# Chapter 2

# Evaluating the Distributional Impacts of Disasters and Climate Change, and the Development of Adaption Roadmaps: Rethinking ASEAN Strategy, Policies, and Actions

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CHAPTER 2

# Evaluating the Distributional Impacts of Disasters and Climate Change, and the Development of Adaptation Roadmaps

## RETHINKING ASEAN STRATEGY, POLICIES, AND ACTIONS

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## ABSTRACT

Climate change is a significant threat the impacts of which are already upon us. All Association of Southeast Asian Nations (ASEAN) member states have ratified the 1994 United Nations Framework Convention on Climate Change (UNFCCC). Since then, a number of national climate-related policies have emerged in Southeast Asia. The region, however, lacks an overarching, coherent, and concrete adaptation framework for climate change adaptation. This is problematic because the ASEAN region faces its own set of climate impacts and vulnerabilities that, in turn, can worsen the distributional impacts of climate change. Distributional impacts refer to the uneven manner in which populations or groups are affected by issues, with some groups being more vulnerable than others. Such impacts can be seen in the food sector, notably food security and supply, access to food (physical and economic), and nutritional outcomes in the region. A lack of downscaled assessments of climate impacts, insufficient customised initiatives to respond to region-specific challenges, and a lack of inter-sector collaboration in mitigating the impact of climate change on certain populations further pose a hindrance to effective climate solutions. Considering the similar climate-related challenges that ASEAN Member States are facing, the regional grouping holds enormous potential for actionable cooperation that may benefit the region and increase its capacity to adapt to climate change. The study thus recommends the region to establish an ASEAN Climate Change Adaptation Centre; to develop downscaled impact assessments of climate change on food security that feed into assessments of vulnerabilities and prioritisation of initiatives, following a research road map for the region; and to complement government approaches to resilient policies with private sector participation.

## 2.1 Introduction

Climate change is a significant threat the impacts of which are already upon us. As many scientists have pointed out, climate change acts as a threat multiplier, generating climate-induced threats to health and the availability of resources like water and energy that amplify the scale of human insecurities and vulnerabilities in various aspects of daily life. These implications also apply to food security. Given the serious concerns brought about by the changing climate, policies addressing climate change no longer consider mitigation alone but are increasingly focusing on adaptation. While there has been much debate on mitigation and disaster risk reduction (DRR) at the global level, particularly for regions vulnerable to climate change, adaptation has become a more important consideration.

All Association of Southeast Asian Nations (ASEAN) member states have ratified the 1994 United Nations Framework Convention on Climate Change (UNFCCC).[1] Since then, a number of national climate-related policies have emerged in Southeast Asia. Despite the UNFCCC's relatively early ratification, the topic of climate change adaptation (CCA) only entered national climate change policies much later, since climate change mitigation received more attention in the earlier stages. The initial emphasis on mitigation is not surprising considering that greenhouse gas emissions are seen as a major culprit of the changing climate. Thus, it was inevitable that bringing such emissions down would be the top priority in the global climate agenda.

Due to developments that increasingly attribute disaster events to climate change, focusing on mitigation efforts alone has proved insufficient. CCA first began to enter mainstream climate change deliberation more prominently in the 2007 Bali Action Plan. Together with the formulation of the 2005–2015 Hyogo Framework for Action and the 2014 Fifth Assessment Report of the International Panel for Climate Change (IPCC) on Climate Change Impacts, Adaptation and Vulnerability, CCA has begun to make inroads into national climate change policies.

As an effective CCA strategy is critical to help states and communities deal with climate change and food security in particular, this chapter examines the nature of CCA policies in the region, at both the national and regional levels. The chapter argues that,

[1] Dates of ratification: Brunei Darussalam (2007), Cambodia (1996), Indonesia (1994), the Lao People's Democratic Republic (Lao PDR) (1995), Malaysia (1994), Myanmar (1994), the Philippines (1994), Singapore (1997), Thailand (1994), and Viet Nam (1994) (UNFCCC).

while ASEAN Member States and ASEAN as a region have positive report cards on climate adaptation policies (as evidenced by the presence of climate change policies at the national and regional levels), there remains a need for more coherent and comprehensive regional CCA strategies. This is especially important when it comes to addressing food security, as this problem is essentially a cross-cutting issue and requires an ecosystem approach to address its attendant threats. The chapter argues further that more responsive policies on food security will be achieved when these are informed by an overarching regional policy and/or action plan on CCA.

## 2.2 Overview of National Climate Change Adaptation Initiatives in Southeast Asia

In Southeast Asia, the initial formulation of climate change policies differed between those countries that fall into the category of least developed countries (LDCs), and the rest. Three countries in the LDC category – Cambodia, the Lao People's Democratic Republic (Lao PDR), and Myanmar – received assistance in developing their national adaptation policies, as stipulated in an outcome of the seventh session of the Conference of the Parties of the UNFCCC that established a special programme for LDCs in 2001. Cambodia and the Lao PDR were the first countries to draft national climate adaptation policies known as National Adaptation Programmes of Action to Climate Change (NAPAs), with Cambodia drafting its NAPA in 2006, and the Lao PDR in 2009. Myanmar launched its NAPA in 2012.

Cambodia's NAPA identified droughts and floods as the main hazards, and formulated adaptive efforts for agriculture and fisheries in particular (Ministry of Environment of the Royal Government of Cambodia, 2006). Subsequently, Cambodia established a National Change Committee, which developed the National Climate Change Strategic Plan (2014–2023) (National Climate Change Committee of the Royal Government of Cambodia, 2013), National Policy on Green Growth Development, and National Strategic Plan on Green Growth Development (2013–2030) (National Council on Green Growth of the Royal Government of Cambodia, 2013). In addition to formulating adaptation plans in the food, water, and energy sectors, Cambodia took a more comprehensive approach by incorporating gender and health, critical ecosystems, biodiversity, protected areas, and cultural heritage sites in its adaptation agenda (National Climate Change Committee of the Royal Government of Cambodia, 2013).

The Lao PDR's NAPA highlighted agriculture, forestry, water, and public health as priority areas. Floods were identified as the top hazard, and the Lao PDR's NAPA aimed to strengthen institutional and human resources capacities on water and water resource management in particular (Lao PDR, 2009). In 2010, a year after launching its NAPA, the Lao PDR came up with its Strategy on Climate Change, which laid down more practical measures in each identified sector (Lao PDR, 2010). For example, in the agriculture sector, the strategy envisioned the development of climate- and disease-resilient crop varieties and the rehabilitation of the flood control system. On forestry and land use change, the planting of different forestry species was planned. As the Lao PDR is highly dependent on water resources for generating electricity, the country is also aiming to construct climate-proof dams and infrastructure.

Myanmar's NAPA identified eight affected sectors and categorised them into four priority areas (Republic of the Union of Myanmar, 2012). Agriculture, early warning systems, and forestry are given first priority; public health and water resources are given second priority; the coastal zone is given third priority; and biodiversity, energy, and industry are given fourth. Myanmar projects that it will suffer from increased temperatures and changes in rain intensity, leading to increased risk of floods and extreme weather events including cyclones or strong winds, floods and storm surges, intense rains, extreme high temperatures, and drought. After launching its NAPA, Myanmar drafted the 2016–2030 Climate Change Strategy and Action Plan, which details adaptation plans for the following six key sectors: (i) agriculture, fisheries, and livestock; (ii) the environment and natural resources; (iii) energy, transport, and industry; (iv) cities, towns, and human settlements; (v) health and wellbeing; and (vi) education, science, and technology (Ministry of Natural Resources and Environmental Conservation of the Republic of the Union of Myanmar, 2016).

The non-LDC Southeast Asian countries (i.e. Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam) employed their own mechanisms in formulating their national climate change-related policies. In general, they referred directly to relevant international agreements, including the 1994 UNFCCC and the 2007 Fourth Assessment Report of the IPCC, as guidelines. Thus far amongst these countries, dedicated CCA policies are only found in Indonesia and Thailand. Other countries have incorporated CCA in either their sectoral plans or their broader climate change strategies. The absence of a dedicated policy for CCA may imply that CCA is currently given low priority, although interviews with relevant officials may be needed to assess the rationale behind this absence further.

**Table 2.1:** Assessment of Climate-Induced Risks in Seven Areas in Indonesia

| Risks | Sumatra | Java-Bali | Kalimantan | Sulawesi | Nusa Tenggara | Maluku | Papua |
|---|---|---|---|---|---|---|---|
| Decrease in water availability | M, H, VH | H, VH | L, M | H, VH | H, VH | L, M | L |
| Flood | H, VH | H, VH | L, M, H | L, M, H | L | L | L, M |
| Drought | H, VH | H, VH | L | L, M | L, M, VH | L | L |
| Coastal inundation | M, H | M, H, VH | M, H, VH | M, H | M, H | M, H | M, H |
| The spread of dengue fever | L, M, H | L, M, H | L, M | L, M | L, M | L, M | L, M, H |
| The spread of Malaria | L, M | L, M, H | L, M | L, M, H | L, M, H, VH | M, H | M, H, VH |
| The spread of Diarrhea | L, M, H | L, M, H | L, M, H | L, M, H | L, M, H | L, M, H | L, M, H, VH |
| Decrease in rice production | H, VH | H, VH | – | – | H, VH | – | – |
| Forest fires | M, H, VH | M, H | – | – | – | – | – |

Note: L: Low; M: Moderate; H: High; VH: Very High.

Source: Republic of Indonesia (2013), *National Action Plan for Climate Change Adaptation (RAN-API) Synthesis Report*. Jakarta: Republic of Indonesia. p. 8. https://gc21.giz.de/ibt/var/app/wp342deP/1443/wp-content/uploads/filebase/programme-info/RAN-API_Synthesis_Report_2013.pdf (accessed 16 March 2018).

Brunei Darussalam established its National Council on Climate Change in 2011 (Knowledge Center on Climate Change, 2011). Although Brunei Darussalam does not have a dedicated policy on CCA, it has already incorporated climate change considerations in its energy, land transport, and building sectors.[2] In its intended nationally determined contribution (INDC) to the UNFCCC in 2015, Brunei Darussalam identified other sectors – including biodiversity, coastal and flood protection, health, agriculture, and fisheries – for future adaptation plans (Ministry of Development of Brunei Darussalam, 2015).

Indonesia launched its National Climate Adaptation Plan in 2013. This plan identified the risk levels of climate-induced disasters, particularly those affecting water, health, agricultural production (especially rice), and forestry in seven areas in Indonesia (see Table 2.1) (Republic of Indonesia, 2013). To boost climate resilience, Indonesia has clustered its adaptation efforts into the following five areas: economic resilience, including food and

[2] See, for example, the 2014 Land Transport White Paper, the 2014 Energy White Paper, and the 2017 Building Guidelines and Requirements.

energy security; livelihood resilience, including health, settlement, and infrastructure; ecosystem resilience; special areas resilience, including urban, coastal, and small island areas; and supporting systems (Republic of Indonesia, 2013).

Malaysia developed its National Policy on Climate Change in 2009, but has yet to create dedicated climate adaptation and mitigation plans. The national policy attempted to address climate change comprehensively by looking into multiple sectors, including agriculture and food security; natural resources and environment (water, biodiversity, forestry, minerals, soil, coastal, marine, and air); energy; industry; public health; tourism; transportation; infrastructure; land use and land use change; human settlements and livelihood; waste management; and DRR (Ministry of Natural Resources and Environment Malaysia, 2009). Despite the broad mandate called for by the 2009 National Policy on Climate Change, the national development policy known as the Eleventh Malaysia Plan (2016–2020) only focused on certain sectors (i.e. water resources, agriculture, and infrastructure) since flooding was identified as the top climate-induced hazard (Economic Planning Unit of Malaysia, 2015).

In the Philippines, climate change measures were given legal status through the enactment of the Climate Change Act of 2009 (Republic of the Philippines, 2009). Subsequently, the Climate Change Commission under the Office of the President formulated the National Framework Strategy on Climate Change 2010–2022, which was expanded in the National Climate Change Action Plan (NCCAP) 2011–2028 (Climate Change Commission of the Republic of the Philippines, 2012). The NCCAP prioritised food, water, the ecosystem, the environment, human security, industries and services, energy, and capacity development in its efforts to combat climate change. The National Framework Strategy on Climate Change 2010–2022 identified CCA as one of its objectives and identified river basins, coastal and marine areas, biodiversity, water, agriculture, health, and infrastructure as priority sectors (Climate Change Commission of the Office of the President of the Philippines, 2013).

Singapore's efforts to address climate change are reflected in its 2008 and 2012 Climate Change Strategies and 2016 Climate Action Plan. Flooding, coastal land loss, water resource scarcity, heat stress, increasing energy demand, climate-induced diseases, and impacts on island and marine diversity were identified as the main threats (Singapore National Climate Change Strategy, 2008). Singapore's CCA efforts have generally focused on infrastructural solutions such as improving drainage systems, erecting hard walls or stone embankments along sections of its coastline, and increasing the minimum level of reclamations

(National Climate Change Secretariat of the Republic of Singapore, 2012). In terms of health impacts, Singapore has looked into the possibility of using Aedes mosquitoes to control its mosquito population in a bid to anticipate the increasing prevalence of dengue brought about by the changing climate.

Thailand's climate change policy processes began with its National Strategy on Climate Change, 2008–2012 (Kraisoraphong, 2010), which was followed by the Climate Change Master Plan, 2012–2050. A dedicated policy on CCA was formulated later, as reflected in the National Adaptation Plan 2015–2023. This plan identified the following priority concerns: floods, drought, and water management; agriculture and food security; tourism; public health; natural resources; and human settlement and security (Sakhakara, 2016).

Viet Nam has no dedicated policy on CCA although a number of climate change-related policies incorporate adaptation.[3] The threat of sea-level rise, which increases the risks of flooding and salinity intrusion, seems to be at the top of the agenda, with agriculture as the most vulnerable sector. Consequently, adaptation efforts focus on coastal zones, water resources, and the agricultural sector.

In summary, most ASEAN Member States already have national climate change policies in place, although they have only commenced development in the last decade. Cambodia, Indonesia, the Lao PDR, Myanmar, and Thailand have dedicated CCA policies, whereas Malaysia, the Philippines, Singapore, and Viet Nam incorporate CCA in their larger climate change policies. Brunei Darussalam addresses climate change concerns in its sectoral policies. The country adopted a holistic perspective that considers multiple sectors, although the risk of flooding remains the main common threat and its implications for agriculture and food security are the main common concern.

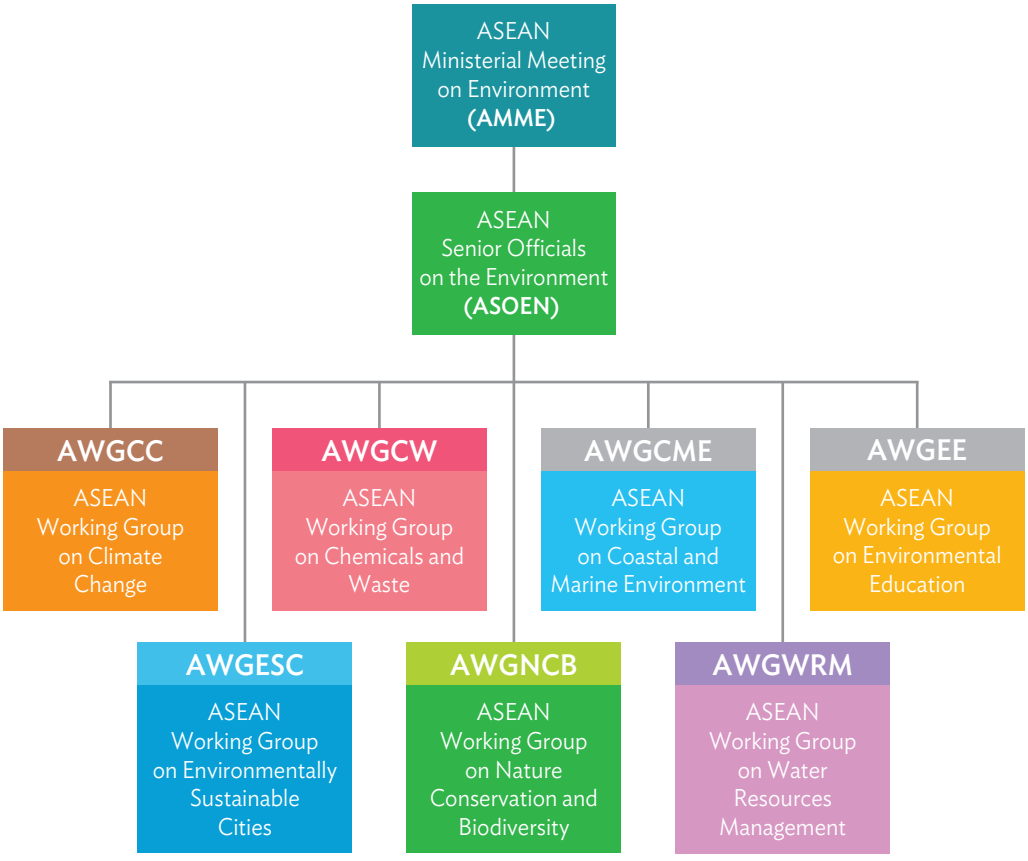
[3] These include the Central Party Committee's Resolution 24/NQ/TW (2013) on Responding to Climate Change (Central Executive Committee, Vietnam Communist Party, 2013), National Climate Change Strategy 2011 (The Prime Minister of Vietnam, 2011), National Action Plan on Climate Change 2012–2020 (The Prime Minister of Vietnam, 2012b), National Green Growth Strategy 2012 (The Prime Minister of Vietnam, 2012a), and National Action Plan on Green Growth 2014 (The Prime Minister of Vietnam, 2014).

### 2.2.1 | Regional Climate Change Initiatives

Parallel to national initiatives, ASEAN Member States have collectively expressed their commitments to addressing climate change at the regional level through the following declarations: the ASEAN Declaration on Environmental Sustainability (13th ASEAN Summit in 2007); ASEAN Declaration on Conference of the Parties-13 to the UNFCCC and Conference of Parties serving as the Meeting of Parties-3 to the Kyoto Protocol (13th ASEAN Summit in 2007); Singapore Declaration on Climate Change, Energy and the Environment (3rd East Asia Summit in 2007); Joint Ministerial Statement of the First East Asia Summit Energy Ministers Meeting (2007); Ministerial Statement of the Inaugural East Asia Summit Environment Ministers Meeting (2008); ASEAN Joint Statement on Climate Change to Conference of the Parties-15 to the UNFCCC and Conference of Parties serving as the Meeting of Parties-5 to the Kyoto Protocol (15th ASEAN Summit in 2009); Singapore Resolution on Environmental Sustainability and Climate Change (11th ASEAN Ministerial Meeting on the Environment [AMME] in 2009); ASEAN Action Plan on Joint Response to Climate Change (12th AMME in 2012); Declaration on Institutionalising the Resilience of ASEAN and its Communities and Peoples to Disasters and Climate Change (26th ASEAN Summit in 2015); and Declaration on ASEAN Post-2015 Environmental Sustainability and Climate Change Agenda (27th ASEAN Summit in 2015) (ASEAN Cooperation on Environment, 2018).

Institutionally, the ASEAN climate change cooperation brings together environment ministers and senior officials on the environment (see Figure 2.1) for regular meetings to discuss the implementation of environment-related strategies and plans. The AMME meets biennially, whereas the ASEAN Officials on the Environment (ASOEN) meet annually. The ASOEN are assisted by seven subsidiary bodies: the ASEAN Working Group on Climate Change (AWGCC), the ASEAN Working Group on Environmentally Sustainable Cities, the ASEAN Working Group in Chemicals and Waste, the ASEAN Working Group on Nature Conservation and Biodiversity, the ASEAN Working Group on Coastal and Marine Environment, the ASEAN Working Group on Water Resources Management, and the ASEAN Working Group on Environmental Education. The ASEAN Secretariat's Environment Division under the ASEAN Socio-Cultural Community (ASCC) pillar handles the workings of the cooperation and reports to the ASOEN.

**Figure 2.1: Institutional Framework of the Association of Southeast Asian Nations Cooperation on Environment**




ASEAN = Association of Southeast Asian Nations.

Source: ASEAN (2017), ASEAN Cooperation on Environment – At a Glance. http://asean.org/storage/2018/02/50.-December-2017-ASEAN-Cooperation-on-Environment-At-A-Glance.pdf (accessed 16 March 2018).

Climate change was one of the 11 priority actions on which the Environment Division was working, based on the environment-sustainability agenda of the 2009–2015 ASCC Blueprint (ASEAN, 2009). This agenda, which identified the need for climate mitigation and adaptation measures, listed 11 priority actions, including the development of the ASEAN Climate Change Initiative, and information exchange on research and development, technology, and best practices. However, the identified priority actions appear to serve more as guidelines than as operational imperatives. This is despite acknowledgment that cooperation needs to be enhanced to address climate change impacts in different sectors,

such as the environment, agriculture and forestry, disaster management, science and technology, health, human development, the economy, energy and transportation, and political and human security. With the AWGCC at the helm, the ASEAN Climate Change Initiative was envisioned as the primary platform to collaborate on formulating climate change policy and strategy, sharing information, building capacity, and transferring technology. The AWGCC holds an annual meeting, the latest one being held in Jakarta in 2019.

Although the AWGCC has been carrying out its role as an information-sharing and confidence-building forum, it is unclear whether it has produced regional CCA plans and guidelines that may lead to collaborative efforts amongst ASEAN Member States. Indeed, aside from several donor-funded, ad hoc projects that engaged ASEAN Member States, there are limited tangible examples of cooperation on the environment amongst the ASEAN Member States themselves.[4]

Following the ASCC Blueprint 2009–2015, CCA featured more prominently in the subsequent ASCC Blueprint 2025, which laid down the vision of an ASCC that 'engages and benefits people, and is inclusive, sustainable, resilient, and dynamic' (ASEAN, 2016b). The ASCC Blueprint 2025 was accompanied by the ASEAN Strategic Plan on Environment, which listed climate change as one of its seven strategic priorities. Under the envisioned characteristic *resilient*, this plan listed DRR and CCA as two of its envisioned key results. Although these issues are receiving increasingly more attention, the strategic measures formulated to attain this vision are still seen as guidelines that individual member states should target. A framework for workable regional cooperation initiatives for CCA and DRR is still missing.

In addition to dedicated environment-related processes, the broader concepts of DRR and CCA are also found in other sectors. The AADMER Work Programme (2016–2020), for example, explicitly incorporates DRR and CCA in one of its priority programmes. This priority programme is designed somewhat like a roadmap as it details the components, outputs, key activities, implementing agency, and timeframe to support the achievement of 'a disaster resilient and adaptive ASEAN community' (ASEAN 2016a).

[4] See, for example, the 2002 ASEAN Agreement on Transboundary Haze Pollution and the ASEAN Centre for Biodiversity established in 2005.

As previously observed in the ASCC Blueprint, the proposed activities in the relevant AADMER Work Programme generally aim to build national capacity for climate resilience. In the few instances where regional mechanisms are mentioned, their purpose seems restricted to sharing information and building confidence. Although the AADMER Work Programme calls for DRR and CCA, in practice, the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre), which is the main operational regional body working on disaster-related matters, has yet to work on this preventive aspect fully, as it is still very much focused on disaster response (Faisal, 2017–2018).

Other sectors also incorporate climate change considerations (Letchumanan, 2010). In the energy sector, ASEAN has collectively set targets for energy intensity reduction and renewable energy share. In the transportation sector, ASEAN has, with donor support, embarked on a number of initiatives such as the ASEAN-Japan Action Plan on Environmental Improvement in Transport Sector, Energy Efficiency and Climate Change Mitigation for the Land Transport Sector, and the ASEAN Air Transport Integration Project. In the agriculture and forestry sector, the 'ASEAN Multi-Sectoral Framework on Climate Change and Food Security' was endorsed in 2009 to promote coordination and cooperation on adaptation and mitigation measures.

At this juncture, the extent of climate change-related policies and mechanisms in ASEAN Member States and in ASEAN as a regional institution is clear. Some countries have even established specialised climate change bodies. However, it is important to note that individual ASEAN countries were able to proceed to introducing national climate change policies without referencing regional climate change policy, as this suggests that their approach to addressing climate change is dispersed and not integrated. Despite a lack of a comprehensive regional policy, individual countries' adaptation policies had already integrated strategies in various sectors, including agriculture and food production. The convergence of concerns in agriculture and food security necessitates an examination of the distributional impacts of climate change on food security and an investigation of potential gaps in current approaches to CCA. Such assessments are particularly important considering that the region is highly integrated and interconnected, with, for example, some countries being food exporters and others being food importers. It is also important to note that food security functions within an ecosystem rather than in isolation. Thus, food security challenges cannot be dealt with separately from responses to and/or strategies for CCA. The symbiotic relationship between climate change and food security is discussed further below.

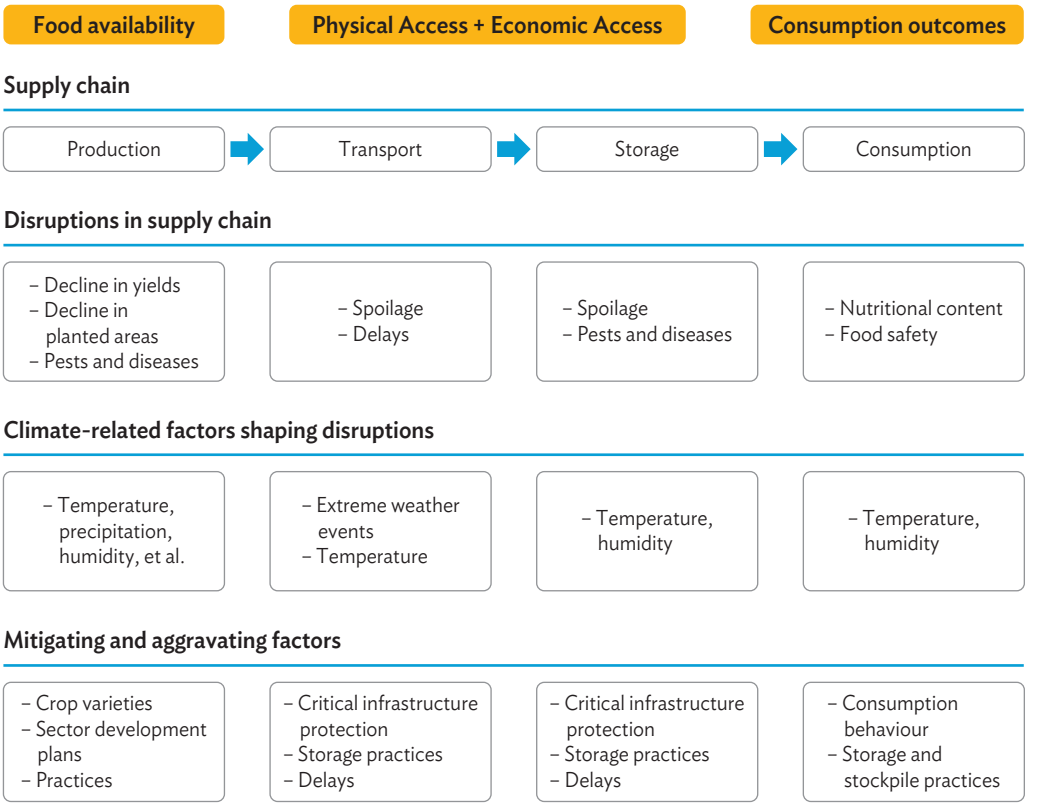
## 2.3 Distributional Effects: How Climate Change and Disasters Affect Food Security

Distributional effects refer to the uneven manner in which populations or groups are affected by issues, with some groups being more vulnerable than others. Regarding the interlinked issue of climate change impacting food security, assessing distributional effects is complex. To appreciate this, it is first necessary to recognise the multifaceted nature of food security. The United Nations Food and Agriculture Organization (FAO) defines food security as '(having) at all times ...physical, social and economic access to sufficient, safe and nutritious food which meets...dietary needs and food preferences for an active and healthy life' (FAO, 2002). This means that a population is not considered food secure if it consistently falls short in any of these aspects, that is to say, (i) if it is consistently unable to meet its consumption needs through both production and imports (food availability); (ii) if it is vulnerable to disruptions that prevent physical access to food (physical access); (iii) if food is so expensive that it is unaffordable for some segments (economic access); or (iv) if consumption habits as well as a high incidence of food-borne diseases lead to poor health and nutritional outcomes (food utilisation/consumption outcomes). The phrase 'at all times' in the FAO definition implies that stability is also an important component, and applies to the four aspects outlined above.

Following this definition, the distributional impacts of climate change on food security are captured in Figure 2.2, which shows that analysis of these impacts is multi-layered. First, it is necessary to look at the affected point in the supply chain, whether it is food production, transport, storage, or consumption. Disruptions along the supply chain can take different forms, such as a decline in yields and planted areas, incidence of pests and diseases that affect food production; spoilage and delays that affect transport; spoilage, pests, and diseases that affect storage; and nutritional content and food safety, affecting utilisation or consumption outcomes. Climate change can increase the likelihood of these disruptions, due to changes in temperature, humidity, or precipitation, or to extreme weather events. Finally, human intervention may either mitigate or aggravate the impacts of these climate-induced disruptions on populations.

The impacts of climate change on the supply chain are discussed further below.

**Figure 2.2:** How Climate Change and Disasters Affect Food Security




Source: Authors.

## 2.3.1 | Impacts on Food Production and Supply

The first impact of climate change is on production and food supply and availability. Extreme weather events (e.g. droughts and floods) may destroy entire batches of crops prior to harvest. For example, the region suffered significant losses in 2015 alone when droughts impacted 492,000 hectares (ha) of cropland, and floods 81,000 ha (ASEAN Plus Three Food Security Information System, 2016). Longer term changes in environmental conditions (e.g. temperature, precipitation, and humidity) make environments less conducive for agricultural production. For instance, fish catch in Southeast Asia has been projected to fall by as much as 40%–60% of fish-catch potential due to climate-induced fish migration, while dry-season rice yields in the Philippines could fall by 10% due to a 1% increase in nighttime temperatures during the dry season (Portner et al., 2014; Peng et al., 2004).

A number of human-induced factors can also mitigate or aggravate the impacts of climate change on food production and supply. Choice of crop varieties is important, as yield reductions can be worsened if the types of crops utilised by farmers are more vulnerable to temperature changes, extreme temperatures, droughts, and submergence. Norms of fertiliser use are important too, as these influence soil quality, while overuse may lead to excessive amounts of nitrogen in the soil, and the growth of invasive weeds and grass that steal needed water and nutrients (e.g. nitrogen and phosphorous) from the planted crops (Settele et al., 2014). On the other hand, having too little of these nutrients may prevent plants from properly absorbing the nutrients and photosynthesis from happening efficiently (Brevik, 2013). Pests and diseases should also be factored in, as changes in temperatures and humidity may make certain areas more conducive to pest growth and the spread of diseases. Alternative scenarios can be configured, taking into account the effects of fertilisation, where increasing the amount of carbon in the soil can actually boost plant growth (Nakagawa et al., 1993). Finally, competing demand for scarce resources is another factor that could mitigate or aggravate the impacts of climate change on production. Given land scarcity, competing uses of land could lead to agricultural land being appropriated for urban or industrial uses. Similarly, there are competing demands for water from the manufacturing, electricity, and domestic water use sectors (Organisation for Economic Co-operation and Development, 2012).

### 2.3.2 | Impacts on Access to Food (Physical and Economic)

Next, we consider the impacts of climate change and disasters on physical access to food. Extreme weather events may delay the transport of food products, while long-term changes in temperature and humidity may cause food to spoil in transit unless proper transport and storage practices are in place. In combination, long-term climate impacts and extreme weather events may increase losses in food production, transport, and storage. This impacts economic access to food because disruptions in food production, transport, and/or storage cause food prices to increase, making food less affordable.

In addition, a number of human-induced factors can mitigate or aggravate the impacts of climate change on transport and storage. Critical infrastructure protection implies safeguarding vulnerable points in food transport and storage (Department of Homeland Security, 2007). Transport and storage practices also require cooling or heating mechanisms to maintain the appropriate temperatures to avoid spoilage, sterilise food, or extend the shelf-life of the food product (Miks-Krajnik et al., 2015).

### 2.3.3 | Impacts on Consumption and Nutritional Outcomes

The factors discussed above can reduce food consumption significantly, resulting in detrimental health and nutrition outcomes especially for the poor. For example, increased food prices during the 2007–2008 food price crisis, together with the price inflation that occurred from June to December 2010, caused an increase in the number of people suffering from hunger (Ivanic, Martin, and Zaman, 2011).

The impacts on consumers can vary depending on the presence of human-induced factors that can mitigate or aggravate the impacts of climate change on food utilisation and consumption. One of these factors is the total food reserves available, considering in particular the stockpile policies adopted by countries or areas within those countries. For example, India's food policy regime enables the country to mandate higher crop production targets and to store the resulting yield in preparation for emergencies (Chand, 2005). Another important factor is population income levels relative to food prices, and the corresponding food subsidies provided by governments. This is because during disruptions, when food becomes scarcer, prices may increase until food becomes unaffordable for many poorer people. Consumer practices, such as certain forms of subsistence farming and food storage in preparation for contingencies, are also important. This final factor may be influenced by the rapid rate of urbanisation, as well as the prevailing view that food production is for rural, not urban areas.

Based on this analysis, the distributional impacts of food depend on the balance between the presence of climate-related factors that can lead to disruptions, on the one hand, and the effectiveness of food- and agriculture-related adaptation mechanisms that can mitigate the impacts of climate on food security across the supply chain on the other. For instance, the urban poor may be worst hit when domestic and international food prices increase. A potential mitigating measure is to allocate space and provide opportunities for subsistence farming to create alternative food sources; however, this measure may not be viable in some cities where the opportunity cost of land is high. Similarly, farmers in drought-affected areas may suffer crop losses and loss of income as a result, thereby reducing their economic access to food. Implementing drought-resistant crop varieties and irrigation facilities in these areas could make farmers more resilient to droughts. Potential challenges to these measures include limited access to drought-resistant varieties, or under-investment in needed irrigation infrastructure; in the presence of one or both these factors, the population will suffer more from droughts. Individuals in other sectors (e.g. processing, exporting and importing, and retail) may be directly affected by extreme weather events, and may also be indirectly affected by climate

impacts on production unless appropriate measures are taken. Net food-importing countries (especially of staple products) are likewise vulnerable to climate impacts on production, as well as on transport and storage.

As these examples show, in light of the potential for changes in climate-related factors, it is necessary to qualify vulnerability and resilience, as well as levels of community preparedness and their ability to implement appropriate measures to reduce the impact of climate change on food security.

## 2.4 Gaps at the Regional and Country Levels in Addressing the Distributional Impacts of Climate Change on Food Security

Thus far, we have described the multifaceted nature of food security, as well as the different factors that come into play in assessing climate change's impact on food security. Our earlier discussion of the state of CCA at the regional and country levels is particularly useful in assessing how this influences the distributional impacts of climate change on food security. This will feed into the recommendations moving forward.

### 2.4.1 | Lack of National Initiatives that Encompass All Sectors Within Countries

It has been observed that CCA activities are not addressed at the national level in most ASEAN countries, but instead are only given focus in selected sectors. This introduces the challenge of a lack of inter-sector collaboration in mitigating the impact of climate change on certain populations. In particular, it is necessary to give more thought to food transport and storage.

While some regions have highlighted agricultural production as a point of focus and intervention, our analysis shows that distributional impacts go beyond food production. For example, even when sufficient food is produced or ordered for import, food shipments can get stuck at chokepoints while being transported within or amongst countries. Yet, ASEAN strategies for mitigating climate impacts on food security do not include the protection of critical infrastructure, which is useful in safeguarding these chokepoints or providing alternative routes. To address this, it is necessary to secure the cooperation of food traders, as well as those in the shipping, air-freight, and other transport industries.

Similarly, food storage requires technologies that can better protect stored food from microbes that cause spoilage. Research is needed to identify ways of preventing food contamination by these microbes, thereby extending the shelf-life of products. This will also require collaboration with other sectors, such as the health sector, and the chemical and microbiological industries.

### 2.4.2 | Lack of Downscaled Assessments of Climate Impacts

In addition to considering the different impacts of food security beyond production, countries should consider the distributional impacts across subnational areas. It was earlier observed that present-day initiatives in ASEAN are primarily information-sharing and confidence-building platforms, rather than platforms for concrete action. It was also highlighted that countries are more operationally aligned with the global climate change agenda rather than the regional agenda, through country-level commitments (i.e. the NAPAs of most ASEAN countries).

The problem with aligning only with global-level climate change initiatives is that this makes it difficult to customise initiatives to different countries' circumstances. Studies conducted by the IPCC (in either the Fourth or Fifth Assessment Report) mostly take place at the regional or country level. However, even within countries, the impacts of climate change are not geographically uniform, as some areas are more likely to suffer severe yield reductions than others. For instance, in Thailand, the world's second largest rice exporter, yields are predicted to improve in some areas and decline in others. Moreover, the size of land plots allocated for growing crops differs across areas, such that even if yield reductions are only moderate, the impact on overall production could still be large if the planted area is large.

Since global initiatives do not go deeper than region- and country-level climate assessments, ASEAN Member States will need to fill this gap and generate their own subnational assessments, referred to as downscaled assessments of climate impacts. These should include factors such as temperature, precipitation, and humidity, as well as the biological impacts of these factors on plant growth and development, and how they feed into crop losses. Without such assessments, ASEAN countries will lack foresight on the specific impacts of climate change within countries.

In the absence of an ASEAN initiative focusing on downscaled assessments, such assessments are currently rather sparse and ad hoc in nature, and rarely treated as a national initiative. In fact, only Singapore has developed an encompassing study on downscaled climate change projections, and these have not yet been translated into the impacts on food production in the city-state (National Environment Agency, 2018). This may be due to high computing costs for conducting these assessments; for example, when Singapore was building its downscaled model, it was deemed financially unfeasible to look at all 40 available climate models (although this was also deemed undesirable as not all models were meaningful when downscaled) (Marzin et al., 2014).

Based on country commitments to the UNFCCC, in which areas requiring support were identified, it was also found that ASEAN countries (especially Myanmar, the Philippines, Thailand, and Viet Nam) need support in developing downscaled assessments of this nature (Marzin et al., 2014). Even worse, the need for downscaled studies in other countries has not been recognised. This raises the question of whether other countries recognise the need to go beyond the IPCC study assessments and develop downscaled assessments.

Beyond downscaled assessments of climate impacts on agriculture production, there are even fewer coordinated studies that trace impacts on food security outcomes of affected communities, taking into account farmer practices and government support policies.

This has several implications for the region's resilience to climate change impacts, including low or slow take-up of climate-adaptive technologies, and limited availability of financing and insurance options for farmers. Governments remain hesitant to take up certain relevant technologies, such as climate-smart crops. A lack of downscaled assessments hinders an appreciation of the urgency of implementing these technologies. Instead, governments may hold on to dogmatic interpretations of international biosafety provisions, resulting in delays in the approval of new crop varieties that could help them more effectively manage larger uncertainties in relation to climate impacts on agricultural production (Kent, 2004).

In the absence of downscaled assessments, governments and the private sector have insufficient basis for developing their own financing and insurance support policies for farmers. This is because such policies require information on the type of risk that farmers face. In the absence of this information, the government or the private sector may suffer financial losses, making financing and insurance a highly uncertain and potentially unviable enterprise. Yet, farmers are in dire need of this support. Whenever farmers suffer crop losses, the impact can be severe in the absence of crop insurance policies provided by firms.

Similarly, the lack of financing support, given the uncertainty of farmers' ability to pay back loans, means that farmers are unable to invest in new technologies that can boost yields, worsening the distributional impacts of climate change on farmers in both the short and long term.

### 2.4.3 | Initiatives Are Not Sufficiently Customised to Region-Specific Challenges

It was observed above that the region lacks an overarching, coherent, and concrete adaptation framework for CCA. This is problematic because the ASEAN region faces its own set of climate impacts and vulnerabilities that, in turn, can worsen the distributional impacts of climate change.

First, some countries in the region face disproportionate exposure to disasters. For instance, in 2015, three of the top 10 countries in terms of number of disasters reported per country were ASEAN members (Indonesia, Myanmar, and the Philippines), with the most frequent type of disaster faced that year being floods (Htet, 2015). From a distributional perspective, people in these countries will require additional support in such areas as infrastructure, and the use of flood-resilient crop varieties.

Next, the interconnected nature of food security, given trade in agricultural products within the region, makes the region less resilient to crises. For instance, as the Philippines is a net importer of rice, it could disrupt regional trade networks by importing a large quantity of rice. This is reminiscent of the chain of events that led to the food price crisis in 2007–2008, when the Philippines panic-purchased from Viet Nam, contributing to the rapid inflation of food prices.

Furthermore, policies may not be aligned with a unique trait of the region, such as the persistence of smallholder farmers while the rest of the world is seeing the advent of larger farms. The mean size of Southeast Asian farms in the 1990s was 1.8 ha, compared to 4.9 ha in West Asia and North Africa, and 178.4 ha in the United States; in fact, a downward trend was found in mean farm size in countries like China, Indonesia, the Republic of Korea, the Philippines, and Thailand (Rigg, Salamanca, Thompson, 2016). Due to the small size of their farms, ASEAN farmers may be unable to invest in better crop varieties, inputs, and farming practices.

Thus, it is clear that the region has specific requirements that can be attended to more directly at the regional level.

### 2.4.4 | Gaps in the Association of Southeast Asian Nations Economic Community and the Region's Socio-Cultural Community 2025 Blueprints

Another earlier observation was that CCA activities are not addressed at the national level in most ASEAN countries, but instead are only focused on in selected sectors. This introduces the challenge of a lack of inter-sector collaboration in mitigating the impact of climate change on certain populations. This is reflected in the fact that the ASEAN Economic Community (AEC) and ASCC blueprints address aspects of this challenge separately. While both blueprints saw significant improvement in linking their agendas to climate change adaptation and food security, there is still room for improvement (Caballero-Anthony et al., 2015).

The Strategic Plan of Action on Food Security in the ASEAN region which falls under the AEC's ambit, aims to ensure long-term food security while focusing primarily on production (including production inputs and reducing post-harvest losses), trade, and food reserves. The strategic plan has been critiqued as not focusing explicitly on CCA, although the updated 2016–2025 AEC Blueprint now states that one of its objectives is to, '[increase] resilience to climate change[,] natural disasters and other shocks' (item 57.iv., C.5, Food, Agriculture and Forestry [FAF]). This line was written in the context of 'promot[ing] deeper integration of the FAF sector in the region and the world' (item 57, C.5, FAF). As such, the blueprint is overly focused on production, and does not yet capture impacts on poorer populations, despite its use of the term 'inclusive' in the vision for the FAF sector.

Moreover, the focus on production practices can be improved by a greater focus on climate uncertainties. The AEC can leverage certain opportunities to help adapt food production to climate change more effectively. For instance, under goal B.8, 'Sustainable Economic Development,' the strategic measures indicated 'reduce post-production losses' (item 41.v), which is obviously impacted by climate change; thus, this requires proper linkage with climate impacts.

Another step towards climate resilience is the integration of climate change with food security impacts with other sectors. The integration of information and communication technology (item C.2, AEC 2025 Blueprint) can still be better harnessed in boosting resilience, and small farming enterprises can also be better supported through private sector involvement.

Similarly, the ASCC, with its 'people-centred' focus, includes a social welfare and protection clause, with an explicit food security objective that emphasises food safety and sufficient access to food.

Previously, the linkage between food access and food production, which is a driver of food access, was not obvious. Climate change fell under the clause on 'ensuring environmental sustainability' in general, and mitigating climate impacts on agriculture; yet, related initiatives have largely been carried out through ad hoc projects. This issue was addressed to some extent in the ASCC 2025 Blueprint, under the banner of 'social safety nets,' which mentioned measures 'to ensure food adequacy and accessibility at the household level, especially vulnerable households, and ability to cope with disaster, food price shocks and scarcity by developing adaptive mechanisms and strategies' (item i, D.5, Enhanced and Optimised Financing Systems, Food, Water, Energy Availability, and other Social Safety Nets in Times of Crises by Making Resources More Available, Accessible, Affordable and Sustainable).

Nevertheless, challenges remain. The safety-net approach to addressing food insufficiency (i.e. in times of crises) is still not the optimal approach. This can be complemented by efforts to reduce the likelihood of such a 'food disaster.' Another, more proactive approach is to address this issue early on in the supply chain, at the production stage. While the approach in the ASCC 2025 Blueprint (item D.5) reflects to some extent our suggestion to link food security outcomes to climate, it only does so in times of climate-related disasters, and at the time of the disaster. While this relates to issues at the distribution stage of the supply chain, it could be improved by beginning at the production stage.

As such, there should be a move towards the ideal approach proposed in our second recommendation (see below) to downscale climate impacts on food production in specific areas while integrating human-induced factors as a means of preventing food insufficiency through the production phase. While climate impacts on food security are more salient during disasters, adaptation measures should not focus on these alone, as seen in the present form of the ASCC 2025 Blueprint.

Finally, the approach of addressing climate impacts on agriculture only in terms of water resource management (through irrigation facilities) is deserving of some criticism (Caballero-Anthony et al., 2015). This again raises the urgency of downscaled assessments, as these would allow a more nuanced appreciation of the different types of climate impacts, beyond flooding.

In brief, this assessment finds that the present state of CCA at the regional and country levels, as highlighted in the early sections of this chapter, introduces specific challenges that prevent countries from addressing the distributional impacts of climate change on food security. Thus, these present opportunities to make communities more resilient to climate change impacts through (i) better regional engagement that addresses the unique constraints faced by the region, (ii) better inter-sector collaboration within countries, and (iii) the updating of the ASCC and AEC blueprints in accordance with these insights. These inform the recommendations below.

## 2.5 Conclusion and Way Forward

From the discussions above, it is apparent that ASEAN Member States have taken measures to adapt to climate change. The formulation of their national climate-related policies is generally modelled after international initiatives as opposed to regional processes. A lack of reference to regional measures in national climate policies may be attributed to the current nature of this cooperation, which mainly takes the form of collective statements (i.e. leaders' statements and declarations, information sharing, and confidence-building exercises). The 2017 Fifth ASEAN State of the Environment Report suggested that ASEAN needs to show the 'responses that ASEAN has taken to confront such [environmental] challenges' for it to 'be perceived as truly doing something beneficial to solving the myriad of critical environmental problems facing the region' (ASEAN, 2017b: 236). Indeed, considering the similar climate-related challenges that ASEAN Member States are facing, the regional grouping holds enormous potential for actionable cooperation that may benefit the region and increase its capacity to adapt to climate change.

Based on these developments, we offer the following recommendations.

(i) Establish an ASEAN Climate Change Adaptation Centre.

ASEAN has a reputation as a norm-builder regional entity. However, the experience of establishing and operationalising the AHA Centre proves that ASEAN can move beyond this reputation. As the concerns posed to this region by climate change become increasingly pressing, and given the distributional impacts highlighted earlier, it is time to found a regional ASEAN Climate Change Adaptation Centre that addresses CCA, with comprehensive coverage of distributional impacts on food security.

The proposed centre should be mandated to do the following:

(a) Formulate and implement CCA policies based on an ecosystem approach, especially in areas where ASEAN Member States share land, water, air, and maritime borders. This would complement the current inward-looking approach employed by ASEAN Member States in their policy-making processes. While understanding and finding solutions to climate-related concerns within domestic boundaries is clearly desirable, it is important to remember that nature knows no boundaries. The protection of the marine environment, forests, and rivers along borders, for example, will arguably be more effective through regional ecosystem-based policies and responses. Similarly, given that ASEAN countries are interconnected in the food and agriculture trade, the centre will encourage collaboration in protecting critical transport infrastructure, and other aspects of the food supply chain. These insights should be fed by the centre to ensure that the ASCC and AEC 2016–2025 blueprints sufficiently address climate change and its impacts on food security, as highlighted in the previous section.

(b) Pool regional resources and develop customised technological solutions to increase climate resilience in the region. Technological and infrastructure applications to respond to the changing climate have been called for in numerous forums and international agreements. Since these solutions mostly hail from developed countries, technology transfer is regarded as a way to enable the use of such technologies. While technology transfer generally takes place directly between technology providers and individual countries, regional frameworks and processes can be set up to facilitate the spin-offs of such transfers. Moreover, considering the region's technological know-how and experience in dealing with CCA, collaborations amongst regional experts may lead to innovative technological solutions that suit the region's needs better and may also cost much less.

The establishment of an operational centre entails special, often political processes within ASEAN. Further studies should be conducted to examine the success factors behind the establishment of the AHA Centre, as well as the challenges in setting up the proposed ASEAN Coordinating Centre for Transboundary Haze Pollution Control (this is yet to materialise as of time of writing). ASEAN Member States need to be part of these consultative processes, and the ASEAN Secretariat will likely be required to facilitate the establishment of the proposed ASEAN Climate Change Adaptation Centre.

(ii) Develop downscaled impact assessments of climate change on food security that feed into vulnerability assessments, following a research roadmap for the region.

As shown earlier, the distributional impacts of climate change are multilayered, requiring analysis not only of environmental changes amid climate change, but also of the affected part of the supply chain, and the affected aspect of food security (availability, physical access, economic access, or utilisation and consumption). Moreover, these impacts vary within countries. One initiative that could be taken up by the proposed centre is the conducting of downscaled assessments of climate change impacts.

This can serve as the starting point for a more comprehensive vulnerability assessment of ASEAN countries, which can translate climate impacts into risk assessments on the actual impacts on consumers. This is strategic from the point of view of developing a coherent regional climate change framework along with a concrete, concerted regional push to deal with CCA.

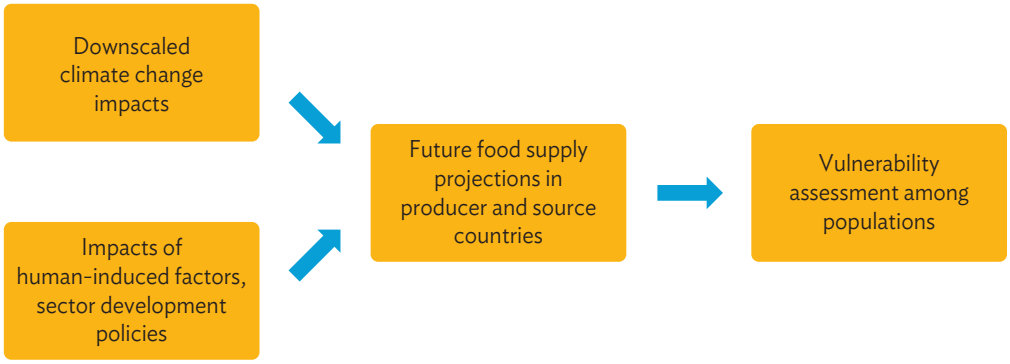
Conducting such assessments allows the region to overcome information barriers that prevent governments from realising the potentially acute impacts of climate change on specific subnational areas. These can in turn allow for greater government support for CCA commitments, and a greater likelihood of them being put into action. As highlighted earlier, recognising these vulnerabilities can help governments appreciate the need for climate-smart crop varieties. It can also enable both the government and the private sector to provide financing and insurance to farmers in a viable manner, since risk plays an important part in pricing and implementing financing and insurance policies, as highlighted earlier.

(a) Develop a research roadmap. An immediate imperative for countries is to draw up a research roadmap to assess what research gaps exist across ASEAN countries that prevent them from initiating and fully utilising the downscaled assessments. Figure 2.3 illustrates the steps required for downscaled assessments to be converted into research outcomes of value to governments, in line with the framework adopted in this chapter that looks at the distributional impacts of climate change on food security.

(b) Develop research capacity in ASEAN governments for downscaled assessments, building on IPCC expertise and financial support from higher income countries that import from the region. The vulnerability assessment described above will require substantial capacity development assistance amongst ASEAN countries. Technical assistance focusing on this should be imperative across all countries.

A potential way forward is to push for the next rounds of IPCC assessment to integrate downscaled assessments. It will also be important to obtain sufficient financial support, especially for higher income countries that depend on regional exporters as food supply sources, given the high computational costs of conducting downscaled assessments.

**Figure 2.3: Research Roadmap for Assessing Climate Impacts on Vulnerability and the Distributional Impacts of Climate-Induced Food Disasters**




Source: Authors.

This initiative can be implemented through collaborative efforts between sectoral ministries and academia. The research roadmap may then be implemented through the proposed centre.

(iii) Complement government approaches to resilient policies with private sector participation.

Finally, approaches to address the distributional impacts of climate change may need to leverage available sources of knowledge and expertise more effectively. Another way forward is to complement present approaches with private sector involvement in order to boost resilience to disruptions in food security arising from climate change. This is because a long period of time may be needed to conduct the encompassing downscaled studies proposed above, while the need for action is clearly urgent.

The 2017 World Agricultural Forum, co-hosted by the S. Rajaratnam School of International Studies, Nanyang Technological University, provided a few examples of how this can be done (S. Rajaratnam School of International Studies, 2017).

(a) The injection of technologies, such as digital crop monitoring, can help farmers know when to plant and when to postpone planting, to avoid losses and sustain yields amid climate change uncertainties. This type of private sector intervention allows farmers to act preemptively, even in the absence of government assessments of climate change impacts. A devolved approach to climate change, which allows for complementation by the private sector, thus seems an ideal approach. Private sector involvement can also strike a balance between climate-adaptive products, on the one hand, and the need to ensure that consumer preferences are also considered, on the other.
(b) Crop insurance is another private sector solution, and is related to the lack of viable insurance coverage for farmers. The private sector should develop new assessment methods with regard to the extent of insurance coverage, and the ability to customise crop insurance policies according to the requirements of the farmer (Khoo, 2017).
(c) Partnerships for improving farming practices is another potential private sector contribution. CCA practices have been promoted by the nonprofit United States Soybean Export Council (Loh, 2017), while partnerships that upgrade processes across the rice production value chain have been promoted by the Better Rice Initiative Asia project of the international organisation Deutsche Gesellschaft für Internationale Zusammenarbeit (Vichitlekarn, 2017).

Thus, the role of sector agencies is to increase public awareness of these initiatives, and to promote greater cooperation between the public and private sectors to increase resilience to climate change.

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