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**Linking Climate Change Adaptation and Food
Security in ASEAN**

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Abstract: *Association of Southeast Asian Nations (ASEAN) food security can be comprehensively governed by the ASEAN Economic Community (AEC) and the ASEAN Social and Cultural Community (ASCC). This paper reviews the ASCC Blueprint and argues that, within the ASEAN framework, it is imperative for the ASCC to address food security in relation to climate change and disaster risks. There are three main reasons for this: the larger scope of environment security, climate change, and disaster risks under the ASCC; food security from beyond an economic standpoint under the flagship of the AEC; and climate change that alters regional food systems, agriculture, and fisheries, which contribute significantly to the livelihoods and well-being of all people in the region. Although the distribution of impacts and risks of climate change will be different from place to place and household to household, marginal farmers, fisherfolk, and poor urban consumers are likely to be impacted disproportionately. Thus the need for a shared governance of food security and climate change under the ASCC and AEC to comprehensively consider the availability, accessibility, utility, and stability of food for populations from both an economic and socio-cultural perspective.*

Keywords: ASEAN Socio-Cultural Community; climate adaptation; climate vulnerability; food security

1. Introduction

Food security is not just about crops and commodities but people. The concern about the impacts of climate change on food security is also largely about human security. Therefore, the debate on climate change and food security needs to be focused on the distribution of risks to different parts of society, and takes into account a range of economic and socio-cultural dimensions, including marginality and inequality.

Under the Association of Southeast Asian Nations (ASEAN) frameworks, food security falls under the ASEAN Economic Community (AEC), whilst climate change is within the realm of the environment under the ASEAN Social and Cultural Community (ASCC). On a regional level, little has been done in terms of merging or looking at these two integrally linked issues, or how one impacts the other. It is now seen that failure to address future food insecurity under the AEC and ASCC will potentially compromise the ASEAN Political Security Community pillar, without which it will be a challenge to ensure food security through both the AEC and ASCC pillars.

There are 63.5 million people with food insecurity in Southeast Asia, or approximately 10.5 percent of the total population.¹ Meanwhile 300 million people constituting the rural population in the region are predominantly dependent on the cultivation of crops and fishing. Agriculture and fisheries provide not only livelihoods to millions of people but are also a source of food, health, and human security in Southeast Asia.

From a macro perspective, agriculture and fisheries are important foundations of the region's economy. Southeast Asia produces close to 30 percent of the world's total rice supply and is home to two of the largest rice exporters (Thailand and Viet Nam) and two of the largest importers (the Philippines and Indonesia). Southeast

¹ Food and Agriculture Organization, World Food Programme, and International Fund for Agricultural Development, *State of Food Insecurity 2014 Report*, Joint Report from FAO, WFP and IFAD, 2014, 8

Asia also produces 50 percent of the world's total fish and seafood supply. Rice and fish thus continue to be important strategic commodities for ASEAN member states (AMSs).

Despite being net producers and exporters of food (especially rice and seafood), AMSs have been facing composite challenges to their food security from steady growth of the middle class, urbanisation, changing dietary preferences, and greater economic integration. The food sector (agriculture and aquaculture) now also faces threats from climate change. Taken together, these factors pose significant challenges for the region economically as well as socio-culturally.

Climate change alters regional food security as warming may exceed the thermal tolerance of crops, marine biodiversity, and aquatic life in Southeast Asia. The Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report in 2014 shows that climate change is likely to alter global and regional distribution of fish catch potential in the Southeast Asian tropics and cause a 40–60 percent drop in ocean fish catch.² Sea level rise and increasing soil salinity are projected to adversely affect rice and aquaculture production in the deltas and coasts of the region. Small farmers and fisherfolk will be most vulnerable to such change as their existing adaptive capacity is limited.

Adaptation strategies and climate-smart agriculture and fisheries are thus vital in softening the blow of the projected climate impacts on food security in the region. So far, most ASEAN countries have done little planning, let alone implementation, of climate adaptation measures. Other than various externally funded and donor-driven pilot projects, there seems little in terms of a coordinated strategy in the region to address the issue.

Whilst it is imperative for AMSs to think of and adopt strategies towards adaptation, ASEAN as a regional institution can play a significant role as a platform

² HO Portner *et al.* 'Ocean systems', *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2014, pp. 411–484

for formulation of policies, sharing of best practices, and cooperation amongst neighbours to tackle common problems.

The ASCC can address the linkage between food security and climate change, largely because environment security and climate change falls under its umbrella. Under the flagship of the AEC, ASEAN can start to think of food security from beyond an economic perspective. The most direct impact of climate change would be a decrease in the total food production and availability, potentially increasing food insecurity. The other equally adverse impact would likely be on small-scale farmers and fisherfolk, as well as marginalised and vulnerable communities, who lack social protection and have little capacity to adapt to climate change.

Thus, in the context of availability, accessibility, utility, and stability of food for the region, the ASCC can approach from a people-centric angle the issue of food security by unpacking and disaggregating the risks and impact of climate change on food security and zeroing in on the communities that are most vulnerable..

This paper will examine the original ASCC Blueprint for addressing food and climate change until the present. Next, we will look at how the AEC addresses food security. We will also provide an overview of the impact of climate change on food security in Southeast Asia. Finally, we will recommend ways to integrate aspects of food security affected by climate change into the post-2015 ASCC framework.

2. Review of the ASCC Blueprint

2.1. Food Security and Climate Change in the ASCC

The ASCC Blueprint states that ‘the primary goal of the ASCC is to contribute to realising an ASEAN Community that is people-centred and socially responsible’ and ‘address the region’s aspiration to lift the quality of life of its peoples through

cooperative activities that are people-oriented and environmentally friendly geared towards the promotion of sustainable development’.³

The ASCC covers: human development, social welfare and protection, social justice and rights, ensuring environmental sustainability, building the ASEAN identity, and narrowing the development gap.⁴

Food security is considered under ‘(b) Social Welfare and Protection – (B.3) Enhancing Food Security and Safety’, with the strategic objective of ensuring ‘adequate access to food at all times for all ASEAN peoples’ and ‘food safety in ASEAN Member States’. So far there has been little emphasis on food production, availability, and access within this ASCC framework. Whilst actions are proposed to increase staple food reserves and establish a network in the region to enhance food trade cooperation, most of the actions recommended by ASCC focus on food safety and health. More actions to tackle other elements of food security like nutrition and security of marginal food producers and consumers in the region can be included in the post-2015 blueprint.

Climate change adaptation is considered under ‘(d) Ensuring Environmental Sustainability’, with the strategic objective of enhancing regional and international cooperation to address the impacts of climate change. Proposed actions include sharing knowledge on scientific research; deployment and transfer of technology; development of regional strategies to enhance adaptation capacity; collaboration amongst AMSs and relevant partners to address climate-related hazards; development of a regional systematic observation system to monitor the impact of climate change on vulnerable eco-systems; and encouraging participation of local governments, the private sector, non-governmental organisations, and communities in addressing the impacts of climate change.

The proposed actions under this ASCC characteristic have so far been through ad-hoc initiatives (Annex 2), such as the ASEAN–India Project on Enhancing Local Level Adaptation to Climate Change in Southeast Asia, an ASEAN–India workshop on adaptation technologies held in 2012. Likewise, actions on climate impacts on agriculture have also largely been ad hoc and considered under water resource

³ ASEAN Secretariat, ‘ASEAN Social Cultural Community Blueprint,’ 2009, p1

⁴ Ibid., p.1

management in the ASCC Blueprint as water is mainly used for irrigation in the region.⁵ Response to extreme weather events is also examined as a component of water resource management. Other than these aspects, impacts of climate change on food security have been considered largely under the AEC.

2.2. Food Security under the AEC

Under the AEC, the ASEAN integrated food security framework aims to address long-term food security in the region. The goal of the Strategic Plan of Action on Food Security in the ASEAN Region is to ensure ‘long-term food security and to improve the livelihoods of farmers in the ASEAN region’, including objectives to increase production, reduce postharvest losses, promote conducive market and trade for agriculture commodities and inputs, ensure food stability, promote availability and accessibility to agriculture inputs, and operationalise regional food emergency relief arrangements.

Of these objectives, only one (operationalise regional food emergency relief arrangements) has been seen as more successful in the form of ASEAN Plus Three Emergency Rice Reserve (APTERR) as well as ASEAN Food Security Information System (AFSIS).

Climate change is not mentioned specifically within the AEC framework. Without adaptation measures, however, the AEC will be hard put to reduce postharvest losses and ensure food stability. Likewise, yields of crops and fish could also decrease due to sea level rise, increase in temperatures, changing precipitation patterns, and fish migration.

To address this absence of link between climate change and food security, the AEC created in 2009 the ASEAN Multi-Sectoral Framework on Climate Change: Agriculture, Fisheries and Forestry Towards Food Security (AFCC). The AFCC is an initiative under the ASEAN Integrated Food Security framework that provides inputs to the ASEAN Climate Change Initiative (ACCI) on the coordination and

⁵ The European Union (EU) Member States have also addressed agricultural climate adaptation through water scarcity issue by attempting to broaden adaptation to include the sustainable use of natural resources in the EU’s 2014–2020 rural development plans (European Commission, 2013).

cooperation amongst AMSs on climate change mitigation and adaptation. This is a major step in bringing together the issues of food security and climate change, which had hitherto been tackled through initiatives focused on knowledge sharing and pilot projects with non-ASEAN countries or non-governmental organisations.

Through this framework, workshops such as the 2011 Regional Workshop on Climate Change and Food Security in ASEAN Plus Three Countries have been organised to promote knowledge sharing on climate adaptation. The ASEAN Ad-hoc Steering Committee on Climate Change and Food Security has also recommended coordinated activities on climate-smart agriculture to the ASEAN Ministers on Agriculture and Forestry. Whilst a step forward, the linkage between climate change and food security under the AEC is still largely focused on production.

Climate initiatives have generally been directed by external parties. Whilst ASEAN Plus collaborations such as the ASEAN–India Project and the ASEAN–Korea Network can help with capacity building, ASEAN needs a regional strategy and vision—with the people who are most likely to be vulnerable and disproportionately impacted in mind—for specific climate adaptation in agriculture and fisheries, in particular, and food systems, in general. A concerted effort to build capabilities on this front from within ASEAN, through expertise from AMSs and local knowledge in the region, is lacking.

2.3. A Coordinated ASEAN Approach

Whilst AMSs have embarked on pilot projects at the sub-national level on climate adaptation in key regions like the Mekong River Delta (MRD) and ASEAN has facilitated information exchange on possible adaptation measures through workshops and sharing sessions, the region can do more to prepare for the impacts of climate change in food, agriculture, and fisheries sectors. These pilot projects and workshops, together with international awareness of climate impacts, have enhanced the awareness of AMSs of the need for climate studies and adaptation policies. With this momentum, in the post-2015 blueprint, ASEAN needs to move beyond knowledge sharing and pilot projects that are largely donor-driven.

The transboundary nature of climate impacts on food security warrants the development of a regional strategy that can tackle it. The merging of fragmented

donor- driven projects within an ASEAN strategy for climate adaptation in agriculture and fisheries will go a long way in pooling resources, expertise, and finance for regions like the MRD. Together, AMSs can conduct local climate impact assessments on key regions as scientific studies are extremely scarce in Southeast Asia. Since most climate adaptation in the region are not systematic, such a consolidation of resources and expertise will help ASEAN gather much-needed scientific data to inform policymaking into crafting anticipatory adaptation measures on a larger scale.⁶ The implementation of anticipatory adaptation measures before the impact of climate change sets in, is important as AMSs will be more resilient towards various effects of climate change such as sea-level rise and increase in soil salinity. Such measures need to be informed by climate assessments based on climate monitoring data in order to prevent maladaptation⁷. Regional coordination will address disparities in capacities and help AMSs tackle climate change together.

A regional plan will also likely encourage AMSs to consider climate change as a policy priority and move beyond disaster management policies, which are merely reactive in nature.⁸ Arguably, the lack of resources and expertise has lowered climate change as a priority for AMSs in their national development plans and this, in turn, prevents ASEAN from agreeing on concrete regional actions to tackle the issue. For example, some countries such as the Lao PDR and Cambodia lack the financial resources and expertise to evaluate climate impacts. Lack of national capacity reinforces the uneven distribution of climate impacts. The first step is thus to put policy implementation on the ASCC agenda and encourage AMSs with the expertise and resources to step forward in the quest for food security.

Another important aspect on climate change is international collaboration. There has been minimal collaboration on climate adaptation in agriculture and fisheries between ASEAN and international organisations such as the IPCC, the International

⁶ Adaptation policies in developing countries are often driven by reactive rather than anticipatory actions.

⁷ Mal-adaptation refers to actions taken are considered counterproductive. For instance, when dealing with drought, farmers in the coastal region may opt to use water pumps. However, excessive use of water pumps may create new problems. Over the long term, it can affect sea water intrusion which in turn, affect quality of crop production.

⁸ J. Trevisan, 'The Common Framework for Climate Policy in South-East Asia', International Centre for Climate Governance Reflection no. 13, 2013, p. 6.

Rice Research Institute (IRRI), the Food and Agriculture Organization (FAO), and the WorldFish Center. This has led to the absence or scarcity of literature on climate impacts, such as the IPCC 5th Assessment Report (2014) on the climate impacts on agriculture and food systems in Southeast Asia, even though the region has been identified as one of the world's most vulnerable. Although IRRI conducts research into climate-resilient rice varieties, ASEAN–IRRI cooperation through the ASEAN Integrated Food Security Framework in the AEC has focused mainly on increasing yields and little else.⁹ This is clearly not sufficient.

3. Climate Change Impact on Food Security: From a Social-Cultural Perspective

Climate change alters biotic stressors (e.g. pests, weeds, and diseases) and abiotic stressors (e.g. precipitation change, warming and droughts, solar radiation, lack of soil moisture content, etc.). These biotic and abiotic stressors are likely to affect sustainability of crop production in the region, affecting rural producers and urban consumers. Impacts of climate variability and change will continue to affect marine fisheries and agricultural sectors. (See the scientific basis for this section in Annex 1, Climate Change Impact on Rice Production and Fisheries in Southeast Asia.)

Change in precipitation, temperatures, and solar radiation are likely to affect production of crops in the regions, affecting rural producers and urban consumers. The IPCC 5th Assessment Report (2014) identified Southeast Asia as the most vulnerable coastal region in the world (Chapters 5 and 6, IPCC Working Group II). Although Southeast Asia has recorded a consistent rate of increase in rice yields over the last 50 years, they are still below the Asian average and have not kept up with population growth rates. With changing climate, regional environmental degradation, coupled with regional and global non-climate drivers such as reduced land area for

⁹ V. Tolentino, 'ASEAN Cooperation: Crucial to Global Food Security', <http://irri.org/rice-today/asean-cooperation-crucial-to-global-food-security>, 2014 (accessed 22 December 2014).

rice and other important crops, ASEAN is likely to face hard times, especially after 2050.

Southeast Asia is particularly vulnerable to the impacts of climate change because much of its population is dependent on agriculture and fishing for income and subsistence. Adaptation strategies are thus important to reduce the effects of projected changes in the climate on food security in the region. Most AMSs have not embarked on mainstreaming of climate adaptation into national development plans. Whilst there are numerous pilot projects, these are not coordinated at the national and regional levels. For example, the GIZ coastal management and biodiversity projects in Bac Lieu and Soc Trang provinces of Viet Nam, Viet Nam Bank of Agricultural and Rural Development pilot project on index-based flood insurance and demonstration projects implemented under the Climate Change and Adaptation Initiative in Lao PDR, Viet Nam, Cambodia, and Thailand are local-level projects that have yet to be extended to the national or regional scales. There is also a need for greater integration of issues relating to food production and availability, and access to the ASCC Blueprint for policymakers to consider the distributed impacts of climate change on food security via disaggregated vulnerabilities.

This section highlights vulnerabilities of Southeast Asia to climatic change vis-a-vis food security. Under the ASCC, one must consider not only the impacts and risks of climate on people and places but also how such impacts and risks are distributed differently amongst places and groups of people. Whilst climate impacts on the four dimensions of food security are assessed, who are likely to be most vulnerable and face disproportional risks will be discussed.

3.1. Climate Impacts on Food Availability

Based on projections, the tropical region of Southeast Asia may lose 40–60 percent of its fish catch potential due to fish migrations resulting from changes in temperature and ocean conditions.¹⁰ Small fisherfolk who do not have adequate

¹⁰ H.O. Portner *et al.* ‘Ocean systems’, *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the

technologies such as satellite imaging could lose their entire livelihoods as well as one of their staple foods. More frequent storms in coastal Indonesia and Philippines often disrupt fishing, reduce farmers' workdays, and affect livelihoods of small food producers.¹¹

Similarly, in the Lower Mekong Delta, of which 80 percent is used to grow rice by an estimated 67 million people, rice is both a staple and a source of income. Salinity intrusion and other climate change–related extremes are likely to affect rice production. Unfortunately, farmers have limited options for adaptation. Diversified livelihood approaches are needed that combine rice production (or cultivation of other crops) with other fresh and brackish water–based livelihoods (e.g. fishing). However, pursuing such adaptation measures might involve higher investment costs such as heavy engineering infrastructure, which may not be efficient in supporting the farmers' welfare.¹² It is thus important to think of climate adaptation in terms of appropriate strategies for particular groups of people.

Pests and diseases have also caused serious damage to Viet Nam's crops. Some estimate that every year about 10 percent of the area under cultivation is destroyed by pests.¹³ Some simulation studies have shown that global climate change is likely to affect rice-leaf blast epidemics, leading to shocks in production loss in the ASEAN region.¹⁴

Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2014, pp. 411–484

¹¹ Indonesia Marine and Climate Support (IMACS), funded by the United States Agency for International Development (USAID), provides rich information based on participatory vulnerability assessment and mapping from more than a hundred villages in Indonesia. See 'USAID IMACS Project'. 2014, <http://www.imacsindonesia.com/v5/index.php/en/> (Accessed 23 January 2015).

¹² F. G. Renaud, Thi Thu Huong Le, C. Lindener, Vo Thi Guong, and Z. Sebesvari, 'Resilience and Shifts in Agro-ecosystems Facing Increasing Sea-level Rise and Salinity Intrusion in Ben Tre Province, Mekong Delta', *Climatic Change* DOI 10.1007/s10584-014-1113-4, 15 April 2014.

¹³ My-Yen Lam, 'A Review of Food Research in Vietnam, with Emphasis on Postharvest Losses', *AOAR Technical Reports no. 26*, 30 December 1993.

¹⁴ Y. Luo, *et al.*, 'Risk Analysis of Yield Losses Caused by Rice Leaf Blast Associated with Temperature Changes Above and Below for Five Asian Countries', *Agriculture, Ecosystems & Environment*, vol. 68, no. 3, 1998, pp. 197-205; Y. Luo, *et al.*, 'The Effects of Global Temperature Change on Rice-leaf Blast Epidemics: A Simulation Study in Three Agroecological Zones', *Agriculture, Ecosystems and Environment*, vol. 68, no.3, 1998, pp. 187-196; Y. Luo, *et al.*, 'A Rice-leaf Blast Combined Model for Simulation of Epidemics and Yield Loss', *Agricultural Systems*, vol. 53, no. 1, 1997, pp. 27-39; Y. Luo, *et al.*, 'Simulation Studies on Risk

Existing climate impacts on postharvest rice loss in ASEAN suggest that most of the losses occur in the rainy season, partly because most small farmers still use traditional drying technology. In Viet Nam, postharvest losses are estimated at over 20 percent in the drying stages. In Can-Tho province (Viet Nam), the most developed province in the MRD, postharvest losses are estimated to be 15–20 percent, due mainly to inadequate drying methods and poor storage. In Indonesia, postharvest losses are above 20 percent of yield losses and most of the loss occurs during drying, transportation, and milling.¹⁵ Poor storing infrastructure is also responsible for such postharvest losses.

Most vulnerable to climate impacts on availability: Small-holder farmers and fisherfolk, low-lying and coastal region farmers, delta regions, farmers of marginal crops and orphan crops.

3.2. Climate Impacts on Access to Food

Possibly the most direct link of risks to access to food is likely to emerge from supply pressures. This will likely increase the overall prices of food as well as the chances and incidences of price volatility. Sharp or even sustained food price increases will affect the food security of the lower-income segments of society across Southeast Asia.

Another dimension where climate can impact access to food would be in supply-chain disruptions, either due to extreme weather events or through increased losses as food moves from farm to fork. Higher costs due to disruptive supply chain will affect poor consumers in both urban and rural parts of ASEAN. With increased exposure and susceptibility of coastal cities to climate extremes in tandem with rapid rates of urbanisation and higher incidences of urban poverty and urban slums, hundreds of millions of people in Southeast Asia could be adversely affected.

Analysis of Rice-leaf Blast Epidemics Associated with Global Climate Change in Several Asian Countries', *Journal of Biogeography*, vol. 22, 1995, pp. 673–678.

¹⁵ J. A. Lassa, 'Emerging "Agricultural Involution" in Indonesia: Impact of Natural Hazards and Climate Extremes on Agricultural Crops and Food System', in Sawada, Y. and S. Oum (eds.), *Economic and Welfare Impacts of Disasters in East Asia and Policy Responses*, ERIA Research Project Report 2011-8, Jakarta: ERIA, 2012, pp.601–640.

Most vulnerable to climate impacts on access: rural populations, urban poor, coastal cities, urban and rural populations who live in disaster-prone areas (multiple natural hazard zone areas)

3.3. Climate Impacts on Utilisation and Nutrition

Nutritional security has been a challenge even without the impacts of climate change. It is estimated that one in three children in Indonesia suffers from stunting, while two in five are undernourished. East Nusa Tenggara in Indonesia has been identified as one of the stunting hotspots in ASEAN, where one in two children is stunted. East Nusa Tenggara also happens to be a drought-prone area.

Climate change is thus likely to be a risk and threat multiplier to nutrition and food utilisation. Given the potential pressures of climate change on food availability and access, child nutrition can also be increasingly problematic due to the potential volatility in household access to food, especially in climatic disaster-prone regions of Southeast Asia such as Indonesia and the Philippines.

In many places of Southeast Asia, women play a significant role in crop production and farming.¹⁶ However, women farmers continue to be overlooked in policy analysis, as their roles are still not fully recognised by scientists and policymakers.¹⁷ The IPCC 5th Assessment Report Working Group II (2014) highlights that gender inequality and discrimination may increase vulnerability to climate hazards. The IPCC report is based on previous studies that suggest that women lacking access to climate information can result in ‘perverse outcomes,

¹⁶ E. Blackwood, 'Not Your Average Housewife: Minangkabau Women Rice Farmers in West Sumatra', in M. Ford and L. Parker (eds.) *Women and Work in Indonesia*, London and New York, Routledge, 2008, pp. 17–40; see also IRRI, *Proceedings of a Conference on Women in Rice Farming Systems*, The International Rice Research Institute, Manila, Philippines, 26–30 September 1983, 1985.

¹⁷ SciDev.Net, <http://www.scidev.net/asia-pacific/gender/analysis-blog/asia-pacific-analysis-asia-s-invisible-women-farmers.html>, 2015, (accessed 23 January 2015).

increasing inequities and widening gender gaps’ and that in ‘small-scale agriculture, women and children are particularly at risk due to the gendered division of labor’.¹⁸

Most vulnerable to climate impacts on nutrition: children, women, senior citizens, and the disabled.

3.4. Climate Impacts on Stability

Climate change concerns suggest that food availability and access will be more volatile in the future. Therefore, ensuring stable availability and access can only be achieved through climate mitigation and adaptation in the long term. However, the IPCC (2014) suggests that even though greenhouse gas emissions can be significantly reduced by the end of the century, climate change impact is likely to affect global and regional food systems in the long term. Therefore, adaptation in the food system is the best way to cope with climate change.

4. Recommendations for the Post-2015 Blueprint

Food security, viewed from an economic perspective, assesses climate vulnerabilities as aggregated economy-wide impacts on populations. This perspective fails to consider that climate impacts reinforce inequalities, and that the most vulnerable groups of society suffer disproportionately when climatic changes affect access to food and livelihoods. A disaggregated approach is required, through a social and cultural perspective.

¹⁸ J. R. Porter, *et al.*, ‘Food Security and Food Production Systems’, in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2014, pp. 485–533.

4.1. Bringing the Food–Climate Issue into the ASCC

The post-2015 ASCC Blueprint has to recognise the interlinkages between food security, climate change, and farmer livelihoods. The insecurities of vulnerable populations and their lack of adaptive capacities need to be addressed under the umbrella of a single ASEAN community. Whilst the AEC has successfully taken a top-down, production, and economic-centric approach towards safeguarding food security, the ASCC provides a complementary bottom-up approach. This shared governance would provide a more comprehensive approach towards a regional strategy for food security, with climate change as a starting point.

Climate change adaptation measures for food production also need to be considered as part of ‘human development’ and ‘narrowing the development gap’ because a reduction in crop yields and fish harvests has a direct impact on the livelihoods of farmers and fisherfolk. Hence, it is timely that the blueprint refocuses attention on these people in ASEAN. An example of how the ASCC Blueprint can conceptualise aspects of food security is highlighted in Table 1.

Under the AEC, food production and/or the availability dimension of food security is often approached from purely economic considerations, where efforts tend to be production-centric, largely focused on increasing yield and productivity at an aggregated scale. With projected climate changes, the ASCC would be a relevant platform to deal with unequal risk distribution and disaggregated impacts on different groups of farmers, vulnerable urban consumers, and small rural producers.

With regard to the food access dimension of food security, the AEC tends to focus on trade and commodity prices, food aid, and emergency rice stockpiles (e.g. under the APTERR and AFSIS). Whilst these measures are legitimate and necessary, it can be argued that the AEC tends to be reactive to the climate crisis and more focused on ensuring stocks after a disaster. Reactive adaptation to climate extremes is not sustainable. Under the ASCC, the focus can be redirected towards more anticipatory adaptation plans.

**Table 1: Conception and Framework for the Understanding of Food Security
within ASEAN**

Dimension of Food Security	ASEAN Pillars	
	AEC	ASCC
Production and Availability	Production-centric: Focus on increasing yields	People-centric: Suggested focus on assisting farmers to increase production, adapt to changes in climate patterns, prepare for disasters, and improve farmer livelihoods
Access	Economic-centric: Focus on trade and commodity prices Current focus is on reactive adaptation to climate crisis, e.g. ensuring food stocks after disaster (APTERR, AFSIS) Focus on food aid and availability of stockpiles	Vulnerable people-centric: Suggested focus on anticipatory adaptation by addressing the root causes of vulnerability to climate change and natural hazards; addressing structural poverty, income inequality, and livelihood diversification of farmers and fisherfolk; people's right to food
Utilisation	Not considered under AEC	Nutrition security: Suggested focus on access to a variety of food, addressing nutrition volatility in poor families, nutrition support for children during the early stages of childhood and pregnant women Current focus is on food safety standards and diet quality of the poor and vulnerable groups
Stability	Economic-centric: Focus on price fluctuations and trade flows	People-centric: Suggested focus on diversification of sources of income for farmer and fisherfolk, microfinance instruments, legislation, and crop insurance

Note : AEC = ASEAN Economic Community, AFSIS = ASEAN Food Security Information System, APTERR = ASEAN Plus Three Emergency Rice Reserve, ASCC = ASEAN Social and Cultural Community, ASEAN = Association of Southeast Asian Nations.

Source: Authors.

How the AEC framework deals with food utilisation is unclear. It is recommended that the ASCC's strength be in a 'people-centred' approach. The ASCC's focus can be expanded beyond food safety standards and diet quality to overall nutritional security, as well. Climate change is likely to 'impinge on diet quality and increased costs may result from measures required to avoid food contamination stemming from ecological shifts of pests and diseases of stored crops or food'.¹⁹ Therefore, intervention in nutritional security should focus on access to a variety of food and addressing nutrition volatility in vulnerable families, including specific support for children in early childhood and pregnant women in vulnerable regions that are prone to climatic hazards.

Stabilising food security can be achieved by mitigating price fluctuations and sustaining trade flows. However, these need to be complemented by efforts such as diversification of sources of income and livelihoods for farmers and fisherfolk and microfinance instruments or crop insurance, which can be made available to vulnerable groups on a larger scale.

4.2. A Shared Governance Mechanism

The Post-2015 ASCC Blueprint can facilitate the regional implementation of climate change adaptation strategies in agriculture and fisheries. The ASEAN Joint Statement on Climate Change in 2014 recognises food security under the AFCC, including the promotion of 'the establishment of a network of research centres in ASEAN Member States to share knowledge and lessons learnt on climate adaptable agricultural products ... to combat the impacts of climate change on agricultural production patterns and promote regional food security'.²⁰

To extend the value of knowledge sharing, the post-2015 blueprint must set its sights on a future shared-governance mechanism to guide governments in systematically incorporating climate adaptation measures into national development

¹⁹ T. Wheeler and J. von Braun, 'Climate Change Impacts on Global Food Security'. *Science*, vol. 341, 2013, pp. 508–513.

²⁰ See *The ASEAN Joint Statement on Climate Change 2014*, http://www.asean.org/images/pdf/2014_upload/ASEAN%20Joint%20Statement%20on%20Climate%20Change%202014.pdf, 2014, (accessed 22 December 2014).

plans. The European Union (EU) has adopted mainstreaming of climate change adaptation as one of its main pillars for the climate adaptation policy. Through its adaptation strategy, the EU provides recommendations for the integration of climate adaptation considerations for agriculture under the 2014–2020 rural development programs,²¹ coordination of adaptation programs, and access to funding.²² The aim is to integrate climate adaptation into the EU’s Common Agricultural Policy. It also supports information sharing amongst EU member states, a strategy that ASEAN has employed in the current blueprint.

According to the ASEAN Climate Change Action Database, AMSs have been implementing more climate change mitigation and adaptation activities in recent years. However, most activities are primarily mitigation projects under the United Nations Clean Development Mechanism (CDM) and Reducing Emissions from Deforestation and Forest Degradation or focus on disaster management.²³ Although food and agriculture is one of the most vulnerable sectors, it is not the main focus for adaptation projects.

Table 2 lists key issues relating to food security highlighted in the national communications of ASEAN countries. AMSs identified two common constraints on climate adaptation: a lack of downscaled climate impact assessments; and a lack of expertise, data, and techniques to inform policymakers on adequate adaptation policies to incorporate into national plans.

²¹ European Commission, *Commission Staff Working Document: Principles and Recommendations for Integrating Climate Change Adaptation Considerations Under the 2014-2020 Rural Development Programmes*. Brussels, European Commission, 2013, pp. 11–13

²² European Commission, European Climate Adaptation Platform, <http://climate-adapt.eea.europa.eu/eu-adaptation-policy/landing>, 2014, (accessed 26 December 2014).

²³ D. Almassy, ‘An ASEAN Climate Change Profile’, in D. Almassy, *Handbook for ASEAN Member states Government Officials on Climate Change and the United Nations Sustainable Development Goals*, Hanoi, Hanns Seidel Foundation Viet Nam, 2014, pp.46–47

Table 2: Coverage of Climate Impacts on Food Security in AMSs’ Most Recent Submission of the National Communications to the UNFCCC²⁴

Country	Discussion on Food Security in National Communications	Areas Requiring Support
Brunei	Did not submit National Communications to the UNFCCC	
Cambodia	The report covered: (i) Historical rice loss due to flooding (ii) Government plans for adaptation, such as water management and use of high-yielding rice varieties	No description
Indonesia	The report covered: (i) Potential climate impacts on rice production, fisheries, and livestock (ii) Climate impacts on water availability (iii) General strategy for adaptation	(i) Decision-support tools for analyses of climate adaptation strategies (ii) Methods for understanding social impacts of climate change (iii) Climate-resilient rice varieties (iv) Early warning systems (v) Financing
Lao PDR	National Adaptation Programs of Action project for agriculture to install small-scale infrastructure for disaster preparedness	(i) Climate scenarios for impact analysis and technical experts in climate modelling and vulnerability assessments (ii) Historical climate data and data on soil properties, water resources, etc. (iii) Studies on socioeconomic vulnerabilities in agriculture and water resources (vi) Mainstreaming of climate risks into national disaster plans (v) Local ownership in National Adaptation Programs of Action projects and accelerated implementation of these projects
Malaysia	The report covered: (i) Climate impacts on water availability (ii) Some discussion on climate impacts on oil palm, rice, rubber, and cocoa	(i) Data on climate impacts on agriculture, crop parameters, and soil properties (ii) Research on practical adaptation measures based on the consideration of various stakeholders’ needs (iii) Studies on ocean acidity, decreasing salinity, and temperature changes

²⁴ UNFCCC *Non-Annex I National Communications* (as of December 2014), http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php, 2014 (accessed 23 January 2015).

	(iii) Crop modelling for oil palm, rice, and rubber	
Myanmar	<p>Identified climate threat to agriculture, livestock, and fisheries as affecting livelihood of 70 percent of rural population</p> <p>Some discussion on concerns regarding water management and rice yields</p>	<p>(i) Vulnerability assessments and downscaled climate impacts</p> <p>(ii) Techniques for evaluating cost-effectiveness of adaptation options</p> <p>(iii) Better access to computers, the Internet, and local climate data</p> <p>(iv) New water management techniques</p>
Philippines	<p>Identified climate threat to agriculture and fisheries as a threat to people's livelihoods</p> <p>Listed implemented adaptation measures</p>	<p>(i) Higher resolution downscaled climate impacts</p> <p>(ii) Data on vulnerabilities (e.g. socioeconomic data)</p> <p>(iii) Enabling environment for private sector investments and improvement in local capacities</p> <p>(iv) Monitoring of natural resources, watersheds and ecosystems, and an integrated information system containing this information</p>
Singapore	No discussion on climate impacts on food security	
Thailand	<p>Agricultural sector identified as the most vulnerable to climate change. However, research is lacking and policy development is too general.</p> <p>Studies have been conducted on disaster preparedness and water management.</p>	<p>(i) Climate scenario downscaling and impact on crops</p> <p>(ii) Techniques for prioritising adaptation</p> <p>(iii) Technologies for disaster warning and climate monitoring systems</p>
Viet Nam	<p>The report covered:</p> <p>(i) Climate impacts on agriculture, livestock, and aquaculture</p> <p>(ii) Proposed adaptation strategies</p> <p>(iii) Establishment of network of hydrological and meteorological stations for climate monitoring</p>	<p>(i) Higher resolution downscaled climate scenarios</p> <p>(ii) More data for cost-benefit analyses of adaptation measures</p> <p>(iii) Technical experts for running impact assessments</p>

Note :UNFCCC = United Nations Framework Convention on Climate Change.

Source: Authors.

ASEAN can bridge the policy gap by encouraging governments to mainstream climate adaptation by providing adequate climate science, communicating guidelines for adaptation to policymakers in AMSs, and coordinating projects with various parties. Mainstreaming climate adaptation into agricultural and development plans will help merge the current patchwork of adaptation measures, which are based on scarce literature. The emphasis on research and scientific evidence reduces the risk of maladaptation.

There are many entry points for adaptation. The first step towards mainstreaming climate adaptation at the national level is to incorporate climate change adaptation for food security into the ASCC. Some literature from FAO and the IPCC Assessment Report Working Group II suggests examples of adaptation strategies, which can be grouped into (i) institutional and governance measures that provide a strong basis for adaptation policy implementation, (ii) community-based approaches, (iii) science and technology, (iv) system innovation, (v) financing and legal instruments, and (vi) climate monitoring systems. Table 3 shows adaptation policy mixes that can be prescriptive in suggesting a future shared governance mechanism that allows integration and linkages between food and climate change in the context of adaptation. An important starting point will be identifying policies and directions of individual AMSs. A recommended questionnaire to conduct such a preliminary stocktaking study of current climate change adaptation strategies for food security in the AMSs can be found in Annex 3.

Details of current and recommended adaptation measures that can be mainstreamed into national development plans and the corresponding ASEAN institutional framework that they can be considered under are listed below:

Table 3: Adaptation Options and Shared Governance

Adaptation Options	Existing Institutional Framework/Policies	Suggestions for Potential Shared Governance within the ASEAN/ASCC
1. Institutions and Governance		
Legislative and administrative solution	ASEAN Law Association	ASCC can consult the ASEAN Law Association on proposed legal protection for fisherfolk and farmers and microfinance instruments
Regional and international cooperation	AFCC on an ASEAN Plus basis FAO; International Fund For Agricultural Development (IFAD); World Food Programme (WFP)	Stronger coordination and cooperation between AFCC and ACCI Increase collaboration with international institutions such as FAO, IFAD, WFP, as well as IRRI, Southeast Asia Regional Center for Graduate Study and Research in Agriculture (SEARCA), and IPCC
Incentive creation and infrastructure (re)development	FAO, IFAD World Bank and Asian Development Bank (ADB) and private sectors	ASEAN can consult with IFAD and FAO Increasing role of private sector in financing development in Mekong region
2. Community Level and Farmers' Adaptation		
Community rice reserves	Pilot projects in Indonesia	Linking APTERR with local and community-based reserves for better disaster-response mechanisms
Community consultations	Pilot project	Increase coordination of training programs in specific locations (e.g. Mekong River Delta)
Farmer training programs and community-level initiatives such as rice-fish rotation and shifting of planting calendar	Pilot projects with NGOs and other countries International donors	Conduct downscaled climate assessments to inform training programs ASEAN can tap the innovation from the Farmers' Field School initiatives
3. Science and Technology		
Biotechnology	IRRI FAO	Creation of a new scientific body under the AFCC, comprising scientists from organisations such as IRRI to provide recommendations on crop varieties
Postharvest processing	None	Incorporating the monitoring and

		tracking of postharvest losses within AFSIS
Database development in loss and damage	AFSIS, AEC	AFSIS - Expand AFSIS to allow for data collection on climate-related loss and damages
4. System Innovation		
Water management	ASCC–ASEAN Strategic Plan of Action on Water Resources Management (ASPA-WRM) - Information sharing	ASPA-WRM - Formulate recommendations for irrigation and infrastructure against climate extreme events - Create an avenue for regional expertise to be utilised for NAPAs under the Global Environment Facility (GEF) ²⁵
Infrastructure	Global Environment Facility for National Adaptation Programs of Action (NAPA) for Least Developed Countries (LDCs)	
5. Financing Instruments		
Microfinance	ADB	Link up with ADB on microfinance instruments for climate resilience in consultation with the ASEAN Law Association
Crop insurance	AEC and ASEAN Insurance Council (AIC) -Index-based flood insurance production for MRD (Viet Nam pilot project)	AIC - Work with private sector partners to provide region-wide crop insurance
6. Monitoring Systems		
Climate monitoring system	Mekong River Commission basin-wide monitoring system FAO System	ACCI - Utilise existing knowledge on the Mekong River Commission monitoring system to extend the system to the Philippines and southern ASEAN
Early warning system	AFSIS, ASPA-WRM	Strengthen AFSIS to include early warning systems for disaster preparedness

²⁵ The GEF has disbursed funds for six adaptation projects in Cambodia, five projects in Lao PDR, and three in Myanmar. (See *Least Developed Countries Fund. 2014*, <http://www.climatefundsupdate.org/listing/least-developed-countries-fund>, 2014 (accessed 23 January 2015)).

		Translate studies and workshops under ASPA-WRM into disaster management and preparedness plans
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Note : ACCI = ASEAN Climate Change Initiative; ADB = Asian Development Bank; AEC = ASEAN Economic Community; AFCC = ASEAN Multi-Sectoral Framework on Climate Change; AIC = ASEAN Insurance Council, APTERR = ASEAN Plus Three Emergency Rice Reserve; ASCC = ASEAN Social and Cultural Community; ASEAN = Association of Southeast Asian Nations; ASPA-WRM = ASEAN Strategic Plan of Action on Water Resources Management; FAO = Food and Agriculture Organization, GEF = , IFAD = International Fund for Agricultural Development; IPCC = Intergovernmental Panel on Climate Change, IRRI = International Rice Research Institute; MRD = Mekong River Delta, NAPA = National Adaptation Programs of Action; NGO = non-governmental organisation; SEARCA = Southeast Asian Regional Center for Graduate Study and Research in Agriculture; WFP = World Food Program,

Source: Authors.

As highlighted by Table 3, some potential areas for climate mainstreaming through the ASCC and ASEAN include the following:

- I. Institutions and governance measures such as reform through legislative processes and administrative imperative. Stronger coordination and cooperation between AFCC and ACCI.

International and regional cooperation can be productive tools to engage more seriously member states in adaptation. ASEAN can also strengthen collaboration with international institutions such as FAO, IFAD, WFP, as well as IRRI, Southeast Asia Regional Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), and IPCC.

- II. Community-level and farmers' adaptation: Indonesia has sought to increase community resilience by launching community rice reserves in selected regions. Non-governmental organisations in the Mekong River Basin have been training local farmers to incorporate climate adaptation strategies into farming. Possible community-level initiatives include shifts in planting calendar and shifts to multiple-stress-tolerant varieties and crops. In some part of Indonesia (e.g. Aceh) as well as in Lower Mekong delta, the promotion of the rice–fish rotation is relevant.

- III. Science and technology
- a. Biotechnology: Some AMSs have capitalised on biotechnology, especially selecting traits associated with tolerance, and developing DNA-based technologies for precise and speedy breeding of more adapted varieties that can cope with multiple stresses such as submergence, drought, and salinity. IRRI leads this initiative regionally and ASEAN can tap IRRI's expertise. SEARCA can also be consulted about suitable rice varieties and new farming technologies.
 - b. Technology: As there has been insufficient improvement in technology for postharvest processing, more research can be done in this field, beginning with the tracking of postharvest losses.
 - c. Database development in loss and damage for ASEAN agricultural loss as well as knowledge production, dissemination, and utilisation are crucial in informing policies. International and regional scientific collaboration in ASEAN and IPCC can also help enhance the scientific literature on climate impacts.
- IV. System innovation: ASEAN has largely approached the impact of food security through water management. Better water management, irrigation, and improvement in efficiencies of cropping systems have helped enhance yields.
- V. Financing instruments: Pilot projects on microfinance and crop insurance have been test-bedded in countries like Viet Nam (i.e. index-based flood insurance product for the MRD). The ASEAN Insurance Council and ASEAN Law Association can help coordinate efforts with the private sector and institutions such as the Asian Development Bank.
- VI. Climate-monitoring systems: The Mekong River Commission agreed to set up a basin-wide climate-monitoring system in 2013.²⁶ An online portal containing monitoring data has been set up for the dissemination of data

²⁶ Global Climate Change Alliance, Addressing Ecosystem Challenges Through Support to the Mekong River Commission's Climate Change and Adaptation Initiative (CCAI), Global Climate Change Alliance, <http://www.gcca.eu/technical-and-financial-support/regional-programmes/gcca-lower-mekong-basin-ccai>, n.d. (accessed 22 December 2014).

relating to hydrology, floods and drought.²⁷ This largest region-wide monitoring system in Southeast Asia. Systems and insights from this project can be used to expand the monitoring system southwards.

There are numerous avenues that ASEAN, under the stewardship of the ASCC in particular, can use to broaden the goal of food security. Climate change impacts and adaptation measures are good starting points which that will not necessarily require brand new committees, institutions, or mechanisms. Using the concept of shared governance between the various existing pillars of the ASEAN, the linkage of food security and climate change can be addressed coherently. Such an approach would comprehensively tackle both food insecurity and the potential impact of climate change.

References

- Almassy, D. (2014), 'An ASEAN Climate Change Profile', in *Handbook for ASEAN Member States Government Officials on Climate Change and the United Nations Sustainable Development Goals*. Hanoi: Hanns Seidel Foundation Viet Nam, pp. 73–82.
- Anbumozhi, V. (2012), 'Framework Conditions for Integrating Climate Change Adaptation into Natural Resource Planning', in *Climate Change in Asia and the Pacific: How Can Countries Adapt?* New Delhi: SAGE Publications India Pvt Ltd, pp. 47–63.
- ASEAN Secretariat (2009), *ASEAN Social Cultural Community Blueprint*. Jakarta: ASEAN Secretariat.
- Bassino, J.P. (2006), 'Rice Cultivation in Southern Viet Nam (1880–1954): A Re-evaluation of Land Productivity in Asian Perspective', *Economic Review*, vol. 73, no. 4, pp. 3–38.
- Blackwood, E. (2008). 'Not your Average Housewife: Minangkabau Women Rice Farmers in West Sumatra', in M. Ford and L. Parker (eds.) *Women and Work in Indonesia*. London and New York: Routledge, pp. 17–40.

²⁷ Mekong River Commission. MRC Data and Information Services Portal. <http://portal.mrcmekong.org/index>, 2014 (accessed 13 July 2015).

- European Commission (2013), *Commission Staff Working Document: Principles and Recommendations for Integrating Climate Change Adaptation Considerations Under the 2014–2020 Rural Development Programmes*. Brussels: European Commission.
- European Commission (2014), *European Climate Adaptation Platform* (accessed 26 December 2014).
- Food and Agriculture Organization, World Food Programme, and International Fund for Agricultural Development (2014), ‘State of Food Insecurity 2014 Report’, *Joint Report from FAO, WFP, and IFAD*.
- Global Climate Change Alliance (n.d.), Addressing Ecosystem Challenges Through Support to the Mekong River Commission’s Climate Change and Adaptation Initiative (CCAI), <http://www.gcca.eu/technical-and-financial-support/regional-programmes/gcca-lower-mekong-basin-ccai>, n.d. (accessed 22 December 2014).
- Intergovernmental Panel on Climate Change (2013), in T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midgley (eds.), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, USA: Cambridge University Press.
- Kuneepong, P., S. Kongton, V. Wangwacharakul, and S. Sumdin (2001), ‘Modelling Economic Crop Yield and Climate Change in Thailand, in *ModSim 1. International Congress on Modelling and Simulation*, 10–13 December 2001, Modelling and Simulation Society of Australia and New Zealand, Canberra, Australia, pp.709–714.
- Lam, M.Y. (1993), ‘A Review of Food Research in Vietnam, with Emphasis on Postharvest Losses’, *AOAR Technical Reports*, no. 26, 111p.
- Lassa, J.A. (2012), ‘Emerging “Agricultural Involution” in Indonesia: Impact of Natural Hazards and Climate Extremes on Agricultural Crops and Food System’ in Y. Sawada and S. Oum (eds.), *Economic and Welfare Impacts of Disasters in East Asia and Policy Responses*, ERIA Research Project Report 2011-8, Jakarta, ERIA, pp.601–640.
- Luo, Y., D.O. Te Beest, P.S. Teng, and N.G. Fabellar (1995), ‘Simulation Studies on Risk Analysis of Rice Leaf Blast Epidemics Associated with Global Climate Change in Several Asian Countries’, *Journal of Biogeography*, vol. 22, pp. 673–678.
- Luo, Y., P.S. Teng, N.G. Fabellar, and D.O. TeBeest (1998), ‘Risk Analysis of Yield Losses Caused by Rice Leaf Blast Associated with Temperature Changes Above and Below for Five Asian Countries’, *Agriculture, Ecosystems & Environment*, vol. 68, no. 3, pp. 197–205.

- Luo, Y., P.S. Teng, N.G. Fabellar, and D.O. TeBeest (1997), 'A Rice-leaf Blast Combined Model for Simulation of Epidemics and Yield Loss, *Agricultural Systems*, vol. 53, no. 1, pp. 27–39.
- Luo, Y., P.S. Teng, N.G. Fabellar, and D.O. TeBeest (1998), 'The Effects of Global Temperature Change on Rice Leaf Blast Epidemics: A Simulation Study in Three Agroecological Zones', *Agriculture, Ecosystems and Environment*, vol. 68, no. 3, pp. 187–196.
- Mainuddin, M., M. Kirby, and C.T. Hoanh (2011), 'Adaptation to Climate Change for Food Security in the Lower Mekong Basin', *Food Security*, 3(4), pp.433–450.
- n.d. (2012), *Report of the Workshop on Adaptation/Mitigation Technologies for Climate Change in Agriculture in the ASEAN Region and India*. New Delhi: s.n.
- Porter J. R., *et al.* (2014), 'Food Security and Food Production Systems' in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, USA: Cambridge University Press, pp. 485–533.
- Portner, H.O. *et al.* (2014) 'Ocean systems', *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, U.K. and New York, USA, 2014, pp. 411–484.
- Renaud, F.G., Thi Thu Huong Le, C. Lindener, Vo Thi Guong, and Z. Sebesvari (2014), 'Resilience and Shifts in Agro-ecosystems Facing Increasing Sea-level Rise and Salinity Intrusion in Ben Tre Province, Mekong Delta', *Climatic Change*.
- SciDev.Net (2015). (Accessed 23 January 2015).
- Shaobing P., *et al.* (2004), 'Rice Yields Decline with Higher Night Temperature from Global Warming', *Proceedings of the National Academy of Sciences*, vol. 101, no. 27, pp. 9971–5.
- Tolentino, V. (2014), *ASEAN Cooperation: Crucial to Global Food Security*.
- Trevisan, J. (2013), 'The Common Framework for Climate Policy in South-East Asia', *International Centre for Climate Governance Reflection*, no. 13, pp. 1–7.
- USAID IMACS Project (2014). (Accessed 23 January 2015).
- Wheeler, T., and J. von Braun (2013), 'Climate Change Impacts on Global Food Security', *Science*, vol. 341, pp. 508–513.

Wong [Insert first name initial] *et al.* (2014), 'Coastal Systems and Low-lying Areas', in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, USA: Cambridge University Press.

World Bank (2010), *Economics of Adaptation to Climate Change: Vietnam*. Washington, DC: World Bank, 84p.

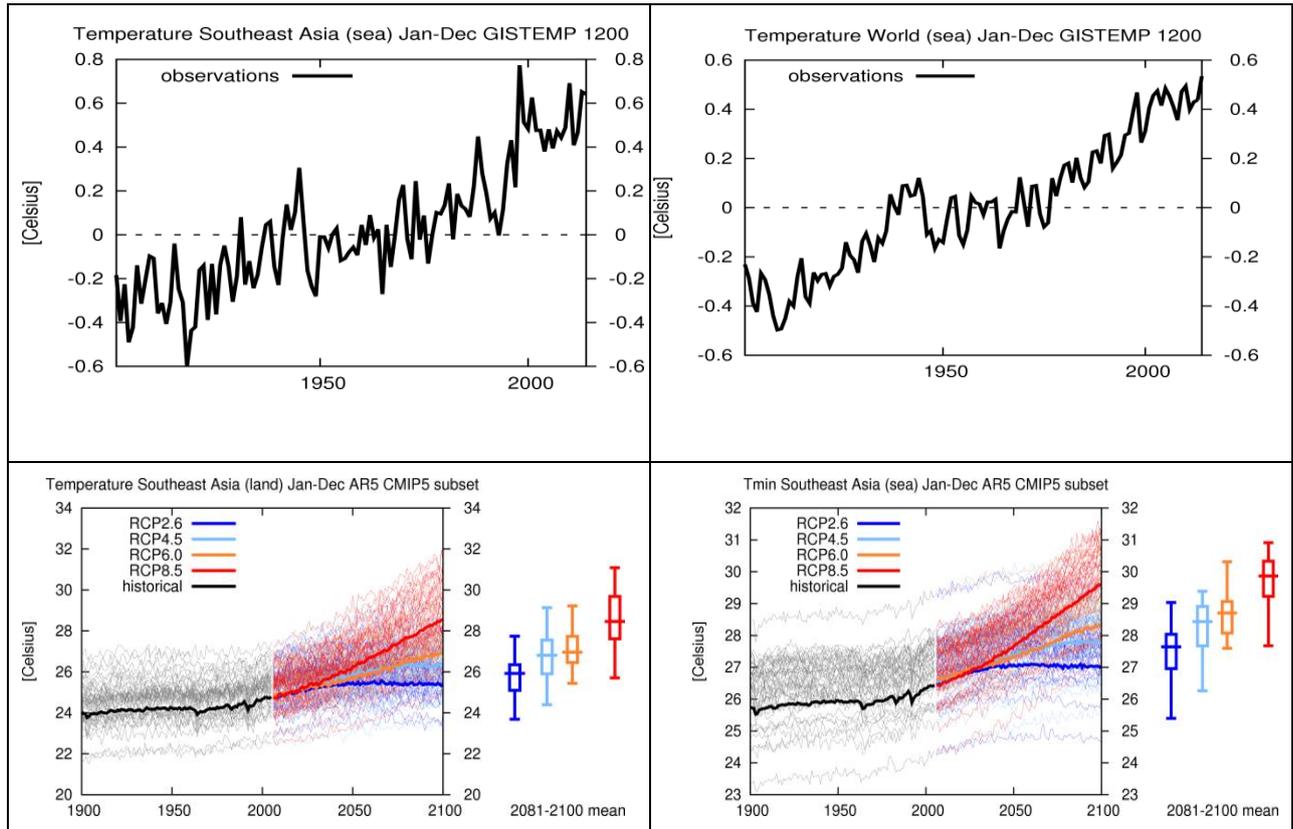
Annex 1. Climate Change Impact on Rice Production and Fisheries in Southeast Asia

A1.1. Climate Change in ASEAN: Evidence and Projection

Southeast Asia is experiencing climatic change. Calculating from the baseline (1961–1990), over the last 20 years the region has experienced an increase in both land and sea temperature of 0.34°C and 0.38°C , respectively (Table 4). Under the Representative Concentration Pathways (RCP 6.0), recently introduced by the Intergovernmental Panel on Climate Change (IPCC) Working Group 1, it is projected that the region's sea is likely to experience 1.28°C increase in temperature in 2050, 1.65°C in 2080, and 2.0°C in 2100. Overall change in land temperature is projected to be higher, where it may reach 1.59°C in 2050, 1.96°C in 2080, and 2.46°C in 2100.

Figure 1 also shows that sea temperatures in Southeast Asia will continue to increase at a higher rate than global sea temperatures. Our study suggests that in Southeast Asia, there have been warmer nights on both sea and land in general. Warmer nights are indicated by the Tmin variable (Figure 1, middle-right). In the production regions of Thailand and Viet Nam, increases in warmer nights have also been observed.

Figure 1: Temperature Change in Land and Sea in Southeast Asia



Source: IPCC 2014 Working Group 1. The top figures are based on observation. The bottom figures are based on projections according to **Representative Concentration Pathways (RCP)** Scenarios 2.6; 4.5; 6.0, and 8.5.

It is predicted that the coastal system in Southeast Asia will be affected by higher sea levels. IPCC recently projected global mean sea level rise to reach 0.28 to 0.98 meters by 2100. The risk is ‘unavoidable’ because even when greenhouse gas emissions can be reduced to some degree, the risk of sea level rise can persist and therefore adaptation is the only plausible solution.

Table 4: Observed Climate Change in Southeast Asia Land and Sea

	SEA Sea Temperature	SEA Sea Temperature	SEA Sea Temperature	SEA Land Temperature
Baseline	27.6157	25.5673	0	0
Avg 1981–2005	27.9569	25.9495	0.3412	0.3822
2020	28.3856	26.712	0.8422	1.1874
2030	28.5931	26.5286	0.9774	0.9613
2050	28.8953	27.1635	1.2796	1.5962
2080	29.2566	27.5253	1.6409	1.9580
2100	29.6483	28.025	2.0326	2.4577

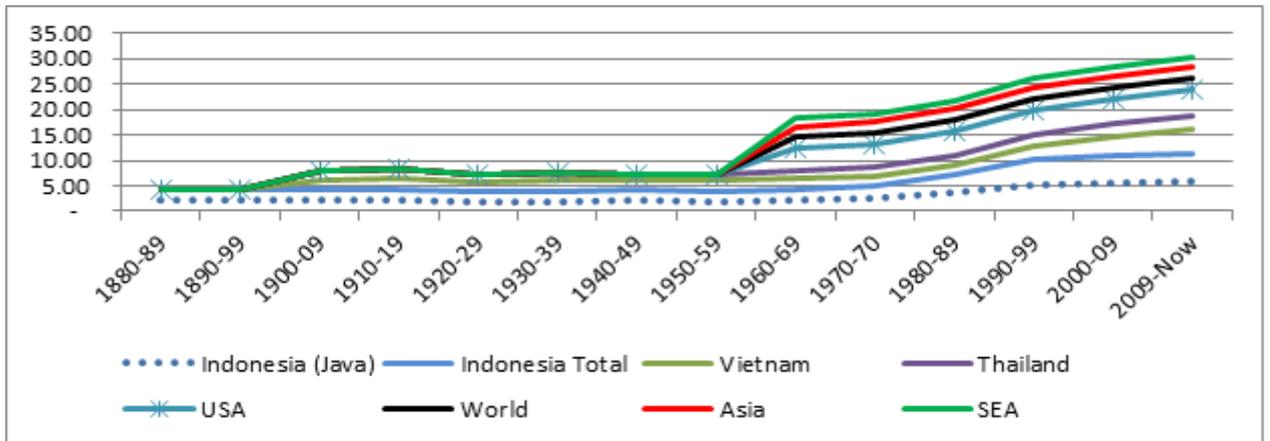
Source: *Based only on One Mean model projected change (IPCC, 2014).

A1.2 Impact of Climate Change on ASEAN Rice: Selected Evidence

Rice yields grew from 1.69 tonnes/hectare (t/ha) in the 1960s to three t/ha for the first time in 1989/1990. Since 2009, the region has been enjoying rice yields above 4.17 t/ha. Figure 2 shows that yield has been about five t/ha in Viet Nam in the last five years and in Indonesia in the last 10 years. Lao PDR, Myanmar, and, recently, Cambodia have caught up with the Philippines, Malaysia, and Thailand’s rice yield. However, Southeast Asia’s rice yield is still below the average in Asia.

Higher yields over the last five to 10 years indicate that, overall, rice farmers have developed greater capacity to adapt to climate variation. Unfortunately, ASEAN, as an aggregate of rice economies has been struggling to ensure that rice yields increase faster than population growth (Figure 3). Despite a continuous declining trend in annual population growth rate since the late 1980s, the region continues to struggle to keep both the growth in yield and rice land area above the rate of population growth. In addition, total ASEAN rice productivity (kilograms/person) continues to increase at a much slower pace, notably since 2000 (Figures 3 and 4). Amongst the highly populated AMSs, only Thailand and Viet Nam continue to grow enough rice to feed their populations.

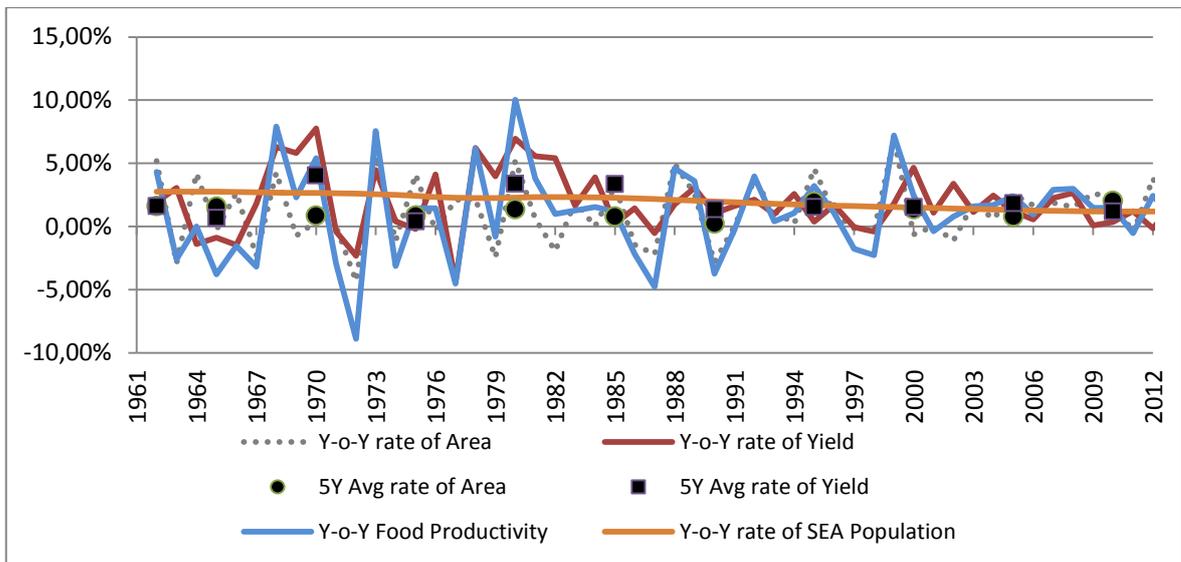
Figure 2: Rice Yield in ASEAN, 1880–2014



Note : *For Indonesia, the yield during 1880–1959 was based on Java’s rice yield.

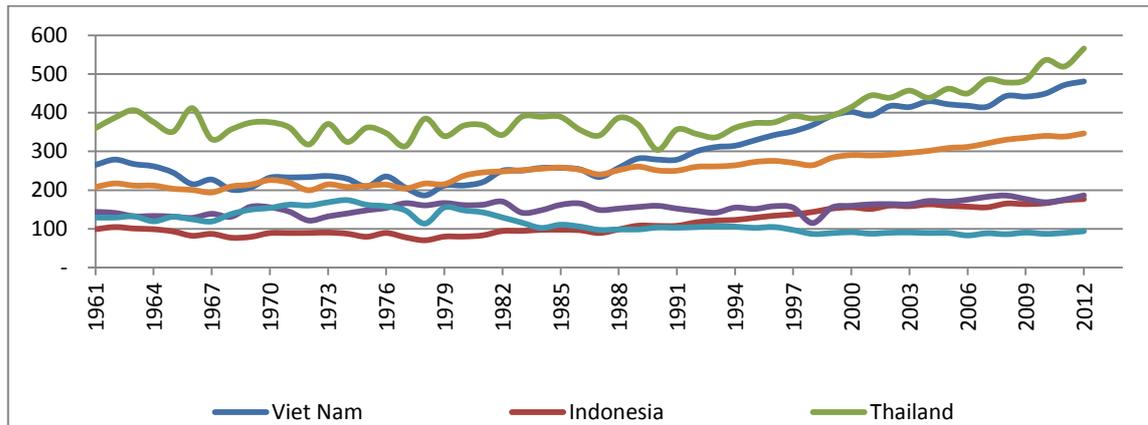
Source: Author, data from FAO Statistics, Pierre van der Eng, Bassino, and others.

Figure 3: Annual Rate of Rice Area, Population, and Yield Since the 1960s [Year on Year or Y-o-Y]



Source: Authors, data from Food and Agriculture Organization statistics.

Figure 4: Annual Rate of Rice Productivity (tonnes/kg)



Source: Authors, data from Food and Agriculture Organization statistics.

Floods are a significant problem for rice farming, especially in the lowlands of Southeast Asia such as the MRD. Sea level rise is associated with both coastal flooding—which causes submergence—and salinity. Climate change may exacerbate losses because rice is generally intolerant to complete submergence, and rice plants die within a few days when completely submerged. Floods and tropical cyclones have been a regular threat to Southeast Asian food security as exemplified by Cyclone Nargis in Myanmar in 2008, Thailand’s floods in 2011, and the Haiyan typhoon in the Philippines in 2013, all of which caused huge losses in food production. Typhoon Haiyan submerged crops for about 16 hours; the ‘super typhoon’, (or a Category 5 hurricane with wind speed of up to 195 mph) battered crops and caused extensive damage. At least ‘600 000 ha of farmland were devastated, 1.1 million tonnes of crops were lost (Coconut – [73 per cent of crop area], Rice [16 per cent of crop area], Corn [4 per cent of crop area])’ (FAO, 2014). Nearly one million coconut farmers were affected by the typhoon and an ‘estimated 33 million trees were damaged or destroyed’. Total agricultural recovery and rehabilitation cost was estimated at US\$724 million. The impacts of floods on rice production in Thailand following the 2011 floods resulted in losses estimated at 29 percent of annual production.

Heat stress during the day and/or night has differential impacts on rice growth and production. Some rice scientists have argued that high night temperatures have been documented to have a greater negative effect on rice yield, with 1°C above

critical temperature ($> 24^{\circ}\text{C}$) leading to 10 percent reduction in both grain yield and biomass.²⁸

A1.2.1 Impact of Changing Climate on Thailand's Rice

Rice statistics in Thailand recognise two rice systems referred to as 'Major Rice' and 'Second Rice'. The 'Major Rice' refers to the rice grown between May and October. The 'Second Rice' refers to the rice grown between November and April of the following year.²⁹ Rice production in Thailand is concentrated in the three main regions: Northeastern, Northern, and Central Thailand. The total agricultural area in the Northeastern region (as of 2012) was 42.6 million hectares (ha), of which 39.6 million ha are cultivated during the main season and three million ha during the secondary season. The second largest concentration of rice farming is in Northern Thailand (22.7 million ha) and the third largest production area is the central part of Thailand where 6.3 million ha are cultivated for rice.

²⁸ P. Shaobing, *et al.*, 'Rice Yields Decline with Higher Night Temperature from Global Warming', *Proceedings of the National Academy of Sciences*, vol. 101, no. 27, 2004, pp. 9971–5.

²⁹ Exception is made for southern areas, namely, Nakhon Si Thammarat, Phatthalun, Songkhla, Pattani, Yala, and Narathiwat where rice is grown between 16th June and 28 February. Their dry season is from 1 March to 5 June.

**Table 5: Selected Studies: Climate Change Scenarios in Thailand and Viet Nam
Rice Sector**

	IPCC Special Report on Emissions Scenarios (SRES)			
Scale/Region	Neutral to High	Neutral to Low	Low to High	Reference
Nationwide Thailand	+10-20%			2nd Communication to UNFCCC
Northeastern Thailand	+49 to -33.9	78.77 to -43.57	+21.45 to - 8.6	DSSAT (Felkner, 2009)
Northeastern Thailand	+0.42 to -12.84	+0.55 to -98.2	+0.83 to - 0.98	Econ Model (Felkner, 2009)
Northeastern Thailand	-0.53 (2020)	-1.41 (2050)	-19.66 (2080)	CGCM1 [0-N] (Kuneepong <i>et al.</i> , 2001) ³⁰
Northeastern Thailand	-17.81 (2020)	-22.92 (2050)	-32.21 (2080)	ECHAM [0-N] (Kuneepong <i>et al.</i> , 2001)
Northeastern Thailand	-2.25 (2020)	-14.21 (2050)	-14.82 (2080)	CSIRO [0-N] (Kuneepong <i>et al.</i> , 2001)
National Viet Nam	-2.2 (2020)	-3.4 (2050)		MONRE (2009)

Note: CGCM1 = First Generation Coupled Model, Canada, CSIRO = Global Climate Model developed by Commonwealth Scientific and Industrial Research Organisation, Australia, DSSAT = Decision Support System for Agrotechnology Transfer, ECHAM = Global Climate Model developed by Max-Planck Institute for Meteorology, MONRE = Ministry of Natural Resources and Environment, Viet Nam, SRES = IPCC Special Report on Emissions Scenarios, UNFCCC = United Nations Framework Convention on Climate Change

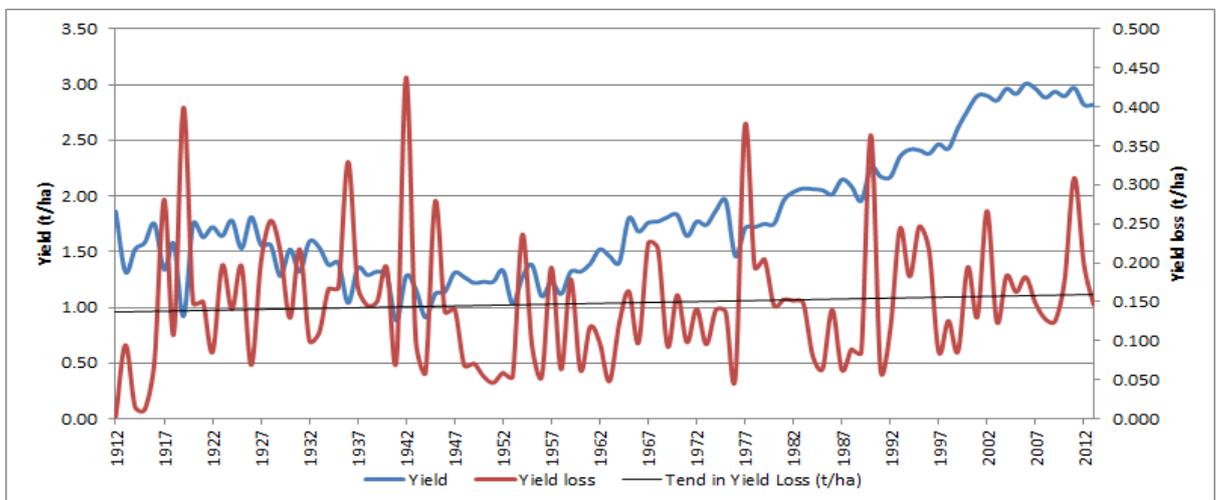
Source: Author compilation based on available literature.

³⁰ P. Kuneepong, S. Kongton, V. Wangwacharakul, and S. Sumdin, 'Modelling Economic Crop Yield and Climate Change in Thailand', in *ModSim 1. International Congress on Modelling and Simulation, 10-13 December 2001*, Modelling and Simulation Society of Australia and New Zealand, Canberra, Australia. 2001, pp.709-714.

Studies on climate impacts on rice in the temperate regions of Thailand often show mixed outcomes as a result of climatic change. Matthews *et al.* (1997) argue that rain-fed rice yield may range from -12 percent to +10 percent in Ubon Ratchathani province. In Roi-et province, rice yields could drop by 57 percent but increase by 25 percent in Surin.

One of the expected effects of temperature rise is the shift in the geographical zones for specific rice diseases and insects. In the case of the devastating rice blast disease, Luo *et al.* (1998) have shown that the northern regions of Thailand and certain central areas will become more prone to blast disease.

Figure 5: Historical Yield Loss in Thailand—Composite Risks



Source: Authors.

Nationally, Thailand’s 100 years of yield dataset (Figure 5) suggests that annual yield loss increased marginally as a direct result of damage and losses from climatic events such as floods, drought, and pest attacks. This suggests that, despite consistent improvement in technology, there is an increasing trend in yield losses. The yield losses above are calculated in a modest way as they are based on the differences between the total area for planting and harvesting.

A1.2.2 Impact of Changing Climate on Viet Nam's Rice

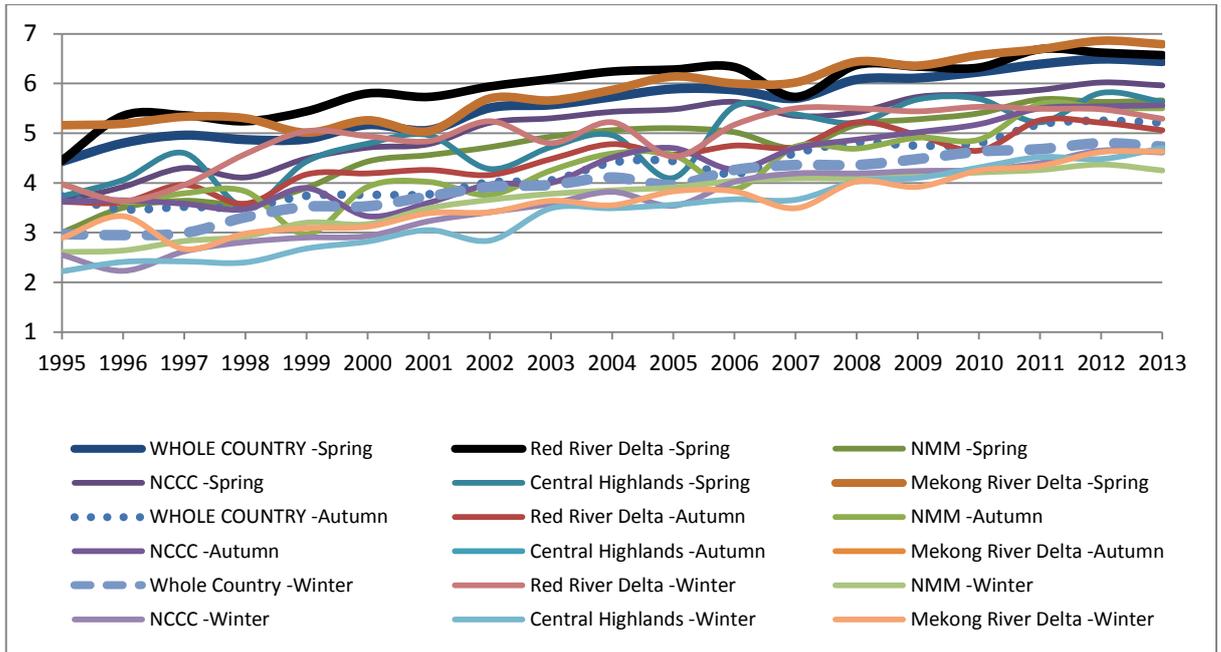
As of 2013, Red River Delta and North Central Coast and Central Highland (NCCC) occupy 1.1 million ha (14 percent of national total) and 1.2 million ha (16 %) of planted paddy land, respectively. The Mekong River Delta (MRD) is the largest rice production region of Viet Nam, contributing 55 percent of the total (4.3 out of 7.9 million planted paddy area).

Based on both formal reports from the French colonial period and estimated figures of paddy yield, especially in MRD of Viet Nam since 1870–1970s, yield has been very volatile.³¹ Figure 6 suggests that winter rice yield in the Central Highland of Thailand has recently increased from around 2.2 t/ha to above 3 t/ha. Whilst the Mekong River Delta's Spring rice yield has increased from 5.2 t/ha to 6.8 t/ha in the last few years. This suggests that differences in the natural climate between regions play important roles in present and future yield project.

Tran, Pham, and Bui (2014) suggest that climate change may create shocks on rice production in the Red River Delta and MRD regions. Dasgupta *et al.* (2009) predict that about seven percent of Viet Nam's agriculture land may be submerged due to sea level rise. The Vietnam Institute for Meteorology, Hydrology and Environment (2007) projected significant increases in annual average temperature in 2100. It estimates that an increase of one meter in sea level would affect over 10 percent of the country's population (Mekong and the Red River Deltas); seasonal rainfall in all regions would increase up to five percent in 2050 (except in the central region, where seasonal rainfall would increase up to 10 percent).

³¹ J. P. Bassino, 'Rice Cultivation in Southern Vietnam (1880–1954): A Re-evaluation of Land Productivity in Asian Perspective', *Economic Review*, vol. 73, no. 4, 2006, pp. 3–38.

Figure 6: Recent Rice Yields Across Viet Nam



Note: NCCC = North Central Coast and Central Highland, NMM = North Mountain and Midlands.

Source: Vietnam Statistical Office 2014.

One of the risks of climate change is the uncertainty in the onset of rainfall, which allows farmers to grow crops on time. As a result, rainfall will be more erratic and yield loss may occur. In this case, adaptation can also include adjustment in the planting calendar. Without adaptation, Viet Nam could lose total agricultural added value by -5.8 to -13.9 percent in 2050 compared with the present value.³² Compared with the present rice yield in Viet Nam (above 5-6 t/ha), a recent study projected that even with adaptive planting scheduling, yield can be reduced to 4.5 t/ha (under SRES A2) and 4.1 t/ha (SRES B2).³³

Anecdotal data on climate extremes in Viet Nam suggest that the country usually has seven to 10 major storms each year. Natural disasters such as storms, floods, and cold winds cause the loss of over 300,000 tonnes of food annually.

³² World Bank, *Economics of Adaptation to Climate Change: Viet Nam*, 2010, 84p.

³³ M. Mainuddin, M. Kirby, and C. T. Hoanh, 'Adaptation to Climate Change for Food Security in the Lower Mekong Basin', *Food Security*, vol. 3, no. 4, 2011, pp. 433-450.

Apart from storms and floods, pests and diseases have also caused serious damage to many Vietnamese crops. Every year, about 10 percent of the area under food cultivation is destroyed by pests. For example, in 1991, about 200,000 tonnes (2%) of winter-spring rice was lost in southern Viet Nam due to pest infestation.³⁴

Climate impacts on postharvest rice loss in Vinh-Long suggest that most of the rice loss occurs in the rainy season (August–November). Postharvest losses in the drying stage are estimated at over 20 percent. In Tra Vinh, most of its area suffers from coastal flooding. In Can-Tho, the most developed province in the MRD, postharvest losses are estimated to be 15–20 percent, due mainly to inadequate drying methods and poor storage.

A1.3 Impact of Climate Change on ASEAN Fisheries

ASEAN continues to be one of the most productive regions by tonnage of fish. The region has gradually emerged as one of the largest contributors to global fish production (20 percent of total world fish production in 2012), where Indonesia contributed 8.4 percent (about 15.5 million tonnes) in 2012. In the FAO's '2014 The State of World Fisheries and Aquaculture', six ASEAN countries are included in the top-18 world leaders in marine capture fisheries, led by Indonesia (2nd), followed by Viet Nam (9th), Myanmar (10th), Philippines (12th), Thailand (14th), and Malaysia (15th). Viet Nam and Indonesia show consistent growth in fisheries capture, whilst Thailand is experiencing a decline owing to depletion of its marine ecosystem in the Gulf of Thailand. The case of Thailand suggests that overfishing and environmental degradation are key drivers in the decline of fisheries.

Whilst AMSs enjoy increasing share in the global fish markets over the last 10 to 20 years (Table 6), the question is how this can be sustained, especially under climatic change. The movement of fish from lower to higher comfort zones under climate change may result in fish migrations beyond state boundaries. Only those with the best fishing ships and satellite imaging technology can compete. The majority of small fisherfolk, who are only equipped with traditional fishing boats, are

³⁴ M. Y. Lam, 'A Review of Food Research in Vietnam, with Emphasis on Postharvest Losses', *AOAR Technical Reports*, no. 26, 1993, 11p.

most likely to have more disrupted fishing days due to an increase in stormy days and sea changes.

Table 6: Fish Production in ASEAN (metric tonnes)

	1950	1960	1970	1980	1990	2010	2012
ASEAN	960,145	2,538,538	5,285,459	7,337,619	11,387,459	31,640,373	36,649,951
Indonesia	245,000	761,700	1,257,200	1,877,956	3,243,345	11,656,697	15,422,366
Malaysia	146,379	155,941	343,096	740,400	1,009,617	2,018,700	2,096,631
Philippines	238,876	499,237	1,104,916	1,717,592	2,504,370	5,161,768	4,868,649
Thailand	183,590	231,420	1,437,837	1,799,988	2,789,953	3,096,742	3,068,450
Viet Nam	70,600	473,160	618,000	559,660	941,227	5,121,200	5,942,300
Rest of ASEAN	75,700	417,080	524,410	642,023	898,947	4,585,266	5,251,555
Global	18,134,448	33,664,084	59,764,748	65,650,293	102,334,145	168,201,566	182,852,799

Source: Authors, data from Food and Agriculture Organization statistics.

Unfortunately, in Southeast Asia, apart from Mekong Delta's inland fisheries, there have been few studies and published works on how climate change impacts fisheries and aquaculture production.

However, global studies from the IPCC 5th Assessment Report recognise Southeast Asia's vulnerability to climate change. Said report suggests that climate change triggers ocean acidification (as a result of carbon uptake in the ocean) and sea and ocean warming, which destroy coral reefs and natural coasts. In coastal regions, submergence, flooding, erosion, salt water intrusion, and wetland loss can be exacerbated by climate change.

Annex 2.

List of ASEAN Statements and Initiatives on Climate Change

Year	Type	ASCC Characteristic	Description	Area of Focus
2005	Action Plan	Continue implementation of ASEAN Strategic Plan of Action on Water Resource Management	The ASEAN Strategic Plan of Action on Water Resources Management (ASPA-WRM) contains actions on four key issues: (i) supply, demand, and allocation; (ii) water quality and sanitation; (iii) climate change and extreme events; and (iv) governance and capacity building. The four key issues have been translated into ten project concepts.	Adaptation
2007	Workshop	Promote the sustainable use of coastal and marine environment	The Proposal on Climate Change and ASEAN Coastal Areas: Vulnerability, Impacts and Adaptation was endorsed in principle at the 12th ASEAN Working Group on Coastal and Marine Environment (AWGCME) Meeting. The meeting agreed to conduct a workshop for AMSs and partners for the implementation of the first component of the project, with an estimated budget of US\$50,000.	Adaptation
2008	Project	Promote conservation and sustainable management of key ecosystems in coastal and marine habitats	Joint research initiative with WorldFish-Philippines on Hotspots of Marine Biodiversity in the Southeast Asian Seas: Mapping Current Location and Climate Change	Food
2009	Statement	Promote common understanding and common position on relevant MEAs	The ASEAN Joint Statement on Climate Change to the 15th Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and the 5th Session of Conference of Parties serving as the Meeting of Parties to the Kyoto Protocol (COP15/CMP5) was adopted by the ASEAN Leaders on 24 October 2009 in HuaHin.	
2009	Action Plan	Encourage efforts to develop the ACCI	The Terms of Reference of ASEAN Climate Change Initiative (ACCI) was adopted by the environment ministers at the 11th ASEAN Ministerial Meeting on Environment (AMME) in October 2009 to be a framework to further strengthen regional coordination and cooperation in addressing climate change, and to undertake concrete actions to respond to its adverse impacts. The establishment of ASEAN Working Group on Climate Change was also endorsed at the 11th AMME to implement the ACCI.	
2009	Action Plan	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the Clean Development Mechanism	The ASEAN Multisectoral Framework on Climate Change: Agriculture and Forestry Toward Food Security (AFCC) was endorsed by the 31st ASEAN Ministerial Meeting on Agriculture and Forestry (AMAF) Meeting in November 2009. The AFCC is an initiative under the Asean Integrated Food Security (AIFS) Framework and provides inputs to the ASEAN Climate Change Initiative (ACCI).	Food

2009	Workshop	Promote forest management involving the community	The ASEAN Social Forestry Network (ASFN) Side Event on 'The Role of Social Forestry in Climate Change Mitigation and Adaptation' was held on 10 June 2009 in the Philippines.	Mitigation and Adaptation
2009	Workshop	Encourage environmentally sustainable planning and management of ASEAN region's forests	ASEAN High-Level Seminar on 'Climate Change Adaptation and Mitigation: Towards a Cross-Sectoral Programme Approach in ASEAN' held on 23–25 March 2009 in Berlin, Germany, wherein an 'ASEAN Multi-Sectoral Framework on Climate Change (AFCC) and Food Security (AFCC-FS)' as a comprehensive program to address the emerging issues of climate change was recommended to be developed.	Food
2009	Network	Promote forest management involving the community	ASEAN–Swiss Partnership on Social Forestry and Climate Change (ASFCC)	
2010	Statement	Promote common understanding and common position on relevant Multilateral Environmental Agreements	The ASEAN Leaders' Statement on Joint Response to Climate Change was adopted by the ASEAN Leaders at the 16th ASEAN Summit on 8–9 April 2010.	
2010	Project	Continue implementation of ASEAN Strategic Plan of Action on Water Resource Management	Risks and Impacts from Flood Extreme Events in AMSs (led by Indonesia, implemented in June 2010)	Adaptation
2010	Project	Continue implementation of ASEAN Strategic Plan of Action on Water Resource Management	Risk and Impacts from Drought Extreme Events in AMSs (led by Thailand, implemented in September 2010).	Adaptation
2010	Workshop	Enhanced collaboration amongst AMSs and relevant partners to address climate-related hazards	Workshops on Risks and Impacts from Extreme Events of (i) Floods and (ii) Droughts in ASEAN Countries were held on 9–10 June 2010 in Indonesia and 22–23 September 2010 in Thailand, respectively.	Adaptation

2010	Workshop	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	The ASEAN High-Level Workshop on the Implementation of the ASEAN Framework on Climate Change (AFCC) was organised on 21–22 July 2010 in Bogor, Indonesia. The workshop discussed and finalised the working modalities for the AFCC and explored resource mobilisation to support the AFCC.	
2010	Workshop	Promote forest management involving the community	The ASFN Conference on ‘Social Forestry in Contributing to Food Security and in Addressing Climate Change was held 14–16 June 2010 in Yogyakarta, Indonesia.	
2010	Project	Enhance the role and capacity of the ASEAN Centre for Biodiversity (ACB) to function as an effective regional centre of excellence in promoting biodiversity conservation and management	Project on Biodiversity and Climate Change (2010–2015).	Adaptation
2010	Action Plan	Encourage efforts to develop the ACCI	The ASEAN Climate Change Initiative is envisaged as a consultative platform to strengthen regional coordination and cooperation in addressing climate change and to undertake concrete actions to respond to its adverse effects. The scope includes (i) policy and strategy formulation, (ii) information sharing, (iii) capacity building, and (iv) technology transfer.	Adaptation
2011	Statement	Promote common understanding and common position on relevant MEAs	The ASEAN Leaders’ Statement on Climate Change to the 17th Session of the Conference of the Parties to the UNFCCC and the 7th Session of Conference of Parties serving as the Meeting of Parties to the Kyoto Protocol (COP17/CMP7) was adopted at the 19th ASEAN Summit in November 2011.	
2011	Workshop	Share experiences, expertise, and technology in areas of urban planning	The Workshop and Exchange on Support for Climate Resilient Cities: Identifying ASEAN Best Practices was held on 18–19 January 2011 in Jakarta, Indonesia. The workshop aimed to address climate change adaptation efforts. The workshop was supported by the ASEAN-US Technical Assistance and Training Facilities.	
2011	Project	Continue implementation of ASEAN Strategic Plan of Action on Water Resource Management	Water Resources Demand Management Learning Forums for Irrigation (led by Thailand, implemented in July 2011).	Food

2011	Statement	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	The 14th ASOF Meeting tasked the ASEAN Regional Knowledge Network on Forests and Climate Change (ARKN-FCC) to develop draft of ASEAN common position on methodological aspect of REDD+ (Reducing Emissions from Deforestation and Forest Degradation) and on the financing of full implementation for submission of ASEAN common position to cover three issues (the modalities in developing Reference Emissions Levels (REL) and Measurable, Reportable, Verifiable (MRV) information, and the guidance on providing information on safeguards) to the United Nations Framework Convention on Climate Change 17 th session of the Conference of Parties (UNFCCC COP-17). The ASEAN Senior Officials on Forestry (ASOF)endorsed the ASEAN Common Position and the common position was submitted to the UNFCCC COP-17.	
2011	Workshop	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	Regional Workshop on Climate Change and Food Security in ASEAN Plus Three Countries from 29–31 March 2011 in Beijing, China.	Food
2011	Action Plan	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	The Cooperation Strategy on Food, Agriculture and Forestry is a comprehensive sectoral approach for ASEAN Plus Three in looking into issues such as food security, climate change adaptation and mitigation, and biomass energy.	Food
2011	Project	Promote conservation and sustainable management of key ecosystems in coastal and marine habitats	Impacts of climate change in the fisheries and aquaculture sector under the Maximising Agricultural Revenue Through Knowledge, Enterprise Development, and Trade Project (MARKET).	Food
2011	Project	Encourage environmentally sustainable planning and management of ASEAN region's forests	ASEAN-Australia Development Cooperation Programme Phase II (AADCP II) Project on REDD+.	Mitigation
2012	Action Plan	Promote common understanding/common position on relevant MEAs	The ASEAN Action Plan on Joint Response to Climate Change was adopted by the ASEAN Environment Ministers in 2012 as a follow-up to the Leaders' Statement in 2010.	

2012	Workshop	Share experiences, expertise, and technology in areas of urban planning	The Yogyakarta City Greenhouse Gases (GHG) Emissions and HEAT+ - Launch and Training: In collaboration with International Council for Local Environmental Initiatives (ICLEI) – Local Governments for Sustainability, the Facility held a two-day workshop, 20–21 September 2012, in Yogyakarta, Indonesia, to present the Yogyakarta City Greenhouse Gases (GHG) Emission Inventory Report and to demonstrate the use of ICLEI’s internationally recognised monitoring software system, the Harmonised Emissions Analysis Tool (HEAT+).	Mitigation
2012	Action Plan	Enhanced collaboration amongst AMSs and relevant partners to address climate-related hazards	The ASEAN Action Plan on Joint Response to Climate Change was adopted by the Environment Ministers at 12th ASEAN Ministerial Meeting on Environment (AMME) in 2012. Partners Consultation was held on 26 March 2013 to explore potential collaboration with dialogue partners and international organisations to implement the Action Plan.	
2012	Action Plan	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	The ASEAN-German Programme on Response to Climate Change: Agriculture, Forestry and Related Sectors (GAP-CC), implemented from April 2012, supports the conduct of Meeting of the Ad-Hoc Steering Committee on Climate Change and Food Security to kick start the implementation of ASEAN Framework on Climate Change.	
2012	Meeting	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	The first meeting of the ASEAN Ad-Hoc Steering Committee on Climate Change and Food Security was held on 13–14 September 2012 in Jakarta.	Food
2012	Meeting	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	The 34th Meeting of The ASEAN Ministers on Agriculture and Forestry (AMAF) noted the outcomes and supported the recommendations of the 1st Ad-hoc Steering Committee on Climate Change and Food Security to effectively monitor the progress of work and coordinate activities (i.e. Climate-Smart Agriculture, and low carbon green growth in agriculture and forestry sectors) being implemented by various subsidiary bodies and partners.	Food
2012	Network	Promote conservation and sustainable management of key ecosystems in coastal and marine habitats	Establishment of the ASEAN-Korea Network on Climate Change Adaptation in Aquaculture.	Food

2012	Project	Promote and facilitate exchange of information on scientific R&D	The ASEAN-India Project Proposal on Enhancing Local-level Climate Change Adaption in Southeast Asia was implemented. The Project assessed the impacts of climate change and status of climate change adaptation efforts in Southeast Asian countries. The output was the Assessment Report on the Impacts of Climate Change and Status of Climate Change Adaptation in Southeast Asian Countries.	Adaptation
2013	Workshop	Share experiences, expertise and technology in areas of urban planning	The CityLinks Pilot Partnership between the U.S. and ASEAN Member States is an 18-month technical exchange program focusing on strengthening urban climate resilience and adaptation in selected cities in ASEAN Member States.	Adaptation
2013	Workshop	Share experiences, expertise and technology in areas of urban planning	The Climate Leadership Academy (CLA) on Urban Climate Adaptation for Cities in Southeast Asia: 'From Risk Barriers to Results— Managing the Social, Political, Environmental, and Financial Risk of Urban Infrastructure' was held on 13–15 August 2013 in Jakarta as the first activity of the CityLinks Pilot Partnership project between the U.S. and AMS.	Adaptation
2013	Meeting	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	Second meeting of the ASEAN Ad-Hoc Steering Committee on Climate Change and Food Security.	Food
2014	Statement	Promote common understanding/common position on relevant MEAs	ASEAN Joint Statement on Climate Change was delivered at the 20th Session of the Conference of the Parties to the UNFCCC and the 10th Session of Conference of Parties serving as the Meeting of Parties to the Kyoto Protocol (COP20/CMP10)	
2014	Meeting	Support global and regional initiatives to reduce emissions from deforestation and to promote afforestation and deforestation under the CDM	Third meeting of the ASEAN Ad-Hoc Steering Committee on Climate Change and Food Security.	Food

Note : AADCP II = ASEAN-Australia Development Cooperation Phase II, ACB = ASEAN Centre for Biodiversity, ACCI = ASEAN Climate Change Initiative, AFCC = ASEAN Multi-Sectoral Framework on Climate Change, AFCC-FS = ASEAN Multi-Sectoral Framework on Climate Change and Food Security, AMAF = ASEAN Ministerial Meeting on Agriculture and Forestry , AMME = ASEAN Ministerial Meeting on Environment, ARKN-FCC = ASEAN Regional Knowledge Network on Forests and Climate Change , ASEAN = Association of Southeast Asian Nations, ASFCC = ASEAN-Swiss Partnership on Social Forestry and Climate Change, ASFN = ASEAN Social Forestry Network, ASOF = ASEAN Senior Officials on Forestry, ASPA-WRM = ASEAN Strategic Plan of Action on Water Resources Management, AWGCME = ASEAN Working Group on Coastal and Marine Environment, CDM = United Nations Clean Development Mechanism, CLA

= Climate Leadership Academy, GAP-CC = ASEAN-German Programme on Response to Climate Change: Agriculture, Forestry and Related Sectors, MARKET = Maximizing Agricultural Revenue Through Knowledge, Enterprise Development and Trade Project, MEA = Multilateral Environmental Agreements, MRV = Measurable, Reportable, Verifiable, REDD+ = Reducing Emissions from Deforestation and Forest Degradation Plus, REL = Reference Emissions Levels, UNFCC = United Nations Framework Convention on Climate Change , UNFCC COP-17 = United Nations Framework Convention on Climate Change, 17th session of the Conference of Parties.

Source: Authors.

Annex 3.

Questionnaire for Members of Concerned ASCC Bodies

Climate Change and Food Security

- 1) Does your country currently have dedicated **policies** which help to address climate change impacts on agriculture and food production?

Yes/No

- 2) If 'Yes' in Q1 (if 'No' please proceed to Q3) ,

- a) Please list these policies. [Also please indicate the scale of implementation, i.e. pilot, sub-national, nation-wide]

- b) How/What aspect of climate change impact is factored into these policies (please tick accordingly)

- (i) Carbon emissions (ii) Increasing intensity of natural disasters
(iii) Increasing frequency of natural disasters (iv) Drought (v) Flooding
(vi) Salinity (vii) Pests and disease outbreaks
(viii) Supply chain disruption (ix) Temperature increase
(x) Change in precipitation (xi) Others [please specify]:

- c) To whom are these policies targeted towards (social groups, communities, etc.)?
Who are likely to benefit the most from these policies?

d) Are there any gaps which you feel have not been addressed yet or should be looked into?

e) Are there any particular groups or communities who you feel are vulnerable to climate change impacts but have yet to be considered in adaptation policies? Please list the identified groups/communities and the potential risks.

3)

If 'No' to Q1

a) Is your country currently drafting or planning on having such policies in the near future?

Yes / No

b) If 'Yes' to the above question, please list these policies below

c) What are the areas with regards to climate change impacts you think your country should be focusing on when formulating new policies?

(i) Carbon emissions (ii) Increasing **intensity** of natural disasters

- (iii) Increasing **frequency** of natural disasters
- (iv) Drought
- (v) Flooding
- (vi) Salinity / rising sea levels
- (vii) Pests and disease outbreaks
- (viii) Supply chain disruption
- (ix) Temperature increase
- (x) Change in precipitation
- (xi) Others [please specify]:

d) Who are the most vulnerable groups and communities that are likely to suffer from greater food insecurity with the onset of climate change?

4) Are there any examples of climate change **adaptation strategies** which impact food and agriculture sector currently being implemented in your country? [e.g. SMART practice, etc.]

5) Does your country have any measures towards reducing GHG emissions or carbon footprint from its food and agriculture sector?

a) If Yes, please specify,

b) If No, do you have any ideas of suggestions on what your country could potentially (and feasibly) do.

6) Do you think there is a need to include food security within the **ASCC Framework**?
Yes/No

7) If Yes in Q6,

a) In what way should food security be included within the ASCC framework?

b) What are some potential implementation mechanisms to achieve this?

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