3.5. Vulnerability and Adaptation to Climate Change

3.5.1. Issues and significance

Climate change may lead to more intense typhoons and more frequent extreme weather events such as wave surges, acute heatwaves, floods in some areas, drought and/or shortage of water supplies. This may also trigger the occurrence of more frequent natural disasters, such as landslides, forest fires, disease outbreaks, etc. The models used by the IPCC predict that by the end of this century (2099), the global average sea level may rise between 0.18 and 0.59 m above the 1980–1999 average, thus threatening regions at or below this predicted rise in sea level, especially the Pacific Island Countries and the coastal regions of Asia [IPCCAR4, 2007]. Global warming and related instances of drought are significantly affecting water resources at high altitudes and the survival of wetlands in the region.

Climate change is often viewed as a gradual, progressive, and long-term phenomenon, however, past climate and disaster history will no longer be an adequate benchmark and future changes could be non-linear and abrupt. Changes might be manifested not just in terms of a change in average temperature and precipitation, but also in terms of increasing variability that will lead to increased vulnerability of social-ecosystems in the Asia-Pacific region and compound the difficulties faced by the region to adapt.

Climate change has significantly impacted the Asia-Pacific region, especially Small Island States and Asian developing countries.

It is expected that climate change impacts will further exacerbate current environmental stress factors in developing countries, whose economies are closely tied to climate-sensitive sectors like agriculture, and who are already facing multiple stresses due to population growth, urbanization, industrialization, and globalization.

Developing countries also lack the financial mechanisms and technical resources to effectively defend themselves against natural disasters. Thus, regions and communities that are unable to cope with current climate hazards are also likely to be the most poorly equipped to cope with the adverse impacts of climate change.

3.5.2. Scope of the activities

In order to transfer knowledge to developing countries in the Asia-Pacific region and develop science and technology for vulnerability assessments as well as explore methodologies for adapting to climate variability and change, APN supported nine (9) projects during its first and second phases (1998–2010). Five of the nine (9) projects dealt with vulnerability assessments while the other four (4) focused on adaptation.

For vulnerability assessments, APN supported the following activities:

- Vulnerability assessment of two important coastal wetland sites to climate change and sea level rise.
- Integrated Assessment Model (IAM) Workshop in East Asia to exchange information on recent developments of IAMs in climate change and to explore and apply the methodology and experiences to use IAMs, to strengthen the capacity of the countries involved to develop and apply IAMs and achieve better understanding between researchers and policy-makers.
- Training course partnered with the Pacific Island Climate Change Assistance Programme on vulnerability and adaptation assessments for Pacific Island Countries using a prototype IAM – PACific CLimate Impacts Model (PACCLIM) developed by IGCI.
- Vulnerability assessment of carbon stores to land use and climate change relating to the extent and carbon content of peatlands in Southeast Asia and associated GHG fluxes using the PEAT CO_2 model combining two approaches for a global analysis using existing datasets, new process understanding, land use and climate change scenarios.

» Assessment of "climate risks" associated with changes in surface water quality as a function of changes in hydro-climates and land use, with translation of scientific data into practical information for the development of an integrated system.

For adaptation, APN supported the following activities:

» Initiated research on community relocation as an option for adaptation to the effects of climate change and climate variability in Pacific Island Countries through both literature search for information on the occurrence of environmental extremes and community relocation in Pacific Island communities and participatory community-based fieldwork in the village of Biausevu in southern Viti Levu (the largest island in Fiji).
» Built sub-region and country-specific knowledge base for assessing, facilitating and removing barriers to adaptation and resilience to climate change in the LDCs of South and Southeast Asia, and co-sponsored by UNFCCC and UNITAR, an up-scaled workshop convened under the New Asian African Strategic Partnership (NAASP) framework so that benefits would be increased to a much wider group extending to Africa.
» Identified priorities, requirements and existing gaps in available information among policy-makers and practitioners to enable the integration of climate change action in all policies, driving co-benefits in the long term and to develop web-based learning package (including relevant information like current state of knowledge, latest climate change science findings, disaster trends and unanticipated changes, strategic opportunities, etc.) for pilot testing and refinement.
» Developed capacity of LGUs, communities and regional universities to effectively respond to climate change for sustainable development in five vulnerable municipalities in four provinces in the Philippines, namely Kawit and Rosario, Cavite, Guagua, Pampanga, San Juan, Batangas and Ilagan, Isabela.

3.5.3. Outcomes

Vulnerability

Climate change will have strongest impacts in developing countries whose economies are closely tied to climate-sensitive sectors. The tropics and sub-tropics of the Asia-Pacific region, where rain-fed agriculture dominates, are faced with multi-dimensional challenges as some crops are already near their maximum temperature tolerance and yields are likely to decrease with even small changes in climate. Often the poorest in rural areas occupy the most marginal lands and this forces people to rely on highly vulnerable livelihoods in areas prone to drought, floods and other hazards.

Extreme weather events have already been observed and are making an impact. For example, in the Philippines, (in Kawit and Rosario, Cavite, Guagua, Pampanga, San Juan, Batangas and Ilagan provinces) people are experiencing larger impacts from increased frequency and intensity of typhoons since the 1990s. Rainfall distribution has changed with rain patterns shifting to more concentrated pockets from what used to be evenly spatially distributed patterns. Coastal communities have observed sea levels at high tide going beyond historical levels inundating some areas with longer flooding times. Vulnerability to climate change also differs by sector. ***Figure 20*** shows the levels of vulnerability by sector to different manifestations of climate change in sample communities in the Philippines.

For Small Island States, hydrology and topography are the critical parameters that determine vulnerability to livelihoods and ecosystems due to climate change. Vulnerability assessment through participatory measures have been developed and applied in the Olango Islands in the Philippines. This study can serve as a template for similar studies.

The effects of climate change are also observed in less obvious sectors such as water quality. In many parts of southern China, lower precipitation with large year-to-year variations has been observed in recent years. This appears to have had a substantial influence on year-to-year variations in acidity and

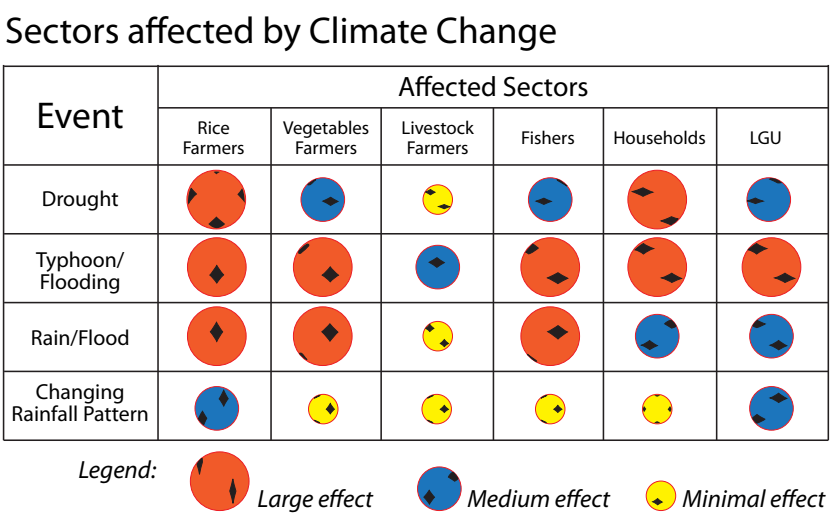

Figure 20: Levels of vulnerability experienced by climate change-related events in sample communities in the Philippines [Source: Peñalba]

nutrient fluxes in forest soils and headwater streams under increasing levels of acid deposition. Intense and extreme rainfall can pose a threat to surface water quality in vulnerable areas such as steep mountainous watersheds, with climate impacts often amplified by land-use change.

Climate change can also be accelerated by positive feedback from ecosystem responses, exacerbated by anthropogenic activities. Current management practices in peatlands combined with climate change and variability are having a major negative impact on peatland carbon pools. Peatlands cover approximately 31 million ha in South East Asia and store an estimated 47 Gt of Carbon. Peatland carbon pools in the region are being severely impacted by drainage (affecting over 6 million ha) and fire (affecting over 3 million ha). Approximately 3 million ha of peatland in the region have been drained for agriculture or logging and then abandoned. These areas are particularly susceptible to peat fires. Drainage may release 100 tonnes h^{-1} of CO_2 per year while a single fire event may release up to 2,400 tonnes h^{-1} of CO_2 . Peatlands in the region are emitting up to 1.5 Gt of CO_2 per year because of anthropogenic activities such as land clearance and conversion, drainage and fire. This represents a major global source of GHG emissions. Slight drainage is able to stop carbon sequestration in apparently healthy forests – turning important carbon sequestering systems into significant carbon emitters.

Adaptation

Adapting to change is not new. Climate extremes, prolonged droughts and seasonal changes have forced communities to adapt to changed conditions. Learning from past experiences is extremely important to prepare and plan for future adaptation needs. A case study of community relocation in the Pacific Islands has demonstrated this approach by establishing generic characteristics of relocation and aspects to be taken into consideration in relocation planning. Categorization based on whether it is a local relocation within land tenure boundaries, local relocation beyond land tenure boundaries, relocation within national boundaries and relocation beyond national boundaries has proved to be useful in such design. The difficulties associated with relocation are also associated with the distance from the origin (***Figure 21***), although the association is not linear as, for example, even where a community may relocate within its own boundaries, its members may have to travel further to get to their gardens and/or water supply, and children may have to walk further to school, etc.

The important steps in relocation are identified as: deciding to relocate, identifying destination, identifying economic costs, identifying other non-economic costs such as social, cultural and spiritual costs, and deciding on the time taken for relocation and the timing of relocation efforts. Such frameworks can be used to identify the resources needed to adapt to future climate change.

Raising awareness among civil society and policy-makers about climate change and its probable impacts is an important step towards developing appropriate adaptation strategies. Information and Communication Technology (ICT) can play a valuable role here through web-based information and tools repositories. Adapting to climate change also requires multi-disciplinary approaches involving a range of stakeholders to identify those issues that need to be addressed in a particular ecosystem or sector. Multi-disciplinary workshops supported by APN have addressed this important need.

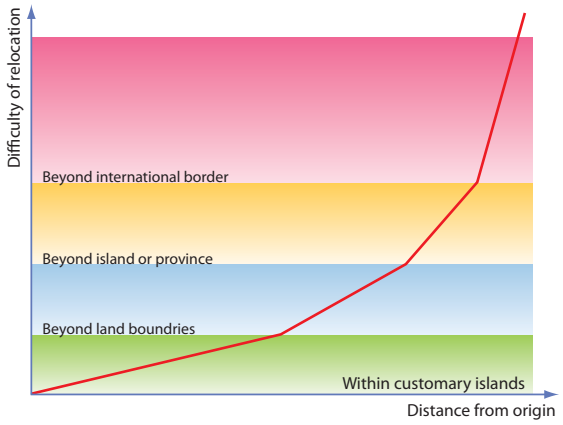

Figure 21: Difficulty of relocation increases when boundary thresholds (land, island, international borders) are exceeded [Source: Campbell]

LGUs are key institutions involved in managing climate risk. Disruptions caused by climate anomalies adversely affect LGUs in terms of revenue loss, increased expenditure for rescue, relief and recovery, and loss of potential investment. A study in the Philippines demonstrated that even without detailed precise vulnerability assessments, participatory approaches to vulnerability assessments through stakeholder meetings can still lead to development of useful indicative climate change adaptation plans by LGUs. However, there is little capacity or preparedness within LGUs for long-term anticipatory planning. Appropriate capacity development programmes should be developed for successful implementation of various national-level decisions taken with regards to climate change adaptation.

Integrated Assessment Models (IAMs)

Adaptation planning needs to be done based on comprehensive assessment of how future climate will alter ecosystems, their services as well as social systems and their interactions. IAMs are used for this purpose and their use has become a key process for policy-making in the recent decade. Developing countries play an increasingly important role in climate change pathways and their understanding and involvement in the use of these models as well as their development is critical. Capacity development workshops have been carried out to introduce different types of IAMs such as:

- Large-scale IAMs that analyze in detail the entire process of social activities and climate change and their impacts on the social economy. These have included models such as AIM, developed in Japan, and IMAGE2, developed in the Netherlands.
- IAMs that focus on the natural phenomena and mechanisms of climate change, its impacts and damage, such as MAGICC, PAGE, etc.
- IAMs that especially analyze the schedule for future countermeasures and the best way for economic development during the process of climate change damage analysis, such as DICE, MERGE, etc.
- IAMs that focus on system development, such as TARGETS, etc.

Feedback from these endeavours have identified the need to extend the simulation from energy and pollutants emission to agriculture, land use, territorial ecosystems, biological diversity, water resources and other fields. PACCLIM is a system that has been developed towards this end and a capacity development workshop for the Pacific Island Countries (PICs) has shown that the model's scenario generators and impact assessment models for different sectors are very well geared towards meeting these needs.

3.5.4. Conclusions

By supporting and encouraging the activities mentioned above, APN has played a leading role in facilitating knowledge transfer to developing countries on vulnerability assessments and adaptation in the Asia-Pacific region. These efforts have even extended to Africa with the collaboration of other related international organizations and institutions.

In the Asia-Pacific region, APN has facilitated the promotion of communication between modelling researchers and policy-makers with the assistance of IAMs. IAMs have supported policy-making through vulnerability assessments for the development of adaptive response strategies to climate change impacts in the Pacific Island region. This was demonstrated in an APN project in the Pacific

Islands where PICs overwhelmingly supported the prototype PACCLIM model and expressed support for its further development to assist in linking science with the policy-making process in PICs.

Adapting to climate change is gaining increasing attention in recent years. At this early phase the major focus is on assessing vulnerabilities and identifying adaptation options for various sectors and/or ecosystems. The complexity of adaptation due to its multidisciplinary nature and challenges in seeking holistic solutions covering multi-sector multi-stakeholder interests make designing optimum adaptation strategies extremely difficult. The difficulties are increased by lack of long-term data pertaining to natural as well as socio-economic parameters. To address these issues it is necessary to develop participatory bottom-up approaches that involve communities and local governments to incorporate climate change adaptation practices into development planning. At the same time, IAMs need to be customized for particular regions and sectors of interest to reduce uncertainties in climate projections and assess impacts at the local level.

The development and application of IAMs in the field of climate change research have great significance in vulnerability assessments in PICs, East Asia and high altitude land in the Asia-Pacific region. The research field and process of integrated assessment are based on modelling, which has turned out to be a key process for policy-making in the recent decade through APN-funded projects and related research.

Finally, developing countries play an important role in climate change research in the Asia-Pacific region. The capacity improvement of developing countries to develop and apply IAMs through expanded international collaboration supported by APN will assist in establishing and implementing global climate change mitigation and adaptation mechanisms.

3.5.5. Recommendations

- Increase emphasis on community-based adaptation approaches, and encourage ground level consultations and multi-stakeholder analyses to disseminate tools and technologies for vulnerability assessments, thus complementing the APN Science and Policy Agendas on global change research.
- Encourage APN member countries to increase the capacity to formulate national strategies on adaptation, to share perspectives on the significance of integrating adaptation strategies with national planning for sustainable development, and establish useful networks to share experiences, and useful contacts with resource personnel for relevant guidance in the future.
- Develop programmes to enhance the capacity of major players in adaptation planning and implementation; local universities and academic institutions, communities and local governments, in an integrated framework to effectively mainstream adaptation into development planning.
- Develop localized climate change impact assessment tools, especially IAMs, as these promise to enhance the capacity to identify policy options and measures for climate change adaptation at local and national levels.
- Increase cooperation between governments, researchers, the private sector and local communities to enhance the management of peatlands to provide sustainable livelihoods and decrease CO_2 emissions from fires and drainage and, as far as possible, protect intact peatlands for their carbon sequestration and storage functions.

3.6. Climate Change Mitigation

3.6.1. Issues and significance

APN has supported five (5) climate change mitigation projects under its scientific capacity development programme, CAPaBLE. These projects can be classified into two major themes:

(1) Appropriate use and adoption (uptake) of environmental technologies for amelioration of emissions from point sources and to enhance the capacity of developing countries in the use of IAMs for climate change mitigation options.
(2) Building inventories for GHG emissions and other aerosols from a range of landscapes and land use activities.

An integrated, non-specific approach to combating climate change is required.

The generation of emission scenarios and the technological approaches used to reduce emissions are largely dependent on a range of country-specific development characteristics, which can differ significantly from one country to the next. In the past, many models used for climate change assessment at the global, regional and national levels did not take into account specific developing country conditions such as differences in socio-economic dynamics and sustainable development issues and priorities. Therefore, there was a need to apply a multi-disciplinary approach to account for a broad range of country-specific dynamics, which could be achieved with IAMs. Similarly, the diffusion of technologies to the developing world is also subject to a range of national factors that may not necessarily be suitable for a particular technology, particularly in light of the cultural and social divide that exists between the developed and developing world.

The development of GHG inventories has also featured as a significant issue over the last decade. Under the UNFCCC, countries must publish a national inventory of their GHG emissions in accordance with IPCC guidelines. These guidelines contain "default" emission factors and activity data to assist countries to construct their inventories. However, there are a range of factors that can affect GHG inventory compilation and the resulting accuracy of emission inventories with respect to both time and space. Therefore, in order to accurately reflect a country's circumstances and conditions, individual countries are encouraged to develop inventories based on their own set of emission factors as opposed to those stipulated in the IPCC guidelines.

3.6.2. Scope of the activities

The development of inventories and effective technology transfer described in the previous section requires the appropriate capabilities and expertise often lacking in many developing countries. APN-supported activities addressed these issues through the delivery of scientific capacity building workshops, training programmes and seminars. These activities have enhanced the scientific capacity in a number of developing countries including India, Thailand, China, Bangladesh, Sri Lanka, Viet Nam and Cambodia.

APN has supported workshops and training on i) GHG inventory compilation ii) sustainable technology transfer for climate change mitigation and iii) measuring GHG emissions from landscapes.

3.6.3. Outcomes

A majority of these activities have essentially focused on i) delivering methods for assessing country specific requirements for determining point sources of GHG emissions from landscapes; ii) the development of emission inventories; and iii) strategies for the effective transfer of environmental technologies for climate change mitigation. One particular project conducted a comparative assessment of sampling

techniques for measuring GHG emissions from rice fields. Another project undertook a detailed assessment and measurement of GHG emissions and aerosols from a range of agricultural landscapes and land use activities across the Mekong River Basin Sub-region. Another outstanding APN project (CSP37) conducted a series of training and workshop activities to enhance the capacity of developing countries in the use of IAMs for climate change mitigation options.

APN has significantly improved the capacity of developing countries to measure and assess their GHG emissions and has assisted in the delivery of strategies to enhance the mitigation effort.

The introduction of IAMs to APN participating countries has led to an improvement in the accuracy of assessing emission pathways and their energy demands. These capacity-building projects have also provided end-users with more informative carbon emission abatement options based on a range of scenarios, which reflect their country's social and economic status. The training outcomes have also demonstrated significant progress with respect to the methodology used to assess the extent of GHG emissions from various land use activities under a range of different field conditions (***Figure 22***).

Figure 22: Know-how transfer on experimental procedures for measurement of GHGs from forest and paddy fields [Source: Towprayoon]

Capacity development

Although accurate and informative GHG inventories are an essential planning tool for policy-makers, APN project leaders identified a number of problems that could be addressed in follow-up activities, particularly with respect to capacity building and the need for appropriate model validation with respect to IAMs. For example, it has been identified that a number of developing countries have not satisfactorily adopted the use of UNFCCC software/manuals/guidebooks to assist their inventory development. A number of APN-funded projects also identified a deficiency in the ability of some project managers to effectively manage staff and projects as well as coordinate a range of technical tasks, suggesting a lack of trained personnel with the necessary management skills required to train and manage others within their institutions. The key to successful human capacity building is the ability of individuals to effectively liaise and develop strong collaborative links with other individuals from institutions working on similar issues. Furthermore, the overwhelming consensus originating from a majority of these APN-funded projects is the need to improve knowledge-sharing capabilities on information such as activity data, emission factors, estimation methodologies, etc.

Science

APN-funded field projects have made an important contribution to our understanding of the relationship between GHG emissions and land-use changes, which has led to a number of peer reviewed papers. Data analysis derived from these APN activities has revealed that a major contributing factor to the overall GHG emissions from developing countries is from biomass burning and biogenic GHG emissions from agriculture. Biogenic and biomass burning in the Mekong River Basin Sub–region constitutes a major source of air pollutants as well as GHG emissions. In Southeast Asia, around 42,000 billion tonnes of carbon is stored in the tropical peatlands but much of this captured carbon store is increasingly being released to the atmosphere through drainage and burning of tropical peatlands associated with logging and palm plantation activities. Current projections point towards a 50% increase in GHG emissions by 2030 if the predicted expansion of palm oil production continues (***Figure 23***). The drainage of peatlands for palm oil production is driven by the increasing global demand for food and biofuels.

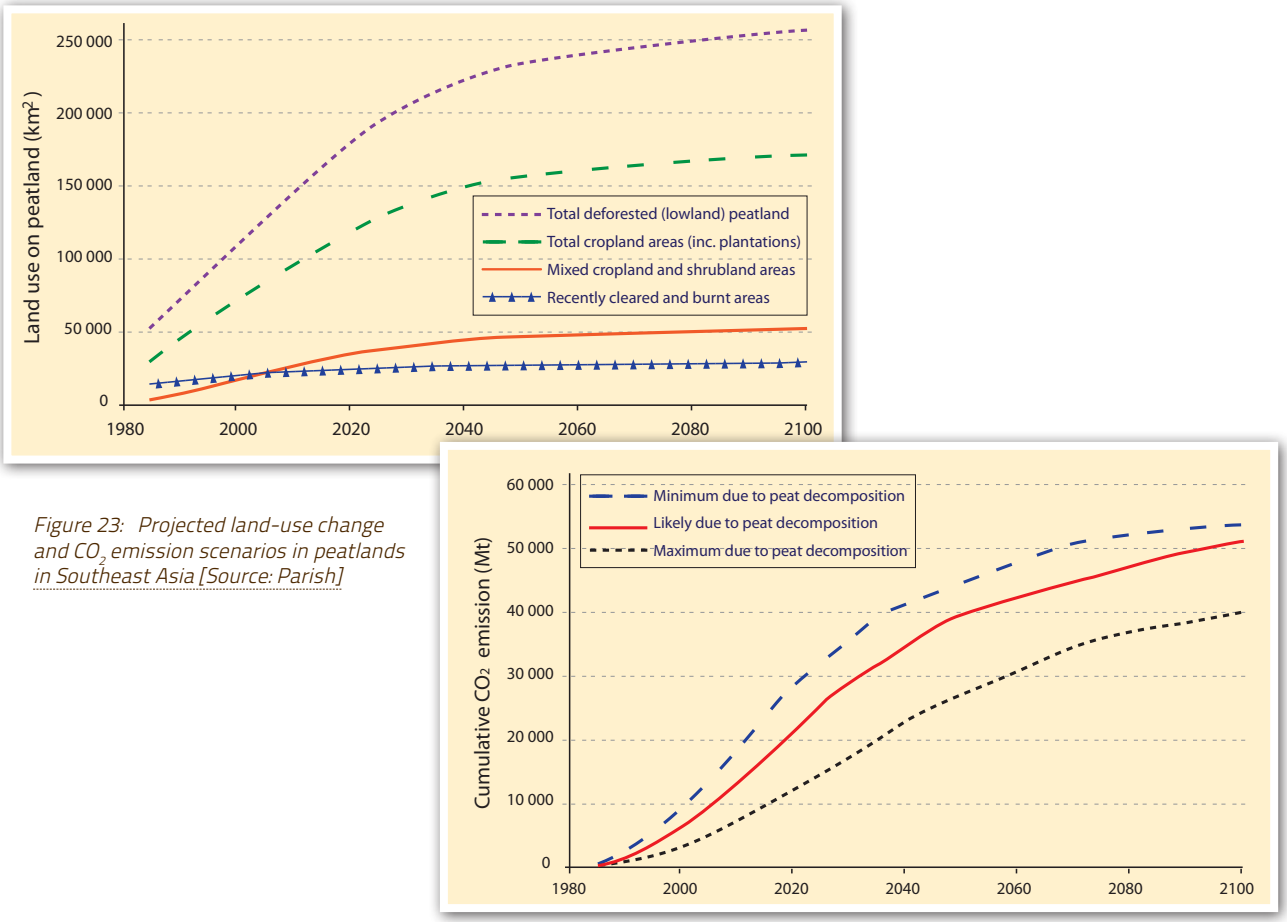

Figure 23: Projected land-use change and CO_2 emission scenarios in peatlands in Southeast Asia [Source: Parish]

Raising awareness of these issues is seen by many researchers as a way of reducing environmental degradation and associated GHG emissions from a range of landscapes. Apart from biomass burning, basic agricultural production is also a contributor to global GHG emissions; for example, rainfed rice cultivation contributes to around 68% in methane emissions.

Given the success of these GHG monitoring programmes, consideration should be given to their expansion to other countries and jurisdictions in the region.

Several peer reviewed papers were published on the effects of land clearing on the production of GHG emissions and on the importance of IAMs in assisting the capacity of developing countries to apply these models for developing climate change mitigation options.

Communication/policy and outreach

In 2004, an APN CAPaBLE-funded training programme, conducted in Japan, China and Nepal, helped raise awareness of the role of locally-owned technologies in contributing to the mitigation effort. A series of workshop lectures emphasized the impediments to effective technology transfer and the benefits associated with locally-owned and manufactured technology using local materials. They also highlighted the importance of encouraging the users of environmental technologies to play a greater role in technology development. These activities also demonstrated the effectiveness of locally-owned technologies for climate change mitigation with particular emphasis on issues relating to the social acceptance of new technologies in the community.

"Train the trainer" models should be supported by educational institutions that have the capacity to provide ongoing support either face-to-face or web-based. There is a need for improved alignment between sustainable development and climate change mitigation efforts.

Finally, the dissemination of information on technology best practices is still an effective mechanism for technology uptake by the developing world. Work has also shown that the uptake of so-called

"intermediate" technologies in association with lowering energy consumption can make a substantial contribution towards reducing GHG emissions. However, it has also been emphasized that in order to achieve greater energy efficiency, a wide-ranging multi-policy approach is required rather than countries adopting a one-size-fits-all policy approach to reducing their increasing reliance on fossil fuels. Most project participants agreed that there was still an ever-increasing need to effectively bridge the gap between policy-makers and scientists.

3.6.4. Conclusions and recommendations

- "Train the trainer" models should be considered in future capacity building activities involving the development of GHG inventories. However, such capacity building activities need to be actively supported by ongoing training programmes. These programmes should operate within the framework of existing tertiary institutions with the capacity to provide ongoing support either via the internet or face-to-face. In addition, training, including the development of country specific training manuals and materials, should be targeted where there is a specific need for further personnel development, rather than on delivering broadly focused training workshops.
- Over the last couple of years, problems associated with the development and use of GHG inventories have emerged. Some inventories still do not reflect country-specific conditions and others require further attention in relation to issues such as inaccessible or inaccurate datasets in some sectors[3]. Although many countries are making progress in the area of GHG inventories, the institutional capacity to undertake this work could be improved. In order to ensure a much smoother transition from a high to a low carbon society, APN project participants identified a need to develop a comprehensive integrated framework or road map that aims to provide better alignment between sustainable development and climate change mitigation efforts. Assistance for the development of a strategic technology database to support IAMs should be considered. Similarly, there is a need to develop stronger coordination and cooperation between institutions throughout the region. The establishment of comprehensive research and development database of research institutions and scholars working in the area of sustainable technology development would help in this process.
- As the population of major cities continues to grow through migration from rural regions, there is an urgent need for more comprehensive and sustainable city planning.
- There should be a strong focus on educating farmers on sustainable farming practices (better water management and fire control strategies in the case of peatlands) that will lead to a reduction in GHG emissions from agricultural land. Emerging carbon markets can also provide opportunities for landowners to divert their attention away from so called "traditional slash and burning practices" to more sustainable land management practices (combined plantings) that offer financial incentives through new economic instruments such as an international carbon pricing scheme.

3 Sectors investigated included energy, industrial processes; agriculture; land use; land-use change and forestry; and waste.

3.7. Coastal Cities and Climate Change

3.7.1. Issues and significance

The frequency of flooding in the coastal areas of Asia has tripled in the last thirty years, with the problems exacerbated by increasing urbanization and population growth. Based on the IPCCAR4, by 2100 sea level rise may be in the order of 0.18 to 0.67 m when polar ice sheet dynamics are included. However, a sea level rise of between 0.5 to 1.4 m above the 1990 level by 2100 cannot be ruled out [Rahmstorf *et al.* 2007].

The vulnerability of coastal cities of Asia to flooding will be exacerbated by sea level rise associated with climate change.

In parallel with increasing sea levels, the coastal zone is expected to become home to 75% of the population of Asia by 2025. Bangkok and Dhaka are already facing severe flooding problems owing to substantial amounts of activity in low-lying urban areas. Indeed, the growing number of mega-cities along the coasts of Asia are increasingly vulnerable to the impacts of severe weather events such as storm surges.

Figure 24: Flooding in Bangkok in October 2006 [Source: www.thaiphotoblogs.com]

3.7.2. Scope of the activities

Recognizing the need for action to assess the socio-economic impacts of flooding on the coastal cities of Asia, the APN has supported a project aimed at gathering and analyzing data for a GIS database of hydrologic characteristics and socio-economic conditions for a number of cities across Asia. The data was used in existing tools for simulating the impacts of and vulnerabilities to flooding under climate change conditions. The activity also aimed at building capacity in flood risk management within a network of researchers, to support policy-making on strategies to mitigate and adapt to flooding, and also to raise public awareness of the issues associated with flooding. The project involved seven (7) countries and there was a focus on the Maghna Delta in Bangladesh, the Mahanadi Delta in India, Karachi in Pakistan, Matara in Sri Lanka, Bangkok in Thailand, and Hue City in Viet Nam (***Figure 25***).

The APN has supported activities aimed at promoting effective interactions between scientists and local decision-makers on strategies for flood risk management.

In addition to the impact assessment project, the APN supported an international workshop in 2009 on "Cities at Risk" focusing on mega-cities in coastal areas of Asia. The activity involved a review of the science of climate change impacts on these coastal cities, and consideration of the vulnerabilities and risk management strategies associated with those impacts. The meeting brought together scientists, urban planners, disaster management experts and development agencies to promote interaction between the range of experts relevant to the issues. Reviews were carried out on activities in Bangladesh, China, India, Indonesia, Pakistan, Philippines Manila, Thailand and Viet Nam.

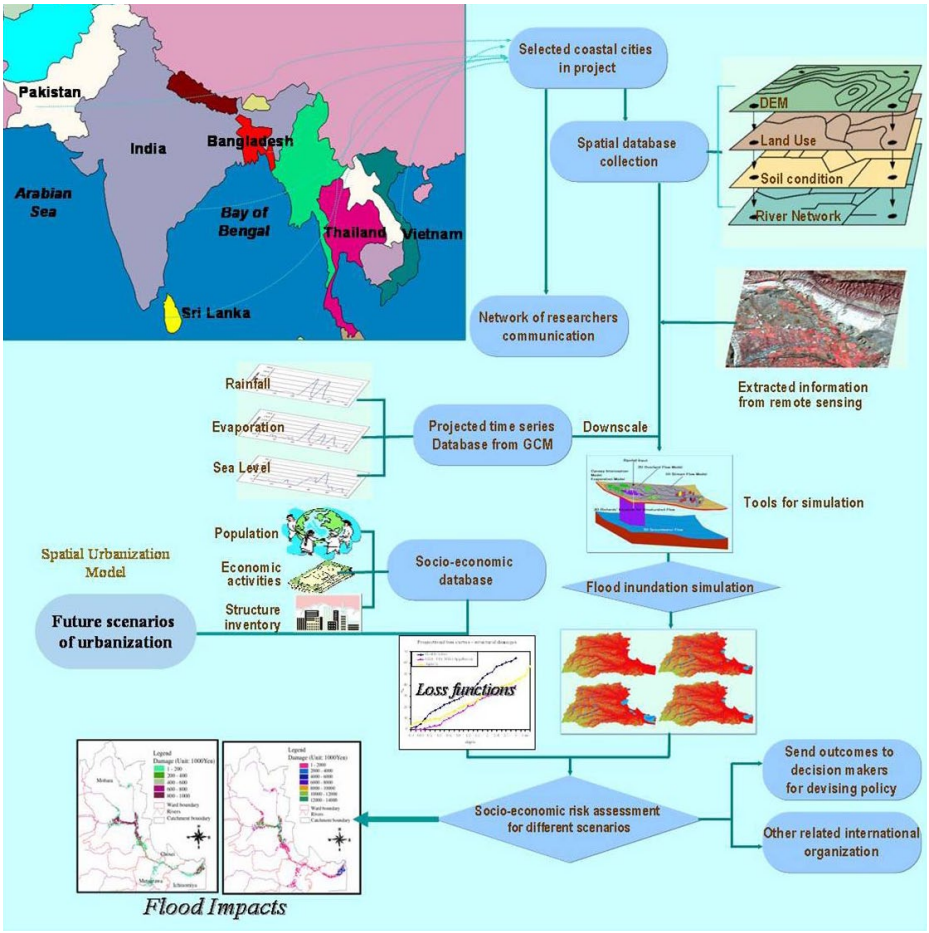

Figure 25: Framework for APN project on risk assessment of flooding in coastal cities [Source: Dutta]

3.7.3. Outcomes

Urban planners participating in the APN activities recognized the need for climate change to be factored into risk assessment and planning for the future development of coastal cities in Asia.

The APN project on risk assessment for a number of specific cities across Asia led to the development of a website to provide a forum for discussion among scientists and for data sharing. A GIS system that utilizes existing databases was developed and applied to the vulnerability studies. Scenario analyses were undertaken to estimate the socio-economic impacts of floods in the selected areas at 2025, 2050, 2075 and 2100 under sea level rise associated with climate change conditions. The vulnerability to flooding was found to vary substantially with the topography of each city. For example, more than 80% of the population in the Meghna Delta was found to be vulnerable to flooding, compared with less than 20% of the population of Matara City. In addition to variations in vulnerability, it was also found that different cities had quite different approaches to preparedness for flooding. In particular, Bangladesh was seen to be carefully addressing climate change as part of the overall policy development for flood mitigation, while other countries were less advanced in relevant policy development.

The participants in the risk assessment project agreed that there would be regional benefits from the establishment of a single body to deal with flood mitigation across the region. That body would need to account for climate change in its planning. The participants also saw the need to delineate flood mitigation issues from activities associated with disaster management. On future activities, the participants decided that the analysis methodology could be readily expanded to include other cities, assessment of risks to the natural environment, and sectoral analyses of optimal strategies for adaptation and mitigation.

The complexity of cities requires the enhancement of effective interactions between scientists, engineers, urban planners and policy-makers in order to plan for and mange the impacts of climate change.

Figure 26: APN brings its policy-makers and scientists together for the "Cities at Risk" workshop [Source: Pulhin]

The "Cities at Risk" workshop reached a number of conclusions that included the need for climate change to be recognized as a relevant aspect of urban planning; the need to promote better understanding between scientists and urban planners on differences in space and timescales used by each group in their analyses; the need to identify local champions to implement policy changes; the need to build capacity at both individual and institutional levels; and the need to extend governance arrangements across traditional sectors.

Owing to the involvement of urban planners and policy-makers in the workshop, the recommendations and summaries of the meeting were widely shared with a number of national institutions for planning and management. The results of the workshop fed into other training and adaptation exercises, and the workshop results were disseminated at UNFCCC COP15 in Copenhagen, Denmark in 2009. Workshops continue to be held in the region and a long-term plan for sustaining these is being considered by the APN, START and the East-West Center.

3.7.4. Conclusions and recommendations

As the population continues to increase in the Asia-Pacific region at the same time as urbanization continues to grow rapidly, the challenges of designing and managing urban environments will continue to grow and new strategies will need to be developed. In particular, urban areas are the main consumers of food, water and energy in most Asian countries; hence, they are the main sources of GHG emissions. The rapid development of mega-cities in Asia (especially along coastal areas) exacerbates the issues to be managed. Coastal cities are particularly vulnerable to the impacts of sea level rise. In order to manage the range of issues associated with urbanization, there is a need to promote links between scientists, engineers and technologists, urban planners and policy-makers to enhance the integration of knowledge across sectors.

Specific recommendations for coastal cities include:

- Encourage the urban planning community to take a comprehensive view of climate risks, including variability.
- Recognize and promote the importance of identifying champions in urban governments to help make climate change a priority.
- Acknowledge gaps in knowledge and invest in learning strategies.
- Move from the traditional top-down impact modelling approach to a critical threshold approach.
- Communicate science and vulnerability more effectively.
- Build capacity for individual and institutional participation in responding to climate change in Asia's coastal megacities.
- Effective overall governance is essential at the systemic level in mainstreaming adaptation strategies.

3.8. Climate Change Policy and Outreach

3.8.1. Issues and significance

Research in climate and climate change science has taken great strides in recent years and APN has been contributing significantly in promoting and facilitating such research. Making good use of climate change science is important for the benefit of humanity and, for this; climate change science has to be appropriately mainstreamed into the development process. This is a major issue and a great challenge. To address this challenge, policy-makers and decision-makers must be provided with appropriate scientific knowledge on climate change including the uncertainty associated with future climate prediction. Therefore, the climate science community has to work toward effectively communicating climate change science to those at the policy- and decision-making levels. Such activities will help narrow the gap between science and policy-making communities.

APN facilitated the mainstreaming of climate change science into the development process and bridging the gap between the scientific community and policy-makers.

APN addresses this issue through its core strategies, one of which "*promotes and encourages policy-relevant regional global change research*" and with one of its main goals of "*strengthening appropriate interactions among scientists and policy-makers, and providing scientific input to policy- and decision-making processes, and scientific knowledge to the public*".

APN facilitated disseminating results of climate change science to policy- and decision-makers as well as to people and communities; and explored means to undertake this task for different groups of people.

APN has been addressing the issue of policy outreach and effective science and policy interactions through its core research (ARCP) and capacity building (CAPaBLE) programmes, and has been systematically evaluating its performance in this area. While steps to enhance this area are taking place, more momentum is needed to reach a "striding" level that will make a difference. Steps taken have included invitations to researchers to submit proposals in the areas of science-policy communications and interactions in GC, as well as invitations, particularly under CAPaBLE, to the Asia-Pacific community including end-users and decision-makers, to submit proposals on relevant science for smooth decision-making in areas of adaptation and mitigation. APN will embark on a series of "Science-Policy Fora" with its GC partners in the near future.

3.8.2. Scope of the activities

APN, as an intergovernmental network, has been working to produce sound scientific results in climate variability and change through its ARCP Programme. APN has made significant progress in achieving good results and many of these are published in peer reviewed scientific journals. However, mainstreaming the results of development processes of participating countries is an area that requires strengthening. At the same time, the APN attempts to provide underpinning science that is policy-relevant rather than policy-prescriptive. The main question is how to best feed scientific results into policy-making processes in the Asia-Pacific region?

Seven (7) projects were funded by APN to address science-policy interaction and outreach. Based on their objectives, the projects can be categorized into two groups: i) Climate change policy; and ii) Outreach. These two categories are dealt with separately in terms of their scope and outcomes.

3.8.3. Climate change policy

The main activities undertaken by APN projects dealing with climate change policy are highlighted here:

- Collaboration among countries in the Asia-Pacific region helped create greater awareness of climate change policy issues of individual participating nations. In this regard, attempts were made to analyze possibilities and constraints in developing collaboration among countries in Temperate East Asia including China, Japan, Republic of Korea and Russia. Possible activities were explored that had substantial financial benefit for the participating countries, such as CDM projects. At the same time, the activity identified barriers in efficiency, coordination, capacity and information fields in governmental mechanisms of the countries involved.
- There were efforts shown by projects to create a suitable atmosphere to allow for appropriate interactions between policy-makers to discuss and communicate climate-related issues.
- One APN-funded global-level activity, which was held in the Philippines, facilitated capacity building towards the preparation of national communications to the UNFCCC and especially targeted non-Annex I countries. The activity involved 50 countries and 11 organizations including governmental and non-governmental organizations.
- In order to convey climate change concerns to policy-makers, it is necessary to have appropriate techniques and skills in "negotiations" language in the international policy arena. For this purpose, APN workshops were conducted to strengthen the capacity of PICs to participate in not only UNFCCC/COP processes, but other international policy-level fora as well.
- Forestry is considered a significant contributor to GHG concentrations in the atmosphere through unsustainable forestry practices. Conferences and training workshops have been conducted on concepts and methods to transform research activities in the field of forestry and forest governance into usable information for problem solving and policy-making.

Outcomes

- Participants were trained in preparing national communications for UNFCCC processes.
- Participants developed the skills required to negotiate in UNFCCC processes and to effectively discuss climate change issues with policy-makers from their respective countries.
- Participants exchanged scientific knowledge on climate change research and its impacts in sectors such as forestry and forestry management. Participants also learned about best practices to work at the interface of forest science and forest policy.

3.8.4. Outreach

In addition to the activities mentioned above, it is equally important to disseminate available climate knowledge and information to all communities, including those at the grassroots level. This provides a better understanding of the science behind climate change and enhances capabilities to interact with leaders from various backgrounds and professions, such as agriculture, livestock, water resource management, health and other sectors influenced by weather and climate. Some of the salient features of the APN's outreach projects are outlined here.

- Projects conducted significant numbers of seminars and meetings to disseminate climate change knowledge, including the adaptation and mitigation aspect. One project based in Sri Lanka conducted 25 public seminars, with participants from a broad range of backgrounds.
- Depending on geographical location, projects were able to innovate unique ways to disseminate climate change messages. In Cambodia, for example, an APN project developed a Mobile Environmental Education Programme (MEEP) to raise awareness about climate change among communities around a lake area.
- Likewise, one case of a project conducted in the Pacific Islands is especially unique. In Fiji, Tuvalu and the Solomon Islands, workshops were conducted incorporating drama and theatre performances to raise awareness of the climate risks posed to Pacific Island communities.

Figure 27: Youth in the Pacific discuss likely impacts of climate change in 50 years [Source: Aalbersberg]

Figure 28: Diagram depicting a process that involves Pacific Island communities in climate change awareness-raising activities [Source: Aalbersberg]

The community-level audiences were then exposed to tailored exercises that improved their understanding of climate change and allowed participants to discuss risk assessment strategies (***Figures 27 and 28***).

Outcomes

- In Sri Lanka, 3448 participants including decision- and policy-makers were involved in an awareness raising campaign on climate change issues.
- Projects were successful in drawing the attention of decision- and policy-makers in dealing with climate change-related issues.
- Manuals and video tapes were prepared especially for PICs to facilitate climate change drama and risk assessment workshops. This specific project provided "training trainers" manuals to ensure sustainability at the community level.

3.8.5. Conclusions and recommendations

As part of the main aim of the APN, projects were able to promote awareness and provide communication materials including manuals, videos, and peer reviewed papers, targeting stakeholders from the science, policy, end-user and civil society communities.

According to geographic and socio-economic parameters, different options were adopted to convey the science of climate change to all stakeholders, as demonstrated in the PICs and Cambodia in particular. Small islands and mountainous countries, such as the Himalayas, with varied cultural and economic backgrounds have to be approached tactfully to ensure their communities, including policy- and decision- makers, are made aware of climate change and the risks and consequences posed. Some of these were taken up by APN projects in effective and unique ways.

Communities were given details on APN activities, which were considered essential to successfully undertake climate change policy and outreach activities in the smaller and least-developed Asia-Pacific countries. The number of individuals involved in seminars and workshops was significantly noteworthy.

One of the main aims of the APN is to sustain project activities in the participating countries beyond the period of APN funding. In this case, mechanisms and indicators to measure the sustainability factor should be developed and implemented by the APN.

4 Emerging Issues and Priorities

While substantial progress has been made by APN-supported projects on climate science, capacity building and policy outreach, much remains to be done in the Asia-Pacific region. Among the key trends impacting the region are rising population, increasing urbanization, globalization, rapid economic development, rising energy demand, massive land-use change, and an increase in extreme weather events related to global warming.

This chapter outlines the pressing issues and priorities that APN might wish to address in its future strategic planning, particularly through its funding process. These issues and priorities are those supportive of its main goals.

4.1. Science and Research (APN Goal 1)

Many countries in the Asia-Pacific region are very vulnerable to climate variability, extreme weather events and climate change. Agriculture and food security depend on timely availability of weather and climate information. More accurate seasonal climate forecasts are lacking in many countries in the region. Multi-year climate models/predictions are needed for agriculture and other sectors. Modelling the effects of climate on agriculture and fishery production needs to be refined. Critical to climate adaptation research, practice, and policy are downscaled climate data. There is a need for RCMs which can help localize GCM results. Especially problematic are Small Islands States and areas with rough and steep terrain like those of the Himalayas.

In an effort to build strategies to enhance resilience, there is a need to further investigate climate variability and trends at the regional level. Climate drivers at the regional level are still poorly understood. Apart from reliable climate data, consistent socio-economic data collection is also needed for development of IAMs. The increasing frequency and severity of floods, droughts and extreme temperatures require use of appropriate indices so as to improve monitoring and prediction of these extreme events.

Vulnerability assessments have been conducted in previous APN projects. However, vulnerability assessment of cities is still not well understood. This is critical as more and more people choose to live in cities and urbanized areas. Coastal cities in the region are particularly vulnerable to rising sea levels, storm surges and more intense typhoons.

Adaptation strategies for decadal climate change in various sectors (e.g. food, water, urban sectors) are insufficient and more adaptation options are needed. The link between climate adaptation and disaster risk reduction (DRR) has to be encouraged as they share many common determinants and goals. Planning at the local and national levels for climate-related hazards such as floods and drought needs to be strengthened. Attention must be given to community-based climate adaptation since this is where the most vulnerable are in developing countries. Technology transfer to developing countries should be increasingly encouraged.

The effects of climate on water resources have been studied in previous APN projects but many issues remain woefully unclear. There is a need for models to predict the effects of seasonal to inter-annual climate on water supply. Projected water supply and demand in cities and in rural areas must be considered. Watershed and water management models need to be coupled with crop simulation models to optimize water use efficiency for food production. Special attention should be given to the Hindukush-Karakoram-Himalaya region, which feeds Southeast Asia's major rivers. Further research using advanced Remote Sensing (RS) and GIS techniques is required to monitor snow cover and temporal changes in the major glaciers in the region. In tropical regions of Asia, water-conserving agricultural practices must be identified.

Urbanization, which is a ubiquitous phenomenon in the Asia-Pacific region, needs to be better understood. Its effect on food, water and energy supply could be very significant. For example, many peri-urban areas, which used to be highly productive farms, have now been converted to housing villages and industrial zones. Migration of young people to cities could leave rural areas without a young skilled labour force threatening food production. In addition, the continued growth of Asian cities has led to severe pollution problems and overcrowding.

Coastal cities are also highly vulnerable to sea level rise and storm surges. Further research is needed to identify appropriate adaptation measures, strategies, and policies in response to further sea level rise. Similarly, small islands are especially vulnerable to sea level rise and research is required into relocation or engineering options.

Most countries recognize the need to reduce their emissions and move towards a low carbon society and mitigation options, such as solar, wind, tidal, wave, biomass, and hydro; fusion or fission power for base load power generation appear to be well understood. However, wide variations exist in GHG emissions between countries, from fossil fuel emissions in China to deforestation in Indonesia and reduction in agricultural emissions from rice fields and livestock. Research is needed to help identify cost-effective and socially acceptable mitigation options that take into account country-specific conditions and economic development. Appropriately designed models that take into account these factors can help validate mitigation options. Among the issues that need to be addressed include large base load energy consumption especially in cities, appropriate farming management practices including the role of trees and forests, and sustainable agricultural practices. Urban design options (e.g. green areas) need to be identified to minimize the heat-island effect. There is also a need to improve national capacity to conduct GHG inventories including the generation of and access to activity data and emission factors. On a regional and national scale, transitions towards a low carbon economy should be explored.

The emerging global market for GHG offers an opportunity for developing countries to participate in climate change mitigation while helping meet their sustainable development goals. However, there is little benefit to the poor both in urban and rural areas. For example, there is much discussion on REDD but it is not clear how small farmers and local communities will benefit. Research is needed to elaborate mechanisms to ensure that the poor benefit from the GHG market including supporting sustainable development.

There is a need to support international efforts to promote open access to all climate data including socio-economic data, as agreed under the UNFCCC.

4.2. Policy and Outreach (APN Goal 2)

In spite of a number of activities to encourage science and policy links, there is still a large gap between the science community and policy-makers. One reason for this is the asymmetry between the time horizon of scientists (up to decades) and policy-makers (often less than two years). More innovative approaches need to be devised to help bridge this gap. One way to do this is by supporting local champions. The flow of communication between experts and decision-makers needs to be studied and facilitated through the identification and study of issues that connect science and policy in a more coherent way. This could be followed by communicating case studies that highlight successful unification of science and policy (referred to as *operationalization of the research*). Disaster management may be a connecting issue to facilitate links between science and policy.

Close collaboration between experts and media organizations needs to be supported to assist in the mainstreaming of climate information in various sectors. The role of farmer groups and associations to spread collective knowledge that farming communities have on climate and crop management need to be explored.

On a wider front, climate policies and programmes need to be mainstreamed or integrated into national and local development planning. This is to affirm that addressing climate issues share common goals and determinants with sustainable development.

4.3. Capacity Building (APN Goal 3)

Capacity building of human resources continues to be important for many countries in the Asia-Pacific region. This activity should focus on the following areas:

(1) Seasonal to inter-annual forecasts critical to agricultural risk management
(2) Integrated regional assessment models
(3) Sustainability issues in capacity development projects
(4) Vulnerability assessments
(5) Climate change mitigation
(6) Improving institutional capacity to undertake quality GHG inventories

APN has supported many scientific capacity development projects. Long-term impact assessments of these projects may now be conducted to glean lessons for future projects. Innovative impact assessments including both quantitative and qualitative indicators should be implemented with in-depth case studies to better reflect APN's influence in developing countries. The sustainability of APN projects should also be evaluated bearing in mind that continuation of capacity building outcomes can be manifested in different forms such as in the widening influence of APN grantees.

4.4. Cooperating and Networking (Goal 4)

Countries in the Asia-Pacific region need to enhance cooperation and networking. Links between regional and global climate modelling communities must be supported especially in the use of RCMs in various sectors.

Targeted climate synthesis and integration into applied risk management are required at the farm level. This requires new institutional arrangements and multidisciplinary partnerships especially between meteorological offices, ministries of agriculture and local farming communities.

There is also a need to promote links between science and technology communities.

Some level of donor coordination of support to developing countries is critical. APN should explore the formation of links with large multi- and bi-lateral donors for greater effectiveness and leveraging of resources.

5 Conclusions and Recommendations

Human activities and the natural environment of Asia and the Pacific are influenced profoundly by the climate of the region. Food and water security depend vitally on local climate, and they are susceptible to the natural variability of climate and to the trends associated with anthropogenic climate change. ***Investments by APN in projects aimed at improving our understanding of the climate of the region, at assessing the risks to society and nature from climate variability and change, and at raising awareness of these issues to decision-makers and the public are well justified in terms of need and benefits.***

For more than a decade, the APN has supported a range of activities related to the climate of the Asia-Pacific region. The scope of activities has extended from leading-edge research on the climate of the region, to forums for dialogue between scientists and decision-makers, and to public meetings to raise awareness of climate change issues. ***Formal assessments and literature citations have demonstrated that these activities have been effective and of high quality.***

In Chapter 2 we have outlined the scope of APN activities in climate research and highlighted some of the outstanding projects. Chapter 3 provides an overall synthesis of the work supported by the APN. Each project has focused on regionally important issues, and has led to significant outcomes as indicated by approximately 100 publications in the scientific literature (***Appendix 3***), citations by the IPCC, and impacts on decision-makers and the public.

While the activities of APN have been comprehensive, there are a number of emerging issues that will need to be taken into consideration as the APN plans its future directions, these issues are discussed in Chapter 4. In summarizing the results of this synthesis, a number of overarching conclusions have become apparent.

It is clear that many projects are extremely successful in their own right, but they should provide a basis for further activity that can be sustained over a longer term. The APN however is not able to continue to fund activities indefinitely and the resources of many institutions in developing countries are insufficient to sustain such activities. ***Given the high quality of APN projects and the potential of many to yield longer-term benefits through the provision of marginal resources, there should be an investigation of innovative means to sustain such projects beyond the term of initial APN support.*** A particular focus should be placed on attempts to employ the strategy of "training trainers," where it must be recognized that trainers need continuous training and support, for example through engagement with local tertiary education institutions.

A key factor in assessing the longer-term impact of research and related activities is the development of indicators of impact that can be used to monitor the benefits of APN and other investments. This issue is internationally recognized as important, yet difficult. ***Strategic planning of APN would benefit***

by ensuring that it maintains close contact with the relevant international developments of indicators on the impact of research and capacity building activities.

Science has benefited over the last century by focusing on the analysis of a problem within its specific discipline. However, the impact of climate across disciplines and societal sectors means that climate activities are essentially multi-disciplinary. It is apparent that modelling provides a mechanism to bring together the complex crosscutting aspects of multi-disciplinary problems. In recent decades, a hierarchy of models has been developed with varying balances of complexity and depth in any one aspect. ***The APN should continue to recognize the benefits of applying appropriate models to assist the integration and synthesis of information in complex systems.***

There is increasing attention to issues associated with adaptation to climate change. Currently, the focus is on assessing vulnerabilities and identifying adaptation options. ***The complexity of adaptation due to the multidisciplinary nature of the solutions required and the lack of long-term data poses a great challenge.*** Approaches that involve communities and local governments to incorporate climate change adaptation practices into development planning will be needed, and IAMs will need to be customized for local to regional and sectoral levels.

Climate change and variability affect almost all sectors of society as well as the natural environment. Food and water security as well as energy efficiency are closely linked to climate on a range of scales. These links mean that ***the effective application of climate knowledge to practical problems of societies across the Asia-Pacific region requires effective dialogue across the traditional boundaries of science, technology and policy.*** The APN has been active in promoting the required dialogues but as climate change continues to impact across our societies these interactions will become more critical.

The importance of cross-sectoral interactions is especially clear when the relationship between climate and sustainable development is considered. There must be advancement in the economic status and well-being of developing societies across the Asia-Pacific, while simultaneously recognizing the need to mitigate and adapt to the impacts of climate change and variability. ***The APN has a role to play in promoting research in the region that clarifies the strategies that lead to true sustainable development.***

The Asia-Pacific region has a rich variety of cultures and the APN has been effective in promoting connections and alliances across all of these cultures. This effectiveness comes from recognition of cultural differences and not imposing a monolithic approach. These sensitivities to culture will be especially important as the APN continues to promote exchanges of knowledge on climate-related issues across disciplines and sectors.

The exchange of knowledge is ultimately dependent upon access to and exchange of observed data. The open exchange of climate related data, which extends from traditional records of temperature and rainfall to socio-economic data that quantify the impacts of climate variability and change on societies, benefits all nations by allowing the regional and global scale features of climate to be documented and understood. These larger scale features provide a vital context for interpreting national scale features and trends. The increasing connections between economies and societies provide greater incentives to enhance understanding of larger scale features. ***It is in the interest of all countries of the APN to promote the open exchange of climate-related data.***

Clearly, the most important aspect of interactions across a region is the human factor. The APN has been effective in promoting innumerable networks of participants in its projects related to climate. These networks have involved scientists from a range of disciplines, urban planners, policy-makers, natural resource managers, farmers and the general public. In addition to establishing such networks, the APN should strive to maintain them beyond the term of specific projects. ***One potential element in the development of sustained networks is through the engagement of young people who can carry their scientific and social networks into the future.***

Appendix 1: Tables and Figures

Table 1: List of 56 Climate Projects

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP1	1998-01 1999-05 2000-05 2001-05 2002-02	Congbin FU	Continuation of Regional Climate Modelling (RCM) Development	Australia, India, Italy, Japan, P.R. China, Republic of Korea, and USA	Asia	Extensive data archive, two workshops, inter-comparison methodologies and results, and development of a web-based platform for regional climate modelling.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/1998/1998-01fr.pdf
CSP2	1998-02	C. M. FINLAYSON	Vulnerability Assessment of Major Wetlands in the Asia-Pacific Region	Australia, Philippines and China	Asia-Pacific	Increased awareness on concepts of climate change and sea level rise, and coastal vulnerability assessment; Vulnerability assessment reports.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/1998/1998-02fr.pdf
CSP3	1998-03 1999-13 2001-01 2002-01 2003-01	Michael MANTON/ Neville NICHOLLS	Asia-Pacific Workshop on Indicators and Indices for Monitoring Trends in Climate Extremes	Australia, Cambodia, Fiji, French Polynesia, Japan, Indonesia, Malaysia, Myanmar, New Caledonia, New Zealand, Pakistan, Papua New Guinea, P. R. China, Philippines, Republic of Korea, Solomon Islands, Thailand and Viet Nam.	Southeast Asia and the Pacific	Developed new knowledge on local / regional climate extremes and trends in APN countries - by building on data and capabilities from within these countries, through providing training and tools. Results were used in IPCC assessments.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/1998/1998-03fr.pdf
CSP4	1998-06	Xiulian HU / Jiang KEJUN/P.R. SHUKLA	International Workshop for Integrated Assessment Model (IAM)	Key IAM teams from USA, the Netherlands, Japan, Austria, and researchers from Asian countries including India, Korea, Viet Nam, Mongolia, Philippines and China presented their research activities.	East Asia	Brought together people from developed and developing countries to exchange information and experience, and to strengthen the capacity for East Asian countries to apply IAMs.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/1998/1998-06fr.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP5	1999-07	Richard WARRICK	The Use and Extension of PACCLIM Integrated Model for Climate Change Vulnerability and Adaptation Assessment in Pacific Island Countries	Australia, New Caledonia, New Zealand, United States of America, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Samoa, Solomon Islands, Tuvalu, Vanuatu, Niue, Papua New Guinea, Tonga	Pacific	Capacity building on the use of PACCLIM prototype model; 35 people attended the training.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/1999/1999-07fr.pdf
CSP6	1999-11	John L. MCGREGOR	Analysis of Climate Change Simulations of Southeast Asia	Australia, Cambodia, Fiji, India, Indonesia, Malaysia, Papua New Guinea, Philippines, Samoa, Singapore, Thailand, Viet Nam	Southeast Asia	15 participants sponsored by APN were trained in the analysis of large data sets produced by regional climate simulations.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/1999/1999-11fr.pdf
CSP7	1999-12 2000-12 2001-12	Yihui DING	Monitoring and Prediction of ENSO Event and SSTA over the Warm Pool in the Western Pacific Ocean	Australia, China (including Hong Kong and Macao), Indonesia, Japan, Malaysia, Philippines, Republic of Korea, United States and Viet Nam	Western Pacific	Collection of data and information relative to ENSO and the warm pool; Establishment of website; International workshop on seasonal to inter-annual monitoring and prediction of ENSO events	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2001/2001-12fr.pdf
CSP8	1999-15	Hassan VIRJI	CLIMAG-Asia Scoping Workshop	Australia, Fiji, Indonesia, Japan, Philippines, Thailand and USA	Pan Asia	The major product of the meeting was a draft proposal for each of the candidate projects.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/1999/1999-15fr.pdf
CSP9	2000-03	Eileen L. SHEA	Training Institute on Climate and Society in the Asia-Pacific Region	Australia, Bangladesh, China, Cook Islands, Fiji, India, Indonesia, Pakistan, Philippines, Papua New Guinea, Sri Lanka, Thailand and Viet Nam. In addition, resources from the NOAA Office of Global Programs were used to support a highly qualified participant from Ethiopia.	Asia-Pacific	Creation of a regional network of individuals actively engaged in the development and use of climate information to support economic development, community planning, resource management and practical decision-making in key sectors throughout the region.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2000/2000-03fr.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP10	2000-04 2001-10 2003-11	Jim SALINGER	APN Workshop on Climate Variability & Trends in Oceania	Australia, Cook Islands , Fiji, French Polynesia, New Caledonia, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.	Oceania	Development of closer collaboration between climate researchers in the region; capacity building for assessment of historical climate in the Pacific; Development of Metadata to support global change and variability research.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2003/2003-11.pdf
CSP11	2000-17	Holger MEINKE	Management Responses to Seasonal Climate Forecasts in Mixed Cropping Systems of South Asia's Semi-Arid Tropics (CLIMAG)	Australia, India, Pakistan and USA	South Asia	Site visits for collection of data and analysis of seasonal weather patterns and effects on agriculture in India and Pakistan; Workshop consisting of an analysis of site visits; Showcased results at Training Institute on Climate Variability and Society in the Asia-Pacific Region.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2000/2000-17fr.pdf
CSP12	2001-07	Hideaki NAKATA	Workshop on the Causes and Consequences of Climate-Induced Changes in Pelagic Fish Productivity in East Asia	China, Japan, Malaysia, Republic of Korea and USA	East Asia	The identification of target species and the identification of subjects for future research in the region.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2001/2001-07fr.pdf
CSP13	2002-07	Jim SALINGER	International Workshop on Reducing Vulnerability of Agriculture and Forestry to Climate Variability and Climate Change	Australia, Bangladesh, Cook Islands, Fiji, India, Indonesia, Malaysia, Maldives, Mongolia, Nepal, New Zealand, Pakistan, P. R. China, Philippines, Russia, Sri Lanka and Viet Nam	Asia-Pacific	Enabled APN scientists to interact with experts and scientists from other regions; Workshop papers were featured in an issue of Climate Change; Summary Report translated into 6 languages and distributed to all co-sponsors.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2002/2002-07fr.pdf
CSP14	2000-15 2001-15	Tae Yong JUNG	Policy Design of Climate Change Collaboration in Northern Asia: Possible Options and Constraints for Cooperative Efforts between Russia, Japan, China and Korea	China, Japan, Republic of Korea, Russia	Temperate Asia	Analysis of co-operative efforts in establishing UNFCCC regulations between the 4 countries; Assessment of Russia's role in and affect on Climate Change; Identification of future research and collaborative opportunities.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2001/2001-15fr.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP15	2001-18	Nguyen Huu NINH	Training Workshop on Forecasting El Niño and La Niña in Indochina	Australia, Cambodia, Laos, Myanmar, Thailand, United Kingdom, USA and Viet Nam	Southeast Asia	The meeting provided further understanding of El Niño and La Niña with specific relation to work area of participants and opportunity for discussion with participants from the region and international advisors on mutual problems and future collaborations.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2001/2001-08fr.pdf
CSP16	2002-10	R. K. GUPTA	Climate Variability and Rice-Wheat Productivity in the Indo-Gangetic Plains	Australia, Bangladesh, Germany, India, Japan, Nepal, New Zealand, Philippines, and USA.	South Asia	Identification of key areas in field research and modelling, as well as, key issues in the rice-wheat systems that need immediate attention.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2002/2002-10fr.pdf
CSP17	2002-09-NMY 2003-02-CMY 2004-01-CMY	Holger MEINKE	Applying Climate Information to Enhance the Resilience of Farming Systems Exposed to Climatic Risk in South and Southeast Asia	Australia, USA, India and Indonesia	South and Southeast Asia	An international, multi-disciplinary network of systems scientists who are committed to the creation of "actionable climate knowledge" by building partnerships with stakeholders; Better understanding of climate variability impacts and climate-related vulnerabilities; A consortium of partners to build and extend the existing nodes and pilot studies.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004_01_CMY-Meinke.pdf
CSP18	2004-17-NSY	Sulochana GADGIL	Climate Prediction and Agriculture: An Assessment and Perspective	Indonesia, Viet Nam, India and China	Southeast Asia	Review and assessment of the application of forecasts of seasonal and intra-seasonal climate variability to agriculture production published in Climatic Research; Identification of gaps in knowledge, tools and methodologies, capacity building priorities and institutional needs.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004_17_NSY-Gadgil.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP19	2005-06-NSY	Julie BRIGHAM-GRETTE	PAGES Second Open Science Meeting	Australia, China, India, Japan, Mongolia, Nepal, New Zealand, Russia, USA	Global activity	Brought together paleoscientists from various disciplines and background (as well as environmental historians and modelers); Facilitated successful dialog and networking between participants from 45 countries; Boosted visibility of paleoresearch in China.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/APN2005-06-NSY-Brigham-Grette.pdf
CSP20	2005-10-NSY	Muhammad Munir SHEIKH	Development and Application of Climate Extreme Indices and Indicators for monitoring Trends in Climate Extremes and their Socio-Economic Impacts in South Asian Countries	Bangladesh, India, Nepal, Pakistan, Sri Lanka, Australia and USA	South Asia	Data collected yielded trend changes in 19 core climate indices; Enhanced capacity building and strengthened collaboration between participating countries.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/APN2005-10-NSY-Sheikh.pdf
CSP21	CBA2005-14-NSY	John CAMPBELL	Community relocation as an option for adaptation to the effects of climate change and climate variability in Pacific Island Countries (PICs)	Kiribati, New Zealand, Papua New Guinea, Solomon Islands, United States of America, Vanuatu	Pacific	Identified various issues concerning costs, land tenure, and political borders; Developed steps that might be considered in relocation decision-making.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/APN2005-14-NSY-Campbell_FinalReport%20formated-no%20appx.pdf
CSP22	2005-15-NSG	Nirmalie PALLEWATA	Climate change impacts on the ecology of the rice pest complex and the resulting threat to food security and farming economy in South Asia	Bangladesh, India, Pakistan, Sri Lanka	South Asia	The workshops refined and provided a final proposal that was submitted to the APN Call for Proposals 2005.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/APN2005-15-NSG-Pallewatta.pdf
CSP23	ARCP2006-10-NMY ARCP2007-05-CMY	Rodel LASCO	Linking Climate Change Adaptation to Sustainable Development in Southeast Asia	Indonesia, Lao PDR, Philippines, Viet Nam	Southeast Asia	Activities helped identify most appropriate climate change adaptation strategies for natural resources, agricultural sector, and rural areas; Synthesized recent climate change adaptation and related research in the region; Results used for capacity building of national decision-makers.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/ARCP2007-05CMY%20Lasco_Final%20Report.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP24	ARCP2006-12-NMY ARCP2007-06-CMY	Samsul HUDA	Climate Crop Disease Risk Management: An International Initiative in the Asia-Pacific Region	Australia, India, Bangladesh, Cambodia, the Netherlands and USA	Asia-Pacific	Created a collaborative network between scientists and policy-makers; Identified, adapted, and tested 2 climate and crop disease models; Provided a regional focus for research in climate and disease risk management. Developed ideas and planned new network activities and research projects.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/ARCP2007-06CMY-Huda%20Project%20Final%20%20Report.pdf
CSP25	ARCP2007-20-NSG	Won-Tae KWON	Development of Indices and Indicators for Monitoring Trends in Climate Extremes and its Application to Climate Change Projection	Australia, Bangladesh, Cambodia, China, Fiji, India, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Philippines, Republic of Korea, Russian Federation, Sri Lanka, Thailand, USA, Viet Nam	Asia-Pacific	Enhanced close collaboration between APN member countries and allowed recognition of the importance of monitoring and understanding global change in Asia-Pacific region.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/ARCP2007-20NSG-Kwon%20Final%20Report.pdf
CSP26	2003-CB02-NMY 2004-CB03-CMY 2005-CB04-CMY	Kanayathu KOSHY	Training Institute on Climate and Extreme Events in the Pacific	Fiji, USA, New Zealand and PICs (Kiribati and Samoa)	Pacific	Training Institute provided understanding of consequences of climate variability and change, extreme events, etc. on society, economy, and resources.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/APN2005-CB04CMY-Koshy_FinalReport.pdf
CSP27	2003-CB04-NSY	Holger MEINKE	Creating Climate Change Knowledge Networks through Strategic Global Linkages	Australia, Brazil	Asia-Pacific	Identified priority areas of research and methodology in South American based on the Asian experience as case study; Brought focused scientists in Asia together in a knowledge-based network.	http://www.apn-gcr.org/newAPN/activities/CAPaBLE/2011/CSP27-Meinke-FinalReport.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP28	2003-CB05-NMY 2004-CB04-CMY	Maasaki NAITO	Capacity Building in Climate Change Mitigation with Locally Owned Technology and Systems	Japan, India, and China	Asia-Pacific	Information gathered on locally owned technology and systems focusing on China and India; Concepts of ecologically sound technology were summarized and intermediate technologies in energy, water, and sanitation were illustrated.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004-CB04CMY-Naito_Final%20Report.pdf
CSP29	2003-CB06-NSY	Martha PERDOMO	UNFCCC Training Workshop for National Climate Change Focal Points on Guidelines for National Communications from Non-Annex I Parties	APN Countries that are parties to the UNFCCC	Asia-Pacific	Attended by 99 experts from Non-Annex I Parties; Participants trained in National Communications; Provided with tools and methodologies to conduct GHG inventories, vulnerability and adaptation assessments, mitigation, etc.	http://www.apn-gcr.org/newAPN/activities/CAPaBLE/2011/2003-CB06-NSY-Perdomo.pdf
CSP30	2003-CB08-NSY-WCRP	Valery DETEMMERMAN	WCRP-01: Conference/ Climate Modelling Workshops on RCMS Travel WCRP-02: Fellowships for Young Scientists to attend the 1st CLIVAR	Young scientists from selected APN member countries	Global activity	Funded 2 scientists from APN region to attend Climate Modelling Workshops on RCMS; Provided travel support for 3 scientists to attend 1st CLIVAR Conference	http://www.apn-gcr.org/newAPN/activities/CAPaBLE/2011/2003-CB08-NSY-WCRP1.pdf http://www.apn-gcr.org/newAPN/activities/CAPaBLE/2011/2003-CB08-NSY-WCRP2.pdf
CSP31	2004-CB01-NSY	Dushmanta DUTTA	An Assessment of the Socio-Economic Impacts of Floods under Climate Change Conditions in Large Coastal Cities in South and Southeast Asia	Bangladesh, India, Pakistan, Sri Lanka and Viet Nam	South and Southeast Asia	Scenario analyses provided comprehensive information for vulnerability assessments; Highlighted the lack of existing policies and strategies dealing with climate change issues in the region.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004-CB01-NSY-Dutta_Final%20Report.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP32	2004-CB07-NSY	Michael GLANTZ	Prototype Training Workshop for Educators on the Effects of Climate Change on Seasonality and Environmental Hazards	India, Malaysia, Philippines, P.R. China, Sri Lanka, Thailand, USA and Viet Nam	Southeast Asia	Website set up with links to relevant sites and publications, Created a network of educators.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004-CB07-NSY-Glantz-Final%20Report.pdf
CSP33	2004-CB09-NSY	G.H.P. DHARMARATNA	National Climate Change Public Awareness and Outreach in Sri Lanka	Sri Lanka	South Asia	Created awareness of climate change amongst stakeholders.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004-CB09-NSY-Dharmarathna_FinalReport.pdf
CSP34	2005-CB01-NSY-GEOSS	Organized by the APN Secretariat in Kobe, Japan; Reports written by Professor LAL	APN Scoping Workshops on Global Earth Observations System of Systems (GEOSS) & the Capacity Building Needs of the Region: Focus Climate	Australia, Bangladesh, China, Cambodia, Indonesia, India, Japan, Korea, Malaysia, Mongolia, New Zealand, Pakistan, Samoa, Sri Lanka, Thailand, and Viet Nam.	Asia-Pacific	Workshops are mentioned in GEOIV documents for presentation at the GEOIV summit in Cape Town in November 2007; Results were disseminated at the 14th UN Commission on Sustainable Development / CAPaBLE Side event	http://www.apn-gcr.org/newAPN/resources/proceedingsAndMeetingReports/workshopsAndMeetings/2nd%20Scoping%20Workshop%20Report.pdf
CSP35	2005-CB07-NSY	Sovannora IENG	Development of a Mobile Environmental Education Programme to Raise Awareness about Climate Change	Cambodia	Southeast Asia	Completed feasibility study and prepared detailed design for MEEP.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/MEEP~Final%20Report~25Jun07-Eng-Pic.pdf
CSP36	2003-CRP01-NMY 2004-CRP01-CMY 2005-CRP01-CMY	Dr. Arshad Muhammad KHAN	Enhancement of National Capacities in the Application of Simulation Models for the Assessment of Climate Change and its Impacts on Water Resources and Food & Agricultural Production	Pakistan, Bangladesh and Nepal	South Asia	Simulation Models (RCMs, WSMs, and CSMs) put to use; 99 personnel trained in Simulation Modelling; 62 personnel trained in Harmonization of Climate Change Research Results	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/2005-CRP01-CMY-Khan_CAPaBLE_FinalReport.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP37	2003-CRP02-NMY 2004-CRP02-CMY 2005-CRP02-CMY	Professor P.R. SHUKLA	Integrated Assessment Model for Developing Countries and Analysis of Mitigation Options and Sustainable Development Opportunities	India, Thailand and China	South and Southeast Asia	Contributed to numerous research publications; Website developed for sharing information, capacity building, and research networking.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/2005-CRP02-CMY-Shukla_CAPaBLE_FinalReport.pdf
CSP38	CBA2006-04NMY CBA2007-01CMY	Channa BAMBARADENIYA	Removing Barriers to Capacity Building in Least Developed Countries: Transferring Tools and Methodologies for Managing Vulnerability and Adaptation to Climate Change	Bangladesh, Cambodia, Indonesia, Lao PDR, Malaysia, Mongolia, Nepal, Pakistan, Sri Lanka, Viet Nam	Southeast Asia	Four-day trans-regional consultative workshop that was organized for developing nations in the Asia and Africa regions; Capacity building of developing country experts and national teams.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/CBA2007-01CMY-Bambaradeniya_Final%20Report.pdf
CSP39	CBA2006-08NSY	M.J. SALINGER	International Workshop on Coping with Agrometeorological Risks and Uncertainties: Challenges and Opportunities	Global activity	Global activity	188 participants from 78 countries attended the Workshop; Policy options to cope with agrometeorological risk were presented and appropriate adaptation strategies were discussed.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2006/CBA2006-08NSY-Salinger_%20Final%20Report.pdf
CSP40	CBA2007-05NSY	Ulka KELKAR	New Risks of Climate Change - Building Capacity to Protect the Most Vulnerable	India	South Asia	Identification of tools and techniques to help policy making related to climate change, Creation of comprehensive web-based database and tools for policy-makers.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/CBA2007-05NSY-Kelkar_APN-Report-Final.pdf
CSP41	CBA2007-07NSY	Bin WANG	Advanced Institute: The Monsoon System - Prediction of Change and Variability	China, India, Malaysia, Pakistan and USA	Asia-Pacific	Brought together early career scientists from APN member countries to learn about advances in the monsoon system; Regional research network was developed.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/CBA2007-05NSY-Kelkar_APN-Report-Final.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP42	CBA2007-09NSY	Moekti SOEJACHMOEN	Capacity Building in Asian Countries on Climate Change Issues Related to Future Regime	Indonesia, Thailand, India, Bangladesh and China,	Asia-Pacific	Series of interactive discussions for researchers and stakeholders; In-country dialogues and brief papers contributed significantly to their country's position and submissions to the UNFCCC process.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/CBA2007-09NSY-Soejachmoen.pdf
CSP43	ARCP2007-11NMY ARCP2008-04CMY	Ji-Hyung PARK	Regional Collaborative Research on Climate Change Impacts on Surface Water Quality in Eastern Monsoon Asia: Towards Sound Management of Climate Risks	Cambodia, China, Indonesia, Malaysia, Republic of Korea, Thailand	Southeast Asia and Temperate East Asia	Identified the complex relationship between climate and surface water quality in East Asia.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2008/ARCP2008-04CMY-Park-Final%20Report.pdf
CSP44	CBA2006-05NMY CBA2007-02CMY	Bill AALBERSBERG	Climate Change and Variability Implications on Biodiversity – Youth Scenario Simulations and Adaptations	Pacific Island Countries	Pacific	138 youth gained skills in using drama for climate change awareness raising, 127 people gained skills in climate change risk assessment and adaptation planning; Conducted a total 51 climate change theater performances; 10 soft measure adaptation activities were undertaken.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/CBA2007-02CMY-Aalbersberg-FINALREPORT.pdf
CSP45	CBA2006-12NMY CBA2008-01CMY	Rizaldi BOER	Increasing Adaptive Capacity of Farmers to Extreme Climate Events and Climate Variability through Enhancement of Policy-Science-Community Networking	Indonesia	Southeast Asia	10 local scientists were trained in using tools and methods for Climate Risk Management; Improved analytical skills of local scientists to identify critical issues in their region, build technical capacity of local government staff, increase awareness of farmers on value of climate information.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2008/CBA2008-01CMY-Boer-Final%20Report_2009.pdf
CSP46	CBA2008-03NSY	Karumuri ASHOK	Training Course on Regional Downscaling for Asia-Pacific Region Using APEC Climate Centre Global Seasonal Climate Prediction	Republic of Korea, New Zealand, Russian Federation, Viet Nam, Philippines, Thailand	Asia-Pacific	Participants acquired latest downscaling and climate prediction techniques; Development of new and existing co-operative networks in the region.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2008/CBA2008-03NSY-Ashok-Final%20Report.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP47	CBA2008-04NSY	Tohru NAKASHIZUKA	Training in Science-Policy Interfacing to Promote the Application of Scientific Knowledge on Adaptation of Forests and Forest Management to Climate Change	Japan, USA, Bangladesh, Cambodia, China, Fiji, India, Indonesia, Lao PDR, Mongolia, Nepal, Pacific Island Countries, Pakistan, Philippines, Sri Lanka, Thailand,Viet Nam	Asia-Pacific	Improved understanding of how to work effectively at the interface of forest science and forest policy; Participants obtained cutting edge knowledge on climate change research and effects on forest management worldwide.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2008/CBA2008-04NSY-Nakashizuka-Final%20Report-MK030609.pdf
CSP48	CBA2008-06NSY	Roland FUCHS	Cities At Risk: Developing Adaptive Capacity for Climate Change in Asia's Coastal Mega Cities	USA, Bangladesh, Sri Lanka, China, Thailand, Japan, Australia, Indonesia, Singapore, Malaysia, India, Pakistan, Viet Nam, Republic of Korea, Philippines	Asia	Initiated a dialogue between scientists, urban planners, representatives of disaster management and development agencies concerning emerging risks and challenges faced by megacities due to climate change; Examined potential vulnerabilities and current coping mechanisms.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2008/CBA2008-06NSY-Fuchs-FinalReport.pdf
CSP49	CBA2008-09NSY	Linda PEÑALBA	Enhancing the Climate Change Adaptation Capacity of Local Government Units and Scientists in the Philippines	Philippines	Southeast Asia	Better understanding of participants of climate change and the need for climate risk preparedness; Established partnerships between public educational institutions, communities and local government units concerning science based adaptation planning.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2008/CBA2008-09NSY-PenalbaFinalReport.pdf
CSP50	2004-CB08-NSY	Michio KISHI	Toward Quantitative Understanding of the Natural Fluctuations of Marine Coastal Fisheries of Sardines and Anchovies and their Impact on Fishing-Dependant Human Communities	Bangladesh, India, Japan, China and USA	Asia	Planned to initiate a review paper on processes that affect sardine and anchovy populations; Development of growth models for sardine and anchovy feeding behaviour and inter-species energetic; Apply and expand the NEMURO.FISH model to include sardine and anchovy populations; Analyze existing field data to compare and quantify response of sardine and anchovy populations to environmental conditions.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004-CB08-NSY-Kishi_FinalReport.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CSP51	2003-CB03-NMY 2004-CB05-CMY 2005-CB05-CMY	Hideaki NAKANE	Capacity Development for Greenhouse Gas Inventory Development in Asia-Pacific Developing Countries	Japan, Cambodia and Thailand	Asia-Pacific	Improved availability of local information and data and standard forest measurement was learnt in Cambodia; Constructed, tested, and confirmed a semiconductor sensor and identified the potential of utilizing the laser gas detector for measurement of methane flux in Thailand; Progress and outcomes of above projects were discussed at a subsequent Workshop.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/2005-CB05CMY-Nakane_FinalReport(submission).pdf
CSP52	CBA2006-06NSY	Sirintornthep TOWPRAYOON	Greenhouse Gas (GHG) and Aerosol Emissions Under Different Vegetation Land Use in the Mekong River Basin Sub-region	Australia, Cambodia, Japan, Thailand, USA and Viet Nam	Southeast Asia	Concluded that biogenic and biomass burning constitutes a major source of air pollutants in the region; Transferred methodologies and experimental procedures were evaluated as appropriate for measuring and monitoring local parameters related to biogenic and biomass burning emissions.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2006/CBA2006-06NSY-Towprayoon_FinalReport.pdf
CSP53	ARCP2005-12-NSY	Faizal PARISH	Vulnerabilities of the carbon-climate system: Carbon pools in Wetlands/Peatlands as positive feedback to global warming	Australia, China, Indonesia, Japan, Malaysia, Papua New Guinea, Thailand, Philippines and the USA	Asia	Riau Declaration on Peatlands and Climate Change; Synthesis on the extent, depth, and carbon content of peatlands in SE Asia; Prepared a special issue in ECOSYSTEMS; Prepared an APN proposal on Mitigation and Adaptation in tropical peatlands.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2005/APN2005-12-NSY-Parish.pdf

CS Project (CSP#)	Project Reference	Project Leader	Title	Collaborating Countries	Regional Focus	Major Outcomes	APN Website
CPS54	ARCP2007-15-NSY	Faizal PARISH	Assessing the Mitigation and Adaptation Options for Tropical Peatlands to Reduce GHG Emissions and Increase Resilience to Climate Change	Australia, Bangladesh, Japan, Sri Lanka, Thailand and Viet Nam	Southeast Asia	Contributed to debate on impact of oil palm cultivation on peatlands on GHG emissions; Enhanced understanding and partnerships researchers, policy-makers, government agencies working on peatlands, biodiversity, climate change and oil palm industry in SE Asia; Contributed to policy decisions on palm oil.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2007/ARCP2007-15NSY-Parish_Final%20Report_formatted.pdf
CSP55	CBA2009-05NSY	Jim SALINGER	International Workshop on the Content, Communication and Use of Weather and Climate Products and Services for Sustainable Agriculture	Australia, Bangladesh, Japan, Sri Lanka, Thailand and Viet Nam	Global activity	Provided Capacity Building in area of strategies for more targeted weather and climate information and forecasting; Attempted to communicate issues on climate variations that impact crop production to farmers through media products.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2009/CBA2009-05NSY-Salinger-FinalReport.pdf
CSP56	2002-12-NMY 2003-04-CMY 2004-02-CMY	Amir MUHAMMED	Water Resources in South Asia: An Assessment of Climate Change—Associated Vulnerabilities and Coping Mechanisms	Bangladesh, India, Nepal, Pakistan and USA	South Asia	Regional maps of climate variability and change with areas at risk identified; Presentations from the final reports presented at stakeholders meetings; Various articles published.	http://www.apn-gcr.org/newAPN/resources/projectBulletinOutputs/finalProjectReports/2004/2004_02_CMY-Muhammed_.pdf

Figures:

Appendix 2: Abbreviations & Acronyms

APN	Asia-Pacific Network for Global Change Research
ARCP	Annual Regional Call for Research Proposals
AusAID	Australian Agency for International Development
AWCI	Asian Water Cycle Initiative
CAPaBLE	Scientific Capacity Building/Enhancement for Global Change and Sustainable Development in Developing Countries
CLIK	Climate Information Tool Kit
CLIMAG	Climate Prediction and Agriculture
CLIVAR	Climate Variability and Predictability (Core Project of WCRP)
COP	Conference of the Parties
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DARLAM	Division of Atmospheric Research Limited Area Model
DIVERSITAS	International Programme of Biodiversity Science
ENSO	El Niño Southern Oscillation
ESC	Earth Simulator Centre (Japan)
ESSP	Earth System Science Partnership
EU	European Union
GC	Global (Environmental) Change
GCISC	Global Change Climate Impact Centre (Pakistan)
GCM	Global Climate Model
GCOS	Global Climate Observing System
GEF	Global Environment Facility
GEO	Global Earth Observations
GEO-4	Global Environment Outlook 4
GEOSS	Global Earth Observation System of Systems
GHG	Greenhouse Gas
GIS	Global Information System
HH	Household (general public) sector
IAM	Integrated Assessment Model
ICT	Information and Communication Technology
IGM	Inter-Governmental Meeting
IGBP	International Geosphere-Biosphere Programme
IGCI	International Global Change Institute (New Zealand)
IHDP	International Human Dimensions Programme on Global Environmental Change
IPCC	Intergovernmental Panel on Climate Change
IPCCTAR	IPCC Third Assessment Report
IPCCAR4	IPCC Fourth Assessment Report
IPCCAR5	IPCC Fifth Assessment Report
LGU	Local Government Unit
MJO	Madden-Julian Oscillation
NAASP	New Asian African Strategic Partnership
NAPA	National Adaptation Programme of Action
NMHS	National Meteorological and Hydrological Service
NGO	Non-Governmental Organization
PACC	Pacific Adaptation to Climate Change
PACCLIM	PACific CLimate Impacts Model
PAGES	International "Past Global Changes" Programme
PICCAP	Pacific Island Climate Change Assistance Programme

PDO	Pacific Decadal Oscillation
RCM	Regional Climate Model
RIEMS	Regional Integrated Environmental Modelling System
RMIP-Asia	Regional climate Model Inter-comParison for Asia
RS	Remote Sensing
SimCLIM	Integrated modelling system for assessing climate change impacts and adaptation
SMS	Short Message Service
SPREP	Pacific Regional Environment Programme
SSTA	Sea Surface Temperature Anomalies
START	global change SysTem for Analysis, Research and Training
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research
WCRP	World Climate Research Programme
WMO	World Meteorological Organisation

Appendix 3: Peer Reviewed Papers & Other Publications

CSP1: Continuation of Regional Climate Modelling (RCM) Development

1. Fu CB and Wen G. 1999. Variation of ecosystems over East Asia in association with seasonal, inter-annual and decadal monsoon climate variability. Climatic Change, 43: 477-494.
2. Fu CB, Diaz HF, Dong DF, and Fletcher JO. 1999. Changes in atmospheric circulation over northern hemisphere oceans associated with the rapid warming of the 1920s. International Journal of Climatology, 19:581-606.
3. Giorgi F, Huang Y, Nishizawa K and Fu C. 1999. A seasonal cycle simulation over eastern Asia and its sensitivity to radiative transfer and surface processes, J.G.R. vol. 104: 6403-6424.
4. Wei HL, Fu CB and Wang, WC 1998. The effect of lateral boundary treatment of regional climate model on the East Asian summer monsoon rainfall simulation. Chinese Journal of Atmospheric Sciences. Vol.22, No.3:231-243.
5. Fu CB and Xie L. 1998. Global oceanic climate anomalies in 1980's. Advances in Atmospheric Sciences. Vol.15, No.2:167-178.
6. Fu CB and Ye DZ. 1998. Towards predictive understanding of the environmental change in China on decadal to centennial scales. Global Environmental Research, Vol.1, No.1&2: 83-93.
7. Qian Y and Giorgi F. 1999. Interactive coupling of regional climate and sulfate aerosol models over eastern Asia. Journal of Geophysical Research, Vol.104, No.D6: 6477-6499.
8. Wei HL and Fu CB. 1998. Study of the sensitivity of a regional model in response to land cover change over northern China. Hydrological Processes, 12: 2249-2265.
9. Fu CB, Wei HL, Chen M, Su BK, Zhao M and Zheng WZ. 1998. Simulation of the evolution of summer monsoon rainbelts over Eastern China from regional climate model. Scientia Atmospherica Sinica. Vol.22, No.4:522-534.
10. Qian Y, Wang HQ, Fu CB and Wang ZF. 1998. The temporal and special distribution of the radiative effects of the antrhopogenic sulfate aerosols over East Asia. Advances in Atmospheric Sciences. Vol.15, No.3.
11. Fu CB, Wei HL, Qian Y, and Chen M: Documentation on Regional Integrated Environmental Modelling System (RIEMS). Version 1, 1999.
12. Wang LZ and Wei HL: A Users Guide to Online RIEMS. 1999.

CSP3: Asia-Pacific workshop on indices & indicators for monitoring trends in climate extremes

1. Manton MJ, Della-Marta PM, Haylock MR, Hennessy KJ, Nicholls N, Chambers LE, Collins DA, Daw G, Finet A, Gunawan D, et.al. 2001. Trends in extreme daily rainfall and temperature in Southeast Asia and the South Pacific: 1961-1998. International Journal of Climatology, 21:269-284.
2. Page CM, Nicholls N, Plummer N, Trewin B, Manton M, Alexander L, Chambers L, Choi Y, Collins DA, Gosal A, et.al. 2004. Data rescue in the Southeast Asia and South Pacific region. Bulletin of the American Meteorological Society, 85:1483-1489.
3. Griffiths GM, Chambers LE, Haylock MR, Manton MJ, Nicholls N, Baek HJ, Choi Y, Della-Marta PM, Gosai A, Iga N, et.al. 2005. Change in mean temperature as a predictor of extreme temperature change in the Asia-Pacific region. International Journal of Climatology, 25:1301-1330.
4. Nicholls N, Baek HJ, Gosai A, Chambers LE, Choi Y, Collins D, Della-Marta PM, Griffiths GM, Haylock MR, Iga N, et.al. 2005. The El Nino – Southern Oscillation and daily temperature extremes in east Asia and the west Pacific. Geophysics Research Letters, 32, L16714, doi:10.129/2005GL022621.

CSP13: International workshop on reducing vulnerability of agriculture and forestry to climate variability & climate change

1. Salinger J, Sivakumar MVK, and Motha R (Eds.) 2005. Increasing Climate Variability and Change: Reducing the vulnerability of agriculture and forest. Climatic Change, Volume 70:Nos. 1–2. http://dx.doi.org/10.1007/1-4020-4166-7_1.

CSP17: Applying Climate Information to Enhance the Resilience of Farming Systems Exposed to Climatic Risk in South and Southeast Asia

1. Kumar KK, Kolli RK, Ashrit RG, Deshpande NR and Hansen JW. 2004. Climate impacts on Indian agriculture. Int. J. Climatol. 24:1375-1393.
2. Selvaraju R. 2003. Impact of El Niño-Southern Oscillation on Indian foodgrain production. Int. J. Climatology. 23:187-206.
3. Meinke H, Nelson R, Stone RC, Selvaraju R and Baethgen W. 2006. Actionable climate knowledge – from analysis to synthesis. In: Hansen JW, Sivakumar MVK and Bates BC (Eds.), Advances in Applying Climate Prediction to Agriculture. Climate Research Special 16, Volume 33: 101-110.
4. Selvaraju R, Venkatesh R, Babu C, Meinke H and Hansen JW. 2006. Impact of climate variability on smallholder farmers' farm level income inequality and food security: a comparison across farming systems and water availability scenarios. World Development.
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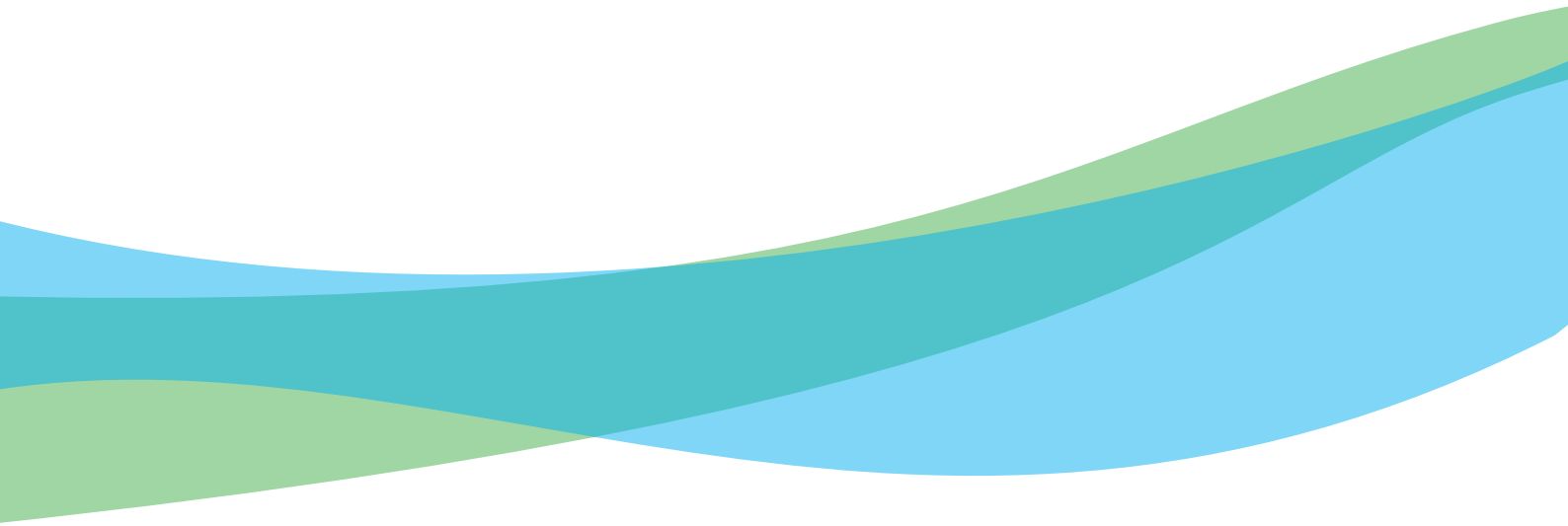

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