Climate Resilient Farming Communities through Innovative Risk Transfer Mechanisms:

Integrated Financial Package-cum-Weather Index-based Insurance (WIBI)

An Experience in Southern Philippines

A presentation by

Lurraine Baybay Villacorta

Project Manager, Climate Change Adaptation Project,

International Labour Organization (ILO)

CCAP is Outcome 3.4 Demo Project of

MDG ACHIEVEMENT FUND

MDG-F 1656: Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change

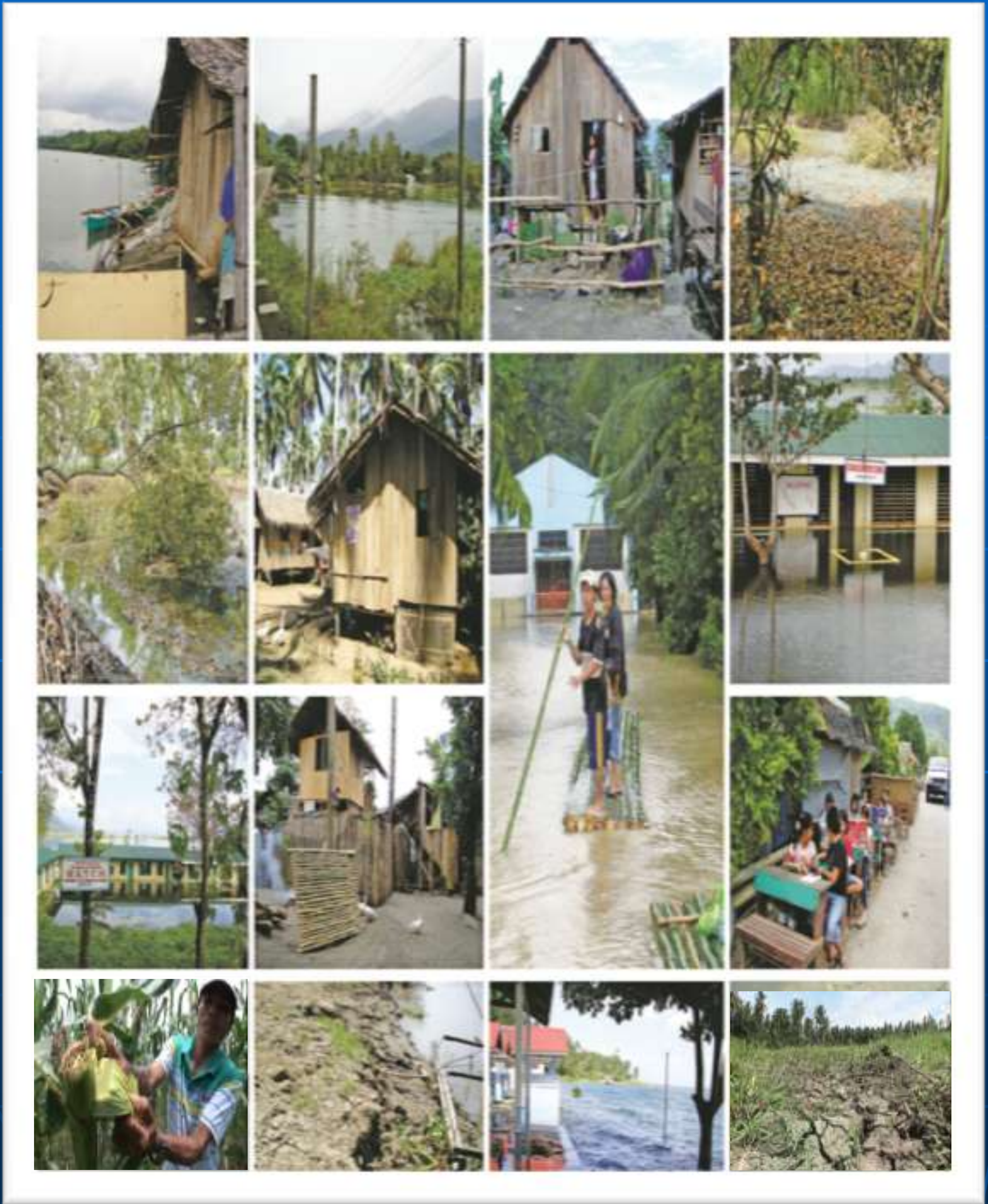
Implemented by:

International Labour Organization

A UN-GOP and Public-Private Partnership

Key Partners:

Other Collaborators:



Climate-related disasters represent a major source of risks for the POOR in particular, the FARMERS who are dependent on "good weather" for their survival and livelihood!

International Labour Organization

Premises:

Key Determinants of Adaptive Capacity to CC

1-Economic condition

2-Availability of and access to financial & productive resources

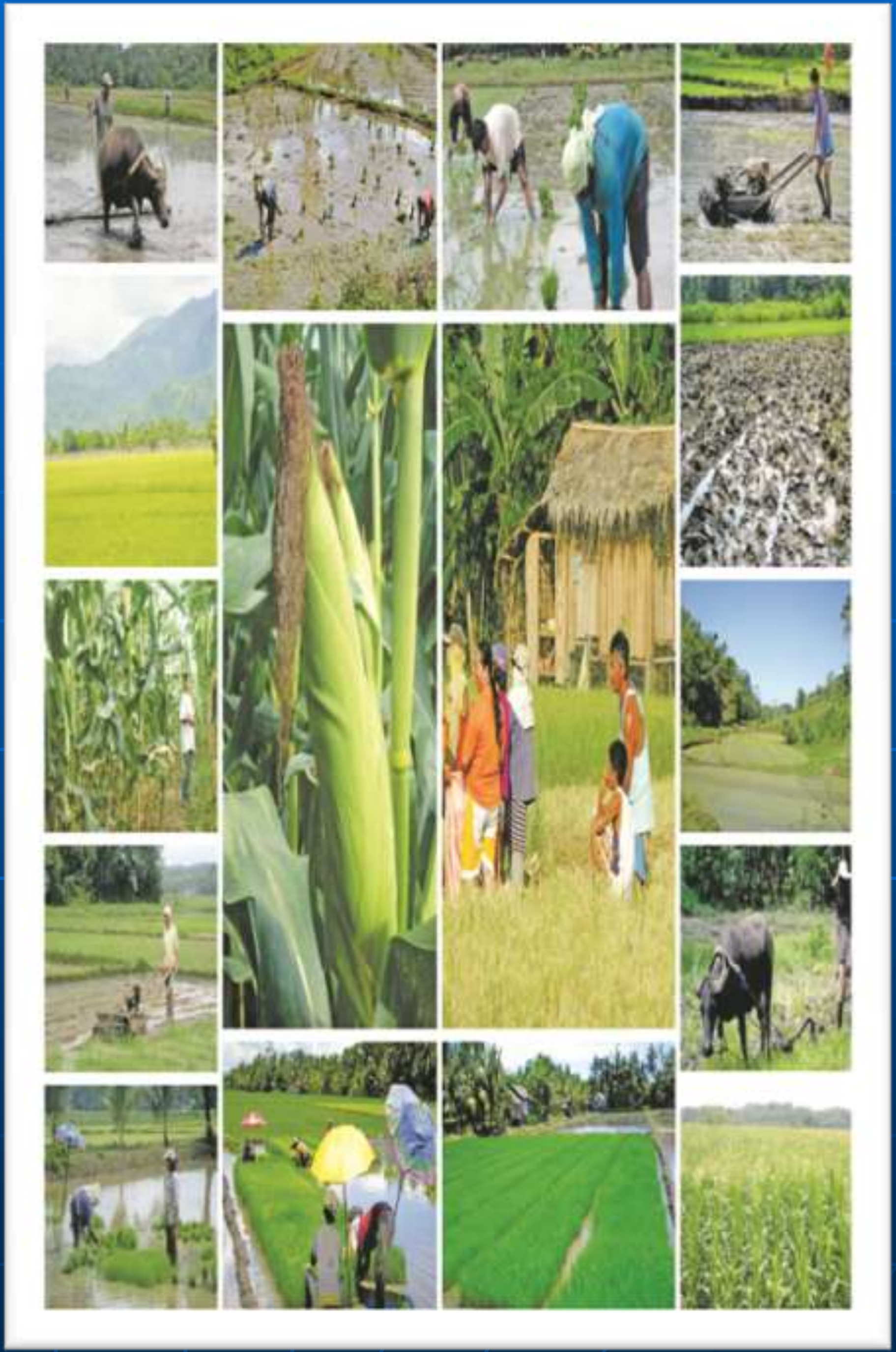
International Labour Organization

...measures to provide access to "market-based instruments" often fail as they do NOT address the CORE PROBLEM...

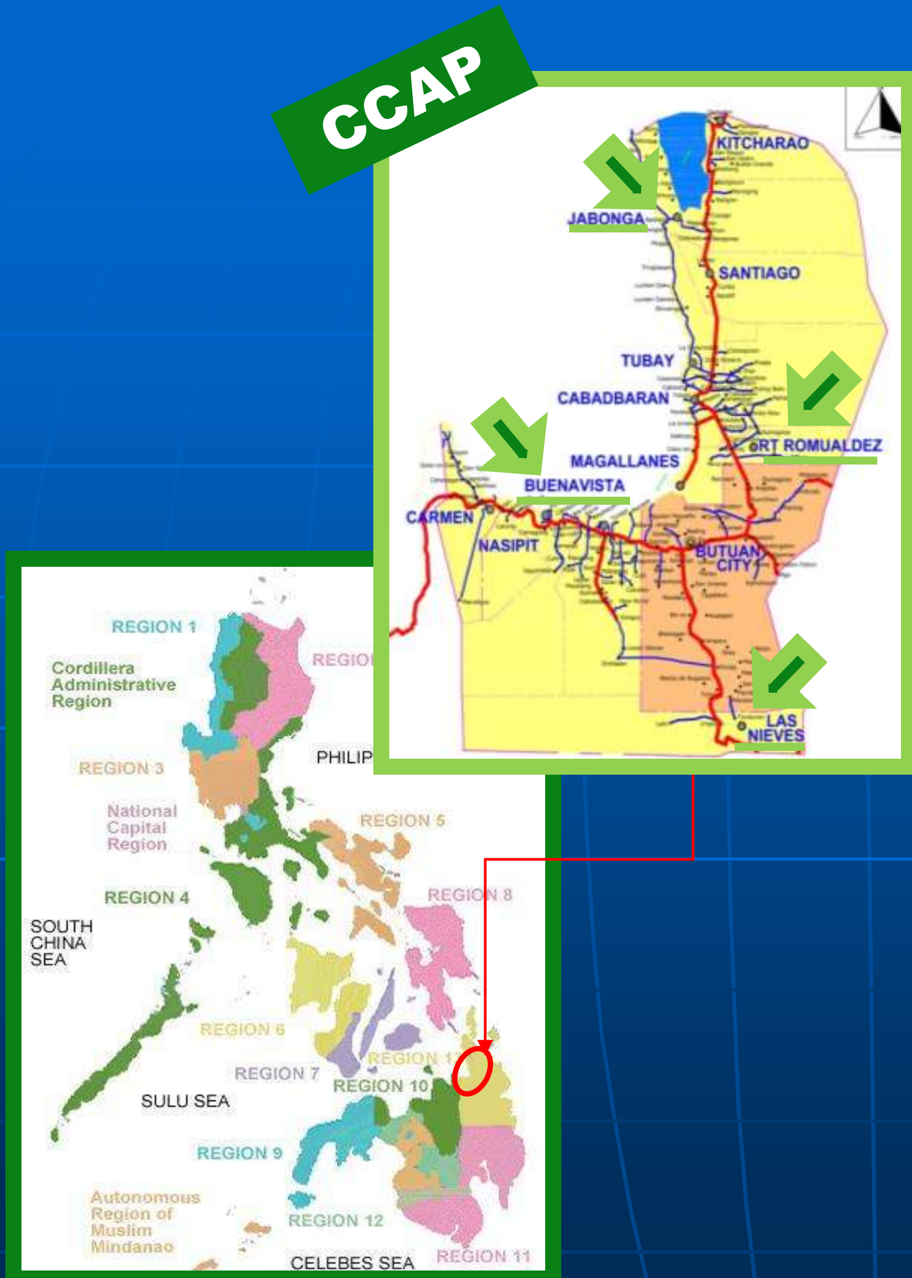
the POOR just could NOT afford them.

International Labour Organization

"Integrated Financial mechanisms that facilitate risk transfer & risk sharing (credit and insurance) are key "Agricultural Solutions" for Farming communities enhancing their adaptive capacity thereby reduce their vulnerability, to climate change risks & impacts "



International Labour Organization



Agusan del Norte

"where water flows" allusion to the mighty Agusan River

1 city, 10 municipalities
167 barangays, 126 rural
273,024 hectares
314,027 population
57 % or 31,913 households live below poverty line. Majority are farming HHs
7 banks with MF function operate in Agusan del Norte.

International Labour Organization

Agusan del Norte Farmers

- Lack access to credit Information
- Generally obtain financing from traders at very high interest
- Lack acceptable collateral
- Have unstable income & cash flow
- Have low paying capacity- Low availment of insurance (crop and health)
- With limited business knowledge and experience

International Labour Organization

3 Models of Innovative Integrated Financial Package :

Credit delivery cum Savings, Social Protection Mechanisms, Capability-building Support for crop production and alternative livelihoods of Climate risks-vulnerable farming communities.

Test Run: 836 farmers
(435 W/347M)

Total loans released:
- Php15,130,500 - US$ 350,000+
- Rice/Corn Prodn- US$262,000+
- Corn 81 farmers/143.1 has.
- Rice 455 farmers/659.2 has.
- Alternative livelihood- US$89,000+

International Labour Organization

NOT

Financing as Usual: LGU, Coop & Rural Bank

0.83% 1% 2.3%

- Low interest
- Non-collateralized
- Less document requirements
- Simplified processing
- Production-cycle responsive releasing
- Coop/RB-w/ savings component

- Bundled with non-financial services
  - Financial literacy
  - Techno support (Envt-CC Briefings, FFS/IPM IPM/Organic Farming
  - Market info/Assistance
- Insurance
  - health, crop, credit life

International Labour Organization

Financing NOT as Usual: Integrated Financial Package

Development /Implementation Experience

- Preparatory Studies- Baseline Study
  Vulnerability & Adaptation Assessment
  Farming Value Chain Mapping & Analysis,
  Market Research- DTI and other partners

- Establishing partnerships with financial service providers- private & public [Peoples Bank of Caraga, Baug CARP Beneficiaries Multipurpose Coop and LGUs

- Orientations & Awareness raising on the financial packages by the FSPs

DTI- CCAP Focal Team

International Labour Organization

Insurance ^NOT as Usual: Weather-Index based Insurance (WIBI) Package : Rice and Corn- Low and Excess Rainfall

- Affordable premiums 3.04% Rice 6.18% Corn
- Faster pay-outs
  - -No field assessments of damages
  - -No need for filing of claims pay-out automatic upon breach of index
- Bundled with support services:
  - - WIBI literacy
  - - Techno Training: Good Agri Practices& Pest Control (FFS-IPM)

International Labour Organization

Insurance NOT as Usual: ILO-PCIC WIBI Weather-Index based Insurance Product

Development Experience

- Preparatory Studies- Baselines, V&A, Value Chain Mapping & Analysis, Market Research
- Partnerships- PCIC, DOST-PAGASA, DA, Municipal Agriculture Offices, PhilRice, Financial Service Providers
- Support from ILO-Microinsurance Innovation Facility
- Data Sources
  - 30 year historical data
  - Climate Scenarios and Projections
  - Crop yield data from DA, MAO Farmers
  - Crop water requirements from DA/PhilRice

ILO-PCIC WIBI Product Devt Team

International Labour Organization

Insurance NOT as Usual: ILO-PCIC WIBI Weather-Index based Insurance Product

Implementation Experience (Cycle 1)

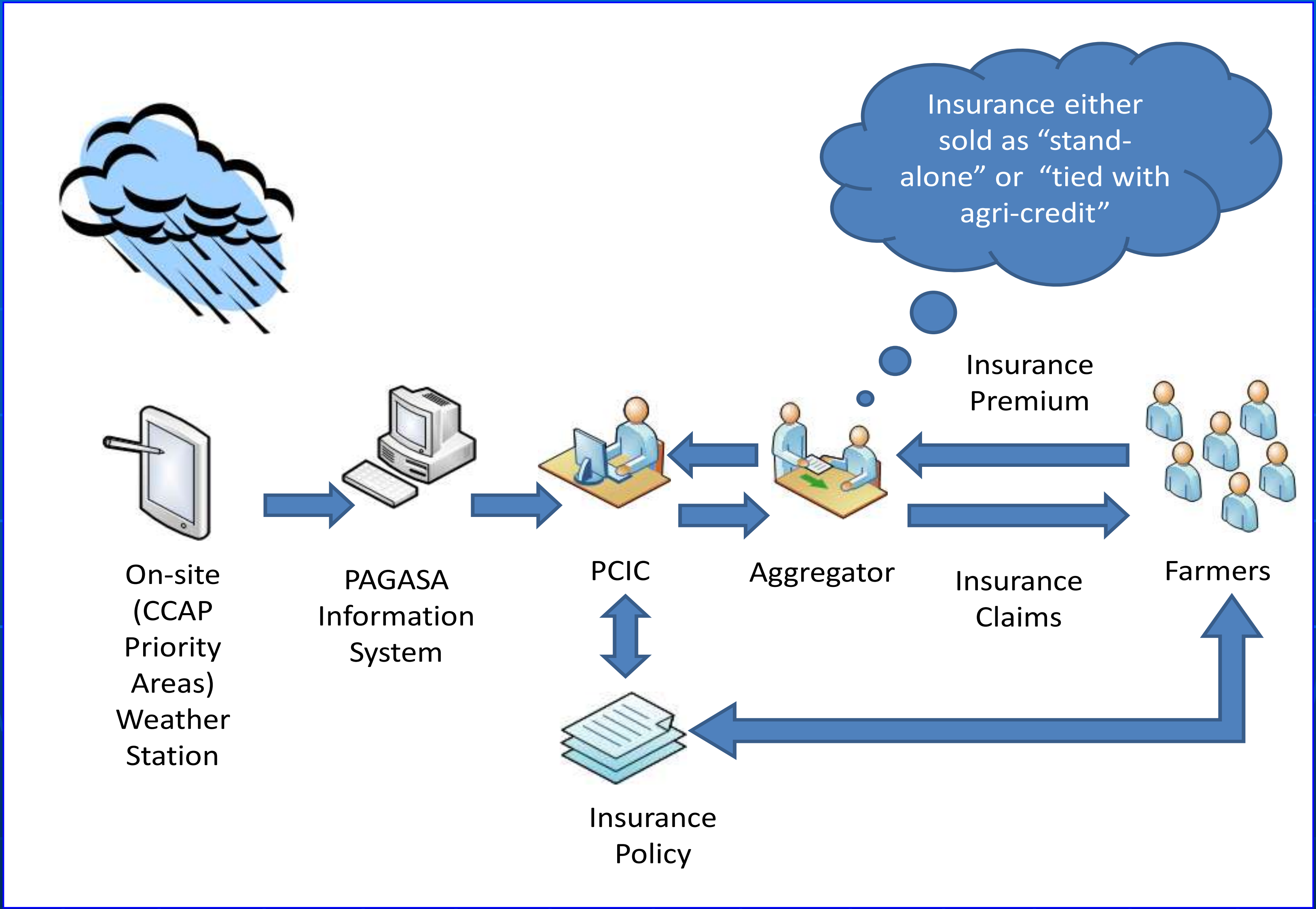
- WIBI Literacy- Mun. CCAP Focal Teams
- Sales, Mgt of Claims- PCIC & FSPs
- Climate Information System-
- DOST-PAGASA supported by
- DOST-Regional Office & LGUs
- Technology Support-LGUs/DA

145 rice farmers enrolled 83women/62men
165 hectares
Insurance coverage-Php4.09M

56 farmers 27 women/29men *received*

Payout ~Php500T+ from PCIC for breach of low rainfall index

International Labour Organization


Insurance either sold as "stand-alone" or "tied with agri-credit"
Insurance Premium
On-site (CCAP Priority Areas) Weather Station
PAGASA Information System
PCIC
Aggregator
Insurance Claims
Farmers
Insurance Policy

Financing + Insurance + Risk Reduction through Early Warning & Preparedness

- Weather Instruments/ EWDs installed
- Municipal/Barangays with operational EWS plans and trained monitors

- Local AWS Reference Stations
- Back-up Stations and EWDs

International Labour Organization

Lessons Learned

- Understand target group' characteristic and needs for financial and non-financial services through relevant analysis inc. V&A in order to for more effective design of diversified, affordable and sustainable packages
- Emphasis on offering savings products (voluntary or compulsory) to help farmers to better deal with emergencies including disasters and to be less loan dependent for their economic activities.
- Consider bundling financial services with non-financial services such as trainings (agricultural, business, financial education trainings) in order to make a package more attractive to the farmers & increase their opportunities to maximize farm outputs, diversify or engage in more productive activities.

International
Labour
Organization

Lessons Learned

- Integrate social protection mechanisms to include crop, credit life and health to strengthen confidence of farmers to engage in agriculture risk taking while protecting their crops and their families.
- Engage in Public and Private Partnership with LGUs, training institutes, insurance companies) to facilitate the effective and sustainable provision of financial (insurance) and/or non-financial (agricultural and entrepreneurship training) services.
- Integrate risk reduction measures to financial packages for reduced exposure and more effective resilience-building work.

International
Labour
Organization

...seen as resulting as well in incomes from related jobs & industries- potentially GREEN JOBS

- Workers in the Organic Fertilizer Production Plants
- Workers in Hauling & trucking
- Local labourers for rural protective structures
- Fabricators of Weather/Early Warning devices (EWDs)
- EWD Monitors and recorders
- Training-Skills & Tooling

International Labour Organization

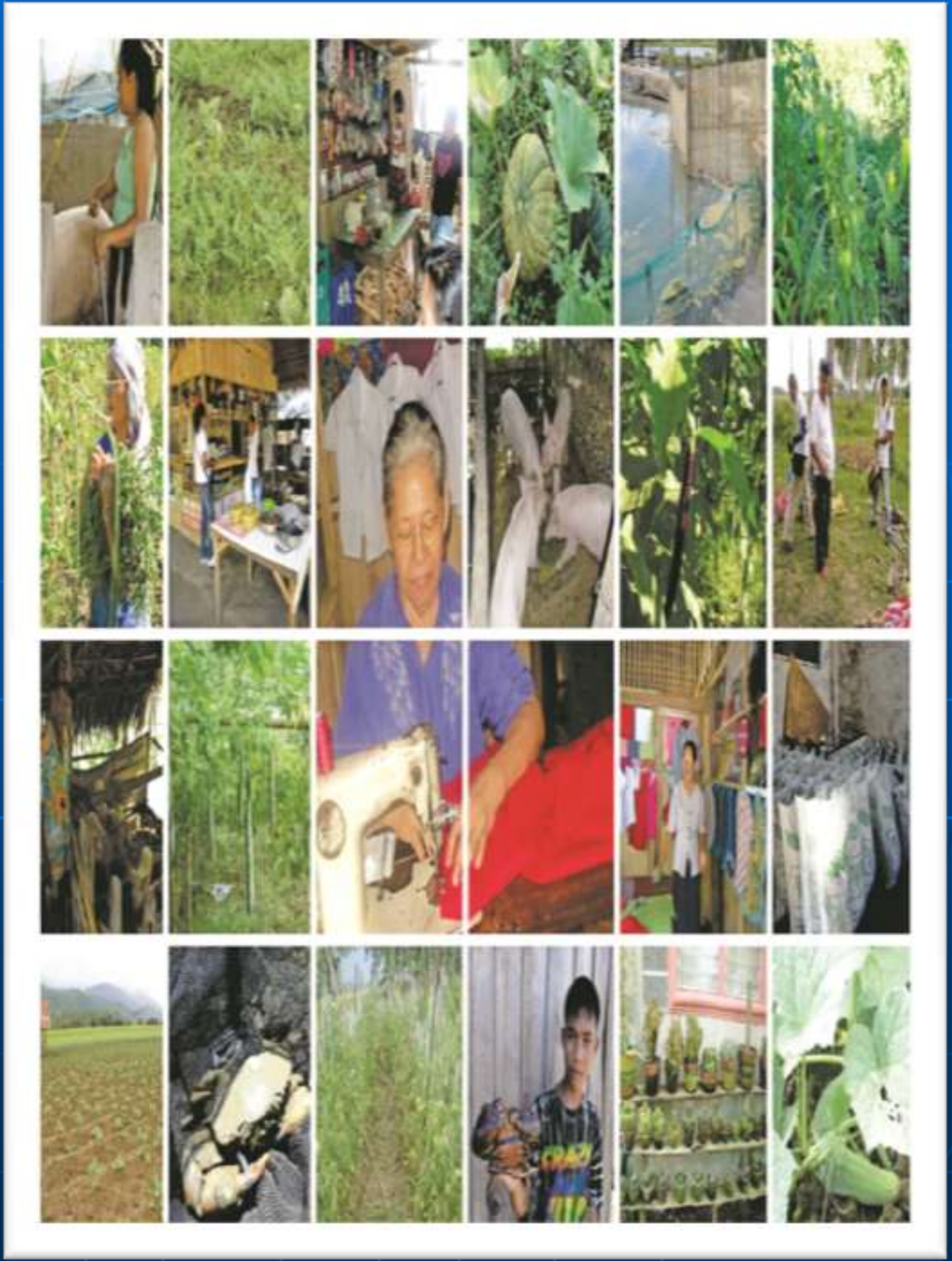
“demonstration that financial mechanisms build resilience as they:

- **Unlock productivity,**
- **allow farmers to undertake alternatives & “greener” economic activities**

and

- **plan out a more sustainable livelihood”**

International
Labour
Organization



Innovative Integrated Financial Packages with Risk Reduction & Preparedness work to increase Adaptive Capacity, address Inequalities, minimize exposure and help ensure CC risks- resilient communities.



A resilient community can ANTICIPATE and PLAN for a sustainable future.

Thank you!

International Labour Organization

SPECIAL FEATURE

Adapting agriculture to climate change

S. Mark Howden*[†], Jean-François Soussana[‡], Francesco N. Tubiello[§¶], Netra Chhetri[‖], Michael Dunlop*, and Holger Meinke**

*Commonwealth Scientific and Industrial Research Organization, Sustainable Ecosystems, GPO Box 284, Canberra ACT 2601, Australia; [‡]Institut National de la Recherche Agronomique, UR874, 63100 Clermont-Ferrand, France; [§]Goddard Institute for Space Studies, Columbia University, 2880 Broadway, New York, NY 10025; [¶]International Institute for Applied Systems Analysis, Schlossplatz 1, A-2361 Laxenburg, Austria; [‖]Consortium for Science, Policy and Outcomes, Arizona State University, P.O. Box 874401, Tempe, AZ 85287-4401; and **Department of Plant Sciences, Wageningen University, P.O. Box 430, NL 6700 AK, Wageningen, The Netherlands

Edited by William Easterling, Pennsylvania State University, University Park, PA, and accepted by the Editorial Board August 16, 2007 (received for review March 1, 2007)

The strong trends in climate change already evident, the likelihood of further changes occurring, and the increasing scale of potential climate impacts give urgency to addressing agricultural adaptation more coherently. There are many potential adaptation options available for marginal change of existing agricultural systems, often variations of existing climate risk management. We show that implementation of these options is likely to have substantial benefits under moderate climate change for some cropping systems. However, there are limits to their effectiveness under more severe climate changes. Hence, more systemic changes in resource allocation need to be considered, such as targeted diversification of production systems and livelihoods. We argue that achieving increased adaptation action will necessitate integration of climate change-related issues with other risk factors, such as climate variability and market risk, and with other policy domains, such as sustainable development. Dealing with the many barriers to effective adaptation will require a comprehensive and dynamic policy approach covering a range of scales and issues, for example, from the understanding by farmers of change in risk profiles to the establishment of efficient markets that facilitate response strategies. Science, too, has to adapt. Multidisciplinary problems require multidisciplinary solutions, i.e., a focus on integrated rather than disciplinary science and a strengthening of the interface with decision makers. A crucial component of this approach is the implementation of adaptation assessment frameworks that are relevant, robust, and easily operated by all stakeholders, practitioners, policymakers, and scientists.

adaptation | greenhouse | cropping | grazing | forestry

Agriculture is the major land use across the globe. Currently ≈1.2–1.5 billion hectares are under crops, with another 3.5 billion hectares being grazed. Another 4 billion hectares of forest are used by humans to differing degrees, whereas, away from land, global fisheries are used very intensively, often beyond capacity (1). To meet projected growth in human population and per capita food demand, historical increases in agricultural production will have to continue, eventually doubling current production (e.g., ref. 2). Agriculture is also a major economic, social, and cultural activity, and it provides a wide range of ecosystem services. Importantly, agriculture in its many different forms and locations remains highly sensitive to climate variations, the dominant source of the overall interannual variability of production in many regions and a continuing source of disruption to ecosystem services. For example, the El Niño Southern Oscillation phenomenon, with its associated cycles of droughts and flooding events, explains between 15% and 35% of global yield variation in wheat, oilseeds, and coarse grains (3). This existing sensitivity explains why a changing climate will have subsequent impacts on agriculture. Hence, it has become critical to identify and evaluate options for adapting to climate change in coming decades. Here we use the term "adaptation" to include the actions of adjusting practices, processes, and capital in response to the actuality or threat of climate change, as well as responses in the decision environment, such as changes in social and institutional structures or altered technical options that can affect the potential or capacity for these actions to be realized (4).

We argue there is a strong rationale for an increasing focus on adaptation of agriculture to climate change. This need arises from several considerations:

1. Past emissions of greenhouse gases have already committed the globe to further warming of ≈0.1°C per decade for several decades (5), making some level of impact, and necessary adaptation responses, already unavoidable.
2. The emissions of the major greenhouse gases are continuing to increase (6), with the resultant changes in atmospheric CO_2 concentration, global temperature, and sea level observed today already at the high end of those implied by the scenarios considered by the Intergovernmental Panel on Climate Change (IPCC) (7). Furthermore, some climate change impacts are happening faster than previously considered likely (5). If these trends continue, then more proactive and rapid adaptation will be needed.
3. There is currently a lack of progress in developing global emission-reduction agreements beyond the Kyoto Protocol, leading to concerns about the level of future emissions and hence climate changes and associated impacts.
4. The high end of the scenario range for climate change has increased over time (5, 8, 9), and these potentially higher global temperatures may have nonlinear and increasingly negative impacts on existing agricultural activities (1).
5. Climate changes may also provide opportunities for agricultural investment, rewarding early action taken to capitalize on these options (10).

There is an immense diversity of agricultural practices because of the range of climate and other environmental variables; cultural, institutional, and economic factors; and their interactions. This means there is a correspondingly large array of possible adaptation options. The objectives of this paper are first to outline these options for cropping and livestock systems, forestry, and fisheries, using the literature on crop yields as an example to assess the benefits of adaptation; and second, to suggest some general pathways that can help move from technical assessment of adaptation options to more practical action. Accordingly, we identify some preconditions for more effective uptake of adaptations; develop an adaptation framework to engage all decision makers (farmers, agribusiness, and policymakers) that builds on the existing substantial knowledge of

Author contributions: S.M.H. and N.C. analyzed data; and S.M.H., J.-F.S., F.N.T., M.D., and H.M. wrote the paper.

The authors declare no conflict of interest.

This article is a PNAS Direct Submission. W.E. is a guest editor invited by the Editorial Board.

Abbreviation: IPCC, Intergovernmental Panel on Climate Change.

[†]To whom correspondence should be addressed. E-mail: mark.howden@csiro.au.

This article contains supporting information online at www.pnas.org/cgi/content/full/0701890104/DC1.

© 2007 by The National Academy of Sciences of the USA

SUSTAINABILITY SCIENCE
AGRICULTURAL SCIENCES

agricultural systems; and outline how science itself needs to adapt to remain relevant in this issue.

Results

Adaptation: What Is in It for Us? The purpose of undertaking agricultural adaptation is to effectively manage potential climate risks over the coming decades as climate changes. Adaptation research undertaken now can help inform decisions by farmers, agrobusiness, and policy makers with implications over a range of timeframes from short-term tactical to long-term strategic (1). However, it is particularly important to align the scales (spatial, temporal, and sectoral) and reliability of the information with the scale and nature of the decision. For example, short-term climate adaptation by farmers may be accomplished by taking into account local climate trends if there is a strong correspondence between these trends and projected climate changes, or it may be via climate forecasting at scales from daily to interannual. However, farmers may find limited utility in long-term projections of climate, given the high uncertainties at the finer spatial and temporal scales at which their decisions are made (11). In contrast, the general trends at larger time and spatial scales able to be more reliably projected with current climate models may be quite useful for input into policy and investment analyses, provided potentially critical factors are incorporated such as changes in climate extremes (12). A significant benefit from adaptation research may be to understand how short-term response strategies may link to long-term options to ensure that, at a minimum, management and/or policy decisions implemented over the next one to three decades do not undermine the ability to cope with potentially larger impacts later in the century. In the sections below, we try to identify other key benefits from an increased focus on climate change adaptation.

Keeping Policy Relevant. At the current relatively early stage of the debate, it is understandable that climate change adaptation is largely being dealt with in isolation from other issues (although see ref. 13). However, over time, this situation needs to evolve so that climate change is linked with a much broader set of policies. In particular, there is a need for linkage with existing policies on climate risk such as those on drought or structural adjustment, which otherwise may become poorly targeted. Climate change will require these policies to become more dynamic, to cope with the high level of uncertainty in the timing and magnitude of potential climate changes and the rapidly evolving knowledge base. Furthermore, climate change adaptation policies will interact with, depend on, or perhaps even be just a subset of policies on sustainable development and natural resource management, such as those necessary to regulate genetically modified organisms, protect human and animal health, and foster governance and political rights, among many others. This process is often referred to as the "mainstreaming" of climate change adaptation into policies intended to enhance broad resilience to risk or to promote sustainable development (4, 14). The critical issues of how climate change and adaptation may affect food security and trade and the risk of malnourishment are dealt with in a companion paper (13).

Informing Mitigation Targets. Importantly, identifying and evaluating possible adaptation strategies are of fundamental value to determine a set of dynamic climate policy options that lead to the "avoidance of dangerous anthropogenic interference" component (Article 2) of the United Nations Framework Convention on Climate Change (65). This is because maximizing societal welfare under future climate risk will likely involve a mix of both mitigation and adaptation; the percentage contribution of each strategy will depend on monetary and nonmonetary cost/benefit analyses. For example, we would expect the size and cost of the adaptation task to be lower if there is effective, but perhaps costly, mitigation and higher if there is no mitigation. Similarly, the benefits of adaptation will be a function of the nature of climate change and the scale of impact. Consequently, inadequate consideration of adaptation options could result in the vulnerability to climate change being significantly overstated, giving rise to more severe mitigation targets. Additionally, mitigation policies can affect the range of adaptation options that practitioners have at their disposal (e.g., subsidizing biofuel production strongly influences the market for agricultural produce). Another perspective is that implementing effective adaptation can "buy time" until an effective mitigation response can be mounted. Hence adaptation analyses may be used to inform both the magnitude and timing of mitigation. Achievement of this complex task of effectively integrating mitigation impacts and adaptation to inform public policy development remains a significant challenge for the scientific community, although some studies are now emerging (15). This interaction of science and policy needs to evolve as the scientific knowledge base changes and may also focus attention on the importance of integrative rather than disciplinary science within the science–policy interface (16).

Informing Investment. Adaptation analyses can also help inform governments and industry of the investment or disinvestment decisions they need to make now or in the near future in relation to climate-sensitive aspects of their portfolios (e.g., ref. 1). In particular, this applies to long-term investments such as plant and animal breeding programs; building capacity in the scientific and user communities; developing quarantine systems; establishing perennial crops and forest plantations; purchasing or selling land; or building (or decommissioning) major infrastructure such as dams and water distribution systems, flood mitigation works, and storage and transport facilities. Climate risks are, of course, only one consideration within more complex decision-making processes (10). For example, in Western Australia, increased risk of drought under global warming was integrated with projections of population growth, economic development, and social norms in relation to water use, resulting in the construction of a major new dam and development of other new water sources (17).

Rewarding Early Adopters. Participatory research into climate change adaptation options can help agricultural decision makers realize that acting on the existing trends in climate now is likely to be to their advantage (e.g., ref. 18). For example, in northeast Australia, crop management that has continuously adjusted to the progressive reduction in frost risk experienced over the past several decades can almost double gross margins when compared with management based on either the long-term risk or management that does not consider frost risk (19). Participatory engagement with decision makers, by bringing their practical knowledge into the assessment, can also identify a more comprehensive range of adaptations than are typically explored by scientists, as well as being able to assess the practicality of options and contribute to more realistic assessment of the costs and benefits involved in management or policy change (19).

Focusing on Climate Risk Management. Finally, it should be recognized that "adaptation" is an ongoing process that is part of good risk management, whereby drivers of risk are identified, and their likely impacts on systems under alternative management are assessed. In this respect, adaptation to climate change is similar to adaptation to climate variability, changes in market forces (cost/price ratios, consumer demands, etc.), or institutional or other factors. Differences may be in the rate of realized climate change, compared with how fast we are able to implement needed solutions. Isolating climate change from other drivers of risk may be helpful, especially during the initial stages of assessment when awareness of the relative importance of this risk factor is still low. Operationally, however, translating adaptation options into adaptation actions requires consideration of a more comprehensive risk management framework. This would allow exploration of quantified scenarios dealing with all of the key sources of risk, providing more effective

Table 1. Mean benefit of adapting wheat cropping systems to impact of temperature and rainfall changes calculated as the difference between percent yield changes with and without adaptation

Adaptation benefit	Rainfall change	Temperature change, °C		
		Less than 2°C	2–4°C	Greater than 4°C
Yield change, %	Rainfall increase	26.9 ± 6.0	18.7 ± 4.7	17.4 ± 4.0
	Rainfall decrease	9.0 ± 5.3	11.1 ± 2.6	15.0 (na)

Values are means and standard errors [not applicable (na): $n = 1$]. The mean benefit of adapting was not significantly different for temperate and tropical systems (17.9% vs. 18.6%, $P = 0.86$). Data sources are listed in figure 5.2 of Easterling *et al.* (1).

decision making and learning for farmers, policymakers, and researchers: an increase in "climate knowledge" (20).

Changing Management Unit Decisions

Changes in practices at the management unit level will be a key component in adapting agriculture to climate change (1). Consequently, we outline here a range of such adaptations for cropping, livestock, forestry, and fishery systems. However, adaptations at this level can be strongly influenced by policy decisions to establish or strengthen conditions favorable for effective adaptation activities through investment in new technologies and infrastructure (4), which are dealt with below.

Cropping Systems. Many management-level adaptation options are largely extensions or intensifications of existing climate risk management or production enhancement activities in response to a potential change in the climate risk profile (1). For cropping systems, there are many potential ways to alter management to deal with projected climatic and atmospheric changes (including refs. 21–26). These adaptations include:

- Altering inputs such as varieties/species to those with more appropriate thermal time and vernalization requirements and/or with increased resistance to heat shock and drought, altering fertilizer rates to maintain grain or fruit quality consistent with the prevailing climate, altering amounts and timing of irrigation and other water management.
- Wider use of technologies to "harvest" water, conserve soil moisture (e.g., crop residue retention), and use and transport water more effectively where rainfall decreases.
- Managing water to prevent water logging, erosion, and nutrient leaching where rainfall increases.
- Altering the timing or location of cropping activities.
- Diversifying income through altering integration with other farming activities such as livestock raising.
- Improving the effectiveness of pest, disease, and weed management practices through wider use of integrated pest and pathogen management, development, and use of varieties and species resistant to pests and diseases and maintaining or improving quarantine capabilities and monitoring programs.
- Using climate forecasting to reduce production risk.

If widely adopted, these adaptations singly or in combination have substantial potential to offset negative climate change impacts and to take advantage of positive ones. For example, in a modeling study for Modena, Italy (23), simple and feasible adaptations altered significant negative impacts on sorghum (−48% to −58%) to neutral to marginally positive ones (0 to +12%). In that case, the adaptations were to alter varieties and planting times to avoid drought and heat stress during the hotter and drier summer months predicted under climate change. When summarized across many adaptation studies, there is a tendency for most of the benefits of adapting the existing systems to be gained under moderate warming (<2°C) then to level off with increasing temperature changes (Table 1; ref. 27). Additionally, the yield benefits tend to be greater under scenarios of increased than decreased rainfall (Table 1), reflecting that there are many ways of more effectively using more abundant resources, whereas there are fewer and less-effective options for significantly ameliorating risks when conditions become more limiting.

The figures in Table 1 are from a synthesis of climate change impact simulations for the recent Intergovernmental Panel on Climate Change review (1), spanning the major cereal crops wheat, rice, and maize, and representing a wide range of agroclimatic zones and management options. This synthesis indicates that benefits of adaptation vary with crop (wheat vs. rice vs. maize) and with temperature and rainfall changes (Table 1; ref. 1). For wheat, the potential benefits of management adaptations are similar in temperate and tropical systems (17.9% vs. 18.6%; Table 1). The benefits for rice and maize are smaller than for wheat, with a 10% yield benefit when compared with yields when no adaptation is used (1). These improvements to yield translate to damage avoidance of up to 1–2°C in temperate regions and up to 1.5–3°C in tropical regions, potentially delaying negative impacts by up to several decades (1), providing valuable time for mitigation efforts to work.

There are several significant caveats that need to be applied in relation to the above positive results on impacts and adaptation. In particular, the simulation models used in the component studies do not yet adequately represent potential impacts of change in pest and disease effects or air pollution, and there remains uncertainty as to the effectiveness of the representations of CO_2 responses (2). Additionally, many of these studies changed neither the variability of the climate nor the frequency of climate extremes, both of which can significantly affect yield (2). There is also often the assumption of full capacity to implement the adaptations, whereas this may not be the case, particularly in regions where subsistence agriculture is predominantly practiced (28). Last, some of the studies were of irrigated production systems where the implications of possible reductions in irrigation water availability are not included (29). Collectively, these factors could reduce the beneficial effects, such as those associated with elevated CO_2, and increase the negative effects, such as those from increased temperatures and rainfall reductions. This would reduce the amount of time that adaptation would delay significant negative impacts, i.e., adaptation would "buy less time" than is indicated above. On the other hand, the adaptations assessed were only a small subset of those feasible, usually focusing on marginal change in practices to maintain the existing system such as changing varieties, planting times, and use of conservation tillage. Inclusion of a broader range of adaptations, including more significant and systemic change in resource allocations, would presumably increase the benefits, particularly if those adaptations included alternative land use and livelihood options. For instance, so-called Ricardian studies (30) that implicitly incorporate such adaptation routinely find impacts of climate change that are lower than those assessed using crop models. The balance between these opposing tendencies is currently unclear; more comprehensive analyses to identify the limits of adaptation are warranted.

Livestock Systems. Adaptations in field-based livestock include additional care to continuously match stock rates with pasture production, altered rotation of pastures, modification of times of grazing, and timing of reproduction, alteration of forage and animal species/breeds, altered integration within mixed livestock/crop systems including using adapted forage crops, reassessing fertilizer applications, care to ensure adequate water supplies, and use of supplementary feeds and concentrates (31–33). It is important to note, however, that there are often limitations to these adaptations; for example, more heat-tolerant livestock breeds often have lower levels of productivity.

In intensive livestock industries, there may be reduced need for winter housing and for feed concentrates in cold climates, whereas in warmer climates there might be increased need for management and infrastructure to ameliorate heat-stress-related reductions in productivity, fertility, and increased mortality. Furthermore, the capacity to implement infrastructural adaptations could be low in many tropical regions, whereas in the midlatitudes, the risk of reduction in water availability for agriculture (29) may limit adaptations that use water for cooling.

Forestry. A large number of adaptation strategies have been suggested for planted forests, including changes in management intensity, hardwood/softwood species mix, timber growth, harvesting patterns within and between regions, rotation periods, salvaging dead timber, shifting to species or areas more productive under the new climatic conditions, landscape planning to minimize fire and insect damage, adjusting to altered wood size and quality, and adjusting fire management systems (34–36). Adaptation strategies to control insect damage can include prescribed burning for reducing forest vulnerability to increased insect outbreaks, nonchemical insect control (e.g., baculoviruses), and adjusting harvesting schedules, so that those stands most vulnerable to insect defoliation would be harvested preferentially. Under moderate climate changes, these proactive measures may potentially reduce the negative economic consequences of climate change (37). However, as with other primary industry sectors, there is likely to be a gap between potential adaptations and realized actions. For example, large areas of forests, especially in developing countries, receive minimal direct human management (38), limiting adaptation opportunities. Even in more intensively managed forests where adaptation activities may be feasible (37), the long time lags between planting and harvesting trees will complicate decisions, because adaptation may take place at multiple times during a forestry rotation.

Fisheries. Marine ecosystems are, in some respects, less geographically constrained than terrestrial systems. The rates at which planktonic ecosystems have shifted their distribution have been very rapid over the past three decades, and this can be regarded as natural adaptation to a changing physical environment (39). Most fishing communities depend on stocks that fluctuate because of interannual and decadal climate variability and consequently have developed considerable coping capacity (40). With the exception of aquaculture and some freshwater fisheries, the exploitation of natural fish populations, which are common property resources, precludes the kind of management adaptations to climate change of the kind suggested for the crop, livestock, and forest sectors. Adaptation options thus center on altering catch size and effort and improving the environment where breeding occurs. Three-quarters of world marine fish stocks are currently exploited at levels close to or above their productive capacity (41). Reductions in the level of fishing are therefore required in many cases, independently of climate change stresses, to sustain yields of fish stocks. Such reductions may at the same time improve resilience of fish stocks to climate change (42). The scope for management-level adaptation is increasingly restricted as new regulations governing exploitation of fisheries and marine ecosystems come into force. Scenarios of increased level of displacement and migration are likely to put a strain on communal-level fisheries management and resource access systems and weaken local institutions and services. Despite their adaptive value for the sustainable exploitation of natural resource systems, human migrations negatively affect economic development (43).

Changing the Decision Environment

Adaptation at the management unit level, based on current decision environments, may not fully cope with climate changes. Hence, deliberate measures, planned ahead of time at local, regional, national, and international levels, may be needed to facilitate a broader range of responses. Many options for policy-based adaptation to climate change have been identified for agriculture, forests, and fisheries (18, 44–47). These can involve adaptation activities such as developing infrastructure, capacity building in the broader user community and institutions, and in general modifications to the decision-making environment under which management-level adaptation activities typically occur (4). The process of "mainstreaming" adaptation into policy planning in the face of risk and vulnerability at large is an important component of adaptation planning (14). However, there are formidable environmental, economic, informational, social, attitudinal, and behavioral barriers to the implementation of adaptation (4). The following is a suggested approach to beginning to deal with these barriers, building adaptive capacity and changing the decision environment to promote adaptation actions (18).

1. To change their management, enterprise managers need to be convinced that projected climate changes are real and are likely to continue (48, 49). This will be facilitated by policies that maintain climate monitoring and by communicating this information effectively, including targeted support of surveillance of pests, diseases, and other factors directly affected by climate.
2. Managers need to be confident that the projected changes will significantly impact on their enterprise (50). Policies that support the research, systems analysis, extension capacity, industry, and regional networks that provide this information could thus be strengthened. This includes modeling techniques that allow scaling up knowledge from gene to cell to organisms and eventually to the management systems and national policy scales.
3. Technical and other options necessary to respond to the projected changes need to be available. Where existing technical options are inadequate, investment in new technical or management strategies may be required (e.g., improved crop, forage, livestock, forest, and fisheries germplasm), including biotechnology. In some cases, old approaches can be revived that may be suited to new climate challenges (51).
4. Where climate impacts may lead to major land use change, there may be demands to support transitions such as industry relocation and migration of people. This may be achieved through direct financial and material support, creating alternative livelihood options with reduced dependence on agriculture, supporting community partnerships in developing food and forage banks, enhancing capacity to develop social capital and share information, retraining, providing food aid and employment to the more vulnerable, and developing contingency plans (e.g., refs. 20 and 52). Effective planning for and management of such transitions may result in less habitat loss, less risk of carbon loss (e.g., ref. 53), and also lower environmental costs compared with unmanaged reactive transitions (54).
5. New infrastructure, policies, and institutions could be developed to support new management and land use arrangements. Options include addressing climate change in devel-

opment programs; enhancing investment in irrigation infrastructure and efficient water use technologies; ensuring appropriate transport and storage infrastructure; revising land tenure arrangements, including attention to property rights; and establishing accessible, efficient markets for products and inputs (seed, fertilizer, labor, etc.) and for financial services, including insurance (55).

6. Importantly, policy must maintain the capacity to make continuing adjustments and improvements in adaptation by "learning by doing" via targeted monitoring of adaptations to climate change and their costs, benefits, and effects (56).

Many adaptation-planning frameworks have been developed in the last decade, with contributions from both social and physical scientists attempting comprehensive coverage of planned adaptations, in the process describing many useful tools and methods (e.g., refs. 57 and 58). There has been significant discussion on the balance between the focus on underpinning biophysical processes or on the socioeconomic aspects critical to policy making (e.g., refs. 59 and 60). The consensus appears to be that products developed under such theoretical frameworks should be closely aligned to the needs of agricultural decision makers, and that different levels of engagement should be considered. Involving stakeholders from project inception is critical if adaptation research is to be reflected in changed decisions and altered strategies and actions (20). We suggest that a participatory approach that cycles systematically between the biophysical and the socioeconomic aspects [supporting information (SI) Fig. 1; ref. 61] could most effectively harness the substantial scientific knowledge of many agricultural systems, while retaining a focus on the values important to stakeholders, achieving relevance, credibility, and legitimacy (62). The inclusion of an adaptive loop in such frameworks is critical to developing flexible, dynamic policy and management that can accommodate climate surprises or changes in the underlying knowledge base.

Discussion

The increasing urgency for developing effective adaptation responses to climate change suggests several research areas: enhancing existing climate risk management, more effective representation of the processes by which key climate drivers impact on agriculture, assessing the effectiveness of adaptation options, understanding likely adoption rates and how to improve these, and developing more resilient agricultural systems.

Agriculture in many regions remains sensitive to climate variability, and the capacity to manage this risk is variable (e.g., ref. 32). Given that climate change will be expressed via changes in variability at several temporal ranges, enhancing the capacity to manage climate risk is a core adaptation strategy (e.g., refs. 10 and 48). Developing this capacity involves increasing the "climate knowledge" of decision makers so they become more cognizant of climate impacts on their systems and of how to use management options to intervene, thereby reducing negative impacts and using opportunities. It also means moving the rhetorical focus from adaptation to climate change to management of climate risk, integrating climate change into a broader research domain.

There has been widespread adoption of statistical climate forecasting in agricultural management decisions, although many issues of forecast reliability, communication, and delivery remain (e.g., ref. 20). If the relationships between local weather and broad-scale climate phenomena (e.g., the Walker Circulation, regional sea surface temperatures, or the Madden–Julian Oscillation) remain largely stable, the continued use of statistical climate forecasts provides a key way for agriculture to proactively "track" climate changes (48). This also maintains coherence between the time scales of the management unit decision and of climate information. Additionally, process-based forecasts using coupled ocean-atmosphere models hold out the prospect of improved forecasts at a range of time scales that will automatically incorporate climate changes (e.g., ref. 63). These models have significantly improved their utility in recent years (64). Continued development of this modeling capability and the translation of the results to decision makers are likely to be warranted to enhance adaptation to climate risk (20). There are many region- or situation-specific climate risk management options (e.g., transhumance) that may also have adaptation value.

There is substantial room for improvement in the capacity to assess how combinations of various factors, such as CO_2, temperature and rainfall, pests and diseases, and air pollution, affect agricultural systems (2). Robust estimates of baseline impacts are necessary before reliable assessments of the costs and benefits of adaptations can be made. Improved knowledge is required to enable prediction of the magnitude and often even the direction of future climate change impacts on agriculture, as well as to better define risk thresholds and potential for surprises (2).

The results of adaptation will be a function of both the likely technical effectiveness of adaptations (e.g., Table 1) and their adoption rate. However, there is a paucity of studies that have assessed these two components in a thorough way, especially for higher levels of climate change and for more vulnerable systems (4). There is a particular need to expand the number of studies that engage with stakeholders in a structured way to assess adoption rates. These could focus on the acceptability of adaptation options in terms of factors important to stakeholders and their perceptions of synergies and barriers. Particular interest may be in question as to (*i*) the costs and benefits of adaptation when both market and nonmarket values are taken into account, (*ii*) the feasibility and costs of simultaneously reducing greenhouse gas emissions and adapting to climate change, (*iii*) the effect of limitations in capital and other resources such as irrigation water, energy, and fertilizer and pesticides (because of environmental concerns), and (*iv*) adoption rates in highly impacted areas if food prices decline as a result of positive climate change impacts and/or land-use intensification in temperate regions, or if demand for biofuels increases competition for land.

Finally, assessing climate risk and devising response strategies must be done in the face of many uncertainties in the underlying socioeconomic, political, and technological drivers and how these will affect climate, as well as fundamental uncertainties in characterizing the climate system (5, 11). However, uncertainty is often used as an excuse for inaction and can be inappropriately interpreted as a case of "no knowledge." Scientists need to become better at quantifying and communicating uncertainties, whereas decision makers need to accept that fuzzy knowledge is better than no knowledge at all (16). Given these circumstances, response strategies need to focus on developing more resilient agricultural systems (including socioeconomic and cultural/institutional structures), to cope with a broad range of possible changes. Enhanced resilience is likely to come with various types of costs or overheads that are often overlooked but that need evaluation. Additionally, given the above uncertainties, there is a need for directed change in management, science, and policy that in turn is monitored, analyzed, and learned from, to iteratively and effectively adjust to actual climate changes that will be experienced in coming decades. Consequently, adapting agriculture to climate change will be much more systemic than simply a farm-level activity.

Conclusions

There is increasing urgency for a stronger focus on adapting agriculture to future climate change. There are many potential adaptation options available at the management level, often variations of existing climate risk management. However, there are as yet relatively few studies that assess both the likely effectiveness and adoption rates of possible response strategies. A synthesis of studies for cropping systems indicates first that the potential benefits of adaptation in temperate and tropical wheat-growing systems are similar and substantial (averaging 18%), even though the likely adoption rates may differ; and second, that most of the benefits of marginal adaptations within existing systems accrue with moderate climate change, and there are limits to their effectiveness under more severe climate changes. Hence, more systemic changes in resource allocation, including livelihood diversification, need to be considered. We argue that increased adaptation action will require integration of climate change risk with a more inclusive risk management framework, taking into account climate variability, market dynamics, and specific policy domains. Many barriers to adaptation exist; overcoming them will require a comprehensive and dynamic policy approach, covering a range of scales and issues, from individual farmer awareness to the establishment of more efficient markets. A crucial part of this approach is an adaptation assessment framework that can equitably engage farmers, agribusiness, and policymakers, leveraging off the substantial collective knowledge of agricultural systems, yet focusing on values of importance to stakeholders. To be effective, science must adapt, too, by continuing to review research needs and enhancing the central core integrative science in the communication and management tools developed with decision makers.

We thank Keith Brander, John Morton, and Andrei Kirilenko for their input in the IPCC process; Bill Easterling and Pramod Aggarwal, who ably coordinated the IPCC chapter on food, fiber, and forestry; Steven Crimp for constructive comments on an earlier draft of the manuscript; and two anonymous reviewers for useful suggestions.

1. Easterling W, Aggarwal P, Batima P, Brander K, Erda L, Howden M, Kirilenko A, Morton J, Soussana J-F, Schmidhuber J, Tubiello F (2007) in *Climate Change 2007: Impacts, Adaptation and Vulnerability*, eds Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE (Cambridge Univ Press, Cambridge, UK), pp 273–313.
2. Tubiello FN, Soussana J-F, Howden SM (2007) *Proc Natl Acad Sci USA* 104:19686–19690.
3. Ferris J (1999) *Am J Agric Econ* 81:1309–1309.
4. Adger WN, Agrawala S, Mirza MMQ, Conde C, O'Brien K, Pulhin J, Pulwarty R, Smit B, Takahashi K (2007) in *Climate Change 2007: Impacts, Adaptation and Vulnerability*, eds Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE (Cambridge Univ Press, Cambridge, UK), pp 717–743.
5. Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL (2007) *Climate Change 2007: The Physical Science Basis* (Cambridge Univ Press, Cambridge, UK).
6. Raupach MR, Marland G, Ciais P, Le Quere C, Canadell JG, Klepper G, Field CB (2007) *Proc Natl Acad Sci USA* 104:10288–10293.
7. Rahmstorf S, Cazenave A, Church JA, Hansen JE, Keeling RF, Parker DE, Somerville RCJ (2007) *Science* 316:709.
8. IPCC (1995) *Climate Change 1995: The Science of Climate Change* (Cambridge Univ Press, Cambridge, UK).
9. IPCC (2001) *Climate Change 2001: The Scientific Basis* (Cambridge Univ Press, New York).
10. Meinke H, Stone R (2005) *Climatic Change* 70:221–253.
11. Giorgi F (2005) *Meteorol Atmos Phys* 89:1–15.
12. White MA, Diffenbaugh NS, Jones GV, Pal JS, Giorgi F (2006) *Proc Natl Acad Sci USA* 103:11217–11222.
13. Schmidhuber J, Tubiello FN (2007) *Proc Natl Acad Sci USA* 104:19703–19708.
14. Agrawala S (2005) in *Bridge Over Troubled Waters: Linking Climate Change and Development*, ed Agrawala S (Organisation for Economic Cooperation and Development, Paris), pp 23–43.
15. Tubiello FN, Fischer G (2007) *Technol Forecast Social Change* 74:1030–1056.
16. Nelson R, Webb T, Byron I (2006) *Australian National Land and Water Resoures Audit* (Australian Government Printers, Canberra, Australia).
17. Power S, Sadler B, Nicholls N (2005) *Bull Am Met Soc* 86:839–844.
18. Easterling WE, Chhetri NB, Niu X (2003) *Climatic Change* 60:149–173.
19. Howden SM, Meinke H, Power B, McKeon GM (2003) in *Integrative Modelling of Biophysical, Social and Economic Systems for Resource Management Solutions*, ed Post DA (The Modelling and Simulation Society of Australia and New Zealand, Canberra, Australia), pp 17–22.
20. Meinke H, Nelson R, Kokic P, Stone R, Selvaraju R, Baethgen W (2006) *Climate Res* 33:101–110.
21. Alexandrov V, Eitzinger J, Cajic V, Oberforster M (2002) *Global Change Biol* 8:372–389.
22. Adams RM, McCarl BA, Mearns LO (2003) *Climatic Change* 60:131–148.
23. Tubiello FN, Rosenzweig C, Goldberg RA, Jagtap S, Jones JW (2002) *Climate Res* 20:259–270.
24. Aggarwal PK, Mall RK (2002) *Climate Change* 52:331–343.
25. Butt TA, McCarl BA, Angerer J, Dyke TP, Stuth JW (2005) *Climatic Change* 68:355–378.
26. Travasso MI, Magrin GO, Baethgen WE, Castaño JP, Rodriguez GR, Pires JL, Gimenez A, Cunha G, Fernandes M (2006) *Working Paper no 28* (Assessments of Impacts and Adaptations to Climate Change) www.aiaccproject.org/working_papers/working_papers.html.
27. Howden SM, Crimp S (2005) in *Advances and Applications for Management and Decision Making*, eds Zerger A, Argent RM (The Modelling and Simulation Society of Australia and New Zealand, Canberra, Australia), pp 170–176.
28. Morton JF (2007) *Proc Natl Acad Sci USA* 104:19680–19685.
29. Arnell NW (2004) *Global Environ Change* 14:31–52.
30. Mendelsohn R, Nordhaus W (1999) *Am Econ Rev* 89:1046–1048.
31. Daepp M, Nosberger J, Luscher A (2001) *New Phytol* 150:347–358.
32. Adger NW, Huq S, Brown K, Conway D, Hulme M (2003) *Prog Dev Studies* 3:179–195.
33. Batima P, Bat B, Tserendash D, Bayarbaatar L, Shiirev-Adya S, Tuvaansuren G, Natsagdorj L, Chuluun T (2005) in *Adaptation to Climate Change*, eds Batima P, Tserendorj D (Admon, Ulaanbaatar, Mongolia), pp 59–115.
34. Spittlehouse DL, Stewart RB (2003) *J Ecosyst Manage* 4:1–11.
35. Sohngen B, Mendelsohn R, Sedjo R (2001) *J Agric Res Econ* 26:326–343.
36. Weih M (2004) *Can J For Res* 34:1369–1378.
37. Shugart H, Sedjo R, Sohngen B (2003) *Forests and Global Climate Change, Potential Impacts on US Forest Resources* (Pew Center on Global Climate Change, Arlington, VA).
38. Food and Agriculture Organization (2000) *Global Forest Resources Assessment 2000*, Food and Agriculture Organization Forestry Paper 140 (Food and Agriculture Organization, Rome).
39. Beaugrand G, Reid PC, Ibanez F, Lindley JA, Edwards M (2002) *Science* 296:1692–1694.
40. King JR (2005) *Report of the Study Group on Fisheries and Ecosystem Responses to Recent Regime Shifts*, PICES Scientific Report 28 (Institute of Ocean Sciences, Sidney, BC, Canada).
41. Bruinsma J, ed (2003) *World Agriculture: Towards 2015/2030: An FAO Perspective* (Earthscan, London and Food and Agriculture Organization, Rome).
42. Brander KM (2005) *ICES J Mar Sci* 62:339–343.
43. Allison EH, Adger WN, Badjeck MC, Brown K, Conway D, Dulvy NK, Halls A, Perry A, Reynolds JD (2005) *Project No R4778J*, Fisheries Management Science Programme London (MRAG for Department for International Development), p 167.
44. Aggarwal PK, Joshi PK, Ingram JS, Gupta RK (2004) *Environ Sci Pol* 7:487–498.
45. Antle JM, Capalbo SM, Hewitt J (2004) *Climate Change* 64:289–315.
46. Bryant CR, Andre P, Thouez J-P, Singh B, Frej S, Granjon D, Brassard JP, Beaulac G (2004) in *The Structure and Dynamics of Rural Territories: Geographical Perspectives*, eds Ramsey D, Bryant C (Rural Development Institute, Brandon University, Brandon, MB, Canada).
47. Kurukulasuriya P, Rosenthal S (2003) *Climate Change and Agriculture: A Review of Impacts and Adaptations*, World Bank Climate Change Series (World Bank Environment Department, Washington, DC), Vol 91, p 96.
48. McKeon GM, Howden SM, Abel NOJ, King JM (1993) in *Proceedings of the XVII International Grasslands Congress* International Grasslands Congress, Palmerston North, New Zealand (SIR Publishing, Wellington, New Zealnd), pp 1181–1190.
49. Parson EA, Corell RW, Barron EJ, Burkett V, Janetos A, Joyce L, Karl TR, Maccracken MC, Melillo J, Morgan MG, *et al*. (2003) *Climatic Change* 57:9–42.
50. Burton I, Lim B (2005) *Climatic Change* 70:191–200.
51. Bass B (2005) in *Climate Change: Building the Adaptive Capacity, Environment Canada*, eds Fenech A, MacIver D, Auld H, Bing Rong R, Yin Y (Environment Canada, Toronto), pp 34–36.
52. Olesen JE, Bindi M (2002) *Eur J Agron* 16:239–262.
53. Goklany IM (1998) *BioScience* 48:941–953.
54. Stoate C, Boatman ND, Borralho RJ, Rio Carvalho C, de Snoo GR, Eden P (2001) *J Environ Manage* 63:337–365.
55. Turvey C (2001) *Rev Agric Econ* 23:335–351.
56. Perez RT, Yohe G (2005) *Adaptation Policy Frameworks for Climate Change* (Cambridge Univ Press, New York).
57. Willows RI, Connell RK (2003) *Climate Adaptation: Risk, Uncertainty and Decision-Making*, UKCIP Technical Report (UK Climate Impacts Programme, Oxford).
58. Carter TR, Parry ML, Harasawa H, Nishioka S (1994) in *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations with a Summary for Policy Makers and a Technical Summary* (University College, London), p 59.
59. Burton I, Huq S, Lim B, Pilifosova O, Schipper EL (2002) *Climate Pol* 2:145–159.
60. Reilly J, Schimmelpfennig D (2000) *Climatic Change* 45:253–278.
61. Steinitz C (1999) in *Landscape Futures*, eds Brunckhorst D, Mouat D (UNESCO, Armidale, NSW, Australia).
62. Cash D, Buizer J (2005) *Knowledge–Action Systems for Seasonal to Interannual Climate Forecasting: Summary of a Workshop* (National Academies Press, Washington, DC).
63. Doblas-Reyes FJ, Hagedorn R, Palmer TN (2006) *Climate Res* 33:19–26.
64. Barnston AG, Kumar A, Goddard L, Hoerling MP (2005) *Bull Am Meteor Soc* 86:59–72.
65. United Nations (1992) in *United Nations Framework Convention on Climate Change* (United Nations, Geneva), p 25.

Asia-Pacific
Economic Cooperation

APEC SYMPOSIUM ON CLIMATE CHANGE

"Adaptation Strategies with Mitigation Potential
for Food and Water Security"

Resolution

Whereas the members of the Asia-Pacific Economic Cooperation (APEC) play a highly significant part of the world's agricultural production;

Whereas the agriculture of the economies of the APEC remain sensitive to climate variability and climate change and thus threaten the food security of its members but also that of the association and of the world;

Whereas APEC Symposium on "Climate Change Adaptation Strategies with Mitigation Potential for Food and Water Security" held in Manila, Philippines from 6-8 February 2012 reveal the following facts:

1. Member economies realize that climate change is one of the greatest ecological, economic, and social challenges facing them that threaten the food security of the respective economies.

2. Member economies' comprehensive climate change strategy on agriculture is, building upon resiliency in agriculture, to shape adaptation strategies with mitigation potential;

3. Member economies recognize that adaptation to climate change in agriculture needs to be addressed with a thorough understanding of its positive interaction with mitigation.

4. Member economies responding to climate change in agriculture, to ensure food security, are generally anchored on four important policy instruments: (1) research and development, (2) information, education, and extension, (3) regulations, and (4) financial mechanism.

5. Member economies have rich and unique experiences and variable capacities on the application of policy instruments in response to climate change.

6. Member economies have great potential in strengthening their collective capacity of APEC if systematically shared with one another.

Therefore it is hereby resolved that we, the participants of the APEC Symposium, in our individual and professional capacities, do hereby make the following recommendations:

1. That APEC and multilateral agencies such as the World Bank, the Food and Agriculture Organization of the United Nations, the Asian Development Bank and other multilateral organizations to support follow-up activities to this symposium to further address issue of adaptation strategies with mitigation potential towards food and water security;

2. Encourage APEC to launch an Adaptation & Mitigation Initiative in Agriculture (AAMIA) to follow-up collective action to ensure a systematic response, collective action and a continuing focus on the issue;

3. That the Asia Pacific Adaptation Network (APAN) expands knowledge generated by this symposium on climate change adaptation strategies with mitigation potential and help disseminate this information, create public awareness and promote cooperation.

It is also hereby resolved that we thank the Philippines for hosting the symposium, and the Kingdom of Thailand and Chinese Taipei for their co-sponsorship.

Signed this 8th day of February 2012, Manila, Philippines during the APEC Symposium on "Climate Change Adaptation Strategies with Mitigation Potential for Food and Water Security:"

1. **Mr. Takeyaudin Haji Mohmad**
   Brunei Darussalam

2. **Mr. Izzanuddin Haji Bujang**
   Brunei Darussalam

3. **Mr. Ignacio García**
   Chile

4. Mr. Daniel Barrera
Chile

5. Dr. Huu-Sheng Lur
Chinese-Taipei

6. Dr. Churng-faung Lee
Chinese-Taipei

7. Mr. Takehiko Sakata
Japan

8. Mr.Christopher John Biai
Malaysia

9. Mario Bin Valeriano
Malaysia

10. Ms. Fan Xiaoli
People's Republic of China

11. Mr. Songcai You
People's Republic of China

12. Dr. Segfredo R. Serrano
Philippines

13. Hon. Rosalina L. Bistoyong
Philippines

14. Hon. Joel S. Rudinas
Philippines

15. **Mr. Milton Pascua**
Philippines

16. **Ms. Alicia G. Ilaga**
Philippines

17. **Dr. Eufemio T. Rasco**
Philippines

18. **Dr. Libertado C. Cruz**
Philippines

19. **Dr. Silvino Q. Tejada**
Philippines

20. **Ms. Shiela M. Encabo**
Philippines

21. **Atty. Nathaniel C. Santos**
Philippines

22. **Dr. Evelyn Aro Esquejo**
Philippines

23. **Mr. Carlos L. Magnaye**
Philippines

24. **Mr. Mikhal C. De Dios**
Philippines

25. **Dr. Ricardo Orge**
Philippines

26. **Mr. Dennis dela Torre**
Philippines

27. **Mr. Jose Ira Archimedes Borromeo**
Philippines

28. **Ms. Marita Carlos**
Philippines

29. **Dr. Jinho Kim**
Republic of Korea

30. **Dr. Kyongseok Oh**
Republic of Korea

31. **Dr. Kalaya Boonyanuwat**
Thailand
Kalaya Boonyanuwat.

32. **Dr. Jirapa Inthisang**
Thailand

33. **Mr. Nguyen Vu Hoan**
Viet Nam

34. **Mr. Pham Hong Hien**
Viet Nam

35. **Mr. Perfecto Corpuz**
The United States of America

36. **Mr. Philip Shull**
The United States of America

37. **Mr. William Verzani**
The United States of America

38. **Dr. Reiner Wassmann**
International Rice Research Institute

39. **Dr. Esteban Godilano**
Philippines

40. **Dr. Saturnina Halos**
Philippines

41. **Ms. Lurraine Villacorta**
Philippines

42. **Dr. Eliseo R. Ponce**
Philippines

43. **Mr. Raul Montemayor**
Philippines

44. **Dr. Puja Sawhney**
India

45. **Mr. Mozaharul Alam**
Bangladesh

46. **Dr. Le Thi Thu Huong**
Vietnam

47. **Mr. Victorino E. Aquitania**
Philippines

48. **Ms. Amalia Cabusao**
Philippines

Adaptation Financing: Status and Prospects

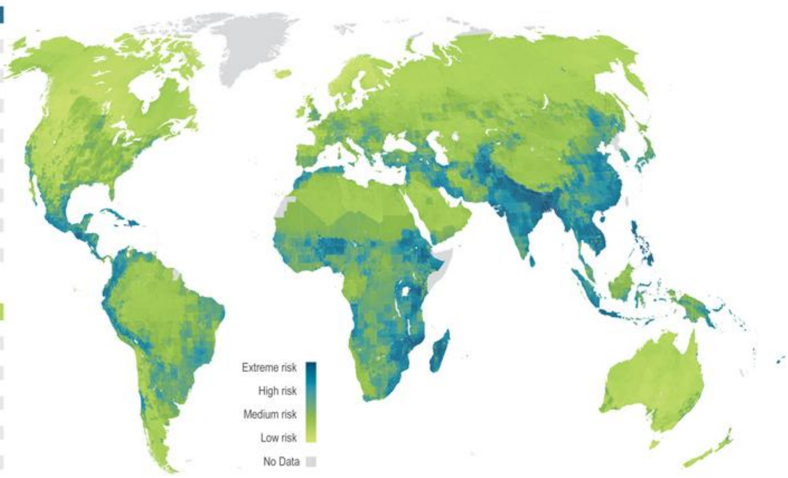
Ancha Srinivasan, Ph.D.
Asian Development Bank

Disclaimer: The views presented here are solely of the author.

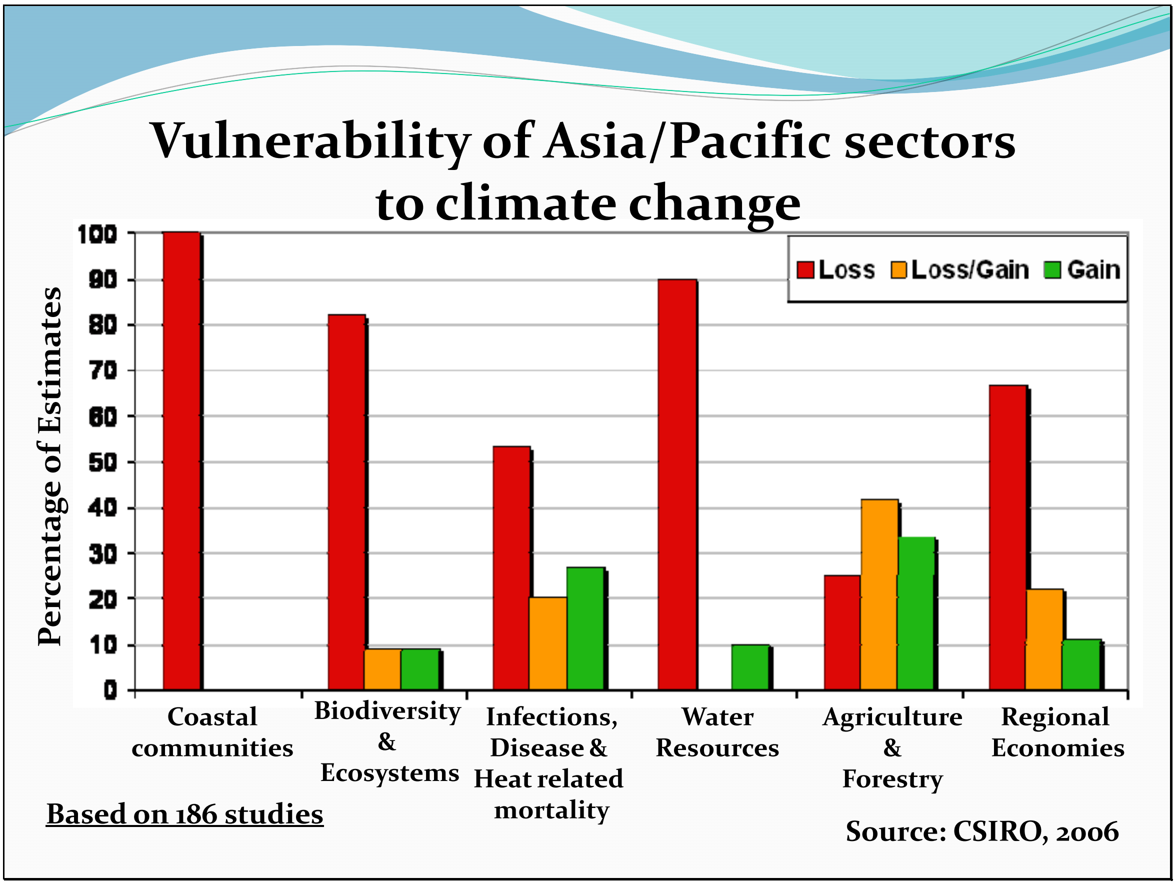
Asia Tops the list of "Most Vulnerable to Climate Change"

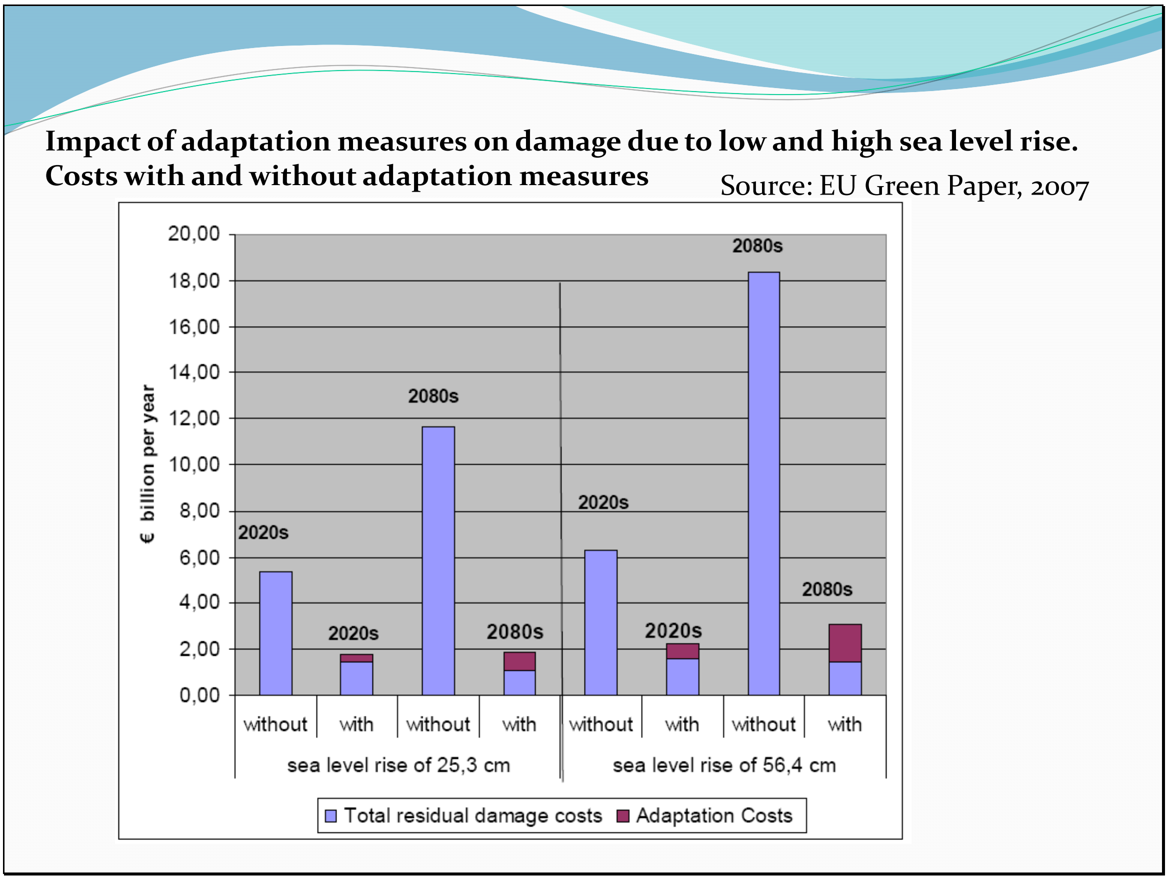
Rank	Country	Category
1	Bangladesh	Extreme
2	India	Extreme
3	Madagascar	Extreme
4	Nepal	Extreme
5	Mozambique	Extreme
6	Philippines	Extreme
7	Haiti	Extreme
8	Afghanistan	Extreme
9	Zimbabwe	Extreme
10	Myanmar	Extreme
11	Ethiopia	Extreme
12	Cambodia	Extreme
13	Viet Nam	Extreme
14	Thailand	Extreme
14	Malawi	Extreme
16	Pakistan	Extreme

Rank	Country	Category
160	Netherlands	Low
161	Latvia	Low
162	Lithuania	Low
163	Qatar	Low
164	Estonia	Low
165	Denmark	Low
166	Sweden	Low
167	Ireland	Low
168	Iceland	Low
169	Finland	Low
170	Norway	Low

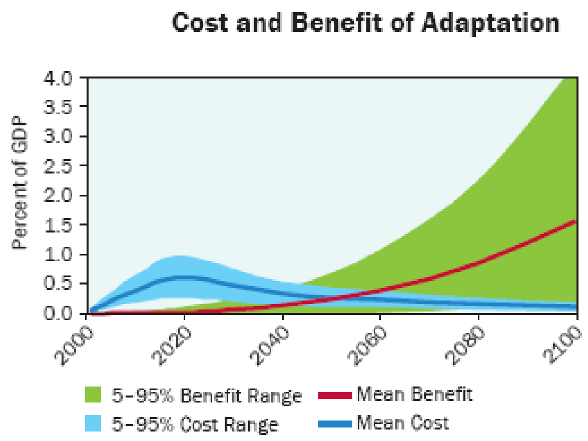


Source: New Scientist
http://www.newscientist.com/article/mg20827832.400-asia-tops-climate-changes-most-vulnerable-list.html


Vulnerability of Asia/Pacific sectors to climate change
Percentage of Estimates
100
90
80
70
60
50
40
30
20
10
0
Loss
Loss/Gain
Gain
Coastal communities
Biodiversity & Ecosystems
Infections, Disease & Heat related mortality
Water Resources
Agriculture & Forestry
Regional Economies
Based on 186 studies
Source: CSIRO, 2006


Impact of adaptation measures on damage due to low and high sea level rise.
Costs with and without adaptation measures
Source: EU Green Paper, 2007
€ billion per year
20,00
18,00
16,00
14,00
12,00
10,00
8,00
6,00
4,00
2,00
0,00
2020s
2020s
2080s
2080s
2020s
2020s
2080s
2080s
without
with
without
with
without
with
without
with
sea level rise of 25,3 cm
sea level rise of 56,4 cm
Total residual damage costs
Adaptation Costs

Proactive Adaptation



Note: 'Mean' indicates the average outcome of the simulations and the range of estimates from the 5th to the 95th percentile is the shaded area. Benefit in terms of avoided damage is based on A2 scenario.
Source: ADB study team.

Scaling up adaptation

Water: improving water management and flood control

Agriculture: more efficient irrigation/new crop variety

Forestry: safeguarding forests/planting new forests

Coastal resources: mangrove conservation/ protective sea walls

Health: better surveillance/ disease prevention

Infrastructure: climate proofing

Costs of impacts & adaptation

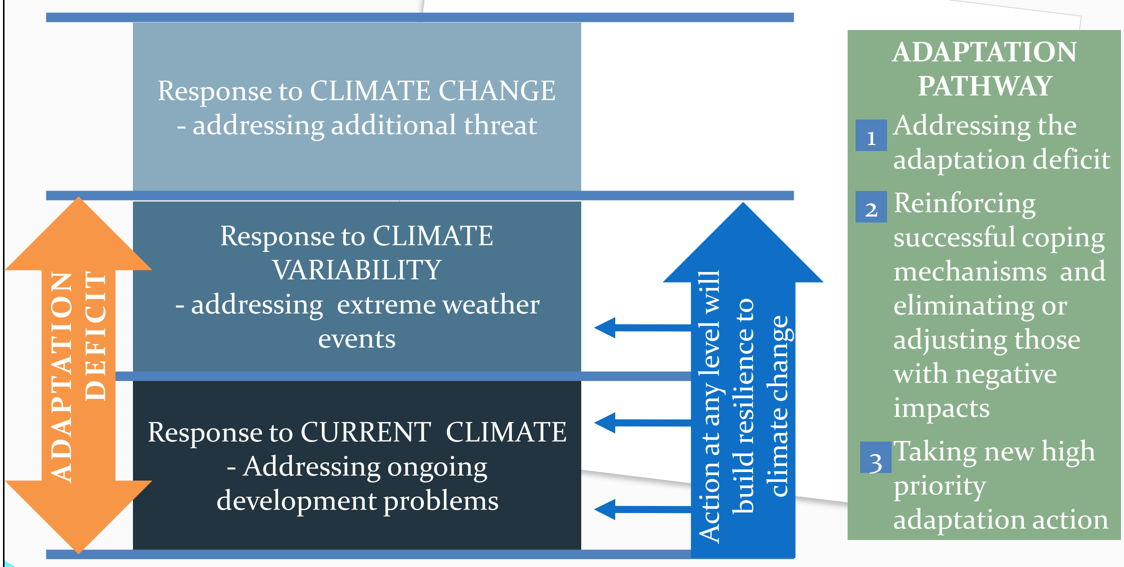
- **CC impacts may vary across Asia but they will place immense strains on public sector budgets in all countries**
  - In the Philippines, almost 300 weather-related events in the past 25 years took more than 21,700 lives and caused losses of > US$4.3 billion (~20% of national budget) [GermanWatch]
  - Climate disaster losses in developing countries could exceed **US$ 1 trillion/year** by 2040 (Oxfam)
- **Costs of adaptation**
  - With a 3-4°C rise, additional costs of adapting infrastructure & buildings: 1-10% of the costs invested in construction in OECD countries. (Stern Review)
  - Additional costs of making new infrastructure and building resilient to climate change in OECD: $15-150 billion per year. (Stern Review)
  - Costs of climate-proofing investments in developing countries: US$ 9-41 billion per year (World Bank)
  - Additional estimated investment and financial flows needed in 2030 for adaptation: **US$ 28-67 billion per year in 2030** (UNFCCC, 2007)

Adaptation Costs – Other estimates

- Additional costs of coverage of CC impacts
  - **$50-100bn/year (UNDP)**
  - 100bn/year (Christian Aid)
- **At least $50 bn/year** (Oxfam)
- **US$50-170 billion/yr** (AWG4, 2007)

- **Further work on costs of adaptation in Asia necessary**

Adaptation Pathway - addressing the adaptation deficit



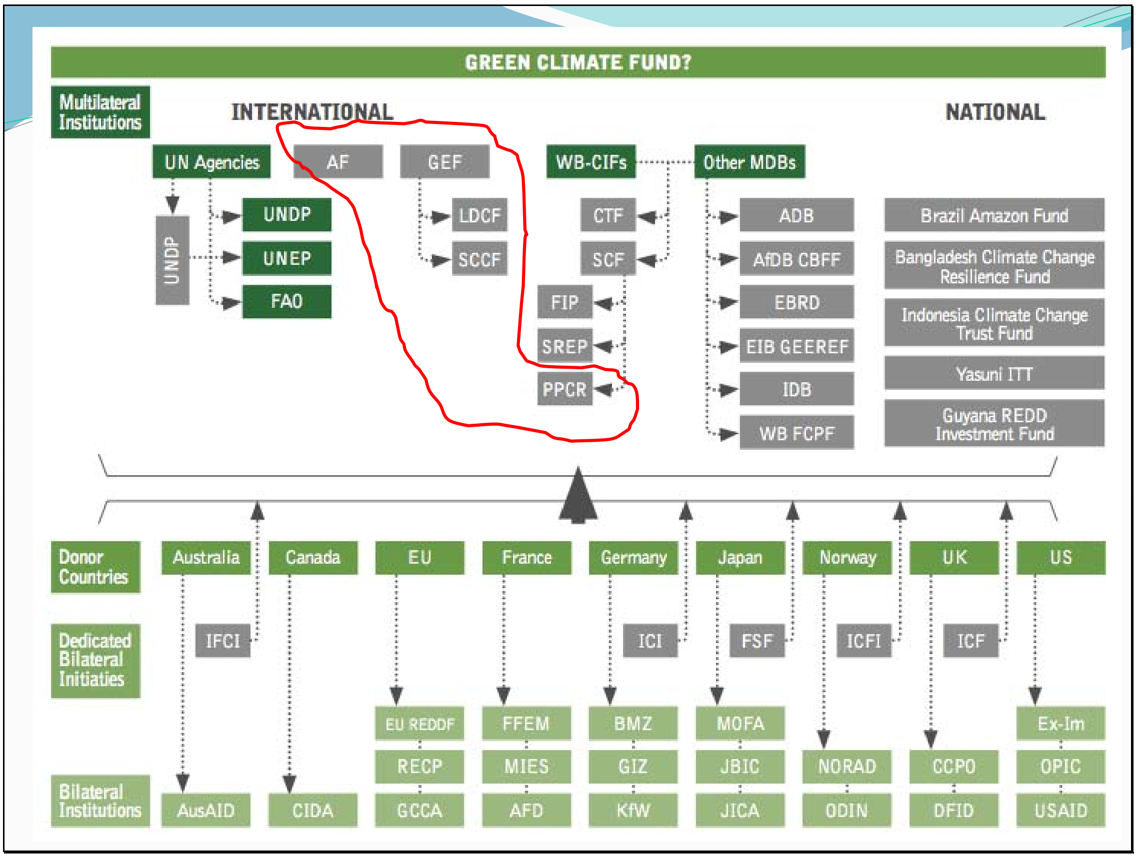
Source: Jeremy Carew-Reid, 2011 (ICEM)

Some views on Adaptation Financing: Developed countries

- Adaptation is a great challenge that cannot be addressed through the climate regime; It may become a bottomless pit, absorbing a disproportionate amount of funds.
- Full assistance for adaptation through various initiatives such as ODA must be accounted for.
- Adaptation is largely a national responsibility and international climate regime should only play a facilitative role.
- Scientific uncertainties in differentiating the impacts of climate variability and climate change will continue to hinder discussions on burden sharing.

Some views on Adaptation Financing: Developing countries

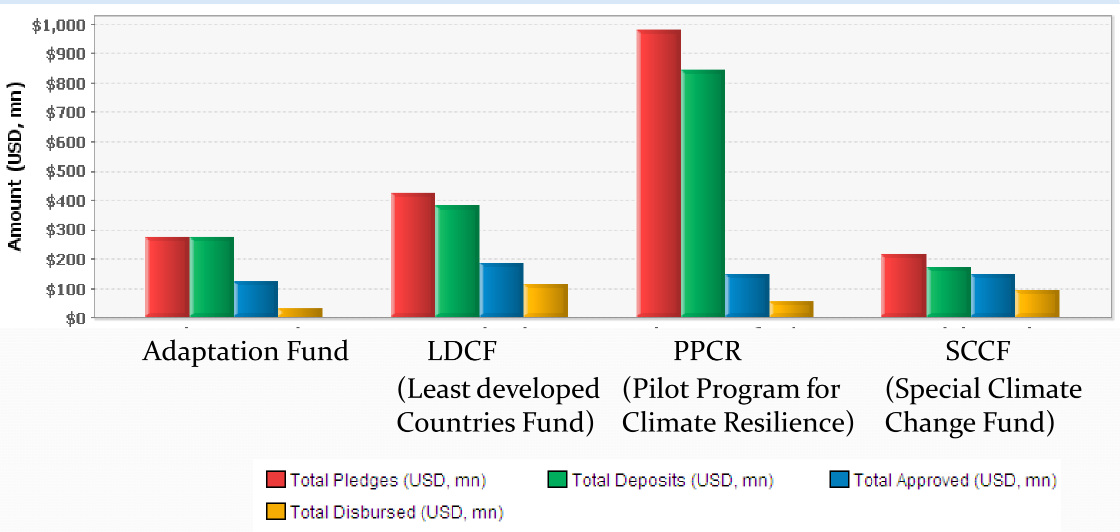
- Developed countries are not seriously committed to supporting adaptation in developing countries even though climate change is largely a problem created by the former (equity and justice).
- The focus on scientific uncertainties is an excuse for inaction or delayed action.
- Divisions among developing countries are a reason for slow progress: Linkage with response measures issues in discussions on Article 4.8
- Climate negotiations from 1992 to 2001 paid no attention to adaptation; Later discussions have been largely ineffective without much progress.



Selected bilateral adaptation programs active in Asia

- EU – Global Climate Change Alliance
  - Cambodia Climate Change Alliance ($8.9 M);
  - Lao PDR Climate Change Alliance (€ 6.2 M)
- USAID – ADAPT-Asia ($17 M)
- AusAID ($150 M worldwide)
- UK - International Climate Fund (£ 2.9 billion, of which 50% is for adaptation worldwide)
- Germany: International Climate Initiative

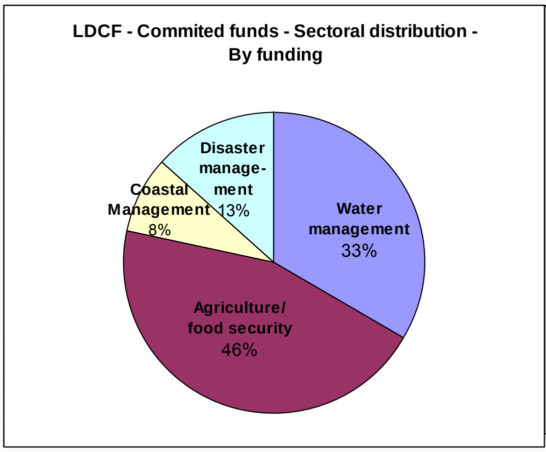
Main Sources of Adaptation Finance

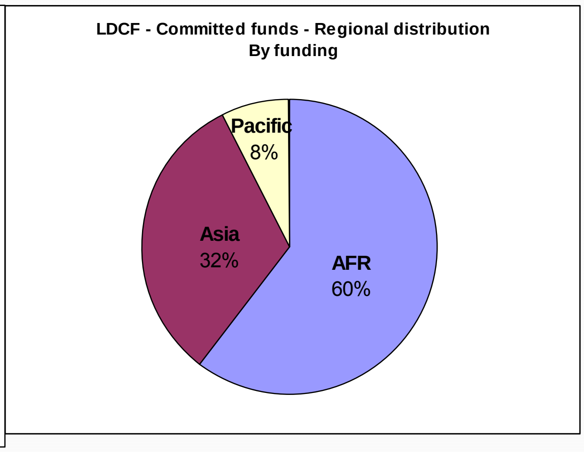


~27% to Asia and Pacific so far

Source: www.climatefundsupdate.org

Least Developed Countries Fund (LDCF)





Bhutan:

Reduce CC-induced Risks and Vulnerabilities from Glacial Lake Outbursts in the Punakha-Wangdi and Chamkar Valleys (LDCF)

LDCF/GEF amount: $3.64M

CC Vulnerabilities:

- Glacial lakes reaches critical threshold as Himalayan glaciers melt → massive flashfloods in river valleys

↓

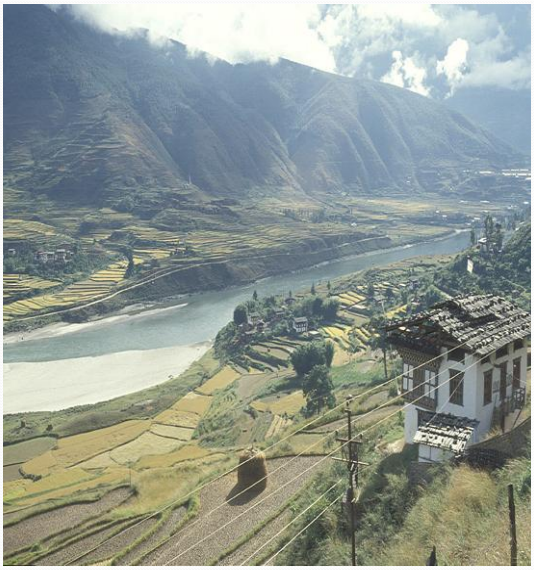
Adaptation Actions:

- Increase disaster risk management capacity in affected valleys
- Artificial lowering of water level in glacial lakes
- Creation of an Early Warning System for glacial flashfloods

↓

Outcomes:

- Decreased risk of massive destruction from glacial flash floods
- Limitation of human and economic loss if/when catastrophic flash floods occur



Cambodia:

Building Capacities to Integrate Water Resources Planning in Agricultural Development (LDCF)

LDCF/GEF $1.85M

CC Vulnerabilities:

- Increased drought and/or flooding poses risk to agricultural sector and food security

↓

Adaptation Actions:

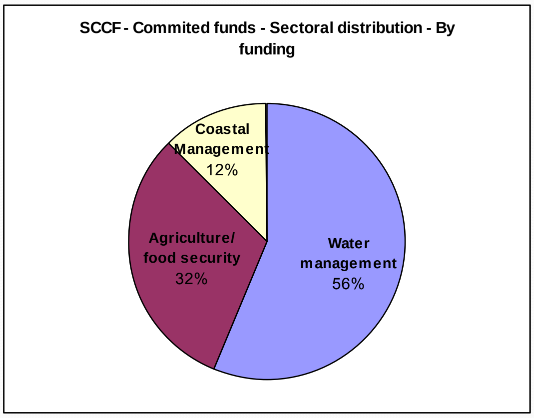
- Training of 'adaptation experts' in agricultural extension teams a
- Implementation of pilot projects in local communities
  - Rainwater harvesting techniques
  - Measures to decrease soil erosion and preserve genetic diversity in rice agriculture
  - Changed design of reservoirs and irrigation channels to prevent risks from increased peak flows
- Lessons learned disseminated to national and international levels

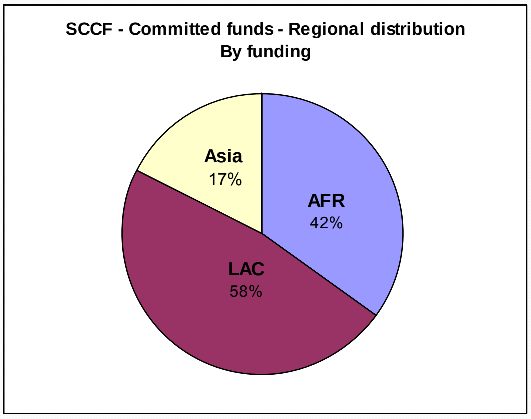
↓

Outcomes:

- Increased food security and sustainable agricultural development
- Reduced risks of climate induced disasters

Special Climate Change Fund (SCCF)





Vietnam:

Climate resilience of rural infrastructure (SCCF)

SCCF/GEF $3.4M

CC Vulnerabilities:

- Increased drought and/or flooding poses risk to rural infrastructure and food security

↓

Adaptation Actions:

- Training of 'adaptation experts' in extension teams
- Implementation of pilot projects in local communities
  - Bioengineering techniques
  - Measures to decrease soil erosion
  - Changed design of irrigation channels to prevent risks from increased peak flows
- Lessons learned disseminated to national and international levels

↓

Outcomes:

- Increased food security and sustainable agricultural development
- Reduced risks of climate induced disasters on rural infrastructure

PPCR Financing & Co-Financing in Cambodia

Project	Provinces/ Sites	PPCR Request			Expected co-financing ($ Million)
		Grant (50 M)	Credit (55 M)	Total (105 M)	
1. Climate risk management and rehabilitation of irrigation schemes	Kampong Thom, Banteay Meanchey, and Siem Reap	7.00	12.00	19.00	63.00
2. Flood and drought management	Pursat and Kratie	6.00	8.00	14.00	35.00 (79.50 for GMS)
3. Promoting climate-resilient agriculture	Koh Kong and Mondulkiri	8.00	0.00	8.00	20.40 (76.77 for GMS)
4. Climate proofing of agricultural infrastructure and business-focused adaptation	Banteay Meanchey, Kampong Cham, Kampong Thom, and Siem Reap	5.00	10.00	15.00	60.00

PPCR Financing & Co-Financing in Cambodia

Project	Provinces/ Sites	PPCR Request			Expected co-financing ($ Million)
		Grant (50 M)	Credit (55 M)	Total (105 M)	
5. Climate proofing of roads	Prey Veng, Svay Rieng, Kampong Chhnang and Kampong Speu	7.00	10.00	17.00	61.00
6. Climate proofing of infrastructure in the Southern Economic Corridor	Poipet, Battambang, Neak Leung and Bavet	5.00	10.00	15.00	20.00 (290.20 for GMS)
7. Flood-resilient infrastructure development	Sisophon, Siem Reap, Kampong Thom, Battambang Pursat, Kampong Cham	5.00	5.00	10.00	40.00
8. Cluster Technical Assistance	**National**	7.00	0.00	7.00	TBD

ADB's Climate Change Priorities & Modalities

Modalities

Priorities	Finance	Knowledge	Partnership
Scaling-up Clean Energy			
Encouraging Sustainable Transport and Urban Development			
Managing Land Use and Forests for Carbon Sequestration			
Promoting Climate-resilient Development			
Strengthening Policies, Governance and Capacity			

ADB and adaptation financing

- $14 million Adaptation window under ADB Climate change fund
- $1.2 M small grant activities
- Adaptation project co-financing from other sources (CIF-PPCR [$270 M], SCCF, LDCF, AF, JFPR, NDF, ICF, etc.)
- Key sectors: Water resources, agriculture, transport infrastructure

Key Issues for Adaptation Financing

- What are the sources of funding?
  - Can we avoid fragmentation and overlaps?
- Are the funds new and additional?
- Type of access (direct access?)
- Governance
  - Management
  - allocation procedures
- Grants versus loans
- Adequacy, Predictability, Sustainability
- Absorptive Capacity

Options for Enhancing Resource Flows for Adaptation

- Increased attention to adaptation by regional & international financial institutions
- Development of market mechanisms to facilitate adaptation (adaptation credits, adaptation vouchers, payment for ecosystem services, corporate social responsibility, etc.)
- Enhanced synergies among climate, disaster risk and development assistance communities
- North-South and South-South public and private investments including strengthening of linkages between adaptation and voluntary carbon markets
- Creating a region-wide adaptation facilities

Additional options

- Mobilize new and additional resources through
  - Developing additional local/national finanicng mechanisms (microfinance, customized credit schemes, climate-insensitive income generating opportunities, etc.)
  - "Climate proofing" of ODA investments by integrating adaptation concerns in development assistance
- Enhance the role of insurance sector through
  - Creation of Catastrophic Risk Insurance facilities
  - Utilization of risk transfer instruments such as weather derivatives, weather hedges and catastrophe bonds
  - Insurance backstop to cover premiums by vulnerable communities

Adaptation financing: Basic allocation principles

1. **Adaptation beneficiaries pay principle**
   - Beneficiaries of adaptation measures bear the costs
   - Not equitable in terms of historical responsibility and ability
2. **Emitters pay principle**
   - Emitters pay in proportion to cumulative GHG emissions over a certain period (e.g., after 1992, after industrial revolution, etc)
3. **Ability to pay principle**
   - Burdens shared in proportion to the levels of income or wealth
4. **Climate-change winners pay principle**
   - Burdens shared in proportion to climate change benefits
   - May not provide much incentives to curb emissions: climate change benefits and emissions are not necessarily linked

Classification of existing adaptation funds and new proposals according to allocation principles

I. Existing funds

Name of fund	Source of funding /Distinct features	Principles
1. Special Climate Change Fund (SCCF)	Voluntary contributions from 13 developed countries	Ability to pay principle (voluntary contributions)
2. Least Developed Countries Fund (LDCF)	Voluntary contributions from 17 developed countries	Ability to pay principle (voluntary contributions)
3. Strategic Priority on Adaptation (SPA)	Agreement among 32 donor countries, plus voluntary supplementary contributions	Based on GEF rules (GEF Trust Fund)
4. Adaptation Fund	2% share of proceeds from CDM	Climate-change winners pay principle

II. Proposals based on emitters pay principle

Proposal	Source of funding/Distinct Features
5. International Air Travel Adaptation Levy (IATAL) (Muller and Hepburn 2006)	Levy on aviation emissions (polluter pays) Levy can be proportional to ticket prices (partially based on ability to pay principle)
6. TERI's alternative perspective on adaptation financing (TERI 2005)	Special compensatory financing based on fairness and polluter pays principle
7. ICCTF proposal on funding (ICCTF 2005)	Contributions must be linked to current and historical responsibility for emissions
8. Adaptation credits and vouchers (Schellnhuber and Cornell 2003)	Creating a market for "adaptation credits" or "vouchers" which can be traded among parties
9. Carbon tax (Zhu, Ullrich, and Höhne 2004)	Tax on energy sources which emit CO_2 or on burning of fossil fuels in proportion to C content

III. Proposals based on emitters pay and ability to pay principles

Proposal	Source of funding/Distinct Features
10. Specialised funds (Tuvalu 2005)	A share of proceeds from a levy on fossil fuel sales in Annex I countries
11. UNFCCC Impact Response Instrument (Muller 2002)	Establish UNFCCC Disaster Relief Fund to be financed by contributions from industrialized countries
12. Risk management schemes (Parry et al 2005)	Mandatory contributions from industrialized countries in proportion to GHG emissions and GNP
13. Greenhouse Development Rights (EcoEquity and Christian Aid 2006)	Share burdens determined by responsibility and capacity indicator (RCI)
14. Adaptation Financing Index by Oxfam (Oxfam 2007)	Burdens shared by selected countries based on historical emissions and the value of human development index

IV. Proposals based on other principles

Proposal	Source of funding /Distinct features	Principles
15. Two-track approach for adaptation funding (Bouwer and Aerts 2006)	Fixed percentage of GDP for Annex I countries	Ability to pay principle only
16. Enhancing the base of adaptation fund (unpublished)	Broadening the tax base for adaptation levy from CDM to JI and emission trading	Climate-change winners pay principle
17. Brazilian proposal on burden-sharing approach (Filho et al 1997)	Up to 10% of the Clean Development Fund could be used to finance adaptation	Climate-change winners pay principle
18. Risk transfer instruments (UNEP-FI 2005)	Risk of climate damages is spread through private insurance	Modalities of implementation not specified

Financial feasibility of selected proposals

Proposal	Fund raising mechanisms
International Air Travel Adaptation Levy (IATAL)	• 800m international air travelers per year • US$10 on each ticket could raise up to US$8 billion annually
Carbon tax (Zhu, Ullrich, and Höhne 2004)	• US$1/ton CO2 in Annex I countries • Up to US$14 billion annually (Authors' calculation)
Two-track approach for adaptation funding (Bouwer and Aerts 2006)	• Fixed percentage of GDP for Annex I countries • 0.03% of GDP produces a total of approximately US$10.9 billion (Authors' calculation)
Specialised funds (Tuvalu 2005)	• A share of proceeds from a levy on fossil fuel sales in Annex I countries – effectively same as carbon tax
Risk management schemes (Parry et al 2005)	• Mandatory contributions from industrialized countries in proportion to their GHG emissions and GNP: Carbon tax + payment based on GDP

Adaptation Financing - Conclusions

- Adaptation is critical and costly in the short term. None of the proposals are likely to raise sufficient amounts, especially if contributions are voluntary.
- Both emitters pay and ability to pay principles have a potential to raise sufficient amount of funds; Private sector can be involved more effectively if climate-change winners pay and emitters pay principles are employed.
- Future focus should be on adaptation metrics, private sector involvement, and promoting synergies between adaptation and disaster risk financing.

World Bank's Financing and Technical Assistance on Climate-Smart Agriculture (CSA)

A presentation by:
Carolina V. Figueroa-Geron
Lead Rural Development Specialist
Sustainable Development Department
East Asia and the Pacific
The World Bank

APEC Symposium on Climate Change
"Adaptation Strategies with Mitigation Potential for Food & Water Security"
February 6-8, 2012
Manila, Philippines

Outline of the Presentation

- Assessment of Challenges and Practical Successes of Client Countries in Moving Towards CSA
- Key Messages coming out of the Assessment on CSA
- Mobilizing Financing for CSA

Outline of the Presentation

- ***Assessment of Challenges and Practical Successes of Client Countries in Moving Towards CSA***
- Key Messages coming out of the Assessment on CSA
- Mobilizing Financing for CSA

Assessment of Challenges and Practical Successes of Client Countries on CSA

Globally,

a number of countries have made impressive progress in integrating climate-smart agriculture into their broader development and growth programs…..

Policy & Program initiatives include:

- Soil and moisture conservation, esp in drought-prone areas
- Agri water mgt and watershed mgt
- Addressing sea surges, salinity and coastal area flooding
- Better management of risks associated with livestock and fisheries (eg., Mongolia)
- Addressing deforestation
- Including agriculture and NRM as core of their low carbon growth strategies
- Including CSA as a core element in broader green growth agenda (eg., Ethiopia, China)

Assessment of Challenges and Practical Successes of Client Countries on CSA

- Programs which have been successful have been implemented to scale, over a substantial period of time, adapting and taking on new lessons as they progress (eg., Philippines' Mindanao Rural Dev. Program, China, Bangladesh, Mexico, Burkina, Ethiopia)
  - Strong local farmer ownership and participation
  - Interventions often delivered within decentralized government structures
  - Integrated landscape approaches key to success, along with support measures for managing weather risks, diversifying HH incomes, improving market linkages

Assessment of Challenges and Practical Successes of Client Countries on CSA

- Food-insecure countries face the greatest challenges of all (eg. African countries)
  - coping mechanisms through social protection and local/community-level initiatives in soil and water conservation to promote resiliency
  - support to early warning systems,
  - enhancing on-farm productivity and value added

Assessment of Challenges and Practical Successes of Client Countries on CSA

Barriers to large-scale adoption of CSA still remain, especially due to the need to overcome aversion to short- term costs associated with such a transition …

Assessment of Challenges and Practical Successes of Client Countries on CSA

- The private sector plays a key role in CSA, especially where the enabling environment (at both the policy and institutional fronts) has been favorable
  - Example: recent regulatory reform in Brazil which has improved incentive framework for CSA and environmentally responsible investment in agriculture & forest mgt.
  - Example: rapid transition to aquaculture in Vietnam in the low-lying Mekong delta areas which are exposed to salt water intrusion

Assessment of Challenges and Practical Successes of Client Countries on CSA

- Key elements of a broader policy environment supportive to CSA
  - Secure land rights
  - A focus on research and knowledge dissemination
  - Public policy measures favoring sustainable land and water mgt, rather than price support & energy subsidies
  - An enabling environment for value adding, commercialization and trade
  - Matching sound legal & policy frameworks with practical incentives and support measures to overcome short-term costs which constrain adoption of CSA (eg., support to IT-based access to critical production and market info, pilot testing of affordable weather-based insurance)

Assessment of Challenges and Practical Successes of Client Countries on CSA

- CSA requires an integrated approach, tackling productivity and food security, risk and resilience and low carbon growth together
- BUT, integration and institutional coordination remains a daunting challenge for most client countries ….

Assessment of Challenges and Practical Successes of Client Countries on CSA

Daunting Institutional Challenges Remain ….

- *Multiple agencies involved (in ag, forestry, envi, NRM, WRM, weather forecasting) face enormous challenges in designing and supporting implementation of multi-sector, integrated projects*
- *Weather and climate services and financial and risk mgt mechanisms need to be strengthened and adapted to the needs of diverse stakeholders at various levels*
- *Resource programming, planning, budgeting and financing sources often do not facilitate coordination*
- *Coordination within Govt. (at the national and at the sub-national levels), as well as ensuring active citizen participation remains a critical challenge*
- *Development partners also face similar challenges of meaningful coordination within the donor community*

Outline of the Presentation

- Assessment of Challenges and Practical Successes of Client Countries in Moving Towards CSA
- ***Key Messages coming out of the Assessment on CSA***
- Mobilizing Financing for CSA

Key Messages Coming out of the Assessment on CSA

- Sustainable intensification and productivity enhancement are key elements of CSA & would need to be combined with broader agricultural landscape restoration (eg., China, Mexico and Vietnam)

- Successful programs need long-term commitment and strong local ownership, through bottom-up approaches adapted to local circumstances, & scaled up to have impact mixed with elements of social protection and risk reduction measures (eg., Kenya, Philippines, Burkina, China, ECA)

Key Messages Coming out of the Assessment on CSA

- The quality of public policies and support measures is as important as the quantity – those which focus on research, soil & water conservation, weather & climate services, land tenure, technology and value chain development ARE more effective for long term sustainability and benefits to farmers, RATHER THAN commodity or input support (except where input use is very low) (eg., Brazil, Kenya, Vietnam)

- Aligning strategies and policies with enabling measures, incentives and institutional support mechanisms is key to the success of climate-smart agriculture. These need to be adapted to country circumstances and provide incentives for responsible private sector investments (eg., China, Brazil, Uzbekistan, Niger)

Key Messages Coming out of the Assessment on CSA

- Water management is critical and measures to enhance agri water productivity is most effective if combined with measures to support broader economic diversification (eg., Morocco, Yemen, China, Bangladesh, Vietnam)

- In countries most highly exposed to climate variability and change, disaster mgt and a climate-resilient, diverse agricultural sector are closely linked (Bangladesh, Albania, Vietnam, Ghana)

Key Messages Coming out of the Assessment on CSA

- Integration of strategies and financing mechanisms for the productivity, adaptation and mitigation agendas remains a challenge for achieving CSA, within countries, within development partners and financing organizations
  - Different institutional structures and different funding channels for ag, envi, water, forestry, weather & climate services
  - Food security, adaptation and mitigation benefits are often addressed separately, rather than jointly, in order to achieve CSA
  - New funds for food security & CSA will be most effective if blended with ongoing support programs in order to maximize synergies
  - Carbon finance projects worked better when combined with other development financing

Key Messages Coming out of the Assessment on CSA

- CSA must play a key role in GHG emissions reduction, strategies to facilitate this are being developed in some countries
  - Holistic approach of Uruguay in combining measures to support resilience and reduced emissions is contributing to reduced GHG
  - Agriculture and forestry form part of the low carbon growth strategies (of China, Brazil and Mexico), combining adaptation & mitigation benefits
  - Low income countries have focused on adaptation, rather than mitigation, but are increasingly adopting integrated approaches – improving agricultural land use practices and reducing deforestation forms part of the core agenda in order to promote agricultural resilience and for long-term soil fertility and productivity (Ethiopia, Ghana, Burkina, Niger, Kenya)

Outline of the Presentation

- Assessment of Challenges and Practical Successes of Client Countries in Moving Towards CSA
- Key Messages coming out of the Assessment on CSA
- ***Mobilizing Financing for CSA***

Mobilizing financing for CSA

- World Bank Group loan commitments to Agriculture have increased substantially in the past decade …..
  - Average of **US$2.5 billion per year** in 2000-2005
  - Average of **US$4.1 billion per year** 2006-2008
  - **US$7.3 billion in 2009** (inc. due to the 2008 food price crisis)
  - **US$4.1 billion** in 2010
  - **US$3.6 billion** in 2011

Mobilizing financing for CSA

- In addition, the WB assists its various client countries in accessing a number emerging funds aimed at tackling climate resilience, low carbon growth, or food security issues
- The challenge is to be able to use these funds with other public and private fund sources in order to achieve CSA, which integrates productivity, food security and climate change

Mobilizing financing for CSA

- Global Agriculture and Food Security Program (GAFSP)
- Global Food Price Crisis Response Program (GFRP)
- Climate Investment Funds (CIF)– includes Clean Technology Fund, Pilot Program for Climate Resilience and Forest Investment Program
- Reduced Emissions from Deforestation and Forest Degradation (REDD)
- Global Environment Fund (GEF)
- CGIAR Research Program on Agriculture, Food Security & Climate Change
- Green Climate Fund
- Carbon Finance Facility , Clean Development Mechanism (CDM)

Mobilizing financing for CSA

- Global Agriculture and Food Security Program (GAFSP)
  - Multilateral financing mechanism, with US$925 million committed
  - CC cuts across all components , no separate component
  - Allows immediate targeting & delivery of additional funding to public & private entities to support national & regional strategic plans and scale up assistance for agriculture & food security in a coordinated manner in poor countries
  - Financing is for raising agricultural productivity, linking farmers to markets, reducing risks and vulnerabilities, enhancing non-farm rural livelihoods, TA, institutional and capacity building
  - As of 2011, grants have been approved for Cambodia, Mongolia, Bangladesh, Ethiopia, etc.)

Mobilizing financing for CSA

- Global Food Crisis Response Program (GFRP)
  - With authorized ceiling of US$2 billion
  - Contributes to a reduction in the stress on the environmental and social systems that arise from food shortages and lack of access to food, especially among communities most at risk due to high food prices
  - So far, US$1.2 billion committed to 35 countries (including the Philippines with US$200million availed in 2009)

Mobilizing financing for CSA

- Climate Investment Funds (CIF)
  - Total of US$6.3 billion: **CTF, PPCR, FIP**
  - Established to help developing countries to move towards low carbon growth paths & to integrate climate resilience in broader development programs
  - Programs are designed and implemented by client countries, with the assistance of regional development Banks, WB and IFC.
  - Finance provided by the CIF should be integrated into planned or ongoing programs, for scaling up and for mainstreaming resilience

Mobilizing financing for CSA

- *Clean Technology Fund (CTF)*
  - Programs for US$4.4 billion have been approved for 13 countries, mostly MICs and large emitters (Thailand, Vietnam, Philippines, Mexico, Indonesia)
  - Despite importance of Agriculture & land use change in GHG emissions, none of the CTF programs has included measures addressing ag emissions
  - Focus has been on energy efficiency, renewable energy and urban transport
  - Have been successfully blended with other forms of finance

Mobilizing financing for CSA

- *Pilot Program for Climate Resilience (PPCR)*
  - Total of US$967 million
  - Adaptation is the key focus & aims to help countries transform to a climate resilient development path
  - All programs include agriculture, forests or water mgt as priorities, including disaster mgt, coastal zone mgt, improved design and maintenance of infrastructure, etc.
  - Nine countries (such as Cambodia, Nepal,etc.) and 2 sub-regions (The Caribbean and the South Pacific) have been approved as of June 2010

Mobilizing financing for CSA

- *Forest Investment Program (FIP)*
  - Has a financing envelope of US$602 million
  - Eight countries approved so far – Mexico, Brazil, Peru, Ghana, Burkina, DR Congo, Nepal, Laos, Indonesia)
  - Aims to help countries develop and finance programs which reduce emissions from deforestation and forest degradation
  - Key elements: transparency, improved governance, envi and social sustainability, & local participation

Mobilizing financing for CSA

- Reduced Emissions fr Deforestation & Forest Degradation & Sustainable Forest Mgt (REDD Plus)
  - Has financing commitments of up to US$3.3 million million
  - Policy brief emphasizes that agricultural intensification, mgt of agricultural resources and restoration of degraded landscapes are key to successful REDD+ implementation and for CSA

Mobilizing financing for CSA

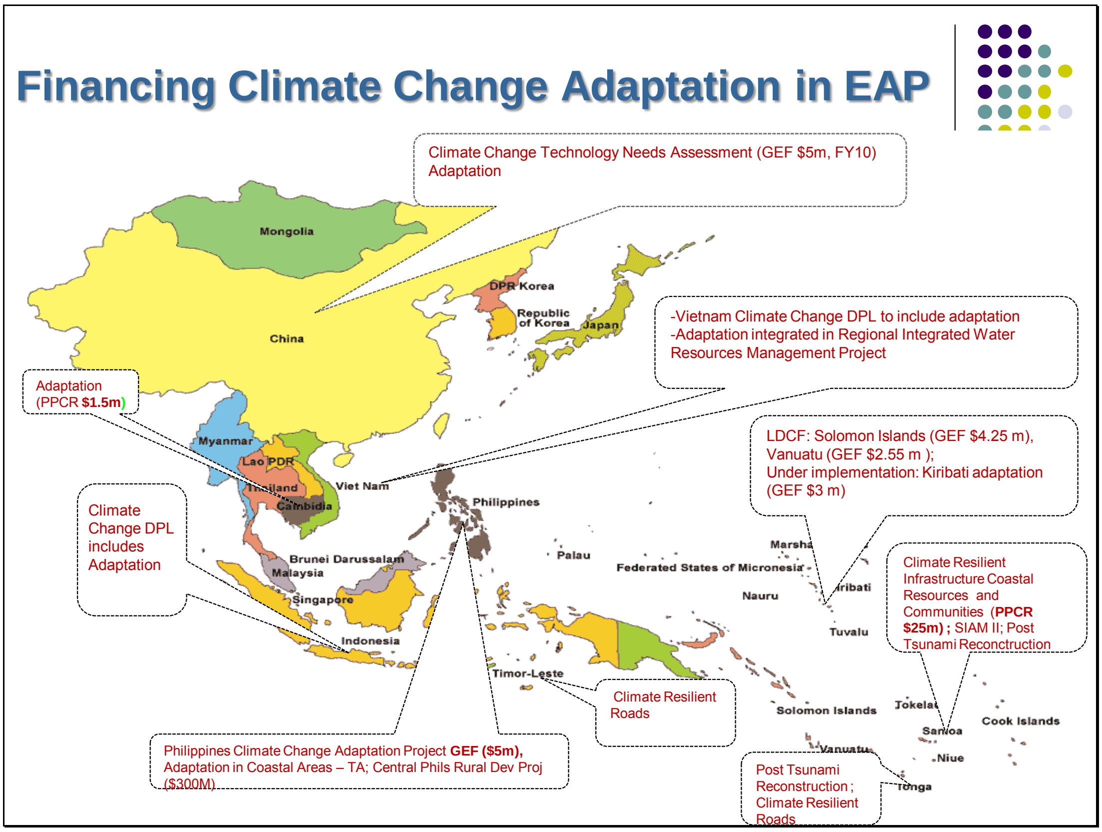
- Global Environment Facility (GEF)
  - Invests in a number of activities relevant to CSA through its operational programs on biodiversity, CC, land degradation and protection of international waters
  - On Land Degradation, over US$300million has been invested from 2005-2010, with funding mostly blended with other WB-assisted operations
  - UNFCCC established the Least developed Countries Fund (LCDF) which is being managed under the GEF, where US$224million as of June 2010 has been mobilized for the preparation & implmn of National Adaptation Plan of Actions (NAPAs), which has CSA and land & water mgt as key priorities
  - New program to fund SLM for 12 African countries has also been established

Mobilizing financing for CSA

- Green Climate Fund (GCF)
  - Copenhagen Accord (2009) included the establishment of the GCF
  - Cancun COP 16 (2010) decided to prepare GCF proposal, with WB acting as interim Trustee for 3 years
  - It aims to be an institutional mechanism to deliver scaled-up finance to address climate change
  - Experience from CIF implementation will provide useful experiences in implementing climate-smart agenda and financing
  - More negotiations on this will take place in the upcoming Rio+20 event

Mobilizing financing for CSA

- CGIAR Research Program on Agriculture, Food Security and Climate Change
  - Launched in partnership with the Earth System Science Partnership
  - Fifteen CGIAR research centers and other thematic organizations will be collaborating under the leadership of the International Center for Tropical Agriculture (CIAT) in Colombia
  - To be implemented over 10 years
  - Aims to close the knowledge gaps on how to enhance food security, livelihood and environmental goals and understanding trade offs in a changing climate, develop and evaluate options for adaptation and facilitate assessment, tracking & adjustments of actions taken to address changes in climate


Financing Climate Change Adaptation in EAP
Climate Change Technology Needs Assessment (GEF $5m, FY10) Adaptation
-Vietnam Climate Change DPL to include adaptation
-Adaptation integrated in Regional Integrated Water Resources Management Project
Adaptation (PPCR $1.5m)
LDCF: Solomon Islands (GEF $4.25 m), Vanuatu (GEF $2.55 m); Under implementation: Kiribati adaptation (GEF $3 m)
Climate Change DPL includes Adaptation
Climate Resilient Infrastructure Coastal Resources and Communities (PPCR $25m) ; SIAM II; Post Tsunami Reconctruction
Climate Resilient Roads
Philippines Climate Change Adaptation Project GEF ($5m), Adaptation in Coastal Areas – TA; Central Phils Rural Dev Proj ($300M)
Post Tsunami Reconstruction ; Climate Resilient Roads
Mongolia
China
DPR Korea
Republic of Korea
Japan
Myanmar
Lao PDR
Thailand
Cambidia
Viet Nam
Philippines
Palau
Brunei Darussalam
Malaysia
Singapore
Indonesia
Timor-Leste
Federated States of Micronesia
Nauru
Tuvalu
Solomon Islands
Vanuatu
Tokelau
Samoa
Niue
Tonga
Cook Islands

This presentation material drew heavily from:

Climate-Smart Agriculture

Increased Productivity and Food Security, Enhanced Resilience and Reduced Carbon Emissions for Sustainable Development, Opportunities and Challenges for a Converging Agenda

September 2011

Agriculture and Rural Development (ARD), World Bank

ASIA PACIFIC ADAPTATION NETWORK

Overview and background of the Asia Pacific Adaptation Network (APAN)

Puja Sawhney
Coordinator, APAN
Institute for Global Environmental Strategies

Manila, The Philippines
8th February, 2012

UNEP | Ministry of the Environment, Government of Japan | IGES | ADB | Sida | AIT/UNEP RRC.AP

Outline

* Background
* Vision
* Aims
* Activities
* Outcomes

Background

UNFCCC SBSTA at its 28th Session

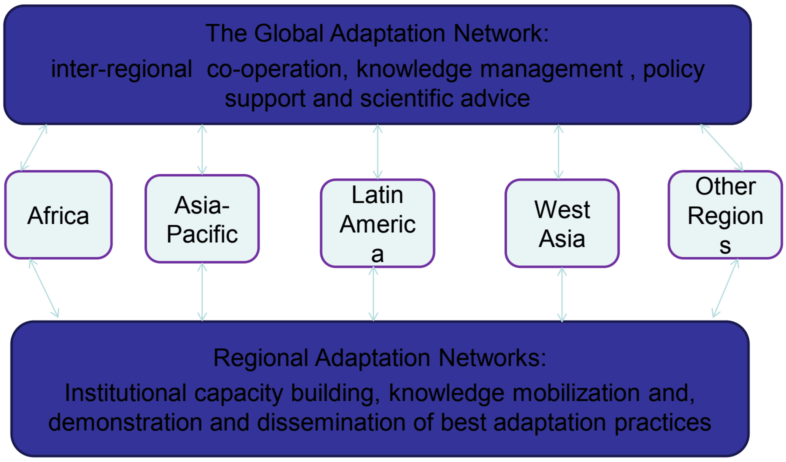
"recognized that regional centres and networks undertaking work relevant to climate change play an important role in enhancing adaptation" and "agreed to promote existing networks for impacts, vulnerability and adaptation and encouraged the establishment of new networks."

Responding to SBSTA- 28 Decision

United Nation Environment Programme (UNEP) organized

* International consultation meeting (2008)
* Regional consultation meeting (2009)
  - Africa
  - Asia-Pacific
  - West Asia
  - Latin America and the Caribbean

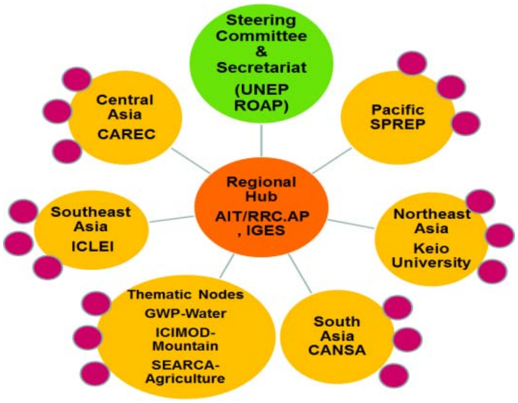
UNEP's Global Climate Change Adaptation Network (GAN)



APAN Development Process

- In Asia Pacific Region
- Regional consultation, Interim Steering Committee meetings during 2009
  - Japan and Thailand
- Launch of the Asia Pacific Adaptation Network, October 2009
  - Thailand during Bangkok Climate Change Talk

APAN Structure



Process of selection of Sub regional/ Thematic Nodes

* Open call for expression of interest
* More than 30 applications received
* First shortlisting was conducted by UNEP and the APAN regional hub
* Further shortlisting and final selection by the APAN Steering Committee
* 5 sub regional nodes and 3 thematic nodes selected

APAN – Sub regional Nodes

Sub Regions	
Southeast Asia	Local Governments for Sustainability (ICLEI)
South Asia	Climate Action Network for South Asia (CANSA)
Central Asia	Central Asia Regional Economic Cooperation (CAREC)
Pacific	Secretariat of the Pacific Regional Environment Programme (SPREP)
Northeast Asia	Keio university

APAN – Thematic Nodes

Thematic Nodes	Thematic Area
Global Water Partnership (GWP)	Water
International Centre for Integrated Mountain Development (ICIMOD)	Mountains
Southeast Asia Regional Centre for Graduate Study and Research in Agriculture (SEARCA)	Agriculture

Vision

To build climate resilience of vulnerable human systems, ecosystems and economies through the mobilization of knowledge and technologies to support adaptation capacity building, policy-setting, planning and best practices.

Aims

* Facilitate application of appropriate knowledge to adaptation programs/projects;
* Inform development planning and investment decisions to support sustainable adaptation approaches;
* Generate and share knowledge, experiences and information for improved capacity and effective implementation of adaptation to reduce the impacts of climate change;

Aims

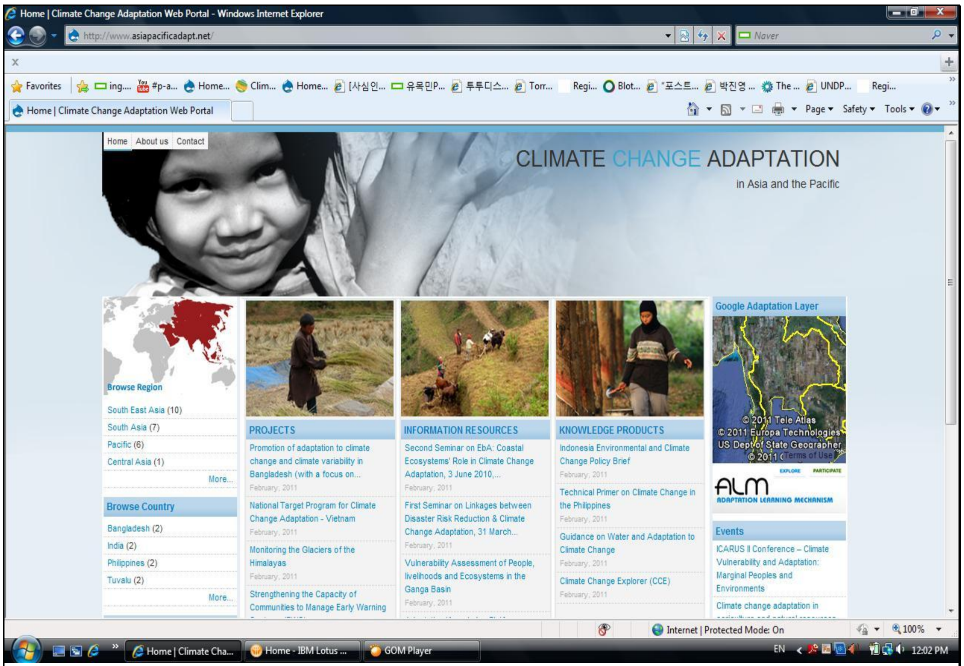
* Assist developing countries to access adaptation finance mechanisms; and
* Strengthen the capacity of national and local planners, communities, institutions and development partners in adaptation.

Activities

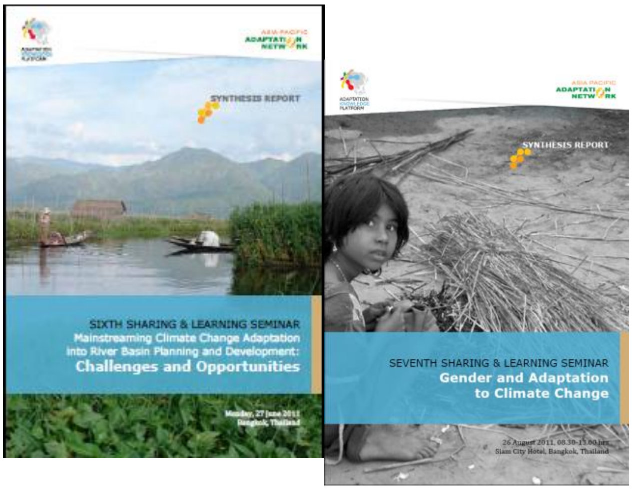
* Identification of gaps and needs in current adaptation knowledge including technology;
* Development of tools and methods for good adaptation practices;
* Provision of synthesis reports / or policy briefs;
* Scientific capacity development for vulnerability assessments, adaptation planning, science-based decision making strategies;

Activities

* Knowledge and lessons sharing at the sub-regional and regional levels through forums, on-line portal and the APAN website;
* Networking activities in region;
* Bi-monthly Knowledge Sharing & Learning Seminars;
* Database on good adaptation practices from the region;
* Organization of capacity building and training on climate adaptation.



Bi-monthly Sharing & Learning Thematic Seminars



Monthly E-Communique

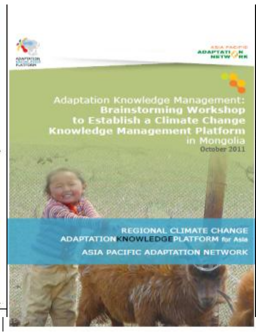
List Serve: Community of Practice (COP)

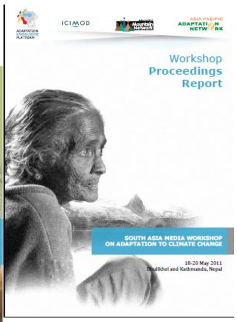

Asia-Pacific Climate Change Adaptation Forum 2010
21- 22 October 2010
United Nations Conference Center
Bangkok, Thailand
MAINSTREAMING ADAPTATION INTO DEVELOPMENT PLANNING


ADAPTATION KNOWLEDGE PLATFORM
ASIA PACIFIC ADAPTATION NETWORK
Asia-Pacific Climate Change Adaptation Forum 2011
MAINSTREAMING ADAPTATION INTO DEVELOPMENT:
ADAPTATION in ACTION
27-28 October 2011
United Nations Conference Center
Bangkok, Thailand
ADB
環境省
Ministry of the Environment
Sida

Activities

* Organization of capacity building and training on climate adaptation and Disaster Risk Reduction





Activities

* Database on good adaptation practices from the region

Expected outcomes

* **Output 1 - regional knowledge sharing system**
  - Promote dialogue and improved availability and accessibility of knowledge, information and methods for adaptation, including ecosystem based adaptation
* **Output 2 - assimilation of current and generation of new knowledge**
  - To generate new knowledge and promote understanding and provide guidance relevant to development and implementation of national and regional climate change adaptation policy, plans and processes
* **Output 3 – access to finance**
  - Improved access to adaptation finance mechanisms
* **Output 4 – targeted capacity building**
  - Increased capacity of national and regional institutions to support adaptation actions
  - Strengthened knowledge support to governments, communities and development partners

- Further information regarding APAN &
- for uploading information regarding projects/ events & meetings/ good practices on the web portal as well as the APAN website, can be found at:

http://www.apan-gan.net


Alt+G を押して検索
検索
詳細 »
ログイン
ASIA PACIFIC
ADAPTATION NETWORK
E-Forum
Home
AdaptationForum2011
Join Us
Contact us
About Us
Partners
E-Communiqué
Publications
Activities
Brochure
Database
Asia Pacific Adaptation Network (APAN)
The Asia Pacific Adaptation Network (APAN) was established in October 2009 as part of the Global Climate Adaptation Network (GAN). It aims at building the climate resilience of vulnerable human system, ecosystem, and economies through the mobilizations of knowledge and technologies to support adaptation capacity building, policy-setting, planning and practices. APAN is the first network under the GAN supported by the UNEP, IGES, AIT-UNEP RRCAP, ADB, SIDA, and APN.
10:57

Thank you for your attention!

sawhney@iges.or.jp

APEC SYMPOSIUM ON CLIMATE CHANGE

Southeast Asia Climate Change Focal Points and Experts Consultation Meeting
8-9 February 2012, Manila

Capacity Building on Climate Change Adaptation

Le Thi Thu Huong
Asia Pacific Adaptation Network (APAN)
IGES Bangkok Regional Center

1

Outlines

Why capacity building on climate change adaptation?

APAN's capacity building activities in Asia Pacific region:

- Capacity development of key training institutions
- Capacity development of national/sub-national policy makers/ government officers
- Other capacity building activities

Capacity building in Southeast Asia:

- Identification of capacity gaps and challenges
- Identification of capacity development needs
- Action plan to address identified capacity needs
- Priorities of action in Southeast Asia

2

Why capacity building?

- Though there is no regional level research carried out on the availability of human resource capacity for adaptation, the country level research indicates that there is a need to build the human resource capacity for adaptation.
- The Nairobi Work Program (NWP), several National Communications, and National Adaptation Plan of Action (NAPAs) have indicated the need for additional human resource capacity to help adapt to climate change impacts.
- We need adaptive capacity to deal with climate hazards

Adaptive capacity varies across Asia and the Pacific, based on social system, economic capacity and the level of environmental disruptions.

3

APAN's capacity building activities

- Developing capacity of key training institutions

APN funded project:

"Scientific capacity development of trainers and policy-makers for climate change adaptation planning in the Asia and Pacific"

Countries: Bangladesh, Cambodia, Lao PDR, Mongolia, Nepal

Sector: Agriculture and water related to agriculture

Objectives:

- To undertake appraisal of training needs in terms of knowledge and skill areas for effective adaptation (including the needs of personnel and gaps in training programs)
- To design training modules for imparting knowledge and skills for effective adaptation (in policy making process)

4

APAN's capacity building activities (cont.)

ASIA PACIFIC ADAPTATION NETWORK

1st Training Needs Assessment Meeting (January 31, 2011 in Bangkok)

2nd Training Needs Assessment Meeting (March 11, 2011 in Bangkok)

Training modules design workshop: August 10-12, 2011 in Bangkok

5

APAN's capacity building activities (cont.)

ASIA PACIFIC ADAPTATION NETWORK

- Developing capacity of national/sub-national decision makers

Regional Training on Cross-Sectoral Climate Change Adaptation Planning

Time: October 25-26, 2011 in Bangkok

Organizers:

- Asia Pacific Adaptation Network (APAN)
- Korea Environment Institute (KEI) - Korea Adaptation Center for Climate Change (KACCC)
- United Nations Environment Programme – Regional Office for Asia and the Pacific (UNEP-ROAP)

Overall objective: To improve the capacity of national and sub-national policy makers in their adaptation planning for climate change.

6

APAN's capacity building activities (cont.)

Geographical priority: 12 countries:

- SA: Bangladesh, Bhutan, India, Nepal, Sri Lanka;
- SEA: Cambodia, Indonesia, Lao PDR, Philippines, Thailand, Vietnam;
- East and Central Asia: Mongolia

7

APAN's capacity building activities (cont.)

- **Other activities**

Together with Regional Climate Change Adaptation Knowledge Platform (AKP), **APAN co-organized:**

- South Asia Media Workshop on Adaptation to Climate Change (Nepal, May 18-20, 2011)

8

APAN's capacity building activities (cont.)

ASIA PACIFIC ADAPTATION NETWORK

- Climate Change Adaptation Knowledge Management Workshop: Issues on Climate Change Adaptation (Mongolia, May 26-27, 2011)

- Media and Community Scenario Exercise Workshop: Quy Nhon in 2050 - Visioning Development Options in the context of Climate Change (Vietnam, July 13-15, 2011)

9

Capacity Building in Southeast Asia

ASIA PACIFIC ADAPTATION NETWORK

- Identification of capacity gaps and challenges at sub-regional and nation levels
  - Institutional support: policy framework for capacity building in general and specifically for climate change adaptation (CCA)
  - Existing human resources: number of CC experts, their knowledge and skill on CCA, etc.
  - Current capacity building programmes: education, training (induction/on-job), etc.
  - Facilities: CC knowledge center, training facilities, laboratories/ equipments, etc. for CCA researches

10

Capacity Building in Southeast Asia (cont.)

ASIA PACIFIC ADAPTATION NETWORK

- **Identification of capacity development needs:**
  - Sectors that urgently need capacity building on CCA
  - Areas of needs: human resource (personnel development), adaptive facilities, etc.
  - Targeted levels:
    - National/ provincial/ local level
    - Individual/ institutional/ societal level

11

Capacity Building in Southeast Asia (cont.)

ASIA PACIFIC ADAPTATION NETWORK

- **Action plan to address the identified capacity needs**
  - CC awareness raising through education, media, etc.
  - Workshops/seminars for sharing CCA knowledge (CCA support tools, methods, …), experiences or good adaptation practices, CC information, etc.
  - Training for different groups of stakeholders (policy makers, private sector, practitioners, communities, CSOs, etc.) and at different levels (sub-regional , national, etc.) -- Topics of training are indentified based on the needs

    …

12

Capacity Building in Southeast Asia (cont.)

ASIA PACIFIC ADAPTATION NETWORK

- **Priorities of action in Southeast Asia**

  Build capacity (knowledge and skill) of policy makers and government officials on CCA on regular basis through:

  - Training of trainers in key national-level training institutions which are active in training policy makers and government officials
  - Improvement of sector-based training programmes: insert or bring CCA knowledge into the existing training programmes (induction and on-job training)

  → **Core activities include:**

  - Undertake training needs assessment in Southeast Asia countries
  - Develop training modules which include CCA knowledge and skill

13

Open discussion

ASIA PACIFIC ADAPTATION NETWORK

Guiding questions:

1) Which sector(s)/ area(s) should be prioritized?

2) What subject matters should be chosen for training?

3) Which groups of people should be targeted for capacity building, e.g. training?

4) How to build the adaptive capacity of the targeted groups? (e.g. methods, frequency, timeframe, …)

5) Which activities should be proposed at sub-regional level?

And at country level?

…

14


ICLEI
Local Governments for Sustainability
ASIA PACIFIC
ADAPTATION NETWORK
Thank you
15

Paper from "**APEC SYMPOSIUM ON CLIMATE CHANGE**: Adaptation Strategies with Mitigation Potential for Food and Water Security", APEC#212-AT-04.2, © 2012 APEC Secretariat

ASIA PACIFIC ADAPTATION NETWORK

Managing Climate Change Adaptation Knowledge

Jihyun Kim
Institute For Global Environmental Strategies (IGES)
Southeast Asia Climate Change Focal Points and Experts Consultationon Meeting
9 March 2012
Manila, Philippines

Contents

- **Knowledge Management**
- **APAN's activities related to KM**
- **Contact points & Communication channels**

ASIA PACIFIC ADAPTATION NETWORK

Why Knowledge Management?

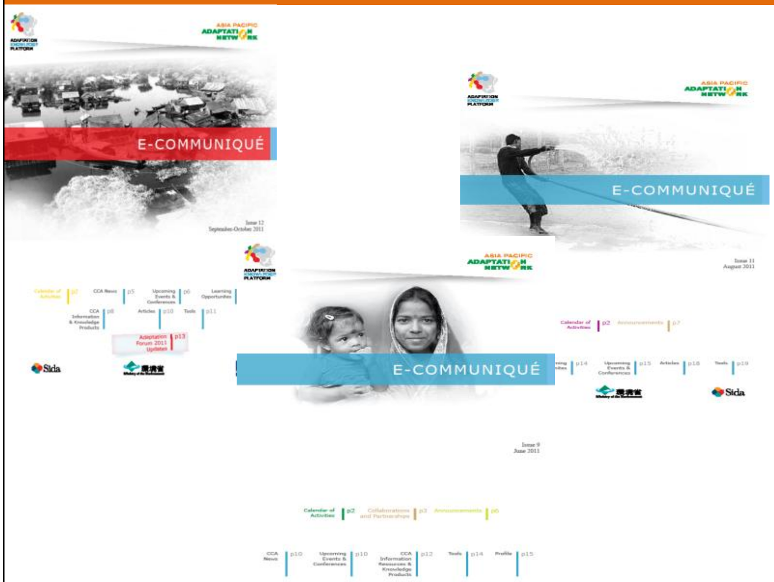
- Initiatives undertaken independently from each other
- Proliferation of adaptation experience, research and innovations
- Little organised exchange of information and knowledge
- Linking research, policy, and 'on the ground' action
- Blending traditional/indigenous knowledge with science

ASIA PACIFIC ADAPTATION NETWORK

From fragmented information provision towards an Integrated knowledge base for climate change adaptation

ASIA PACIFIC ADAPTATION NETWORK

E-Communiqué



- Calendar of activities
- Announcements
- CCA News
- CCA Events
- Learning Opportunities
- Knowledge Products
- Articles
- Tools

ASIA PACIFIC ADAPTATION NETWORK

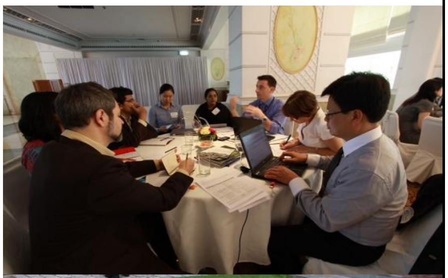
Bi-Monthly Thematic Seminars

- **Gender** and Adaptation to Climate Change (AIT and CARE International)
- Mainstreaming Climate Change Adaptation into **River Basin** Planning and Development (MRC)
- Reaching the Masses: Building Critical **Public Awareness** of Climate Change Adaptation (SENSA and Media Alliance)
- A Role for **Business** in Climate Change Adaptation (CSR Asia)

ASIA PACIFIC ADAPTATION NETWORK

Workshops

- **Climate Change Adaptation Knowledge Management Workshop: Issues on Climate Change Adaptation**, 26-27 May 2011, Mongolia
- **South Asia Media Workshop on Adaptation to Climate Change,** 18-20 May 2011, Nepal
- **The Knowledge Management Workshop on Harnessing Adaptation Knowledge in the Asia Pacific Region,** 28 February 2011, Thailand



ASIA PACIFIC ADAPTATION NETWORK

Asia-Pacific Climate Change Adaptation Forum 2010

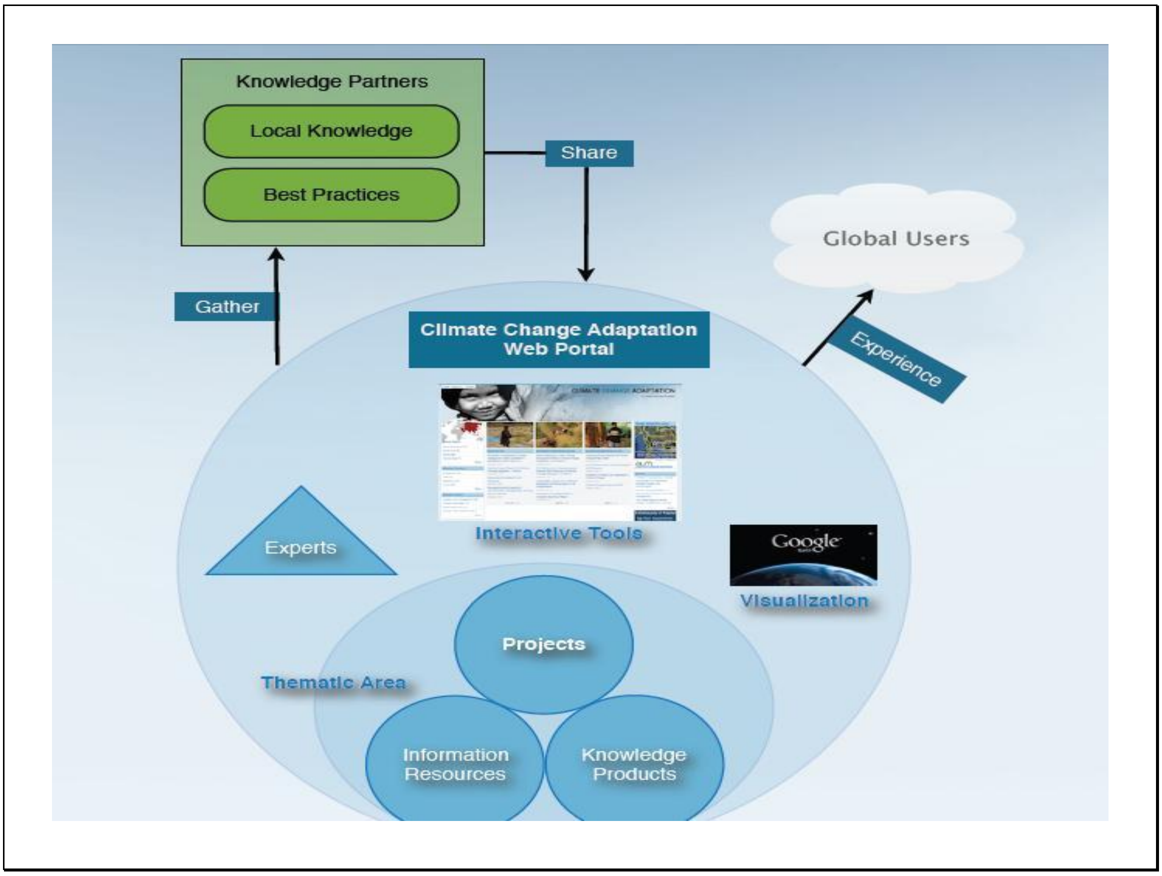
21- 22 October 2010

United Nations Conference Center
Bangkok, Thailand

MAINSTREAMING ADAPTATION INTO DEVELOPMENT PLANNING

Knowledge Products


CCA Webportal -www.asiapacificadapt.net
CLIMATE CHANGE ADAPTATION
in Asia and the Pacific
Browse Region
Browse Country
PROJECTS
INFORMATION RESOURCES
KNOWLEDGE PRODUCTS
Google Adaptation Layer
Events
ASIA PACIFIC
ADAPTATION
NETWORK


Knowledge Partners
Local Knowledge
Best Practices
Share
Gather
Global Users
Climate Change Adaptation Web Portal
Experience
Interactive Tools
Experts
Visualization
Projects
Thematic Area
Information Resources
Knowledge Products

Communication Channels

CCA Web portal: **http://www.asiapacificadapt.net/**

APAN Website**: http://www.apan-gan.net/**

Dr. Puja Sawhney

Senior Climate Change Adaptation Specialist
<sawhney@iges.or.jp>

Ms. Jihyun Kim

Knowledge Management Coordinator
<j-kim@ges.or.jp>

ASIA PACIFIC ADAPTATION NETWORK

ICLEI Local Governments for Sustainability

ICLEI Local Governments for Sustainability Southeast Asia Secretariat



Victorino Aquitania

Regional Director

ICLEI – Local Governments for Sustainability

Southeast Asia Secretariat

© ICLEI 2008 www.iclei.org

ICLEI Local Governments for Sustainability

ICLEI—Local Governments for Sustainability is...

- An international association of local governments and national and regional local government organizations that have made a commitment to sustainable development;

- A movement of cities, towns, counties and their associations accelerating sustainable development through local action;

- A sustainable development agency for local governments.

© ICLEI 2008 www.iclei.org

History

I.C.L.E.I
Local Governments for Sustainability

- Founded at United Nations, New York, 1990 as the International Council for Local Environmental Initiatives.
- The council was established when more than 200 local governments from 43 countries convened at our inaugural conference, the World Congress of Local Governments for a Sustainable Future, at the United Nations in New York.
- ICLEI - established as the international local government association, movement and agency for sustainability.
- Rio 1992, Chapter 28 LA21 , Johannesburg 2002, Johannesburg Call, Local Government Declaration
- ICLEI-Local Governments for Sustainability

© ICLEI 2008 www.iclei.org

Mission

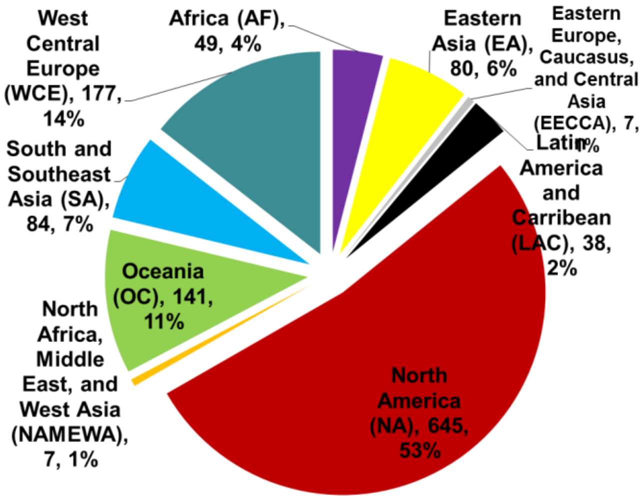
I.C.L.E.I
Local Governments for Sustainability

- To build and serve a worldwide movement of local governments to achieve tangible improvements in global sustainability with special focus on environmental conditions through cumulative local actions

© ICLEI 2008 www.iclei.org

More than 1200 ICLEI Members all over the world

ICLEI Local Governments for Sustainability



	Number of Members (% of Total)
Africa (AF)	49 (4%)
Eastern Asia (EA)	80 (7%)
Eastern Europe, Caucasus, and Central Asia (EECCA)	7 (1%)
Latin America and Carribean (LAC)	38 (3%)
North America (NA)	645 (53%)
North Africa, Middle East, and West Asia (NAMEWA)	7 (1%)
Oceania (OC)	141 (11%)
South and Southeast Asia (SA)	84 (7%)
West Central Europe (WCE)	177 (14%)
Total	1228 (100%)

© ICLEI 2008 www.iclei.org

What does ICLEI do?

ICLEI Local Governments for Sustainability

- Develops and runs a broad range of campaigns and programs that address local sustainability issues while protecting global common goods (such as air quality, climate, water), and link local action to internationally agreed goals and targets.
- Help local governments generate political awareness of key issues; establish plans of action towards defined, concrete, measurable targets; work towards meeting these targets through the implementation of projects; and evaluate local and cumulative progress toward sustainable development.
- Provides information, delivers training, organizes conferences, facilitates networking and city-to-city exchanges, carries out research and pilot projects, and offers technical services and consultancy.

© ICLEI 2008 www.iclei.org

Eight Major Goals

ICLEI Local Governments for Sustainability

- Goal 1: Integrated sustainability policy
- Goal 2: Resource-efficient city
- Goal 3: BiodiverCities securing ecosystem services
- Goal 4: Low carbon and climate neutral cities
- Goal 5: Resilient communities
- Goal 6: Green infrastructure
- Goal 7: Green urban economy & jobs
- Goal 8: Healthy & happy communities

© ICLEI 2008 www.iclei.org

The Southeast Asia Secretariat

ICLEI Local Governments for Sustainability

- The ICLEI Southeast Asia Secretariat started its operations in 1999 with the Cities for Climate Protection™ Campaign in the Philippines, and then it expanded to Thailand and Indonesia in 2002. It became a legal entity in 2004.
- 30 Members in Thailand, Indonesia and Philippines.

© ICLEI 2008 www.iclei.org

Program Areas

ICLEI Local Governments for Sustainability

ACCESSanitation

DReAMS

AsianCitiesAdapt

- Biodiversity
  - Local Action for Biodiversity
- Water and Sanitation
  - ACCESSanitation – Accelerating City to City Exchange for Sustainable Sanitation
  - Sustainable Water Integrated-Management & Governance (SWIM)
- Green Climate Cities
- Sustainability Management
  - ecoBUDGET
  - Realising DReAMS – Development of Resources and Access to Municipal Services
- Resilient Communities
  - AsianCitiesAdapt
  - Disaster Risk Management

© ICLEI 2008

www.iclei.org

ICLEI Local Governments for Sustainability

Thank you!

www.iclei.org/sea

© ICLEI 2008

www.iclei.org

CChAMPioning Food Security and Poverty Alleviation in Southeast Asia

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development

SEARCA is one of 20 Centers of the Southeast Asian Ministers of Education Organization or SEAMEO, a treaty organization of 11 countries founded in 1965 to promote regional cooperation in education, science, and culture.

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development

SEARCA's 3 Major Functions

To provide high quality **graduate education** and **training** in agriculture to member countries

To promote, undertake, and coordinate **research** related to the needs and problems in agriculture of the region

To **disseminate** the **findings** of agricultural research and experimentation

SEAMEO SEARCA — SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Enabling Institutions in Agriculture and Rural Development in a Globalizing Southeast Asia: SEARCA's 9th 5-Year Plan 09-14

ORGANIZATIONAL STRATEGY

THEMATIC FOCUS
- Natural Resource Management
- Agricultural Competitiveness

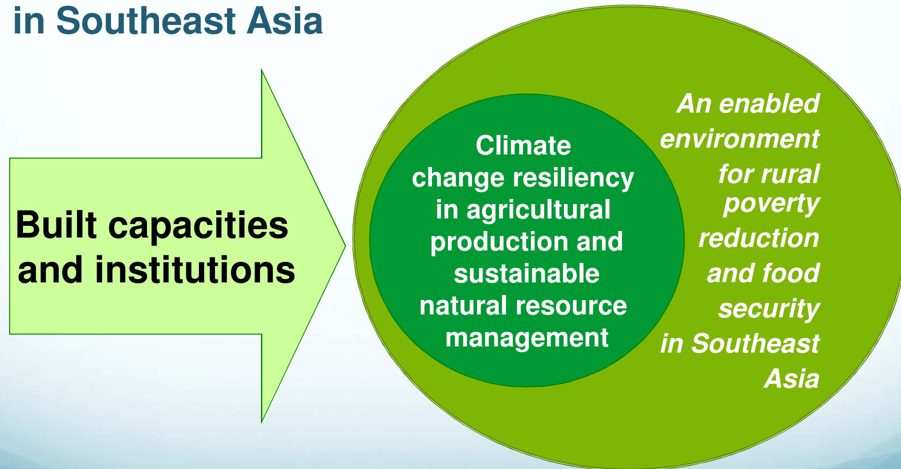
MISSION AREAS
- Graduate Scholarship
- Research and Development
- Knowledge Mgt

- Intensive project development and management
- Regionalized operations
- Stronger strategic partnerships/linkages
- Long-term financial viability
- Operational efficiency and productivity

OUTCOME

An enabled environment for rural poverty reduction and food security in Southeast Asia via built capacities and institutions

SEARCA's Climate Change Adaptation and Mitigation Program (CChAMP) for Agriculture and Natural Resource Management in Southeast Asia



SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Main issues in CCA in ANR in SEA

- Reduced crop yields due to heat stress and drought (El Niño); and floods (La Niña)
- Inconsistent timing of production cycle due to erratic precipitation patterns also affecting life cycles of pests and diseases
- Loss of arable land due to amplified soil salinity from seawater intrusion (rising sea levels)
- Reduced aquaculture harvest due to saltwater intrusion and reduced fish catch due to coral bleaching

SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Gaps/needs and Solutions

SOME GAPS/NEEDS

1. Vulnerability of climate-sensitive sectors
2. Limited access to financing and investment for CChAM
3. Limited capacity for CChAM
4. Gaps in policies and development plans
5. Translation of science-based knowledge to action

POSSIBLE SOLUTIONS

1. Appropriate and useful tools in and data management on vulnerability assessment
2. KM and capacity development on financing and CChAM
3. Policy studies, fora, and materials
4. Action research on mainstreaming

SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Expected Outputs

- Empowered agriculture and natural resource institutions to address Climate Change Adaptation and Mitigation (CChAM)
- Well-informed policy and decision makers on the impact of CC in agriculture and natural resources (ANR)
- Science-based CC knowledge
- Mainstreamed CChAM in national and sub-national development plans
- Informed public and effective KM on CC in SEA

SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

CChAMP Components

- Research and Development
- Mainstreaming in Development Management
- Capacity Building and Knowledge Management
- Scholarships and Grants

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development

Research and Development

1. Seed fund for research and development activities focused on CC in SEA
2. Research projects on risk and vulnerability assessment and impacts of CC on agri-biodiversity
3. Policy studies on CC

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development

Mainstreaming in Development Management

- Special projects mainstreaming CChAM at regional, sub-regional, national, and sub-national levels
- Assistance to government institutions and other partners' projects addressing CChAM
- Assistance in experts database buildup

SEAMEO SEARCA SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Capacity Building and Knowledge Management

- Regional and national training programs and online courses on climate risks in ANR
- Regional CChAMP conferences, symposia, seminars, policy forums, and workshops related to ANR
- Information and resources on CC through KC3, publications, and other knowledge products

SEAMEO SEARCA SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Scholarships and Grants

- Dissertation grants addressing CC concerns
- Exchanges and cross visits of CC experts to enhance adaptation and mitigation measures in SEA
- Support for participation of graduate scholars and fellows to symposia, forums, and training courses related to CC

Some SEARCA CCA Projects/Initiatives

1. Mainstreaming of CChAMP in Local Development Plans (EU-SEARCA Focused Food Production Assistance to Vulnerable Sectors)
2. KC3, a repository website on CCA in ANRM in SEA
3. EEPSEA-SEARCA Building Capacity to Adapt to CC: VA and Econ Analysis of Adaptation in Camb, Phil, Viet
4. IRRI-SEARCA Impact of CC on Phil Rice Sector

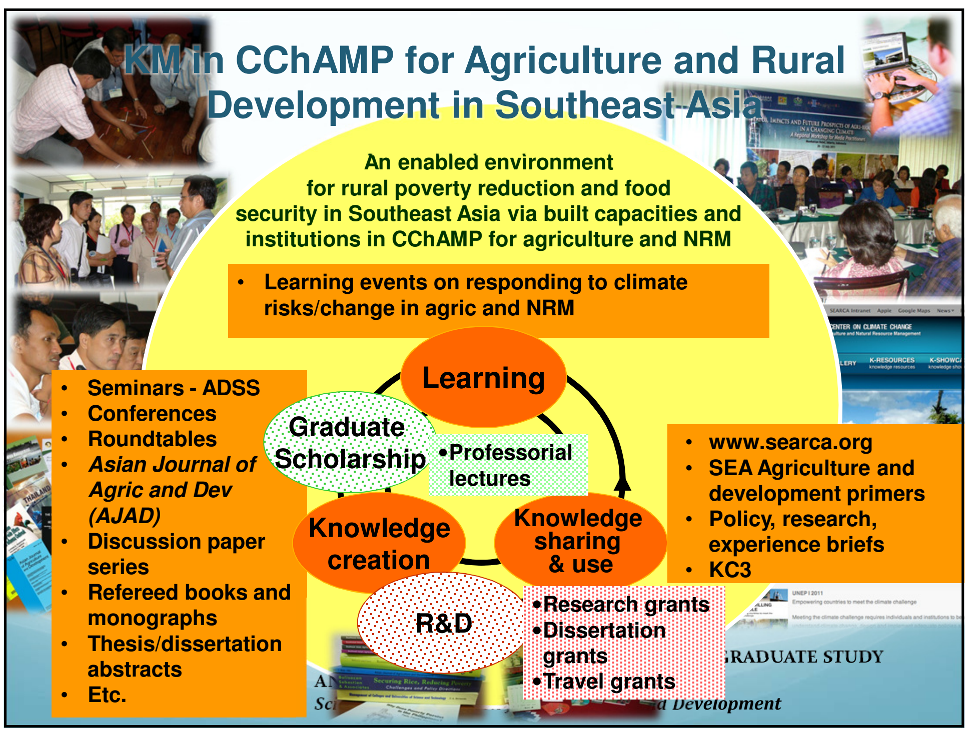
S E A M E O SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

5. Phil DA-BAR/SEARCA Capability Building on Responding to CC through R&D in Agriculture
6. Online Course on Responding to Climate Risks in ANRM in SEA
7. Residential int'l/regional learning events
   a. International Training Course on Responding to Changing Climate: Knowledge-based Strategies for Managing Risks in Agricultural Production, Sep 2008, Nov 2009, Sep 2010
   b. Study Tour/Writeshop on CChAM in Indonesia, Nov 2010
   c. Environmental Leadership in CCA in SEA, 6-10 Feb 2012
   d. Status, Impacts and Future Prospects of Agri-biotechnology in a Changing Climate: A Regional Workshop for Media Practitioners, 20-22 July 2011

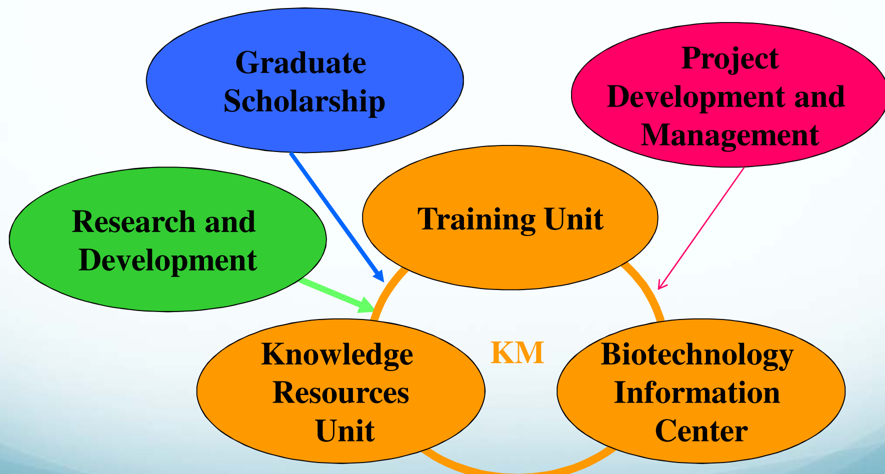
SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development



KM Configuration at SEARCA



SEAMEO SEARCA SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

SEARCA Vision: Towards K-sharing ARD Communities

Networks:

- University Consortium
- Graduate Fellows
- Asian Association of Agric Colleges and Universities
- Food Security Center
- Biotechnology Information Center
- KC3

SEAMEO SEARCA SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

KM Users/Partners

- Higher education institutions in SEA
- Ministries of agriculture and environment/natural resources
- Other decision-makers, researchers and leaders/ champions: in national and international public and private sector organizations, civil society, local governments, and peoples' organizations

SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

KM in A/NRM for Responding to CC in SEA

1. Promoting a learning culture

- International Training on Responding to Changing Climate: Knowledge-based Strategies in Managing Risks in Agriculture and Environment
- Regional platform for K/L-sharing and solutions exchange
- Development of online offerings with mentoring on specific areas on CC adaptation: rice production, crop protection, soil conservation, aquaculture, local governance and community-based DRM, climate monitoring, weather insurance, etc.

SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER
AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and

KM in A/NRM for Responding to CC in SEA

2. **Promoting knowledge creation** through platforms of knowledge sharing, reflection and synthesis
   - Regional platform for peer mentoring and solutions exchange
   - Seminars
   - Knowledge events on Climate Change Adaptations in Agriculture and NRM in SEA
   - *Asian Journal of Agriculture and Development*
   - SEA Agriculture and Development Primers

SEAMEO SEARCA SOUTHEAST AS
AND RESEARCH
Science and Edu

KM in A/NRM for Responding to CC in SEA

3. **Promoting knowledge use** through capture, repackaging, re-use via the **KC3**

K-harvesting to develop knowledge/ learning materials for easier regional access to knowledge solutions via KC3 website

SEAMEO SEARCA SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

KC3

- The Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) is developing the **Knowledge Center on Climate Change Adaptation in Agriculture and Natural Resource Management (KC3)** to strengthen the capacity of Southeast Asians in climate change adaptation, specifically within the domains of agriculture and natural resource management.

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development

MAIN OBJECTIVE

- to track meaningful events of application/adoption of a technology or of a best practice applicable to Southeast Asia

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

ONE-STOP SHOP ON CLIMATE CHANGE

- access to information and media materials
- science-based knowledge solutions/adaptation technologies
- best practices on climate change adaptation
- graduate scholarship
- fellowship
- research and development
- short-term training
- learning events (conferences, seminars, workshops, roundtable discussions, study tours)
- policy advocacy

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

KC3 WEBSITE

KC3's main platform for knowledge sharing across the Southeast Asian region is its website, www.climatechange.searca.org.

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

WEBSITE FEATURES

The KC3 website is a portal that not only stores SEARCA-generated information, but also allows contribution by a global community of knowledge on climate change vis-à-vis agriculture and natural resource adaptation.

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

IN THE NEWS

Climate change adaptation and mitigation news and feature stories gathered from web feeds across Southeast Asia and from SEARCA's existing scholarly outputs, knowledge products, and learning events like seminars, workshops, conferences, training courses, roundtable discussions, and study tours implemented by SEARCA

E-NEWS SERVICE

Provides KC3 updates to subscribers through an electronic newsletter redirecting the readers to the website for full content

A repository of published reference materials and other knowledge products on climate change drawn from relevant online sources, local and international conferences, policy forums, and existing SEARCA publications related to climate change adaptation

KNOWLEDGE RESOURCES

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

KNOWLEDGE SHOWCASES

Experience notes, reports and stories on good practices on climate change adaptation in Southeast Asia

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

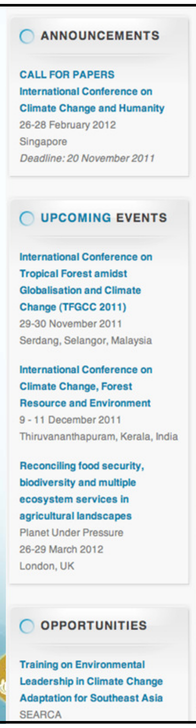
KC3 GALLERY

A collection of images and videos related to climate change

The photos are entries of Southeast Asian photographers in the annual SEARCA Photo Competition, while the videos are short features and documentaries linked from online sources.

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development



KC3 BULLETIN

Announcements on:

- upcoming activities and learning events in the region
- occasional Calls for Papers/Proposals
- opportunities for research or scholarship grants, fellowships
- project funding in climate change adaptation in agriculture and natural resource management

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

A contacts database of climate change experts, practitioners, activists and other climate change adaptation and mitigation enthusiasts

COMMUNITY DIRECTORY

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development

SEARCA can be found in Facebook (www.facebook.com/seameo.searca)

while KC3 is in Twitter (www.twitter.com/searca_kc3)

SOCIAL NETWORKING

SEAMEO SEARCA

SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE

Science and Education for Agriculture and Development

KNOWLEDGE PARTNERS

SEAMEO SEARCA SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Way forward

1. Regional knowledge sharing conference-workshops/writeshops on CCA
2. Grants for action research, dissertations/theses and policy studies
3. Grants/support for knowledge packaging and sharing
4. Community and platform building support (SEARCA's KC3)
5. Training scholarships/grants for regional learning events – financing CCA, mainstreaming CChAM

SEAMEO SEARCA SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Thank you!

www.searca.org
ww.climatechange.searca.org

SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Science and Education for Agriculture and Development

Synthesis & The Way Forward

by E. R. Ponce (eliseoponce@gmail.com)
Resource Person

Symposium on “Climate Change Adaptation Strategies with Mitigation Potential for Food and Water Security

6-8 February 2012
Manila, Philippines

The Objectives

1. To have an increased understanding and promote information exchange in climate change adaptation strategies with mitigation in crop and livestock production , as well as identify the sources of greenhouse gas (GHG) emissions in agriculture and the corresponding strategies with mitigation potentials;
2. To come out with effective governance frameworks for wider dissemination and adoption with mitigation potential at the national and local levels in APEC economies; and
3. To promote region-wide dissemination and adoption of these strategies through the establishments of networks and linkages with international and regional organizations.

The Participants & Papers

- 37 total participants
- 14 technical presentations
- 4 papers from multilateral agencies
- 10 economy presentations
- 1 circulated

3

Technical Papers

LESSONS LEARNED

4

Technical Papers Presented

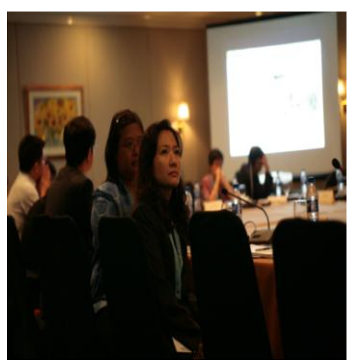
TOPIC	Number
1. R&D	4
2. Framework for Planning	3
3. IEC	6
4. Regulations	1
5. Financing	3
TOTAL	**17**

Note: Some of the papers are classified in two or more topics

5

What have we learned? . . 1

Climate change is one of the greatest ecological, economic, and social challenges facing APEC members; it threatens their individual and collective food security.



6

What have we learned?. . 2

There are five major policy instruments that economies can use to address climate change:

- Research and development
- Information, education, and extension
- Regulations
- Financing

What have we learned? . . 3

Comprehensive climate change strategy in agriculture shall be aimed at building a more resilient food system to insure food & water security, helping to reduce GHG, and help shape a global solution .

What have we learned?. . 4

Adaptation to climate change in agriculture needs to be addressed with a thorough understanding of its interaction with mitigation.

9

What have we learned? . . 5

Practices that reduce emissions may interact with adaptation and climate change impacts in numerous ways.

10

What have we learned? . . .6

5. There are potential synergies and trade-offs between adaptation and mitigation

FAO, 2009

Examples of synergies between adaptation and mitigation in major practices

Management	Details of the Practices
Agronomy	Cover crops
	Improved crop or fallow rotations
	Improved crop varieties
Nutrient management	Organic fertilization (use of compost, animal and green manure)
Tillage and residue management	Incorporation of crop residues, mulching
	Reduced/minimum/zero tillage
Water management	Terraces, contour farming
	Water harvesting
Agroforestry	Live barriers, fences
	Trees on cropland

FAO 2011a

What have we learned?. . .7

Economies must understand and address the classic barriers to technology adoption in their programs:

- Tenure security: lack of tenure security and limited property rights, may hinder adoption of adaptation/mitigation practices
- Limited access to information, local experiences and capacity development, e.g. very low levels of investment/support for agriculture research and extension
- Up-front investment costs on the ground can be high, while on-farm benefits not realized until medium-long term

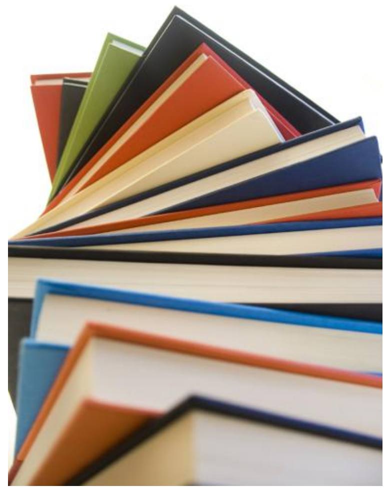
What have we learned?

7. Economies can take advantage of existing multilateral institutions in the areas of financing and IEC to develop and implement their respective programs

- World Bank
- Asian Development Bank
- Food & Agriculture Organization
- Asia Pacific Adaptation Network

Economy Papers

LESSONS LEARNED



Economy Papers

	EAST ASIA		SOUTH-EAST ASIA		USA		AUSTRALIA		TOTAL	
	P	I	P	I	P	I	P	I	P	I
1. R&D		3	1	4		2		1	1	10
2. IEC		3				1				4
3. Regulations										
4. Financing										
TOTAL		**6**	**1**	**4**		**3**		**1**	**15**	

Note: Some of the papers are classified in two or more topics

What we learned? . . 1-2

1. Economies have understood the importance of adapting and mitigating climate change not just to address food & water security but also the consequences to the welfare of their people.
2. Adaptation and mitigation activities and strategies vary from economy to economy because context/situations varies.

What we learned? . . 3-4

3. Experiences are rich and capacities varies from economy to economy.
4. Much discussion has focused on R&D, little on IEC but practically none on the role of regulations in "climate smart agriculture" .

What we learned? . . 5-6

5. There is now greater awareness of the potential synergies from cooperation and partnerships;
6. In order to attain effective transition to climate smart agriculture (CSA), there is a need for adequate policy and institution support.

What we learned? . . 7

There are member economies with good experience on the effective use of regulatory instruments in promoting climate smart agriculture.

FORWARD

21

Participants Resolution

The participants of the symposium, on their personal and professional capacities, urged APEC to launch an "APEC Adaptation with Mitigation in Agriculture Initiative" (AAMAI)."

AAMAI features should cover:

- Framework for cooperation to include:
  - Goals & objectives
  - Programs/activities supported
  - Economy to economy cooperation
  - Public-private partnerships
- Financing
- Networking

23

END

Symposium on "Climate Change Adaptation Strategies with Mitigation Potential for Food and Water Security

6-8 February 2012
Manila, Philippines

24