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Climate Change and the R&D sector

INSIDE...

Managing the global climate through R&D

by Dr. Nicomedes P. Eleazar, CESO IV

Climate change is here. And it is disconcerting that humans are causing this drastic change in our climate. Scientifically-proven, we feel the trend of extreme weather events, from drought causing water shortage to severe typhoons bringing too much water and destroying lives and causing undeniable damage to our economy.

Now, more than ever, people around the world need to step up and press for change. The Philippines is no exception, particularly us in the agriculture and fisheries sector.

We, at the Bureau of Agricultural Research (BAR), are doing something to contribute to this need to step up and press for change. Recently, BAR spearheaded the formulation of the Climate Change RDE Program to provide guidance on appropriate mitigation and adaptation research and extension efforts to strategically respond to climate change especially its relevance to the agriculture sector.

But the implementation of this RDE program is ineffective and perhaps, pointless, if our researchers and research managers themselves are not capable and equipped, information- and knowledge-wise, to put into action the research strategies and mitigating measures to address climate change. Hence, we are conducting capability building, one of which is through short-term training that aims to strengthen initiatives on research and technology development, technology management, and their effective implementation and transfer and adoption of stakeholders.

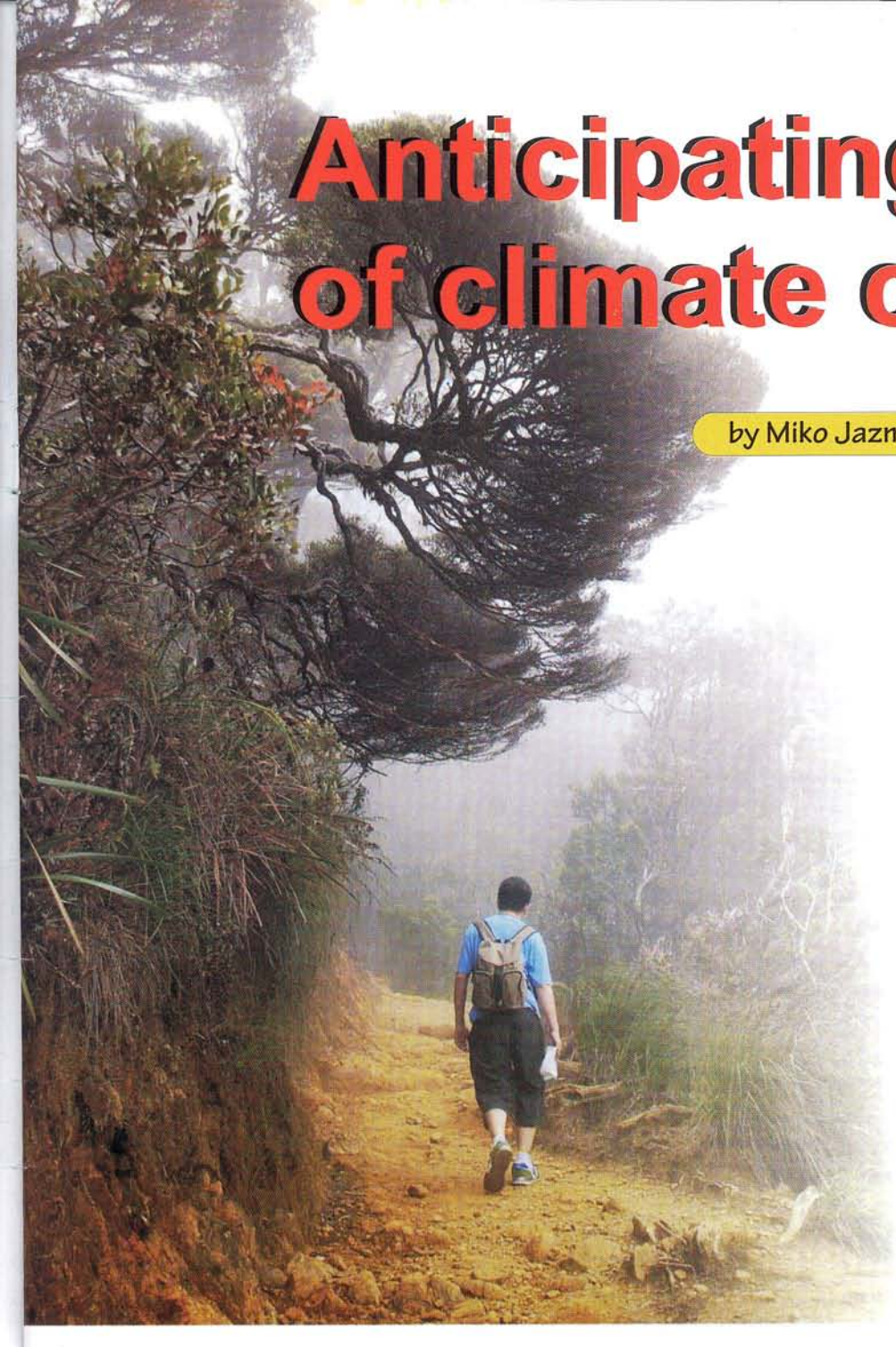
Climate change serves as a wake-up call for us in the sector, encouraging us to rethink our view on agriculture not only for food security but also for profitability. We have to combine protection, rehabilitation, and development of our resources in a sustainable manner. On the basis of our current experience, there are only five resources that should be managed for sustainability leading to measures which are crucial to mitigate the impact of climate change. Interactive and complementary, these five aspects include: social, technical, economic, environmental, and political.

To get the best benefit that can be derived from effectively managing our resources, our focus must be on improved and innovative management. I want to stress the significance of innovation because of a paradigm shift in the way we manage our resources. What we need today is a more pro-active action mobilizing the organization of farmers through organizational development and harnessing to the fullest their potentials in managing the environment along with production and profit.

Science teaches us that if we act decisively and collectively, soon we can manage global climate. The sooner our acts on this, the cheaper it will be for the country. ###

Anticipating the peril of climate change

by Miko Jazmine J. Mojica



From Rio de Janeiro to Kyoto, from Bali to Copenhagen. This would have been the perfect itinerary to see the world and explore it in awe and leisure except that people who have convened in these places did not come as adventurous backpackers.

From all over the world at different times but with one constant objective, they were national and global leaders and policy makers who came to debate on ideas and pick one another's brains in order to get a consensus on how best to save Mother Earth and its living occupants from climate change. What a noble cause then, one would think.

But where are we now?

In the technical paper, "In the Eye of the Perfect Storm: What the Philippines Should Do about Climate Change", Villarin, et.al., delved into a wide range of climate change issues from the realms of science, politics, global and local impacts, and the corresponding international and local responses.

What's in store for the Philippines

Being a developing country, the Philippines is included among the poor countries that would bear the brunt of the destructive impacts of climate change. According to Villarin, et. al., it is expected to affect the country's weather conditions in terms of unfavorable changes in temperature, rainfall, and tropical cyclone activity. Consequently, this will affect a number of economic sub-sectors such as agriculture, forestry, and water resources, with those living in the coastal and low-lying areas becoming increasingly subject to sea level rise.

The authors stated that in order to determine our capacity to adapt to climate change and mitigate its impact, we need to understand the nature, scale, and structure of vulnerability of the country in order to address its complexity and its impacts on all sectors.

According to the authors, the Philippines, a country that is very active and already advanced in terms of climate change policy, requires a more proactive and comprehensive strategy to effectively chart a sustainable future and ensure that it can well adapt to the impacts of climate change.

Solutions to climate change

As basis for the Philippines' response to climate change, Villarin, et. al., proposed an integrated adaptation-mitigation framework which is anchored on sustainable development. The authors believe that efforts to address climate change impacts have to meet the needs of the present without compromising the ability of future generations to meet their own needs. This means that the development

agenda should address poverty and its lingering effects while protecting the environment.

Following the integrated framework of the Inter-governmental Panel on Climate Change (IPCC), the framework proposed by the authors to address the impacts of climate change on the natural environment and socio-economic development paths of humans includes four factors.

"First is the development of science-based climate policies. Second is the use of market-based mechanisms to attract the use of cost-effective technologies and options to address climate change. Third is the prioritization of research and development in order to come up with better strategies to combat the impacts of climate change. The last factor is effective capacity development and information awareness campaigns. The authors have identified the relevant sectors needed for each of the factors," stated in the report.

At the national level, the authors recommend that the government provide sound regulatory structures and policies that would attract investment in climate-friendly technologies. Moreover, the government should also come up with strategies to appropriately address issues particularly involving vulnerable sectors. Local government units (LGUs) likewise have an important role in identifying and addressing climate change impacts at the local level by adapting strategies appropriate to their area. Not to forget the role of proactive citizens, they should be encouraged to influence the government and the business sector to come up with effective measures and policies that are eco-friendly.

Impact assessments undertaken through research and development (R&D) is another recommendation that the authors believe would be life-altering for future generations. A systematic observation of climate systems and their impacts on the most vulnerable sectors of the society is one important undertaking for academic and research institutions.

"Climate data must be freely shared, and a clear policy be defined for the boundaries and conditions of its use," stated the report.

Agriculture as a vulnerable sector

The thorny issue of climate change spans a gamut of sectors that comprise society and the ecosystem which are believed to be under threat from climate change's devastating impacts. While the world is already experiencing some of the dreadful damage arising from climate change, such as stronger and more frequent typhoons and floods, extinction of plants and animals, and intensifying global warming, our world leaders have yet to reach agreement and commitment on what should be done.

In the midst of this uncertainty, the agriculture sector is at great risk. According to the Department of Agriculture's (DA) website, the country's population is predominantly rural (70 percent) and two-thirds of this population depends on farming for their livelihood. In terms of employment, about one-half of the labor force is engaged in agricultural activities. Thus, adapting to and mitigating the impacts of climate change is not something that could wait for the global majority to make a decision. It needs swift and sweeping

national action and the decision time is here.

Attainable mitigation-adaptation strategy

Agriculture Undersecretary Segfredo R. Serrano, said that people often confuse the concepts of mitigation and adaptation. "To be distinct, mitigation is the reduction of carbon footprint while adaptation aims to minimize the adverse impacts of climate change," he explained.

One mitigation-adaptation strategy that the agriculture sector has developed and is already implementable is organic agriculture. This is in accordance with the Organic Agriculture Act of 2010 of which Agriculture Secretary Proceso J. Alcala is one of the principal authors during his term as the Representative of the 2nd District of Quezon Province.

The DA will advocate a system that will push organic and natural-based farming although farmers will be allowed the option of using the conventional method – the use of chemical-based farm inputs – at the same time.

Prof. Oscar B. Zamora of the University of the Philippines Los Baños (UPLB), a convenor of the Go Organic! Philippines, said that organic agriculture production systems reduce the vulnerability of farmers to climate change because the practice is less affected by extreme weather conditions such as drought and flooding.

In his paper, "Organic Agriculture as a Climate Change Adaptation and Mitigation Strategy", Zamora identified some climate change-resilient crops and potential substitutes for rice during periods of low rainfall. The crops include avocado, carrot, cashew, eggplant, garlic, lettuce, mango, mustard, okra, onion, peanut, *pechay*, pepper, sweet sorghum, squash, sweet potato, tomato, and watermelon, among others.

As an adaptation strategy, Zamora said that organic farming increases the soil's organic matter content and improves water holding capacity making crops more resistant to drought. On the other hand, as a mitigation strategy, he said that organic farming works to reduce GHG emissions with its use of environment-friendly forms of farming system inputs such as fertilizers and pesticides.

Impact on future generation

Indeed, climate change is already affecting our lives today but its potential to drastically impact the lives of future generations can be tremendous. Addressing climate change is developing into a moral obligation of the people of today since our actions (or inactions) will definitely have consequences that future citizens will have to face.

The cooperation and contribution of everyone brings the issue of climate change beyond science and technology, as many advocates put it. In the end, it leaves us all with the profound question about what kind of world we will shape for those that we will leave behind. ###

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Research & Development: Developing climate-friendly technologies

by Rita T. dela Cruz

Given the complexity and magnitude of the issue of climate change, there is a need for a continuous study and improvement on the information and knowledge on its effects and options to address its impacts.

Since climate change is relatively a new challenge in the agriculture and fisheries sector, Research and Development (R&D) has been a viable means to find out its causes, manifestations, and effects. Results of these researches enable us to advance rapidly and reduce uncertainties.

To cope with the effects of climate change, the Department of Agriculture (DA) ensures the take-up of new technologies particularly the development of climate-friendly technologies necessary to limit the effect of climate change.

Climate proofing the sector

Studies have showed that the successful development of low-carbon technologies needs a two-way approach combining both the needed 'technology' as a result of R&D and the 'marketing or promotion' through incentives and regulatory framework.

In response to the urgent call on climate proofing the farm and fisheries sectors and enabling the country to adapt to the negative impacts of climate change, DA has retooled its budget to address the challenge along with increasing global free trade. This is to ensure support to specific programs and activities on the provision of postharvest facilities and equipment for farm produce, market linkages, strengthening of regulatory and disease eradication capabilities, and establishing satellite-based remote sensing and geographic information systems (GIS).

DA has been strengthening its statistics and forecasting capabilities, developing and distributing climate-ready crops seeds, which are submergence, drought and disease tolerant, engineering climate change adapted infrastructure for production and processing, enabling more financing for agriculture through innovative weather-based insurance schemes, and disseminating more information, knowledge and training in crops science and planting techniques.

Setting the R&D program to address climate change

The Philippines is one of the top 12 countries at highest risk to climate change according to World Bank. Among the five main threats arising from climate change, namely, droughts, floods, storms, rising sea levels, and greater uncertainty in agriculture, the Philippines leads the list of nations that is most in danger of facing frequent and more intense storms. Thus, given this alarming scenario, DA has been working in full force with other partner-agencies to abate the anticipated negative impact of climate change.

The Bureau of Agricultural Research (BAR), as the national coordinating agency for agriculture and fisheries R&D, led in the crafting of the Research and Development (R&D) Program on Climate Change. This effort is in collaboration with experts from the University of the Philippines Los Baños (UPLB), UP Diliman, Department of Science and Technology-Philippine Atmospheric Geophysical and Astronomical Services Administration (DOST-PAGASA), Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), and DA-Bureau of Soils and Water Management (DA-BSWM).

"Given the enormity of the challenge, there is a need for a focused research effort to fully understand the drivers of climate change and provide options to reduce its impacts," said BAR Director Nicomedes Eleazar. He stressed that with an effective R&D programs on climate change supported with economic analysis, the sector will be able to identify the most cost-effective measures to mitigate climate change.

"We need research to predict climate-related changes, both at national and regional levels, so that we can take measures to adapt to them as well as facilitate the formulation of practical policy objectives to support the sustainability of the program" he added.

According to Dr. Ma. Victoria D. Espaldon, dean of the School of Environmental Science and Management (SESAM) and lead expert of the multi-collaborative program of Climate Change R&D, the program aims to generate technologies for the mitigation and adaptation of climate change and improve the adaptive capacity of farmers and fisherfolk by providing relevant technologies and information. Through the program, BAR and its partners hope to breed plants/animals/fishery resources that are more resilient to climate variability, assess the vulnerability of aquatic and marine resources to climate change, and promote cost-effective alternatives to fossil fuel use in agriculture.

The program specified several priority researchable areas which were categorized as short and long term adaptation strategies, and the short and long term mitigation strategies.
Dr. Espaldon identified 10 priority researchable areas under the short-term adaptation strategies. These included: 1) documentation of indigenous knowledge, 2) promotion and dissemination mechanisms of soil and water conservation, 3) development and promotion of technologies fro water use efficiency in agriculture, 4) development of an updated dynamic cropping calendar for major crops, 5) localized weather-based early warning system for agricultural production, 6) developing sound methodologies for localized seasonal climate forecast system, 7) establishment of climate change



sensitive mariculture zoning system, 8) development of agri-aqua farming systems in inundated areas, 9) promotion of value adding strategies for agricultural produce, and 10) improvement of the Comprehensive Agricultural Land Use Plan incorporating climate change risk information.

For the long-term adaptation strategies, she cited five areas for research. These included 1) selection/breeding of drought-resistant, pest/disease-resistant, and flood-tolerant varieties, 2) knowledge-based crop forecasting using advances in S&T, 3) improved estimation of loss in fish production due to climate change, 4) estimation of carrying capacity of seaweeds and other mariculture commodity to increased temperature, 5) monitoring of ocean acidification, salinity and ocean color, 6) vulnerability mapping in coastal areas/assessment of marine resources/marine protected areas, and 7) changes in spatial distribution and migration patterns of fish.

For the short-term mitigation strategies, five priority researchable areas were identified. These were: 1) assessment of marginal lands/grasslands for expansion of food production using lesser known fruit trees species, 2) implementation of community-based watershed projects, 3) reduction of methane emission from swine farms, 4) management and control of diseases and pathogens of livestock and poultry, and 5) improving capacities by knowing climate risk assessment and management.

For the long-term strategies, the researchable priority areas included, 1) biofuels utilization of agricultural waste and biomass, 2) freshwater production using cost-effective community based hybrid biomass-solar desalination system, 3) assessment of crop quality in different agro-climatic conditions, 4) evaluation of agricultural management practices for soil carbon sequestration and mitigation of greenhouse gases in long-term crop protection under upland agro-ecosystem, and 5) identification of changes in the soil microbial diversity in the lowland, upland, and hilly lands as affected by climate change. ###

Charting the stormy sea:
BAR joins the effort on climate change

by Amavel A. Velasco

According to the National Statistics Office, 30 years from now, the Philippine population would reach over 140 million. With decreasing land area devoted to agriculture, higher prices of agricultural inputs, lesser people engaging into agriculture and education in agriculture, and now, the advent of climate change, feeding the nation is becoming a a huge challenge. How then can we attain food security in this stark scenario?

The Herculean task of finding ways to feed this huge population in the years to come falls squarely upon the shoulders of the government, most especially, the Department of Agriculture (DA). There may be a way to stop or control the rate that agricultural lands are being converted to other uses. There may be a way to develop cheaper sources of farm inputs. There may be a way to lure the youth's interest and redirect it towards agriculture.

But, is there a way to halt or inhibit climate change?

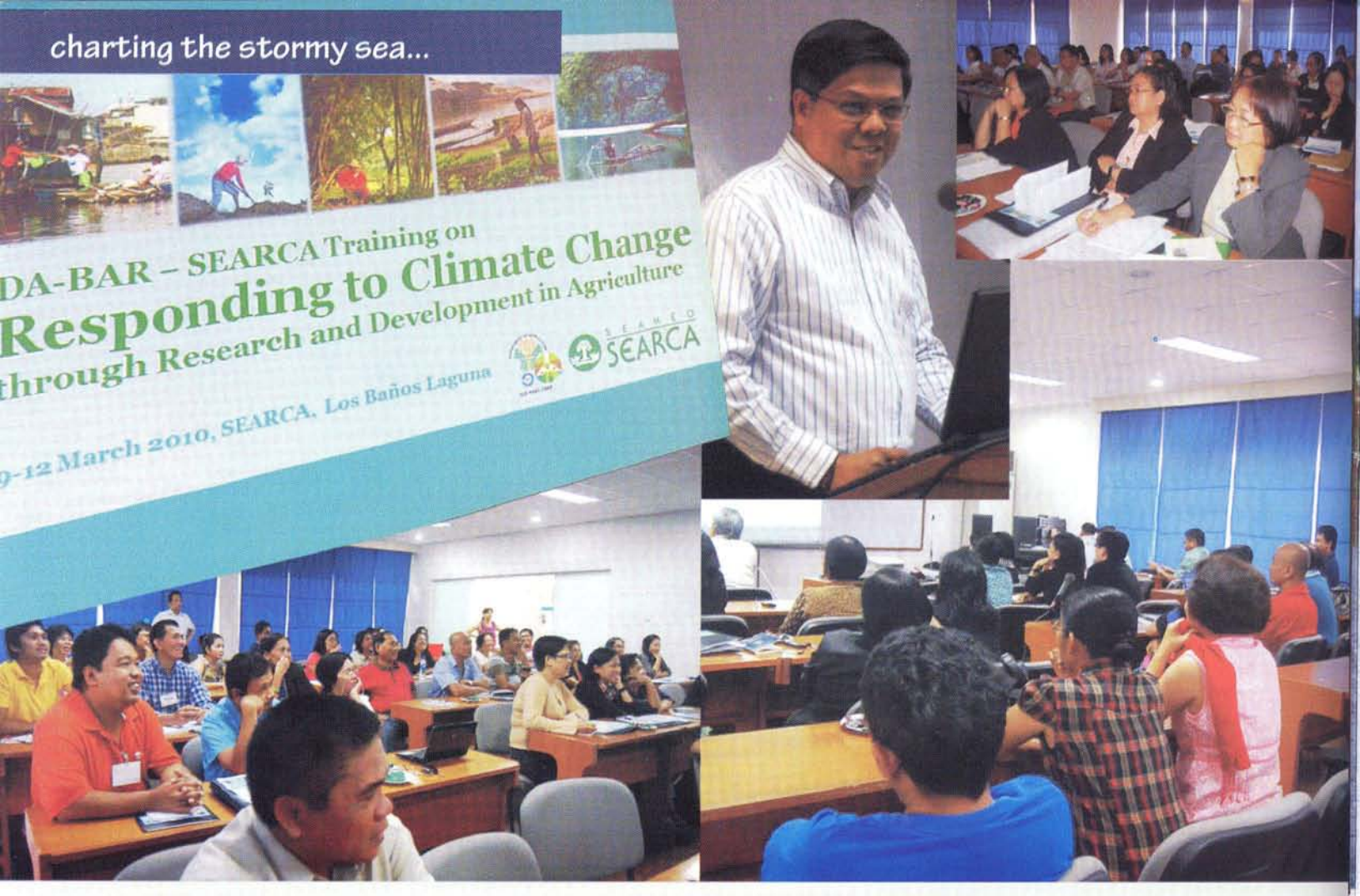
Scientists are looking at geo-engineering to slow down if not stop climate change altogether. But future machines such as aerosol blimps that blast chemicals into the stratosphere to reflect the sun's rays, space mirrors (orbiting lenses that can diffuse sun's rays), artificial carbon-eating trees (synthetic trees that can absorb CO_2 from the air and store it underground), and then cloud brightening gadgets (gadgets that are wind-powered ocean vessels that spray sea water to create clouds to reflect sun's rays) costs billions to trillions of dollars to be assembled and built (that is, if they make the jump to reality from the drawing board). It will take decades to about 50 years to build one of these.

In any case, if there's one keyword for the impending catastrophe, it's the word NOW. We have to act now!

BAR responds to the challenge

All the information given by the scientific community on climate change is a wakeup call for all of us, a wakeup call that the bureau has immediately responded to.

The Bureau of Agricultural Research (BAR) recognizes the urgency to take early action and so in 2009 it conducted a consultation meeting to address climate change which was participated in by experts in their fields from the following institutions: University of the Philippines Diliman (UPD), UP Marine Science Institute (UPMSI), UP Los Baños (UPLB) School of Environmental Science and Management (SESAM), UPLB-Graduate School (GS), Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Bureau of Soils and Water Management (BSWM) and DOST-PAGASA. The outcome of this and subsequent meetings of BAR together with the different participants is the Climate Change (CC) RDE Agenda.



Climate change RDE in agriculture

In a statement on climate change RDE, BAR Director Nicomedes P. Eleazar said, "As you might be all aware of, BAR spearheaded the formulation of the Climate Change RDE Program to provide guidance on appropriate mitigation and adaptation research and extension efforts to strategically respond to climate change.

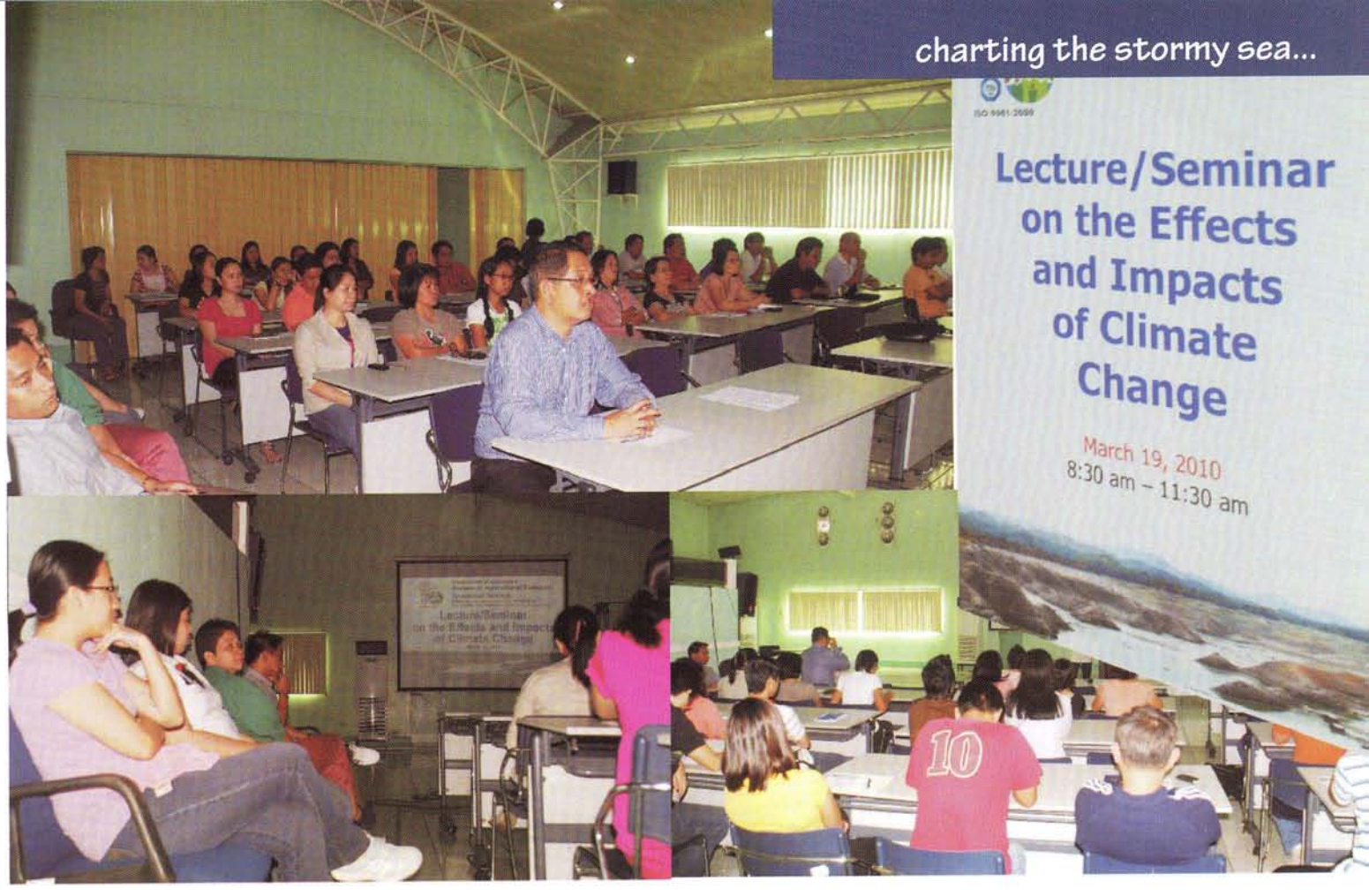
"But the implementation of this RDE program will be ineffective and, perhaps, pointless if our researchers and research managers themselves are not capable and equipped, in terms of information and knowledge, to put into action the research strategies and mitigating measures to address climate change. Hence, we are conducting this capability building, one of which is this short-term training, which aims to strengthen initiatives on research and technology development, technology management and their effective implementation and, more importantly, the transfer and adoption by stakeholders.

"Science seems to indicate that, if we act decisively, collectively and soonest, we can manage global climate. The sooner our nation acts on this, the cheaper it will be. We cannot afford to wait", said Director Eleazar

Thus, BAR has tapped SEARCA to provide assistance in the implementation and management of the project titled, "Capability Building on Responding to Climate Change through Research and Development in Agriculture". The said project aims to: 1) update the knowledge and learnings of DA research managers and researchers, including LGU personnel and farmers, on climate change concepts and related issues; 2) impart among the participants understanding of climate change and its consequences in agriculture, forestry and fishery; 3) impart analytical tools in the conduct of climate change vulnerability assessments; 4) strengthen local and international partnerships among researchers and managers working on climate change R&D especially in Southeast Asia; 5) enhance the skills and experience of participants in developing climate change-related R&D programs and projects; and 6) identify appropriate location-specific mitigating and adaptation measures that will be considered for incorporation into the respective action plan of the LGUs.

The project involves in-country short-term trainings and overseas educational visits. It shall also provide support for attendance to international workshops and conference by researchers and shall include:

1. **In-Country Short-Term Trainings.** These aim to provide participants with core climate science concepts for them to get a clearer understanding of climate change as well as its impact on agriculture, forestry and fisheries. Among the expected outputs for this training is the climate change RDE Action Plan and research proposals on climate



change adaptation and mitigation in agriculture.

2. **Overseas educational visits** aim to provide the identified participants first-hand knowledge and information on how neighboring ASEAN countries develop and implement programs and activities addressing climate change. It would be an exchange of ideas and sharing of experiences, like comparing notes. BAR also believes in the multi-agency initiatives to address climate change. This is why another objective of the overseas educational visits is to explore and strengthen partnerships and collaboration between and among DA institutions and with other RDE institutions in other countries to work together.
3. **Attendance/ participation in international workshops and conferences**, aims to provide the participants with the latest updates on CC by looking at how other countries are preparing for it.

Trainings such as these shall help the RFUs, researchers, academicians, and LGUs who have been the partners of the bureau in spreading the word about climate change and the appropriate responses to the farmers and other agricultural stakeholders and translate the different technologies and information in ways that farmers can understand. Itself, the bureau has been taking part in disseminating information on climate change issues and in educating the agricultural sector to include its LGU and SUC partners.

Indications are that we can make the adaptations to the changing climate. But, we have to be equipped with the right information/knowledge and the right tools on how to adapt to the changes in order for us to be adequately be guided in decision-making. This scientific knowledge should not be limited only to the scientific community, but has to be spread out to the local communities, a task that is being done now by the bureau. Creating awareness is the initial action and is important for it helps people anticipate the things to come, enlighten us on what to expect, and enable us to develop possible strategies to lessen the impact of climate change.

In meeting the challenge of climate change, we have a long way to go but what is important is that the bureau has taken the first step. It will be a long journey ahead.

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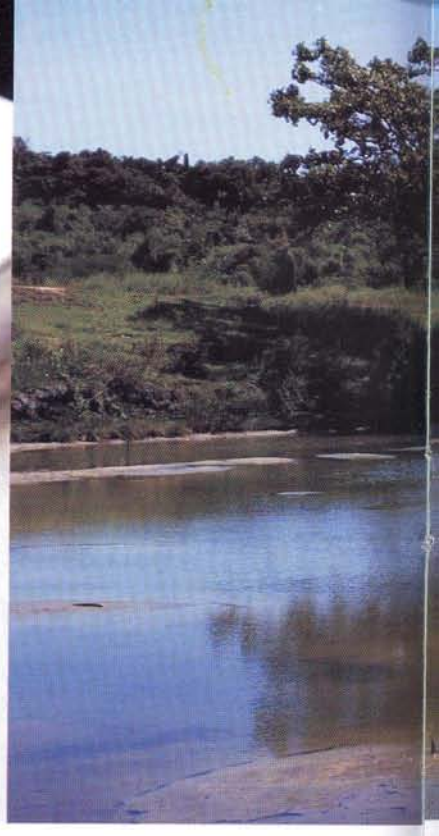
Policy imperatives of climate change

by Josefina M. Lantican



The agriculture and fisheries sector is seen by the World Bank as a significant source of national economic growth and has high potential for poverty reduction. This view is premised on the respectable growth of the sector which posted an annual average of 3.79 percent during the period 1995-2009. In 2008, the sector contributed 15 percent to the Gross Domestic Product, equivalent to PhP 1.1 trillion in current prices. The performance of the sector and its untapped potential could spell more economic benefits, given some adjustments in the development strategies being implemented. However, with the onset of climate change and its becoming more pronounced, expectations about the sector appear to be waning. Prolonged dry spells and excessive flooding brought about by the phenomenon have adversely affected productivity such that effective measures to mitigate or forestall damage to crops, livestock and fishery resources have to be adopted immediately. But the task to minimize losses is a formidable challenge, needing synergistic efforts on a national scale.

Research and development programs in agriculture and fisheries and other allied activities need to be holistic to address the multifarious problems emerging from climate change. As such measures would require adequate R&D resources, which are difficult to secure even under normal conditions due to national budgetary constraints, it is necessary to come up with a national policy framework that would streamline and integrate efforts in order to elicit significant impact in terms of climate change mitigation and adaptation.

The Department of Agriculture-Bureau of Agricultural Research (DA-BAR), prompted by the destruction wreaked by recent extreme weather conditions, created a technical working group to craft a climate-sensitive research, development, and extension program for the agriculture and fisheries sector. This program covers mitigation and adaptation measures aimed at improving existing practices and generating new technologies that would give short- and long-term solutions to climatic problems and concerns. Involved in crafting the program were inter-disciplinary experts from various agencies, namely University of the Philippines at Los Baños, University of the Philippines Diliman, DA-Bureau of Soils and Water Management (BSWM), Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Department of Science and Technology-Philippine Atmospheric, Geophysical, and Astronomical Administration (DOST-PAGASA), and BAR.

Rationalization of the resource allocation to R&D

Rationalization of the budgetary allocation system of the Department of Agriculture (DA) is in order. Rationalization should consider trade-offs and give bigger chunks of the budget to programs/projects that would impact immediately and more heavily on food security. The small farmers and fisherfolk who provide the bulk of the food needs of the population should be enabled to sustain production.

Climate change mitigation and management, along with other interventions, would rely more heavily on pertinent new and improved technologies. Mitigation would involve the reduction of carbon gas emission to minimize greenhouse effect while adaptation is directed towards reducing climate change risks. Research imperatives would cover an array of endeavors ranging from better soil and water conservation, pest and disease control, risks and hazard management, to cross-cutting activities that would provide much needed data and

information and other relevant researchable areas. Research requiring longer gestation period to address foreseeable problems and concerns would be also called for to enhance the resilience of the agriculture and fisheries sector to any eventualities brought by erratic climatic conditions. All these would require hefty increases in the resources provided to research.

Unification of efforts

Research agencies of the DA, together with other concerned departments and the state colleges and universities, need to bond closely together and craft strategic programs with immediate impact and help create national readiness for any potential risk. Research institutions must give paramount attention to adaptation and mitigation, giving priority to projects that would give the strongest positive impacts in achieving environmental, livelihood, and food security goals. For food security, which is foremost among the concerns, priority must be on mapping out the vulnerable food production areas. Research institutions must not only be reactionary to the effect of climate change, but must also be pro-active in order to forestall the effects of extreme weather conditions over the short and longer terms.

The service of the DA regional integrated research centers is necessary for the conduct of adaptation and verification research in order to suit technologies to the various location-specific needs under different physical-ecological environments. Local government units, farmers' organizations, and non-governmental institutions must participate in research and in research-related activities. Their involvement will not only stir awareness in their respective communities, but would also accelerate dissemination and adoption of technology. Climate change research must be mainstreamed in all R&D programs for readiness for any risks brought about by the phenomenon.

Linkages with international agencies must be established to facilitate sharing of experiences and information, and empirical and spatial data. This information would be useful in climate change assessment and in developing decision-support systems needed for modifying planting calendars, changing land use policy, and forecasting the effect of climate change. This could be facilitated by advances in science and technology such as crop simulation models, technical coefficient generators, geographic information system, and multiple goal linear programming.

Vulnerability and impact assessment

The Philippine S&T Agenda on Climate Change 2010-2016 of the Department of Science and Technology identified two major concerns which should be given prompt attention. These are: 1) mapping the areas of agriculture, fisheries, and natural resources that are vulnerable to climate change and 2) monitoring, evaluation, and risk assessment. In mapping vulnerable areas, priority has to be given to critical food, feed grains, and pasture areas. In the second concern, focus should be on the development of more precise location-specific early warning systems, determination of the carrying capacity of areas, agrometeorology, species-environment interaction, periodic biological phenomena and climatic relations, and the etiology and virulence of pathogenic organisms on livestock. Socio-economic evaluation of climate change impacts and integrated assessment of climate change-related S&T activities and technologies should form part of the R&D program. When given in a timely manner, this information shall be the basis for prompt decision-making and planning by

turn to page 20

CLIMATE CHANGE and the fisheries sector

by Catalino R. de la Cruz, PhD

Our fishery resources are vast. These are composed of marine areas (territorial water area - coastal and oceanic; shelf area; and coral reef area) and coastlines, and inland resources (swamplands – freshwater and brackishwater; fishponds – freshwater and brackishwater; and lakes, reservoirs and rivers). Fish production, a major sector in agricultural production, comes from these resources as these provide most of the fish supply of the country.

Fish is produced from three sub-sectors: municipal fisheries, commercial fisheries, and aquaculture. Municipal fisheries include fishing done in coastal and inland waters with or without the use of boats of three gross tons or less. Commercial fisheries are capture fishing with the use of fishing vessels more than three gross tons in weight. Aquaculture production includes brackishwater and freshwater fishponds, fish pen and fish cage in fresh and marine waters, and mariculture.

Among the three sub-sectors, of the total fisheries production of 4.967 million mt in 2008, aquaculture contributed the highest production share of 48 percent (2.408 million mt) followed by the municipal sub-sector with 27 percent (1.333 million mt), and the commercial sector with 25 percent (1.23 million mt) share (2008 Phil. Fisheries Profile, BFAR). The production growth of aquaculture from 40 percent in 2003 (BAS 2005) to 48 percent underscores its importance in maintaining the supply of fish.

In 2008, the fishery contribution to the country's total Gross Domestic Product was 2.3 percent (or P170.4 billion) at the then current prices. It also accounted for 15 percent (P170.4 billion) of the Gross Value Added in Agriculture, Fishery and Forestry Group, which was next to agricultural crops (*palay*, corn, coconut, etc) contribution of 60.6 percent (P668.4 billion) at current prices.

In the world's fisheries scenario, the 2008 Philippine Fisheries Profile indicates that in 2007, the Philippines: 1) ranked 8th in the world with its total production of 4.71 million mt of fish, crustaceans, mollusks and aquatic plants (including seaweeds). This value is about 3.02 percent of the total world production of 156.36 million mt (FAO Website); 2) ranked 10th in the world with its 0.710 million mt aquaculture production of fish, crustaceans and mollusks that constitutes a 1.4 percent share to the total global aquaculture production of 50.3 million mt; and 3) ranked as the third largest producer of aquatic plants (bulk of which is seaweeds) having produced a total of 1.5 million mt or nearly 10.1 percent of the total world production of 14.86 million mt (FAO Website).

The contribution of the fisheries sector to the Philippines' national economy and its place in the world's fisheries scenario is indeed significant but it is now under threat by climate change. The negative effects of climate change on aquatic ecosystems and fisheries are now being felt and observed globally, and our country's fishery resources is perceived as one of those sectors that shall be severely affected. The evidences or changes felt, its impacts on the aquatic ecosystems and fisheries, and initiatives / approaches done by various agencies in adapting and mitigating the damaging effects of climate change is presented in this article.

The contribution of the fisheries sector to the Philippines' national economy and its place in the world's fisheries scenario is indeed significant but it is now under threat by climate change.

A glimpse at socio-economic trend in fisheries sector

The people involved in the fisheries sector for their livelihood belong to different components of the socio-economic strata. They are composed of coastal fishing communities, traders, exporters, and processors of fishery products. Among these, it can be said that the socio-economic group heavily dependent on the industry and vulnerable to climate change is the coastal communities group, as about 70 percent of the communities in the country are located in the coastal areas.

In 2002, about 1,614,368 persons were dependent on fisheries. Of these,

about 1,371,676 (or 85 percent) were engaged in municipal fisheries; 16,497 (or 1 percent) in commercial fisheries, and 226,195 (or 14 percent) in aquaculture (NSO, 2002). With the continuous increase in the country's aquaculture production, it can be deduced that more people are now engaged in aquaculture. Back in 2001, the Seaweeds Industry Association of the Philippines indicated that the total number of people involved in the industry had reached about one million.

Seaweed farming, which belongs to aquaculture, is one of the main sources of livelihood of coastal dwellers and fishing families. The latest production of 1.67 million mt in 2008 suggests that a big number of people are engaged in the industry. As the Department of Agriculture promotes the expansion of seaweed farm areas and utilization of idle aquatic resources, this number is expected to increase in the future. The estimated potential area for seaweed farming is 255,000 ha but the area farmed is only about 59,000 ha. Thus, 196,000 ha are available for expansion (PCAMRD, 2008).

Impact of climate change on aquatic ecosystem and fishery resources

Three-fourths of the earth's surface is covered by water, which is home to aquatic animals that feed the world. Significant changes that have been observed and monitored could have great potential damages to these aquatic animals and their habitats.

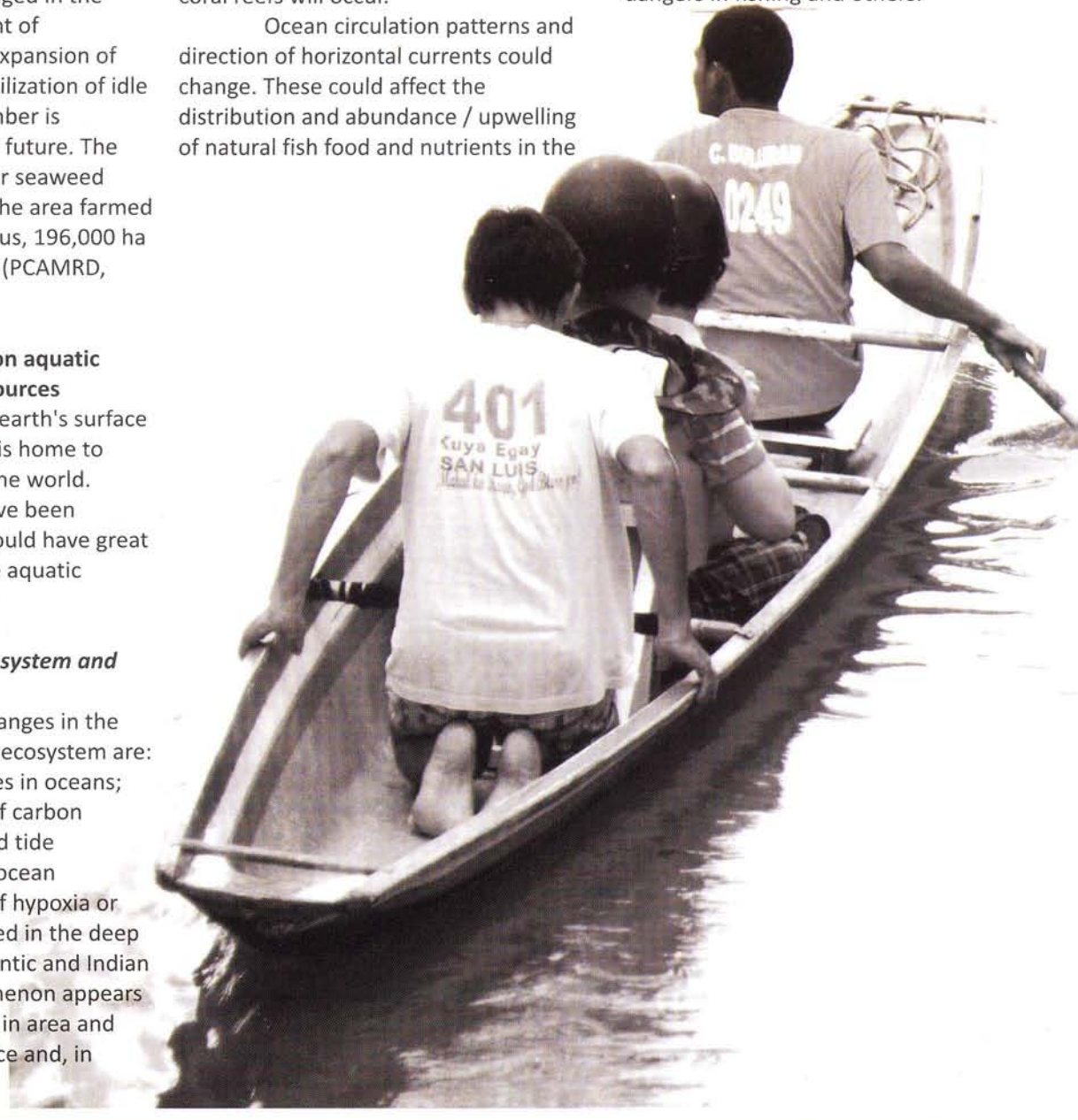
Ocean, marine aquatic ecosystem and fisheries

Some observed changes in the earth's oceans and aquatic ecosystem are: expanding low-oxygen zones in oceans; increase in concentration of carbon dioxide; coral bleaching; red tide outbreaks; and changes in ocean circulation pattern. Areas of hypoxia or low oxygen have long existed in the deep oceans – in the Pacific, Atlantic and Indian oceans. Lately, this phenomenon appears to be spreading, increasing in area and creeping towards the surface and, in some places, such as the Pacific Northwest, encroaching on the continental shelf within sight of the coastline (Les Blumenthal, McClatchy Newspapers, Mar. 17, 2010).

According to the experts, the concentration of carbon dioxide, resulting from global warming sinking into the ocean, will rise to a level that will exceed the ocean's buffering system and will tend to lower seawater pH from 8.3 to 6-7. This ocean acidification will affect the calcification processes that will negatively impact and cause poor health of coral reefs and shelled mollusks and, hence, result to reduced growth and reproduction. Coupled with increases in temperature, more bleaching episodes in coral reefs will occur.

Ocean circulation patterns and direction of horizontal currents could change. These could affect the distribution and abundance / upwelling of natural fish food and nutrients in the sea which, in turn, can affect fish larval supply and production, and the migratory patterns of small and large pelagic fishes.

The FAO (2010) has indicated that: 1) all fisheries resources and stocks are highly vulnerable to the impacts of climate change; 2) estimates of fisheries stocks in the changing climatic condition will render high degree of uncertainty; and 3) there is lack of capacity on new fields of science and technology spawned by needs to mitigate and adapt to climate change. Other consequences of climate change on fisheries are: changes in monsoon patterns and in the distribution range of exploited stocks; reduced yield and profitability; increased dangers in fishing and others.



For the Philippines, the observed status or trend on the conditions of its marine resources or habitat is shown in Table 1.

Table 1. Status of Philippine coastal and marine resources (source: M. Santos, BFAR)

Resource /Habitat	Status	Source
Corals	Degraded state Unknown	BFAR-NFRDI-PAWB, 2005. BINU
Seaweeds	(except declining seed source)	- do - ; GTZ, 2009
Seagrasses	Heavily stressed	BFAR-NFRDI-PAWB, 2005. BINU
Mangroves	Degraded state	- do –
Invertebrates	Declining trend Declining	- do –
Demersal fishes	trend	- do –
Small pelagic fishes	Declining trend	- do –
Tunas	Stable trend (except big eye tuna) Declining	WCPFC, 2009
Sharks and rays	trend	NPOA Sharks, 2009
Marine turtles	Threatened	BFAR-NFRDI-PAWB, 2005. BINU
Marine mammals	Threatened	IUCN Red List, 2009

Marine and inland aquaculture

The elements of climate change (typhoon and extreme weather events, sea level rise, temperature rise and associated change in water quality, and water shortage or drought) have varying impacts on aquaculture in various water environments.

Typhoons and extreme weather events. On marine aquaculture (or mariculture), the present designs of fish cages as to their framework or structure, are not strong enough to withstand the devastating strength of typhoons and extreme weather events. On inland aquaculture (brackish- and fresh-water), typhoons, together with sea level rise and increased flood heights, will destroy or inundate farm facilities and will increase the cost of putting up facilities and their maintenance cost. Further, these elements, together with changes in wind direction, will alter the characteristics (depth, salinity patterns, and water turbidity) of near shore habitats (mangroves, sea grasses, coral communities) and, thus, could affect the larval nursery grounds and fish seed supply for sustaining aquaculture operation.

Temperature rise and change in water quality. These could be damaging to the farming of fishes in cages, seaweeds and shellfishes. The usual water temperature for normal growth of many species is 28°-30°C. Rising of temperature well above the normal range will be stressful and could lead to increase in mortality of cultured fish.

High CO_2 and resulting acidification of the sea could affect the growth and production of farmed finfishes, seaweeds and shellfishes if pH falls below 6.5.

With regard to brackish- and fresh-water pond aquaculture, the depth of pond water is vulnerable to rise in temperature. The usual depth of fishponds to keep water temperature within the desired level for cultured species is one meter to 1.5 m. Increased temperature, could cause excessive pond water evaporation or heating of the water above the suitable value down to the pond bottom. To continue operating the farm using the usual depths, would need more water exchanges and /or aeration in regulating water quality (temperature, dissolved oxygen, ammonia level, etc) for the normal growth of fish.

On reservoirs, rise in water temperature will affect the desired water quality for sustaining fish growth from stocking until harvest. Reservoirs used for irrigation and generation of electricity will have reduced depths, especially during El Niño episodes. In March 2010, media reports indicated that water level in most of the reservoirs in Luzon (i.e., Angat, Ambuklao, and Magat dams) fell below normal level by 5.7-6.1 m. Due to the continuing recession of water depth, and the advent of El Niño and accompanying high temperature and dissolved oxygen depletion, massive fish kills of tilapia (more than 28,000 kg in February 2010 alone) in floating cages in Magat Reservoir in Isabela were reported.

The reduction in depth will also decrease the usable areas for caged fish farming. Floating cages have to be sited or moved toward the deeper parts where water quality is suitable. And for the fish stock in the open fishing area, receding water levels along the shorelines will affect its spawning areas.

On deep inland lakes, water level does not fluctuate too much if it is not

used for domestic supply, irrigation or generation of electricity. For shallow lakes, however, the problem of deteriorating water quality brought about by warming could be expected.

Mitigation/adaptation measures on climate change

In 2008, the consultations /round table discussions conducted by government agencies (DOST, DA, DOE, DENR, and others) to address the various concerns /issues on climate change resulted to the realization that, in our country, there is a dearth of information about the climate change phenomenon. The magnitude of potential damage to fishery resources, and the places or resources that are most vulnerable or exposed to risk or hazards are barely known. Enormous top quality information needs to be obtained or generated. Even protocols on how to gather / measure / monitor this needed information are yet to be developed. Science-based information is necessary to arrive at sound decisions and policies to address climate change issues on fishery resources.

Meantime, while waiting for the much needed information to become available, for aquaculture some knowledge-based strategies on responding and managing risks from changing climate already exist and can be tapped. Some of these are as follows:

On the destructive effects of typhoon

In mariculture, design of much stronger fish cage frameworks and mooring systems may be adopted. In the event of an impending typhoon, the harvestable fish crop may be harvested ahead of schedule to reduce crop loss.

On coastal fishfarms, higher protective dikes should be constructed. Alternatively, net –fence barrier may also be installed on top of perimeter pond dikes to prevent fish loss during overtopping of dikes by floodwater.

On temperature rise

Its adverse effect in the mariculture of finfishes in floating cages may be mitigated by increasing the depths of net cage enclosures. This will allow the cultured species to seek the depth where water temperature is suitable to their growth. For seaweeds, the following may be considered: moving the farm site to deeper and less crowded areas where salinity is stable (or with minimal variation) and where free water movement exists; the production line (of polyethylene rope) of plants may be lowered to depths with suitable temperature level; or preventing too much exposure of the plants to sunlight. For shellfishes (such as oysters and mussels), the hanging production lines of the species may also be lowered to depths with suitable temperature.

For ponds, increased water depths (by building higher dikes or excavating ponds deeper) than the currently prevailing practice can be done to mitigate the negative effects of increased temperature and associated impairment of water quality.

Some of these mitigating measures, however, entail extra investments - in putting up fishfarm facilities and sustaining operational cost (i.e., higher dikes, deeper ponds cost more to excavate; more fertilizer to propagate and sustain plankton bloom in deep water; water pumping to fill or maintain depth; and so on).

Current initiatives on climate change and fisheries R&D and E framework

The determination of the magnitude or extent of the damaging impacts of climate change has been focused on the Philippine marine ecosystem and fishery resources. Ways on how to cope with it are also being explored or developed. Concerned government and regional agencies have taken necessary actions to provide and disseminate available knowledge and in-depth understanding of the effects of climate change on fisheries.

Training

DA-BAR, in collaboration with SEARCA, has sponsored two training courses on responding to climate change: 1) Knowledge-based strategies in managing risks for agricultural production (8-12 Sep 2008); and 2) Responding to climate change through R&D in agriculture and fisheries (March 9-12, 2010). These promote greater appreciation by R&D workers of the dimensions of the climate change problem and sets the stage for future R&D interventions.

The National Fishery R&D Framework and Program

The DA-BAR, in collaboration with experts (from UPLB, UP Diliman,

DOST – PAGASA, SEARCA, DA-BSWM), led in the crafting of the Agriculture and Fisheries R&D Program on climate change in 2009. On the fisheries side, this program aims to contribute to the mitigation of climate change and to improve the adaptive capacity of the fisheries sector to the threats of climate change. The priority research areas for adaptation and mitigation strategies are each categorized as short- and long-term.

Following consultations in 2008, the DOST, in collaboration with the PTF-CC (Presidential Task Force on Climate Change created by AO 171) of which the Department of Agriculture is a member agency, has proposed S & T interventions on climate change. The interventions consist of three areas of action: assessment studies; mitigation measures; and adaptation measures on climate change. Vulnerability assessment and governance /planning are identified as the top two priorities that need to be addressed in the fishery resources sector. The latter will involve various sectors that affect the socio-economic and cultural well-being of coastal communities.

The aspect on vulnerability assessment served as the focal point in forging the proposed national climate change R & D framework for marine and fishery resources. Its goals are to: understand the most vulnerable areas in fisheries; understand the processes and mechanisms to be able to adapt to climate change; reduce the vulnerability and risk of disaster and adverse impact of climate change; and enhance resilience to vulnerability. These are supported with broad areas of research components, which are: vulnerability assessment of marine and fishery resources; socio-economic and impact assessment; policy studies; and economic valuation of coastal and marine/fishery resources.

In 2009, the DOST-PCAMRD already received two top priority research program proposals on fisheries and climate change with very good chance of getting DOST funding. These are titled: 1) Integrated Coastal Enhancement: Coastal Research, Evaluation and Adaptive Management (ICE-CREAM); and 2) Ecology and Oceanography of Harmful Algal Blooms (HABs) in the Philippines. The two research programs, composed of 8 and 7 projects, respectively, are to be implemented through collaborative efforts of selected State Universities / Institutes, and Private Universities.

Other specific fishery programs/ projects areas that fall under the R & D framework for climate change include:

1. Integrated coastal enhancement: coastal research, evaluation and adaptive management program. This covers Marine Protected Areas (MPAs), fishery ecosystems, coral reefs, and effects of coastal erosion, invertebrates, and others.
2. Studies on vulnerability of fishery-dependent communities
3. Impacts on aquaculture and fish production systems towards developing strategies for mitigation and adaptation.
4. Studies on vulnerability of aquaculture-dependent communities.
5. Development of technologies on sustainable / responsible / environment-friendly aquaculture systems adapted to climate change
6. Development of agriculture-aquaculture farming systems in inundated areas. Use of salinity-tolerant and submergence-tolerant rice varieties – cum- fish (milkfish, prawn, saline-tolerant tilapia)

The programs or projects are not limited to the above-mentioned topics. Other research proposals within the context of the framework may be submitted for funding. The Department of Agriculture through BAR, and the DOST are now preparing for the fund requirement of this huge R & D task.

All the R & D institutions, LGUs, NGOs, POs and other concerned agencies in the country, are expected to participate vigorously and actively to do their share in conducting / carrying out fisheries R&D activities and in developing more appropriate technologies that will alleviate vulnerability to climate change and enhance food production.

Addressing the concern on

climate change has already been incorporated in the priority research program for 2010-2016 of the DOST - PCAMRD S&T Environment Road Map. This research program focuses on the impact of and adaptation to climate change of fisheries and coral reefs. Examples of expected tangible outputs from this program are: climate change mitigation measures, adaptation technologies, vulnerability maps of fishery resources, and strategies on reef restoration.

Conclusion

Climate change can have hazardous and damaging effects to our marine and inland fishery resources. Rise in temperature, changes in rainfall patterns and frequent typhoons with extreme flooding, together with change in wind direction will alter the characteristics (depth, salinity patterns, turbidity) of near shore fish habitats (mangroves, sea grasses, coral communities), biodiversity (through extinction and succession of species), ocean circulation pattern, coral reef production, fish migration pattern, and others.

The fisheries sector is anticipated to be one of the most affected by climate change. It shall be greatly felt in coastal areas through rise in sea level and increase in temperature. Weather disturbances shall become apparent through increased frequency and intensity of typhoons and extreme flooding. Sea level rise shall inundate low-lying wet and dry land areas, erode shorelines, exacerbate storm flooding; increase salinity of estuaries and threaten freshwater aquifer (Perez et al, 1999; Nicholls, 2002). Also, accretion in shorelines may occur due to drowning and inundation of coasts.

The consequence of all these, simply put, is that climate change will affect fishing- and aquaculture-dependent Filipinos. Fishery resources will decrease while important fish species may move to other areas making it less available to fishers. Fishing communities as a result will have less food for their families and less opportunity to make a living. Displacement of coastal communities can potentially occur with sea level rise, more frequent typhoons and its associated flooding.

Climate change, however, is not the end of the world. While documented science-based information on its damaging effect and corresponding methods on countering it are still scarce, there already exist knowledge and practical experiences with solutions that could be applied to adapt to or reduce its adverse effects.

The country has to develop the resiliency in responding, coping and adapting to climate change. As NaRDSAF institutions, we can integrate climate change programs / projects into regional and national development plans, and build local capacity to set baseline data, monitor and report changes for decision-makers. ###

***Policy imperatives**...from page 13*

researchers, policymakers, farmers, fisherfolk, and other stakeholders.

Water conservation and management efficiency

The development, rehabilitation, and management of watershed projects must be done in a participatory and holistic manner that involves multi-stakeholders. This modality has been proven to be effective in the implementation of development projects. Watershed management should include addressing the issues and concerns on the biophysical, socio-economic, and cultural dimensions surrounding the community that hosts the watershed. Sense of ownership driven by community involvement in integrated development programs would lead to collective efforts in sustaining watershed protection and preventing ecological degradation of the uplands. At the same time, it is necessary to address the socio-economic needs of upland communities through the promotion of suitable livelihood opportunities. In non-watershed locations, farmers and fisherfolk must be taught how to build and manage small water impounding projects. On efficient use of water, existing technologies must be tailor-fit to climatic variations.

Integrated climate change concerns

The research, development, and extension agenda should include the establishment of a climate change information technology system for major cross-cutting concerns. This should be made readily accessible to planners and other users in the agriculture and fisheries sector, and those working on natural resources to enable them to strategically respond to possible risks. Capacity enhancement at the national, local, and community levels, and innovative techno-transfer modalities for climate change must be put in place.

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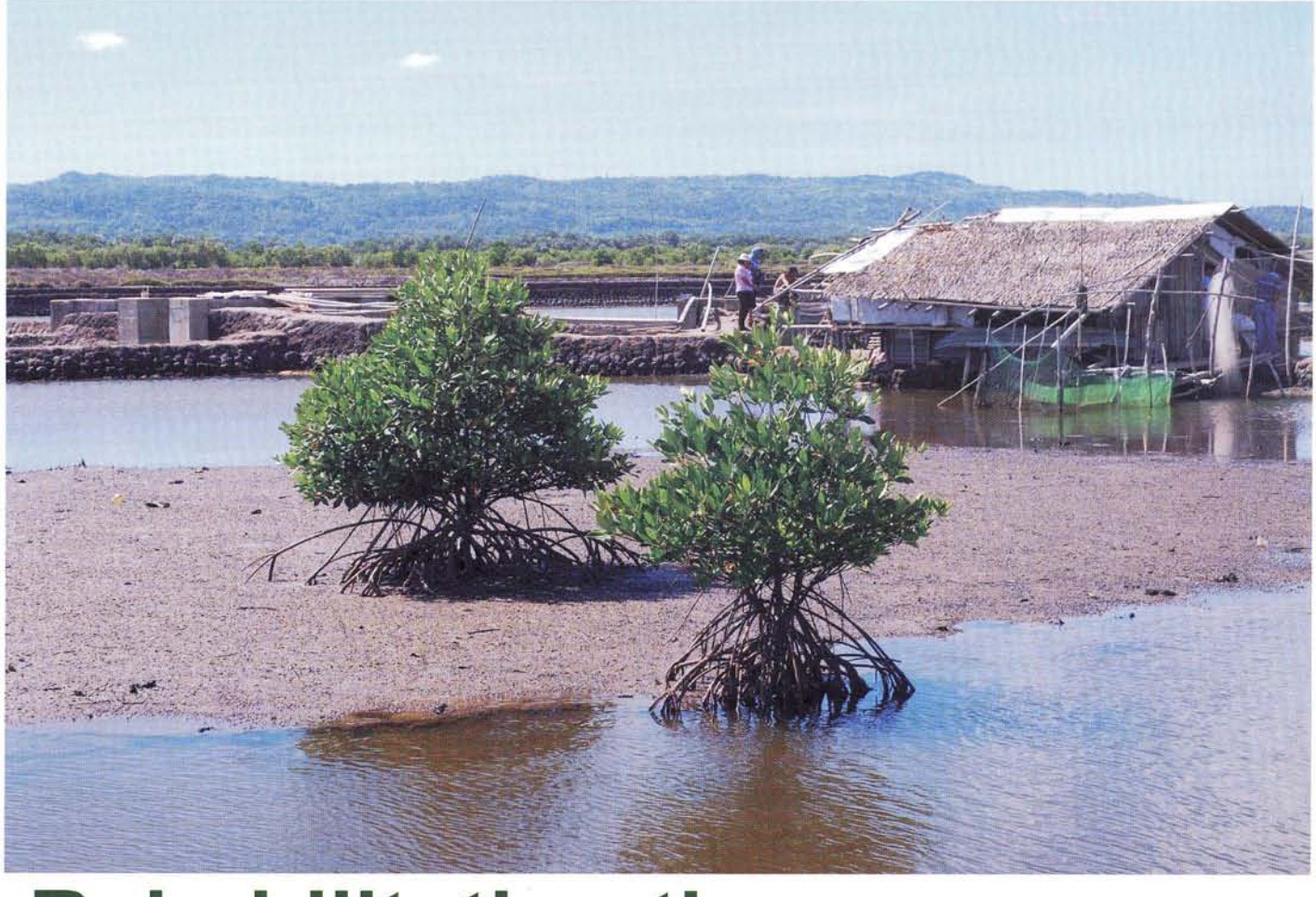

Rehabilitating the mangroves

Social Psychology of Adaptation: Bridging actions and relations

by Manuel F. Bonifacio, PhD

When I was requested to write a paper on climate change, I accepted the challenge most especially because I knew that I will be able to discover something that may prove invaluable to the approach to climate change. In order to validate my hunch, I spent a substantial amount of time surfing through four major search engines namely, Google, Yahoo, Bing and Alot. Although there is some duplication in the entries, one is likely to be overwhelmed at the amount of literature written on the subject. I suddenly realized what another paper will do in the plethora of subjects written on climate change. There is an overwhelming consensus that we must join hands to introduce mitigating measure and help promote adaptation strategies.

In the course of my reading, one thing stood out in the literature and this is – the need for a coherent approach to climate change. Another thing I discovered was the lack of clear delineation between coping and adaptation. In fact, quite a number of writers do not even touch on the issue of coping. I encountered literature where coping is taken as a product of adaptation. Armed with this information, I decided that I will not write a paper. Instead I will give attention to the need to have a more coherent approach to climate change.

Conceptual guide to adaptation - an overview

I perceived that what is needed is a conceptual guideline that may unravel the complex nature of adapting to climate change. As a social scientist, I noted that the issues associated with adaptation to climate change are global, and that this is the first time that a general framework can be developed that is free of cultural bias. This is my main reason for not developing a detailed framework. I do not want to introduce my personal bias on the topic. The framework that will be developed must be *general in nature* since climate change affects all countries. However, I hope that the adaptation framework is flexible enough such that it can readily be adapted to suit the needs of a particular country. In other words, priority setting must be country-specific. The elements of the framework must be built into the specific country program.

I hope the outline could be fleshed out by an international multi-disciplinary team. What needs to be done is for the team to develop a general theoretical framework on adaptation to climate change using the suggested conceptual guideline. The country-specific framework will have to be derived from the general framework. Country-specific application of the framework will serve as a feedback mechanism to continuously improve the theoretical orientation of the general framework. Its local application must be given attention especially from the point of view of theory construction.

On the basis of the conceptual guideline developed below, adaptation is taken as a social fact conditioned by a psychological fact known as coping. This means that one must experience an event then cope with it and prepare the mode of adaptation one plans to undertake. This is best shown in people's response to disaster. It is indeed very obvious that one can only adapt on the basis of how he will cope with the situation. It is in consideration of this fact that a disaster is always considered a crisis because of the varying manners by which people will cope. This is very important for vulnerable groups in agriculture and fisheries. The key is the harm brought about by the event. One's experience of harm will greatly influence his pattern of adaptation. The experience of harm borne out of disaster is a universal phenomenon and yet not enough attention has been given to it so as to develop a more adequate

theoretical framework of adaptation.

Adaptation is a social fact and it must be understood as such. It is institutional in nature and readily observed in social relations. In other words, adaptation is a relational concept which is modifiable through improvements, innovation and change. A particular type of adaptation should be given attention and it is the *planned adaptation.* This is best illustrated by the relocation of people, adjusting various human activities deliberately like changing patterns of production and job relocation.

It is important to be cognizant that in the case of adaptation, most especially for the vulnerable group, the experience of harm may be anticipatory and therefore mobilizing people to adapt to climate change may be far more difficult than the way it is presently understood. The sense of harm may be purely vicarious rather than direct. Hence, it will probably be very easy for people to rationalize the situation. *That is not likely to happen in my lifetime or the event is too far removed from us.* The point that will have an important bearing on the theory of adaptation is the *idea of harm as anticipatory.*

In view of the complex nature of adaptation, a general theory of adaptation must be developed. The connection between coping and adaptation must be given substantial attention. In developing the theory, attention must also be given to how people view the environment. Again, since it is social in nature, its image and meaning will vary across groups. The vulnerable group is a case in point. Through the years moving squatters from one location to another is a major political issue. Once more, intentional/deliberate adaptation of people must be handled with care.

The rest of the conceptual guideline takes into serious consideration that adaptation to climate change must be taken as a positive event but it must be focused on opportunities. In other words, people can live better provided that they adopt an innovative management of community resources. A new concept of resource management must be formulated. It must be process oriented emphasizing the inter-connected processes of prevention, rehabilitation, protection and development. *(see Fig 1)*

It must be noted that the new management must begin by taking opportunities as the point of entry complemented by potentials and, of course, constraints. The methodology is process oriented -- improvement complemented by innovation and change. In view of its management focus, decision making will be central and the role of information will be critical. The mobilization of support system must be conceptualized as decision support system. Overall planning of resources must be community-based in the context of local development planning.

Fig.1 An example of a resource management approach

	Improvement	Innovation	Change
Opportunities	x		
Potentials		x	
Constraints			x

The foregoing conceptual overview reflects the demand for a more rigorous theoretical orientation on adaptation. A new paradigm on adaptation is badly needed so as to address the needs of those affected by climate change – the vulnerable groups. An international multi-disciplinary team of experts must be mobilized to work on the general framework of adaptation to climate change and develop a more theoretically oriented approach to adaptation. In short, a critical theory of adaptation is in order.

A new paradigm on adaptation is badly needed so as to address the needs of those affected by climate change – the vulnerable groups.

Proposed Conceptual Guide

Conceptual Outline

1) General perspective
2) Image of the environment
3) Idea of Harm
4) Experience of harm and coping style – Impact on Adaptation
5) Scale of adaptation
6) Role of human action
7) Local development planning
8) Participation and collective action
9) Common framework of action – collaboration
10) Resource management model
11) New paradigm of action

CONCEPTUAL GUIDE

1) General perspective

- Through the years, program planning and execution have been focused on what is to be done – activity focused – the setting of objectives is primarily addressed to the generation of output – fund driven--the conceptual framework of the activates is never given its appropriate theoretical attention. The conceptual guideline developed below is theoretically oriented.
- Reversing the trend in the destruction of the environment
- The new management of the agricultural environment
- Coping vs. adaptation
  - Coping – psychological
  - Stress – cope – adapt
  - Adaptation - social
- You have to cope to be able to adapt

2) Image of the environment

- Symbolic management of the environment
- New paradigm of action
  - Sense of urgency - -critical orientation – change oriented management –risk reduction
  - Adaptive flexible –willingness to change – asset improvement, innovation and change
  - Construction and meaning
  - Environmental crisis – havoc / no boundary – drought, floods, dry spell land degradation, water scarcity
  - Question of uncertainty
    - Role of information
    - Risk management
    - Moderating the impact of climate change
      - New support system
        - Training
        - Livelihood development
        - Information management
        - Complementation and collaboration
          - Community of practice

3) Idea of Harm

- Actual – cope
- Anticipated -- adapt

- Harm – imagined ,real, anticipated – vulnerability
- Sense of harm – meaning and context of harm
- Reframing harm – from fate to faith, social capital, trust building
- Collective perception of harm
- Social psychological of blaming
- Reframing and sense of accountability and responsibility
- Manageability and management of harm

4) Experience of harm and coping style – Impact on Adaptation

- Coping – reframing action
  - Life threatening events
  - Building resistance
  - Positive orientation of coping – opportunities and potential resource management
  - Process – problem identification, solving management and organizing action
  - Proactive action – adaptation

5) Scale of adaptation

- New perspective on the management of resources
  - focus on opportunity – creating new ones
  - Synergy and self-adjusting system
- Reducing vulnerability – new management of resources – reducing vulnerability
- Multi-disciplinary approach
  - Adjustment / modification of action
  - Change – positive development of action
    - Change our way of life—we can live better
    - Collective action – transformative
    - New value orientation – Commitment, Accountability, Responsibility and Trust (CART)

6) Role of human action

- Framing of action – new framework of action – adaptation
  - We must act now – enhancing new opportunity structure proactive action
  - New management order
    - Conflict, accommodation, cooperation, incorporation/assimilation, integration and institution-building
- Interpretive action
- Adaptive action / activity
- Reactive – coping
- Proactive – adapting
  - Transformation

7) Local Development Planning

- New capability – community-based, participatory, systems oriented, multi-disciplinary farming systems development local development focus—municipal development plan
- New conditions created by climate change
- Asset building -- resource management
  - Adaptation –adjust, prepare, accommodate
    - Performance oriented – community of practice
      - Process of continuous learning follows trajectories of action – process oriented
  - Proactive action --- conflict – negotiation—accommodation—cooperation—assimilation –integration –sustainability
- New capability / skills development
  - community-based, participatory, systems oriented, multi-disciplinary farming systems development, local development focus
  - local development plan

8) Participation and collective action

- Information and knowledge management
  - Decision making – action planning –integrated approach
- Shared perspective – community organizing
- Identification, organization, planning, communication , m/e
  - Developing community of practice
    - Incorporation, integration and transformation

9) Common framework of action – collaboration

- Overcoming fragmentation
- Value orientation -- Commitment, Accountability, Responsibility and Trust (CART)
  - Focus on social enterprise
    - Innovation and change
- Positive oriented action - proactive
  - New mind-set –
  - New management of resources
    - Rehabilitation, Conservation, Protection, Development - Sustainability

10) Resource management model

- Comprehensive resource planning
  - Effective land use plan
  - Rehabilitation, protection, conservation and development
- Emergence of new practice
- Social enterprise – minimizing vulnerability
  - Social capital
- New mind – set
  - management –improvement, innovation and change
- New concept of cooperative – focus on social enterprise
- Security of the community in terms of access and control of resources
- Livelihood security focus on new management of resources – social, technical, economic environmental and political (STEEP)
  - New value-orientation – Commitment, Accountability, Responsibility and Trust (CART)
  - Use of ICT as DSS

11) New paradigm of action

- Sense of urgency - -critical orientation – change oriented management –risk reduction
- Adaptive flexible –willingness to change – uses of asset
- improvement, innovation and change
  - Developing community of practice
    - Incorporation, integration and transformation
- New capability – community-based, participatory, systems oriented, multi-disciplinary farming systems development local development focus—municipal development plan
- Asset building – innovative management of resource

Climate change is the next big thing in agriculture - US biotech advisor

by Miko Jazmine J. Mojica

At a special presentation to an audience composed of some officials and staff from the Department of Agriculture (DA), US Senior Advisor for Biotechnology Jack A. Bobo drew attention to the role of agriculture in climate change.

"Climate change is the next big thing in agriculture," said Bobo during his brief lecture when he visited the DA office to meet with its officials.

In his presentation, he cited some of the most recent studies undertaken by recognized international organizations related to agriculture and climate change such as the UN Food and Agriculture Organization (FAO), Inter-governmental Panel on Climate Change (IPCC), International Food Policy Research Institute (IFPRI), and World Bank.

"If the IFPRI is saying that weather variability due to climate change will result in 27 percent decline in global productivity by 2050, this means that we have to double or triple our current production by that time in order to meet the demands of a ballooning world population," said Bobo.

Accelerating agricultural productivity, however, means high costs of adaptation. Bobo cited IFPRI's report that said, "aggressive agricultural productivity investments of US$7.1–7.3 billion are needed to raise calorie consumption enough to offset the negative impacts of climate change on the health and well-being of children." Out of this figure, at least $1 billion for research and irrigation efficiency is required for South Asia alone.

Impact of climate change on agriculture

Bobo cited reports that said agriculture and land-change emit 31 percent of greenhouse gas (GHG) emissions, most notable of which are carbon dioxide, nitrous oxide, and methane. "Tree burning and decomposition contribute to GHG emissions. Deforestation contributes to soil erosion, which reduces agricultural productivity," he said. According to recent reports on deforestation, more than 80 percent of the world's forests, where 80 percent of life on Earth can be found, have been destroyed.

Bobo likewise pointed to soil erosion and degradation as major contributing factors to the decline of agricultural productivity. "Soil degradation has reduced agricultural productivity by 13 percent in the past 50 years especially in Central America and Africa. Each year, 12 million hectares – enough land to grow 20 million tons of grain and an area the size of Greece – are lost to desertification which leads to accelerated soil erosion."

Moreover, Bobo brought up the impending water crisis concern as agriculture accounts for 70 percent of freshwater use worldwide. "Competition with cities and other sectors such as mining for water will grow over time. In 20 years, about two-thirds of global population will live in cities."

Sensible solutions

In order to address the impact of climate change on agriculture, Bobo advocated for appropriate climate policy, investment in R&D and technology from both the private and public sectors.

"Issues such as food safety, food security, and drought surround every major policy issue when tackling climate change but, if we will notice, 90 percent of policy on climate change is about energy. Climate policy should take into account the need to support global food security by promoting synergy between food security research and climate mitigation and adaptation research," he said.

Bobo quoted the IPCC when he emphasized the role of technology in climate change mitigation. "Recent trends in both public and private energy funding indicate that the role of 'technology push' in reducing GHG emissions is often overvalued and may not be fully understood. Ultimately, it is only by creating a demand-pull market rather than supply-push that technological development, learning from experience, can develop advantageous economies of scale in production and related cost reductions can result."

Bobo stood by funding for agricultural technology for reducing inputs that contribute to GHGs as a way that benefits the farmer and the consumer at the same time. "Farmers want, and are willing to pay for new technologies that reduce inputs as this increases income or lead to reduce cost. As a result, the environment and the public receive a benefit at no additional cost, he said."

Moreover, Bobo stressed the importance of investments in agricultural research which will deliver high rates return in all regions of the world. He said that agricultural technologies are available today should begin making a difference with respect to mitigation and adaptation. Some of the areas of R&D and technology development he identified as crucial included reduced fertilizer use, drought tolerance, increasing yield gains, plant variety protection and patents.

Some caveats

Although positive about addressing the impact of climate change to agriculture, Bobo cautioned that not all climate mitigation and adaptation strategies, and technologies will enhance global food security. According to him, this is where appropriate climate policy should come into play.

"There are a lot of calls to make technology freely available but you just can't take an insect-resistant corn from the US, for example, and bring it to the Philippines. There should be a regulatory review and approval for these things," Bobo explained. He likewise gave importance to having access to private sector investments in R&D and technology. He said that a system should be in place for private-public sector partnerships to make it work. Then again, Bobo's belief is that when technology is available, farmers will be willing to pay for it. Thus the government eventually does not need to spend for it since it is likely to be challenged particularly in a developing country such as ours.

Citing the previously widely-circulated Stern Review on the economics of climate change, the International Assessment of Agricultural Science and Technology for Development (IAASTD) highlighted the fact that while there is a range of activities that could be undertaken to reduce agricultural emissions, it is not necessarily the case that they will be adopted simply by virtue of the fact that they appear to make sense.

"Farmers are unlikely to adopt practices that will benefit society as a whole if they alone have to bear the cost. Even low cost mitigation options will not be adopted if the farmer must pay to undertake work from which wider society gains most of the benefit. Government must intervene to overcome this 'market failure' and to encourage adoption of mitigation options and introduce wider measures to help reduce emissions."

The Climate Change Act recently signed by President Gloria Arroyo on the other hand, is only focused on crafting and implementing "a national adaptation plan to help Philippine agriculture and other vulnerable sectors cope with the worst effects of altered weathered patterns triggered by global warming". ###

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King crabs for sale

Pedro Pido, a fishpond farmer-recipient of a CPAR project in Magsaysay, Occidental Mindoro, discusses to his fellow fishers the potential of "alimango" (King Crabs) in the foreign and local markets. According to him, in the seafood market, underweight mudcrabs are discouraged as they should be of good size to command a good price. "The bigger the mudcrab, the better is the profit," he said. Hence, fattening is an important aspect toward a profitable mudcrab production. The CPAR project on mudcrab has introduced the pen culture technology or the use of net enclosures in mangroves or tidal zones which not only cost-effectivet but is also environment-friendly as it improves the growth of mangroves in the area. TEXT & PHOTO: RDELACRUZ

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