Chapter 1 2
Education, Extension, and Training for Climate Change

Isaac Bekele
The University of the West Indies, Trinidad and Tobago

Wayne Ganpat
The University of the West Indies, Trinidad and Tobago

ABSTRACT

This chapter details the education, extension, and training interventions that are needed in this changing global climate situation, with a focus on Small Island Developing States (SIDS); new content will have to be taught, and innovative education and extension methods will have to be embraced. Actions will be needed at the highest levels of government to build capacity in all sectors and funding will have to match programmes and projects. SIDS are by nature not well-endowed with financial resources, and as such, there will be challenges with the training of teachers and extension staff and the conduct of public education activities. Notwithstanding, creative ways can be developed by governments, community leaders, and all civic-minded persons in SIDS to access such funds and undertake the appropriate actions that are needed to educate and train resource persons in these areas.

INTRODUCTION

While some academics continue to debate whether or not the phenomenon of climate change is valid, it is clear that changes in climate patterns are being experienced globally. The fact that there is consensus among scientists world-wide that our climate is warming, and that the changes evoked over the last 100 years can be at-

DOI: 10.4018/978-1-4666-[65]01-9.ch0[12]

tributed to human activity, is very troubling and demands urgent attention (IPCC, 2007; Doran and Zimmermann, 2009). The effects of climate change vary around the world, and in places where persons are most affected, the phenomenon is now being embraced with concern, and actions are actively pursued to address the challenges presented. The increasing level of concentration of greenhouse gases (GHG) in the atmosphere has been directly linked to the changes being experienced in the world's climate. Although, global warming is a world-wide phenomenon, by its very nature, its expected impact would not be uniform geographically nor will the risk of associated hazards be similar. Global warming impacts several important biological and physical processes at various levels, and world economies face varying degrees of vulnerability to it (Allison et al., 2009). Climatologists have presented a number of scenarios of future climate change patterns, to illustrate the impact that changes in surface temperatures, rainfall patterns, sea level rise, ocean temperatures, ocean pH and ice levels can bring about. In all instances, the effects on the world and its inhabitants are negative, with the increasing frequency of extreme weather events associated with global warming, having the potential to transform lives across the world.

Because climate change effects will not be equally felt around the world, some countries and broad regions of the planet will be more vulnerable than others and are likely to feel the impacts much more. In other words, while countries face various challenges due to climate change, they differ in the degree of vulnerability as well as adaptive capacity and preparedness. According to Kelan et al. (2009), Small Island Developing States (SIDS) are particularly prone to climate change due to their geographic, ecological and socio-economic circumstances as well as resource constraints, and further, because of their limited response capacities, face serious climate change-driven challenges. The area of food production however is at greater risk, so that SIDS must strategize now, rather than later, to ensure their food is secure.

Sea level rise which is predicted to proceed at a rate of 5 mm/year, loss of biodiversity and damages to coral reefs and degradation of coast lines, along with a higher risk of more powerful natural hazards, pose additional challenges for SIDS (Kelan et al., 2009). Consequently, they are likely to face shrinking national economies as main economic activities like tourism, fisheries and agriculture weaken and decline over time. All these potentially serious threats are envisioned in regions where adaptive capacity is generally considered to be low (Kelan et al., 2009). So for SIDS, climate change resilience is highly dependent on building human capacity for mitigation, adaptation, effective mobilization and deployment of the inhabitants. Climate change and its ecological impacts are not going to be short lived phenomena and building capacity of at-risk people to respond to anticipated impacts of climate change through education, extension and training must be of highest priority.

Already in some SIDS in the domain of food production, actions are being taken in many areas such as water management, postharvest, pest and diseases management and other relevant activities to meet food and nutritional security challenges to address the issue of climate change. As such therefore, this chapter will focus on primary education, public education, the provision of food production related extension services to those most vulnerable, and the training required to help communities that depend on food production for their livelihood.

SCOPE OF EDUCATION, EXTENSION, AND TRAINING

According to Herren (2013), "agriculture represents the lowest hanging fruit for climate change mitigation by simply doing what we already know how to do at and at little costs to the transition". A shift in food production to more sustainable forms involving eco-friendly practices is thus required. Further, "the transition would be accompanied by a number of windfalls from a substantial reduction in healthcare costs because of healthier eating and living habits and to a drastic reduction of eco-system service costs and substantial savings for reducing subsidies" (Herren, 2013). It is in this context that the scope of education, extension and training activities are discussed. For purposes of this chapter therefore,

- Education refers to the systematic provision of knowledge and skills to those in the formal school system. This will involve children in pre-schools, young ones in primary and secondary schools, tertiary level institutions, and other formal public education programmes.
- Extension on the other hand, refers to planned educational interventions for those people in the non-formal system and includes farmers, fisher folk, coastal communities and to some extent the general public.
- Training will focus on both formal and informal educational activities to enhance capacities in specialised areas to meet and treat properly with the challenges presented by climate change.

These interventions to build human technical capacity in SIDS are intricately linked, so that there will be some overlap, which in the face of climate change is desirable and could be effectively used to prepare all at-risk peoples and communities, not only for climate change events in general, but also for food security adaptations in particular.

Content: What Will Have to Be Taught?

Climate change will have impacts in many areas and all these will have to be communicated to people if they are to be prepared to meet the challenges positively and with appropriate responses. The question then is, "what are the issues that need to be communicated?" Some of the major issues and associated impacts include:

1. Surface temperatures are expected to increase by > 2 °C: increased frequencies of high temperature and extreme events like heat waves, can have disastrous consequences for food production, particularly in those areas where water for irrigation is a scarce resource.
2. Sea level rise: the consequences of any rise in sea level could be grave for small island states, with sea water intrusion resulting in land becoming unproductive for growing crops and fishing will also be affected.
3. More frequent droughts: the increased incidences of droughts will impact negatively on food production, and in many SIDS, because rain fed agriculture is still the norm, any disruption to the pattern of farming by extended periods without rain will affect a country's food security and demographic stability.
4. More frequent and stronger hurricanes and cyclones: these cause tremendous damage because of the high winds and high intensity rainfall which destroy crops, buildings and animal housing, and can also result in disastrous landslides and flooding. The consequences for food production are severe in countries vulnerable to these events. While some food crops can withstand these events to some extent, the majority cannot, and farmers' losses can be high, especially in the case of long to medium term crops.
5. Proliferation of potentially serious human, crop and livestock diseases: this could result in a decline in food production and higher morbidity, increased human health care costs and mortality.
6. Challenge to water quality and quantity: surface water will be insufficient to meet needs and when coupled with drought and potential salinization of fresh water, will hamper food production efforts.
7. Sea fisheries will be seriously impacted: the population of fish in coastal areas and turtles in special communities will decline.
8. Coastal communities: there will be negative consequences for marine wetlands, community housing, and recreation.

Specific impacts of climate change on food security include:

1. Temperature rise: heat stress results in lower crop productivity, reduced feed intake by animals and frequent and serious disease incidences, lower pasture productivity and lower carrying capacity of grazing land.
2. Extreme climate events, for example floods, droughts, cyclones, hurricanes: these affect crop establishment, lead to reduced crop and livestock production and availability of forages for animals, increased soil erosion on cultivated and other high risk lands, and increased leaching of plant nutrient and fertilizer from agricultural land to ground water. There can also be destruction of farm infrastructure, for example protected agriculture (PA) structures, livestock houses, in addition to loss of animals by drowning.
3. Sea level rise: this has consequences in the salinization of irrigation water in coastal and adjoining low lying areas, coastal flooding, and loss of agricultural land around the coast.
4. Rainfall: high frequency and intensity rainfall will result in flooding and crop damage in productive farm areas, severe erosion on sloping lands, and loss of fertile top soil. Over extended periods inadequate rainfall will affect crop establishment and the ability to maintain livestock.

Table 1 summarises the consequences for one developing nation, Mauritius, and may be extrapolated to other SIDS around the world.

As a consequence of the above, all education, extension and training interventions must involve both mitigation and adaptation strategies.

CLIMATE CHANGE EDUCATION

As previously noted, climate change and its ecological impacts are unlikely be short lived phenomena, and therefore capacity building to respond to its anticipated impacts through education of citizens, in particular of children and young adults is essential. It is generally through education and mobilization of global inhabitants that climate change and its impacts can be tackled with some degree of success. Launching climate change education based on a relevant and appropriate curriculum at every level is an essential prerequisite for SIDS to empower themselves in order to enhance their own capacities to formulate and adopt effective adaptation response strategies and mitigation activities.

Table I. The multiple effects climate change is likely to have on ROM's agriculture sector

Impacts	Consequences
Temperature rise	• **Change in soil moisture status** • **Shift in agricultural zones from lower to higher altitudes** • **Change in cropping pattern and crop cycle** • **Heat stress, which will lead to lower crop productivity, reduced feed intake by livestock, lower livestock productivity, increased mortality in poultry** • **Increased incidence of agricultural pests and diseases** • **Lower pasture productivity and lower carrying capacity of grazing land**
Increasingly variable rainfall	• **Increased risk of flooding and crop damage in certain agricultural zones** • **Severe soil erosion on sloping land. loss of fertile top soil** • **Severe drought affecting crop establishment** • **Loss of crop production and livestock production**
Climate extremes (e.g. drought, tropical cyclones, flash flooding)	• **Change in frequency and intensity of drought leading to severe drought which affects crop establishment; reduced crop/livestock production; shortage of fodder/ low quality feed for livestock** • **Flooding of food crop production areas** • **Increased soil erosion on slopping cultivated land** • **Increased leaching of plant nutrients and fertilizer from agricultural land to groundwater** • **Damage to crops; farming infrastructure; loss of animals**
SLR (sea level rise)	• **Salinization of irrigation water in coastal zones** • **Coastal flooding** • **Loss of agricultural land around the coast**

Source: Adapted from UNDP (2011)

Why Climate Change Education?

Education within the context of today's complex global social, economic, environmental, technical and scientific frame is an essential mechanism for humans to realize their life goals. Even when these are threatened by natural forces, the best way out is to work for the realization of life goals through the acquisition of the key knowledge and skills necessary to combat the possible hazards. Education is also as an effective platform for preparing and mobilizing young men and women to serve as vanguards for effecting transformational and behavioural changes. Climate change and associated environmental, ecological and potential demographic challenges have long-term effects, and therefore require appropriate human responses on a sustained basis in every sphere and over many generations. Via education people can learn about climate change, its causes, possible impacts and mitigation and adaptation measures suitable and appropriate for a particular situation. Education can be used by individuals to:

- Acquire knowledge about global warming, including its causes and effects, both globally and regionally as well as the localized variations of its consequences
- Develop critical thinking and other useful and relevant skills to meet climate change challenges
- Adopt the appropriate attitudes essential for climate change adaptation. For example, it has been reported from studies undertaken in Ethiopia that educating the head of a household enhances the likelihood of the household undertaking climate change adaptive measures in farming (Deressa, et al. 2009)
- Transfer the technology needed to respond to climate change impact, in addition to empowering individuals to become lifelong learners

Education therefore is critical for acquiring climate change knowledge, developing effective strategies for mitigation as well as conceptualisation and implementation of climate change adaptation measures at the local level, as well as bringing about changes in people's attitudes towards global warming and associated natural hazards.

SIDS and Global Warming

SIDS are particularly prone to global warming and its negative effects due to their geographic, social, economic and technological states (Kelan et al., 2009). While all SIDS are generally prone to climate change, some are more vulnerable than others, and are expected to face varying levels of risks of frequent and severe natural hazards. These include sea level rise and its associated ill effects, such as coastal erosion, decline in indigenous biodiversity and possible intrusion by invasive species. In general, SIDS are ill prepared to design and implement strategies for combating climate change and its impacts (Kelan et al., 2009). As previously stated, education will be an essential tool for such countries to build capacities required to respond to climate change.

Facing Climate Challenge

SIDS face potential environmental degradation and ecological disruptions of varying levels based on the geographic and socio-economic conditions, as well as the level of scientific and technical preparedness. This is occurring within a global demographic, technological and political context that is historically unprecedented. The global population has soared to over six billion and is still climbing at an alarming rate, particularly in many parts of the developing world. Worldwide, people live in countries demarcated by political boundaries and defended by each country's armed forces, limiting free movement of people across borders even at times of

demographic stress. Unlike prehistoric human ancestors who could have moved freely as hunter-gatherers without the need for passports or visas, and facing low risk of conflict between various bands, modern-day humans are, geo-politically speaking, "stationary". However, despite political constraints, unlike the era of our prehistoric ancestors, in today's world there are global bodies, multilateral and bilateral arrangements through which interactions among nations are regulated. While such arrangements are playing useful roles in the global warming saga, the aim is more on mitigation and adaptation efforts at national, regional and local levels, which in the context of developing world would require building capacities for mitigation and adaptation through education. This focus on education as an essential tool in any climate change mitigation and adaptation strategy is particularly urgent for SIDS with variable but high index of vulnerability to climate change (Kelan et al. 2009). Technology also has a key role to play in addressing the issue of global warming, particularly in light of the unparalleled advances being made in this area in the history of mankind.

State of Climate Change Education in Certain SIDS

Because formal climate change education is still evolving in SIDS, this provides excellent opportunities to influence the course of its development, especially in light of the fact that there appears to be strong international and sub-regional interest in it. A review of the state of education in various SIDS indicates that there is an active process taking place in an attempt to incorporate climate change education into a broader teaching and learning platform at various levels of the education system. In the Caribbean region, in September 2011, a United Nations, Educational, Scientific and Cultural Organisation (UNESCO) experts meeting on climate change education for sustainable development in SIDS was held in Nassau, Bahamas which brought together participants from both the Caribbean and the Pacific regions and which also included international experts and politicians (UNESCO, 2012). Coming on the heels of this meeting a three-day sub-regional planning workshop on climate change education for the Pacific region was also held in September 2011 in Nadi, Fiji Islands (Sabass, 2011). In the following sections an overview will be provided of the state of formal climate change education in some SIDS.

Caribbean

In the English-speaking Caribbean there is a history of strong and tangible partnerships between countries in the sphere of education. In many countries high school students sit examinations of the Caribbean Examination Council (CXC) and therefore pursue its common curriculum. In addition, the majority of countries have access to

a single University system with three campuses located in Mona, Jamaica; Cave Hill, Barbados and St. Augustine, Trinidad and Tobago, with a fourth campus focusing its service primarily on non-campus countries delivering curricula through mixed modes. The case of Trinidad and Tobago will now be examined in order to provide an overview of the current state of climate change education in the Caribbean.

Climate Change Education in Trinidad and Tobago

Trinidad and Tobago is a twin-island state located in the extreme south of the Caribbean island chain. There, climate change education has already been incorporated into the education system in curricula at the primary, secondary and university levels. Because climate change is a multi-disciplinary subject, when it is taught at primary and secondary schools, the relevant topics of climate change are incorporated with compatible subjects.

For example at the primary level, those subjects containing embedded topics are all compulsory, and as a result all primary students are required to take them, thereby providing them with the opportunity to learn about climate change and its causes and effects. The relevant topics of climate change education are embedded primarily in the Agricultural Science curriculum which has been designed to encompass topics in Agriculture, Technology and the Environment'. This curriculum allows students to be exposed to relevant information on GHG, and the role they play in global warming, and to understand that they are the underlying cause of climate change.

At the secondary level, students prepare for Caribbean Secondary Examination Certificate (CSEC) where topics on climate and climate change are again embedded in a number of subjects. Here too; there is no single subject dedicated to climate and climate change education as found at the primary level. In this instance, and in order to engage the discussion at the secondary level, topics that speak to global warming as a challenge to agriculture are found in the Agricultural Science curriculum. This is however limited in scope.[2] The Geography curriculum includes aspects that cover the definition, cause and consequences of global warming, citing sea level rise as one consequence.[3] Although students may register for these subjects, they are optional and only those registered for certain combinations of subjects which would allow the inclusion of any or both of the subjects have the opportunity to learn about climate change. While possibilities for students to gain knowledge on climate change exist therefore, in reality not all students are able to do so as stated, due to the restrictions in subject selection for the CSEC examination. Topics on climate change also form a component of the CXC's Caribbean Advanced Proficiency Examinations (CAPE) syllabus of Environmental Science.[4] In Unit 2, modules dealing with agriculture and environment incorporate different topics on climate change impacts and causes. Students may also register for the examination in this subject area, but with restrictions.

At the University of the West Indies, St Augustine Campus, global warming and climate change topics are covered in various undergraduate level courses. Once more, due to the multi-disciplinary nature of subjects, topics on climate change education are scattered in various programmes and the University does not have a core foundation course on climate change offered across Faculties, nor are there special programmes on climate change at any level .[5]

Pacific Region

The Pacific Islands are particularly vulnerable to climate change, with some islands facing a higher risk than others. There is evidence that this region is a focus of intensified efforts, both in terms of planning for relevant, effective and sustainable climate change education, as well as adaptation and mitigation programmes. In the report of the September 2011 regional planning workshop on climate change education it is noted that a systematic and effective process is in motion for the introduction of climate change education, into the formal education curricula of each participating country (Sabass, 2011). The workshop brought together representatives of the five pilot Pacific island countries, namely Fiji, Kiribati, Samoa, Tonga and Vanuatu, from Ministries of Education and teacher training institutes, as well as participants from funding agencies and international experts. Its major objective was the planning of climate change education programmes and related activities for the region as well as each participating country. Major outcomes of the planning workshop compiled from the report include (Sabass, 2011):

- Acquiring an understanding of the regional impacts of climate change and regional initiatives on climate change education, and holding discussions on country specific needs for adaptation and mitigation.
- Learning from the experiences of each of the five pilot countries about ongoing works on climate change education and outlining goals to be achieved in this area at the primary, secondary and technical and vocational education and training levels between 2012 and 2015.
- Identifying major activities for implementation by each pilot country in addition to the steps to be undertaken at the regional level to enable the countries to operationalize climate change education.

Apart from setting each country on the right path to planning the introduction of climate change education, the pragmatic and systematic approach pursued in this case which involved five pilot **countries, clearly mapped out** the mechanism for regional collaboration and the processes for each participating country to consider in

the adoption of climate change education at pre-college levels within this regional framework. All this effort is undertaken through donors' support and co-operation, which is particularly critical at this development phase.

Papua New Guinea (Pacific)

In Papua New Guinea, environmental study is part of the primary school syllabi, however, neither global warming, climate change nor GHG are mentioned explicitly in the curriculum document except in the syllabus of geography for upper secondary students, where topics in causes and consequences of global warming are included.[6] At the University level, a syllabus for Environmental Science and Geography includes .an elective course on climate change variability, impacts and adaptation strategies.'

Climate Change Curriculum for SIDS

Consequences of climate change are inevitable and are likely to negatively impact life on the planet. If-people can take steps both as communities as well as individuals, it will be possible to minimise the effects which are likely to accompany climate change. In order to do so however, adequate knowledge in the area, along with key skills and the right attitudes, plus the requisite motivation will be required. The role of education in this process can never be overemphasized in particular among inhabitants residing in the more vulnerable, resource challenged countries to enhance their own ability to combat climate change.[8] The indispensable role of education for combating climate change in SIDS has been recognized and needs to be given the urgent attention it deserves. Designing and launching climate change curricula for the various rungs of the educational ladder in the SIDS is critical for such countries to have enhanced capacities to combat climate change through enquiry, knowledge and technology.

Climate Change Education in Primary and High Schools

In order for climate change education to be effective, the following three components are required:

1. Locally relevant, adaptive, empowering and science-based curricula
2. A sustainable enabling educational environment
3. Community based school activities driven and founded on the principle of equity

Science-Based Curricula for Climate Change Education

Developing an appropriate curriculum is a necessary step for the successful implementation of climate change education. This however involves recognizing the complex and multidisciplinary nature of climate change, its causes, effects and human responses. As a result, curricula at various levels should share the following features:

1. Be designed at least initially to inform students about the climate system and its influence on the environment, in order to provide the foundation for the introduction of a climate change component (Shepardsona et al., 2011). Consequently, climate change education should be grounded in a scientific understanding of the climate system, its behaviour, environmental and ecological systems responses.
2. Incorporate relevant content knowledge and critical thinking skills, as well as clearly articulated learning outcomes. (Anderson, 2010).
3. Be activities-based to help students to understand and explore their own environment and ecosystems and the effect of climate change. Through these activities, they can learn relevant quantitative and field skills.
4. Must combine local and global dimensions of climate change, its mitigation and adaptation (Burleson, 2007).
5. Should take indigenous knowledge, local traditions and opinions into consideration (Roehrig, et al. 2012; Pruneau et al., 2001).
6. Should serve as platform for technology transfer (Henderson et al., 1993).
7. Should serve as a medium for combating misconceptions about climate change and associated issues (Lombardi et al., 2013; Lombardi et al., 2012; Liarakou et al., 2011; Ferrer-Balas et al., 2010; Cordero et al., 2008).

A Sustainable Enabling Educational Environment

Climate change education is evolving in SIDS. As seen above, some SIDS have introduced climate change education in their schools' curricula while others are in the process. These countries however face challenges in successful introduction and sustainability of relevant climate change curricula. The evolving and complex and multi-disciplinary nature of climate change also exacerbates the challenges SIDS face in the adoption of climate change education into the existing educational agenda. Many SIDS face other challenges in areas such as a lack of finances, trained manpower, teaching materials, development capacity and infrastructure. To address these challenges, a sustainable educational environment for climate change education must of necessity include:

1. A special curriculum committee to design, upgrade and monitor the climate change curricula in every Ministry of Education;
2. Retraining of teachers to enable them to deliver the curriculum effectively and assess learning outcomes properly and adequately (Burleson, 2007);
3. Provision of sufficient resources for schools to effectively carry out practical activities associated with climate change curricula;
4. The availability of misconception-free, relevant and affordable textbooks with relevant local content. Such books should be published with clear understanding of the perceptions of the target school population on key climate change issues, as a means of lessening the misconceptions that may be held (Choi et al., 2010). This could also hopefully assist members of their communities confront their own misconceptions
5. The construction of appropriate school buildings which can withstand climate events (with minimal additional cost), which are likely to occur from time to time.

These challenges-are not insurmountable, but with regional co-operation and reliable multilateral assistance, most SIDS should be able to implement and sustain climate change education (Sabass, 2011). There is already external support for some Pacific island states in this regard, as this is critical to kick start the process. In addition, because the Caribbean and Pacific Islands have a history of collaboration in higher education, this could serve as a basis for collaboration in the area of climate change education at every level. SIDS should also create a joint platform to learn from each other and assist one another in combating climate change. In addition, curricula should be based on an Information Technology (IT) platform to ensure that both students and teachers alike have access to ever expanding resources in the world-wide web to support climate change education. Close scrutiny by teachers would nevertheless be required to avoid further misinformation of students, as some sites are likely to contain questionable information (Hamilton, 2010).

Community-Based School Activities Driven and Founded on the Principle of Equity

This comprises two key elements:

- The planning and execution of climate change mitigation and adaptation activities involving the whole community which the school serves, as part of the curriculum, and
- Utilization of curricula as a medium for the school communities to engage in local mitigation and adaptation activities.

Since as has been reiterated, climate change is not a short-term phenomenon, combating global warming and its consequences would have an enhanced chance of success, if all inhabitants, young and old, women and men are mobilized everywhere. Because education provides a means to do this, it would be essential that every school aged child (male or female), be given the opportunity to attend school. Curricula for climate change education in tertiary level institutions should be designed and implemented through existing University systems in the SIDS, based on clearly articulated learning outcomes, relevant and sound content knowledge and critical thinking skills, along with participatory methodologies. The achievement of this would require strengthening the technical skills of staff, upgrading facilities and engaging in real mitigation and adaptation activities. In this sense, universities are therefore in a much better position than primary or secondary schools.

CLIMATE CHANGE EXTENSION

Although extension has several functions, its historical role was to extend knowledge from the centres of learning to communities outside these knowledge centres, and more importantly rural peoples. Despite this, its primary function however, is to empower people, in most cases rural communities through the delivery of technical services, organising or strengthening of rural people into groups like cooperatives, along with the provision of appropriate, tested and verified information. The traditional focus of the extension system was on the transfer of information on production technologies and the achievement of increases in crop and livestock production to meet the needs of growing populations through enhanced productivity. Very little focus was placed on any activities beyond the farm gate, and even less on other issues that impacted food production at a national, regional or global level. Post-harvest or marketing issues are not usually addressed in traditional extension, and even to a lesser extent environmental issues, although these are closely linked to agricultural production. The reality of climate change is evident in areas such as (Christoplos, 2010):

- Dissemination of information about technologies, new research, markets, inputs, financial services as well as climate and weather.
- Training and provision of advice to individual farmers, groups of farmers, farmer organisations, co-operatives and other agribusinesses along the value chain.
- Supporting development of business management skills.
- Facilitating linkages among market actors, including brokering collaboration and promoting learning among them.

- Linking small farmers, rural entrepreneurs and other members of the agricultural community with institutions that offer training and education on climate change.
- Contributing to the development of more appropriate policies and programmes by facilitating feedback from farmers and local entrepreneurs.
- Providing support for government policies and programmes through information, awareness and advice on technology options.

The Organisation of Extension

In most developing countries, while the state-led extension service continues to be dominant, many other extension service providers exist. These may be private providers (mostly input suppliers), other state-assisted bodies and non-governmental organisations. The focus of each organisation may vary and there is the real possibility that the issue of climate change extension may fall through the cracks. In this regard, the government would be responsible for co-ordinating the provision of extension services to ensure that national priorities relating to the education of rural people are given sufficient attention. Traditionally, in SIDS extension organisations are usually geared toward crop production with less emphasis being placed on livestock and even less is put on the fisheries sector. Not many countries have the luxury of specialised extension for fisheries, as such, fisher-folk often get little or no organised education and extension service. Since many coastal communities in SIDS depend on fish for food and cash sales, the emerging impacts of climate change will mean that deliberate action will have to be taken to empower them by sensitising them to all the possible impacts that are likely to occur; making them aware of the need to shift patterns of livelihood sustenance; alerting them of the action areas needed to be taken by them; and by pointing out to them those issues which have to be addressed by the political directorate.

The Role of Extension in a Climate Change Era

Davis (2009) stated that extension can help with mitigation of climate change through: (i) the provision of links to new markets, (ii) provision of information about new regulatory structures, and (iii) facilitating new government priorities and policies. It will have to pay closer attention to more at-risk communities, such as those on hillsides and coastal areas, who will need to be educated on the range of adaptive responses. While some technologies maybe broadly appropriate, some may have to be location specific, as SIDS vary widely in terms of topography and cropping/farming/fishing systems. Since the extent of resources available to these communities may also vary, technologies proposed will have to match existing re-

sources, mainly financial ones. Already, poor farmers are being asked to implement costly soil conservation measures or adopt micro-irrigation systems. Such projects will be challenging for many small-holding farmers and as a result, the extension service will have to be aware of the wide range of options available and advise on the most affordable options. Opportunities therefore exist for participatory research and development activities to determine what works in a given situation. For this to happen however, extension will have to:

- Establish close links with research: in many SIDS, because research facilities are usually located in larger territories, the research findings are sometimes not always appropriate for smaller islands. SIDS are usually resource-strapped and funding for research is usually limited. As a result, research on developing technologies for "the future" may not be priority due to the existence of more urgent short-term problems.
- Learn to work closer with communities: extension will have to radically improve its capacity in the area of people skills and traditional approaches to extension delivery, and move the focus away from efforts that concentrate on the individual, to those that involve working with communities. While working with individuals can have tremendous benefits, in terms of serving as a demonstration for the rest of the community, active engagement of community is an approach needed in extension in the era of climate change. Working with community has always been challenging, especially in the Caribbean. Nonetheless, most technical options will require capacity strengthening and community engagement. Participatory approaches will have to be emphasised to solicit buy-in for adaptive strategies, and will require training and retraining of extension staff to move them away from the technology-transfer top down approaches still practised in many developing countries. It will also require a reorientation of staff from the provision of management advice to supporting farmers with the knowledge and skills needed to enable then to make wise choices in the face of climate uncertainty and variability. High level directives at the policy level will also be required to guide the direction of extension organisations.

It has been shown that when communities are actively involved in a process, solutions can be developed which can be more sustainable than top-down recommendations developed elsewhere. In St. Vincent and the Grenadines, farmers in the Fairtrade banana production system, using a participatory research and development (PR&D) approach, adopted a sustainable weed management protocol to replace the synthetic option of weed control (Ganpat et al. 2009).

Some Challenges

Simpson and Burpee (2014) have noted that to assist rural communities to reduce their vulnerability, increase their resilience and adapt to climate change, extension providers will have to focus there efforts on:

- Assisting rural populations to adapt their livelihoods to current and future changes in local weather conditions and the evolving status of natural resource systems;
- Strengthening the physical and social resilience of natural and human systems to withstand and recover quickly from increasingly frequent and severe weather events (e.g. hurricanes/typhoons, floods, droughts, heat waves); and
- Helping to mitigate the risks of further climate change through the preservation of existing carbon stocks and reduction of CO_2 emissions from agriculture, and helping to sequester CO_2 already released into the atmosphere in trees and organic matter.

All of this will be challenging, as traditional concerns such as poverty reduction, economic growth and food security will still have to be addressed (Simpson and Burpee, 2014).

What Extension Has to Communicate

For Crop Producers

- General education to all farmers and other communities on:
  - Climate change
  - Causes of climate change
  - The consequences of climate change
  - The need to take action
- Promotion of sustainable agriculture, such as those good agricultural practices that have withstood the test of time, especially in the area of soil and soil fertility management. These are especially applicable to farmers on hillsides and include:
  - Contour planting and share cropping
  - Crop rotation
  - Use of terraces
  - Use of cover crops and vegetative barriers
  - Multiple cropping
  - Use of ridges and raised beds on both flat land and contours

- Wise utilization of water
  - Use of micro- irrigation
  - Practise rain water harvesting
  - Cultivation of drought tolerant crops
  - Practice mulching
  - Use of organic manure, compost, green manure
- Alternative agronomic practices
  - Promotion of local cultivars of drought-resistant crops, including provision of information about them
  - Cropping and management systems that are robust to changing climate conditions, such as: agroforestry, intercropping, sequential cropping and low tillage agriculture

Prior to this however, it is essential that a Technology Needs Assessment (TNA) be conducted, based on a process which prioritises climate change resilient technologies that can then be provided to extension to disseminate. A TNA is essential to learn about the practices that exacerbate risks and enhance resilience, as well as the capacity of specific communities to embrace alternative climate change mitigation strategies. A Technology Needs Assessment (TNA) done by scientists in the Republic of Mauritius and presented earlier in this book is cited as an example of the application of this tool.

There are special requirements for various categories of farm circumstances and extension will have to respond to the location-specific problems faced by farmers. Some of the specific decisions related to climate change adaptation may include (Simpson and Burpee, 2014):

- When to switch to varieties and crops with greater tolerance to emergent climate change stressors.
- When to modify or switch land-use systems, for example from annual crops to perennial species with more extensive root systems that access water resources out of reach to annuals and that withstand more intensive rainfall events.
- When to transition from rain-fed production to supplementary irrigation as the frequency and length of dry spells increase.
- When to augment and increase the capacity of drainage systems to handle extreme rainfall events.
- When to shift use of land types, for example, moving away from increasingly vulnerable drought prone lands to better watered lowlands
- When to diversify out of agriculture and ultimately abandon certain activities or areas altogether as they become unsuitable for food production.

These authors noted however that in reality, these choices offer varying degrees of robustness in their ability to meet a range of possible climate futures and there will be limits to adaptation.

For Coastal Agricultural Communities

Farmers and fisher-folk in coastal communities face special challenges. Changes in ocean temperatures, sea level rise, ocean acidification, increased ultraviolet radiation, increased storm frequency and intensity, all of which are likely to produce shifts in marine species ranges, ocean productivity, species composition and population dynamics (Harley et al., 2006; Hoegh-Guldberg and Bruno, 2010). The effects on coastal communities are wide ranging and include impacts to coastal wetlands, coastal forests, beaches, cliffs and shorelines, coastal reefs, coastal pelagic fish species, seabirds, marine animals and sea turtles. Vulnerability assessments have suggested that hotels, ports, human settlements are also at risk.

Communication Approaches to Empower People

The traditional approach usually involves didactic lectures and formal discussions which although useful, may not be effective enough because of the nature of the content to be disseminated. Many rural communities in SIDS do not have access to those modern communication aids which are more suited to the delivery of integrated and stimulating educational programmes that can effectively show, in addition to simply discuss climate change. The "show and tell" method is a well-recognized approach and would be generally more effective, particularly in the rural setting. The impacts of climate change on communities can have a dramatic effect when presented visually to an uninformed or ill-informed audience.

Given the very complex nature of climate change issues, adoption of participatory methods as another tool in extension work can stimulate and deepen the role of the target communities and their members. The participatory approach is an important tool for empowering individuals as well as communities when applied wisely. From our experience, this approach is not yet popular with extension services, but its relevance and usefulness where applicable, can never be overstated. A participatory approach is particularly useful to change attitudes and is very important in cases where there is a lack of information, such as in situations where the possible consequences of climate change on farming or fishing communities are unclear, for example. In such instances, scenarios may be simulated and participants can discuss the implications and some of the actions that they would take, as against the actions they are being told to take. Role playing can also be used to win over those sceptical about climate change and to have them embrace some actions.

The critical incident approach can also be used as an effective teaching method. This is an open-ended simulation technique in which each participant gives his or her own opinion about the likely outcome of a particular scenario. The incident can be based on real incidents for the purpose of maximizing effectiveness, and facilitating exchanges in which proposed solutions can be compared and discussed (FAO, 1984).

The "learning by doing approach" in the form of the farmer field schools (FFS) represents yet another method that can be used to better prepare farmers and fisher-folk to increase their resilience to climate change. The Food and Agriculture Organisation of the United Nations (FAO) has used both the climate field schools (CFS) and FFS to educate persons on the issue of climate change. This approach is based on the premise that collective learning is potentially more effective for outreach than an individual approach. According to Boer et al. (2001) the main purpose of the CFS includes: (i) increasing farmers knowledge on climate and their ability to anticipate extreme climate events affecting their farming activities; (ii) assisting farmers in observing climatic parameters and their use to support their farming activities; and (iii) empowering farmers to correctly interpret (forecast) climate information for supporting farming activities, in particular planting decision and cropping strategy.

In the CFS, farmers acquire the much needed critical thinking skills to be employed in those situations where the exact nature of the impact is uncertain. CFS can be utilized to impart ecosystem knowledge and problem-solving skills, which will enable communities to formulate locally relevant and better strategies to mitigate disasters, such as droughts, hurricanes/cyclones and other climate change induced-effects impacting heavily on livelihood. FAO (2011) reported that CFS based on the FFS model were meant to disseminate knowledge about climate change; its causes, potential impact on livelihoods and local coping strategies. With curricula essentially focused on relevant local topics such as specific climate change-related knowledge and skills, CFSs can assist farmers adapt, develop better climate-resilient integrated farming systems and improve their ability to cope with disasters and other challenges. Via these tools, efforts to build climate change resilient communities can be effected. To achieve this, new and broader range of topics and methods that integrate the agricultural, fisheries and livestock subsectors can be covered.

The FAO (2011) reported on the outcome of a CFS in Indonesia where following the training the participants reportedly were able to:

- Establish networks on climate observations and communication.
- Determine the planting season according to their observations and climate data interpretation.
- Identify saline and drought-tolerant rice varieties.
- Practice better water harvesting and better crop water management to minimize the risk associated with drought.

In the delivery of extension programmes, it is critical that appropriate, cost-effective and reliable technology platforms are available. While radio and television have been widely used as educational tools since the 1950s, modern ICTs have valuable use to raise awareness on climate change. In some SIDS however, their use may be limited due to infrastructural challenges related to electricity supply, connectivity and ICT penetration into rural areas. Although radio and TV are all useful media, ICTs provide more effective, robust and convenient options for education and information dissemination. Educational and training materials can be delivered to individuals or communities with access to the internet at homes and/or community centres. Access to the internet and availability of useful and relevant materials on the world-wide web is a liberating factor for farmers and extension practitioners because it enables them to access information when they have the time to do so.

Where on-line services exist, specialized material can be transferred from centres of learning to extension staff at their work stations via teleconferencing and audio/video conferencing, to facilitate the live (real-time) exchange of voice/video messages over a network. Text and images such as graphs, diagrams or pictures can be exchanged along with voice messages. Moreover, extensive broadband access now allows for educational content to be delivered directly to the learner's home thereby eliminating the need for travel to distant locations.

Changes to Extension Organisations

While pluralism in the provision of extension services is gaining ground in many SIDS, state controlled extension remains the dominant service provider around the world. However, non-governmental extension service providers often respond much faster to the changing local and global realities than their government counterparts. More significantly, climate change extension has already been embraced by some NGOs in an effort to help those most at risk despite the fact that the state extension service has a mandate to respond to meet the needs of its people. Actions are thus required in the areas of environmental and climate change extension programmes which will have to be developed and operationalized.

The need for extension to fulfil an ever expanding mandate would of necessity require the strengthening of the system through capacity building, without which it would be impossible to address the ever complex challenges that the communities face on a timely basis. Building capacity would require the deployment of sufficiently trained extensionists and other support staff in the right number, provision of equipment and machinery required for the job and allocation of sufficient funding. Subject matter specialists in the area of climate change will have to be included in the extension organisation not only to source and test relevant information, but to also train staff and direct climate change extension programmes.

In-service training of extension staff will be needed as the issue of climate change is currently neither at the top of their agenda, nor are they knowledgeable in the area. In a study in Ethiopia, it was noted that information on climate and adaptation measures across different agro-ecologies, as well as the formation of informal social networks was needed by staff to prepare them for climate change (Deressa, 2010). Training would also be needed in the content and methodologies required to effectively equip them to deliver relevant information that will assist the targeted communities in embracing adaptive measures. In-service training is a function of the service provider so that if the capacity to train does not exist in the organisation, help from external organisations may be necessary. For small islands, the state and other competent institutions should take the lead role in the organisation of such training activities, and invite all service providers to participate in order to build national capacity.

Public Awareness and Education

Climate change is likely to impact one way or another on mankind for generations. Because of this, a climate change awareness and education programme for the general public must also be considered. The effort to combat climate change cannot be effective if the general public is kept out of this process. Public mobilization is critical to combat climate change, and public education should contain the content needed to bring about changes in attitudes towards the climate, as well as enhancing the public's will to act for the common good. Public education programmes should include campaigns targeting 'at risk' communities as the primary audiences, to assist them to develop and execute adaptive strategies as part of their own effort to reduce climate change related risks. School buildings can be used for the conduct of public education campaigns, which can be effected using mass media tools including ICTs as well as face-to-face didactic approaches. This should be done at times that are conducive to community members, and when schools are not in session. Public education should aim at informing all about the causes and effects of climate change at the global and local levels, and must include actions to be taken to combat both the effects, as well as the contributing factors. Further, there would also be a need to make the public aware of the challenges posed by climate change food security, infrastructure, housing and buildings, and the contemporary way of life in addition to socio-economic development.

Requirements for Successful Education, Extension, and Training

In SIDS, programmes to educate and enlighten whether through formal process, extension or public awareness approaches require a set of conditions to be met in order to be effective:

- Teachers will have to be retrained. The first level of training would have to be done at the various teachers' training colleges in at-risk regions, which could be followed up by in-service trainings at regular intervals. Curriculum specialists may need external training to get a better understanding of the issues and the teaching and learning outcomes and methods appropriate for climate change education.
- Extension systems in many developing countries and those most affected by climate change still practise the entrenched model based on technology transfer. Extension practitioners whose role it is to disseminate information will require training and retraining to acquire new content and change the various mind sets (Davis, 2009).
- Policy changes are needed from the education, agriculture, environment, and natural resources arms of governments. Climate change must be put at the top of their agendas and pursued aggressively, and they must be encouraged to take decisive and urgent actions to educate and enlighten the target groups.
- Community based organisations (CBOs) as well as non-government organisations (NGOs) must embrace advocacy roles to get these issues on the agendas of the relevant government departments and Ministries. They may also have to lobby parliament to raise these issues at the highest political levels.
- NGOs could produce promotional materials which vividly demonstrate the impacts climate change is having on SIDS and urge action by all peoples, with governments taking the lead roles.
- Adequate funding will only come if governments have climate change high on their agendas. As such, actions by the citizenry will be required to have climate change given the attention it deserves by governments. Perhaps as a group, politicians can be targeted as a special category for climate change education and the appropriate programmes developed to educate them.

CONCLUSION

Unprecedented changes are taking place in our lifetime. The climate is becoming increasingly more turbulent, and is likely to have severe impacts in all areas of endeavour, in particular the area of food production. If the predictions of consequences of climate change become reality, then the very survival of mankind is likely to be threatened, and SIDS, because of their fragile nature, are likely to feel the brunt of climate change impacts.

This chapter detailed the education, extension and training interventions which are needed to prepare inhabitants to face climate change with a focus on SIDS; new content will have to be taught, and innovative education and extension methods will have to be embraced. Actions will be needed at the highest levels of government to build capacity in all sectors, and funding will have to match programmes and projects. SIDS, are by nature not well endowed with natural resources, and as such, there will be challenges with the training of teachers and extension practitioners and the conduct of public education activities. Notwithstanding, creative ways can be developed by governments in SIDS to access such funds and undertake the appropriate actions that are needed to educate and train their populations.

REFERENCES

Allison, E. H., Perry, A. L., Badjeck, M., Adgers, W. N., Brown, K., & Conway, D. et al. (2009). *Vulnerability of national economies to the impacts of climate change on fisheries.* Hoboken, NJ: Blackwell Publishing Ltd.

Anderson, A. (2010). *Combating Climate Change through Quality Education.* Washington, DC: The Brookings Institution.

Boer, R., Kusnomo, T., & Subbiah, A. R. (2001). *Communicating climate forecast to farmers though climate field school: Indonesian experience.* Paper presented at the NOAA Workshop on Adaptation. Available from ipcc-wg2.gov/njlite_download.php?id=5960

Burleson, E. (2007). Multilateral climate change mitigation. *University of San Francisco Law Review. University of San Francisco. School of Law, 41,* 373.

Choi, S., Niyogi, D., Shepardson, D. P., & Charusombat, U. (2010). Do earth and environmental science textbooks promote middle and high school students' conceptual development about climate change?: Textbooks' consideration of students' misconceptions. *Bulletin of the American Meteorological Society, 91(7),* 889-898. doi:10.1175/2009BAMS2625.1

Christoplos, I. (2010). *Mobilizing the potential of rural and agricultural extension.* Available from http://www.fao.org/docrep/012/i1444e/i1444e.pdf

Cordero, E., Todd, A. M., & Abellerra, D. (2008). Climate change education and the ecological footprint. *Bulletin of the American Meteorological Society, 89(6),* 865-872. doi:10.117$^{5}/_{2}$007BAMS2432.1

Davis, K. (2009). Agriculture and climate change: an agenda for negotiation in Copenhagen: The important role of extension systems. *Focus Briefing Paper, 16,* 11. Available from http://www.ifpri.org/publication/important-role-extension-systems

Deressa, T. T. (2010). *Assessment of the vulnerability of Ethiopian agriculture to climate change and farmers' adaptation strategies.* Available from http://repository. up.ac.za/bitstream/handle/226$^{3}/_{2}$8969/thesis.pdf?sequence=

Deressa, T. T., Hassan, R. M., Ringler, C., Alemu, T., & Yusuf, M. (2009). Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change, 19(2),* 248-255. doi:10.1016/j. gloenvcha.2009.01.002

Doran, P. T., & Zimmerman, M. K. (2009). Examining the scientific consensus on climate change. *Eos, Transactions, American Geophysical Union, 90(3),* 22-23. doi:10.1029/2009E0030002

Ferrer-Balas, D., Lozano, R., Huisingh, D., Buckland, H., Ysem, P., & Zilahy, G. (2010). Going beyond the rhetoric: System-wide changes in universities for sustainable societies. *Journal of Cleaner Production, 18(7),* 607-610. doi:10.1016/j. jclepro.2009.12.009

Food and Agriculture Organisation (FAO). (1984). *Agricultural extension: a reference manual.* Rome: FAO.

Food and Agriculture Organization (FAO). (2011). *Lessons from the field: experiences from a FAO climate change project. Report of FAO climate change workshop.* Rome: FAO.

Ganpat, W., Isaac, W., Brathwaite, R. A. I., & Bekele, I. (2009). Farmers' attitude towards a participatory research method used to evaluate weed management strategies in bananas. *Journal of Agricultural Education and Extension, 15(3),* 235-244. doi :10.1080/13892240903069728

Hamilton, L. C. (2010). Education, politics and opinions ^{about} climate change evidence for interaction effects. *Climatic Change, 104(2),* 231-242. doi:10.1007/ s10584-010-9957-8

Harley, C. D. G., Hughes, A. R., & Hultgren, K. M. (2006). The impacts of climate change in coastal marine systems. *Ecology Letters, 9(2),* 228-241. doi:10.1111/j .14610248.2005 .00871.x PMID:16958887

Herren, H. R. (2013). The role of research and technology and extension services. In Trade and environment review 2013: Wake up before it is too late: Make agriculture truly sustainable now for food security in a changing climate, (pp. 176-177). Geneva, Switzerland: UNCTAD.

Hoegh-Guldberg, 0., & Bruno, J. F. (2010): The impact of climate change on the world's marine ecosystems. *Science,* 328(5985), 1523-1528. doi:10.1126/science.1189930 PMID:20558709

Intergovernmental Panel on Climate Change (IPCC). (2007). *IPCC 4th Assessment Report 2007.* Available from www.ipcc.ch

Kelan, I., Mercer, J., & West, J. J. (2009). Combining different knowledge: Community-based climate change adaptation in small island developing states. *Participatory Learning and Action, 60(1),* 41-53.

Liarakou, G., Athanasiadis, I., & Gavrilakis, C. (2011). What Greek secondary school students believe about climate change? *International Journal of Environmental and Science Education, 6(1),* 79-98.

Lombardi, D., & Sinatra, G. M. (2012). College students' perceptions about the plausibility of human-induced climate change. *Research in Science Education,* 42(2), 201-217. doi:10.1007/s11165-010-9196-z

Lombardi, D., Sinatra, G. M., & Nussbaum, E. M. (2013). Plausibility reappraisals and shifts in middle school students' climate change conceptions. *Learning and Instruction, 27,* 50-62. doi:10.1016/j.learninstruc.2013.03.001

Pruneau, D., Liboiron, L., Vrain, E., Gravel, H., Bourque, W., & Langis, J. (2001). People's ideas about climate change: A source of inspiration for the creation of educational Programs. *Canadian Journal of Environmental Education,* 6(1), 121-138.

Roehrig, G., Campbell, K., Dalbotten, D., & Varma, K. (2012). CYCLES: A culturally-relevant approach to climate change education in Native Communities. *Journal of Curriculum and Instruction, 6(1),* 73-89. doi:10.3776/joc i.2012.v6n1p73-89

Sabass, H. (2011). *2011 Workshop report and documentation.* Paper presented at the Regional planning workshop on climate change education: Coping with Climate Change in the Pacific Island Region (CCCPIR). Nadi, Fiji Islands.

Shepardsona, D. P., Niyogib, D., Roychoudhuryc, A., & Hirschd, A. (2011). Conceptuali7ing climate change in the context of a climate system: Implications for climate and environmental education. *Environmental Education Research, 18(3),* 1-30.

Simpson, B. M., & Burpee, C. G. (2014, January). *2014 Modernizing extension and advisory services (MEAS) Discussion Paper 3.* Urbana, IL: MEAS.

United Nations Educational Scientific and Cultural Organization (UNESCO). (2012). *2012 Report and recommendations.* Paper presented at the UNESCO Experts Meeting. Nassau, Commonwealth of the Bahamas

KEY TERMS AND DEFINITIONS

Climate: Weather observations averaged over long periods of time, typically 30-year periods.

Climate Change: Documented changes in the climate that appear to be more than the natural, subtle changes observed previously throughout history.

Curriculum: The planned interaction of pupils in the formal education system with instructional content, materials, resources, and processes for the attainment of stated educational objectives.

Education: Imparting or acquiring general knowledge or systematic instructions especially at a school or university.

Extension: The non- formal system designed to educate people mostly in rural areas as a means of empowerment. While primarily in the field of agriculture, it may be in other areas such as environment, health and now climate change.

Small Island: A land mass, especially one smaller than a continent, entirely surrounded by water.

Small Island Developing States (SIDS): Low-lying coastal countries characterized by similar sustainable development challenges such as limited resources, susceptibility to natural disasters, vulnerability to external shocks and an excessive dependence on international trade.

Training: Teaching a person or animal a particular skill or type of behaviour.

ENDNOTES

Further details on the Agricultural Science curriculum can be obtained from: http://wvvw.moe.gov.tt/curriculum_pdfs/Agri_Science_CurriculumPrim.pdf.

2 Further details can be obtained from: http://www.exc.org/SiteAssets/syllabusses/CSEC/CSEC%20Agricultural%20Science.pdf.

3 Details on the Geography curriculum can be obtained from: http://www.cxc.org/S iteAssets/syllabusses/CSEC/CSEC%20Geography.pdf.

4 For further details see: http://www.cxc.org/SiteAssets/syllabusses/CAPE/CAPE%20Environmental%20Science.pdf.

5 The Faculty of Food and Agriculture booklet, provides further details on the possibilities available. http://sta.uwi.edu/resources/documents/facultybooklets/FoodAgriUndergrad.pdf.

6 Reference can be made to the following websites, which provide information on the primary school syllabi and the geography syllabus respectively: http://www.education.gov.pg/Teachers/pritn/lower/syllabus-lower-primary-environmental-studies.pdf; http://www.education.gov.pg,/Teachers/secondary/u pper/syllabu s-upper-secondary-geography.pdf.
The Environmental Science and Geography syllabus can be obtained from: http://www.upng.ac.pg/courses/1.22352.html.

H See for example Burleson (2007) and Allison et al. (2009) for a more detailed discussion on the role of climate change education in SIDS.