

CLIMATE CHANGE AND ADAPTATION

K. S. Kavi Kumar

BIBLIOGRAPHICAL SURVEY SERIES – III

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CLIMATE CHANGE AND ADAPTATION

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Preface

This bibliographical survey focuses studies related to on climate change and adaptation, drawing largely studies from economics journals. The topics covered include, economics of climate change adaptation, estimates of macroeconomic costs of climate change adaptation, adaptation instruments, adaptation to climate extremes and ecosystem adaptation. Studies covering both national and international experiences are included in the survey. Recognizing the inter-disciplinary nature of the subject, a few studies from other disciplinary journals covering concepts such as adaptive capacity and resilience are also included.

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CLIMATE CHANGE AND ADAPTATION

BIBLIOGRAPHICAL SURVEY

Adger, W. Neil, "Institutional Adaptation to Environmental Risk under the Transition in Vietnam" *Annals of the Association of American Geographers*, December 2000, 90 (4), pp: 738-758.

Content: This paper develops a theoretical perspective on institutional adaptation to social vulnerability to environmental risks. It is evaluated in Nam Dinh Province in northern Vietnam, which is presently undergoing rapid economic and political transitions or fluxes.

Adger, W. Neil, "Social and Ecological Resilience: Are they Related?" *Progress in Human Geography*, 2000, 24 (3), pp: 347-364.

Content: This article defines the term 'social resilience' and shows a link between the social and the ecological resilience, particularly for the social groups or communities-dependent on ecological and environmental resources for their livelihoods. Further the study explores potential link between social and ecological resilience in the context of coastal community in Vietnam.

Adger, W. Neil, "Social Capital, Collective Action, and Adaptation to climate Change" *Economic Geography*, 2003, 79, pp: 387-404.

Content: This article reviews the emerging perspectives on collective action and social capital and argues that insights from these areas inform the nature of adaptive capacity and normative prescriptions of policies of adaptation. The study draws inference from communities coping with extremes in weather in coastal areas of Southeast Asia and community based coastal management in the Caribbean.

Adger, W. Neil; Huq, Saleemul; Brown, Katrina; Conway, Declan; and Hulme, Mike, "Adaptation to Climate Change in the Developing World" *Progress in Development Studies*, 2003, 3 (3), pp: 179-195.

Content: The objective of this article is to assess the current adaptive capacity of the society and how it will cope with the future risks of the climatic related events. The paper explores the nature of risk and vulnerability in the context of the climate change and reviews the evidence on present day adaptation in developing countries and on coordinated international action on future adaptation.

Adger, W.N. and Kelly, P.M., "Social Vulnerability to Climate Change and the Architecture of Entitlements", *Mitigation and Adaptation Strategies for Global Change*, 1999, 4, 253-266.

Content: The vulnerability or security of any group is determined by the availability of resources and, crucially, by the entitlement of individuals and groups to call on these resources. This study develops proxy indicators of vulnerability related to the structure of economic relations and the entitlements which govern them, and shows how these can be applied to a District in coastal lowland Vietnam. The paper also outlines the lessons of such an approach to social vulnerability for the assessment of climate change at the global scale.

Adger, W.N., "Social Vulnerability to Climate Change and Extremes in Coastal Vietnam", *World Development*, 1999, 27(2), 249-269.

Content: Vulnerability is defined in this paper as the exposure of individuals or collective groups to livelihood stress as a result of the impacts of such environmental change. Analysis based on coastal northern Vietnam shows that baseline social vulnerability is enhanced by some institutional and economic factors associated with Vietnam's economic transition from central planning, namely the breakdown of collective action on protection from extreme events and an increasingly skewed income.

Adger, W.N., "Vulnerability", *Global Environmental Change*, 2006, 16, 268-281.

Content: This paper reviews research traditions of vulnerability to environmental change and the challenges for present vulnerability research in integrating with the domains of resilience and adaptation. The paper argues that the challenges for vulnerability research are to develop robust and credible measures, to incorporate diverse methods that include perceptions of risk and vulnerability, and to incorporate governance research on the mechanisms that mediate vulnerability and promote adaptive action and resilience.

Adger, W.N., Arnell, N.W., and Tompkins, E.L., "Successful Adaptation to Climate Change across Scales", *Global Environmental Change*, 2005, 15, 77-86.

Content: This paper reviews the nature of adaptation and implications of different spatial scales for both physical and ecological systems. The paper outlines a set of normative evaluative criteria for judging the success of

adaptations at different scales. It argues that elements of effectiveness, efficiency, equity and legitimacy are important in judging success in terms of the sustainability of development pathways into an uncertain future.

Agrawala, S. and Fankhauser, S. (ed.), “Economic Aspects of Adaptation to Climate Change: Costs, Benefits and Policy Instruments”, 2008, OECD, Paris.

Content: This report provides a critical assessment of adaptation costs and benefits in key climate sensitive sectors, as well as across sectors at the sectoral, national and global levels. It also moves the discussion beyond cost estimation to examine market and regulatory mechanisms that can be used to incentivize adaptation actions.

Agrawala, Shardul; Ota, Tomoko; Ahmed, Uddin Ahsan; Smith, Joel; and Aalst, Maarten van, “*Development and Climate Change in Bangladesh: Focus on coastal flooding and the Sundarbans*” 2003, Environment Directorate and Development Co-operation Directorate, OECD, Paris.

Content: This report presents the integrated case study for Bangladesh with reference to the development and the climate change. The report focuses on three issues: first, recent climatic trends and climate change scenarios for Bangladesh are assessed and key sectoral impacts are identified and ranked along multiple indicators to establish priorities for adaptation; second, donor portfolios in Bangladesh are analysed to examine the proportion of development assistance activities affected by climate risks; and third, an in-depth analysis is conducted for coastal zones, particularly the coastal mangroves in the Sundarbans, which have been identified as a particularly vulnerable areas to the impacts of the climate change.

Armitage, Derek, “Socio-Institutional Dynamics and the Political Ecology of Mangrove Forest Conservation in Central Sulawesi, Indonesia” *Global Environmental Change*, 2002, 12, pp: 203–217.

Content: Drawing on insights and concepts offered by political ecology and complex systems, processes of mangrove forest conversion and aquaculture development in the coastal zone of Banawa District, Central Sulawesi, are analyzed in this paper.

Bapna, M. and McGray, H., “Financing Adaptation: Opportunities for Innovation and Experimentation”, chapter in *Climate Change and Global Poverty: A Billion Lives in the Balance?*, 2009, Brookings Institution Press.

Content: This paper explores the opportunities and challenges involved in financing adaptation efforts in developing countries. In particular it tries to address questions such as, how much will adaptation cost? Which proposals are most likely to generate an adequate and predictable flow of funds? How should these funds be channeled so that they reach those most in need? How do we ensure adaptation funds are used most effectively?

Birkmann, J. and von Teichman, K., “Integrating Disaster Risk Reduction and Climate Change Adaptation: Key Challenges- scales, knowledge, and norms”, *Sustainability Science*, DOI 10.1007/s11625-010-0108-y

Content: This paper examines the reasons for the practical barriers when linking climate change adaptation and disaster risk reduction according to different spatial and temporal scales, the knowledge base, and norm systems followed in both the disciplines. The paper outlines recommendations and measures that need to be adopted for overcoming the existing barriers.

Blankespoor, B., Dasgupta, S., Laplante, B., and Wheeler, D., “The Economics of Adaptation to Extreme Weather Events in Developing Countries”, 2010, CGD Working Paper 198, Center for Global Development. Washington, D.C.

Content: Focusing on economics of adaptation to extreme weather events, this paper addresses several questions that are relevant for the international discussion: How will climate change alter the incidence of these events, and how will their impact be distributed geographically? How will future socioeconomic development, notably an increased focus on education and empowerment for women and girls, affect the vulnerability of affected communities? And, of primary interest to negotiators and donors, how much would it cost to neutralize the threat of additional losses in this context?

Boyd, E., Grist, N., Juhola, S., and Nelson, V., “Exploring Development Futures in a Changing Climate: Frontiers for Development Policy and Practice”, *Development Policy Review*, 2009, 27(6), 659-674.

Content: Discussion on how development policy is responding to the increasingly pressured global climate agenda, this article reviews what is being

done and still needs to be done, paying particular attention to action on three policy frontiers: (i) adaptation actions and finance, (ii) mitigation policies and their governance, and (iii) the implications for development planning.

Callaway, J.M., “Adaptation Benefits and Costs: Are they important in the global policy picture and how can we estimate them”, *Global Environmental Change*, 2004, 14, 273-282.

Content: This paper argues that information about the value of the marginal global benefits of reducing climate change may not be as important to decision makers as we might intuitively assume, but that information about the local value of these benefits is extremely important. It further suggests that some of the limitations associated with current estimates, especially with reference to their treatment of adaptation can be overcome using traditional planning approaches that link both the risk of current climate variability and variability in climate change ‘forecasts’.

Cannon, Terry, “Gender and Climate Hazards in Bangladesh” *Gender and Development*, July 2002, 10 (2), pp: 45-50.

Content: This article discusses the impacts of climate hazards in Bangladesh, especially focusing on the gender related issues. The extreme climate events will affect women more and bring additional stress for them.

Chatterjee, Kalipada; Chatterjee, Anish; and Das, Sarmistha, “Case Study 2: India Community Adaptation to Drought in Rajasthan” *IDS Bulletin*, October 2005, 36 (4), pp: 33-52.

Content: This article analyses vulnerability and the community adaptation to drought in Rajasthan, India.

Costanza, Robert; and Farley, Joshua, “Ecological Economics of Coastal Disasters: Introduction to the Special Issue” *Ecological Economics*, 2007, 63, pp: 249-253.

Content: This paper reviews ten papers that apply different frameworks in the analysis of the coastal disaster, seeking to understand their impacts and how to mitigate them, how to predict and plan for them, and how to use this information to redesign coastal areas in a more sustainable and desirable way.

Dang, Hanh H.; Michaelowa, Axel; and Tuan, Dao D., “Synergy of Adaptation and Mitigation Strategies in the Context of Sustainable Development: The case of Vietnam” *Climate Policy*, Special Supplement on Climate Change and Sustainable Development, November 2003, 3 (1), pp: S81-S96.

Content: This article explores possible contradictions and synergies between adaptation and mitigation strategies and the implications for developing countries and sustainable development targets. Following this, it uses the case study of Vietnam to demonstrate how to integrate both mitigation and adaptation strategies that can provide additional benefit to the social welfare of the society.

Dash, Biswanath, “Lessons from Orissa Super Cyclone: Need for Integrated Warning System” *Economic and Political Weekly*, October 2002, XXXVII (42), pp: 4270-4271.

Content: This paper explains the usefulness of the warning system based on lessons learned from Orissa super cyclone.

Dell, M., Jones, B.F., and Olken, B.A., “Temperature Shocks and Economic Growth: Evidence from the Last Half Century”, *American Economic Journal: Macroeconomics*, 2012, 4(3), 66-95.

Content: This paper uses historical fluctuations in temperature within countries to identify its effects on aggregate economic outcomes. The results suggest that, higher temperatures substantially reduce economic growth in poor countries; higher temperatures may reduce growth rates, not just the level of output; and higher temperatures have wide-ranging effects, reducing agricultural output, industrial output, and political stability.

Deressa, T., Hasan, R.M., Alemu, T., Yesuf, M., and Ringler, C., “Analyzing the Determinants of Farmer’s Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia”, *IFPRI Discussion Paper*, 2008, Discussion Paper Number 00798, IFPRI, Washington, D.C.

Content: This study identifies the major methods used by farmers to adapt to climate change in the Nile Basin of Ethiopia, the factors that affect their choice of method, and the barriers to adaptation. The methods identified include use of different crop varieties, tree planting, soil conservation, early and late planting, and irrigation.

Dillon, A., Mueller, V., and Salau, S., “Migratory Response to Agricultural Risk in Northern Nigeria”, *American Journal of Agricultural Economics*, 2011, 93(4), 1048-1061.

Content: Using temperature degree-days as proxy for agricultural risk, this paper investigates the extent of internal migration undertaken by the Nigerian households. The results show evidence of household response to *ex ante* risk by sending males to migrate. The paper further draws inference for climate change adaptation.

Dixit, Ajaya, “Floods and Vulnerability: Need to Rethink Flood Management” *Natural Hazards*, 2003, 28, pp: 155-179.

Content: This paper reviews the nature of flood disaster in the Himalaya-Ganga by focusing on plains of Nepal and argues that conventional approach has not been able to provide the security envisaged and also suggests that vulnerability of people in risk prone areas must be addressed by enhancing resilience capacity.

ECA (Economics of Climate Adaptation), “Shaping Climate-Resilient Development: A Framework for Decision-making”, *Report of the Economics of Climate Adaptation Working Group*, 2009, Climate Works Foundation.

Content: This report by the Global Environmental Facility, McKinsey & Company, Swiss Re, the Rockefeller Foundation, ClimateWorks Foundation, the European Commission, and Standard Chartered Bank summarizes the findings of a study by the Economics of Climate Adaptation Working Group. The broad questions addressed in the report include, what is the potential climate-related loss to our economies and societies over the coming decades? How much of that loss can we avert, with what measures? What investment will be required to fund those measures – and will the benefits of that investment outweigh the costs?

Fankhauser, S., “The Costs of Adapting to Climate Change”, 1998, Working Paper 16, Global Environmental Facility, Washington, D.C.

Content: This early contribution to the climate change adaptation field provides a conceptual discussion on what constitutes adaptation cost. Defining imposed costs as the least-cost combination of adaptation costs plus residual damage costs, the paper suggests a possible framework for calculation of imposed costs and for the assessment of individual adaptation measures.

Fankhauser, Samuel; Smith, Joel B.; Tol, Richard S. J., “Weathering Climate Change: Some Simple Rules to guide Adaptation Decisions” *Ecological Economics*, 1999, 30, pp: 67-78.

Content: This paper discusses some of the elements that characterise an efficient strategy to adapt to a changing climate, which may bring severe climate extreme events.

Feng, S., Krueger, A.B., and Oppenheimer, M., “Linkages among Climate Change, Crop Yields and Mexico-US Cross-border Migration”, *Proceedings of National Academy of Sciences*, 2010, 107(32), 14257-14262.

Content: This paper examines the linkages among variations in climate, agricultural yields, and people’s migration responses using an instrumental variable approach. The paper uses state-level emigration data from Mexico, the study finds significant effect of climate-driven changes in crop yields on rate of emigration to the United States.

Fernando, M T N; Zubair, L; Peiris, T S G; Ranasinghe, C S; and Ratnasiri, J, “Economic Value of Climate Variability Impacts on Coconut Production in Sri Lanka” *AIACC Working Paper No. 45*, March 2007, START, Washington DC.

Content: This paper assesses the economic value of climate variability, using time-series data of 31 years national annual coconut production from 1971 to 2001 in Sri Lanka.

Few, Roger, “Health and Climatic Hazards: Framing Social Research on Vulnerability, response and Adaptation” *Global Environmental Change*, 2007, 17, pp: 281–295.

Content: This article argues that there is a high correlation between health and climate hazards. It explores how vulnerability to health impacts varies within society and how actors make decisions and take action in relation to climate hazards and health.

Haddad, Brent M., “Ranking the Adaptive Capacity of Nations to Climate Change when Socio-political goals are Explicit” *Global Environmental change*, 2005, 15, pp: 165-176.

Content: This paper posits 11 possible national socio-political goals that fall into the three categories of teleological legitimacy, procedural legitimacy, and norm based decision rules to rank the adaptive capacity of the nations to the impacts of the climate change.

Haque, C. Emdad; and Burton, Ian, “Adaptation Options Strategies for Hazards and Vulnerability Mitigation: An International Perspective” *Mitigation and Adaptation Strategies for Global Change*, 2005, 10, pp: 335-353.

Content: The broad objective of this paper is to address some of the gaps in our knowledge and understanding of the policies, programs, and measures that might be applied to natural hazards and their impacts in an era of the climate change.

Howden, M.S., Soussana, J-F., Tubiello, F.N., Chhetri, N., Dunlop, M., and Meinke, H., “Adapting Agriculture to Climate Change”, *Proceedings of National Academy of Sciences*, 2007, 104(50), 19691-19696.

Content: This paper argues that achieving increased adaptation action will necessitate integration of climate change-related issues with other risk factors, such as climate variability and market risk, and with other policy domains, such as sustainable development. It further argues that a crucial component of the proposed approach is the implementation of adaptation assessment frameworks that are relevant, robust, and easily operated by all stakeholders, practitioners, policymakers, and scientists.

Huq, S., Yamin, F., Rahman, A., Chatterjee, A., Yang, Xiu, Wade, S., Orindi, V. and Chigwada, J., “Linking Climate Adaptation and Development: A Synthesis of Six Case Studies from Asia and Africa”, *IDS Bulletin*, 2005, 36(4), 117-122.

Content: This overview article summarizes the case studies undertaken as part of Linking Climate Adaptation project which aimed to collect examples of coping with changing climatic conditions from various developing countries in Asia and Africa. The countries covered are China, India, Bangladesh, Senegal, Kenya and Zimbabwe.

Kahn, Matthew E., “Two Measures of Progress in Adapting to Climate Change” *Global Environmental Change*, 2003, 13, pp: 307–312.

Content: The main objective of this article is to highlight the key role of the adaptation in determining the economic and the social costs of the climate change. It uses two data sets, deaths caused by natural disasters and skin cancer deaths in warmer and cooler US states, to test the hypothesis.

Kumar, K.S.K. and Viswanathan, B., “Influence of Weather on Temporary and Permanent Migration in Rural India”, *Climate Change Economics*, 2013, 4(2).

Content: Arguing that agricultural distress along with inter-regional differences can fuel out-migration from rural areas and that such migration acquires importance in the context of climate change adaptation, this paper provides evidence from India based on household level data. The paper recognizes the presence of temporary migration alongside permanent migration and explores the role of temperature and rainfall variability in such migration decisions.

Kurukulasuriya, P., Kala, N., and Mendelsohn, R., “Adaptation and Climate Change Impacts: A Structural Ricardian Model of Irrigation and Farm Income in Africa”, *Climate Change Economics*, 2011, 2(2), 149-174.

Content: This paper examines how climate affects the choice to irrigate (which is often considered as an important adaptation strategy) and the conditional income earned by each farmer. The paper develops a selection model of irrigation choice and conditional income. Using data from farmers across eleven African countries, the paper demonstrates that the choice of irrigation is sensitive to both temperature and precipitation.

Lambert, L. Don, “The Role of Climate in the Economic Development of Nations” *Land Economics*, November 1971, 47 (4), pp: 339-344.

Content: This paper highlights a long recognised notion that tropical climate has detrimental effect on the economic development of the nations.

Lewin, P.A., Fisher, M., and Weber, B., “Do Rainfall Conditions Push or Pull Rural Migrants: Evidence from Malawi”, *Agricultural Economics*, 2012, 43, 191-204

Content: This paper uses household level survey data to examine the influence of rainfall conditions on rural workers’ decision to migrate to urban or other rural areas. The paper shows that migrants often choose to move to areas with lower rainfall variability and drought probability.

Lisa, Schipper; and Mark, Pelling, “Disaster Risk, Climate Change and International Development: Scope for, and Challenges to, Integration” *Disasters*, March 2006, 30 (1), pp: 19-38.

Content: This paper reviews the theoretical and policy linkages between disaster risk reduction, climate change and the development. It argues for an integrated approach as reduction of losses to the weather related disasters are important ingredients achieving Millennium Development Goals.

Luo, Haiping; Skees, Jerry R.; and Marchant, Mary A., “Weather Information and the Potential for Inter-temporal Adverse Selection in Crop Insurance” *Review of Agricultural Economics*, September 1994, 16 (3), pp: 441-451.

Content: This study investigates the potential usefulness of the early-season weather information to forecasting corn yields in the Midwest, USA.

Meinke, H., Howden, S.M., Struik, P.C., Nelson, R., Rodriguez, D. and Chapman, S.C., “Adaptation Science for Agriculture and Natural Resource Management – Urgency and theoretical basis”, *Current Opinion in Environmental Sustainability*, 2009, 1, 69-76.

Content: Focusing on agriculture and natural resource management, this paper proposes an adaptation cycle that first, provides a reflective analysis-action continuum; second, ensures broad-based scientific input and feedback; and third, helps to increase the adaptive capacity of everyone involved (including farmers, policy-makers and scientists).

Mendelsohn, R., “The Economics of Adaptation to Climate Change in Developing Countries”, *Climate Change Economics*, 2012, 3(2).

Content: The empirical literature on climate change adaptation has largely focused on how private actors have adapted to the current range of climates across the earth. From these studies, researchers are extrapolating what changes would make sense in the future as climate changes. The results suggest that adaptations are local in nature and therefore look like patchwork adjustments across space. They depend on the current local climate, how it changes and the various local conditions. Although public adaptations in health and conservation look promising, there are virtually no economic analyses of their potential

Mirza, M. Monirul Qader, "Climate Change and Extreme Weather Events: Can Developing Countries Adapt?" *Climate Policy*, September 2003, 3 (3), pp: 233-248.

Content: This paper argues that vulnerability to extreme weather events, disaster management and adaptation must be part of long-term sustainable development planning in the developing countries. So, the investment needs to focus more on capacity building instead of just investing in recovery operations and infrastructure development procedure.

Mustafa, Daanish, "Reinforcing Vulnerability? Disaster Relief, Recovery, and Response to the 2001 Flood in Rawalpindi, Pakistan" *Environmental Hazards*, 2003, 5, pp: 71-82.

Content: This paper conducts a retrospective analysis of the relief and recovery efforts in the aftermath of the 2001 flood disaster in the Rawalpindi-Islamabad in Pakistan.

Mustelin, J., Kuruppu, N., Kramer, A.M., Daron, J., de Bruin, K., and Noriega, A.G., "Climate Adaptation Research for the Next Generation", *Climate and Development*, 2013, 5(3), 189-193.

Content: Arguing that several issues are relevant for early career researchers and practitioners interested in adaptation research, this paper provides a comprehensive discussion about the same. The highlighted issues include working in an area of science that crosses disciplinary boundaries, improving the quality of and capacity to undertake adaptation research, and equity and ethics. The paper further elaborates on these themes based on personal experiences as early career adaptation researchers working in developed and developing countries.

Nelson, G.C., Rosegrant, M., Koo, J., Robertson, R., Sulser, T., Zhu, T., Msangi, S., Ringler, C., Palazzo, A., Batka, M., Magalhaes, M., and Lee, D., "Climate Change Impact on Agriculture and Costs of Adaptation", 2009, International Food Policy Research Institute, Washington, D.C.

Content: This report brings together, for the first time, detailed modeling of crop growth under climate change with insights from an extremely detailed global agriculture model, using two climate scenarios to simulate future climate. The report argues that aggressive agricultural productivity investments of US\$ 7.1–

7.3 billion are needed to raise calorie consumption enough to offset the negative impacts of climate change on the health and well-being of children.

Neumann, N., Hudgens, D., Herter, J. and Martinich, J., “The Economics of Adaptation along Developed Coastlines”, *WIREs Climate Change*, 2011, 2, 89-98.

Content: This paper presents a framework for evaluating the economics of adaptation to permanent inundation from sea level rise (SLR) that employs detailed local scale data and is spatially comprehensive. It applies the framework to estimate costs of adaptation for the full coastline of the continental US. The results show that the economic cost of SLR is much larger than prior estimates, but is only one-fourth the total value of low-lying property vulnerable to SLR.

Paavola, Jouni; and Adger, W Neil, “Fair Adaptation to Climate Change” *Ecological Economics*, 2006, 56, pp: 594-609.

Content: This article identifies social justice dilemmas associated with the necessity to adapt to the climate change, examines how they are currently addressed by the climate change regime, and proposes solution to overcome the prevailing gaps and the ambiguities.

Panda, A., Sharma, U., Ninan, K.N., and Patt, A., “Adaptive Capacity Contributing to Improved Agricultural Productivity at the Household Level: Empirical Findings Highlighting the Importance of Crop Insurance”, *Global Environmental Change*, 2013, 23, 782-790.

Content: This paper analyses factors that give rise to greater or lesser adaptive capacity among households, using a household level survey administered in the Indian state of Odisha. The paper argues that crop insurance stood out as an effective factor that increases the adaptive capacity among households.

Pandey, Deep Narayan; Gupta, Anil K.; and Anderson, David M., “Rainwater Harvesting as an Adaptation to Climate Change” *Current Science*, July 2003, 85 (1), pp.46-59.

Content: This paper argues that in the context of climate extremes people may modify dwelling environments by adapting new strategies to optimize the utility of available water, such as harvesting rain rather than migrating to the new areas.

Parry, M., Arnell, N., Berry, P., Dodman, D., Fankhauser, S., Hope, C., Kovats, S., Nicholls, R., Satterthwaite, D., Tiffin, R., and Wheeler, T., “Assessing the Costs of Adaptation to Climate Change: A review of UNFCCC and other recent estimates”, 2009, International Institute for Environment and Development and Grantham Institute for Climate Change, London.

Content: This report illustrates the uncertainties in the UNFCCC estimates on costs of adaptation. The report argues that the main reasons for under-estimation associated with the UNFCCC estimates include: (i) some sectors have not been included in an assessment of cost (e.g. ecosystems, energy, manufacturing, retailing, and tourism); (ii) some of those sectors which have been included have been only partially covered; and (iii) the additional costs of adaptation have sometimes been calculated as ‘climate mark-ups’ against low levels of assumed investment.

Patt, A., “Should Adaptation be a Distinct Field of Science?”, *Climate and Development*, 2013, 5(3), 187-188.

Content: This reflective article raises fundamental questions on what constitutes climate change adaptation. It further provides important food for thought with regard the need for moving from disciplinary to inter-disciplinary research.

Patt, A., and Schroter, D., “Perceptions of Climate Risk in Mozambique: Implications for the Success of Adaptation Strategies”, *Global Environmental Change*, 2008, 18, 458-467.

Content: Arguing that adaptation strategies crucially depend on the willing cooperation of the intended beneficiaries, this paper illustrates the point through a case study of resettlement program in Mozambique.

Schipper, L.E.A., “Meeting at the Crossroads?: Exploring the linkages between Climate Change Adaptation and Disaster Risk Reduction”, *Climate and Development*, 2009, 1, 16-30.

Content: Adaptation to climate change and disaster risk reduction both focus on society-risk dynamics. Recently, dialogue between the adaptation and disaster risk-reduction communities has focused on creating stronger links between the two by putting greater effort into learning from each other and collaborating conceptually and practically. This paper addresses among other things some outstanding questions for these communities that include whether a convergence

of the two tracks is desirable; and if such a convergence were to occur, what forms would it take and what outcomes could be expected.

Smit, B.; Burton, I.; Klein, R. J. T.; and Wandel, J., “An Anatomy of Adaptation to Climate Change and Variability” *Climatic Change*, 2000, 45, pp: 223-251.

Content: This article explains the meaning of the adaptation, and how it has been characterised as well as classified. It also reviews methods to evaluate adaptation options, particularly for the prescriptive analyses.

Smit, Barry; and Wandel, Johanna, “Adaptation, Adaptive Capacity and Vulnerability” *Global Environmental Change*, 2006, 16, pp: 282–292.

Content: This paper reviews the concept of adaptation of human communities to the global changes, especially the climate change. Drawing inputs from both impact studies and vulnerability literature, the article highlights the high importance given to adaptation.

Thomalla, Frank; and Schmuck, Hanna, “We All Knew that a Cyclone was Coming: Disaster Preparedness and the Cyclone of 1999 in Orissa, India” *Disasters*, 2004, 28 (4), pp: 373-387.

Content: This article discusses the adaptation options employed during the super cyclone of 1999 in Orissa, India. In addition, it examines why such a large loss of life occurred and looks at measures taken since then to initiate comprehensive disaster preparedness programmes.

Tol, Richard S. J.; and Yohe, Gary W., “The Weakest link Hypothesis for Adaptive Capacity: An Empirical Test” *Global Environmental Change*, 2007, 17, pp: 218-227.

Content: This article again extends the discussion on ‘weakest link’ hypothesis proposed by the authors in their 2002 paper.

Tol, Richard S. J.; Frankhauser, Samuel; and Smith Joel B., “The Scope for Adaptation to Climate Change: What Can we learn from the Impact Literature?” *Global Environmental Change*, 1998, 8 (2), pp: 109-123.

Content: This paper discusses the extent to which the vast body of literature on climate change impacts can provide insights into the scope and likely cost of

adaptation by grouping the available studies into four categories: no adaptation; arbitrary adaptation; observed adaptation; and modeled adaptation.

Yohe, Gary; and Tol, Richard S.J., "Indicators for Social and Economics Coping Capacity-Moving Toward a Working Definition of Adaptive Capacity" *Global Environmental Change*, 2002, 12, pp: 25–40.

Content: This paper offers a practically motivated method, which is designed to assess the potential contribution options to improving systems' coping capacities by focusing on the underlying determinants of the adaptive capacity. The proposed method is used to understand how adaptation could reduce vulnerability in the Netherlands to increased flooding along the Rhine River.

Centre of Excellence in Environmental Economics

The Ministry of Environment and Forests, Government of India has designated Madras School of Economics as a Centre of Excellence in the area of Environmental Economics for a period of ten years from April 1, 2002. The centre carries out research work on: Development of Economic Instruments, Trade and Environment, and Cost-Benefit Analysis. The Centre is primarily engaged in research projects, training programmes, and providing policy assistance to the Ministry on various topics. The Centre is also responsible for the development and maintenance of a website (<http://coe.mse.ac.in>), and for the dissemination of concept papers on Environmental Economics.

Madras School of Economics

Madras School of Economics was founded in 1993 as a private post-graduate institution for teaching and research in economics. MSE offers a two-year Master's program in General Economics, Financial Economics, Applied Quantitative Finance, Actuarial Economics and Environmental Economics affiliated to Central University of Tamil Nadu, and a Ph.D Programme affiliated to both University of Madras and Central University of Tamil Nadu. Since its inception, MSE has undertaken a large number of research projects funded by various national and international funding agencies. MSE has also undertaken policy oriented projects for various State Governments and different Ministries of the Central Government.

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