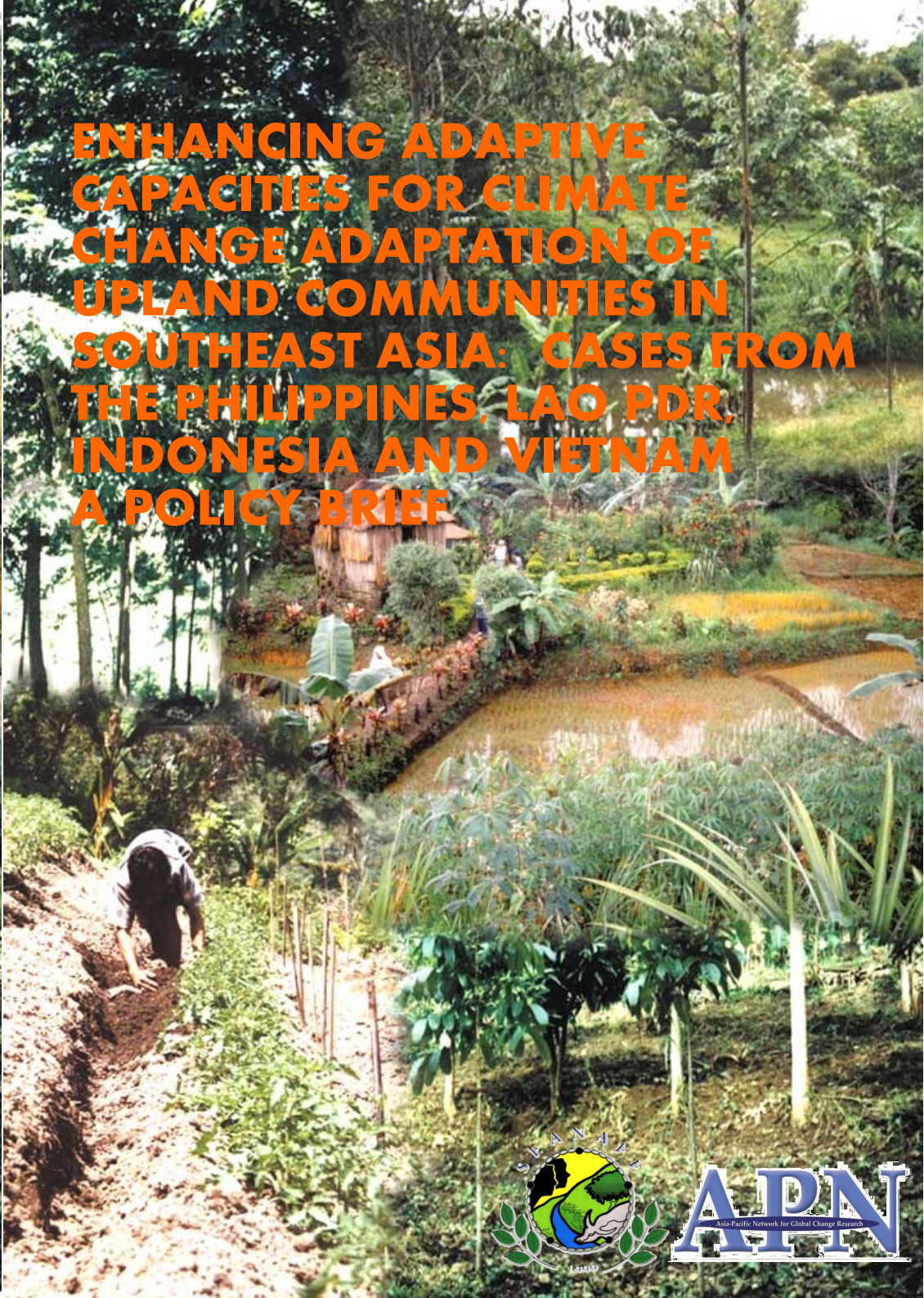
ENHANCING ADAPTIVE CAPACITIES FOR CLIMATE CHANGE ADAPTATION OF UPLAND COMMUNITIES IN SOUTHEAST ASIA: CASES FROM THE PHILIPPINES, LAO PDR, INDONESIA AND VIETNAM
A POLICY BRIEF



APN
Asia-Pacific Network for Global Change Research

PREFACE

This Policy Brief is one of the major outputs of the project entitled "Capacity Development of Local Climate Change Communicators in Vulnerable Upland Communities in Southeast Asia. This project was carried out by the country-networks of the Southeast Asian Network for Agroforestry Education (SEANAFE), namely: Indonesia Network for Agroforestry Education, Lao Network for Agroforestry Education, Philippine Agroforestry Education and Research Network (PAFERN) and the Vietnam Network for Agroforestry Education (VNAFE), with fund support from the Asia-Pacific Network for Global Change Research (APN). Primarily, this project was implemented to enhance information exchange and technical capacity development among the SEANAFE member-countries in agroforestry development and promotion in Southeast Asia.

This policy brief highlights the farmer-level evidences and impacts of climate change on the agricultural production and how these are being experienced by the smallholder farmers in Southeast Asia, particularly countries such as Indonesia, Lao PDR, Philippines and Vietnam. Likewise, different research and policy initiatives towards climate change adaptation are discussed in this document to showcase how the national and regional organizations/ agencies respond to this global phenomenon. However, there may be some concerns that may not have been addressed by the national and regional initiatives, thus, this policy brief also stresses the gaps, and therefore, further forwards some policy recommendations to address these gaps.

The project collaborators believe that this policy brief will serve as its instrument in its advocacy of institutionalizing agroforestry at various levels and sectors in Southeast Asia.

WILFREDO M. CARANDANG
Project Leader

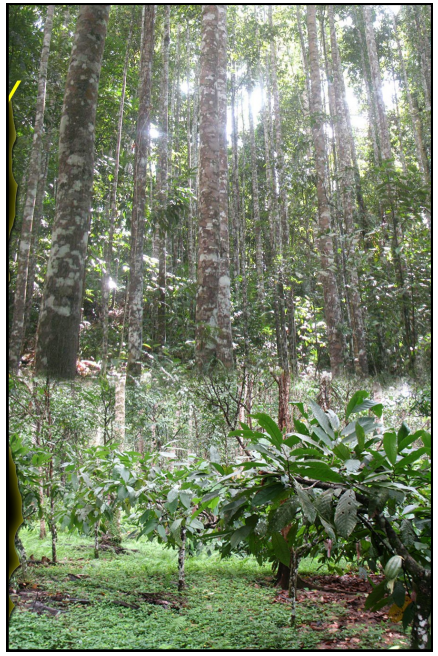
INTRODUCTION

Climate change is defined as a statistically significant variation that persists over longer time scales, typically decades or longer (Pittock, 2011; IPCC 2007). It includes shifts in the frequency and magnitude of sporadic weather events as well as slow continuous rise in global mean surface temperature. Climate change has become a serious global problem as evidenced by the erratic change in the temperature and rainfall patterns around the world. These changes have been causing a number of impacts to all sectors of the society, particularly the stronger and frequent typhoons which cause sea-level rise, storm surges, heavy floodings and landslides, long drought, decline in agricultural production, and health risks, among others. This environmental issue has become a global concern because of the magnitude and scale of its impacts, and the fact, that most scientists say, it is anthropogenic (man-made) in nature.

According to UNFCC (2007), the rising fossil fuel burning and land use changes have emitted, and are continuing to emit, increasing quantities of greenhouse gases into the Earth's atmosphere. These greenhouse gases include carbon dioxide (CO_2), methane (CH_4) and nitrogen dioxide (NO_2), and a rise in these gases has caused a rise in the amount of heat from the sun withheld in the Earth's atmosphere, heat that would normally be radiated back into space. This increase in heat has led to the greenhouse effect, resulting in climate change.

Climate change poses two distinct sets of challenges for poor rural households: challenges related to the increasing frequency and severity of weather shocks; and challenges related to long-term shifts in temperature, rainfall patterns, water availability and other environmental factors (Baez, et al 2013). The IPCC Report (2001) highlights that "*yields of some crops in tropical agricultural areas decrease with even minimal increase in temperature because they are near their maximum temperature tolerance. Where there is also a large decrease in rainfall in subtropical and tropical dryland/rainfed systems, crop yields would even be more adversely affected*".

According to Mertz et al (2009), while greenhouse gas emissions associated with the use of fossil fuels mainly comes from rich industrialized and post-industrial countries, the impacts of climate change will be more severe in poor developing countries. This is because the physical impacts are



Integrated agroforestry system in Northern and Southern Mindanao
Photo courtesy of Institute of Agroforestry)

Agrisilvipastoral system in Claveria, Misamis Oriental
Photo courtesy of Institute of Agroforestry)

DIFFERENT AGROFORESTRY MODELS AND SYSTEMS IN THE PHIILIPPINES

Cutflower-based agroforestry system in Nagcarlan, Laguna
(Photo courtesy of Institute of Agroforestry)

Fruit tree-based agroforestry system in Nabunturanm Compostela Valley
(Photo courtesy of Institute of Agroforestry)

Alley cropping system in Argao, Cebu
(Photo courtesy of Institute of Agroforestry)

expected to be relatively large in developing country regions, where increases in the already high temperatures are likely to lead to large evaporation losses and in many developing countries, precipitation is not likely to increase as is expected in many high-latitude regions (Christensen et al, 2007).

The high number of poor people in these countries is generally more vulnerable and likely to feel the negative effects of climate change (Yobe and Tol, 2002) since their economic and technological capacity to adapt to climatic change is also very limited. Moreover, the economy of many poor developing countries relies heavily on agriculture which is mostly a vulnerable sector because of its dependence to water and temperature conditions. Most of the climate change models predict that the small farmers particularly those engaged in rainfed agriculture would bear the negative impacts of climate change (Altiere and Koohafkan, 2008). This is because rainfed agriculture is largely dependent on rainfall, and therefore, any disruption in the rainfall pattern would surely influence the agricultural production activities of the smallholder farmers. Conway (1997) asserts that about 370 million of the poorest in the world live in resource-poor, risk-prone and highly heterogeneous areas. These rural poor mostly live in marginal areas which make them more vulnerable to the negative impacts of climate variability.

In view of these concerns, the member-countries of the Southeast Asian Network for Agroforestry Education (SEANAFE) joined together in organizing capacity development activities that are aimed at creating public awareness about climate change, particularly its causes, impacts and the possible adaptation strategies that could be employed by the smallholder farmers in the upland communities with emphasis on agroforestry as a key adaptation strategy; discussing and lobbying with the local policy makers about instituting local policies and development programs along climate change adaptation; developing building the capabilities of local extension workers, teaching staff and farmer trainers on communicating climate change in their respective areas; and, establishing on-farm demonstration farms showcasing appropriate agroforestry systems and technologies as climate change adaptation strategies.

This policy brief highlights the farmer-level evidences and impacts of climate change on the agricultural production and how these are being experienced by the smallholder farmers in Southeast Asia, particularly countries such as Indonesia, Lao PDR, Philippines and Vietnam. Likewise, different research and policy initiatives towards climate change adaptation are discussed in this document to showcase how the national and regional organizations/ agencies respond to this global phenomenon. However, there may be some concerns that may not have been addressed by the national and regional initiatives, thus, this policy brief also stresses the gaps, and therefore, further forwards some policy recommendations to address these gaps.

HOW IS CLIMATE CHANGE BEING EXPERIENCED IN THE REGION?: A SITUATIONER

Among the projections and predictions of climate change experts/scientists, the agriculture and food security in Asia would be highly vulnerable to the impacts of climate change. Specifically, there would be crop yield decline which may put many millions of people at risk from hunger; reduction in the soil moisture and increase in evapo-transpiration which may increase land degradation and desertification; and, expansion of agricultural productivity in northern areas (UNFCC, 2007).

The ecological conditions of mountainous mainland in Southeast Asia have continued rapidly changes due to recent population increased and changed of government policy of Asian nations to intensify land use practice by introducing cash crops and promote permanently used agriculture fields. The main intention is to protect forests and reforestation of degraded areas due to swidden cultivation activities. Thus, villagers had to adapt themselves to the new land use intensification activities in unstable natural conditions and direct exposure to more pest and diseases infestation. Most of researchers have proposed to replace the traditional cultivation with a modern practice including permanent cash cropping. Others have also tried to promote various systems of mixture cultivation. Relating to the replacement and adoption of new modified systems by villagers depends very much on socio-economic, and land-use conditions.

Meanwhile, traditional swidden cultivation is ecologically stable under low population density.

Coffee cropping with Gaharu trees

Photo courtesy of Dr. Anoulom Vilayphone)

Para-rubber mixed with Cassava and Cattle feeding grasses

Photo courtesy of Dr. Anoulom Vilayphone)

Rubber mixed with Maize and peanut

Photo courtesy of Dr. Anoulom Vilayphone)

DIFFERENT AGROFORESTRY MODELS AND SYSTEMS IN LAO

The model of Cajanus cajang inter-cropped with paper mulberry in former Swidden cultivation

Photo courtesy of Dr. Anoulom Vilayphone)

The model of fruit trees mixed with Leguminous species.

Photo courtesy of Dr. Anoulom Vilayphone)

Coffee planting under degraded secondary forest.

Photo courtesy of Dr. Anoulom Vilayphone)

There have been some macro-level projections and technical recommendations from experts to the agriculture sector about mitigation and adaptation strategies to the impacts of climate change as contained in the IPCC Report in 2007. A more important concern now is to assess whether climate change is indeed real at the field-level, evidences and indications of climate change, including the observable effects of climate change in their agricultural production activities, and how the smallholder farmers respond and initiate actions to cope with the impacts of climate change.

Case 1: Philippines

As one of the developing countries in Southeast Asia, the Philippines is highly vulnerable to climate change impacts considering its geographical features, low level of economic development and exposure characterized by poor access to resources. More importantly, agriculture is the major economy of the majority of the populace in the Philippines. Generally, the agriculture or farming sector is comprised of smallholder farmers. The smallholder farmers are those whose primary source of income is the small-scale subsistence farming (RA 8435 or AFA, 1997) and who cultivate agricultural lands that are not over five hectares (Landbank of the Philippines, undated).

According to Raquedan (2010), the Philippines was the "world's top climate victim" in terms of damage caused by extreme weather events, and is among the top ten countries on a "climate risk index" for the years 1998 to 2007 on the basis of average damage from such events. El Niño tends to affect agriculture in the Philippines through drought, while La Niña tends to produce greater rainfall and increased flooding.

The two strongest El Niño events in the past century occurred in 1982-1983 and 1997-1998 and both events affected agricultural production, with substantial declines in production of four main crops, namely: rice, corn, coconut and sugarcane (Amadore, 2005). Most recently, the El Niño of 2009-2010 produced substantial declines in farm production in the first quarter (2.8%) and second quarter (3.5%), evidently as a result of drought (Felix, 2010 as cited by Lang, 2011).

Rao et al (2007) stressed that the major processes of agriculture that are directly influenced by climate change are soil, water, carbon and nitrogen cycles, crop growth and development, and incidence of weeds, pests and diseases. These effects are manifested in terms of increased heat stress, increased evapo-transpiration, shortened seasons, and increased photosynthesis.

Studies conducted by the University of the Philippines Los Banos-Institute of Agroforestry and Lampung University revealed that climate change is indeed real and is already being experienced in the Philippines and Indonesia, respectively. This is especially true among the upland farming communities in the country, whose main element in their agricultural production is rainfall.

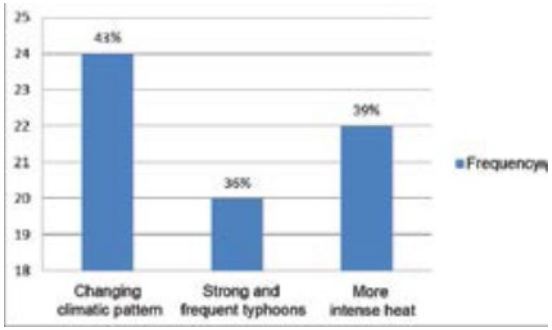


Figure 1. *Indications of climate change as observed by the respondent-farmers in the Philippines*

Upland farmers have already been expe-riencing climate change (Visco et al., 2011). All farmers noted considerable changes in climate compared with prevailing climate of the past. They recalled that, in the past, they could accurately plan their agricultural production because of predictable rainfall patterns. But 43% of the respondents have observed changing climatic patterns in recent years, particularly since 2000. Specifically, 39% observed that heat is more intense, while 36% mentioned strong and frequent typhoons especially in year 2010 and 2011 (Figure 1). Specifically, in Northern Mindanao area and Eastern Visayas, the classified Type IV climate should result in an even distribution of rains throughout the year. However, farmers perceived longer rainy seasons to the extent that heavy rains are still observed during the summer season. This was also the claim of farmers in North-ern and Southern Luzon.

Plantation forest – homegarden – bee-keeping in Dak Rong District, Quang Tri Province
Photo courtesy of Dr. Bao Huy)

Industrial garden with rubber tree – upland rice and Winbreak belf in Dak Lak Province.

Photo courtesy of Dr. Bao Huy)

Plantation forest with Euca-lyptus, Acacia and fruit trees in Agroforestry model in the Central Highlands
Photo courtesy of Dr. Bao Huy)

DIFFERENT AGROFORESTRY MODELS AND SYSTEMS IN VIETNAM

Forest – Fruit tree – Annual crop – Animal husbandry in Quyet Thang Commune, Thai Nguyen city

Forest - farm or pasture - terraced field in Mu Cang Chai District, Lao Cai Province , Northern mountain of Vietnam
Photo courtesy of Dr. Bao Huy)

Forest – homegarden – farming in Con Cuong District, Ha Tinh Province
Photo courtesy of Dr. Bao Huy)

Climatic changes have affected the agricultural production of respondent-farmers, simply because agri-culture is influenced largely by rainfall and temperature. Visco et al. (2011) noted that generally, there has been a decline in the crop production of the respondents in the Philippines. Figure 2 shows that the decline in crop production is attributed to higher incidence of pests and diseases (35%), stunted growth (39%), and increased labour costs (14%). In addition, delayed fruiting (21%) and livestock mortality (8%) were also observed.

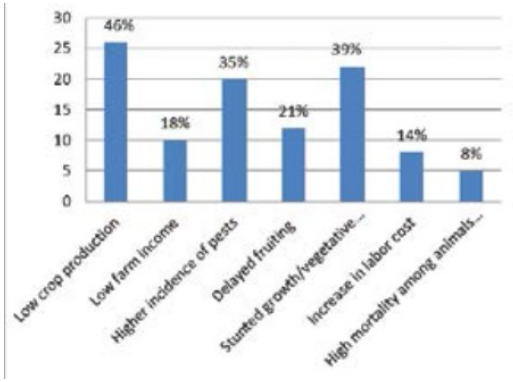


Figure 2. *Observed effects of climate change in agricultural production of respondent-farmers in the Philippines*

Results revealed that farmers make use of their local knowledge in addressing the effects of climate change to their agricultural production in both countries (Visco et al., 2011; Wulandari et al., 2011). Most of them mentioned changing their crops to suit the changing rainfall patterns, integrating more crops to maximize production, and a few practice rituals to prevent crops from pest infesta-tion, while most of the respondents would not only plant the crops, but also engage in off-farm and/or non-farm activities, leaving their farms uncropped (Figure 3). Perhaps the lack of resources and motivation to address the impacts of climate change has resulted in the engage-ment in off-farm and non-farm activities.

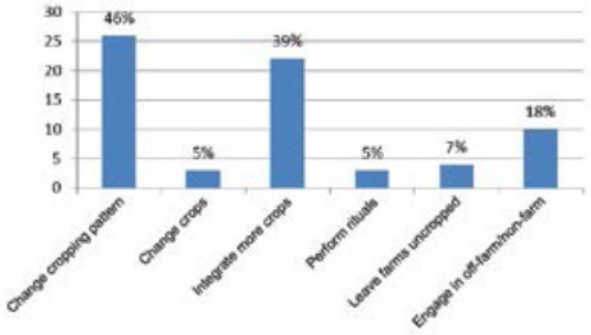


Figure 3. *Climate change adaptation strategies of smallholder farmers in the Philippines*

Case 2: Indonesia

A study conducted by Lampung University in Indonesia revealed that 79% of the farmer-respondents considered the change in temperature as an indication of climate change (Wulandari, et al., 2011). At present, the climate is much hotter as compared to the past. Also, in the past, they could easily predict rainy and summer seasons, but now, fluctuating climatic patterns are observed. According to 48.15% respondents, climate change occurs because the forests are barren as a result of illegal logging. While 40.74% of respondents said that climate change occurs because of the environmental damage. And, the last 11.11% stated that climate change occurs due to global warming (see Figure 3).

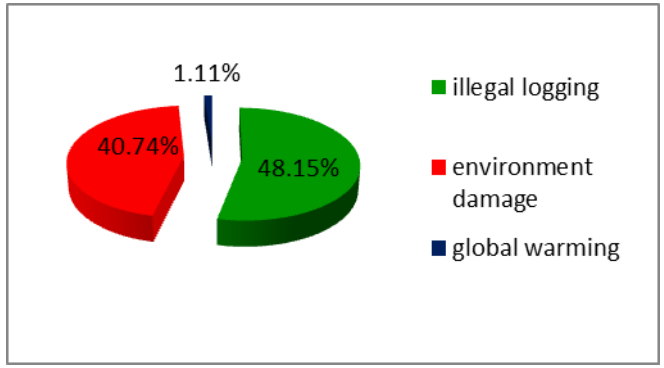


Figure 3. Perceived causes of climate change in Indonesia

- Oriented-agroforestry mixed crops with the reasonable coordination of crops. Development of sustainable farming systems, focusing on environmental factors.
- Systems of suitable industrial crops such as rubber, Macadamia towards sustainably mixed
- Protection and development of forests to absorb CO_2, to protect watershed forest and to conserve biodiversity need to be considered
- Forest rehabilitation and reforestation in watershed areas, along rivers and streams to protect water source.
- Enrichment of natural forest by valuably indigenous species, NTFP

Similar conditions are also being experienced by the community living along the upstream of Kapuas River Basin. Even some of their villages are moving by themselves due to a quite big flood, although the rain fell not too long ago (WWF, 2007). Based on his research, Boer et al. (2010) stated that climate change would provide a significant impact on agricultural production in Indonesia, especially food crops. The impacts could be direct impact, which is decreasing productivity due to increased air temperature and rainfall patterns and more frequent of crop failures due to increased frequency of extreme climate events such as floods and droughts.

According to Handoko *et al*. (2008) in Djuni (2009), the impact of rising temperatures on the food crops is more significant than the decreasing rainfall as occurred in six provinces (West Java, East Java, North Sumatra, South Sulawesi, Gorontalo, and North Sulawesi). Things like this happen on the field because most of the strategic crops lands are using irrigation water. Although there are also plants from rain-fed water sources, such as corn, which would be very sensitive if the rainfall decreases. It is found that rising temperature also affects the process of respiration and photosynthesis of plants.

Plants in tropical regions with relatively high temperatures, such as in Indonesia, have a shorter growing period and a higher respiration rate, so that a rising temperature will decrease the production of biomass and crop yields. Further, Handoko (2008) in Djuni (2009) stated that the result of the survey and verification in the field shows, most of the agricultural sector actor, particularly farmers, admit that they are now dealing with the uncertainty rainfall with the greater the variations. This is because the global warming increases water vapor transfer processes to the atmosphere thus increasing atmospheric humidity. Consequently, in some areas, the precipitation are increasing, while in some other areas are decreasing.

In their study, Wulandari et al (2011) emphasized that most of the farmer-respondents (82%) noted the delay of crop harvests because of the shift in the rainy season. Furthermore, 63.4% of 82.2% (or 77.2.%) of respondents said that their crop yields have decreased, while 65% observed the reduced quality of their harvest. Same statement also mentioned by key resource respondents of study of Community based Watershed Management in West Lampung, include decreasing of honey as one of non-timber forest product (Wulandari, 2010). Due to climate change, the farmers stated that pests and diseases also increased (51%).

These findings are validated by Wiyono (2009) who mentioned that in the last five years there was an increase of pests and diseases of agricultural crops in Indonesia. Wiyono also stated that in order to anticipate simultaneously to overcoming it, it is required to hold a comprehensive study of the impact of climate change on pests and diseases; develop appropriate agricultural techniques to make the crops to be healthier and more resilient to climate change particularly resistant to floods and droughts that caused by climate change.; and, increase awareness and understanding about the sustainability of the agro-ecosystems within which the farmers work on.

Furthermore, as much as 40.3 % out of 51% of respondents stated that the pests and disease attacks when the plant is still in the "poles" phase, although there are also 10.7% said that pest attack increases when it is in the phase of the tree (see Figure 4).

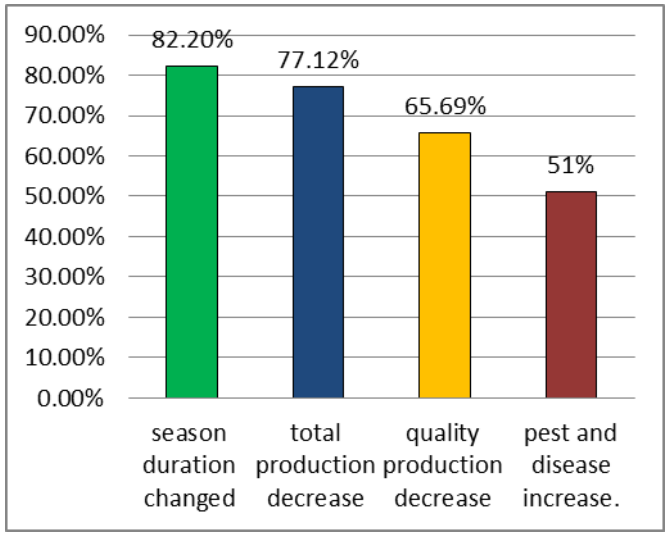


Figure 4. Impacts of climate change on agricultural production in upland communities in South Lampung, Indonesia

developing policies to ensure the implementation of community capacity -building related to climate change issues in a sustainable manner.

Lao PDR

- Climate change has significant implications for livelihoods of rural people, whom are heavily depend on agriculture and forestry sector for food security.
- The impacts of climate change are widely recognized by the government, communities, farming households and other stakeholders such as donor communities, non-governmental organizations, private investors, etc.…
- Awareness raising on climate change adaptation and factors threaten livelihoods should be provided to farming households and communities, so that they are aware of the potential impact and able to adapt their livelihoods.
- Government and researchers should engage local communities in local-level research identification and observation of climate change issues.
- Indigenous knowledge is important in identifying suitable adaptation actions.
- Regional dialogue and collaboration can provide valuable insights and exchange models for climate change adaptation.
- Climate change needs to be mainstreamed into development strategies and plans.
- Adaptation actions need to be translated into development plans at national and local levels.

Vietnam

- More perennial trees are encouraged in farming systems to increase capacity of CO_2 absorption, land erosion prevention, windbreaks, water protection and moist keeping. Variety of species that can be resistant to pests and diseases. Structure of seasonal plants should be suitably sessional.

village regulations are possibly done in the existing research locations. Some other villages have also had their own regulations such as Kebar Village (Manokwari District, Papua Province) with a regulation concerning deer hunting and keeping. Besides, in Situgal, Logas Tanah Darat, Sikijang, Rambahan and Lubuk Kebun Villages (Kuantan Sengingi District, Riau Province) there are 5 village regulations on the conservation of sialang-tree, favourable for wild bee-nesting. These 5 regulations are follow-ups to customary regulations in 5 villages, having common ground i.e. sialang-trees conservation. In addition, 7 villlages: Fatumnasi, Tutem, Nenas, Tune, Kuan Noel and Nunbena (Fatumnasi Sub-district, Soe District, East Nusa Tenggara Province) has issued 7 village regulations concerning herding, grazing and marketing so that cattle (cows and horses) do not enter the protected forests around those 7 villages.

Specifically, the following programs should be installed to ensure the sustainability of the earlier initiatives towards climate change adaptation in the agriculture and forestry sectors:

- *Participatory extension and training.* A model of extension involving farmers in the overall decision-making process from data collection and analysis, problem identification, constraint analysis and implementation, and monitoring and evaluation. The role of extension agents in this issue is to strengthen the capabilities and potentials of farmers to improve their cultivation in managing agro-businesses and utilizing the forests. Participatory extension approaches will be done by the farmers individually or in groups.
- *Community empowerment*. Process or an effort to empower all of the community with increased capacity and self-reliance of the community to be capable and to have the power to solve their own problems. CC adaptation and mitigation –based community empowerment aims to increase the capacity, productivity, capability and self-reliance of the community as the sustainable main driver and support the realization of democratic economy
- Local governments should develop program to minimize the negative impacts of climate change either through dissemination or extension through extension agents followed by structured training, or by

Wulandari et al. (2011) also highlight that the farmers employ their own local knowledge in addressing the impacts of climate change. These include rejuvenation of trees, enrichment of crop species using local knowledge, textbook studying, and radio broadcasts. These strategies, according to 70% of the farmer-respondents, were effective in addressing the impacts on fruit crops, crop yield, water management, and soil conditions (Wulandari et al, 2011). However, these strategies did not address the problem of increased pest and disease incidences. About 74% of the respondents believed that agroforestry could be a best alternative land use management system that could address the impacts of climate change.

In terms of the institutional support, around 89% of the farmer-respondents noted the absence of assistance or programs to mitigate or adapt to the impacts of climate change, particularly in the farming communities. Meanwhile, 11% of the respondents mentioned that the forestry sub-department had provided information about climate change, but did not extend to climate change mitigation and adaptation strategies. Thus, farmers believed that proper information dissemination and strengthening of community organizations are necessary to enhance their capacities to adapt to the impacts of climate change.

Case 3: Lao PDR

According to Worldbank (2012), the total population of Laos is 6,645,827. Of its total land area of 23,080,000 hectares, its forest cover occupies about 15,751,000 hectares. Similar with other countries in Southeast Asia, the rate of deforestation in Laos is quite high with an average loss if 78,000 hectares/ year. Lao PDR was likewise recorded as the 135th country in the world with high risk and impact of extreme weather events between 1991 and 2010. Among the projected impacts of climate change include shorter monsoon season and longer dry season that would lead to the decreasing availability of freshwater; declining productivity of rainfed agriculture, and more frequent and severe flooding and drought (World Bank, 2012).

According to information changes released by (www.climatewizard.org) in annual mean precipitation and temperature of Laos from 1951-2001 indicated that over the last 50 years, annual rainfall in Lao PDR has declined by 3.209 mm/year, with a total decline of 160 mm. Meanwhile, the mean

temperature has raised 0.85 °c, with an average of 0.017 °c per year. The regional prediction of mean temperature indicated that a mean temperature increase between 0.1 to 0.3 °c per decade, which caused a greater magnitude and frequency of extreme weather events like flooding and prolonged droughts (Figure 5).

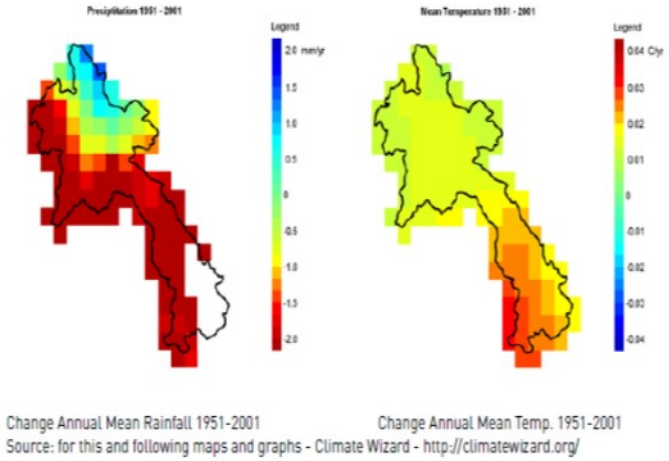


Figure 5: Changes in annual mean temperature and precipitation from 1951-2001

In 2008, the Mekong River reached highest record which caused severe flooding in many provinces along the river. Two years later adverse impact was recorded the lowest level which caused the shortage of water supply and irrigation water. Floods and droughts frequently occur and threaten agriculture production and food security. Farmers are struggling with more pests and diseases invasion.

Monoculture cash cropping is vulnerable to climate change. Especially, subsistence agriculture is notably vulnerable, as individual households are unable to cope with climate change. Agroforestry system plays an important role in mitigating it through enhanced carbon sequestration and that can also enhance the system's ability to cope with adverse impacts of changing

Integrated Watershed Management, in which natural resource conservation is expressed indirectly. In addition, West Nusa Tenggara has Provincial Regulation No. 4 year 2007 on Environmental Services Management, mentioning that natural resource management can be approached through a upstream-downstream scheme. It means that communities downstream have to give fair or equitable incentives to those upstream having conserved natural resources there. Besides, it is possible for other regions to develop similar regulations, including that some incentives are also given to communities conserving forest biodiversity since its role is very important to dynamic potency of carbon sequestration.

At the district level. It is likely that districts can also develop local regulations concerning on correlation of agroforestry and climate change. Lampung Barat District has got District Regulation No.18 year 2004 on Natural Resource Management, where article1 sub-article1 clearly mentions the definition of natural resources and environment, natural resources. It is meaning that environment will related to climate change. Meanwhile, a district regulation on Forest Resource Management, as informed by the local Forestry Office, is being discussed at local House of Representatives. Providing there are some revisions to make, a clause concerning correlation between agroforestry and climate change may be added whether in an article or on explanation notes. Therefore, it willhave an umbrella policy and can be enforced more effectively. Another example is Kuantan Sengigi District Head Regulation (Riau Province) No. 14 year 2006 on *Sialang* Trees Protection and Conservation its Environment in Kuantan Sengigi District, which has been developed from 5 village regulations in Situgal, Rambahan, Logas Tanah Darat, Lubuk Kebun and Sikijang Villages plus propriety studies made in other villages as well as private/company-management areas. It means that companies operating around Kuantan Sengigi District have to follow this regulation, too. Meanwhile, Muara Bungo District has already got a district regulation concerning customary and Guguk village forests (*Hutan Adat Guguk*). Interestingly, this regulation is developed further into a climate change adaptation strategy as this village potentially produces 261.25 tons of carbon/ha or equal to 19 billion rupiah.

At the village level. According to Law No. 10/2004 concerning Indonesian Policy Hierarchy, village regulation is equal to district/provincial regulation. Assuming the local communities have realized the importance of agroforestry for reducing climate change impacts, the development of some

should be well recognized by the farmers via information education campaign and capability-building programs.

⇒ Social capital enhances the capacity of an individual to address his/her problems or concerns by way of networking and establishing good relationship and solidarity between and among the members of the community (bonding capital) and their linkages with outside organizations (bridging capital). In most cases, the local development organizations channel their technical support services to the existing people's organizations from which farmers are given the opportunity to attend trainings and seminars, avail of the planting materials, and gain access on the recent developments and information about agriculture. In most cases, there has been very little support services that are being provided by the local development organizations. This implies, therefore, the need to link the farmers to relevant organizations to enable them tap the latter's assistance in any agriculture-related problems or concerns (e.g. marketing of products, climate change, etc).

Indonesia

Some policies that could be arranged or developed from its derivatives and expected to regulate simultaneously to manage the forest resources in the era of climate change are as follows:

At the province level. There have been several provincial regulations concerning natural resource management and conservation. Nanggroe Aceh Darussalam (NAD) province, for example, has got 3 provincial regulation, or "Qanun", on Forestry, Conservation Natural Resources and Natural Resource Management. Forestry Qanun No. 14 year 2002, at some articles and sub-articles, implicitly raises the importance of bio-natural resource conservation and protection. Also at some articles and sub-articles at both Qanun No. 21 year 2002 on Natural Resources Management and qanun no. 20 year 2002 on Natural Resources Conservation mentions similar issue. Although those three qanun do not specifically mention agroforestry and climate change, it is quite possible to generate other policies, stating forest resources management and conservation, from these 3 regulations. Similar to Aceh, East Nusa Tenggara has issued Provincial Regulation No.5 year 2008 on

climate conditions. The importance of agroforestry systems as carbon sink has recognized as important component of climate change mitigation.

Figure 6. Landslide during the heavy downpour on monocrop cultivation

Case 4: Vietnam

Vietnam is one of the five countries that is vulnerable to the impacts of climate change. Among the major impacts of climate change are flooding and salinity that bring about negative effects on the structure of agriculture, forestry and aquatic products in the Mekong River Delta and Red River.

The Central Highlands of Vietnam is home to many indigenous ethnic minorities; their lives are also difficult. Agricultural and forestry production is mainly extensive, highly dependent on natural factors. In recent years, in the Central Highlands, climate change presented as the extraordinary changes of the weather phenomena such as more severe dry season, hot dry wind blowing more strongly and more intense, and rainfall regime has also changed. The climate change in the country has greated a number of impacts to the agriculture sector as follows:

- Increased in crop pests especially in farms with monocropping as the main production system
- Reduced crop growth and productivity
- Change in the distribution, growth and seasonality of non-timber wood products, aquatic products in rivers and streams
- Flooding and landslides in the depression areas.

WHAT HAVE BEEN THE INITIATIVES IN ADDRESSING THE IMPACTS OF CLIMATE CHANGE IN THE AGRICULTURE AND FORESTRY SECTORS?

Recognizing the fact that climate change is already a worldwide phenomenon, a number of initiatives have been installed at the regional and national levels aimed at enhancing the adaptive capacities of the different sectors of the society. Foremost, the provisions of the UNFCC have been translated/downloaded at the regional and national levels by forging different agreements and policies . Specifically, the Philippines, Indonesia, Vietnam and Lao PDR have crafted their own national initiatives along climate change mitigation and adaptation.

Case 1: Philippines

Recognizing the fact that the Philippines is one of the tropical countries that is vulnerable to climate change impacts, the government has promulgated a Climate Change Act of 2009, which provides for mainstreaming climate change into government policy formulations, establishing the framework strategy and program on climate change. Specifically, Section 14 of this Act mandates the local government units as the frontline agencies in the formulation, planning and implementation of climate change action plans in their respective areas, consistent with the provisions of the Local Government Code, the Framework, and the National Climate Change Action Plan. Their specific roles and institutional arrangements are as follows:

- *The villages shall be directly involved with municipal and city governments in prioritizing climate change issues and in identifying and implementing best practices and other solutions. Municipal and city governments shall consider climate change adaptation as one of their regular functions. Provincial governments shall provide technical assistance, enforcement and information management in support of municipal and city climate change action plans. Inter-local government unit collaboration shall be maximized in the conduct of climate-related activities*

marginal conditions of the biophysical and social aspects. Agroforestry can be included as one of the development programs in the barangay and municipal levels. With this, there could be a regular funding allocation for relevant agroforestry activities that may be identified in the upland communities. These may include training programs, information drive, and establishment of on-farm demonstration areas showcasing different agroforestry technologies and systems that are appropriate to the local conditions

- Enhancing adaptive capacities of smallholder holders in a holistic manner such that, the human, social, financial and natural capitals are taken into consideration as follows:

  ⇒ The human capital should be developed in the form of capability-building or training programs, particularly on the appropriate/site -specific climate change adaptation strategies. As discussed above, there are smallholder farmers in other tropical countries who have been employing climate change adaptation strategies such as changing their cropping patterns, establishment of soil and water conservation measures, planting of short-duration crop varieties, among others. The smallholder farmers

  ⇒ The natural capital including the land and the farming system should be enhanced. The farms of the smallholder upland farmers are highly dependent on rainfall (being rainfed areas), and therefore, any change in the rainfall pattern would surely affect crop performance, farm productivity and farm income. They have small landholdings which are classified as public lands, and therefore, these are bound within the policies of the government. Cost-effective and environment-friendly soil and water conservation measures should be introduced in these rainfed areas, without jeopardizing the policies that govern the cultivation of upland areas/farms within the public lands. The farmers should capitalize on the presence of forest and fruit trees on their farms. The ecological services of trees, particularly their potential in climate change mitigation and adaptation,

WHAT POLICY MEASURES SHOULD BE INSTITUTED?

Climate change is real, and we cannot do away with it. This phenomenon has become part of human life, and thus, we have to adapt to its impacts. At the same time, we have to employ measures that could also help mitigate climate change. Because of the severity of the impacts of climate change on the agriculture sector, policy measures should be in place that would help sustain the capacity development for climate change adaptation.

Philippines

- Creation of a Local Climate Change Team comprised of the representatives from the state colleges and universities , local government units at the municipal and barangay levels, and farmer-trainors who would develop a plan for enhancing adaptive capacities of the upland farming communities in their respective areas. The team shall also be responsible in:

    ⇒ organizing local public awareness programs about climate change so that all sectors within their local community would be able to understand this worldwide phenomenon
    ⇒ pursuing research and development programs related to climate change to test for appropriate crops and cropping combination in the changing climate in their respective areas
    ⇒ establishment of demonstration farms showcasing climate change adaptation strategies
    ⇒ linking with the local policy makers to ensure that climate change adaptation measures are integrated in their development programs
    ⇒ documentation of best practices showcasing climate change adaptation

- Mainstreaming agroforestry in the development programs of local government units whose majority of land area is classified as upland areas. These areas are vulnerable to climate change because of the

- *LGUs shall regularly update their respective action plans to reflect changing social, economic and environmental conditions and emerging issues.*
- *The local chief executive shall appoint the person responsible for the formulation and implementation of the local action plan*
- *The national government should extend technical and financial assistance to local government units for the accomplishment of their Local Climate Change Action Plans*
- *The local government units are authorized to appropriate and use the amount from its Internal Revenue Allotment necessary to implement said local plan effectively*

The climate change action plan of most of the local government units, however, are along disaster reduction and risk management, particularly among the communities that are vulnerable to floods and strong typhoons; and, solid waste management. Very little is talked about climate change adaptation of farming communities in their agricultural production. In fact, research results suggest the lack of information dissemination or communications from the local development organizations on relevant climate change issues and strategies for climate change adaptation that could be employed by the farmers in the selected upland farming communities in the Philippines (Tolentino and Landicho, 2013) as shown in Figure 4. It is apparent, therefore, that local government organizations need to be equipped with the knowledge and skills pertaining to climate change and options for mitigation and adaptation, so these could be transferred to upland farmers within their area.

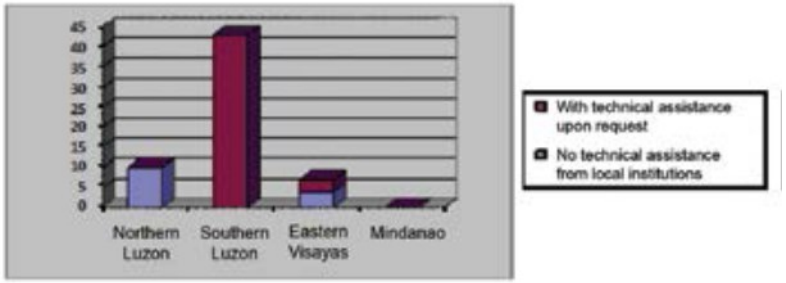


Figure 4. *Availability of technical assistance at the local level among the study sites in the Philippines*

As such, a number of non-government organizations, research institutions and academic institutions have focused on the vulnerable farming communities towards enhancing their adaptive capacities to climate change impacts. Among these include training programs on climate change adaptation strategies, policy forum and discussions revolving around the impacts of climate change in the agriculture sector and how these concerns could be addressed, and research activities that aim to pilot test certain climate-resilient technologies or farming systems that could later on serve as models to other farmers for their adoption. Among these initiatives are as follows:

- *National Agroforestry Roadshows, conducted by the Philippine Agroforestry Education and Research Network (PAFERN), Indonesia Network for Agroforestry Education (INAFE), Thailand Network for Agroforestry Education (ThaiNAFE), Lao Network for Agroforestry Education (LaoNAFE) and the Vietnam Network for Agroforestry Education (VNAFE) in 2009. These roadshows served as a public awareness program about the issues of climate change, and how agroforestry's potentials can serve as a climate change adaptation strategy among the smallholder upland farmers in the country. The roadshows centered on the "actual roadshow" around the upland municipalities; sharing of experiences from the farmers, and seminar. These roadshows were organized with funding support from the Asia-Pacific Network for Global Climate Change Research (APN).*

- *National Training on Climate Change Adaptation Strategies, conducted by PAFERN, VNAFE and INAFE in 2012. This training convened the agricultural technicians of the local government units, and the junior agroforestry teaching staff of the PAFERN member-institutions to share the indications of climate change in their respective areas, with emphasis on the its impacts to agricultural production. It also served as a venue to develop a climate change action plan to address the upland farmers' problems brought about by climate change.*

- *Documentation of Climate Change Adaptation Strategies of Smallholder Upland Farmers in the Philippines and Indonesia in 2012. This research was conducted to determine the farmer-level evidences and indications of climate change; identify the climate change impacts on their agricultural production; and, find out their climate change adaptation strategies. This research was conducted in the upland farming communities in Northern Luzon, Bicol Region, Southern Luzon, Eastern Visayas, and Southern Mindanao. The research results indicate that the smallholder upland farmers have been experiencing climate change as evidenced by the changing rainfall pattern and season. As such, they have observed the impacts on their agricultural production such as the higher incidence of pests and*

of engaging stakeholders in the issue. The said article also emphasizes the responsibility of the participating countries to develop and implement educational and public awareness programs on climate change and its effects, to ensure public access to information and to promote public participation in addressing the issue (UNFCC, 2008). Action on climate change consists of two complementary elements – mitigation and adaptation (http://www.espace-project.org).

Somerville and Hasson (2011) argued that while the IPCC and other scientific community have been coming out with publications and other communication materials about climate change, the public were still not aware and have differing perceptions about climate change. They have identified four factors that influence this: In most cases, the public or the people tend to neglect science particularly during the difficult times. Second, there were disinformation campaigns against climate change science from the well-organized groups; third is the widespread scientific illiteracy such that the people believe only on those whom they share their cultural values and systems; and, sixth is that when it comes to weather and climate, people usually attribute it to God and the climate science, that any weather or climate disturbance is a signal of God's intervention.
Local people are more likely to believe and respond to others who seem like themselves and who share their concerns and interests (www.energysavingtrust.org.uk) . This is because they have direct access to local people, understand issues and sensitivities and can sustain people's activity over time. According to www.energysavingtrust.org.uk, these three components are crucial for communication and behaviour change.

It is therefore, hightime, to capitalize on the earlier research and policy initiatives both at the national and regional levels to share and disseminate information about climate change – its causes and impacts, and how each individual or sector could help mitigate its impacts, and more importantly, how people, particularly the upland farming communities – the producers of food, could adapt to this worldwide phenomenon.

- *Support Programme to Respond to Climate Change (SP-RCC). SP-RCC was established as a support arm in the implementation of the NTP-RCC. This programme developed a policy matrix for the main pillars for building overall capacity in climate change actions. These pillars are mitigation, adaptation and cross-cutting themes. In the last three years, SP-RCC has crafted 122 policy actions regarding climate change mitigation and adaptation. Specifically, SP-RCC harmonizes and coordinates the financial, technical and knowledge assistance received from various donors in line with enhancing Vietnam's response to climate change*
- *National Green Growth Strategy (VGGS). This strategy was promulgated by virtue of the Decision 1393/QD-TTg of 2012. NGGS is seen as an important part of sustainable development that contributes to social benefits including poverty reduction, and implementation of national climate change adaptation strategies. NGGS focuses on the efficient use of natural capital, reduction of GHG and an improvement in the environmental quality. Among the targets of the NGGS are as follows:*

    - ⇒ *Reduce the intensity of greenhouse gas emissions per GDP and promote the use of clean and renewable energy (e.g. reduce GHG emissions by 8-10% compared to 2010 level (2011-2020), by 1.5-2% per year by 2030, and 1.5-2% per year towards 2050*
    - ⇒ *Greening production (e.g. application of technology will reach 50% towards 2020*
    - ⇒ *Greening lifestyle and promoting sustainable consumption (e.g. 60% grade III cities with wastewater and treatment systems towards 2020.*

- *Policies in the agriculture and forestry sector. Decision 186/2006/QD-TTg mandates the forestry administration responsibilities of government agencies at the central and local levels in mitigating climate change. Specifically, the agriculture sector is mandated to reduce the use of methane in wetland rice cultivation; effectively use the nitrogen fertilizers. On the other hand, the forestry sector is mandated to continue on reforestation, and implement strategies that would reduce emissions cause by deforestation and forest degradations*

WHAT ARE THE POLICY GAPS?

Because climate change is a global concern with wide-ranging impacts, it is therefore essential that the climate change messages are communicated successfully and efficiently with many different groups including residents, farmers, and other stakeholders. As highlighted in Article VI of the UNFCC, it is important that climate change is communicated to the general public and

diseases, delay in the fruiting of crops, stunted crop growth, and reduced crop yield. Research results suggest the need to enhance the adaptive capacities of the smallholder upland farmers to climate change impacts through provision of relevant capability-building/training programs on relevant farming technologies; information education campaign; and, testing or trials of site-specific crop species and cropping combinations that are climate-resilient. Furthermore, the results served as basis in developing project proposals that would help address the needs of the smallholder upland farmers.

- *Policy Forum with the Local Government Units Towards Mainstreaming Agroforestry in their Climate Change Adaptation Programs, organized by PAFERN, VNAFE and INAFE in 2013. A forum with the local government units was intended to create awareness among the local executives about the concepts and issues of climate change, how the farming sector in their municipality experiences the impacts of climate change, and how the local government unit could help the farmers adapt to the impacts of climate change. At least 20 participants representing the local government units (where vulnerable upland communities are located) in each of the three countries were invited to the forum. They include those from the units of the environment, agriculture, planning, and the office of the local executive who are directly involved in the policy-making processes. The forum dwelled on the presentation of the presentation of the recent trends in climate change and its impacts on agricultural production/farming sector based on those that were articulated by the farmers during the farmers' training; and, a workshop on identifying mechanisms and strategies towards enhancing the adaptive capacities of the farming communities within their jurisdiction.*

- *National Training on Site-Specific Climate Change Adaptation Strategies, conducted by PAFERN, INAFE and VNAFE in 2013. Training of farmer-trainers on site-specific climate change adaptation strategies aims to equip the farmers with the knowledge and skills in employing appropriate climate change adaptation strategies in their respective communities. Twenty-five (25) farmer-trainers from upland communities in each of the three countries, were selected as training participants based on the following criteria: a) currently engaged in agroforestry farm development; b) willingness and capability to share with other farmers the knowledge and learnings that would be gained from the training; and, c) availability. A two-day training was conducted, which revolved around the following methodologies:*

    - ⇒ *Workshop, which served as an opportunity for the farmers to discuss among themselves their observed evidences of climate change, and their impacts to their agricultural production activities*

⇒ *Lecture-discussion, which dwelled on the concept, causes and impacts of climate change, and the different climate change adaptation strategies such as organic agriculture, agroforestry, and rainforestation, among others.*

⇒ *Field visit, which served as a cross-farm visit among the farmer-participants for them to observe some strategies that could help mitigate and/or enable them to adapt to climate change impacts*

⇒ *Re-entry plan preparation, which enabled the farmer-participants to draw up plans highlighting the most appropriate climate change adaptation strategies that could be employed in their farms, based from the lecture given to the m, and their field visit as well.*

- *Establishment of an On-Farm Demonstration Farm of Climate Change Adaptation Strategies, established by PAFERN, INAFE and VNAFE in 2013. From the action plans that were presented by the farmers during the Farmers' Training, the project team selected one farm where appropriate climate change adaptation strategies would be showcased. The selection of the farm where community projects were established, was based on the following criteria: a) willingness of the farmer; b) strategic location of the farm; and, c) representativeness of the farm in terms of the farming system/farm components. The project collaborators had initial reconnaissance of the farmers' farm to assess the extent of problems brought about by climate change impacts; and, suggest potential solutions and strategies to the farmers that could help them mitigate or adapt to the impacts of climate change. When the farmer agreed for his farm to become the site of the community project, farm planning was conducted with the active participation of the farmers.*

Case 2: Indonesia

The government of Indonesia has also instituted a number of policies that could help mitigate or adapt to the impacts of climate change, particularly on the forestry sector.

- *Ministry of Forestry Regulation No. 29 Year 2013 setting the guidelines for forestry development assistance. The regulation states that assistants could be from the private forestry extension which is derived from state, local and private enterprises, through the Corporate Social Responsibility (CSR).*
- *Ministry of Forestry Regulation P/29/2013 Article 12, states that financing could be derived from the local budget and from other sources, such as forestry development management institutions including local, state, private, NGOs, other donors, especially the REDD+ which is relevant to climate change*
- *REDD+ National Strategy state that there is possibility to have the program of human resources capacity-building through five pillars of national strategy namely: institutions and processes, legal framework and regulations, strategic programs, paradigm changes, and work culture and the involvement of various parties*

Case 4: Vietnam

Because of its vulnerability to climate change, the Government of Vietnam has developed policies on climate change mitigation and adaptation as early as in 2005. These national policies are in line with the United Nations Framework for Climate Change (UNFCC), where Vietnam is among the signatories. Among these policies are as follows:

- National Target Program to Respond to Climate Change (NTP-RCC). This is the first policy that was adopted by Vietnam in response to the issue of climate change. The first phase of the NTP-RCC, covering the period of 2008-2010 focused on assessing the impact of climate change to various sectors, localities and periods, and preparing the feasible action plans in response to climate change. This program puts emphasis on eight (8) targets, namely:" assessing the impact of global climate change in Vietnam; specifying the measures of responses to climate change; boosting the scientific and technological activities to set up the fundamentals of RCC; reinforcing the institutional capability to cope with climate change; raising awareness among communities and people about climate change and its impacts as well as capacity-building for these tasks; strengthening the international cooperation in this issue; integrating climate change into SEDPs at the central and local levels; and, preparing action plants at sectoral and provincial levels to cope with climate change. Meanwhile, the second phase of this program covering the period of 2011-2015 aims to: a) ensure food security, energy security, water security, poverty alleviation, gender equality, social security, public health; enhance living standards, conserve natural resources in the context of climate change; b) consider low-carbon economy and green growth as principles in achieving sustainable development; emission of GHG reduction and removal to become a mandatory index in social and economic development; c) raise awareness, involvement and coping capacity of stakeholders; strengthen scientific and technological potential and human resources; *strengthen institutional arrangements to utilize the financial assistance, enhance the economic competitiveness and status of Vietnam; d) join forces with international communities in addressing climate change; increase international cooperation to address climate change effectively.*

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Southeast Asian Network for Agroforestry Education
2/F Tamesis Hall, College of Forestry and Natural Resources
University of the Philippines Los Banos
College, Laguna, Philippines
Telefax +63 49 536 3809
Email: seanafe@yahoo.com

With funding support from the

Asia-Pacific Network for Global Change Research (APN)
1-5-2 Wakinohama Kaigan Dori
Chuo-ku, Kobe 651-0073, Japan
Fax +81 78 230 8018
Website: www.apn.gr.jp