

Practitioners and Policy-makers Exchange on Climate Change Adaptation in Agriculture

Frequently Asked Questions Booklet
March 2011



ADAPTATION
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Event partners



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Prepared by **Satya Priya¹, Gernot Laganda², Felicity Woodhams², Shirley Kai³, Serena Fortuna³, Nicole Hansen², Hiromi Inagaki¹, Roopa Rakshit¹, Kim Jihyun¹.**

¹ AIT- UNEP Regional Resource Centre for Asia and the Pacific (RRC.AP)

² United Nations Development Programme (UNDP) Asia-Pacific Regional Centre

³ United Nations Environment Programme Regional Office for Asia and the Pacific (UNEP ROAP)

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ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
ADPC	Asia Disaster Preparedness Center
AIT	Asian Institute of Technology
ALM	Adaptation Learning Mechanism
APAARI	Asia-Pacific Association of Agricultural Research Institutions
APFED	Asia-Pacific Forum for Environment and Development
ATRC-NHRL	Australian Tsunami Research Centre & Natural Hazards Research Laboratory
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
CCA	Climate Change Adaptation
CCAI	Climate Change and Adaptation Initiative
CGIAR	Consultative Group on International Agricultural Research
CPWF	Challenge Program on Water and Food
CSDI	Communication for Sustainable Development Initiative
CSIRO	Australian Commonwealth Scientific and Research Organization
DRR	Disaster risk reduction
EC-FAO	European Commission - Food and Agriculture Organization
EET	Environment Education Training
EU	European Union
FAO	Food and Agriculture Organization
FEWS NET	Famine Early Warning System Network
FiBL	Research Institute of Organic Agriculture
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GWP	Global Water Partnership
IAIA	International Association for Impact Assessment
ICBA	International Center for Biosaline Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid-Tropics
IFAD	International Fund for Agricultural Development
IFOAM	International Federation of Organic Agriculture Movements

IFPRI International Food Policy Research Institute
ILEIS Centre for Information on Low External Input and Sustainable Agriculture
IRRI International Rice Research Institute
ISDR International Strategy for Disaster Reduction
IUCN International Union for Conservation of Nature
IWMI International Water Management Institute
LEISA Low External Input and Sustainable Agriculture
LI-BIRD Local Initiatives for Biodiversity Research and Development
MDG-F Millennium Development Goal Achievement Fund
MFF Mangroves for the Future
NWP Nairobi Work Programme
PAR Platform for Agrobiodiversity Research
RIMES Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
SDCC Sustainable Development in the Context of Climate Change
SRI System of Rice Intensification
SWEPs Systemwide and Ecoregional Programmes
UNDP United Nations Development Programme
UNESCAP United Nations Economic and Social Commission for Asia and the Pacific
UNESCO-IWE United Nations Educational, Scientific and Cultural Organization, Institute for
UNFCCC United Nations Framework Convention on Climate Change
UNISDR United Nations International Strategy for Disaster Reduction
UNPAN United Nations Public Administration Network
USAID United States Agency for International Development
VBARD Viet Nam Bank of Agricultural and Rural Development
WFP World Food Programme
WMO World Meteorological Organization
WRI World Resources Institute
WSBI World Savings Banks Institute
WWF World Wildlife Fund



By adapting agricultural systems to become more resilient to climatic trends and changes, losses in production can be reduced.

BACKGROUND & SUMMARY

Climate change induced increases in temperature and the variability of rainfall and extreme weather events are projected to influence the occurrence of crop failures, pest and disease outbreaks, and the degradation of land and water resources. These impacts are likely to affect developing countries in South and Southeast Asia especially hard, as they push to expand their agricultural production to support growing populations and pursue income from export markets.

By adapting agricultural systems to become more resilient to climatic trends and changes, losses in production can be reduced. However, the concept of adaptation is still relatively new and practical lessons from agricultural adaptation projects are limited, leaving policy makers in South and Southeast Asian countries often lacking the technical armory to take timely steps toward adaptation. There is a distinct need for agricultural practitioners to further their understanding of climate change adaptation practices.

The 'Practitioners and Policy makers Exchange on Climate Change Adaptation in Agriculture', which was held at the Asian Institute of Technology (AIT) in Bangkok / Thailand from 30 August to 1 September 2010, aimed to address this need. With 25 practitioners, researchers and policy makers from Bangladesh, Cambodia, Lao PDR, Myanmar, Philippines, Thailand and Viet Nam, the event facilitated the transfer of knowledge gained from increasing experience with adaptation in the agriculture sector. Linkages between different adaptation projects and their management teams were established, access to new research results were facilitated, and resources to support mutual learning and knowledge sharing were provided. Throughout the event, the participants of this exchange were at the center of this learning experience, being at the same time providers and receivers of information.

ABOUT THIS FAQ

Over the course of the three days exchange, the organizers recorded all participants' questions and attendees then voted on the questions they felt to be most relevant to their particular situation. The top 15 questions are captured in this booklet, divided into the following sections:

Over the course of the three days exchange, the organizers recorded all participants' questions and attendees then voted on the questions they felt to be most relevant to their particular situation. The top 15 questions are captured in this booklet, divided into the following sections:

- Advocacy and Engagement
- Climate-resilient Farming Practices
- Climate Change Adaptation Financing
- Knowledge Sharing
- Thematic linkages between Climate Change Adaptation and other fields

This booklet aims to provide participants with access to relevant resources, examples, case studies and specialized organizations which might be useful in addressing these questions in a particular country context. Together with all presentations and material delivered during the practitioners and policy makers exchange, it is available on the Knowledge Portal, 'Climate Change Adaptation in Asia and the Pacific' (www.asiapacificadapt.net).

The Practitioners and Policy-makers Exchange on Climate Change Adaptation in Agriculture was co-organized by the Regional Climate Change Adaptation Knowledge Platform for Asia (Adaptation Knowledge Platform) and the United Nations Development Programme (UNDP) with support from the Adaptation Learning Mechanism (ALM), the European Commission/Food and Agriculture Organization (EC/FAO) Food Security Programme, and the Millennium Development Goal Achievement Fund (MDG-F).

Question 1

What are some good approaches to engage policy-makers and other stakeholders in climate change adaptation for the agriculture sector?

Basic concepts and terminology**Who are stakeholders?**

When it comes to climate change adaptation in the agriculture sector, the term “stakeholder” generally refers to a broad range of individuals/groups who have an active interest in the resilience and protection of agricultural processes from climate-related shocks and stresses. This generally includes the whole agribusiness value chain consisting of the following groups:

1. **Seller/s of agricultural products:** Independent individual operations, small groups, whole sellers, exporters and importers, corporate sellers
2. **Buyers:** Independent individual buyers, small-independent retailers, institutional bulk buyers, whole sellers, exporters and importers, retail chains
3. **Producers:** Independent individual farmers/producers, groups of farmers, co-operatives, contract farming agencies, corporate farming agencies
4. **Consumers:** raw produce consumers, processed bulk produce consumers, retail packed produce consumers
5. **Knowledge Management Service Providers:** Non-Governmental Organizations (NGOs) and Not-for-Profit Organizations (NPOs), contract farming organizations, group promoters - developers - managers, international organizations (FAO, IFAD, WFP, UNDP)
6. **Network Suppliers:** Suppliers of inputs, tools and equipments, supplier/s of technology and services
7. **Network Marketing:** Independent individuals, unorganized groups, organized groups
8. **Processing Facilities:** Micro enterprises, small and medium enterprises, large processors
9. **Logistics and Linkage Service Providers:** Packaging and labeling, transport, warehousing, handling, procurement management, cold chain management, banking, credit and investment services, insurance and risk management services
10. **Regulatory - Quality Certification agency/ies:** Accreditation agencies, quality regulatory and certification agencies
11. **Public sector representatives:** Policy makers, agricultural planners, land-use planners, economic and fiscal planners
12. **Others:** Trade promotion bodies and agencies, research organizations, academic institutions, technology development agencies, quality management organization/s.

Source: Agri-infotech, <http://www.agri-infotech.com>

Links to examples and case studies

- **Agro-Biodiversity and Climate Adaptation Project Proposal**

This project is designed to enhance capacity and awareness at key national agencies and at local levels, to respond to climate variability and change and better equip local communities to cope with climate change through the conservation and use of agro-biodiversity.

Source: World Bank (2009), Global Environment Facility (GEF) trust fund programme proposal: Adaptation to Climate Change Using Agrobiodiversity Resources in the Rainfed Highlands of Yemen.
<http://www.thegef.org/gef/sites/thegef.org/files/documents/document/03-29-2010%20ID%203267-%20Council%20Letter.pdf>

- **Climate change and adaptation in African agriculture**

This study, commissioned by the Rockefeller Foundation, set out to identify and understand how information from climate change models is being integrated into agricultural development practice and decision making.

Source: SEI (2008), Climate change and adaptation in African agriculture.
http://www2.gtz.de/wbf/4tDx9kw63gma/SEI_Rockefeller_Africa_Climate_Report_04April08.pdf

- **Southeast Asia regional learning event on System of Rice Intensification (SRI) in context of climate change and water productivity**

SRI experts from Vietnam, Cambodia, Laos and Thailand gathered for a regional workshop. It was organized by the Asian Institute of Technology (AIT) in collaboration with World Bank Institute, Washington DC, USA to help disseminate information to varied audiences, including both farmers as practitioners as well as policymakers, researchers, project managers and others who may be interested in promoting SRI as a way to produce more with less input, especially water productivity and climate change. Workshop participants actively discussed and exchanged ideas to understand the different country experiences, benefits by farmers, problems encountered in SRI adoption, gaps in information, and opportunities for regional collaboration and networking in knowledge dissemination.

Source: AIT (2009), Southeast Asia Regional Knowledge Exchange on SRI Producing More with Less Water. <http://www.ait.ac.th/research/workshop-reports/AIT-WBI-Workshop-Report.pdf>

- **Lessons learned from FAO's participatory environment education and training for sustainable agriculture**

Food and Agriculture Organization (FAO) supported bottom-up Environment Education Training (EET) initiatives with eight institutions in six countries (China, Bangladesh, Thailand, Indonesia, the Philippines, and Malaysia). Highlights of the lessons learned from the experiences in planning, implementing and managing the participatory and collaborative EET activities in the Asian region are drawn and best practices in EET are offered for improving similar programmes and/or replications by other interested institutions or agencies.

Source: Adhikarya, R. (2001), Participatory environment education and training for sustainable agriculture, Chapter 13 Mainstreaming environment education into agricultural extension and training programmes: best practices and lessons learned. <http://www.fao.org/docrep/006/y0923e/y0923e16.htm>

- **Communication for Sustainable Development Initiative (CSDI) project in Bangladesh**

The Government of Bangladesh recognizes the key role of participatory techniques and community media encouraging the use of radio trainings, video and audio-visual training materials to facilitate and accelerate technological transformation in agriculture.

Source: CSDI (undated), CSDI project in Bangladesh. <http://www.csdinitiative.org/projects/project-bangladesh.html>

Links to specialized institutions

- Local Initiatives for Biodiversity Research and Development (LI-BIRD): <http://www.libird.org/>
- Platform for Agrobiodiversity Research (PAR): <http://agrobiodiversityplatform.org/>
- Consultative Group on International Agricultural Research (CGIAR) - CGIAR Systemwide and Ecoregional Programmes (SWEPs) and other Inter-Center Initiatives: <http://www.cgiar.org/impact/initiatives.html>
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) - Climate Adaptation Flagship : <http://www.csiro.au/resources/CAF-working-paper-3.html>
- International Fund for Agricultural Development (IFAD)-Climate change and the future of smallholder agriculture : <http://www.ifad.org/climate/roundtable/index.htm>

Links to further reading

- Tomich, T., Garbach, K. & Cantor, A. (2007), A framework for assessment of California agroecosystems: Pitfalls and possibilities. Retrieved from http://aic.ucdavis.edu/research/sustainability/agroecosystems/AGECO2_Tomich.pdf
- Gardner, J., Dowd, A.M., Mason, C. & Ashworth, P. (2009), A framework for stakeholder engagement on climate adaptation, CSIRO Climate Adaptation Flagship Working Paper Number #3. Retrieved from <http://www.csiro.au/files/files/pph1.pdf>
- Australian Commonwealth Scientific and Research Organization (CSIRO) (undated), Project profile: Developing climate change adaptation strategies for farming communities in Cambodia, Laos, Bangladesh and India. Retrieved from <http://www.csiro.au/science/adapt-farming-Asia.html>
- Australian Centre for International Agricultural Research (ACIAR) (undated), Country partnership: Cambodia Agricultural Value Chain Programme. Retrieved from <http://www.aciar.gov.au/cavac>
- Conde, C. & Lonsdale, K. (2004), Engaging Stakeholders in the Adaptation Process. UNDP website, GEF documents, APF, Technical paper2. Retrieved from <http://www.undp.org/gef/documents/publications/apf-technical-paper02.pdf>
- Pretty, J.N., Guijt, I., Thompson, J. & Scoones, I. (1995), Participatory Learning and Action: A Trainer's Guide, International Institute for Environment and Development. Available at: <http://pubs.iied.org/6021IIED.html>
- Heck, B. (2003), Participatory Development: Guidelines for Beneficiary Participation in Agricultural and Rural Development, Rural Development Department of FAO, 2nd edition. Retrieved from <http://www.fao.org/docrep/007/ad817e/ad817e00.htm#Contents>
- Kumar, P. (2009), Impact of climate change on crop production and protection (with special reference to SE Asia): what are the lesson for IPM Programme. Retrieved from <http://www.scribd.com/doc/47229389/Impact-of-Climate-Change-on-Asian-Plant-Protection-Lessons-for-IPM-FFS-Programmes>

Question 2

How can we adapt farms to dryer conditions?

Basic concepts and terminology

Basic adaptation options for drier conditioned farms include:

- Expanded use of traditional rainwater harvesting and water conserving techniques
- Rotation of irrigation during water shortage
- Adjustment of planting regimes and crop varieties (e.g. planting drought resilient species)
- improvement of soil condition that enhances water storage capacity (For more information see Question 7) - Which farming practices increase soil water holding capacity?
- Adjustment of farming practices (e.g. spatial separation of plots for cropping and grazing to diversify exposures)

Source: M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds) (2008), Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch17s17-2-2.html

Links to examples and case studies

● Supplemental irrigation in India

Stored water is used communally for supplemental irrigation during dry spells or for growing a post-rainy season crop. A promising technology that has been widely adapted in India is the percolation tank, a small reservoir that captures runoff and holds the water for percolation into shallow water tables.

Source: International Water Management Institute (IWMI) (2007), A Comprehensive Assessment of Water Management in Agriculture. http://www.iwmi.cgiar.org/assessment/files_new/synthesis/Summary_SynthesisBook.pdf

● Dry land ecosystem-based methods in Bangladesh

Projected higher temperatures and water stress due to heat could pose an additional risk of droughts, causing reduction in vegetation and agricultural production. In response, several ecosystem-based adaptation methods were introduced, including supplemental irrigation (mini- ponds), diversification of crops, and dry seedbeds for rice and homestead gardens.

Source: FAO (2008), Project Summary Report Phase I. Improved Adaptive Capacity to Climate Change for Sustainable Livelihoods in the Agriculture Sector, Community Based Adaptation in Action: A case study from Bangladesh. <ftp://ftp.fao.org/docrep/fao/010/i0481e/i0481e.pdf>

● Community preparedness for climate change and increased water use efficiency for rice cultivation using principles of System of Rice Intensification (SRI) in Central Thailand, <http://www.apfed.net/showcase/project/index.htm>

This project is strengthening farmers' capacities to deal with location-specific heterogeneity and develop area-specific technologies on rice production. It focuses on optimal use of purchased input and water in order to prepare against the negative externalities of climate change, and achieve higher net returns from rice farming.

Source: The Asia-Pacific Forum for Environment and Development (APFED)(undated), APFED II Activities. <http://www.apfed.net/showcase/project/index.htm>

● Potential role of green mulches in combination with clay and organic amendments to soils as a means of enhancing the fertility and water holding capacity of degraded sandy soils in Northeast Thailand

AIT and Consultative Group on International Agricultural Research (CGIAR) have set up experiments to integrate and evaluate the introduction of rice and green mulch with improved soil amendment techniques (bentonite and termite mound) to enhance the soil's water holding capacity as well as the productivity of jasmine rice.

Source: CGIAR, Civil Society Organizations and the CGIAR. http://www.cgiar.org/csos/cso_cgiar_grant_program.html

Links to specialized institutions

- International Water Management Institute (IWMI): <http://www.iwmi.cgiar.org/>
- Food and Agriculture Organization (FAO) Conservation agriculture: <http://www.fao.org/ag/ca/>

Links to further reading

- Molden, D. (2007), Water for food, water for life: a comprehensive assessment of water management in agriculture, Earthscan/James & James: IWMI. Retrieved from <http://www.iwmi.cgiar.org/assessment/>
- International Food Policy Research Institute (IFPRI) & Asian Development Bank (ADB) (2009), Building Climate Resilience in the Agriculture Sector of Asia and the Pacific, ADB. Retrieved from <http://www.adb.org/Documents/Books/Building-Climate-Resilience-Agriculture-Sector/Building-Climate-Resilience-Agriculture-Sector.pdf>
- Kijne, J., Barker, R., & Molden, B. (2003), Water Productivity in Agriculture: Limits and Opportunities for Improvement, CABI Publication, Wallingford UK and Cambridge MA USA. Retrieved from <http://www.iwmi.cgiar.org/Assessment/files/Other%20Pubs/Waterproductivity.pdf>
- Bouman, B.A.M., Hengsdijk, H., Hardy, B., Bindraban, P.S., Tuong, T.P. & Ladha, J.K. (2002), Water-wise Rice Production, International Rice Research Institute (IRRI). Retrieved from http://books.irri.org/9712201821_content.pdf
- World Wildlife Fund (WWF) - International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT) (2010), More Rice for People: More Water for the Planet. System of Rice Intensification. Retrieved from <http://www.indiawaterportal.org/node/11786>
- Altieri, M., & Koohafkan, P. (2008), Enduring Farms: Climate Change, Smallholders and traditional Farming Communities, Third World Network, Malaysia. Retrieved from http://www.fao.org/nr/water/docs/Enduring_Farms.pdf
- Mishra, A. & Kumar, P., (2009), Southeast Asia Regional Knowledge Exchange on SRI: Producing More with Less Water. Asian Institute of Technology, Bangkok, Thailand. Report of a workshop organized at AIT, June 22-23, 2009, in collaboration with World Bank Institute. Retrieved from <http://www.ait.ac.th/research/workshop-reports/AIT-WBI-Workshop-Report.pdf>

Question 3

What are the benefits of on-farm water storage?

Basic concepts and terminology

On- farm water storage

On-farm storage includes tanks, ponds, natural wetlands, soil moisture, groundwater and reservoirs. Tanks and ponds are cisterns or cavities (uncovered or covered, unlined or lined) built on-farm to store water. These are filled either by runoff, groundwater or from nearby water sources. On-farm water storage presents many adaptive benefits for farmers as they can improve control over water application, increase production and reduce the risks that limit water access. Water stored in on-farm storage installations can help to cover peaks in demand and also smooth out variations in supply, thus presenting both environmental and economic benefits.

Source: IWMI (2010), Water Storage in an Era of Climate Change: Addressing the Challenge of Increasing Rainfall Variability. http://www.iwmi.cgiar.org/Publications/Blue_Papers/PDF/Blue_Paper_2010-final.pdf

Links to examples and case studies

- **Drip irrigation helps farmers in Bangladesh grow crops in salt-affected soil during the dry season**

Using drip irrigation technology on raised planting beds, tomato farmers were able to increase their yields fourfold by leeching salts out of the root zone of the plants. Water for drip irrigation was taken from rainwater ponds. As a result, salinity levels dropped to less than 30% of levels typically recorded. Researchers at the International Center for Biosaline Agriculture (ICBA <http://www.biosaline.org/>) in conjunction with the Bangladesh Agricultural Research Institute (BARI <http://www.bari.gov.bd>) determined that for every dollar invested in this innovative farming practice, it would return \$4.71 extra in profits.

Source: Farming First (2009), Drip Irrigation Helps Farmers in Bangladesh Grow Crops in Salt-affected Soil during Dry Season. <http://www.farmingfirst.org/2009/10/drip-irrigation-help-farmers-in-bangladesh-grow-crops-in-salt-affected-soil-during-dry-season/>

- **Restoration of earth-made water tanks in India**

Together with a local NGO and a number of target villages, the WWF restored 12 tanks in the 88,000 ha sub-catchment of the Maner River, a tributary of the Godavari River, through de-silting to capture more monsoon runoff. Village committees were formed to maintain the tanks and further manage water use. The villagers benefited from increased water availability and enriched biodiversity.

Source: WWF (2008), Water for life: Lessons for climate change adaptation from better management of rivers for people and nature. http://assets.panda.org/downloads/50_12_wwf_climate_change_v2_full_report.pdf

Links to specialized institutions

- International Water Management Institute (IWMI) on water storage: http://www.iwmi.cgiar.org/Topics/Water_Storage/
- International Fund for Agricultural Development (IFAD)- Water retention and harvesting: <http://www.ifad.org/english/water/innnowat/topic/harvesting.htm>

Links to further reading

- IWMI (2006), Water Policy Briefing: Recycling Realities: Managing Health Risks to Make Wastewater an Asset, Issue 17. Retrieved from http://www.iwmi.cgiar.org/Publications/Water_Policy_Briefs/PDF/wpb17.pdf
- McCartney, M. & Smakhtin, V. (2010), Water Storage in an Era of Climate Change: Addressing the Challenge of Increasing Rainfall Variability. IWMI. Retrieved from http://www.iwmi.cgiar.org/Publications/Blue_Papers/PDF/Blue_Paper_2010-final.pdf
- Economic and Social Commission for Asia and the Pacific (2009), Sustainable Agriculture and Food Security in Asia and the Pacific, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). Retrieved from <http://www.unescap.org/65/documents/Theme-Study/st-escap-2535.pdf>
- FAO (2008), Evaluation of FAO cooperation with India, Andhra Pradesh Farmer Managed Groundwater Systems - Evaluation Report. Available at: <http://www.indiawaterportal.org/node/573>

Question 4

How can we increase production gains in rain-fed agriculture?

Basic concepts and terminology**Soil and Nutrient Management**

This does not only relate to fertilizer management, but also to the efficient management of organic nutrients in the soil. Nutrients from straw and manure are important parts of the farming system and can be managed to enhance productivity in rain-fed agriculture. Nutrient availability can be improved by avoiding over application of fertilizer, planting green manure crops, adopting reduced or no-till farming practices and avoiding over application of water.

Drought and Flood Management

Reducing the risk of crop losses caused by flooding in rain-fed systems may include work on embankments and drainage channels, altering bund height, adjusting planting regimes and planting flood-tolerant crop types. Drought risk can be managed by responsibly using on-farm water storage and groundwater, by increasing the soil water holding capacity [refer to question 7], by adjusting planting regimes and by planting drought resilient crop types. Managing for both drought and flood can be made easier by gaining access to climate forecasting services, such as those delivered by Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES).

Source: FAO (2011), Climate-Smart Agriculture, <http://www.fao.org/climatechange/climatesmart/66303/en/>

Links to examples and case studies

- **Improved rice cultivation in Cambodia**

The Cambodia Farmers' Association Federation for Agricultural Development started an initiative to help adapt the sector to climate change impacts. The organization formulated a new sustainable farming practice called 'System of Rice Intensification' which helps smallholder farmers increase their yields by following the principle of 'transplanting young seedlings singly and widely spaced', a technique that has the advantage of requiring less seeds and minimum irrigation.

Source: Council for Agricultural and Rural Development, The system of rice intensification in Cambodia (undated). <http://www.foodsecurity.gov.kh/sri/whatSRI.htm#principle>

- **Improving water and fertilizer-use-efficiency in rain-fed rice cultivation in Northeast Thailand**

In Thailand, farmers of the Northeast province were interested to grow more rice with less water using green mulch and cover crops in SRI rice field. This was suggested as an attractive option because the ground cover would not only suppress weeds and reduce the rate of soil moisture depletion, but would add readily decomposable organic matter, which after incorporation would enhance the soil's fertility and fertilizer-use-efficiency in preceding crops. With support from AIT and the Consultative Group on International Agricultural Research (CGIAR) Challenge Program on Water and Food (CPWF), farmers' evaluation of this innovative idea showed that rice crops grown with SRI practices that also had mung bean as an intercrop gave higher yield, along with highest foliage cover, compared to non-intercropped SRI crops using herbicides for weed control.

Source: SRI (undated), Thailand: Initial project report. <http://ciifad.cornell.edu/sri/countries/thailand/index.html>

Links to specialized institutions

- International Rice Research Institute (IRRI) on rain-fed agriculture: http://beta.irri.org/solutions/index.php?option=com_content&task=view&id=63&Itemid=69, <http://irri.org/our-partners/networks/ifad-facility-grant/enhanced-farming-system-productivity-in-rainfed-areas>
- International Water Management Institute (IWMI)-Comprehensive Assessment on Water Management in Agriculture: http://www.iwmi.cgiar.org/Assessment/Synthesis/rainfed.htm?zoom_highlight=rainfed+
- System of Rice Intensification (SRI): <http://sri.ciifad.cornell.edu/index.html>

Links to further reading

- Wani, S.P., Rockstrom, J. & Oweis, T. (2009), Rainfed Agriculture: Unlocking the Potential, IWMI, Retrieved from http://www.iwmi.cgiar.org/Publications/CABI_Publications/CA_CABI_Series/Rainfed_Agriculture/Protected/Rainfed_Agriculture_Unlocking_the_Potential.pdf
- Haefele, S.M. & Konboon, Y. (2009), Nutrient Management in Rainfed Lowland Rice in Lao PDR, Field Crops Research, 114, 374–385. Retrieved from <http://www.thaiscience.info/Article%20for%20ThaiScience/Article/2/Ts-2%20nutrient%20management%20for%20rainfed%20lowland%20rice%20in%20northeast%20thailand.pdf>
- Noble, A. (2010), Irrigation Management and Water Management in Rainfed agriculture Systems – Planning for Changing Water Availability. Pers. Comm. Presentation available at: <http://www.climateadapt.asia/events/Practitioners%20Exchange/view/10>
- Hussain, S. G. (2010), New Crop Technologies: Developments in Crop Modeling under Climate Change. Pers. Comm. Presentation available at: <http://www.climateadapt.asia/events/Practitioners%20Exchange/view/10>
- Lansigan, F. (2010), Adapting Farm Management Practices for Climate Resilience. Pers. Comm. Presentation available at: <http://www.climateadapt.asia/events/Practitioners%20Exchange/view/10>
- Farming First (2010), Case Study: Improved rice cultivation in Cambodia. Retrieved from <http://www.farmingfirst.org/2010/04/improved-rice-cultivation-in-cambodia/>
- Uphoff, N. & Mishra, A. (2009), Climate-proofing' crop production in response to climate change: Opportunities with the System of Rice Intensification (SRI). The Hindu Survey of Indian Agriculture, 12-13. Retrieved from http://www.wassan.org/sri/documents/SRI_SurveyofIndianAgriculture2009.pdf

Question 5

How can groundwater be used to improve water reliability on small farms?

Basic concepts and terminology**Small-scale groundwater irrigation**

Small-scale irrigation schemes have significantly contributed to agricultural productivity in several parts of the world, especially in Asia. Diversion or direct pumping from rivers and streams, gravity flows from small reservoirs (tanks), and pumping from underlying groundwater aquifers constitute the principal means of sourcing water for small-scale irrigation schemes.

Source: Nayak, S. & Nandagiri, L. (2008), Characterization of small-scale ground water irrigation schemes in a humid coastal region of southern India. <http://www.jtropag.in/index.php/ojs/article/viewFile/461/224>

Links to examples and case studies

- **Rainwater harvesting bylaw in India**

In India, rainwater harvesting is a bylaw in urban construction regulations in cities such as Chennai, Delhi, and Rajkot. Artificial recharge is promoted and financially supported by the government. At the local level, rainwater harvesting has gained the character of a mass movement, especially in western India, where groundwater exhaustion is a real impediment for agricultural activities.

Source: IWMI (2007), Groundwater: a global assessment of scale and significance. <http://www.iwmi.cgiar.org/assessment/Water%20for%20Food%20Water%20for%20Life/Chapters/Chapter%2010%20Groundwater.pdf>

- **Autonomous smallholder shallow groundwater irrigation in Ghana**

In Ghana's upper east region, farmers have started using shallow groundwater to produce horticultural crops. Groundwater infrastructure is developed using rudimentary digging/drilling technologies, banking on the abundant human labor during the long dry season.

Source: IWMI (2010), Toward sustainable groundwater in agriculture conference, Presentation: Autonomous smallholder shallow groundwater irrigation development in Upper east region of Ghana. <http://ag-groundwater.org/presentations/title/?uid=1213&ds=517>

- **Small-holder System Innovations in Integrated Watershed Management in Tanzania and South Africa**

This programme is an applied and multidisciplinary research initiative which focuses on the potential of indigenous and exogenous water system innovations in smallholder farms for improved land and water productivity.

Source: United Nations Educational, Scientific and Cultural Organization - Institute for Water Education (UNESCO-IWE) (undated), Project activities. <http://www.unesco-ihe.org/Project-activities/Project-database/Small-holder-System-Innovations-in-Integrated-Watershed-Management>

Links to specialized institutions

- Food and Agriculture Organization (FAO): http://www.fao.org/corp/google_result/en/?cx=018170620143701104933%3Aqq82jsfba7w&q=Groundwater&cof=FORID%3A9#1043
- International Water Management Institute (IWMI) on groundwater: <http://www.iwmi.cgiar.org/sitesearch.aspx?cx=018045567733918951572%3Af9s-u72dlpc&cof=FORID%3A11&q=groundwater#1138>
- Centre for Information on Low External Input and Sustainable Agriculture (ILEIA): www.ileia.org

Links to further reading

- IWMI (2005), Water Policy Briefing: Planning Groundwater Use for Sustainable Rural Development, Issue 14. Retrieved from http://www.iwmi.cgiar.org/publications/Water_Policy_Briefs/PDF/wpb14.pdf
- Water Wiki (2009), Aquifer Types. Retrieved from http://waterwiki.net/index.php/Aquifer_types
- Purdue University, Types of Water Wells. Retrieved from <http://www.purdue.edu/envirosoft/well/src/types2.htm>
- India Water Portal, Recharge Wells (undated). Retrieved from <http://www.indiawaterportal.org/node/6217>

Question 6

Which farming practices increase soil water holding capacity?

- Waller, R. M. (1994), Ground water and the rural homeowner, US Dept. of the Interior, US Geological Survey. Retrieved from http://pubs.usgs.gov/gip/gw_ruralhomeowner/gw_ruralhomeowner_new.html

Basic concepts and terminology

Soil water holding capacity

Soil water holding capacity refers to the ability of the soil to hold water and use the stored moisture to retain and supply the nutrients for plant growth. Soil water holding capacity is increasingly becoming an issue for climate resilient agriculture, particularly as a result of changing rainfall patterns, higher temperatures and increasing drought.

Farming practices which can be implemented to increase soil water holding capacity include:

- conservation tillage;
- mulching and compost/manure use; and
- application of soils from termite mounds and clay materials (bentonites).

Source: IFAD (undated), Topic sheet, InnoWat, Managing green water: Soil moisture management. http://www.ifad.org/english/water/innowat/topic/Topic_6web.pdf

Links to examples and case studies

- **Improved water holding capacity of sandy soil in Northeast Thailand**

Field based soil studies were undertaken to evaluate local traditional practices currently adopted by farmers and innovative approaches to improve the productivity of these soils. The treatments included: composted leaf litter, termite mound material, and bentonite.

Source: IWMI (2009), Economic gains of improving soil fertility and water holding capacity with clay application: the impact of soil remediation research in Northeast Thailand. http://www.iwmi.cgiar.org/Publications/IWMI_Research_Reports/PDF/PUB130/RR130.pdf

Links to specialized institutions

- Centre for Information on Low External Input and Sustainable Agriculture (ILEIA), resources on Water: [http://ileia.leisa.info/index.php?url=show-blob-html.tpl&p\[o_id\]=242594&p\[a_id\]=237&p\[a_seq\]=1](http://ileia.leisa.info/index.php?url=show-blob-html.tpl&p[o_id]=242594&p[a_id]=237&p[a_seq]=1)
- International Fund for Agricultural Development (IFAD) on water: <http://www.ifad.org/english/water/index.htm>

Links to further reading

- Goddard, T., Zebisch, M., Gan, Y., Ellis, W., Watson, A. & Sombatpanit, S. (2008), No-Till Farming Systems. Special Publication No. 3, World Association of Soil and Water Conservation, Bangkok, ISBN: 978-974-8391-60-1, 544 pp. Retrieved from <http://homepage2.nifty.com/waswc/WASWC%20Strage/S-Publication/non-till-book.pdf>
- IFAD (undated), Topic sheet, InnoWat, Managing green water: Soil moisture management, IFAD. Retrieved from http://www.ifad.org/english/water/innowat/topic/Topic_6web.pdf
- FAO (2000), Manual on integrated soil management and conservation practices, FAO Land and Water Bulletin 8. Retrieved from <ftp://ftp.fao.org/agl/agll/docs/lw8e.pdf>
- Suzuki, S., Noble, A. D. & Ruaysoongnern, S. (2007), Improvement in water-holding capacity and structural stability of a sandy soil in Northeast Thailand, Arid Land Research and Management, 1532-4900, 21: 37-49. Available at: <http://www.informaworld.com/smpp/content~db=all~content=a769139429>

Question 7

How can we manage agriculture/land use to deliver ecosystem services?

Basic concepts and terminology**Ecosystem services**

The ecosystems approach is a strategy for the integrated management of agriculture, land, water and living resources that promotes conservation and sustainable use in an equitable way. Examples of agriculture/land use to deliver ecosystems services include:

- Agricultural productivity or biodiversity maintenance;
- Provision of livelihood services such as food, fiber, or fish;
- Maintaining health services such as carbon sequestration; and
- Cultural services such as eco-tourism.

Source: WWF (undated), Agriculture: major impacts on species and places. http://wwf.panda.org/about_our_earth/agriculture_impacts/

IUCN (2010), Ecosystem management. http://www.iucn.org/about/work/programmes/ecosystem_management/

Links to examples and case studies● **Shrimp farming and mangrove losses in Thailand**

A study of mangrove conversion near Tha Po Village in Thailand compared the economic returns from shrimp farms with those from sustainably managed mangroves. Conversion of mangroves to shrimp farms appeared the economically sound choice when only the values of the shrimp harvest and forest products were considered in the economic analyses.

Source: Mangroves for the Future (MFF) (2010), Ecosystem approaches to coastal resources management: the case for investing in mangrove ecosystems. <http://www.mangrovesforthefuture.org/Assets/documents/MFF-ADB%20FAO%20Investment%20Forum.pdf>

● **Reconnection of lakes to the Yangtze River in China**

The WWF initiated a project to reconnect three lakes of Zhangdu, Hong and Tian'e Zhou back to the Yangtze River through opening the sluice gates. In connection with this activity, illegal and unprofitable aquaculture facilities and other infrastructures were removed or modified. As a result, floodwater storage is improved and livelihood sources are enhanced.

Source: WWF (2008), Water for life: Lessons for climate change adaptation from better management of rivers for people and nature. http://assets.panda.org/downloads/50_12_wwf_climate_change_v2_full_report.pdf

Links to specialized institutions

- World Wildlife Fund (WWF): http://wwf.panda.org/about_our_earth/agriculture_impacts/
- International Union for Conservation of Nature (IUCN)- Ecosystem Management Programme: http://www.iucn.org/about/work/programmes/ecosystem_management/
- Mangroves for the Future (MFF): <http://www.mangrovesforthefuture.org/>
- The Ecosystems and Livelihoods Adaptation Network (ELAN): <http://www.elanadapt.net/>

Links to further reading

- Tompkins, E.L. & Adger, W.N. (2003), Building resilience to climate change through adaptive management of natural resources, Tyndall Centre Working Paper 27. Retrieved from http://leeds.academia.edu/EmmaTompkins/Papers/107842/Building_resilience_to_climate_change_through_adaptive_management_of_natural_resources
- Dudley, N., Stolton, S., Belokurov, A., Krueger, L., Lopoukhine, N., MacKinnon, K., Sandwith, T. & Sekhran, N. (2010), Natural Solutions: protected areas helping people cope with climate change, IUCN/WWF, TNC, UNDP, WCS, The World Bank and WWF, Gland, Switzerland, Washington DC and New York, USA. Retrieved from http://cmsdata.iucn.org/downloads/natural_solutions.pdf
- Ash, N., Lucas, N., Bubb, P., Iceland, C., Irwin, F., Ranganathan, J. & Raudsepp-Hearne, C. (2008), Ecosystem Services: A Guide for Decision Makers, WRI. Retrieved from http://pdf.wri.org/ecosystem_services_guide_for_decisionmakers.pdf

Question 8

What funding opportunities exist to work on Climate Change Adaptation in agriculture?

Basic concepts and terminology

Funding opportunities

Numerous international aid and non-government funding opportunities exist which can be used to implement on-the-ground adaptation projects to enhance resilience to climate change. Most of these are not solely focused on the agricultural sector, however more on climate change adaptation in agriculture.

Links to examples and case studies

- **Optimal rainfall insurance contracts for maize producers in Ghana's Northern Region**

This paper assesses the feasibility of rainfall insurance contracts for agricultural production in Ghana's Northern Region. The theoretical contract is implemented using monthly rainfall and annual maize crop yield data from 1998 to 2004 from 12 districts in the Northern Region under varying premium rates.

Source: IFPRI (2010), Optimal rainfall insurance contracts for maize producers in Ghana's Northern Region. <http://www.ifpri.org/publication/optimal-rainfall-insurance-contracts-maize-producers-ghana-s-northern-region>

Links to specialized institutions

- Climate Funds List: <http://www.climatefundsupdate.org/listing>
- Climate Financing Options: <http://www.climatefinanceoptions.org/cfo/index.php>

Links to further reading

- Echeverria, R. G. & Beintema, N. M. (2009), Mobilizing Financial Resources for Agricultural Research in Developing Countries, Trends and Mechanisms. Retrieved from <http://www.fao.org/docs/eims/upload/261898/mobilizing%20financial%20resources%20for%20AR4D.pdf>
- ICF International (2009), Financing Climate Adaptation and Mitigation in Rural Areas of Developing Countries, USAID. Retrieved from http://pdf.usaid.gov/pdf_docs/PNADO826.pdf
- FAO (2010), Towards a work programme on agriculture: a submission to the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA). Retrieved from <http://unfccc.int/resource/docs/2010/smsn/igo/081.pdf>
- Beintema, N. M. & Stads, G. S. (2008), Diversity in agricultural research resources in the Asia-Pacific region: Agricultural Science and Technology Indicators Initiative. IFPRI and Asia-Pacific Association of Agricultural Research Institutions (APAARI). Retrieved from <http://www.apaari.org/wp-content/uploads/2009/05/asti-publication.pdf>

Question 9

Can early warning systems and climate forecasts be used in remote areas and how do we transfer the information to the farmers?

Basic concepts and terminology**Sources of climate information**

Improved access to climate information can reduce the impacts of drought, flood and other extreme weather events on the agriculture sector. Climate information can come from four potential sources.

- Past climate figures – high potential, underutilized
- Climate information monitoring – moderate potential, reasonably well utilized
- Climate forecasting – moderate potential, underutilized
- Climate change scenarios – not yet systematically applied, utilization largely unknown

Sources: RMSI (2006), Draft Final Report on the Integrated Modeling System submitted to World Bank (internal document). The World Bank, United Nations International Strategy for Disaster Reduction, World Meteorological Organization and Finish Meteorological Institute (undated), Chapter 2: User Needs Assessment, Strengthening the Hydrometeorological Services in South Eastern Europe. http://www.unisdr.org/preventionweb/files/7650_StrengtheningHydrometeorologicalSEE1.pdf

Links to examples and case studies● **Climate field school in Indonesia**

Climate Field Schools have been set up to improve the basic knowledge of farmers to help them to use climate forecast information when designing crop management strategies. Materials to be used in the field schools were mostly developed with farmers, based on their experiences.

Source: FAO (undated), Technology for agriculture: Climate Field School for Farmer. <http://www.fao.org/teca/content/climate-field-school-farmers>

● **AgroMetShell –a crop yield forecasting software**

The FAO developed the AgroMetShell, a crop specific soil water balance model which is a useful “early warning” indicator for yield reduction due to water stress. This software is especially useful for countries that rely on rain-fed agriculture and inadequate availability of water to the crop is the main constraint.

The software can be downloaded from: <http://www.hoefsloot.com/agrometshell.htm>

● **Mobile phone used to transfer climate information in India**

The Indian Farmers Fertilizer Cooperative Limited launched a project to leverage communication technology, in particular mobile telephony, to disseminate expert agricultural knowledge to small-scale farmers in rural India.

Source: Farming First (undated), Using Mobile Telephony to Provide Agricultural Services and Advice to Smallholders in Rural India. <http://www.farmingfirst.org/2009/04/using-mobile-telephony-to-provide-agricultural-services-and-advice-to-smallholders-in-rural-india/>

Links to specialized institutions

- World Meteorological Organization (MWO): <http://www.wmo.int>
- United States Agency for International Development (USAID) - The Famine Early Warning System Network (FEWS NET): <http://www.fews.net/>
- Asia Disaster Preparedness Center (ADPC): <http://www.adpc.net/>

Links to further reading

- ADPC (2010), ADPC Completes Regional Multi-Hazard Warning System. Retrieved from <http://www.adpc.net/v2007/announcement/2010/RIMES/RIMES.asp>
- ADPC (2007), Climate Variability and Change: Adaptation to Drought in Bangladesh: a resource book and training guide. Retrieved from http://www.preventionweb.net/files/9140_CCAandCVdroughtBangladesh1.pdf
- Fakhruddin, S. H. M. (2010), Climate Risk Information/Early warning Information Systems. Pers Comm. Retrieved from http://www.climateadapt.asia/upload/events/files/4c849b067cd73ClimateRiskManagementEarlyWarningInformationSystems_SHM_Fakhruddin_LowRes.pdf
- International Livestock Research Institute (2004), Development of a Farm Field School Methodology for Smallholder Dairy Farmers in Kenya. Retrieved from http://share4dev.info/kb/output_view.asp?outputID=3161

Question 10

What mechanisms exist to support farmers gain access to new adaptation practices?

- Riesenberger, L. (1989), Farmers' preference for methods of receiving information on new or innovative farming practices.USA. Retrieved from <http://pubs.aged.tamu.edu/jae/pdf/Vol30/30-03-07.pdf>

Basic concepts and terminology

Existing mechanisms : Research

A large amount of agricultural research has been carried out on sustainable adaptive farming practices in the region, including:

- Asia-Pacific Association of Agricultural Research Institutions (APAARI): <http://www.apaari.org/>
- Consultative Group on International Agricultural Research (CGIAR): <http://www.cgiar.org/>
- Agricultural Science and Technology Indicators: <http://www.asti.cgiar.org/>
- Southeast Asian Network for Agroforestry Education: <http://www.worldagroforestry.org/>
- International Rice Research Institute (IRRI): <http://beta.irri.org/>
- Council for Partnership on Rice Research in Asia : <http://irri.org/partnerships/networks/council-for-partnership-on-rice-research-in-asia>

Existing mechanisms : Advisory services

A number of agricultural advisory services and information systems have developed knowledge sharing toolkits and manuals which can be used by farmers to gain new practices which increase their resilience to climate change, including

- Publications from the Consultative Group on International Agricultural Research (CGIAR) centre, available at: <http://www.cgiar.org/publications/index.html>
- Agricultural manuals provided by Eldis (a knowledge service provided by the Institute of Development Studies, Sussex, UK), available at: <http://www.eldis.org/go/topics/resource-guides/agriculture/agriculture-manuals>

Existing mechanisms : Insurance

The current lack of a suite of financial risk-sharing mechanisms (e.g. index based insurance) is a key constraint to funding climate change adaptation initiatives in the agricultural sector. This barrier can be addressed by flexible insurance mechanisms which encourage risk reduction initiatives and provide payment in a timely manner.

- Examples of index insurance, compiled by United Nations Development Programme (UNDP): <http://www.undp.org/evaluation/documents/Essential-on-microfinance.pdf>

Existing mechanisms : Micro-finance options

Microfinance is the provision of small-scale financial services to the poor. The Asian microfinance market structure varies significantly across the countries, depending on the stage of financial development, the level of economic development and the policy environment.

- Essentials of Micro-finance, provided by United Nations Development Programme (UNDP): <http://www.undp.org/evaluation/documents/Essential-on-microfinance.pdf>Source

Links to examples and case studies

● Flood insurance in the Mekong Delta

An index-based flood insurance product has been offered to the Vietnam Bank of Agricultural and Rural Development (VBARD). The product is designed to pay for consequential losses that are suffered by VBARD when flooding creates problems for farmers in repaying loans. The contract is being offered by a Vietnamese insurance company, has support from a global reinsurer, and has been approved by the Vietnam regulatory authority.

- **Stakeholder communication is key in Thailand agricultural insurance**

The Thailand case study demonstrates how careful pilot project management within a conducive external environment contributes to success. The project has had a significant demonstration effect and has generated wide interest from other institutions in Southeast Asia, as well as international reinsurers.

Source: International Research Institute for Climate and Society (IRICS) (2009), Index insurance and climate risk: prospects for development and disaster management. http://www.preventionweb.net/files/10755_ClimateandSocietyIssueNumber21.pdf

Links to specialized institutions

- International Food Policy Research Institute (IFPRI): <http://www.ifpri.org/>
- GTZ Climate Change and Agriculture – Threats and Opportunities: <http://www.gtz.de/de/dokumente/en-gtz-climate-agriculture.pdf>
- Low External Input and Sustainable Agriculture (LEISA) : <http://www.leisa.info/>
- Agriculture links in Practical Action : <http://practicalaction.org/links/agriculture>
- UNDP Climate Risk Transfer Facility: <http://europeandcis.undp.org/poverty/show/7B3B261B-F203-1EE9-B8410E1A81B58989>

Links to further reading

- Bryla, E. & Syroka, J. (2007), Developing index-based insurance for agriculture in developing countries. Sustainable Development Innovation Briefs Issue 2. United Nations Department of Economic and Social Affairs. Retrieved from <http://www.un.org/esa/sustdev/publications/innovationbriefs/no2.pdf>
- Staiger-Rivas, S., Galié, A., Hack, B., Jorge, M. A., Meadu, V. & Tateossian, F. (2009). Learning to share knowledge for global agricultural progress, Inderscience. 6: 209-226. Retrieved from http://gisweb.ciat.cgiar.org/dapablogs/Dapa-impact/wp-content/uploads/2010/03/05-STAIKER-RIVAS_final-galley.pdf
- World Savings Banks Institute (WSBI) (2008), Overview of microfinance in Asia/ Pacific and selected experiences from WSBI members. Retrieved from [http://www.wsbi.org/uploadedFiles/Publications_and_Research_\(WSBI_only\)/mmicrofinance%20WSBI%20Asia%20Pacific%20screen.pdf](http://www.wsbi.org/uploadedFiles/Publications_and_Research_(WSBI_only)/mmicrofinance%20WSBI%20Asia%20Pacific%20screen.pdf)

Question 11

How can we use and retain indigenous knowledge?

Basic concepts and terminology

What is indigenous knowledge?

Indigenous knowledge (also known as ‘traditional knowledge’) refers to the methods and practices developed by a group of people from an advanced understanding of the local environment, which has formed over numerous generations. This knowledge contains several other important characteristics which distinguish it from other types of knowledge. These include originating within the community, maintaining a non-formal means of dissemination, collectively owned, developed over several generations and subject to adaptation, and imbedded in a community’s way of life as a means of survival.

Source: United Nations International Strategy for Disaster Reduction (UNISDR), Kyoto University and European Union (EU) (2008), Indigenous Knowledge for Disaster Risk Reduction: Good practices and lessons learned from experiences in the Asia-Pacific Region. http://www.undp.org.bd/info/HQ%20Publications/Indigenous_Knowledge-DRR.pdf

Why is indigenous knowledge important?

- Significant contributions to global knowledge have originated from indigenous people
- Indigenous knowledge systems are at risk of becoming extinct
- Indigenous knowledge is part of the lives of the rural poor
- Not yet fully utilized in the development process livelihood

Source: World Bank (undated), Sub-Saharan Africa; What is Indigenous Knowledge? <http://www.worldbank.org/afr/ik/basic.htm>

Links to examples and case studies

- **Weather forecasting through indigenous knowledge for crop cultivation in Vietnam.**

Since weather forecasting is still limited in some areas, the use of indigenous knowledge for weather forecasting is useful in crop cultivation, for instance the methods of atmospheric and moon observations for predicting weather changes. Another is the observations of dragonfly habits which is passed down from generation to generation in the local folk song.

“Dragonfly flies high, sunny sky / Flies low, rain / Flies neither high nor low, cloudy sky”

Source: UNISDR, Kyoto University and EU (2008), Indigenous Knowledge for Disaster Risk Reduction: Good practices and lessons learned from experiences in the Asia-Pacific Region. http://www.undp.org.bd/info/HQ%20Publications/Indigenous_Knowledge-DRR.pdf

- **The zabo (the word means ‘impounding run-off’) system (also known as the ruza system) practiced in Nagaland in North-Eastern India.**

Villages such as Kikrumba, where zabos are found even today, are located on a high ridge. Though drinking water is a major problem, the area receives high rainfall. The rain falls on a patch of protected forest on the hilltop; as the water runs off along the slope, it passes through various terraces. The water is collected in pond-like structures in the middle terraces; below are cattle yards, and towards the foot of the hill are paddy fields, where the run-off ultimately meanders into.

Source: Agarwal A. & Narain, S. (1997), Dying Wisdom: rise, fall and potential of India's traditional water harvesting systems. <http://www.rainwaterharvesting.org/rural/Traditional3.htm>

Links to specialized institutions

- International Union for Conservation of Nature (IUCN)- Indigenous Peoples & Climate Change: http://www.iucn.org/about/union/commissions/ceesp/ceesp_news/0209_5.cfm
- International Fund for Agricultural Development (IFAD)-Indigenous people: <http://www.ifad.org/english/indigenous/index.htm>
- Indigenous Portal- Climate Change: <http://www.indigenousportal.com/Climate-Change/Indigenous-Knowledge-and-Climate-Change-We-have-the-answers.html>

Links to further reading

- UNISDR, Kyoto University & EU (2008), Indigenous Knowledge for Disaster Risk Reduction: Good practices and lessons learned from experiences in the Asia-Pacific Region, Thailand. Retrieved from http://www.undp.org.bd/info/HQ%20Publications/Indigenous_Knowledge-DRR.pdf
- Altieri M. A. & Koohafkan P. (2008), Enduring Farms: Climate Change, Smallholders and traditional Farming Communities, Third World Network, Malaysia. Retrieved from <http://www.agroeco.org/doc/Enduring%20farms.pdf>
- Twarog, S. (undated), Preserving, Protecting and Promoting Traditional Knowledge: National actions and international dimensions. Retrieved from http://www.unctad.org/trade_env/test1/meetings/tk2/twarog.pdf
- Agarwal & Narain S. (1997), Dying Wisdom: rise, fall and potential of India's traditional water harvesting systems, Centre for Science and Environment, India. Retrieved from <http://www.rainwaterharvesting.org/rural/Traditional3.htm>

Question 12

Can we set up a regional network with experts and practitioners working on climate change adaptation in agriculture?

Basic concepts and terminology**Establishment of a regional network**

To address common climate change concerns that are shared by different countries, regions and institutions across Asia and the Pacific region, better links between local, national and regional institutions are required. A network involving individuals and organizations who share a common interest in agricultural adaptation work, aimed at addressing emerging climate constraints, could be a relevant starting point. Before such a network can be established, a scoping assessment of existing networks is necessary to maximize synergies and reduce duplication of efforts.

Links to examples and case studies

- **Centre of Excellence on Sustainable Development in the Context of Climate Change (SDCC) at AIT, Thailand**

The goal of the AIT Center of Excellence in SDCC is to consolidate the institute's research efforts and broaden the networks and partnerships by providing a platform to discuss and launch shared initiatives and pool resources to effectively address the issues and challenges of sustainable development in the context of climate change. The platform coordinates and implements project activities and also serve as platform for facilitating policy dialogue on food security, on climate change mitigation and adaptation, and on research, marketing, and extension issues for Asia.

Source: SDCC. <http://www.sdcc.ait.asia/>

Links to specialized institutions**Existing global networks**

- Links to resources on climate change adaptation networks and knowledge platforms maintained by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat and the Nairobi Work Programme (NWP) partner organizations. Available at: http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/5135.php
- In 2008 SEI Oxford developed a list of large global and regional networks and initiatives (existing and being developed). Available at: http://www.weadapt.org/wiki/Overview_of_major_climate_adaptation_intitatives_and_networks

Existing regional networks

At the regional level, there are a number of existing regional networks including **Agriculture networks**

- Asia Network for Sustainable Agriculture and Bioresources: <http://www.ansab.org/>
- Asia-Pacific Association of Agricultural Research Institutions (APAARI): <http://www.apaari.org/>
- Asia Pacific Natural Agriculture Network: <http://www.apnan.org/>
- Network of Aquaculture Centers in Asia-Pacific: <http://www.enaca.org/>
- South Asia Conservation Agricultural Network: <http://sacanasia.org/>
- South Asian Network for Social and Agricultural Development: <http://www.sansad.org.in/>

Climate change networks

- Adaptation Knowledge Platform: <http://www.climateadapt.asia/>
- Asia-Pacific Network on Climate Change: <http://www.apn-gcr.org/>
- Asia Pacific Network for Global Change research: <http://www.apn-gcr.org/newAPN/indexe.htm>
- ADB: <http://www.adb.org/Climate-Change/default.asp>
- Capacity Building for integrated water resource management: <http://www.cap-net.org/node/1176>
- Climate Change and Adaptation Initiative (CCAI): <http://www.mrcmekong.org/ccai/Climate-change-n-adaptation-initiative.htm>

- UNDP Adaptation Learning Mechanism (ALM) <http://www.adaptationlearning.net/>
- World Bank Institute (WBI) climate change: <http://wbi.worldbank.org/wbi/about/topics/climate-change>

Links to further reading

- Hewlitt A. & Lamoureux L. (2010), Introducing knowledge sharing methods and tools - a facilitator's guide, Electronic Networking for Rural Asia/Pacific. Retrieved from <http://www.eldis.org/go/country-profiles&id=56954&type=Document>

Question 13

What are the links between organic agriculture and climate change adaptation

Basic concepts and terminology

Organic agriculture

Organic agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

Source: International Federation of Organic Agriculture Movements (IFOAM) (undated), Definition of organic agriculture. http://www.ifoam.org/growing_organic/definitions/doi/index.html

Links between organic agriculture and climate change adaptation

Organic agriculture has significant potential for enhancing resilience to climatic variability and change:

- Organic agriculture commonly builds on traditional farming management practices which are highly adaptive to changing conditions and focus on long-term sustainability
- Organic agriculture reduces vulnerability associated with reduced water availability. Measures to improve soil fertility and soil moisture content are often central to organic agriculture practices
- Organic agriculture reduces the amount of environmentally detrimental pesticides, herbicides, fertilizers, etc which are released into the agro-ecosystems

Source: Niggli, U., Schmid, H. & Fliessbach, A. (2008), Organic Farming and Climate Change. <http://orgprints.org/13414/3/niggli%2Detal%2D2008%2Ditc%2Dclimate%2Dchange.pdf>

Links to examples and case studies

• Emerging organic agriculture in Lao PDR

In Lao PDR, organic rice is being developed under the “ProRice Program,” referred to as PROFIL. The program is being carried out by Helevatas and the Department of Agriculture. The goal is to produce and market good quality organic rice produced in the marginal rain-fed rice growing environments of the Lao PDR.

Source: ADB Institute (undated), Organic Agriculture and Biofuels in the Lao PDR. <http://www.adbi.org/discussion-paper/2008/04/11/2523.organic.crops.energy.crops/organic.agriculture.aa.and.biofuels.in.the.lao.pdr/>

Links to specialized institutions

- International Federation of Organic Agriculture Movements (IFOAM): http://www.ifoam.org/partners/advocacy/CC_Campaign.html
- Research Institute of Organic Agriculture (FiBL) : <http://www.fibl.org/en.html>
- Organic Agriculture Certification Thailand: <http://www.ioas.org/act.htm>
- Round Table on Organic Agriculture and Climate Change: <http://www.organicandclimate.org>

Links to further reading

- Niggli, U., Schmid, H., & Fliessbach, A. (2008), Organic Farming and Climate Change. International Trade Centre, Geneva. Retrieved from <http://orgprints.org/13414/3/niggli%2Detal%2D2008%2Ditc%2Dclimate%2Dchange.pdf>
- Khor, M. (2009), The Food Crisis, Climate Change and the Importance of Sustainable Agriculture, Third World Network, Malaysia. Retrieved from <http://www.twinside.org.sg/title/end/end08.htm>
- Boron, S. (2006), Building Resilience for an Unpredictable Future: How Organic Agriculture Can Help Farmers Adapt to Climate Change, Rome: FAO. Retrieved from <ftp://ftp.fao.org/docrep/fao/009/ah617e/ah617e.pdf>
- Eyhorn F. (2007), Organic Farming for Sustainable Livelihoods in Developing Countries: The Case of Cotton in India, Zurich: VDF Hochschulverlag AG. Retrieved from http://www.helveta.ch/global/pdf/topic/biobaumwolle/Flyer_organic_cotton.pdf

Question 14

What are the links between climate change adaptation and disaster risk reduction?

Basic concepts and terminology

Climate Change Adaptation (CCA) is the process of adjusting to a changing climate, either through explicit and planned interventions, or spontaneously as a consequence of inherent flexibility. Because climate change will affect every aspect of society, environment and the economy, adaptation includes activities that are both directly and indirectly related to the impacts of climate change.

Disaster Risk Reduction (DRR) includes a suite of interventions, approaches and policy frameworks needed to avoid or minimize the impacts of natural hazards on vulnerable societies and the environment. Disaster risk reduction includes the concept of disaster risk accumulation, i.e. it reflects that each disaster event reduces the ability to cope with the next event.

Source: Australian Tsunami Research Centre & Natural Hazards Research Laboratory (ATRC-NHRL) (2010), Disaster risk reduction and climate change adaptation in the Pacific: the challenge of integration. <http://www.eldis.org/go/topics/dossiers/climate-change-adaptation/themes/community-based-adaptation&id=55413&type=Document>

Links to examples and case studies

● Philippines Climate Change Act of 2009

The Philippines is among the most disaster-prone countries worldwide. Every year, the country is exposed to numerous powerful tropical cyclones, and it also suffers from periodic droughts. In 2009, the tropical storms Ketsana and Parma caused hundreds of casualties and severe damage to housing and other property. In response to the concern about increasing disaster risks arising from climate change, the Philippines Government enacted the Climate Change Act of 2009, which integrates disaster risk reduction measures into climate change adaptation plans, development and poverty reduction programmes.

Source: UNISDR (2009), Adaptation to Climate change by reducing disaster risk: Country Practices and Lessons. http://www.unisdr.org/preventionweb/files/11775_UNISDRBriefingAdaptationtoClimateCh.pdf

● Viet Nam, National Forum to Link Climate Change and Disaster Risk Reduction Agendas

Viet Nam, a coastal country with a long monsoon-affected coastline and a number of major river deltas, will be highly affected by climate change and is among the most disaster-prone countries in Asia. In response, the Vietnamese Government organized a National Forum in late 2009 to enhance the synergies between the two agendas of the “National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020” (2007) and the “National Target Program to Climate Change Response” (2008).

The Forum aimed to identify areas of overlap and interface between disaster risk reduction and climate change adaptation, and to improve linkages between government agencies responsible for both programmes as well as streamlining the financial channels for joint initiatives.

Source: UNISDR (2009), Adaptation to climate change by reducing disaster risk: Country practices and lessons. http://www.unisdr.org/preventionweb/files/11775_UNISDRBriefingAdaptationtoClimateCh.pdf

Links to specialized institutions

- Prevention web : <http://www.preventionweb.net/>
- United Nations International Strategy for Disaster Reduction (UNISDR): <http://www.unisdr.org/>
- Global Facility for Disaster Reduction and Recovery (GFDRR) : <http://www.gfdr.org>

Links to further reading

- Venton P. & La Trobe S., (2008), Linking climate change adaptation and disaster risk reduction. The Tearfund. Retrieved from http://www.tearfund.org/webdocs/Website/Campaigning/CCA_and_DRR_web.pdf

- Adger, N., Brooks N., (2003), Does Global Environmental Change Cause Vulnerability to Disaster?, in Pelling, M. (ed.) *Natural Disasters and Development in a Globalising World*, Routledge: London. Retrieved from http://www.aiaccproject.org/meetings/Norwich_02/Norwich_CD/APPENDICES/ARTICLES_VULN_ADAPTCAP/EC_VULN_TO_DISASTER.PDF
- Füssel H-M. & Klein R.J.T., (2006), *Vulnerability and Adaptation Assessments to Climate Change: An Evolution of Conceptual Thinking*. Retrieved from http://www.pik-potsdam.de/~fuessel/download/undp02_en.pdf
- Handmer J., (2003), *Adaptive Capacity: What Does it Mean in the Context of Natural Hazards?* In Smith J.B., Klein R.J.T. & Huq S., (eds.), *Climate Change, Adaptive Capacity, and Development*, Imperial College Press: London. Retrieved from http://books.google.com/books?id=MTxmiGNjIqoC&printsec=frontcover&dq=Climate+Change,+Adaptive+Capacity,+and+Development&source=bl&ots=2k4y47e62l&sig=wnlTswypfbNgsTzUIeGLM204dKk&hl=en&ei=VVJKTarBL9HlrQep4ITkDg&sa=X&oi=book_result&ct=result&resnum=5&ved=0CEAQ6AEwBA#v=onepage&q&f=false
- Mercer, J. (2010), *Disaster Risk Reduction or Climate Change Adaptation: Are we reinventing the wheel?*, *Journal of International Development*, 22: 247-264. Retrieved from http://unfccc.int/files/adaptation/nairobi_work_programme/partners_and_action_pledges/application/pdf/nwp_expert_jessica_mercer.pdf
- Selvaraju, R., Subbiah, A.R., Baas, S. & Juergens, I. (2006), *Livelihood adaptation to climate variability and change in drought-prone areas of Bangladesh*, Asian Disaster Preparedness Center, FAO. Retrieved from <http://www.fao.org/docrep/009/a0820e/a0820e00.HTM>
- Venton, P. & La Trobe S. (2008). *Linking climate change adaptation and disaster risk reduction*, Tearfund; Institute of Development Studies. Retrieved from http://www.tearfund.org/webdocs/Website/Campaigning/CCA_and_DRR_web.pdf
- Lisa E. & Schipper F. (2009), *Meeting at the crossroads?: Exploring the linkages between climate change adaptation and disaster risk reduction*, Stockholm Environment Institute, Bangkok, Thailand. Retrieved from http://unfccc.int/files/adaptation/nairobi_work_programme/partners_and_action_pledges/application/pdf/nwp_expert_lisa_schipper.pdf
- *International Strategy for Disaster Reduction* (undated), *Disaster risk reduction and adaptation to climate change*. Retrieved from <http://www.unisdr.org/eng/risk-reduction/climate-change/cc-adaptation.html>

Question 15

What is the difference between a vulnerability assessment and an impact assessment?

Basic concepts and terminology

Impact Assessment

Impact assessment is the process of identifying the future consequences of a current or proposed action. The 'impact' is the difference between what would happen with the action and what would happen without it.

Source: International Association for Impact Assessment (IAIA) (2009), *What Is Impact Assessment?* http://www.iaia.org/publicdocuments/special-publications/What%20is%20IA_web.pdf

Vulnerability Assessment

Vulnerability assessment is the process of identifying, quantifying, and prioritizing (or ranking) the vulnerabilities in a system/unit of concern. Vulnerability assessment selects a particular group or unit of concern (e.g. landless farmers, tropical forest ecosystems, coastal communities, development sectors) and seeks to determine the risk of specific adverse outcomes for that unit in the face of a variety of hazards and stresses. In doing so, it identifies a range of factors that may reduce response capacity and adaptation to stressors.

Source: EuropeAid (2007), *Methodological Framework for Vulnerability Assessment of Climate Change Impacts on Forest-based Development Sectors*. <http://www.cifor.cgiar.org/trofcca/attachment/03%20TroFCCA%20Annual%20Report%20-%20%20Year%202%20-%20web.pdf>

Links to examples and case studies

● Vietnamese project to reduce vulnerability to climate change and disasters

The project combines a participatory approach and water modeling. The main objective is to strengthen the capacity of the sectors, institutions, and Vietnamese people to adapt and respond to climate change impacts. It aims to reduce their vulnerability to climate change and disasters by raising their understanding and preparedness to foresee impacts and minimize losses.

Source: UN ALM (2008), Vietnam - Preparing for the Impacts of Climate Change in Huong River Basin and the Coastal Phu Vang District. <http://www.nlcap.net/fileadmin/NCAP/Countries/Vietnam/NCAP.VN.CON-01.FinalReport.final.pdf0106.pdf>

● Vulnerability assessment of people, livelihoods and ecosystems in the Ganga Basin, India

The Ganga Basin is one of the most densely populated and fertile basins in the world and supports approximately 300 million Indians. There are various approaches and methods which can be used to assess vulnerability to climate change. A detailed study of existing assessment methods was undertaken as part of the project and a LVI-IPCC (Livelihoods Vulnerability Index) methodology was determined to be most appropriate for the scale of the assessment. The assessment methodology involves four key steps, starting with the identification of specific and measurable indicators (e.g. crop production and land capacity for Agriculture) and finally calculating the vulnerability index (vulnerability index = [exposure – adaptive capacity] x sensitivity) and then scaling the results from low to high vulnerability.

Source: UN ALM (2010), Vulnerability Assessment of People, Livelihoods and Ecosystems in the Ganga Basin. <http://www.adaptationlearning.net/research/vulnerability-assessment-people-livelihoods-and-ecosystems-ganga-basin>

Links to specialized institutions

- International Association for Impact Assessment (IAIA): <http://www.iaia.org/default.aspx>
- Programme of Research on Climate Change Vulnerability, Impacts and Adaptation: <http://www.unep.org/climatechange/adaptation/ScienceandAssessments/PROVIA/tabid/29580/Default.aspx>

Links to further reading

- Reilly J. (undated), Climate change, global agriculture and regional vulnerability, Natural Resources and Environment Division, Economic Research Service, USDA, Washington DC, USA. Retrieved from <http://www.fao.org/docrep/w5183e/w5183e0c.htm>
- IPCC (2007), Impacts, Adaptation and Vulnerability, Summary for Policy-makers, Assessment Report 4, Working Group 2. Retrieved from <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf>
- European Commission, Impact Assessment. Retrieved from http://ec.europa.eu/governance/impact/index_en.htm



ADAPTATION KNOWLEDGE PLATFORM

A number of initiatives have been launched to help countries build their capacity to respond to the changing climate, but many of these are undertaken independently of each other. The Adaptation Knowledge Platform addresses this challenge by building bridges between initiatives, researchers, policymakers, business leaders, and those working on climate change adaptation “on the ground”. The overarching goal of the Adaptation Knowledge Platform is to strengthen adaptive capacity and facilitate climate change adaptation in Asia at local, national, and regional levels. It focuses on three pillars:

Establishing a regional system for sharing knowledge on climate change adaptation, making it easy to understand and available to those who need it;

Generating new knowledge about adaptation that national and regional policymakers can use as they plan for climate change; and

Promoting the application of new and existing knowledge about climate change in Asia.

Who and Where

In its first phase (2009-2011), the Adaptation Knowledge Platform will actively engage with governmental and non-governmental practitioners, researchers, media and private sector who are interested in climate change adaptation issues in 13 countries: Bangladesh, Bhutan, Cambodia, China, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, the Philippines, Sri Lanka, Thailand and Viet Nam.

Initial Partners

The Adaptation Knowledge Platform is supported by the Swedish International Development Cooperation Agency (Sida). Initial partners are the Stockholm Environment Institute (SEI), the Swedish Environmental Secretariat for Asia (SENSA), the United Nations Environment Programme (UNEP) and the Asian Institute of Technology (AIT)-UNEP Regional Resource Centre for Asia and the Pacific (RRC-AP), which also hosts the Adaptation Knowledge Platform Secretariat.

Join us!

Join us in strengthening the adaptive capacity in Asia by sharing your projects and learning experiences through the Climate Change Adaptation in Asia and the Pacific web-portal (www.asiapacificadapt.net) or the Asia-Pacific Climate Change Adaptation Forum. For more information on this and other ways of collaboration and mutual benefit, contact:

Secretariat

Adaptation Knowledge Platform
AIT-UNEP Regional Resource Centre for Asia and the Pacific
Outreach Building, P.O. Box 4, Klong Luang
Pathumthani 12120, Thailand
Tel: +662 524 5386/5384;
Email: info@climateadapt.asia
Website: <http://www.climateadapt.asia>



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