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Eye of the Storm

Integrated Solutions to the Climate, Agriculture and Water Crises

This brief is based on the paper, "Integrated solutions to the water, agriculture and climate crisis," March 2009. There is growing recognition that water is the "key medium through which climate change impacts will be felt."[1] Climate impacts on water will directly affect agriculture. And, of course, agricultural practices can both impact and mitigate climate change. Yet, all three—climate, agriculture and water—are facing severe crises. It is the dramatic convergence of these crises that compel us to shift away from the dominant industrial agriculture model toward more sustainable and just alternatives. Ultimately, agriculture will play a critical role in addressing global challenges related to climate, water, social justice and food.[2]

These challenges cannot effectively be addressed in isolation. Instead, it is time to identify the interconnection between them and develop complementary policy options and action steps.

UNFCCC and Water: An Overview

A 2008 Intergovernmental Panel on Climate Change (IPCC) report found that "Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems."[3] The projected impacts from climate change include rising sea levels and rising temperatures, extreme variations in frequency and patterns of precipitation (be it rainfall, snowfall or snow melt) that result in floods and droughts, as well as an increase in pathogens and pests.[4] These climate-related changes are expected to affect fresh water availability for a whole range of human uses, including agriculture.

Water-related adaptation strategies are now gaining greater attention in climate-related discussions.[5] Unfortunately, the technofix mentality dominates. A range of technologies including genetically modified crops, biofuels, biochar and geo-engineering, dykes and dams—are being put forward as agricultural solutions to climate change. These technologies, it is claimed, will provide answers to the challenges of water scarcity, pollution and floods, and have the added value of reducing GHG emissions either by sequestering carbon, deflecting solar radiation or by providing a low-carbon energy source.[6] At best, some of them (such as flood defenses and dykes) can help as a short term adaptation strategy. However, we contend, that most of these strategies reflect a narrowly conceived approach to adaptation techniques (such as water use efficiency improvement through genetic modification), or a combination of adaptation and mitigation (such as renewed investments in large hydro-electric dams) that will result in long-term negative social and ecosystem impacts that far outweigh the benefits.

It is clear why agriculture water use, which accounts for almost 70 percent of world water withdrawals, is at the intersection of three interconnected crises—food, water and climate—and what we do to address these crises must explicitly include the valuable social, cultural and biological role water plays in the world.

Reaching Limits in an Unequal World

In 2000, it was estimated that over one billion people did not have access to safe drinking water.7 Despite worldwide efforts to increase water supply and sanitation, in 2006, 1.069 billion people still did not have access to safe drinking water and a staggering 2.612 billion were without access to water for sanitation.[8]

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In June 2009, the number of world's hungry topped a billion.[9] Food deficit nations, almost all of them in the South and many of them experiencing water scarcity, are further compromised by their limited access to adaptation resources. The reality is that, on a global scale, there are not enough new land or water resources that can be diverted for agricultural production without the problem incurring large environmental and social costs. If current water use patterns continue, by 2050 the world may not have enough water to meet the food and nutritional requirements of the growing population.[10]

Even as many global institutions recognize these limits, the strategies being proposed to address the crisis often adopt the same approach that has brought us to this position in the first place. For example, even as the World Bank is calling for investment in agriculture and rural development to help alleviate poverty, its "New Deal on Global Food Policy" promotes new seeds and fertilizer for increased industrial agricultural production, and trade reform to reduce distorting subsidies and barriers that may help more sustainable, local food systems grow.[11]

On the other hand, a new climate framework that recognizes the multi-functional nature of agriculture can support a shift towards a truly climate-friendly and sustainable food production system that does not compromise water security.

Rain-fed Crops, Climate Change and Food Security

Especially vulnerable to climate-related stresses and accounting for over 80 percent of agricultural land, rain-fed agricultural systems not only require the greatest adaptation, but also have been identified as pivotal to addressing the food crisis. Rain-fed agriculture is practiced in many parts of the developing world and in temperate regions of the North where it tends to be part of industrial agricultural systems.

There are a myriad of local rain-fed crops that sustain communities living in marginal areas. In 2002, it was estimated that about 1.4 billion people (three-fourths of them in Africa and Asia) eke out a living from these marginal lands.[12] In addition, it is estimated that unmanaged natural systems (e.g., forest products, fish or firewood) could sustain about 600 million people in the world.[13] All these are remnants of multifunctional agricultural systems that have lost out in the race for agricultural resources.

There have been a number of recent efforts that recognize "the vulnerability and food insecurity in poor countries that depend on rain-fed production."[14] And others that recognize the importance of rain-fed systems to achieving food security, and advocates investing in such systems.[15] Addressing the climate crisis and its impacts on humanity will involve paying close attention to solutions that increase people's access to water and other resources they need to adapt to a changing climate.

Water Use in Irrigated Agriculture[16]

While irrigated agriculture has long been practiced around the world to a varying extent, its expansion in the 20th century coincided with the introduction of industrial agricultural practices. Substantial amounts of water were fundamental to the success of the new industrial agriculture. The development and use of high-yielding varieties of seeds (HYV seeds) with higher nitrogen absorption capacity contributed to increased demand as water became an even more essential component of industrial agriculture.

The problem is that continuous and exclusive application of chemical fertilizers gradually reduces the water retention capacity of soil, which leads to the increased frequency of irrigation application, raising substantially the water requirements for crop production.[17] The end result is that this type of agriculture greatly reduces agricultural water use efficiency. In contrast, organic farming systems serve to increase soil carbon, improving water infiltration and the water retention capacity of soil (increased storage of rain water), which in the end results in a positive water balance and the reduced need for irrigation.[18]

Industrial Agriculture = Water Crisis

While irrigation can provide some insurance against weather and climate-related uncertainties in agriculture, the massive water transfers and ground water withdrawals used for irrigation as part of industrial farming practices have helped create a water crisis. A Pilot Analysis of Global Ecosystems (PAGE) by World Resources Institute estimated that "dams, diversions or canals fragment almost 60 percent of the world's largest 227 rivers."[19] Freshwater systems around the world are modified for both energy and agriculture production to such an extent that their natural functions in the ecosystem have been greatly affected. Such changes in this natural resource base affect the food security of vulnerable communities, including the poor, women and children, who depend on these ecosystems for their livelihoods. In many cases, such water diversion projects also result in the massive displacement of communities, destruction of cultures and social disruption. The most recent examples of such massive water diversions and associated problems include the Three Gorges Dam in China and the Narmada Valley Project in central India.

Unfortunately, a technofix orientation underlies most efforts to help supply water to otherwise water-stressed areas. In 2004, New Scientist reported that the *tube-well revolution*, a technology adapted from the oil industry, was driving Asian

countries towards an environmental catastrophe.[20] As the more complex technology of deep tube-wells is employed, with its high capacity for water extraction, the shallower hand-dug wells utilized by small farmers are going dry. Withdrawals exceeding natural recharge rates of aquifers are leading to the lowering of water tables, salinization of groundwater and land subsidence in many parts of the world as a result.

Intensive water use, in combination with industrial farming systems, has resulted in widespread soil and water contamination from pesticide and fertilizer runoff, degrading habitats, and greatly affected quality and quantity of water available for other uses. It is one of the biggest causes of water quality deterioration and environmental degradation in North America and Europe. In the United States, about half of the nitrogen reaching the Gulf of Mexico comes from fertilizer; 15 percent comes from animal manure from confined animal feeding operations (CAFOs). Such industrial farming practices have played a huge role in causing hypoxia (a condition in which dissolved oxygen levels are too low to sustain marine organisms) in the Gulf of Mexico.[21] In countries such as Mexico, where about 75 percent of drinking water comes from ground water, agro-chemical contamination is affecting peoples' access to clean water for meeting basic needs.[22]

Women Uniquely Affected

One cannot talk about the food, climate or water crises without addressing the concerns of women and children. Women are the *keepers* of water in varying parts of the world, responsible for collecting water for daily tasks such as cooking and cleaning, and the multiple needs of their families—both in rain-fed and irrigated farming systems.

Climate change related variability in precipitation results in droughts and floods, extreme events that disproportionately affect women. Longer hours spent in search of potable water increases the burden of their work and the risks they face. Lack of potable water also results in water-related diseases, and in increasing women's work burden as health care providers.

Women also have a central role in small-scale food production. The challenges they face as food becomes unavailable or unaffordable creates a heavy burden on women and children who are physiologically vulnerable to nutritional scarcities. Global policymakers acknowledge the role of women and the need to target their inclusion more directly in policies that address water access, quality, control, and stewardship. However, clearly more needs to be done. The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) report calls for strengthening women's land and water rights and empowering women to have a greater voice in water management.[23]

Unfortunately, policymakers regularly ignore the fact that the shift from locally oriented agriculture to export-oriented agriculture has had a significantly negative impact on women.[24] As the fourth assessment report on climate change states, "Gender differences in vulnerability and adaptive capacity reflect wider patterns of structural gender inequality. One lesson that can be drawn from the gender and development literature is that climate interventions that ignore gender concerns reinforce the differential gender dimensions of vulnerability."[25] If effective solutions to climate, water and the food crisis are to be developed, it is critical that the unique social and physical needs of women and children be at the forefront.

Conclusion

Water resources and how they are managed impact almost all aspects of society and the economy, not just our food production system. The reverse is also true: How we manage our economy, our energy production, our food systems and our health needs also affect the way we manage our water. Climate adaptation and mitigation will to a significant degree be mediated through water.

Therefore, when designing mitigation and adaptation strategies, especially for the agricultural sector, climate negotiators should:

- Ensure an assessment of prospective agriculture-based climate change mitigation and adaptation strategies includes not just a carbon balance accounting, but also a water efficiency assessment, a larger ecosystem impact assessment and a wider set of socioeconomic impact assessments.

- Provide support for the implementation of the Right to Food and the Right to Water. These two rights establish legally protected rights that can help all people, including the poor, meet their basic needs. By providing legally recognized access to water for practicing subsistence food production and other livelihood activities, the rural poor (who comprise the majority of the world's poor) can be protected from climate related food and water insecurities.

- Ensure that water availability is prioritized for ecosystem resilience and for basic needs. This includes institutionalized support for farm-based soil moisture and organic matter management in rain-fed areas; rainwater harvesting structures; small-scale water

storage structures; small-scale community-based irrigation; improved irrigation systems; and maintenance of water sources for meeting the needs of grazers and small-holder livestock production.

- Ensure that the voices of small-holder farmers and women are central to policy reform and that their concerns are part of any global, regional and national solutions for food, water and climate security. Some steps could include support for transparent, democratic decision-making processes in which women and other vulnerable groups (small-holder farmers, livestock holders, fisher-folk and farmworkers) can participate; laws to protect their use, access to and control of land and natural resources; required impact assessments of farming practices and new technology on farmworkers and women's health; and programs to guarantee education, science, credit, technology and resources to women producers.

- Institutionalized support for agro-ecological practices as per the recommendations of the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD, 2008).

References

1. Stockholm International Water Institute, Press Information: "The Stockholm Statement from World Water Week to the COP-15", Aug 2009, http://www.worldwaterweek.org/documents/WWW_PDF/Media/PR_Stockholm_Statement_090821.pdf

2. International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD): "Executive Summary of the Synthesis Report," Island Press, Washington DC, 2009 (January, 2009) http://www.agassessment.org/docs/IAASTD_EXEC_SUMMARY_JAN_2008.pdf

3 Intergovernmental Panel on Climate Change (IPCC): "Report by Working Group II: Climate Change Impacts, adaptation and vulnerability," April 2008, http://www.ipcc-wg2.org/

4 Martin Parry, Osvaldo Canziani, Jean Palutikof and Co-authors 2007: Technical Summary. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 23-78, http://www.ipcc-wg2.gov/AR4/website/ts.pdf

5 Intergovernmental Panel on Climate Change (IPCC): "Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change," April 2007, http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf

6 ETC Group News Releases: "No to Dubious Biotech-fixes for Climate Change," July 2009, http://etcgroup.org/en/node/4694; 'US Government's Push for Geoengineering is Unacceptable, February 2007, http://etcgroup.org/en/node/606

7 United Nations Environment Programme: "World Water Day, 22 MARCH 2000," UNEP News Release 00/30, Nairobi, 2000 http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=80&ArticleID=1545&l=en&t=long

8 World Health Organization/ UNICEF, "Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade," Global Water Supply and Sanitation Assessment, 2006 World Health Organization and United Nations Children's Fund 2006, p:6-7 http://who.int/water_sanitation_health/monitoring/jmpfinal.pdf

9 Food and Agricultural Organisation: FAO Media center, "1.02 billion people hungry," Rome, FAO Media Center, June 2009 http://www.fao.org/news/story/en/item/20690/icode/

10 Comprehensive Assessment of Water Management in Agriculture. 2007. Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture. London: Earthscan, and Colombo: International Water Management Institute. http://www.iwmi.cgiar.org/Assessment/files_new/synthesis/Summary_Synthesis-Book.pdf

11 World Bank:"Food Security Focus of Madrid Meeting," WB News and Broadcast, 23 January 2009, (January 2009) http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:22043218~pagePK:64257043~piPK:437376~theSitePK:4607,00.html

12 World bank, World development Indicators, Section 3. Environment, Table 3.1, 2006, http://devdata.worldbank.org/wdi2006/contents/Section3_1.htm

13 Food and Agricultural Organisation (FAO): "Agriculture, food and water", A contribution to the World Water Development Report, 2003. http://www.fao.org/docrep/006/y4683e/y4683e00.htm; http://www.fao.org/docrep/006/y4683e/y4683e06.htm#P10_2399

14 Food and Agricultural Organisation (FAO): "Climate change, water and food security", Synthesis Paper, Expert Meeting held in Rome 26–28 February 2008, in preparation for the FAO High Level Conference (HLC) on World Food Security and the Challenges of Climate Change and Bioenergy in June 2008, ftp://ftp.fao.org/docrep/fao/meeting/013/ai783e.pdf

15 Comprehensive Assessment of Water Management in Agriculture. 2007. Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture. London: Earthscan, and Colombo: International Water Management Institute. http://www.iwmi.cgiar.org/Assessment/files_new/synthesis/Summary_Synthesis-Book.pdf p.3

16 Comprehensive Assessment of Water Management in Agriculture (CA) 2007: "Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture," London: Earthscan; Colombo: International Water Management Institute http://www.iwmi.cgiar.org/Assessment/files_new/synthesis/Summary_Synthesis-Book.pdf

17 S. Sarkar, S.R Singh and R.P Singh, "The effect of organic and inorganic fertilizers on soil physical condition and the productivity of a rice–lentil cropping sequence in India," The Journal of Agricultural Science (2003),140:4:419-425, Cambridge University Press

18 Building Soil organic Matter at http://agwaterstewards.org/txp/Resource-Center-Articles/31/Building_Soil_Organic_Matter; S.M. Shaaban, "Effect of Organic and Inorganic Nitrogen Fertilizer on Wheat Plant under Water Regime", Journal of Applied Sciences Research, 2(10): 650-656, 2006, © 2006, INSInet Publication, http://www.insinet.net/jasr/2006/650-656.pdf

19 World Resources Institute: "New WRI report reveals world's freshwater systems in peril," WRI News Release, October 2000, http://archive.wri.org/news.cfm?id=1&z=?

20 New Scientist, "Asia Faces Water Catastrophe," Aug 26 2004, http://www.lk.iwmi.org/Press/coverage/pdf/discovery.pdf

21 Institute for Agriculture and Trade Policy, Hypoxia in the Gulf of Mexico, a growing problem, IATP, 2002 http://www.iatp.org/iatp/publications.cfm?accountID=421&refID=36133

22 Perry L. McCarty, The Insidious Nature of Groundwater Contamination –The Great Need for Protection, Department of Civil and Environmental Engineering, Stanford University, Powerpoint presentation available at: http://www.bgr.bund.de/nn_324952/EN/Themen/Wasser/Veranstaltungen/symp__sanitat-gwprotect/present__mccarty__pdf,templateId=raw,property=publicationFile.pdf/present_mccarty_pdf.pdf

23 International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD): "Executive Summary of the Synthesis Report," Island Press, Washington DC, 2009 http://www.agassessment.org/docs/IAASTD_EXEC_SUMMARY_JAN_2008.pdf

24 Shiney Varghese, "Water Crisis and Food Sovereignty from a Gender Perspective", Institute for Agriculture and Trade Policy, January 2007 http://www.tradeobservatory.org/library.cfm?refid=97668

25 W. Neil Adger, Shardul Agrawala, M. Monirul Qader Mirza, Cecilia Conde, Karen O'Brien, Juan Pulhin, Roger Pulwarty, Barry Smit, Kiyoshi Takahashi, 2007: "Gender aspects of vulnerability and adaptive capacity", Box 17.5. Assessment of adaptation practices, options, constraints and capacity. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 717-743, http://www.ipcc-wg2.gov/AR4/website/17.pdf