those plans to translate them into tangible actions.

Viet Nam is highly vulnerable to natural disasters such as floods and typhoons, so the country has an extensive long-standing institutional response system for these events. Disaster risk management activities are coordinated primarily by the Central Committee for Flood and Storm Control (CCFSC), chaired by the Minister of Agriculture and Rural Development. Other members of the CCFSC include relevant line ministries, the Department of Floods and Storm Control and Dyke Management, the Disaster Management Centre, the Ministry of Natural Resources and Environment (MONRE), and the Viet Nam Red Cross (VNRC). The Natural Disaster Mitigation Partnership (NDM-P) is

made up of Government, NGOs and donors to promote dialogue and common ways of working, and support coordination for implementation of the Second National Strategy and Action Plan for Disaster Mitigation and Management.

Vietnam's policy framework for disaster management is set in the Second National Strategy and Action Plan for Disaster Mitigation and Management 2001-2020. This Strategy prioritises increased awareness raising and participation, minimizing loss of life and assets, and stresses the importance of co-existence with floods in situations which demand it. Other key initiatives of the Second National Strategy include: establishment of disaster forecast centres; construction of flood corridors and flood retention areas in southern Viet Nam; the use of advanced information and communication technology; strengthening the role of schools and the media in awareness raising; maintaining and upgrading equipment for local Flood and Storm Control Committees; and a proposal for a national disaster fund for projects on disaster mitigation and preparedness, and setting up a disaster insurance company.

Agricultural policies

Since 1986, agricultural policy has changed from a centrally planning to an open and market-oriented one. In the reform package, the most important components are land reform, trade reform, and the development of policy instruments to assist agricultural production in general. In addition, the producer price of all commodities was liberalized (Hoang Kim Tran, 1994).

The Land Law (1993) granted long-term land use rights to farming households as well as the rights to exchange, transfer, lease, inherit, and mortgage.

Besides the direct policies, the state has released indirect policies to encourage and facilitate agricultural production. These include input subsidy policies and general supporting policies.

There are many programs in which seeds or breeds are provided to farmers at subsidized rates.

At the national level, the following programs exist:

- Program 125 provides VND 10-13 billion every year for the breeding of pigs, cows and poultry.

- Program 225 provides about VND 100 billion for upgrading research institutes which develop crop and animal seeds, to subsidize seed import and promote seed multiplication.

- The agricultural extension scheme initiated in 1993, provides a subsidy of VND 30-50 billion each year to support the transfering of new technologies into agricultural production.

- Water fees: For a long time, farmers paid a subsidized fee for using water for irrigation. Decree 143 (2003): water fees were reduced at 50% - 70% for agricultural production with difficult conditions and no fees applied in the extremely difficult conditions. With the Decree 154 (2008), the government exempt all irrigation fees from farmers.

- Other supports: Farmers receive other supports such as concession loans with half interest rates; electricity use with reduced charge, fertilizer subsidy, etc.

In addition to the above mentioned policies, there are numbers of policies to facilitate agriculture but differ from input subsidy policies. They include science research (VND 200-260 billion per year on scientific research of the agricultural sector); training (VND 120-140 billion spent each year on training agricultural technicians, economists, specialists and workers); agricultural infrastructure (every year, the Vietnamese

government spends more than VND 3,000 billion on building and upgrading irrigation and drainage systems, dams, and technical infrastructure of institutes, colleges, etc.).

In the Mekong River Delta, the strategy "Living together with floods" is integrated in major programs and plans. Integrated water resources management has been applied in the Mekong River Delta to ensure the sustainable and equitable distribution of benefits to all stakeholders in the MRD. The government has developed and initiated other measures to specifically protect the livelihoods of the Mekong Delta communities. In recent decades these include the encouragement of residential clusters, flood proofing of houses, building dykes and boundary embankments, establishing child care centers and providing training in schools during flood periods.

Regarding agriculture, this includes restructuring agricultural plans and cropping patterns; adjusting cropping calendars; developing new crop varieties and developing farming systems and techniques appropriate to climate change. The alternative measures have been introduced to diversify agricultural products, to reduce vulnerability to climate-related disasters, and increase local people's incomes. The primary measures are:

- Increase productivity of paddy farming for new climate conditions
- Expand non-farm economic activities

Climate Change and Sustainable Development

The Fourth Assessment Report of IPCC has clearly mentioned that "climate change is projected to impinge on sustainable development of most developing countries of Asia, as it compounds the pressures on natural resources and the environment associated with rapid urbanization, industrialization, and economic development". Ignoring sustainable development's importance to climate policy may or may not impact the future of sustainable development but will nearly certainly adversely impact the future of the global climate regime.

Adaptation has been proposed as a means of mitigating the impacts of climate change, especially for developing countries which experience high dependence on agriculture and related climate dependent sectors and lack of good governance and strategic planning (Prabhakar, 2007). The priority must be on those countries that are climatically most vulnerable as well as economically impoverished and therefore unable to 'cope' or 'adapt' with sudden and significant climatically induced disasters. The most pressing challenge in this regard is to strengthen the social, economic and technical resilience of the poorest and most vulnerable against extreme climatic events.

Vietnam is characterized by rapid economic changes. The GDP growth rate of Vietnam is about 7 - 8% during 2005- 2007. Concerns have been raised on the sustainability of these growth rates and the environmental consequences these rates may have. Despite the economic growth, climate change is a concern as large proportion of population depends on the climate influenced sectors such as agriculture, animal husbandry and forestry for their livelihoods.

Viet Nam ratified the UNFCCC in 1994 and the Kyoto Protocol in 2002. The Ministry of Natural Resources and Environment (MONRE) has been assigned by the Government of Vietnam to be the National Focal Agency for implementing the UNFCCC and KP and is the managing government institution for all climate change activities. The National Action Plan has two main roles: 1) to assist in the formation of socio-economic development strategies which take into account climate change; and 2) to control the diffusion of greenhouse gases which cause global warming.

MONRE also established the National Office for Climate Change and Ozone Protection

(NOCCOP), which is responsible for the national co-ordination of work on climate change, the construction of national policies to deal with impacts of climate change, and the encouragement of international co-operation in climate and climate change issues.

Vietnam Initial National Communication to the UNFCCC (INC, 2003) was carried out under MONRE and includes an assessment of the potential impacts of climate change on major economic activities as well as an overview of key vulnerable sectors and potential adaptation measures. Adaptation measures are considered for water resources, agriculture, coastal zone, forestry, energy and transport, aquaculture, and human health.

Linking Climate Change Adaptation and Sustainable Development

Until recently, most Vietnam national polices, programs and development plans focus on poverty reduction and environment protection. With climate related issues, more attention has been put on natural disasters, climate change mitigation rather than climate change adaptation.

In Vietnam Agenda 21, climate change is not directly mentioned. Again the issue is related is stated as:

- Alleviate climate changes and restrict the detrimental impacts of climate changes, prevent and combat natural disasters.
- Implement measures for mitigating climate change, limiting its negative impacts, preventing and controlling natural disasters.

Following Vietnam Agenda 21, provinces also prepare their own Sustainable Development Strategy. An example is for Ben Tre Province (in Mekong River Delta): Sustainable Development Strategy 2006-2010 and vision for 2020 (Mar 2006): for the whole document, the word of "Climate" is mentioned twice as climate change & climate variability (as adverse factors influencing the development).

Vietnam Five Year Socio-Economic Development Strategy 2006-2010 states overall objectives, main targets, major tasks and resolutions set out in Vietnam's five year socio-economic development plan for 2006-2010: 9 times of 'environment', 4 times 'poverty', 2 'natural resources', 2 times of "sustainable development', only 1 time "climate change" is stated but in terms of "restrict negative impacts of climate change".

In the 5-year Plan for the Agricultural and Rural Development 2006 – 2010, 16 national and ministerial programs are to be implemented in which only 1 is related to climate (Natural disaster control and mitigation) but with emphasis on strengthening dyke systems and improving dyke management and protection, setting up early disaster warning system; relocating people in high-risk areas and preparing emergency relief system. Special attention for the Mekong river delta is to carry out the program of flood control, strengthening existing embankments and sea dykes, with the view to living together with floods and ensuring the safety of lives and assets.

In overall, there has been an inadequate attention to climate change adaptation until recent release of the Four Assessment Report (IPCC, 2007) and the World Bank Report on the consequences of climate change and sea level rise to the Asian countries.

To date, Vietnam government has mainly focused on inventories and the reduction of green house gas emissions. The Initial National Communication (INC) to the UNFCCC (MONRE 2003) only explored climate change impacts and necessary adaptation measures in a preliminary and qualitative way. A series of sector assessments were made and adaptation options identified, but these did not include socio-economic analysis, and they have not yet been followed by specific programmes. More indepth vulnerability and adaptation assessments and the preparation of a policy framework for

implementing adaptation measures are currently being undertaken for the Second National Communication (SNC) to the UNFCCC, which should be completed by 2010.

The Second National Strategy is still, however, designed principally to address short-term climate extremes rather than to respond to future climate change, and focuses on emergency response and reconstruction, rather than risk prevention and adaptation. There is also a marked lack of integration between disaster risk reduction policies and wider policies for rural development and poverty reduction, with little cross sectoral integration or coordination, either in policy, or practice. There is limited Government ownership yet of an adaptive approach to future climate related risks, and limited financing available for climate change adaptation.

In Dec 2007, MONRE has been assigned to set up the National Target Program to cope with Climate change and Sea Level Rise (NTP). Several consulatation workshops have been organized throughout the country to gather participants' recommendations and contributions from other ministries and sectors. Strategic objectives of the NTP are to ***enhance the country's capacity and efficiency in response to climate change in specific periods*** to ensure sustainable development of Viet Nam, protect people from harmful impacts of climate change, and prevent, mitigate and minimize risks posed by climate change; joint international community's effort to mitigate climate change impacts and protect global climatic system.

The NTP of Vietnam is a combination of the nation's efforts in the implementation of various commitments as stipulated in regulation of the Convention, at the same time as a request of enjoying various financial support and technology transfer to carry out proper measures to deal with climate change. Adaptation to climate change has now become the first and immediate as well as long term issue. The NTP for coping with climate change should be considered as a priority program to achieve sustainable development goals of the country. After the approval of the Government, it will be the basic orientation and strategies of the State to respond to climate change.

Being aware that agriculture is the most affected by climate change, the Ministry of Agriculture and Rural Development (MARD) was prompt to set up an action plan for adaptation to climate change for the period of 2008-2020. A program for water resource management in the Mekong river Delta to cope with climate change and sea level rise is also proposed. Given the linkages between climate change and development, adaptive policies can only be effective if they are integrated into the wider development agenda. With potential increases in the magnitude and frequency of natural hazards because of climate change, creating closer links between the governance of climate adaptation and the governance of disasters is crucial. The climate adaptation community can also learn from the recent experiences of mainstreaming disaster risk reduction, and may be able to take advantage of existing initiatives in this field.

As in other developing countries, the mainstreaming process in Vietnam is also in its early stages. In the past, many solutions responded to climate variability with a range of isolated structural and non-structural responses. Often these ignored the most vulnerable – for example, engineered flood control measures, drought early-warning systems and flood wall construction. More generally, government actions and plans which have the potential to reduce climate vulnerability are either restricted to a single ministry with few resources or fragmented across sectors with no co-ordinating mechanism, and as a result have not been fully implemented.

Vulnerability to Climate Change in the Mekong Delta

With the experience of the 2000 floods, Government departments in the MRD and mass organisations mobilised staff, distributed literature, organised meetings, visited households and warned of rising flood waters. Awareness raising after the 2000 floods concentrated on schools to reduce child fatalities, but many of the poorest children

could not attend school as they had to work (in fishing & agriculture) and thus remained extremely vulnerable during floods. Women volunteers through the Women's Union were key in staffing these centres, with several reporting that their prestige increased as a result. Safe water campaigns were launched, and people were also mobilised to clean up their local environments once the flood waters receded, in order to avoid epidemics. Also important is that following the 2000 floods several aid organisations distributed boats, which are used as a means of transport and for fishing during floods and in normal times (IFRC 2002). Such programmes also happened after the 2001 foods, with a focus on the poorest people.

The policy slogan during and after this time was 'living with the floods', which reflects a realisation that ever higher dykes in the Mekong Delta are not the answer to seasonal floods, that fields and forests must store flood water instead, and that people's livelihoods must adapt. Government has subsequently launched a programme of safe settlement areas for home relocation and the raising of homes above flood levels so that evacuation will no longer be necessary (IFRC 2002).

The risk of Mekong Delta floods and also droughts are increasing with expected higher intensity rains in the rainy season and intensified dry spells. Vulnerability of rice crops and therefore farmers' livelihoods are expected to be serious, but many mitigation measures are also already known and being tried, at the farm level (e.g. changing seed varieties and crops, diversifying to non farm techniques and seasonal migration), community level (e.g. enhancing, protecting common resources such as fish ponds, developing village funds and shared processing facilities) and national level (e.g. infrastructure investments, research & development, strengthened information systems) (Suppakorn et al. 2006).

Until recently, the concept of climate change, its potential impacts and the need for adaptation are not yet well known in Viet Nam beyond a small community of experts and development workers, some concerned state management agencies, and some localities (which have benefited from climate change related projects). To improve on this requires strengthened communication, and comprehensive research on the possible impacts of climate change on the Vietnamese economy and key development goals, particularly poverty reduction. And little is known yet on the potential social and economic implications of climate change and sea level. Research is needed on the most effective long-term adaptation measures and strategies to ensure human well-being and continued economic growth and poverty reduction. According to the United Nations Development Program (UNDP, 2007), Vietnam has made a remarkable progress in human development. Poverty levels have fallen and social indicators have improved, putting the country ahead of schedule on almost all of the Millennium Development Goals. Climate change poses a real and imminent danger to these achievements – and nowhere more so than in the Mekong Delta. Around 4 million people living in poverty in the Delta. Many of these people lack basic health. For this group, even a small decline in income or loss of employment opportunities linked to flooding would have adverse consequences for nutrition, health and education. The poor face a double risk. They are far more likely to live in areas vulnerable to flooding, and they are less likely to live in "more robust permanent homes".

There are main approaches which need to be adopted for considering adaptation to climate change in development policies, plans and programs: 1/Addressing adaptation challenges for climate change within various stages of preparing the development plans, programs or policies; 2/ Incorporating climate change adaptation into assessment tools.

With regards to entry points to mainstream climate change, NTP workshops and consultations revealed the following:

- The policy framework

- Institutional arrangements
- Consultation and coordination processes
- Financing and budgeting
- Tools and methods for adaptation
- Awareness raising

Conclusion

Climate change is a very real threat to Viet Nam's continued socio-economic development. Higher temperatures, increasingly variable rainfall, more intense extreme weather events like typhoons, droughts and heavy rainfall causing floods, and the rising seawater level will all have significant impacts across sectors, regions, and income groups, and particularly on livelihood security of the poorest rural people.

Agriculture plays a major role in Vietnam's economy. Mekong river Delta in Viet Nam is the country's largest rice and agro product producer and exporter. At the same time, it is highly vulnerable to climate change and sea level rise.

In the past, most attention had put on poverty reduction, environmental protection and natural disaster mitigation. The threat of climate change is beginning to be acknowledged but information and awareness remains at a low level. Viet Nam is now underway to set up a national climate change adaptation strategies, and national and local capacity building is urgently needed to ensure that policy responses are adequate and effective. Coordination between line ministries also needs to be urgently improved, and cooperation with international agencies and NGOs enhanced so that climate change can be addressed in an integrated way with long-term socio-economic and poverty reduction efforts.

References

Asian Development Bank (ADB). Asian Development Outlook 2007.

Asian Disaster Reduction Centre (ADRC), 2002: 20th Century Asian Natural Disasters data Book. accessed on 10 Mar, 2008. http://web.adrc.or.jp/publications/databook/databook_20th/top_e.htm,

Central Committee for Flood and Storm Control: http://www.ccfsc.org.vn, accessed on 22 Apr, 2008.

CCFSC, 2005, National Report on Disasters in Vietnam, Vietnam Central Committee for Flood and Storm Control, Working paper for the World Conference on Disaster Reduction, 18-22 January 2005, Kobe-Hyogo, Japan. 31 pp.

Chaudhry P., and G. Ruysschaert, 2007: Climate Change and Human Development in Viet Nam, UNDP Human Development Report 2007/2008.

Chinvanno S., S. Souvannalath, B. Lersupavithnapa, V. Kerdsuk, and Nguyen T. H. Thuan, 2006: Climate risks and rice farming in the lower Mekong River countries. AIACC Working Paper No. 40. http://www.start.or.th/ , accessed on 15 Jul, 2008

Climate Protection Programme, Climate Change and Development in Vietnam:

Agriculture and Adaptation for the Mekong Delta Region, December 2003. http://www.gtz.de/de/dokumente/en-climate-adaptation-vietnam.pdf, accessed on 15 May, 2008.

Dasgupta S., B. Laplante, C.Meisner, D. Wheeler, and J. Yan, 2007: The Impact of Sea Level Rise on Developing Countries. World Bank Research Working Paper 4136.

Disaster Management Unit: http://www.undp.org.vn/themes/disaster/, accessed on 25 May, 2008.

General Statistics Office Of Vietnam: Statistical Handbook of Vietnam, 2007.

Initial National Communication, 2003: Vietnam Initial National Communication under the United Nations Framework Convention on Climate Change. Ministry of Natural Resources and Environment, Hanoi, 135 pp.

Linking Climate Change Adaptation to Disaster Risk Management for Sustainable Poverty Reduction: Vietnam Country Study, 2006. Vulnerability and Adaptation Resource Group (VARG). http://www.climatevarg.org/essd/env/varg.nsf/48d8e9, accessed on 1 Jun, 2008.

Natural Disaster Mitigation Partnership: http://www.undp.org.vn/ndm-partnership/, accessed on 10 Jun, 2008.

National office for Climate Change and Ozone Protection, Ministry of Natural Resources and Environment: http://www.noccop.org.vn, accessed on 28 Jun, 2008.

Nguyen Hoa and U. Grote, 2004: Agricultural Policies in Vietnam: Producer support eatimates, 1986-2002. International Food Policy Research Institute, ZEF Discussion Paper No. 93.

Nguyen Huu Ninh and Luong Quang Huy, 2006. Climate Change Vulnerability: Challenges and Opportuniries in Indochina. Global Change Newsletter No.67 December 2006.

Nguyen Thi Hien Thuan, 2004: Preliminary research findings on the climate change impacts on rice production in the Mekong River Delta in Vietnam. Proceedings of 2004 Annual Scientific Workshop, Sub-Institute of Hydrometeorology and Environment of South Vietnam, Ho Chi Minh City, pp. 1-10.

The strategic orientation for sustainable development in Vietnam (Vietnam Agenda 21), 2004, Ha Noi. 80pp.

Tran Viet Lien, 2002: Climate Change scenario for Red River catchment. Civil Engineering & management Research Report 2002 W-007/WEM-007, University Twente, the Netherlands, 29pp.

United Nations Country Team, 2005: The Millennium Development Goals and Viet Nam's Socio-Economic Development Plan 2006-2010. Ha Noi, 41pp.

World Bank in Vietnam, 2004, Country Report: Comprehensive Poverty Reduction and Growth Strategy CPRGS, UNDP, Vietnam http://ww.worldbank.org/vn, accessed on 25 Jul, 2008.

7.2 Conference / Symposia / Workshops

7.2.1 Synthesis Meeting Report

Rodel Lasco and Rafaela Jane Delfino

Introduction

The project entitled: "Linking Climate Change Adaptation and Sustainable Development in Southeast Asia" is a two-year collaborative project of the World Agroforestry Centre (ICRAF), Asia Pacific Network for Global Change Research (APN) and Global Change System for Analysis, Research and Training (START). Its main objective is to clarify the links between climate change adaptation and sustainable development. Specifically it aims to synthesize research on adaptation strategies for climate change and climate variability in SE Asian countries; analyse the links of adaptation strategies to the sustainable development goals of the respective countries; hold a science-policy workshop to disseminate results and solicit recommendations; and publish the results of the study in a format that is useful to policy makers and other stakeholders. The project is participated by four SE Asian countries: Indonesia, Lao PDR, the Philippines and Vietnam.

The synthesis meeting was held at Khush Hall, International Rice Research Institute (IRRI), Laguna, Philippines on September 25 – 26, 2007. The meeting was conducted to gather the synthesis writers from collaborating countries to review the initial country synthesis papers. It was done to identify the common lessons emerging across the different countries, and to finalize the methods on the basis of the climate change situation and development priorities of their respective countries. After the meeting, the synthesis writers will finalize the papers in preparation for the science-policy workshop.

This document contains the report of the Synthesis Meeting. It provides a summary of the presentations, discussions and outputs of the two-day meeting. This section is an introduction for the document. Section 2 is the brief description of the program and agenda. Section 3 is the synthesis of the country presentations. Section 4 is the summary of the discussions and methods and Section 5 is the highlight of writeshop outputs and the project timeline.

Design of Program

The final activity of the project is the conduct of the science-policy workshop in which the key output are policy recommendation that will facilitate the mainstreaming of climate change adaptation to sustainable development of the countries involved. In preparation to this, a synthesis meeting was conducted to present and review the initial country synthesis papers and finalize the methods on the basis of the respective countries' priorities. The final synthesis papers will be the main input for the science-policy workshop.

The synthesis meeting has a total of 6 participants: the project leader, four collaborators – one from each country, and a support staff. A two-day program was developed to ensure the achievement of the meeting's goals and agenda. The first day dealt on country presentations and the second day was devoted for the discussion and writeshop.

Dr. Rodel Lasco, the project leader, opened the meeting by welcoming the participants and was followed by the introduction of the collaborator. Each one gave a brief educational and professional background. Then, Dr. Lasco provided an overview of the

project. He presented the project background, objectives, relevance, status and results to date. Also, the project framework of analysis, scales and methods was provided.

Day One, 25 September 2007

The first day was devoted for the country presentations. It was started by the presentation of Dr. Lasco on the highlights of the Chapter 20 and working group report of the IPCC Fourth Assessment Report. Then, each collaborator provided an introduction to the climate change situation of the country, synthesis of previous and on-going climate change, climate change adaptation and other climate-related researches. The sustainable development framework of each country was discussed by giving the different national programs, plans, policies and strategies. The collaborators also provided the potential entry points for mainstreaming climate change. An open discussion was held after every country presentation.

Day Two, 26 September 2007

The second day was divided into three sessions. The first focused on the identification of methodologies, which elaborated on the methodological approaches and strategies for mainstreaming climate change adaptation into sustainable development initiatives of each country. The second session was a writeshop wherein each collaborator was asked to develop the outline for the final country synthesis paper. After the writeshop, each country presented the outline by emphasizing the identified sector focus of the paper as well as the methodologies that will be used in mainstreaming climate change adaptation to sustainable development. The last session was used for setting the timeline and deliverables for the last phase of the project.

Synopsis of Presentations

The first day of the meeting concentrated on the presentations of the initial country synthesis papers. First, as a backgrounder, the project leader presented the major points of the IPCC AR4. Each collaborator provided an inventory of the climate change researches and analysis of the national policies, plans, programs and strategies of their respective countries. Significantly, each one gave the key concerns and/or potential entry points for mainstreaming climate change adaptation into sustainable development in the country. The highlights of the presentations are given below.

IPCC Fourth Assessment Report

Dr. Rodel Lasco presented the Chapter 20 of the IPCC Fourth Assessment Report (AR4) entitled *Perspectives on Climate Change and Sustainability.* The key concerns presented were:

- Sustainable Development Concept
- Two-way linkage between climate change adaptation and sustainable development
- Connection among the three pillars of sustainable development and climate change adaptation

He also presented the working group report on *Climate Change Impacts and Adaptation in Asia* by emphasizing:

- Effects of future climate change on agriculture, risk of hunger and water resource scarcity

- Adaptation measures for the sectors: hydrology and water; agriculture, marine and coastal ecosystems; ecotourism; and coastal and low lying areas

VIETNAM

Dr. Thuan provided a brief description of the climate change situation and sustainable development framework in Vietnam. The issues presented were:

- Climate situation, and occurrence and impacts of natural disasters
- Current and Future Climate Change in Vietnam
- Climate Change Impacts and Adaptation
  - Water Resources
  - Agriculture
  - Coastal Zones
- Sustainable Development Framework
  - Institutions:
    - Environmental Protection Law of 1993
    - CDM and KP in Vietnam
  - Focus of National Adaptation Projects
  - National Plans and Programs

The following key points of concern were emphasized:

- Weak national capacity for comprehensive quantitative & qualitative Vulnerability and Adaptation (V&A) assessment to arrive at the economic context of effective adaptation measures;
- Lack of comprehensive implementation plans for adaptation;
- Limited staff capacity, particularly the analytical, planning, monitoring and evaluation skills for assessing trade offs between development decisions;
- Poor data on adaptation options and lack of mechanisms for information sharing and management across sectors; and
- Limited awareness of stakeholders and population on climate change adaptation.

LAO PDR

The presentation focused on the national programs for Climate Change including:

- Lao Convention on Climate Change
- National Adaptation Plans of Action (Lao PDR Program Update)

Dr. Phon-asa provided a framework for mainstreaming climate change in Laos in which the energy sector was the major point of entry. He also discussed the potential research collaborations and network connections for mainstreaming climate change adaptation through the energy sector.

INDONESIA

Mr Perdinan presented the following Climate-related studies and projects in Indonesia:

- AIACC Project
- Reducing Climate Risk for Agriculture Production in Bandung
- Climate Field School Program

He also enumerated the different Climate Change Adaptation Strategies and Indonesia's MDGs in relation to Climate Change Adaptation from which he had a more detailed discussion on the 1st and 7th goal:

Goal 1: Overcoming Poverty and Starvation
Goal 7: Maintaining Sustainable Environment

The following potential entry points for mainstreaming were laid out:

- Continuing the implementation of modified planting calendar and reforestation
- Enhancing the role of national working group on climate anomaly
- Strengthening the networking that has been initiated by CAPaBLE APN project
    - Increasing the awareness of local community
    - Gather information from community, scientist, and government at provincial to district level about the climate related problem

PHILIPPINES

Dr. Pulhin provided a brief background and discussed the following:

- Climate change researches in the Philippines:
    - Carbon Stocks Assessment
    - GHG Inventory and Emissions
    - Impacts, Vulnerability and Adaptation to Climate Change
    - Climate Projections
- Studies/Researches on Climate Change and Sustainable Development
- National Programs for Sustainable Development
    - Medium Term Development Plan (2004-2010)
    - Philippine Millennium Development Goals
    - Philippine Agenda 21

The potential entry points for mainstreaming climate change in the Philippines were as follows:

- Programs and plans to address the impacts of climate–related hazards
- Strategies to adapt to such impacts can be formulated and mainstreamed to the developed programs and plans.
- Design and management of flood control projects.
- Inclusion of climate change scenarios such as precipitation as one of the considerations in designing the project.
- Through action programs to address global warming to be drafted by the task force on global warming
- Adaptation strategies to reduce impact and vulnerability of climate change can be included in the action programs that will be formulated
- Regular programs of the government agencies (i.e. Pag-asa–early warning device)

Summary of Discussions and Methods

Key questions

The presentations and discussions during the meeting were guided by the following major questions:

- How to mainstream climate change to sustainable development?
- What are the entry points for mainstreaming?
- Are there conflicts between climate change and sustainable development?

Issues and Challenges

Before the country presentations, the following issues and the challenges that await the project team were emphasized.

- The previous studies/researches conducted in relation to climate change focused more on climate change mitigation not on adaptation. Climate change adaptation is an emerging issue in most if not all of the countries involved.

  Challenge: Identify the most promising adaptation strategy and its link to sustainable development.

- It is a difficult challenge convincing policy makers to integrate climate change adaptation to development policies since climate change impacts are based on long-term projections.

  Challenge: Find ways to integrate climate change adaptation into sustainable development planning in such a way that the policy makers will see climate change as an issue needing immediate action.

Methodologies

The project team identified and discussed the methodological approaches for mainstreaming climate change adaptation to the sustainable development initiatives of each country based on the key findings and discussions made during the previous day. Below is the synopsis of the methods identified:

- Identify the specific sector in the country that will serve as the focus of analysis and show its links to sustainable development;

- Review and analyze existing national/regional/sectoral development plans, programs, strategies and activities, and identify whether climate change have been integrated;

- Review and synthesize past and present climate change, climate risks and climate-related researches/studies to identify the most appropriate adaptation strategies/measures and analyze its links to sustainable development; and

- Conduct consultation and Key informant interviews with stakeholders to identify the extent of integration of climate change into policies and the adaptation measures that needs to be mainstreamed.

Other concerns / issues

The minor concerns, issues and questions that need to be addressed and be given emphasis on the writing of the final synthesis papers as raised during the brainstorming are as follow:

- On drivers of policy
  - What/Who are the drivers of policies?
  - What is the role of the donors in financing climate risks adaptation?

- On continuity of projects
  - Do projects continue after the project support?
  - How to move from project base to operational base?

- On laws and innovations
  - What are the impacts of these policies to the social and natural systems?

- On institutional analysis
  - Does institutional change lead to conflicting policies? How?

Summary of Writeshop Outputs

The major output of the meeting is a detailed country outline of the final synthesis paper. Provided below are the sector focus and methodologies (as provided in the outline) for each country:

Vietnam

Sector Focus: Agriculture and Livelihood security (Mekong Delta River in Vietnam)
Methods:

- Review researches on Climate Change Adaptation and Climate risks
- Analysis of national and regional policies, programs and plans
- Key informant interview

Indonesia

Sector Focus: Agriculture and Food Security (Case Study on Rice Production)
Methods:

- Synthesize Climate Risks Research in Indonesia
- Review Problems on rice production in relation to climate risks and farmers' perspectives
- Analysis of MDGs and agricultural strategies for food security

Lao PDR

Sector Focus: Energy Sector
Methods:

- Review national programs, plans and activities concerned with climate change
- Conduct a key informant interview and workshop

Philippines

Sector Focus: Water Resources
Methods:

- Review documents discussing development agenda of the Philippines to determine whether climate change adaptation is integrated;
- Review development projects/programs
- Review past researches on climate change adaptation
- Identify points of entry based on key informant and consultation meeting

Project Timeline and Deliverables

2007	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sept***	***Oct***	***Nov***	***Dec***
Finalize science-policy papers												
2008												
Finalize science-policy papers												
Review of papers												
Revisions of papers												
Preparation for the workshop												
Final draft of papers												
Science-policy Workshop												
Final Report Writing												

Annex 1. ABBREVIATIONS

ADB	Asian Development Bank
AIACC	An Integrated Assessment of Impacts of Climate Change
APN	Asia Pacific Network for Global Change Research
BMG	Bureau of Meteorology and Geophysics, Indonesia
CC	Climate Change
CDM	Clean Development Mechanism
CFS	Climate Field School
CIDA	Canadian International Development Agency
CPWC	Cooperative Programme on Water and Climate
DA	Department of Agriculture, Philippines
DNA	Designated National Authority
DP	Disaster Preparedness
ENSO	El Niño/Southern Oscillation
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GLOSS	Global Sea Level Observing Station
ICZM	Integrated Coastal Zone Management
IMH	Institute of Meteorology and Hydrology
IPB	Bogor Agricultural University
IPCC	Inter-governmental Panel on Climate Change
IPCC TAR	IPCC Third Assessment Report
IPCC AR4	IPCC Fourth Assessment Report
KP	Kyoto Protocol
LUCF	Land Use Change and Forestry
MDG	Millennium Development Goal
MFR	Makiling Forest Reservesd
MONRE	Ministry of Natural Resources and Environment, Vietnam
MTDP	Medium Term Development Plan
NAPA	National Adaptation Plans of Actions
NCAP	Netherlands Climate Assistance Programme
NDCC	National Disaster Coordinating Council, Philippines
NEDA	National Economic Development Authority, Philippines
NOCCOP	National Office for Climate Change and Ozone Protection
PA 21	Philippine Agenda 21
PCW	Pantabangan-Carranglan Watershed
SAP	Stakeholder Action Plan
SCC	Social Cost of Carbon
SE	South East Asian Countries
SIHYMETE	Sub-Institute of Hydrometeorology and Environment of South Viet Nam
START	Global Change System for Analysis, Research and Training
STEA	Science Technology and Environment Agency
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
UPLB	University of the Philippines, Los Baños
VNRC	Vietnam Red Cross
WRI	World Resources Institute

Annex 2. PROGRAM OF ACTIVITIES

September 25, 2007

Time	Activities
8: 00 – 8:30	Registration
8:30 – 8:35	Welcome Remarks
8:35 – 9:00	Introduction of Collaborators
9:00 – 9:30	Key findings of the IPCC Fourth Assessment Report paper on *"Perspectives on Climate Change and Sustainability"* and *"Climate Change Impacts and Adaptation in Asia"* - ***Dr. Rodel Lasco***
9:30– 10:00	**Overview of the Project and Overall Project Framework** - ***Dr. Rodel Lasco*** (Project Leader)
10:00 – 10:15	Coffee Break
10:15 – 10:45	**Presentation of Initial Country Synthesis Paper** **VIETNAM** - ***Dr. Nguyen Thi Hien Thuan***
10:45 – 11:15	Discussion
11:15 – 11:30	Coffee Break
11:30 – 12:00	**Presentation of Initial Country Synthesis Paper** **LAOS** - ***Dr. Chanthaphone Phon-asa***
12:00 – 13:00	Lunch
13:00 – 13:30	Discussion
13:30 – 14:00	**Presentation of Initial Country Synthesis Paper** **INDONESIA** - ***Mr. Perdinan***
14:00 – 14:30	Discussion
14:30 – 14:45	Refreshment
14:45 – 15:15	**Presentation of Initial Country Synthesis Paper** **PHILIPPINES** - ***Dr. Florencia Pulhin***
15:15 – 15:45	Discussion
15:45 – 16:00	Open discussion and preparation for 2nd day agenda - ***Dr. Lasco***
18:00 – 21:00	Dinner (Arla Restaurant, Maahas, Los Baños, Laguna

September 26, 2007

8:30 – 9:00	Opening
8:15 – 10:30	Identification of Methodologies
10:30 – 10:45	Coffee Break
10:45-12:00	Writeshop: Draft of Country Paper Outline
12:00 – 13:00	Lunch
13:00 – 14:30	Presentation of Writeshop Outputs
14:30 – 14:45	Coffee Break
14:45 – 16:30	Timeline, Contracts, Conclusions and Closure - ***Dr. Lasco***
18:00 – 21:00	Dinner (Kamayan sa Palaisdaan, Bay, Laguna)

Annex 3. LIST OF PARTICIPANTS

PROJECT LEADER

Dr. Rodel D. Lasco
Philippine Programme Coordinator
World Agroforestry Centre (ICRAF)
Email: r.lasco@cgiar.org; rdlasco@yahoo.com

INDONESIA

Mr. Perdinan
Faculty of Mathematics and Natural Science
Bogor Agricultural University
Email: perdinan@gmail.com

LAO PDR

Dr. Chanthaphone Phon-asa
Faculty of Forestry and Agriculture
National University
Lao PDR
Email: cpa6465@yahoo.com

PHILIPPINES

Dr. Florencia Pulhin
University Researcher
Forest Development Center/ Environmental Forestry Program
College of Forestry and Natural Resources
University of the Philippines, Los Baños
Email: enfor@laguna.net; yaybpulhin@yahoo.com

VIETNAM

Dr. Nguyen Thi Hien Thuan
Deputy Director
Sub-Institute of Hydrometeorology and Environment of South Viet Nam (SIHYMETE)
Institute of Meteorology and Hydrology (IMH)
Ministry of Natural Resources and Environment (MONRE)
Email: hien.thuan@hcm.vnn.vn; hienthuan@sihymete.org.vn

SUPPORT STAFF

Rafaela Jane P. Delfino
Research Assistant
World Agroforestry Centre (ICRAF)
Email: rafaelajanepdelfino@gmail.com; R.Delfino@cgiar.org

ANNEX 4. Photo of the participants

7.2.2 Science Policy Workshop Report

Florencia Pulhin

Introduction

The project entitled: "Linking Climate Change Adaptation and Sustainable Development in Southeast Asia" is a two-year collaborative project of the World Agroforestry Centre (ICRAF), Asia Pacific Network for Global Change Research (APN) and Global Change System for Analysis, Research and Training (START). Its general objective is to clarify the links between climate change adaptation and sustainable development. Specifically it aims to: (1) synthesize research on adaptation strategies for climate change and climate variability in SE Asian countries; (2) analyse the links of adaptation strategies to the sustainable development goals of the respective countries; (3) hold a science-policy workshop to disseminate results and solicit recommendations; and (4) publish the results of the study in a format that is useful to policy makers and other stakeholders. The project is participated by four SE Asian countries: Indonesia, Lao PDR, the Philippines and Vietnam.

The science-policy workshop was held at Sulo Hotel, Quezon City, Philippines on September 24, 2008. The workshop was conducted to: (1) disseminate results of the project; (2) solicit comments and recommendations; (3) identify potential points of entry, strategies/activities to be undertaken and responsible agencies.

This document contains the report of the Science-Policy Workshop on Linking Climate Change Adaptation in Sustainable Development. It provides a summary of the presentations, discussions and outputs of the workshop. This section is an introduction for the document. Section 2 shows the brief description of the program and agenda. Section 3 includes the synthesis of the country presentations. Section 4 contains the issues and concerns raised during the workshop and Section 5 presents the outputs of the workshop.

Design of Program

Dr. Rodel Lasco, the project leader, opened the meeting by welcoming the participants. Right after the "Welcome Remarks", Dr. Lasco provided an overview of the project. He presented the rationale of the project, objectives, relevance to APN science and policy agenda, the framework of analysis, and the methods used.

After the project overview, a background paper was presented by Dr. Juan M. Pulhin, Professor of the College of Forestry and Natural Resources, University of the Philippines Los Banos and one of the IPCC-AR4 lead authors. Titled "Climate Change and Sustainable Development" Dr. Pulhin's presentation covered the following: (1) overview of climate change; (2) impacts of climate change in Asia; (3) climate change and sustainable development; and (4) conclusion.

After the paper presentation, an open forum was held to provide a venue for discussion.

Following the background paper, synthesis papers were presented by the country collaborators from Indonesia, the Philippines and Vietnam. The synthesis papers contain the results of the studies conducted in each country The paper from the Philippines focused on water and sustainable development while the papers from Indonesia and Vietnam linked agriculture with sustainable development.

After the presentations of the country papers, an open forum was undertaken to solicit comments and recommendations.

In the afternoon, a workshop was held to identify potential points of entry, strategies/ activities to be undertaken and responsible agencies in the three sectors: (1) agriculture and natural resources; (2) infrastructure; and (3) policy. Each group was asked to report during the plenary session to solicit comments/suggestions/critique on the outputs presented.

Synopsis of Presentations

Project Overview

The paper by Dr. Lasco provided an overview of the project. His paper emphasized that adaptation will be necessary to address impacts resulting from the warming which is already unavoidable due to past emissions. A wide array of adaptation options is available, but more extensive adaptation than is currently occurring is required. To attain sustainable development amidst the new climate regime, adaptation needs to be mainstreamed. He stressed that the project hopes to contribute to the mainstreaming of climate change adaptation to the sustainable development agenda of SE Asian countries. Specific objectives of the project were also mentioned which include:

- Synthesize research on adaptation strategies for climate change and climate variability in SE Asian countries;
- Analyze the links of adaptation strategies to the sustainable development goals of the respective countries;
- Hold a science-policy workshop to disseminate results and solicit recommendations; and
- Publish the results of the study in a format that is useful to policy makers and other stakeholders

He further mentioned that the main hypothesis of the project is that climate change adaptation strategies and policies are consistent with and promote sustainable development at various scales (farms to watersheds to nations). Other things considered in the project were:

- How to mainstream climate change to (sustainable) development
- What are the entry points in mainstreaming
- Cases where there is conflict between climate change adaptation and sustainable development

Climate Change and Sustainable Development

Dr. Juan Pulhin provided an overview of climate change by discussing the causes of climate change, the contribution of human activities to climate change and the increasing trend of global temperatures observed over time.

The second part of his paper dealt with the impacts of climate change in Asia. These include: (1) sea level rise: (70-90 cm in Huanghe; 50 to -70 cm in Changjiang; 40 to -60 cm in Zhujiang); (2) decrease in rice yields by up to 40% in irrigated lowland areas of central and southern Japan under doubled atmospheric CO_2; (3) decrease in cereal yields by 30% by 2050 in South Asia; (4) severe water stress in the 21st century in West Asia; (5) decline of gross per capita water availability in India from 1,820 m^3/yr in 2001 to as low as 1,140m^3/yr in 2050; (6) likely to lose around 30% of Asia's coral reefs in the next 30 years due to multiple stresses and climate change; (7) decline of net primary productivity of grassland in colder regions of Asia; (8) reduced milk yields and increased incidence of diseases in animals due to limited herbaceous production, heat stress and

poor water intake; (9) increase in forest production in North Asia due to carbon fertilization but combined effects of climate change, extreme weather events and human activities are likely to increase forest forest-fire frequency; (10) increase in coastal water temperatures would exacerbate abundance and / or toxicity of cholera in South Asia; (11) disappearance of Tibetan Plateau glaciers of <4 km with 3°C temp rise without change in precipitation; (12) decline of freshwater decline in Central, South, East, South East Asia; (13) 0.12 to 1.2 billion people will be under increased water stress by 2020 and 0.185 to 0.981 B by 2050; (14) additional 49 million people will be at risk of hunger by 2020 and it will increase by 132 million and 266 million by 2050 and 2080, respectively; (15) increase in maximum monthly flow (35-41%) by 2038 and decrease in minimum monthly flow (17-24%) of Mekong River; (16) increase in endemic morbidity and mortality due to diarrhoeal_disease associated with floods and droughts in East, South and South East Asia; (17) in Bangladesh 1,000 km^2 of cultivated land and sea product culturing area could become salt marsh; and (18) 5,000 km^2 of Red River delta, and 15,000-20,000 km^2 of Mekong River delta could be flooded

The third part of Dr. Pulhin's paper discussed the linkage between sustainable development and climate change. In his discussion, he emphasized that the bottom line is that climate change will drag the economy and sustainable development because there will be loss of lives, destruction of infrastructures, loss of income, more sickness, will make the poor people poorer and will threaten/degrade ecosystems.

The best way to address climate change according to him is to integrate climate change adaptation in development programs of the country. This can be done by: (1) making climate information more relevant and usable; (2) developing and applying climate risk screening tools; (3) using appropriate "entry points" for climate information; (4) shifting emphasis to implementation rather than developing new plans; and (5) encouraging meaningful coordination and the sharing of good practices

In conclusion, he mentioned that climate change poses challenge to social and economic development. Developing countries including most of South East Asian nations are particularly vulnerable because their economies are generally more dependent on climate-sensitive natural resources, and they are less able to cope with the impacts of climate change. Furthermore, he mentioned that how development occurs has in turn implications to climate change and for the vulnerability of societies to its impacts. Efforts to cope with the impacts of climate change and attempts to promote sustainable development share common goals and determinants which include: (1) access to resources (including information and technology); (2) equity in the distribution of resources, stocks of human and social capital; and (3) access to risk-sharing mechanisms and abilities of decision-support mechanisms to cope with uncertainty. Thus, alternative development pathways should be pursued that will address both climate change and unsustainable development

Photo 1. Dr. Rodel D. Lasco presenting the overview of the project

Photo 2. Dr. Juan M. Pulhin presenting his paper on climate change and sustainable development

Synthesis Papers

Indonesia

The paper by Perdinan, Boer and Kartikasari was presented by Ms. Kiki Kartikasari of the Climatology Laboratory, Department of Geophysics and Meteorology, Bogor Agricultural University. It centered on linking climate change adaptation options for rice production and sustainable development goals in Indonesia. They pointed out that rice, being a staple food for Indonesians is a very important commodity. However, amount of production has been observed to decrease because of the impacts of current climate variability and extremes. With climate change, it is expected that rice production will be further affected.

Ms. Kartikasari mentioned that the Indonesian government through the Ministry of Environment proposed that adaptation to climate change should be undertaken through a number of ways: (1) integrate the climate change adaptation agenda into national development plans such as Medium and Long Term Development Plans; (2) review and adjust the existing initiatives or programs, so they will be resilient to climate change; (3) institutionalize the use of climate information in order to have capability to manage climate risk; (4) encourage local autonomy to integrate consideration of climate risk into local development plans; (5) strengthen the information and knowledge to reduce present and future climate risk; (6) ensure the availability of domestic resources and funding for adaptation activity and maximize the use, probably with the international support; (7) choose no regret option, which is conducting adaptation action with or without climate change so the benefit received could be used to reduce the vulnerability to climate change, but also could be used for national development benefit; and (8) encourage a national dialogue to accelerate implementation process of adaptation agenda to climate change in Indonesia.

In terms of adaptation options proposed by the researches conducted in Indonesia, Ms Kartikasari enumerated the adaptation options offered by Boer (2007) and (GOI 2007) for rice production in the country. These include: (1) change in cropping pattern; (2) use of cropping calendar; (3) efficiency of water use; (4) rain fed rice development; (5) pest and diseases control; (6) search for new variety tolerant to high temperature; (7) develop early warning system to flood and drought; and (8) integrated management of water use.

Moreover, programs by the RAN-MAPI (Rencana Aksi Nasional Menghadapi Perubahan Iklim - National Action Plan to Cope with Climate Change) for the agriculture sector was presented. Based on that document the government is decided to pursue the program on "Revitalized Agriculture" for the period 2005-2009 The three major programs focused on food supply, agribusiness development and farmers' income. Thus, in the context of climate change adaptation for rice production, the proposed adaptations should be directed not only to increase the production but also to increase the farmers' income and agribusiness development. Achievement to these three focused programs will lead to improved economy of livelihoods in the rural region in Indonesia.

The next section of the paper established the link between climate change adaptation for rice production and sustainable development. According to the paper, by implementing climate change adaptation strategies, sustainable development is also achieved. Adaptation programs that would be useful to stabilize and increase the rice production in Indonesia as well as to cope with climate change risks include: (1) mapping of vulnerable regions to drought/flood; (2) modified cropping pattern and institutional development; (3) insurance system to secure the yield or revenue from

cultivating rice; and (4) come up with the real action by establishing "Rice Information and Distribution Center"

In conclusion, the paper made four points: Firstly, the inclusion of climate change adaptation strategies to rice development will secure and enhance the implementation of the rice production increasing strategies to meet its demand. This expected achievement will lead directly to economic development in the rural regions and alleviate the poverty which is related to the first target of the Millenium Development Goals. Secondly, the two major programs devoted to increase the rice production (intensification and extensification) have also been addressed well by the inclusion of climate change adaptation strategies. Thirdly, adaptation options for the agriculture sector are already formulated by the Indonesian government through the Ministry of Environment within the RAN-MAPI document. In addition, the State Ministry of Government Planning attempted to incorporate the climate change issues including the adaptation options to Medium-term and Long-term National Development Plan. Finally, further research on developing reliable projected climate change data for conducting real assessment of possible impacts of climate change on Indonesia rice production is a key challenge that should be addressed seriously.

Philippines

The paper from the Philippines was presented by Dr. Florencia B. Pulhin, Researcher of the Forestry Development Center, College of Forestry and Natural Resources, University of the Philippines Los Banos. The paper was divided into nine sections: (1) introduction; (2) review of climate change adaptation studies in the Philippines; (3) method used; (4) climate change and sustainable development; (5) water and sustainable development; (6) analysis of policies, sustainable development plans and programs; (7) mainstreaming climate change adaptation in sustainable development agenda of the water resources as viewed by the stakeholders; and (8) conclusion

The first part of the paper discussed the evidences of climate change in the Philippines and the vulnerability of the poor people to climate related events. According to the paper, records show that temperature in the country had increased from 1951 to 2006. Aside from rising temperatures, it has been observed that amount of precipitation decreased by 6% during the turn of the century. In the same manner, occurrence of ENSO events was observed to become more frequent since 1980. For instance from 1982 onwards, strong El Nino event occurred every five years (1982-1983, 1987-1988, 1992-1993, 1997-1998). Number of strong typhoons (> 185 kph wind speed) hitting the Philippines from 1980 to 2006 also follow an increasing trend. Rising sea levels, one of the indicators that climate change is occurring, have been observed to happen from five major stations (Manila, Legazpi, Cebu, Davao and Jolo). Annual mean sea level is observed to increase in Manila since 1960s while for the rest of the stations, sea level rise occurred in 1970s. In the Manila, Legazpi and Davao stations, an increase of almost 15 cm was observed from 1980-1989. This value is the lowest expected sea level rise set by the IPCC (Perez, 1998).

At current climate variability and extremes, such as flooding, drought, delay and early onset of rainy season, the poor sectors are already vulnerable because most often, sources of their livelihood are limited and are mostly based on natural resources. During floods or drought, their sources of livelihood fail to provide them with crops to eat and cash to meet the needs of their families.

The second part of the paper discussed the researches undertaken in climate change adaptation where she emphasized that currently, there are limited studies conducted on this aspect. These include study undertaken by Jose and Cruz (1999) who assessed the

impacts of climate change on water resources using hydrological model, Acosta-Michlick (2005) who assessed vulnerability of the farmers to globalization and climate change using the agent based model and Lasco *et al* (2006) who conducted the first integrated assessment of climate change impacts, vulnerability and adaptation in watershed areas and communities in the Pantabangan-Carranglan watershed (PCW).

The third section described the methodology used in the study conducted which includes one on one interview with stakeholders and analysis of water policies and sustainable development plans and programs.

Part 4 of the paper discussed the concept of sustainable development as espoused by the 1987 Brundtland Commission Report. According to that report, sustainable development is the "development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs". Also, the three pillars of sustainable development: ecology, economy and social were elaborated.

The next section established the link between sustainable development and climate change. According to the paper, sustainable development and climate change are closely linked with each other since climate change is a significant factor that can influence sustainable development. To attain sustainable development amidst the climate change regime, development activities to be undertaken must contribute to the country's overall efforts of poverty reduction among the rural poor.

Section 6 discussed the water resources of the Philippines, problems faced by such sector and its link to sustainable development. According to the paper, insufficient water supply, low water quality and degradation of watersheds decrease productivity of the poor people, decrease crop yield of small farmers and limits the growth of the industry sector. This in turn affects attainment of sustainable development goals of the country.

Section 7 provides an analysis of the policies in the water sector, and sustainable development plans and programs of the country. Dr. Pulhin stressed that although existing policies already deal with the regulation of water quantity and quality, there was no mention of the issue of climate change. Likewise, in all the sustainable development plans (Medium Term Development Plan, Millenium Development Goals progress report, and the Agenda 21), climate change adaptation has not been mainstreamed. However in PA 21, climate change was cited once. According to the document, there is a need to promote and adopt methods for impact assessment of climate change on water resources.

The next section provided the views of the stakeholders on mainstreaming climate change adaptation in the water sector in the Philippines. According to the paper, there is high recognition that mainstreaming climate change adaptation in water sector is important. Various reasons cited for this include: (1) will speed up the formulation of measures/programs that will reduce the impacts of climate change on water quality and quantity; (2) will increase awareness of the different sectors on climate change and its impacts; (3) will ensure funding for adaptation activities and hence will help reduce climate change impacts; (4) will promote more integrated efforts to address climate change; (5) will encourage participation of all sectors of society; (6) will help in proper land use planning; and (7) will support sustainable development.

Likewise, barriers to mainstreaming climate change adaptation to policies, plans and programs were identified by the stakeholders. These include: (1) lack of information on climate change among the policy makers and heads of agencies; (2) climate change is

considered as an emerging issue only; (3) not a priority program of the government; (4) No single agency responsible for water; (5) reactive attitude of the heads of agencies; (6) matters regarding climate change are the concern of PAGASA only; (7) no ensured funds to implement programs related to climate change; and (8) direct relationship between climate change and water sector not fully established

Mainstreaming climate change adaptation can be enhanced through: (1) building the capacity of all sectors (2) providing funds for climate change programs; (3) creation of a single body that will coordinate climate change activities; (4) presence of a strong political will; (5) uplifting the socio-economic conditions of the poor; (6) presence of strong commitment of all sectors and (7) coordination among institutions concerned with water resources.

In conclusion, Dr. Pulhin mentioned that all the stakeholders believe that mainstreaming climate change adaptation in the policies, plans and programs of the water sector are important to cope with the adverse impacts of climate change. She offered potential points of entry in three areas: infrastructure, policy and plans. For infrastructure, points of entry could be adjustment of size of drainage canals to accommodate possible strong flows and adjustment of the design of the dams. For policy, potential points of entry include: (1) mandatory for new buildings/homes to install rainwater harvesting facility; (2) provide incentives i.e reduction on property tax; (3) construction of harvesting ponds; and (4) regulation of shallow tube wells. For plans, potential points of entry are the incorporation in reforestation plan, the use of drought resistant species and incorporation in land use plan of vulnerable areas.

Vietnam

The third synthesis paper was presented by Dr. Nguyen Thi Hien Thuan of the Sub-Institute of Hydrometeorology & Environment of South Viet Nam. She divided her presentation into six parts. The first part provided a brief background about Vietnam. The second part discussed the disasters faced by Vietnam which include tropical monsoon, typhoons, landslides and forest fires and its impacts to different sectors including agriculture. According to Dr. Thuan, climate related events affect the growth and productivity of plants, cropping seasons, and may enhance occurrence of pest and diseases.

The third part stressed the key role that agriculture play in Vietnam's economy. According to the paper, it contributes 21% to the country's gross domestic product (GDP) and 30% of total export earnings in 2006. Rice is the single most important crop. However, with climate change, it is feared that production of rice will be affected.

Section 4 of Dr. Thuan's paper dealt on the inventory of researches on climate change in Vietnam. She reported that one of the high priority areas for research is on the impacts of climate related events on agriculture. Results of researches undertaken indicate that a rice yield will be reduced by 10-20% in Northern Delta. To reduce the impacts of these climate related events, a number of measures have been suggested. These include: change of crop calendars, change in crop patterns, and change in crop rotations.

Part 5 of the paper discussed the sustainable development plans of Vietnam as well as the policies for the agriculture sector in the country. The sustainable development plans include: (1) National Rural Clean Water Supply and Sanitation Strategy to 2020 (RWSS Strategy, 2000); (2) Strategic Socio-Economic Development 2001 – 2010 (SSED, 2001); (3) Vietnam Development Goals (MDG/VDG, 2001); (4) Strategy and Action Plan for Disaster Mitigation and Management in Viet Nam 2001-2020; (5) Comprehensive Poverty Reduction and Growth Strategies (CPRGS, 2003); (6) National

Strategy for Environmental Protection until 2010 and vision toward 2020 (NSEP, 2003); (7) Strategic orientation for sustainable development in Vietnam (Agenda 21 Vietnam, 2004); (8) 5-year Plan for the Agricultural and Rural Development 2006 -2010 (2004) (9) Targets of Socio-economic Development 2006-2010 (TSED, 2006); and (10) Five-year plan for natural resources and environment 2006-2010.

The succeeding section discussed the results of the analysis made by Dr. Thuan as regards the link between sustainable development and climate change. She mentioned that more attention has been put on natural disasters, climate change mitigation rather than climate change adaptation. As in other developing countries, the mainstreaming process in Vietnam is also in its early stages. In the past, many solutions responded to climate variability with a range of isolated structural and non-structural responses.

Furthermore, she discussed that there are main approaches which need to be adopted for considering adaptation to climate change in development policies, plans and programs: (1) addressing adaptation challenges for climate change within various stages of preparing the development plans, programs or policies; and (2) incorporating climate change adaptation into assessment tools. With regards to entry points to mainstream climate change, NTP workshops and consultations revealed the following:

- The policy framework
- Institutional arrangements
- Consultation and coordination processes
- Financing and budgeting
- Tools and methods for adaptation
- Awareness raising

In conclusion, she stressed that climate change is a very real threat to Viet Nam's continued socio-economic development because of the projected impacts of climate change in agriculture. Viet Nam is now underway to set up a national climate change adaptation strategies, and national and local capacity building is urgently needed to ensure that policy responses are adequate and effective. Coordination between line ministries also needs to be urgently improved, and cooperation with international agencies and NGOs enhanced so that climate change can be addressed in an integrated way with long-term socio-economic and poverty reduction efforts.

Photo 3. Dr. Florencia Pulhin presenting the synthesis paper of the Philippines

Photo 4. Dr. Nguyen Hien Thuan presenting the synthesis paper for Vietnam.

Issues/Concerns

After the paper presentations, an open forum was undertaken to provide a venue to discuss issues/concerns. The following provides the highlight of issues/concerns raised:

1. Data availability
   Currently, PAG-ASA does not provide historical data to those who are interested to acquire climate data. They give climate data for 5 years only.

2. Limitations on equipment of PAG-ASA
   Currently, there is limited climate information available in some areas because climate radar is limited. Through the MDG adaptation project, the IACCC whose secretariat seats at DENR is working with PAG-ASA on projection and climate scenario. The project aims to capacitate PAGASA in developing climate scenario with projection and identification of vulnerable areas

3. Irreversibility of climate change
   Climate change is irreversible so there is a need to mitigate and prepare for adaptation

4. Mainstreaming strategies in the full context of sustainable development must be outlined. The manner by which mainstreaming can be undertaken and the timeline must also be indicated.

5. Lack of holistic approach in improving water supply. Fragmented dealing of the problem is a nagging problem in the Philippines. There should be a holistic approach to solve the problem of water supply through improved watersheds.

6. The Philippine government must pursue with law on organic farming although it is not very easy to implement.

7. The use of varieties resistant to floods and drought must be promoted as adaptation strategies.

8. Climate field school similar to the one in Indonesia must be promoted to help farmers cope with the adverse impacts of climate change.

9. To mainstream climate change adaptation, the policy makers must be informed of the impacts of climate change.

10. Women should be taken in consideration in the issue of climate change because aside from children, they are highly affected by climate change

11. Current efforts of the Philippines government in addressing climate change include the creation of a climate change commission under the Office of the President, and the appointment of a Presidential Adviser for Global Warming and Climate Change.

Workshop

The whole afternoon was devoted to workshop proper where the participants were divided into three groups: agriculture and natural resources, policy and infrastructure. Each group identified the potential points of entry, corresponding strategies/activities and the responsible agencies.

Photo 5. Participants during the workshop.

Outputs:

Agriculture and natural resources

Points of Entry	Strategies/Approaches	Responsible Institutions
Technology/sustainable practices	Incorporate Sustainable Agriculture as framework/technology; institutionalize framework Irrigation scheme should be managed properly; utility should not be limited to agriculture but also for industry and domestic Optimization of warning device – disaster mitigation Compatibility of farming practices e.g. adjusting cropping calendar, irrigation management, etc. Greening: Massive restoration and rehabilitation of watershed areas Coastal: wetland restoration Establish a monitoring body -- sea level rise	Inter-agency (through ministries/regional government for Vietnam)

Points of Entry	Strategies/Approaches	Responsible Institutions
Policy	Proclamation of watershed areas Policy change – every major project should have to present a cost and benefit analysis including environmental cost and benefit analysis Provide mandate for local communities to manage and control resources within their area Water User's Fee: Payment for environmental services Should adopt stewardship concept/contract – paying proper tax to appropriate agency Policy should be legislated and institutionalized Capacitate local communities to properly utilize the fees Taxation of Green House Gas Emission; Incentives should be given to pro-envi technology	Congress, DENR No one to take the lead –
Economic	Provide alternative livelihood	
Institutional support	Participatory approach in convening various stakeholders for CC adaptation Task Force on Climate Change (communication plan 2 in the works)	EMB (secretariat of the Inter-Agency Commission on Climate Change)
	Importation of agricultural crops – subsidy of government Review existing bilateral agreements; review of existing policies on importation	

Points of Entry	Strategies/Approaches	Responsible Institutions
	Alternative food e.g. to rice	
Policy compliance	Review of policies Integrate climate change in existing policies Identify laws that require	
Poverty reduction	NRM should adhere to poverty reduction	
Biodiversity	Sustainable agriculture should be followed	

Policy Development

Points of Entry	Strategies/Approaches	Responsible Institutions
1. Legislation	a. coming up with the EO that will integrate climate change in various levels of planning (national to local) as well as sectoral planning (agriculture, forestry, environment, health, etc) b. review the existing structures and mandates of institutions c. Drum up support on Climate change bill (Sen. Legarda's Bill, etc)	SEPO, CPBO, DENR, PMS/OP, academic institutions
2. Medium-term Philippine Development Plan (MTPDP)	Inserting explicit statements on climate change in the appropriate Chapters of the MTPDP	NEDA
A. Planning and Implementation		
1. Revisiting existing sectoral plans/programs	Review the governing laws/codes/technical guidelines including sectoral plans, policies and programs and make them climate change proof and link them towards SD, including among others biodiversity and natural resource conservation a. Review of EIA – inclusion of climate change as one of the factors or criteria for conducting EIA b. Examine conflicting laws	NEDA, DENR , academic institutions and concerned civil society groups

Points of Entry	Strategies / Approaches	Responsible Institutions
	or policies on ENR c. Upscale SD programs of line agencies to link up with CC	
2. Building information management system on Climate change	Develop Climate profile and standards a. Climate change profiling on each political governance unit (regional, provincial and municipal level) b. Set up common climate change indicators/standards for planning, implementation and monitoring purposes	DENR, NSCB/NSO, media and academic institutions
3. Strengthening IEC/Advocacy on climate change	Mobilizing civil society and private sector participation on climate change advocacy	Media, DENR
4. Curriculum development on Climate change	Integration of climate change in the curriculum of academic institutions	DepED, CHED
5. Creation of Advisory Council/TWG on climate change(provide technical inputs to policy development)	Tap professional s in having scientific based planning and implementation of CC	DENR, OP, NEDA, DBM

Infrastructure

Points of Entry	Strategies/Approaches	Responsible Institutions
1) Drainage design	• Enforcement of PD 705 on forestry and other related laws pertaining to easement • Inclusion of extreme events related to climate change in the design of flood mitigation infrastructures	Lead: DPWH Partner: DENR, MMDA, NIA, etc.
2) Building design/water harvesting	• Inclusion of design for ground water recharge in subdivisions and buildings for water harvesting. • Water impoundment for induced infiltration	Lead: HLURB/DA Partner: DPWH, etc.
3) Judicial reform	• Enforce environmental laws so appropriate infrastructure designs are followed	Lead: DOJ Partner: DENR, DA, DPWH
4) National body for climate change adaptation	• incorporating infrastructure concerns into the agenda of the national body	Lead: Office of the President
5) Data accessibility	• make data accessible to enable better forecasting and design by participating agencies for climate change adaptation	Lead: NSCB Partner: PAGASA, other govt data holding agencies
6) Rationalization and harmonization of existing laws and policies	Attune current laws and policies (e.g., EO318, land use, MTPDP) to climate change adaptation	Lead: NEDA and Congress

Annex 1. Programme

8:30 - 9:00	REGISTRATION	
9:01 – 9:11	Opening Remarks	Dr. Rodel D. Lasco *Country Coordinator, ICRAF-Phils and Principal Investigator, APN Project*
9:12 – 9:22	Overview of the Project	Dr. Rodel D. Lasco
9:23 – 9:43	Climate Change and Sustainable Development	Dr. Juan M. Pulhin *Professor and Scientist II, UPLB*
9:44 – 9:59	OPEN FORUM	
10:00 – 10:20	Linking Climate Change Adaptation Options for Rice Production and Sustainable Development Goals in Indonesia	Ms. Kiki Kartikasari *Research Assistant* *Bogor Agriculture University, Indonesia*
10:21 – 10:41	Linking Adaptation Strategies for Water Resources to Sustainable Development in the Philippines	Dr. Florencia B. Pulhin *Researcher* *ICRAF-Phils and UPLB*
10: 42 – 11:02	Linking Climate Change Adaptation Options for Agriculture in the Mekong River Delta to Vietnam's Sustainable Development	Dr. Nguyen Thi Hien Thuan, *Institute of Meteorology and Hydrology, Ministry of Natural Resources and Environment, Vietnam*
11:03 – 11:50	OPEN FORUM	
11:51 – 12:00	Workshop Mechanics	Dr. Florencia B. Pulhin
12:01 – 1:00	LUNCH BREAK	
1:01 – 3:00	WORKSHOP	
3:01 –4:01	PLENARY	
4:02 – 4:30	Next Steps	Dr. Rodel D. Lasco
4:31 –4:51	Closing Remarks	Dr. Thuong Van Hieu *Vice Director, Department of Science and Technology, Vietnam* Dr. Haris Syahbuddin, *Head of Evaluation Section Research and Development Center of Plantation Ministry of Agriculture, Indonesia*

EMCEE/MODERATOR
Dr. Enrique L. Tolentino Jr.

Annex 2. List of Participants

Project Team	
Rodel Lasco Project Team Leader Country Coordinator / Senior NRM Scientist ICRAF Philippines 2/F Khush Hall, IRRI, Laguna, Philippines 049 536 2701 to 2705 local 2675 r.lasco@cgiar.org; rdlasco@yahoo.com	**Florencia Pulhin** Project Collaborator Philippines ICRAF Philippines 2/F Khush Hall, IRRI, Laguna, Philippines 049 536 2701 to 2705 local 2860 yaybpulhin@yahoo.com
Nguyen Thi Hien Thuan Project Collaborator Vietnam Institute of Meteorology and Hydrology (IMH) Ministry of Natural Resources and Environment (MONRE)	**Kiki Kartikasari** Project Collaborator Indonesia Bogor Agriculture University (IPB)
INDONESIA	
Dr. Haris Syahbuddin Head of Evaluation Section Research and Development Center of Plantation Ministry of Agriculture, Indonesia	**Ir. Endang Titi Purwani Pradhana** Head of Mitigation on Climate Impact Section Directorate General of Food Crops Ministry of Agriculture, Indonesia
VIETNAM	
Dr. Thuong Van Hieu Vice Director Department of Science and Technology, Vietnam	**Luong Viet**
LAO PDR	
Bounmi Phommakone Luangprabang Agriculture and Forestry College Luangrabang Province, Lao PDR 09107673548	
PHILIPPINES **Government Agencies**	
Ecosystem Research and Development Bureau (ERDB) - Department of Environment and Natural Resources (DENR)	
Lope Calanog OIC – Assistant Director	**Honorato Palis** Supervising Science Research Specialist

Ecosystem Research and Development Bureau College, Laguna, Philippines	Ecosystem Research and Development Bureau College, Laguna, Philippines
Environmental Management Bureau - Department of Environment and Natural Resources	
Joyceline Goco Supervising Environmental Management Specialist EMB – DENR 2/F, HRD Bldg, DENR Compound Visayas Ave., Quezon City	
Forest Management Bureau - Department of Environment and Natural Resources	
Jesus Javier Chief Reforestation Division FMB Bldg, Visayas Ave, QC	**Jesus DL Posadas, Jr.** Forest Management Specialist
Mayumi Quintos – Natividad Chief Forest Economics Division	**Rebecca Aguda** Senior Forest Management Specialist
Arvie Tirso Caancan Senior Forest Management Specialist	**Orlando Panganiban** Senior Forest Management Specialist
Orly Cariazo Senior Forest Management Specialist	
Laguna Lake Development Authority (LLDA)	
Adelina Santos Borja Division Chief III Rizal Provincial Capitol, Shaw Blvd Pasig City	---
National Power Corporation (NAPOCOR)	
Emmanuel Umali Department Manager Watershed Management Department Bldg1, NPC BLdg, Cor. Quezon Ave & BIR road Diliman, Quezon City ihan5@yahoo.com	**Donald Marcelino** Bldg1, NPC BLdg, Cor. Quezon Ave & BIR road Diliman, Quezon City
National Economic and Development Authority (NEDA)	
Sheila Marie Encabo OIC Director Agriculture NEDA 12 St. J.M Escriva Drive, Ortigas Center Pasig City	**Mayo Grace Amit** Chief Economic Development Specialist NEDA 12 St. J.M Escriva Drive, Ortigas Center Pasig City MCAmit@neda.gov.ph

Katherine Fermiza Senior Economic Development Specialist NEDA 12 St. J.M Escriva Drive, Ortigas Center Pasig City	**Kathleen Anne Capriso** Senior Economic Development Specialist NEDA 12 St. J.M Escriva Drive, Ortigas Center Pasig City
Diane Llanto Economic Development Specialist NEDA 12 St. J.M Escriva Drive, Ortigas Center Pasig City	**Lenard Guevarra** Economic Development Specialist NEDA 12 St. J.M Escriva Drive, Ortigas Center Pasig City
National Irrigation Administration	
Saida Almedona Watershed Management Officer NIA, Edsa, Diliman, Quezon City	
House of Representatives	
Marlon Valencia Supervising Legislative Staff Officer II Committee on Natural Resources mtvnatres@gmail.com	**Rosa Guzman** Committee Secretary Committee on Agriculture
Resi Palma Marinas Consultant for ENR Office of Senator Legarda 2/F, Senate of the Philippines, GSIS Bldg Roxas Blvd, Pasay City	
PHILIPPINES **Academe**	
Miriam College	
Ma Rosario Wood Head, Science Department Miriam College UP PO Box 110, Diliman, QC crivera@mc.edu.ph	
University of the Philippines Los Banos (UPLB)	
Enrique Tolentino, Jr. Director Forest Resource Management College of Forestry and Natural Resources UPLB	**Juan Pulhin** Professor and Scientist II Social Forestry and Forest Governance College of Forestry and Natural Resources UPLB
Renato Lapitan Forest Resource Management	**Elsa Santos** Social Forestry and Forest Governance

College of Forestry and Natural Resources UPLB	College of Forestry and Natural Resources UPLB
Jose Sargento Director Makiling Center for Mountain Ecosystem UPLB	
PHILIPPINES **Non government organization**	
Energy Development Corporation	
Agnes de Jesus Senior Vice President Energy Development Corporation Energy Center, Fort Bonifacio, Taguig City	
HARIBON FOUNDATION	
Gregorio dela Rosa, Jr. Researcher/Biologist 2/F, Santos and Sons Bldg 973 Aurora Blvd, Cubao, QC	
ICLEI Local Goverment for Sustainability	
Zenaida Ranario Tagolino Admisitrative Officer ICLEI Local Government for Sustainability Manila Observatory, ADMU Campus Loyola Heights, QC	
Kalahan Educational Foundation	
Pastor Delbert Rice Executive Director kalahan2@gmail.com	
Lingkod Tao-Kalikasan Foundation, Inc	
Jonjon Sarmiento ltkfi@yahoo.com	
Local Water Utilities Administration	
Virgilio Bombeta Manager MWSS-LWUA Complex Katipunan Avenue, Balara, QC	
PhilDHRRA	

Ernesto Lim, Jr. Coordinator Brgy Kalunasan, Capitol Hills, Cebu City	**Luz Angeles Alamagro-Blanco** Regional Coordinator Brgy Kalunasan, Capitol Hills, Cebu City
Philippine Network on Climate Change	
Roslyn Arayata roslynarayata@yahoo.com	
Upland NGO Assistance Committee (UNAC) Secretariat	
Diana Martinez Administrative Officer 59 C Salvador St. Loyola Heights, QC	
Research Organization **Conservation International – Philippines**	
Oliver Coroza Conservation International Philippines 6 Maalalahanin Street Teacher's Village Quezon City 1101 Philippines +63 2 9248235 o.coroza@conservation.org	**Ruth Grace R. Ambal** Conservation International Philippines 6 Maalalahanin Street Teacher's Village Quezon City 1101 Philippines +632 924-8235/ 433-5129/ 4338429 r.ambal@conservation.org
Rowena Boquiren Conservation International Philippines 6 Maalalahanin Street Teacher's Village Quezon City 1101 Philippines +63 2 9248235 r.boquiren@conservation.org	**Mariano Roy Duya** Conservation International Philippines 6 Maalalahanin Street Teacher's Village Quezon City 1101 Philippines +63 2 9248235 m.duya@conservation.org
World Agroforestry Centre(ICRAF)– Philippines	
Rafaela Jane P. Delfino ICRAF Philippines 2/F Khush Hall, IRRI, Laguna, Philippines 049 536 2701 to 2705 local 2675 r.delfino@cgiar.org; rjpdelfino@yahoo.com	**Rizza Karen Veridiano** ICRAF Philippines 2/F Khush Hall, IRRI, Laguna, Philippines 049 536 2701 to 2705 local 2675 Veridiano_rizzakaren@yahoo.com
Adrian Albano ICRAF Philippines 2/F Khush Hall, IRRI, Laguna, Philippines 049 536 2701 to 2705 local 2860 a.albano@cgiar.org	**Frederick Esternon** ICRAF Philippines 2/F Khush Hall, IRRI, Laguna, Philippines 049 536 2701 to 2705 local 2860

7.3 List of Acronyms / Abbreviations

AFMA	Land Use Act and Agriculture and Fisheries Modernization Act
CA	Commonwealth Act
CFNR	College of Forestry and Natural Resources
DAO	DENR Administrative Order
DENR	Department of Environment and Natural Resources
DOE	Department of Energy
DOST	Department of Science and Technology (),
EIA	Environmental Impact Assessment
ENFOR	Environmental Forestry Programme
ENSO	El Nino Southern Oscillation
IACCC	Inter-Agency Committee on Climate Change
IPCC AR4	IPCC Fourth Assessment Report
LGUs	local government units
MARD	Ministry of Agriculture and Rural Development
MDGs	Philippines Millenium Development Goals
MO	Manila Observatory
MTDP	Medium Term Development Plan
NTP	National Target Program
PA 21	Philippine Agenda 21
PAG-ASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PD	Presidential Decree
PRRM	Philippine Rural Reconstruction Movement
RA	Republic Act
RAN-MAPI	Rencana Aksi Nasional Menghadapi Perubahan Iklim
SFMA	Sustainable Forest Management Act
UPLB	University of the Philippines Los Banos