

FOR PARTICIPANTS ONLY

ESD/RIM/2007/INF. 5
19 November 2007

ENGLISH ONLY

UNITED NATIONS
ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
in collaboration with
FAO Regional Office for Asia and the Pacific
UNCAPSA
UNCCD Asia Regional Coordinating Unit
UNEP Regional Office for Asia and the Pacific

Regional Implementation Meeting for Asia and the Pacific for the
sixteenth session of the Commission on Sustainable Development (CSD-16)

26-27 November 2007
Jakarta, Indonesia

**REVIEW OF THE IMPLEMENTATION STATUS OF THE OUTCOMES OF THE
WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT-AN ASIA-PACIFIC
PERSPECTIVE**

(Item 3 of provisional agenda)

**CLIMATE CHANGE IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT:
NEED FOR HOLISTIC AND INCLUSIVE POLICIES IN AGRICULTURE, LAND,
RURAL DEVELOPMENT, DESERTIFICATION, AND DROUGHT¹**

¹ This paper was prepared by Dr. SVRK Prabhakar of the Institute for Global Environmental Strategies, for the Regional Implementation Meeting for Asia and the Pacific for the sixteenth session of the Commission on Sustainable Development (CSD-16). The views expressed herein are those of the author and do not necessarily reflect the views of the United Nations. This paper has been issued without formal editing.

CLIMATE CHANGE IMPLICATIONS FOR SUSTAINABLE AGRICULTURE AND RURAL DEVELOPMENT²

SETTING THE STAGE: CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

1. The United Nations Conference on the Human Environment held in 1972, adopted the Stockholm Declaration on Human Environment. The declaration brought the environment from the scientific realm, to the developmental realm, and to the international agenda for the first time. Since then, environmental issues have had a decisive role to play in the way the world look at the development.

2. The United Nations Conference on Environment and Development (UNCED) which met at Rio de Janeiro from 3 to 14 June 1992 proclaimed that 'In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it'. The Brundtland Commission Report gave a significant thrust to the paradigm of sustainable development, defined as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs.' Since its advent, sustainable development has taken center stage in development discourse across the globe. The term has been debated in every major forum on development and has become a mother's prescription for all the ills humanity is facing today.

3. Since then, though the world has made some progress, environmental problems continue to plague human development, and sustainable development seems to demand more effort than expected. The many threats to sustainable development, include toxic and nuclear waste, poverty, urban and rural disparities, violence, racism, militarization, population growth, foreign debt and debilitating diseases such as malaria and HIV AIDS.³

4. Climate risks have been increasing over the past 20th century. One of the most significant indicators has been the rise of global average temperatures by 0.74°C. Greenhouse gas concentrations are higher now than in the past 450,000 years and are projected to keep rising. Climate change, defined by the increasing global temperatures and associated impacts, has been threatening the very existence of mankind on the earth. One of the alarming implications of climate change is to threaten sustainable development.

² This information document has been prepared on behalf of the meeting organizers by Dr SVRK Prabhakar, Policy Researcher, Institute for Global Environmental Strategies, Japan under the supervision of ESCAP. The document has been issued without formal editing

³ Earth Council (1994) The Earth Summit-Eco 92: Different Visions. Earth Council and Inter American Institute for Cooperation on Agriculture. Costa Rica, September, 1994

5. Since we argue that there is a long debate over environment and sustainable development, one may ask about what is the new threat that the climate change is posing? A recent survey of more than 250 experts and practitioners from 71 countries rated climate change as the second most important issue (after poverty eradication) in terms of achieving sustainable development.⁴ Any discourse on sustainable development will inevitably include the climate and its change. Hence, climate change requires global action, made possible through the United Nations Framework Convention on Climate Change (UNFCCC).

6. The climate convention, an outcome of the UNCED, aims at stabilizing concentrations of atmospheric greenhouse gases at a safer level and prescribes precautionary measures to achieve the targeted reduction in greenhouse gases.⁵ The subsequently constituted Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP), was mandated to assess the available scientific and socioeconomic evidence on climate change and its impact, and options for mitigating climate change and adapting to it. It also been mandated to provide, on request, scientific/technical/socio-economic advice to the Conference of Parties UNFCCC. Since its inception, the IPCC has brought out four comprehensive assessment reports on the status of climate change and its impacts.

7. The Fourth Assessment Report of IPCC has clearly concluded that “climate change is projected to impinge on sustainable development of most developing countries of Asia, as it compounds the pressures on natural resources and the environment associated with rapid urbanization, industrialization, and economic development.”⁶

8. The observations made by the Working Group I to the Fourth Assessment Report (FAR) of IPCC summarize the current state of affairs on climate change.⁷ The FAR categorically stated that the global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly since 1750 and far exceed the pre-industrial values from ice cores spanning many thousand years. The anthropogenic influence on climate change has also become more evident according to the report. Further, the report has identified several impacts of climate change across the globe such as changes in precipitation amounts, ocean salinity, wind patterns, droughts, heavy precipitation, heat waves and tropical cyclones. A warming of about 0.2°C per decade is projected for a range of emission scenarios and a further warming of 0.1°C per decade can be expected even if the concentrations of all greenhouse gases are kept constant at 2000 levels.

⁴ Najam A, Poling JM, Yamagishi N, Straub DG, Sarno J, DeRitter SM, Kim EM (2002). *From Rio to Johannesburg: progress and prospects*. Environment 44 (7): 26-38

⁵ UNCED (1992) *The Rio Declaration on Environment and Development*. Rio de Janeiro: UNCED Secretariat

⁶ IPCC (2007) *Summary for Policymakers*. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, ML Parry, OF Canziani, JP Palutikof, PJ van der Linden and CE Hanson (Eds), Cambridge University Press, Cambridge, UK, 7-22

⁷ IPCC (2007) *Summary for Policymakers*. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Solomon S, D Qin, M Manning, Z Chen, M Marquis, KB Averyt, MTignor and HL Miller (eds.), Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

9. The last cycle of the CSD addressed climate change, among the themes. These changes hold important implications for sustainable agriculture and rural development, and therefore human security, in Asian and Pacific countries, due to the already-present vulnerability to drought and desertification, and natural disasters in almost every subregion, as well as the fact that a substantial proportion of the population is dependent on agriculture and allied activities that are vulnerable to climate-related threats. The following section provides more insight into the context of the Asia and the Pacific region.

THE CLIMATE AND DEVELOPMENTAL CONTEXT OF THE REGION

10. Climate change has important implications for Asia and the Pacific as the region is undergoing dramatic changes in population and economic status. The region has a population density 1.5 times the global average: India and China together have an average population density of 197.2 persons per square kilometre, in comparison, with a global population density of 49.9 persons per kilometre⁸. In addition, the growth rate of population in Asia and the Pacific has been one of the concerns. In comparison with the world population growth rate of 1.17 per cent per year, the growth rate in India is 1.63 per cent per year though the growth rate in China has come down during recent years to 0.59 per cent.

11. The Asia and the Pacific region is also characterized by rapid economic change. A glimpse at the economic growth rate of some of the countries provides us a good picture of state of the affairs. The GDP growth rate of India and China was 9.3 per cent⁹ and 10.7 per cent respectively by the end of the first quarter of the year 2007. Rapid growth rate is not restricted to China and India in the region. Economies such as Viet Nam too recorded a growth rate of about 8.7 per cent during 2006-07. Concerns have been raised regarding the sustainability of these growth rates and the environmental consequences these rates may have. Concerns have also been raised regarding the economic path these countries are taking, with growing disparity between economic classes. Despite the economic growth, much of the population in these countries continue to depend on agriculture for their livelihood. Hence, climate change is a concern for countries in Asia and the Pacific as large proportion of population depends on the climate influenced sectors as agriculture, animal husbandry and forestry for their livelihoods. Nearly 17.7 per cent of the GDP in India comes from agriculture, fisheries and forestry while the figure is around 15.5 per cent for China though more than 50 per cent of the population in both the countries depend on agriculture for their livelihoods.

⁸ U.S. Census Bureau (2007) International Database. <www.census.gov/ipc/www/idb/index.html>. Sited 20 September 2007

⁹ Ministry of Statistics and Programme Implementation (2007) Government of India. <www.mospi.nic.in/t1_31august07.htm>. Sited 20 September 2007

12. Since these economies are growing rapidly, and since the majority of population still depends on agriculture and allied sectors for their livelihood, it is very likely that any aberrations owing to climate change could spell doom for these economies the wider society will suffer due to impacts on food security. Despite the recent economic growth in Asia and the Pacific, nearly 2/3rd of world poor lives here demanding more need for economic growth. This means more possibility for greenhouse gas emissions and further contribution to the global warming. This calls for growth that does not contribute to the global warming the realization of carbon free society or low carbon society is a key approach.¹⁰

13. The following vulnerabilities are considered important in the context of climate change in this region:¹¹

- Glacier melt in the Himalayas is projected to increase flooding, and rock avalanches from destabilized slopes, and to affect water resources within the next two to three decades. This will be followed by decreased river flows as the glaciers recede.
- Freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease due to climate change which, along with population growth and increasing demand arising from higher standards of living, could adversely affect more than a billion people by the 2050s.
- Coastal areas, especially heavily-populated mega delta regions in South, East and South-East Asia, will be at greatest risk due to increased flooding from the sea and, in some mega deltas, flooding from the rivers.
- Climate change is projected to impinge on the sustainable development of most developing countries of Asia, as it compounds the pressures on natural resources and the environment associated with rapid urbanization, industrialization, and economic development.
- It is projected that crop yields could increase up to 20 per cent in East and South-East Asia while they could decrease up to 30 per cent in Central and South Asia by the mid-21st century. Taken together and considering the influence of rapid population growth and urbanization, the risk of hunger is projected to remain very high in several developing countries.
- Endemic morbidity and mortality due to diarrhea disease primarily associated with floods and droughts are expected to rise in East, South and South-East Asia due to projected changes in the hydrological cycle associated with global warming. Increases in coastal water temperature would exacerbate the abundance and/or toxicity of cholera in South Asia.

¹⁰ Kainuma M (2006) *Low carbon scenario towards 2050 for Japan*. Presented at China-Korea-U.S. Economic and Environmental Modelling Workshop. 20-21 April 2006, Xia Da Du International Conference Center, Beijing, China

¹¹ IPCC (2007) *Summary for Policymakers*. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, ML Parry, OF Canziani, JP Palutikof, PJ van der Linden and CE Hanson (Eds), Cambridge University Press, Cambridge, UK, 7-22

GLOBAL COMMITMENTS TO CLIMATE RISK REDUCTION

14. The developmental needs of the developing countries cannot be overlooked. In introducing the twin concepts of 'adaptive' and 'mitigative' capacity (by working groups II and III, respectively) the third assessment of the IPCC (2001) has made a significant contribution to the policy discourse by outlining what types of capacities are required, by whom, and when.¹² The most pressing challenge in this regard is to strengthen the social, economic and technical resilience of the poorest and most vulnerable against extreme climatic events. The priority must be on those countries that are climatically most vulnerable as well as economically impoverished and therefore unable to 'cope' or 'adapt' with sudden and significant climatically induced disasters. This highlights the need to focus on the issues of adaptation, especially in developing, least developed countries and small island developing states where the threat of climate change is more immediate and intense due to the less capacity to adapt.¹³

15. Adaptation to climate change is critical for the developing countries in the Asia and the Pacific region due to high societal and institutional vulnerabilities, including poverty, weak social support systems, lack of good governance and strategic planning, high dependence on agriculture and related climate-dependent sectors, and lack of long-term risk reduction strategies.

16. Climate change has been one of the concerns raised in Agenda 21, the Programme for Further Implementation of Agenda 21 and the Commitments to the Rio principles. For example, the Agenda 21 has mainly dealt with climate change in the Chapter 9 on Protection of the Atmosphere (9.6, 9.11), on Protection of Oceans and Other Related Environments (17.1, 17.6, 17.96, 17.97, 17.100, 17.101, 17.125, 17.128), in Chapter 18 (18.1, 18.5, 18.25, 18.29, 18.83, 18.85, 18.87) and in Chapter 33 on Financial Resources and Mechanisms.

17. Similarly, the Johannesburg Plan of Implementation (JPOI) has also addressed the issue of climate change in areas of marine environmental protection, effects on wetlands, impacts on developing, small island and least developed countries in the context of poverty, land degradation, access to water and food and human health through adaptation, exchange of information on climate change among nations, a coordinated action to face the threats of climate change, and exploring synergies among major global environmental treaties. On a regional basis, the JPOI identified seven initiatives for Asia and the Pacific which includes action on atmosphere and climate change.

18. A review of the commitments relating to agriculture, land, rural development desertification and drought shows that the following are most critical in terms of adaptation to climate change, given the above-described context of the region (Table 1)¹⁴.

¹² IPCC (2001) *Climate Change 2001*. In: *Proceedings of the Third Assessment Report of the Intergovernmental Panel on Climate Change (Three Volumes)*. Cambridge University Press, London, 2001

¹³ Huq S, Sokona Y (2001) *Climate change negotiations: a view from the South*. Opinion: World Summit on Sustainable Development. International Institute for Environment and Development, London

¹⁴ Based on scoping papers prepared by the CSD Secretariat.

Please note that the listed implications for climate change adaptation are country and region-specific. For example the nature of crop varieties which can withstand climate change impacts may be different for Viet Nam (e.g. focus on flood and droughts) and India (e.g. focus more on droughts).

Table 1: Major priority actions identified by background papers on agriculture, rural development, drought and desertification for the CSD 16/17 and their significance for climate change adaptation

Major priority actions identified	Significance to climate change adaptation
Agrarian reforms are an essential condition for eradication of poverty and hunger and ensuring equitable development in the region	Ensures equitable distribution of productive resources that is essential for higher capacity and resilience to climate impacts
Livelihood diversification	To reduce the dependency on climate influenced sectors such as agriculture and animal husbandry
Natural resource management	To enhance the health of natural resources, avoid over utilization and related fatigue on the system that makes the rural areas more vulnerable to climate change
Drought monitoring	For enhanced preparedness that would reduce the impacts and enhance the resilience capacity
Coordinated approach to rural development, cooperative movement, and entrepreneurial development	Enhances the capacities in rural areas, collective bargaining and reduces vulnerability to climate change
Emphasis on gender disaggregated approach in rural development	Women are one of the most vulnerable sections of the society to climate change due to the limitations placed by the society
Rural infrastructure needs special attention	Essential for flow of materials that is known to enhance the access to markets and subsequently enhance the incomes and resilience capacity to climate change impacts
Private sector participation in agriculture	Enables flow of technologies that are market driven and hence enhances the income opportunity
Expanding area under irrigation	Reduces vulnerability to droughts that are expected to be aggravated due to climate change
Investment in science and technology	Helps in identification/development of crops and varieties those can withstand the impacts of climate change
Rural access to knowledge products	New knowledge required to overcome the threat of climate change can be provided
Integrated ecosystem management	Considers the mainstreaming desertification and deforestation prevention into developmental programmes and hence less vulnerability to the additional risk brought by climate change
Community involvement	Helps in better understanding of the problem such that the proposed solutions are relevant and hence are effective

19. The following section attempts to assess the actions taken by various governments in the Asia and Pacific region on various aspects of adaptation to climate change in agriculture and land, rural development, desertification and drought risk reduction.

ASIA PACIFIC UPDATE ON CLIMATE CHANGE RISK REDUCTION INITIATIVES AND KEY CHALLENGES

Current status: Agriculture and land

20. Climate change will have tremendous impact on agriculture the way land is used and ultimately, on rural development. Climate change impacts agriculture through influencing rainfall pattern, which in turn impacts the frequency and severity of floods and droughts, and atmospheric temperature. Globally it was expected that climate change would have mixed impacts on crop production, with yield enhancements in temperate regions and declines in tropical regions. About 2.5-10 per cent reduction in crop yields is projected for parts of Asia in 2020s and 5-30 per cent decrease in 2050s compared with 1990 levels. These effects will be exacerbated by a projected decline in fresh water availability in major river basins, population growth, droughts, floods, and soil degradation. Hence, it is important that the countries in the region adapt strategic adaptation interventions. Major impacts of climate change on agriculture in some Asia Pacific countries are provided in table 2. From table 2, the following can be concluded:

- (1) Some of the countries have already initiated vulnerability assessments with respect to climate change.
- (2) These vulnerability assessments consisted of identifying and analyzing the impact of climate change and variability on natural eco-systems, socio-economic systems, and human health.
- (3) Some of the assessments also considered the institutional and financial capacities of the local communities, assessing the spontaneous and planned adaptation measures already taken up, and developing technical, institutional and financial strategies to reduce vulnerabilities.
- (4) Major adaptation initiatives being taken up by Asia and the Pacific countries could broadly be grouped into the following
 - a. Development of crop varieties that are tolerant to perceived threats that includes droughts, pests and diseases (Australia, India, Indonesia, Malaysia, and Viet Nam)
 - b. Expanding area under irrigation and efforts for better water management including watershed management practices (Australia, Bangladesh, China, India, Indonesia, Malaysia, Russian Federation , Viet Nam)
 - c. Improving weather forecasts and linking with farm decision making (Australia and India)
 - d. Drought monitoring systems are being put in place though do not completely cover the entire country or are in inception stage (China, India, Viet Nam, and Australia)
 - e. Investment in rural infrastructure that promotes access to markets that in turn enhances the resilience of rural communities which is more relevant for the developing countries in the region (India, China, and Sri Lanka)

Table 2: Significant climate change impacts on agriculture and relevant adaptation mechanisms in some of Asia and the Pacific countries¹⁵

Country	Main Observations	Adaptation mechanisms
Australia	<ul style="list-style-type: none"> • 16-27 per cent reduction in agriculture production if climate change is unchecked¹⁶ • South-west Australia is expected to be more vulnerable to climate change induced productivity losses • Wheat crop is expected to face more impacts and especially in the western part of the country • Changes in cropping pattern due to spatial impacts of climate change • Reduced soil moisture • High pest and disease incidence • Reduced grain quality and nutrient content • Increased variability and seasonality of rainfall 	<ul style="list-style-type: none"> • Developing varietal portfolios for greater weather-year variation • Decision support systems that link weather forecasts and farm decision making • Expanding storage and marketing systems supported by financial markets • Dependency on groundwater through desalinization schemes • Access to knowledge and innovation for farmers to adapt to climate change • Zero-till practices¹⁷ • Diversification of farm enterprises • Adaptation of IPM practices and increased monitoring
Bangladesh	<ul style="list-style-type: none"> • Chances of more droughts in the North-Western Bangladesh pushing agricultural production to marginal values • Decline in area under wheat with increasing temperatures • High inter and intra annual monsoon variation • Drainage congestion could impact agriculture in the coastal areas¹⁸ • Flash floods in North-east and Central region may likely impact agriculture 	<ul style="list-style-type: none"> • Improving irrigation efficiency¹⁹ • Crop diversification • Capacity building of farmers for better management practices • Research for breeding saline (for coastal areas), drought and flood tolerant crops²⁰ • Modifying national agricultural development plan to accommodate the concerns related to climate change • Exploring options for crop insurance • Integrated water resources management²¹
China	<ul style="list-style-type: none"> • Improvements in agriculture production in Huang-Hai Plain²² • Expected moisture deficits and uncertain changes in the timing and frequency of 	<ul style="list-style-type: none"> • Raise investment in research and development • International cooperation and technology transfer

¹⁵ Sources are mentioned as superscripts. Please note that the source has been cited at the beginning of listing the main observations and adaptation mechanisms

¹⁶ Kingwell R (2006) *Climate change in Australia: Agricultural impacts and adaptation*. Australian Agribusiness Review 14:1-29

¹⁷ Australian Greenhouse Office (2007) *Australia's agriculture: Impacts of climate change*. Department of Environment and Water Resources, Australian Government. <<http://greenhouse.gov.au/impacts/agriculture.html#impacts>>. Cited 22 September 2007

¹⁸ Shaheduzzaman (2006) Presentation on Bangladesh NAPA. LDC-GEF Consultation Workshop, Dhaka, Bangladesh

¹⁹ Huq S (2002) *Adaptation to climate change and sustainable development: A case study of Bangladesh*. AIACC Project Development Workshop: Climate Change Vulnerability and Adaptation. 3-14 June 2002, Trieste, Italy

²⁰ Haque Z, Khan AN (2007) *Bangladesh NAPA and status of NAPA implementation*. Presented at Least Developed Countries Expert Group Stocktaking Meeting on NAPA Preparation and Implementation. 3-5 September 2007, Bangkok, Thailand

²¹ Ministry of Environment and Forest (2005) *National Adaptation Programme of Action*. Ministry of Environment and Forests, Government of People's Republic of Bangladesh. <http://unfccc.int/resource/docs/napa/ban01.pdf>. Sited 22 Sept 2007

Country	Main Observations	Adaptation mechanisms
	<p>critical conditions indicate that there are serious threats to the stability and adaptability of China's food production system²³</p> <ul style="list-style-type: none"> • Decline in rice, wheat and maize crops²⁴ • Desertification damaging arable lands • South Central region could face losses of as much as 15 per cent even though aggregate effects nationally would range from about -7 to +7 per cent²⁵ 	<ul style="list-style-type: none"> • Improving the laws and regulations governing agriculture based on Law of Agriculture of People's Republic of China²⁴ • Regulations to control land reclamation • Promoting ecological agriculture in intense agricultural areas • Improved management practices for rice cultivation that releases less methane and uses less water • Enhance water saving methodologies and construction of small scale irrigation projects
India	<ul style="list-style-type: none"> • Decline in area under wheat and extension of area under rice cultivation • Decline in crop yields in long-term in various parts of the country • Declining factor productivity of rice-wheat systems²⁶ • Lack of well established medium and long-term weather forecasting systems 	<ul style="list-style-type: none"> • Altered agronomy of crops²⁷ • Integrated watershed management with local community participation • Development of resource conserving technologies for rice-wheat systems • Improved land use and natural resource management practices • Improving early warning systems • Livelihood diversification
Indonesia	<ul style="list-style-type: none"> • Decline in rice production due to harmful delay in monsoonal rains in some of the rice growing regions²⁸ • Shortened rice growing season due to early drying by warming • Sea level rise could inundate productive coastal areas • Decline in food security due to general impact on other food crops as well • Soil degradation due to sea water inundation could impact soybean and maize production 	<ul style="list-style-type: none"> • Investment in water storage²⁹ • Developing drought tolerant crop varieties • Crop diversification • Guidance tools for local stakeholders on adaptation and vulnerability assessment • Water balance for major islands for effective use of water resources • Watershed and water body management • Capacity building of farmers and irrigation personnel

²²Thomson (2006) *Climate change impacts on agriculture and soil carbon sequestration potential in the Huang-Hai Plain of China*. Agriculture, Ecosystems and Environment 114: 195-209

²³Smit B, Yunlong C (1996) *Climate change and agriculture in China*. Global Environmental Change 6(3):205-214

²⁴National Development and Reforms Commission (2007) *China's national climate change programme*. National Development and Reforms Commission, People's Republic of China. Available at <http://en.ndrc.gov.cn/newsrelease/P020070604561191006823.pdf>. Sited on 22 September 2007

²⁵Cline WR (2007) *Global warming and agriculture: New country estimates show developing countries face decline in agriculture productivity*. CGD Brief, Center for Global Development, September 2007

²⁶Mehla RS, Verma JK, Gupta RK, Hobbs PR (2000) *Stagnation in the Productivity of Wheat in the Indo-Gangetic Plains: Zero-till-seed-cum-fertilizer Drill as an Integrated Solution*. Consortium Paper Series 8. Rice-Wheat Consortium for the Indo-Gangetic Plains, New Delhi, India, pp12

²⁷The Energy Resources Institute (2001) *India's first national communication to UNFCCC*. The Energy Resources Institute, New Delhi, India

²⁸Naylor RL, Battisti DS, Vimont DJ, Falcon WP, Burke MB (2007) Assessing the risks of climate variability and climate change for Indonesian rice agriculture. Proceedings of the National Academy of Science of the United States of America 104(19): 7752-7757

²⁹PEACE (2007) *Indonesia and Climate Change: Current Status and Policies*. The World Bank, DFID, PEACE, pp 90

Country	Main Observations	Adaptation mechanisms
Malaysia	<ul style="list-style-type: none"> • Droughts could impact oil palm, rubber, cocoa, and rice³⁰ • Sea level rise could impact 6 per cent of land under oil palm and 4 per cent under rubber • Increase in water demand due to droughts and increased rainfall variability 	<ul style="list-style-type: none"> • Developing plant varieties that tolerate high temperatures and have high water use efficiency • Preserving water catchment areas for conserving water • Implement micro landscape designing for better water harvesting • Address land use conversion through appropriate policy measures • Reduce crop wastage by enhancing post-harvest measures • Implement IPM measures to reduce pest and disease incidence
Russia	<ul style="list-style-type: none"> • Expansion of area under wheat and maize production • Northward extension of agriculture production zones and production potential³¹ • Increase in agriculture GDP³² • Decreasing trend of annual mean rainfall could impact the existing crop production • If past observed trends in increasing droughts continue, it could lead to substantial reduction in food production³³ 	<ul style="list-style-type: none"> • Infrastructure and policy support to expanding agricultural areas • Enhanced support to withstand short term water shortages through watershed management and irrigation management • Diversification of cropping wherever possible to reduce the climate risk
Viet Nam	<ul style="list-style-type: none"> • Increasing floods and droughts would impact agriculture • Productivity of agriculture crops such as rice may be affected due to increasing temperatures • Significant areas under cultivation in Mekong delta region may become saline due to saline water intrusion 	<ul style="list-style-type: none"> • Development of sustainable farming techniques³⁴ • Improving the irrigation and drainage systems for rice crop • Strengthening the capacities of agriculture universities and institutes such that the climate change could be taken into consideration in the existing research programmes • Research on improved crop varieties and animal breeds • Diversification of agriculture through rural infrastructure development

³⁰ Ministry of Science, Technology and Environment (2000) *Initial National Communication submitted to the UNFCCC*. Ministry of Science, Technology and Environment, Malaysia, pp 120

³¹ Fischer G, Shah M, Velthuisen HV (2002) *Climate change and agriculture vulnerability*. A contribution to the World Summit on Sustainable Development, Johannesburg, International Institute for Applied System Analysis, Laxenburg, Austria, pp 152

³² Fishcer G (2005) *Climate change impacts on agriculture: An integrated assessment*. Presented at Informal Meeting of EU Agriculture and Environment Ministers, 11 September 2005, London, UK

³³ Cruz RV, Harasawa H, Lal M, Wu S, Anokhin Y, Punsalmaa B, Honda Y, Jafari M, Li C, Ninh NH (2007) *Asia. Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, ML Parry, OF Canziani, JP Palutikof, PJ van der Linden and CE Hanson (Eds), Cambridge University Press, Cambridge, UK, 469-506

³⁴ Ministry of Natural Resources and Environment (2003) *Viet Nam Initial National Communication Under Framework of UNFCCC*. Ministry of Natural Resources and Environment, Socialist Republic of Viet Nam

21. As an adaptation mechanism in the agriculture sector, several countries have identified developing crops with altered agronomy with resistance to droughts, floods and diseases. In addition, the emphasis has also been on improving the irrigation efficiency of the crops and ability to produce optimum under relatively poor fertility status.

22. In addition to the emphasis on altered agronomy, countries have given substantial emphasis on watershed based approaches integrating various elements of land, vegetation and animal husbandry practices. While these practices seem to have paid off in certain locations, widespread success is yet due. More elaboration has been given on this in the recommendations section.

23. Resource conservation seems to be emerging as a win-win approach towards climate risk reduction. These technologies, which include zero tillage, bed planting, reduced residue burning and nutrient use, have been put to effective use in the Indo-Gangetic Plains, Australia and China. Countries such as India, Pakistan, Bangladesh and China could effectively use these technologies in both rice and wheat components of rice-wheat systems leading to reduced GHG emissions, enhanced factor productivity and environmental health. Efforts are under way to harmonize their use at the system level.

24. Livelihood diversification has been attempted too, irrespective of the developmental state of the country, as a climate risk reduction strategy. Emphasis has been given on the off-farm livelihood activities those will reduce the farmers dependence on agriculture; enhance the income security with considerable impact on the poverty reduction. While some countries made significant progress others seems to be in the process of identifying possible diversification avenues.

25. Rural infrastructure has been identified as an important element to boost rural development. Nations such as China, India, and Viet Nam have made significant progress in rural infrastructure while others such as Bangladesh, Sri Lanka, and Indonesia have major plans for further investment in this sector. Promoting private sector participation in rural infrastructure projects seems to be negligible.

26. Capacity-building of farmers, research and extension systems gained importance. Training programmes have been organized at various levels to impart knowledge on impacts of climate change, designing cropping practices to avoid climate change impacts, and soil and water conservation practices in countries such as Bangladesh and Viet Nam.

Current status: Rural development

27. Climate change is expected to influence rural development through multiple paths. First and foremost, climate change can influence rural development through impacts such as reduction in crop production, droughts, and floods which will ultimately influence not only the primary producers but also the secondary livelihoods as well as food security.

28. In general, rural development is an important aspect of national development strategy in many of the developing countries in the Asia and the Pacific region. Particularly in countries where rural populations are relatively dense and more impoverished than urban populations. While this importance emerged from the

developmental needs of the countries rather than from the point of climate change adaptation, there is an emerging understanding in many of the developing countries that rural development is crucial for climate change adaptation. It should be understood that while broader development of rural areas can contribute significantly towards improving resilience to climate change, the initiatives listed in Table 3 are more directly related to climate change adaptation than many other initiatives identified in the special background paper on rural development. Looking at the scope of this review process, the countries listed in Table 3 and initiatives identified are largely representative of the region with many omissions to be expected.

Table 3: Significant land and rural development initiatives being taken up in some of the countries in Asia and the Pacific region that are relevant for climate change adaptation³⁵

Country	Land and rural development initiatives
Bangladesh	<ul style="list-style-type: none"> • Livestock enterprise development • Microfinance through self help groups
China	<ul style="list-style-type: none"> • Legal changes that would give farmers long-term security on the land (to provide tenure security)³⁶
India	<ul style="list-style-type: none"> • Secure drinking water supply • Wage employment, employment assurance, food for work, rural housing, social security programmes, land reforms etc • Watershed development programmes such as Drought Prone Areas Programme (DPAP) and Desert Development Programme (DDP)
Indonesia	<ul style="list-style-type: none"> • Food security enhancement³⁷
Viet Nam	<ul style="list-style-type: none"> • Agricultural diversification³⁸ • Strengthening the agriculture extension programmes³⁹ • Ongoing efforts to improve access to rural water supply and sanitation⁴⁰
Sri Lanka	<ul style="list-style-type: none"> • Significant investment in natural resource management⁴¹

29. Significant rural development achievements are found in countries such as China and Viet Nam and have reduced the vulnerability of rural communities to climate change-related stresses. Since initiating economic, China has achieved tremendous economic success. Growth of about 9 per cent per annum since the late 1970s has helped to lift several hundred million people out of absolute poverty, with the result that China alone accounted for over 75 per cent of poverty reduction in the developing world over the last 20 years.⁴² Such a development could have significant implications in enhancing

³⁵ Sources are mentioned as superscripts. Please note that the source has been cited at the beginning of listing the main observations and adaptation mechanisms

³⁶ Rural Development Institute (2007) *Background and problem of rural development in China*. http://www.rdiland.org/OURWORK/OurWork_China.html

³⁷ Government of Indonesia (2006) *Agrarian reforms and rural development in Indonesia*. Country Report; Indonesia. International Conference on Agrarian Reform and Rural Development,

³⁸ The World Bank (2005) *Accelerating rural development in Viet Nam*. Rural development and natural resources sector unit-East Asia and Pacific Region, the World Bank, Hanoi, Viet Nam

³⁹ Bong BB (2004) *Some issues in agriculture and rural development in Viet Nam at present and in the coming years*. Presented at the 8th Meeting of the ISG Steering Board, March 30, 2004

⁴⁰ The World Bank (2006) *Accelerating Viet Nam's rural development: Growth, equity and diversification*. The World Bank, Viet Nam

⁴¹ Department of National Planning (2005) *Sri Lanka: New development strategy*. Sri Lanka development forum 2005, Kandy, Sri Lanka, 16-17 May 2005, <www.erd.gov.lk/devforum/NPD/SLNDS.pdf>

⁴² The World Bank (2007) *Rural development and agriculture in China*. The World Bank. <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/EXTEAPREG>

the resilience of rural society to climate change impacts and shield against fluctuations in income and related wellbeing.

Current status: Drought

30. Drought and desertification are the major threats posed by climate change. It is important to understand that these impacts are, and will not be, uniform throughout the region. The intensity, duration, frequency and timing of droughts could vary from country to country depending on the country's vulnerability to drought and how it manages its natural resources including water resources.

31. Climate change studies have clearly indicated an impending water scarcity in the region. This has also been clearly reflected in the national adaptation plan of actions prepared by the countries in the Asia and the Pacific region. For example, chances of more droughts in the North-Western Bangladesh pushing agricultural production to marginal areas have been reported.¹⁸ Similar reports have also been made for India, China, Australia, and the Mekong region. In Malaysia, droughts are expected to impact oil palm, rubber, cocoa, and rice;³⁰ and threaten the food security of the countries such as Russian Federation³³ and Viet Nam³⁴.

32. Table 4 lists some of the significant drought and desertification reduction initiatives taken up by major countries in the region. Largely, it could be said that the countries in the region are slowly progressing towards drought risk mitigation. While success stories involving basin-level and field-level water management practices involving watershed management and integrated natural resource management practices are evolving, larger scale application of these success stories is still lacking. In addition, governments in the region are emphasizing on the drought response. While drought response is an important aspect, lack of well-planned drought mitigation and drought monitoring mechanisms would not only aggravate the drought intensities and impacts but would make governments to invest more and more on fire fighting.

33. Involvement of local communities and their capacity building seems to be one of the important limitations in the existing drought management practices of the countries in the region. Drought management plans that bring local communities, water use groups, and local governments together are still an exception rather than a rule.

34. Land use planning is an important aspect in drought risk mitigation. There is a clear lack of information on how countries are implementing land use practices in order to deal with drought related risks is a question. Also, improper interpretation of information on local precipitation potentials while designing water conservation reservoirs and other structures has been leading to inefficient use of resources and exorbitant expenditure in making canals and tanks with excessive capacity that would never be realized. This suggests that micro-level planning and management of water conservation and use practices needs to be reviewed and appropriate regulations should be put in place.

Table 4: Significant drought and desertification related initiatives being taken up in some of the countries in Asia Pacific region⁴³

Country	Significant initiatives	Issues at hand/Observations
Bangladesh	<ul style="list-style-type: none"> National level comprehensive disaster management initiative that encompasses drought as a theme which in turn brings together various stakeholders Promotion of groundwater use in Barind region Development of appropriate land and crop management practices to reduce the drought risk 	<ul style="list-style-type: none"> Capacity building of local functionaries to deal with the recurring drought Avoiding overexploitation of groundwater could lead to further problems and hence a legal framework may be put in place Need for developing a national water plan and establishing necessary institutional support⁴⁴
China	<ul style="list-style-type: none"> Drought monitoring using ground based observatories and remote sensing⁴⁵ Drought risk zoning classification in place Massive plantations being planned and implemented to stabilize the desertification process 	<ul style="list-style-type: none"> Climate change to enhance the droughts affecting agricultural production in large areas of the country The drought and desertification in China may have implications for surrounding countries
India	<ul style="list-style-type: none"> National crop weather watch group that monitors drought during monsoon season Integrated watershed development projects being taken up in drought prone areas Desert development programme (DDP) has been implemented in areas prone to desertification 	<ul style="list-style-type: none"> More droughts in western and eastern parts of India with climate change Enhancing the agro-input readiness to take the advantage of monsoonal revival Putting in place a community based drought planning scheme⁴⁶ Improving credibility of drought early warning systems
Indonesia	<ul style="list-style-type: none"> Integrated water resource management in Citarum river basin⁴⁷ 	<ul style="list-style-type: none"> Climate change to intensify drought in Sumatra islands of Indonesia with impacts on forests, land degradation, and reduced hydropower generation⁴⁸ Better enforcement of land use zoning Establishing fire and drought information systems Development of local capacities⁴⁹
Viet Nam	<ul style="list-style-type: none"> Laws and decrees exist that provides for drought and water management Peoples participation in water resource management⁵⁰ 	<ul style="list-style-type: none"> Introduction of integrated river basin management Limited capacity of Department of Water Resource Management for

⁴³ Sources are mentioned as superscripts. Please note that the source has been cited at the beginning of listing the main observations and adaptation mechanisms

⁴⁴ The World Bank (1997) *Water resource management in Bangladesh: Steps towards a new national water plan*. The World Bank Bangladesh

⁴⁵ Shili W (2005) *Monitoring, assessment, prediction and meteorological assessment of agricultural drought in China*, World Conference on Disaster Reduction, Kobe, Japan

⁴⁶ Prabhakar SVRK, Shaw RK (2007) *Climate change considerations for drought risk mitigation: A perspective for India*. Climatic Change. DOI 10.1007/s10584-007-9330-8

⁴⁷ Idrus H (2005) *Introduction of drought management in Indonesia*. First Thematic Workshop on Water Allocation and Water Right, Hanoi, Viet Nam, 5-9 December 2005

⁴⁸ World Resource Institute, Earth Trends, <<http://earthtrends.wri.org/updates/node/147>>

⁴⁹ Asian Development Bank, <www.adb.org/Documents/Reports/Fire_Prevention_Drought_Mgt/default.asp>

Country	Significant initiatives	Issues at hand/Observations
	<ul style="list-style-type: none"> • Development of water resource monitoring network • International cooperation in water resource management • Establishment of Mekong River Commission 	<p>working in complex policy environment and raising challenges</p> <ul style="list-style-type: none"> • Insufficient information on water resources for effective monitoring and allocation • Lack of effective drought monitoring system and emphasis is still on drought response
Australia	<ul style="list-style-type: none"> • Drought relief payment system put in place for the affected farmers⁵¹ • National water initiative by Australian Water Fund • Water proofing projects, water strategies at state level, improving water use efficiency in various water-dependent sectors, emphasis on water recycling, water conservation measures are in place 	<ul style="list-style-type: none"> • Climate change to enhance drought in southern and eastern Australia with significant reduction in production from agriculture and forestry

RECOMMENDATIONS

35. Since climate change impacts human and environmental systems via multiple pathways, there is a need for a holistic and integrated policy framework that encompasses and addresses the problems related to land, water and social systems. Such a policy framework also needs to be strategic in nature. However, considering the uncertainty of future climate change impacts, and due to the possibility of long-term decisions going wrong, a combination of win-win, no-regret policy options needs to be put in place.⁴⁶ It has been argued that it is possible for the nations to identify such options when governments emphasize sustainable development.

36. In this section, efforts have been made to identify some no-regret options for the governments to pursue. These options are based on the identified gaps in the existing adaptation options the governments have been pursuing.

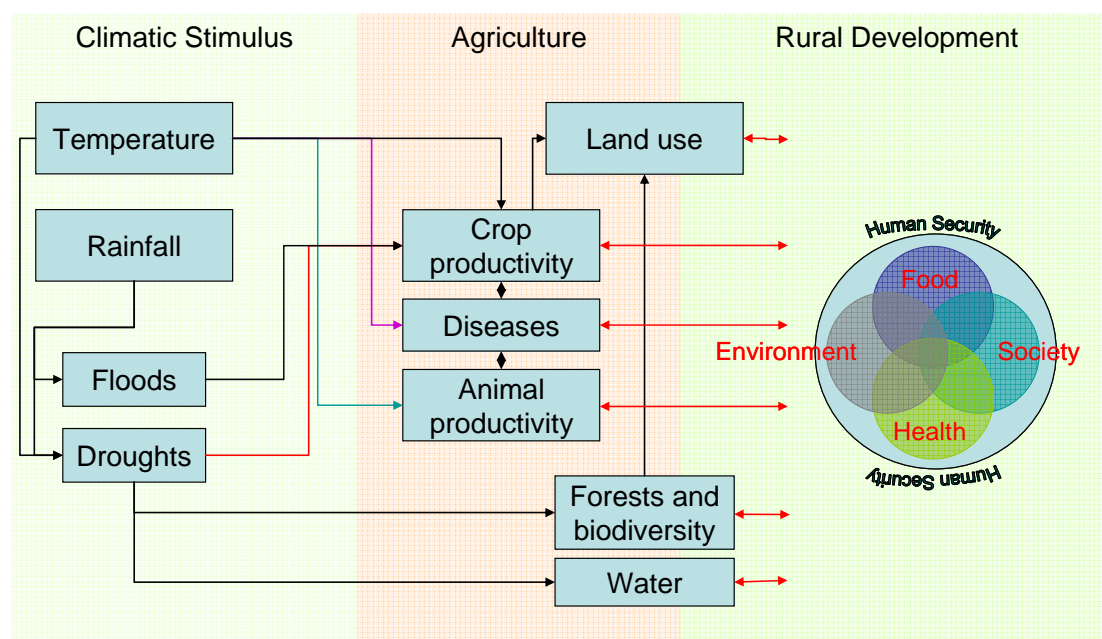
37. Climate change in the region could have serious implications for human security. Human security, if understood as an emerging paradigm governing human vulnerabilities that affect their access to food, environmental benefits and subsequently to the quality of life, could be threatened through multiple pathways as displayed in Figure 1. We have seen in the previous section that climate change has serious implications for agricultural prosperity in Asia and the Pacific region through changes

⁵⁰ UNCEE, Water resource management in Viet Nam. <http://unstats.un.org/unsd/envaccounting/ceea/Plmeetings/AC-116-13.ppt#1>

⁵¹ Hennessy K, Fitzharris B, Bates BC, Harvey N, Howden SM, Hughes L, Salinger J, Warrick R (2007) *Australia and New Zealand. Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, ML Parry, OF Canziani, JP Palutikof, PJ van der Linden and CE Hanson (Eds), Cambridge University Press, Cambridge, UK, 507-540

in rainfall patterns, droughts and floods, which will in turn reduce the crop production. This could put tremendous pressure on the existing land and water resources leading to horizontal expansion of farming activities and pressure on forests with effects on biodiversity and related ecosystem services. This calls for a human security centric approach to the development.

Figure 1: Major pathways of influence of climate change on agriculture, rural development and ultimately on human security⁵²



38. Enhancing the capacities of local governments and communities is important to realize the sustainable development and for achieving resilience to climate change. There are two aspects; firstly improving the capacities of local communities; and secondly improving the capacities of local governments.

39. Involvement of communities in local planning enables local governments to gain better understanding on the vulnerabilities of the communities. Drought preparedness planning that involves communities and other stakeholders can increase the society's capacity to cope more effectively with the extremes of climate and water scarcity and provide substantial benefit in preparing for the potential changes in climate. Currently, countries lack such community-based drought preparedness planning at various levels though some successful examples could be found at local levels. There is a need for these success stories to be widely disseminated and implemented with greater success.

40. It appears that providing drought relief to the effected populations constitutes one of the major drought management strategies for the local and state level governments in various countries. The top-down response mechanism offers no long-term solution. Though the main aim of the relief measures is to alleviate the immediate impact of the drought, this reactive crisis management approach has been found to be inefficient, and

⁵² Prabhakar SVRK. *Climate change implications for human security in Asia and the Pacific* (Unpublished)

ineffective. There exist an opportunity for governments to build sustainable livelihoods by combining drought relief measures with that of sustainable use of natural resources and development of more tangible assets. For example, a shift from ad-hoc measures to planned relief interventions that aims at creating longer-term livelihood options is an important approach to be considered.

41. Identification of community coping mechanisms, change in these coping mechanisms over the time and mapping these trends with the past climate trends such as increasing or decreasing frequency of scarcity events in that location seems to be very much lacking in the existing strategies for climate vulnerability reduction. While doing so, there is also a need to differentiate between planned adaptation and autonomous adaptation which would serve as an indicator of the community's capacities.

42. Integrated water resource management plays an important role in enhancing the adaptive capacity of the rural communities. While countries have already identified water resource management as an important component of adaptation to climate change, much is needed to be done in order to realize a tangible outcome on the ground. For example, countries such as Bangladesh, Viet Nam, Australia, India and Indonesia face the possibility of more droughts in a changing climate. Initiatives such as integrated river basin management should be given more thrust than given at the moment.

43. On the mitigation front, there are number of success stories involving the communities in effective planning and management of watershed management and natural resource management programmes. Many of these community-based watershed management interventions are localized and are small scale operations by local and regional NGOs. Hence, preconditions such as close engagement of stakeholders, promotion of local level watershed planning methodologies, and provision of local level framework for involving various stakeholders and channeling of funds have been suggested for a sustainable scaling up of the community based watershed management programmes.⁵³

44. Demand-side management of natural resources is another issue that is being given less consideration at the moment. Issues such as enhancing the efficiency of resource use including that of water use efficiency at the basin and field level is an important aspect to be considered. Prudent water pricing, putting in place incentives for those who save water would should be promoted.

45. Increasing water scarcity due to climate change means less and less water for agricultural purposes. In addition to this, growing urbanization places additional burdens on the existing water resources and competes with the water being used for agricultural purposes. Hence, prudent water-sharing mechanisms between various water-using sectors is an absolute necessity for the countries in the region. Such a water sharing would not be possible without working out a complete water balance and planned allocation of water to different sectors or allocation via market mechanisms.

⁵³ Farrington J, Lobo C (1997) *Scaling up participatory watershed development in India: Lessons from the Indo-German watershed development programme*. Natural Resource Perspectives 17: <http://www.odi.org.uk/nrp/index.html>. Cited 12 December 2006

46. Revisiting the existing cropping patterns and systems is needed. As monocropping means higher risk, in terms of income security, nutritional diversity in rural areas, and possibility of severe impacts to large areas due to pest and disease outbreak in a changing climate, mixed and intercropping practices are the only alternative that has multiple benefits. Development of varieties that are suitable for such kind of practices is also needs to be considered as a priority activity.

47. There is a need for enhancing the coordination between various institutions and governments at the local, national and regional levels so that the larger threats such as climate change are dealt with effectively. Such regional coordination has become apparent especially in areas related to transboundary water resource management such as in the case of Mekong River Commission.

48. More regional cooperation could be identified in the areas of drought and desertification monitoring. In this regard, more sophisticated drought monitoring using a combination of remote sensing technologies and ground truth information could be effective. Though countries have identified this as an important area for climate risk reduction, very limited progress could be made owing to limited understanding on the monsoonal mechanisms and how they modify with the climate change. The South-east Asia Drought Monitor developed by the International Water Management Institute (IWMI), which currently covers only the western India, Afghanistan and Pakistan, can be a good beginning.⁵⁴ This drought monitoring system would be effective if it is supported by an enhanced operational preparedness for initiating quick response. There is also a need to continue to look at the monsoon prediction methodologies and develop method that is validated for meeting the regions special needs.

49. Another area that needs significant improvement is making available the relevant forecasts that help the end-users to take decisions with more confidence. One of the ways of doing it is by improving the consistency, quality and value of the forecasts. Providing the information specific to the spatial and temporal scales is important for the prediction to be useful for the local level planning, which is not within the means of prediction at present, given the extreme complexity of the monsoon system. Value-added climate information with sufficient lead-time to plan appropriate management options would certainly enhance the adaptive capacity to the extremes. There is also a need to integrate the climate forecasts with other aspects of infrastructure and input supply such as seeds and fertilizers.

50. Integrated natural resource management holds the key in the context of climate change. Since Integrated natural resource management considers the available resources and balances their utilization against the demands, it is necessary that the countries in the region promote Integrated natural resource management at various levels. Though some development in this direction has already been observed in some of the countries, more is required to be done. Effective translation of Integrated natural resource

⁵⁴ Thenkabil PS, Gamage MSDN, Smakhtin VU (2004) *The use of remote sensing data for drought assessment and monitoring in south west Asia*. Research Report 85, International Water Management Institute, Sri Lanka

management principles into more understandable terms for a successful implementation at local level has been called for.

51. There is a clear linkage between rural development and land tenure arrangement. Since much of the rural development, and hence the resilience to climate change, depends on the income generated out of land management, it is highly essential that the countries in the region enhance the process of streamlining land tenure arrangements. While there are significant achievements made at the national level, the local disparities still exist due to unresolved local conflicts. It has been suggested that a sustained dialogue involving various stakeholders helps resolving these issues.

52. The potential of resource-conserving techniques such as zero and reduced tillage may be explored in the region as they conserve the soil moisture and reduce the off-farm inputs considerably. These technologies have already shown significant potential in South Asian Indo-Gangetic Plains where the factor productivity of rice-wheat systems has been a concern. In addition to input use efficiency, these resource conserving technologies are known for reducing carbon dioxide emissions, conserve soil organic carbon and enhance overall environmental health.

-----<>-----