

Theme 5: The Global and National Food and Water System

2005 Synthesis:

Goals, targets, opportunities, expected outcomes and research methodologies

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1. Introduction to the Theme on Global and National Food and Water Systems

This synthesis document lays out activities to date [October 2005] related to the four key research areas of Theme 5. It needs to be considered work-in-progress as research projects have operated for just one year [2 projects], have just started [3 projects], or are yet to receive funding [1 project].

The following sections introduce the goals and research areas of Theme 5, provide an overview of research implementation through dedicated projects operating in the various CPWF basins, and gap-filling synthesis research activities; introduce the conceptual frameworks and research approaches developed for the various projects, which is the chief major developments for most CPWF Theme 5 projects; describes first research insights; and develops a series of conclusions.

Due to space limitation, no attempt has been made to link this research theme with other global and national research efforts in the water and food areas. However, many recent conferences, such as the World Water Forum, several recently completed and ongoing international assessments related to water and food, and generally, growing integration of food and water markets, increasing awareness regarding the uncertainty of future climates, combined with little progress in reducing developing-country malnutrition levels keep attention focused on the Global and National Food and Water System.

2. Goals and Research Areas

The goal of Theme 5 is to support policymaking both within and outside the water sector to enhance food security and human health, to promote the production of more food with less water, to help alleviate poverty, and to protect ecosystems. Research relates to the links between policies normally seen as lying outside the water sector, such as those on trade and macroeconomic issues, and policies specific to the sector, such as those on water rights, prices, and investment. Research also aims at evaluating policy-related strategies for adapting to change, mitigating its negative effects, and enhancing pro-poor agricultural growth.

Theme 5 is being advanced in four distinct key research areas, which were developed in consultation with the Theme 5 advisory committee, CPWF program development workshops, and are based on a background paper/literature review:

- 1) Harnessing Globalization, Trade, Macroeconomic, and Sectoral Policies to achieve water and food security;
- 2) Incentives, Investment and Financing of Agricultural Water Development and Water Supply;
- 3) Transboundary Water Policy and Institutions; and
- 4) Adapting to Changes in the Global Water Cycle.

For details, see Box 1.

Box 1: Research Areas and Topics, Global and National Food and Water System

(1) Globalization, Trade, Macroeconomic, and Sectoral Policies

- Ensuring rights to water for the poor in the process of global change
- Globalization for improved WUE, environmental policy, WQ & water-related ecosystems
- Role of virtual water for water & food security
- Role of economic incentives in responding to increased trade & liberalization

(2) Incentives, Inv. & Financing of Agricultural Water Development and Water Supply

- distributional and poverty consequences of alternative cost recovery policies
- pricing/use rights/institutions for cost recovery, and efficient water use
- role public and private water investment
- optimal allocation of water and other investments enhancing livelihoods
- optimal investment allocation within agriculture
- future role/investment for dams

(3) Transboundary Water Policy and Institutions

- Role of alternative institutions in conflict prevention and transboundary negotiations
- Potential for market-oriented approaches in transboundary water sharing
- Means for integration of agriculture, rural livelihoods & food security into transboundary river basin agreements
- Means for integration of social concerns into transboundary river basin agreements

(4) Adapting to Changes in the Global Water Cycle

- Impact of global/national structural changes on global water cycle
- Impact of changes in global water cycle on ecosystem services and human well-being
- Prevention and mitigation of adverse human impacts on global water cycles
- Prevention and mitigation of global change on water and food security and the poor

3. Research Implementation

Research is implemented through inter-disciplinary, single or two-basin projects spanning several CPWF research themes.

CPWF Theme 5 and Related Research Projects

No	Title	Main Research Theme	Main Research Area
PN 47	Transboundary water governance for agricultural and economic growth and improved livelihoods in the Limpopo and Volta Basins: Towards African indigenous models of governance	Themes 4 & 5	Transboundary water policies and institutions
PN 48	Strategic Analysis of India's Proposal to Link 37 Himalayan and Peninsular Rivers	Theme 5	Incentives, Investment and Financing of Agricultural Water Development and Water Supply
PN 50	Enhancing land and water governance in the Mekong Basin — promoting meaningful stakeholder participation and making better use of research-based knowledge in development dialogues	Themes 4 & 5	Transboundary water policies and institutions & Incentives, Investment and Financing of Agricultural Water Development and Water Supply
Assoc. PN 53	Food and Water Security under Global Change: Developing Adaptive Capacity with a Focus on Rural Africa	Theme 5	Adapting to Changes in the Global Water Cycle
PN 20	<i>Sustaining inclusive Collective Action that Links across Economic and Ecological Scales in upper watersheds (SCALES)</i>	Theme 2	<i>Incentives, Investment and Financing of Agricultural Water Development and Water Supply</i>
PN 42	<i>Groundwater Governance in the Ganga-Meghna-Brahmaputra and Yellow River Basins</i>	Theme 4	<i>Transboundary water policies and institutions</i>

These projects relate directly to Theme 5 research themes and specific basins (Table 1), as well as to other CPWF Themes (see Table 2). For example, relations with Theme 1 on Crop Water Productivity Improvement exist through research on investment options for agricultural science, technology, and development, and through analyzing crop-level climate change adaptation options; with Theme 2 on Water and People in Catchments through economic incentives affecting water poverty, for example, but also through payments for environmental. Relations to Theme 3 exist through research on alternative investment options for preserving instream flows versus irrigation development, for example, or through trade policies facilitating global fisheries trade, thus raising demand for aquaculture development. Theme 5 interacts with Theme 4 through basin-level water allocation mechanisms and investments [PN 48] and transboundary basin sharing mechanisms [PN 47/PN50/PN42].

Table 1: Matrix of Basins and Research Areas of Theme 5

Target Basins	Andes	Indo-Gangetic Basin	Limpopo	Mekong	Nile	Volta	Yellow
Theme 5 Priority Areas							
Globalization, Trade, Macroeconomic, and Sectoral Policies				(PN 50)			

Incentives, Investment and Financing of Agricultural Water Development and Water Supply	(PN 20)	PN 48		(PN 50)	(PN 20)		
Transboundary Water Policy and Institutions	PN 20	PN 42	PN 47	PN 50	PN 20	PN 47	PN 42
Adapting to Changes in the Global Water Cycle			PN53		PN53		

Table 2: Linkages to Other CPWF Themes

Other Themes	Theme 1	Theme 2	Theme 3	Theme 4
Theme 5 Priority Areas				
Globalization, Trade, Macroeconomic, and Sectoral Policies		Water poverty (through water rights work)	Global fisheries trade; Environment & Ecosystem Consequences	
Incentives, Investment and Financing of Agricultural Water Development and Water Supply	Investment options for agricultural science and technology; Incentives for water conservation	Payment for Environmental Services	Incentives for environmental flows	Basin-level management incentives
Transboundary Water Policy and Institutions				Transboundary (groundwater) policies
Adapting to Changes in the Global Water Cycle	Impact of CC on crops			

In addition, synthesis research focusing on global-scale issues and research gaps is being implemented chiefly through synthesis papers and workshops (see Table 3).

Table 3: Gap Filling Synthesis Activities, Theme 5 Core Team / Collaborators/ Consultants

Research Area	Gap Filling Synthesis Activity
Globalization, Trade, Macroeconomic, and Sectoral Policies	<p>Workshop and Book titled: “Globalization and Trade: Implications for Water and Food Security” [G1]</p> <ol style="list-style-type: none"> 1) Globalization and Water Management: An Overview - Asit Biswas 2) Water and Trade, Implications for Investment, a Legal Perspective - Howard Mann 3) Implications on Water and Food from the End of the Multi-Fiber Agreement (MFA) - Claudia Ringler 4) The Role of Public versus Private Service Provision of Water in the Context of Globalization - Esteban Castro 5) Globalization and its Impact on Fisheries - Roehlano Briones 6) Global Water and Food Security: Megatrends and Emerging Issues - Mark Rosegrant 7) Implications of Globalization and Trade on Water Quality in Transboundary Rivers - Hilary Sigman 8) Bilateral and Multilateral Agreements and Implications for Water Quality and Ecosystem Services - José Joaquín Campos 9) Importance of macro-micro links for ensuring water and food security in rural livelihoods strategies in Central America - Dietmar Stoian 10) New Opportunities and Challenges for Financing Water Supply and Irrigation Development - Jim Winpenny 11) How May International Agreements for the Protection of Trade and Investment Affect

	<p>Water, Water Law, and Water Utilities Regulation - Miguel Solanes</p> <p>12) Mobilizing investment for Water Infrastructure – Suzanne Gallagher O’Neal</p> <p>13) Can Trade Save Water? The Impact of Virtual Water Trade on Global Water Use - Charlotte DeFraiture</p> <p>14) Impact of Global Climate Change on the Water Cycle: Implications for Water and Food Security - Anil Kumar Singh</p> <p>15) Adaptive Capacity to Changes in the Water Cycle: A Case Study of Northern China - Shiming Ma</p> <p>16) Failure of the Virtual Water Argument: possible explanations using the case study of Mexico and NAFTA - Jorge Ramirez-Vallejo</p>
Incentives, Inv. & Financing of Agricultural Water Developm. and Water Supply	<p>Workshop and Book titled: “Water Rights Reform: Lessons for Institutional Design” [in press] [G2]</p> <p>1) Frameworks for Water Rights: An Overview of Institutional Options, Bryan Randolph Bruns and Ruth Meinzen-Dick</p> <p>2) Getting the Relationships Right in Water Property Rights, Edella Schlager</p> <p>3) Constructing New Institutions for Sharing Water, Charles L. Abernethy</p> <p>4) Lessons from Implementing Water Rights in Mexico, Héctor Garduño</p> <p>5) Impacts of Water Rights Reform in Australia, Brian Haisman</p> <p>6) Water Rights Reform in South Africa, Ashwin R. Seetal and Gavin Quibell</p> <p>7) Prior Appropriation and Water Rights Reform in the Western United States, Douglas S. Kenney</p> <p>8) Improving Water Allocation for User Communities and Platforms in the Andes, Rutgerd Boelens, Axel Dourojeanni, and Paul Hoogendam</p> <p>9) Analysis of Spanish Water Law Reform, Alberto Garrido</p> <p>10) Development of Water Rights in Indonesia, Suharto Sarwan, Tjoek Walujo Subijanto, and Charles Rodgers</p> <p>11) Institutional Design Considerations for Water Rights Development in China, Bin Liu</p> <p>12) Reforming Water Rights: Governance, Tenure, and Transfers, Bryan Randolph Bruns, Claudia Ringler, and Ruth Meinzen-Dick</p>
Incentives, Inv. & Financing of Agricultural Water Developm. and Water Supply	<p>Review and Synthesis of Water Quality Policies in Developing Countries. (Sarah A. Cline, Helene Heyd, Claudia Ringler and Jing Liu) [G3]</p>
Adapting to Changes in the Global Water Cycle	<p>A Global Perspective on Climate Change Impacts on Developing-Country Agriculture: Towards a Synthesis and Research Agenda for the Challenge Program on Water and Food. Draft for Discussion (Siwa Msangi, Tim Sulser, Claudia Ringler, and Mark W. Rosegrant) [G4]</p>

4. Conceptual Frameworks, Research Approaches, and Methodologies

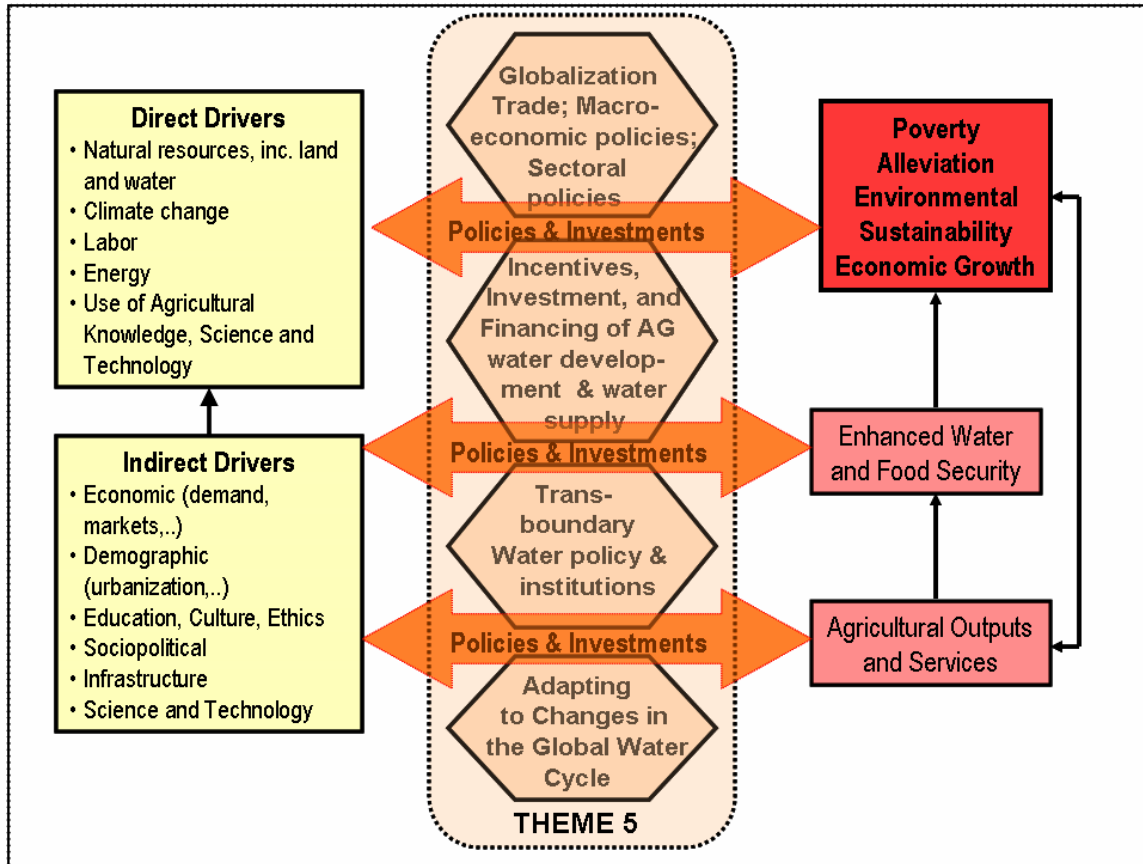
The Global and National Food and Water System theme attempts to impact the nexus of drivers and development goals through changing policies, institutions, and affecting investments in the four research areas described earlier in the document (Figure 1). Theme 5 does so in integration with the other research themes of the CPWF (see Table 2).

The conceptual frameworks for projects under this theme fit in the overall Theme 5 framework. They are shown in Annex 2.¹ Even though these conceptual frameworks differ significantly from one another, and from Figure 1, two sets of basic approaches can be distinguished: Scenario analysis, on the one hand, and stakeholder participatory research and institutional analysis, on the other hand. Moreover, projects differ in scale, from individual farm households and communities [PN20, PN42] to the watershed or basin level

¹ Two of these frameworks were drawn by the Theme 5 core team and might be amended later by project teams.

[PN20, PN53] to the national level [PN48], to the transboundary [PN42, PN47, PN50], and global levels [PN53].

Figure 1: Conceptual Framework of Theme 5 (Draft)



(1) Scenario Analysis

Given the complexities and inherent uncertainties of the Global and National Food and Water System, a conceptual framework of drivers, agricultural outputs and services, and development goals, examined via scenario analysis, as used in PN48 and PN53, is an important and appropriate research approach used in Theme 5. PN48 analyzes the impact of one of the largest water investment projects [US\$120 billion] ever conceived, India's National River Linking Project, affecting the livelihoods and food security of 1 billion people in India, with global impacts on food markets, and the global balance of irrigated and rainfed areas. PN53 uses scenario analysis to identify options for adaptation of rural areas to increasing climate variability and climate change. Research approaches include econometric analyses, for example, for water productivity in PN48 and the development of crop-level production functions [PN53]; but the focus is on simulations of various drivers affecting water and food security, such as population and economic growth [PN48], or climate variability and climate change [PN53]. In addition, workshops with policymakers and stakeholder forums form important methodological components of these projects to ensure both stakeholder input and policy relevance of results.

(2) Stakeholder Participatory Research and (3) Institutional Analysis

PN47, PN50, PN42, and PN20 use a bottom-up, participatory research-type approach. Building on frameworks for Democratizing Water Governance [PN50], for Groundwater Governance [PN42], for the Inclusion of Indigenous Principles [PN47]; and for Multi-scale Interactions in Watersheds, these projects focus on policies and institutions that enhance access to (natural) resources for the poor at different scales: tubewells / groundwater sources [PN42]; (micro-)watersheds [PN20]; and transboundary scale [PN47/PN50]. Research approaches include farmer interviews, analyses of the interaction of biophysical, socioeconomic, and hydrologic factors affecting water poverty [PN20], country-, basin- or community-level case studies [PN47, PN50]; water sector case studies [PN50]; capacity building through strong training components [PN42]; and action research [PN47, PN50, PN20].

5. First Set out Outcomes By Key Research Area

5.1. Globalization, trade and macroeconomic and sectoral policies

This key research area focuses on developing conceptual frameworks for assessing the impact of globalization, trade, macroeconomic, and sectoral policies on water and food security; and on providing insights on the impacts of globalization, trade and macro- and sectoral- policies with the objective of enhanced water and food security; and more effective design of national-level water and agricultural policies.

In 2005, a Theme-level organized workshop titled “Globalization and Trade: Implications for Water and Food Security” took place at the headquarters of the Tropical Agricultural Research and Higher Education Center (CATIE) in Turrialba, Costa Rica. The workshop aimed to identify research gaps, opportunities for collaboration among disciplines, and avenues for policy reform. Participants presented research covering a wide variety of topics and disciplines. In addition to discussing the legal aspects of trade and investments in the water sector, presenters examined the impact of globalization on water pollution and fisheries that cross national boundaries. Research presented on virtual water trade—the water needed to produce a traded product—concluded that trade can save irrigation water. Countries reduce water use when they import food from exporting countries that use water more efficiently to grow exported food (or use rainwater to grow that food). But water use would be only 6 percent higher without virtual water trade. About 20 percent of total cereal trade is thought to be water-related. Researchers also showed that in the future rainfed production, particularly in Sub-Saharan Africa, can be expected to fail more often than it has in the recent past, a reflection of climate variability and change. Climate change will increase demand for water-controlled, i.e. irrigated, agriculture and may prompt a new review of, and more emphasis on, the roles of both small and large dams for food security. The April workshop was organized by IFPRI; the Third World Centre for Water Management, Mexico; and CATIE, and was funded by the CGIAR Challenge Program on Water and Food. Workshop presentations and paper abstracts can be viewed online at <http://theme5.waterforfood.org/events/20050418CR.asp>. For additional details on discussions, see annex 3.

5.2. Agricultural and urban water supplies—incentives, investment and financing

This key research area focuses on strategies for providing incentives, and directing investments and financing for water in agriculture, and on the implications of alternative incentives and investments on water supply, as it relates to water availability for food production. Its main goal is for national governments, the private sector, and international development agencies, and endusers to develop water resources more sustainably and for the benefit of the poor.

In 2005, PN20 examined the potential of payment for environmental services schemes to contribute to maintaining urban water supplies and to improving livelihoods in upper catchments. Moreover, this

project analyzed linkages between water and poverty. Preliminary results show that both direct and indirect relationships between water and poverty matter. Some rural households experience problems with domestic water quantity or quality due to actions of other upstream users. At the same time, upstream users are important employment and income sources for downstream households. Corrective actions regarding land and water management practices—if they reduce employment—could exacerbate poverty. More creative options are required to achieve win-win situation, and some tradeoffs may be required.

Moreover, PN50 started to identify breakthroughs in policies and institutional options, showing the best approaches for managing water and related natural resources—at the field, basin and national/global levels. PN48, finally, started with a series of papers that will culminate in alternative scenarios for Indian water development.

At the Theme 5 overall level, a water rights book manuscript went into publication. Its main conclusions are that water rights can be useful tools for protecting availability of water for basic needs, securing irrigation deliveries, increasing urban water supplies, and enhancing environmental flows. The water rights reforms reviewed in this book show some common patterns in performance problems that induce institutional change, initiative by government, increases in stakeholder consultation, concern with transferability of water rights, and continuing challenges in implementing new policies and responding to environmental needs. As a whole, reform experience suggests that institutional design should pay much more attention to the time dimension of water rights reforms. A phased approach offers a practical pathway to making reforms more effective in 1) redesigning water governance, 2) resolving water tenure, and 3) regulating transfers of water rights. To help guide future reform efforts, research priorities include improving understanding of existing forms of rights to water, analyzing critical factors for institutional design, advance testing of alternative rules, and empirical assessment of institutional alternatives.

5.3. Transboundary water policies and institutions

This sub-theme or research area focuses on the development of mechanisms by which transboundary waters are shared, including institutions, allocation mechanisms, and processes for conflict prevention and resolution, with the goal of further developing and enhancing water and food security. Another research focus is for research on how transboundary institutions and organizations can take account of the voice of indigenous, vulnerable populations, and incorporate food and water security concerns in negotiations, and help ensure that the poor are not disadvantaged in situations of overlapping institutions (PN47).

PN20 has started to assess equity and access issues for the poor in Andean and Kenyan context, looking at both the evolving legal contexts of each country (both are formulating water laws) and more local forums in which water access and rights are negotiated.

According to PN47, which is taking an in-depth look at African transboundary water management, in order to ‘enhance transboundary water governance,’ it is necessary to identify and assess historical and current transboundary water governance issues. These issues can be identified based on hydro-political basin profiles that present issues and significant events involving the use and control of water within water management institutional histories from pre-colonial times through present day. ... Transboundary water governance institutions capable of responding to needs and conditions in sub-Saharan Africa must incorporate local traditions and social arrangements for water management.

5.4. Adapting to changes in the global water cycle

The focus of the adapting to global change research area is to assist in the development institutions, policies, and investment strategies that help build adaptive capacity in those CPWF basins most impacted by global change. PN53 has started to implement household level surveys that examine household-level

responses to extreme weather events in Ethiopia and South Africa. Moreover, the development of closer linkages with Global Change Networks, such as GECAFS, IAASTD, and the Millennium Ecosystem Assessment has helped raise the profile of agriculture in the global change research arena.

5.5. *Other IPGs*

- PN 20 has developed a data collection methodology for assessing local poverty dynamics with a focus on water and collective action
- PN47 created and made public a data base of African water laws, www.africanwaterlaws.com. The largest known database of its kind.

6. **Scaling Up and Out**

Unlike other research themes, and as its name implies, research under the Global and National Food and Water System theme focuses at the national, regional, and global levels. Despite this, activities in PNs 20, 42, 47, and 50 include local or watershed-level case studies. These case studies are set up so that generalizable research results can be obtained. In some instances, such as PN53, scaling down, and—more importantly—linking down to local, sub-basin, and basin-level processes and research needs to increase in importance.

7. **Partnerships/Communities of Practice**

Many new partnerships are developing within ongoing research projects (see Table 4). Research partnerships span several types of organizations [for example, ranging from NGOs to NARES, and ARIs]. Moreover, as several of the projects cover several basins, research experience is exchanged among different CPWF [and sometimes non-CPWF] basins. In addition, projects that focus on transboundary basin management, for example, PN47 and PN50, also help strengthen international relations in these basins. Finally, research projects usually include several disciplines, and combine more than one CPWF research area, which allows to develop innovative research insights and a more comprehensive analysis of the interlinkages between water, food, the environment, and the development goals.

Table 4: Partnerships in Theme 5 and Related Research Projects

Research organization	No in Theme 5 & related projects	Roles	Comparative advantage in terms of expertise and cost effectiveness
CGIAR Center	4	Project leader, conceptual framework development	With research experience in many developing-countries, easier to draw policy conclusions, develop IPG
NARES	28	Data collection	Better connected to local research challenges and with policymakers
Advanced Research Institutes	5	Research methodology, Phd Degrees	International
NGOs	9	Capacity Building	Better connected with the rural poor.

In addition to project-level partnerships, Theme 5 has been increasingly interlinked with other global water and food related research areas, including IHDP and two of its projects [GECAFS and GWSP], and the GLOWA Volta project. Theme 5 also is engaged with a series of international assessments, including the Comprehensive Assessment of Water Management in Agriculture; the Millennium Ecosystem

Assessment; the International Assessment of Agricultural Science and Technology for Development (IAASTD); and the UNEP GEO-4 Assessment;

8. Capacity Building

Capacity building is an important activity for most Theme 5 and related projects. However, at this point, no inventory of capacity building activities ongoing is available. Table 5 therefore just includes a preliminary list.

Table 5: Capacity building

	Training of BA students	Training of MA/MSc students	PhD students	Training activities
PN 47		Several MS students	Several PhD students	Student research methods training course [18 students (masters and Ph.D. levels) and five supervisors from NARES and other institutions were trained]
PN 50				
PN 48				
PN 53			5 PhD students	Vulnerability analysis, scenario analysis, production functions [2 are financed outside PN, but work on PN topics]
PN 20	About 100 BA students [no degree]	1 MS student	1 PhD students	Data Collection Methodology – NGOs, NARES, postdocs
PN 42				80 functionaries from government, civil society, media and academia in an inter-disciplinary program of training and policy research in groundwater governance

9. Conclusions and Outlook

This synthesis report has shown that the six research projects that relate to the Global and National Food and Water System Theme together with the gap-filling Theme-level research advance the overall development goals of poverty alleviation, economic growth, and environmental sustainability through analyses of the impacts of various policy reforms, institutional change, and alternative investments on food and water outcomes, at different scales, but generally focusing on the basin/national/regional/global levels.

Regarding the four broad research areas covered in Theme 5, the role of transboundary policies and institutions is relatively well covered—with the one caveat that by focusing on local constituents and networks, and thus not on directly affecting change at the [transboundary] basin committee level—long-term impact of outcomes focusing on enhanced transboundary institutions will be a challenge. In other projects, such as PN20, change can only be affected through a range of local-level institutions. A comparison of projects working at the transboundary and watershed levels has also opened the question of ‘what constitutes transboundary’? The traditional definition of equating transboundary with international has to be broadened when introducing indigenous voices or remote communities into basin or watershed interactions. Additional research insights on the potential for market-oriented approaches in transboundary water sharing is still needed.

The other research areas of Theme 5 are less well covered, but, importantly, some advances are being made in all areas, particularly through PN48 and PN53.

Research projects at this point are still mostly in their inception phase. Most of the projects have established the methodologies that they will use to address the questions they pose and are completing preliminary background research (literature reviews and concept papers). Major results are not expected before mid-2006. Despite this, several papers have already been produced and/or published [Annex 1].

Annex 1a: Selected Papers and Publications Published under Theme 5

[i.e. including core or co-funding from CPWF]

Globalization, trade and macroeconomic and sectoral policies:

- Sixteen presentations on the topic: Globalization and Trade: Implications for Water and Food Security (<http://theme5.waterforfood.org/events/20050418CRpres.asp>)
- Ringler, C., S.A. Cline, and M.W. Rosegrant. 2004. Water Supply and Food Security: Alternative Scenarios for the Indian Indo-Gangetic River Basin Seminar on “Integrated Water Resource Management for Livelihood Improvement in the Indo-Gangetic River Basin”, under the Challenge Program on Water and Food, Sunday, August 15th, 2004, Stockholm Water Week (will be submitted to JRBM, late 2005).

Agricultural and urban water supplies—incentives, investment and financing:

- Review and Synthesis of Water Quality Policies in Developing Countries. (Sarah A. Cline, Helene Heyd, Claudia Ringler and Jing Liu)
- Bruns, B., C. Ringler, and R. Meinzen-Dick, eds. 2005. Water Rights Reform: Lessons for Institutional Design. In Press.

Transboundary water policies and institutions

Papers presented at African Water Laws workshop (AWIRU, UZIM):

- Malzbender, Daniel, Jaqui Goldin, Anthony Turton, and Anton Earle. Traditional water governance and South Africa’s National Water Act – tension or cooperation.
- Manzungu, Emmanuel, and Rose Machiridza. Economic-legal ideology and water management in Zimbabwe: implications for smallholder agriculture.
- Legal pluralism and rural water management: objectives, definitions and issues (Barbara van Koppen, Ibrahim Juma, and John Butterworth)
- Understanding Legal Pluralism in Water Rights: Lessons from Africa and Asia (Ruth Meinzen-Dick and Leticia Nkonya)
- Preparation of draft Hydro-Political Assessments of Water Governance in the Volta and Limpopo Basins
- African water treaty web-site launched: www.africanwaterlaw.org
- Generic water treaty created and distributed to partners for feedback (Africa)
- Lautze, Jonathan and Mark Giordano. Forthcoming. Does 'equity' really matter in international water law? Evidence from Africa. *Colorado Journal of International Environmental Law and Policy*. [PN 47]
- Swallow, B., N. Johnson, R. Meinzen-Dick, and A. Knox. 2005. The challenges of inclusive cross-scale collective action in watersheds. Submitted to *Agriculture, Ecosystems and the Environment* [as part of a special issue; also CAPRI working paper] [PN20]

- Shah, T., 2004. Groundwater and Human Development: Challenges and Opportunities in Livelihoods and Environment. Presentation, made at the 2004 Stockholm World Water Week. *Water Science and Technology* (Forthcoming). [PN42]
- Lebel, L. P. Garden, and M. Imamura. 2005. The Politics of Scale, Position, and Place in the Governance of Water Resources in the Mekong Region. *Ecology and Society* 10(2): 18. <http://www.ecologyandsociety.org/vol10/iss2/art18/>

Adapting to changes in the global water cycle:

- A Global Perspective on Climate Change Impacts on Developing-Country Agriculture: Towards a Synthesis and Research Agenda for the Challenge Program on Water and Food. Draft for Discussion (Siwa Msangi, Tim Sulser, Claudia Ringler, and Mark W. Rosegrant)

Basin Indicators

- Heidecke, C. 2005. Development and Evaluation of a Regional Water Poverty Index for Benin. Submitted as EPTD Discussion Paper.
- Sullivan, C., C. Vörösmarty, S. Bunn, S. Cline, C. Heidecke, A. Storygard, A. Proussevitch, E. Douglas, D. Bossio, D. Günther, A. M. Giacomello, and D. O'Reganl. 2005. Mapping the Links between Water, Poverty and Food Security. Summary Report on the Water Indicators workshop held at the Center for Ecology and Hydrology, Wallingford, 16th to 19th May, 2005. Mimeo.

In progress (selected)

- “Globalization and Trade: Implications for Water and Food Security” Editors: Claudia Ringler, Asit Biswas, and Sarah A. Cline
- Synthesis Book, working title “Impact of Global Change at Basin Level”
- Ethiopia Study: “Policies to Reduce Vulnerability to Climate Variability and Change”
- Comprehensive Assessment on Water Management in Agriculture: Contribution to “Irrigation Chapter” and Co-authorship [Ruth Meinzen-Dick] in Policies and Institutions chapter

Annex 1a: Selected Papers and Publications Related to Theme 5

Globalization, trade and macroeconomic and sectoral policies:

- Ringler, C., M. Rosegrant, X. Cai, and S. Cline. Auswirkungen der zunehmenden Wasserverknappung auf die globale und regionale Nahrungsmittelproduktion. *Zeitschrift für angewandte Umweltforschung (ZAU) (Journal for Environmental Research)*. Jg. 15/16 (2003/2004), H. 3-5, pp. 604-619.

Agricultural and urban water supplies—incentives, investment and financing:

- Barker, R. C. Ringler, N.M. Tien, and M.W. Rosegrant. Macro Policies and Investment Priorities for Irrigated Agriculture in Vietnam. Comprehensive Assessment Research Report No. 6. Sri Lanka: IWMI.
- Ringler, C., and N.V. Huy. 2004. Water Allocation Policies for the Dong Nai River Basin in Vietnam: An Integrated Perspective. Environment and Production Technology Discussion Paper No.127. Washington, D.C.:IFPRI <<http://www.ifpri.org/divs/eptd/dp/papers/eptdp127.pdf>>
- Cline, S., M.W. Rosegrant and C. Ringler. 2005. The Role of Water Rights and Market Approaches to Water Quality Management in the Americas. In *Water Quality Management*, Asit K. Biswas, Cecilia Tortajada, Benedito Braga and Diego J. Rodriguez (eds.) Springer-Verlag.
- Svendsen, M., C. Ringler, and N., Duy Son. 2005. Water Resource Management in the Dong Nai Basin: Current Allocation Processes and Perspectives for the Future. In *Irrigation and River Basin Management: Options for Governance and Institutions*, ed. Mark Svendsen. Wallingford: CAB International.

Transboundary water policies and institutions

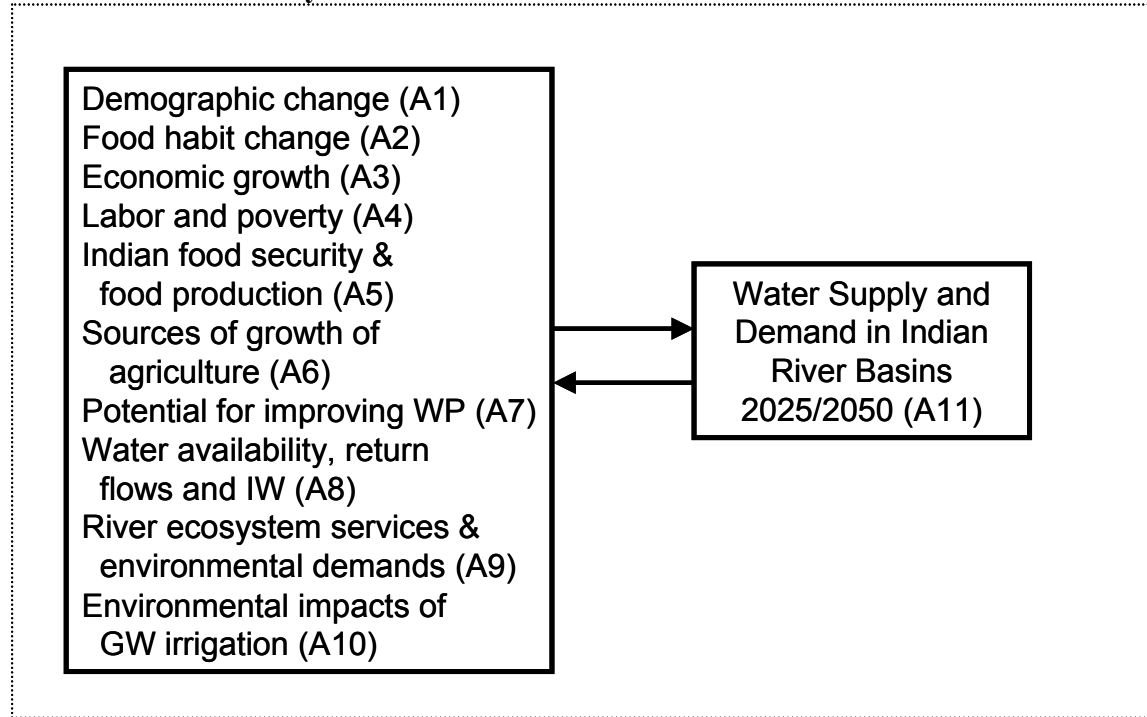
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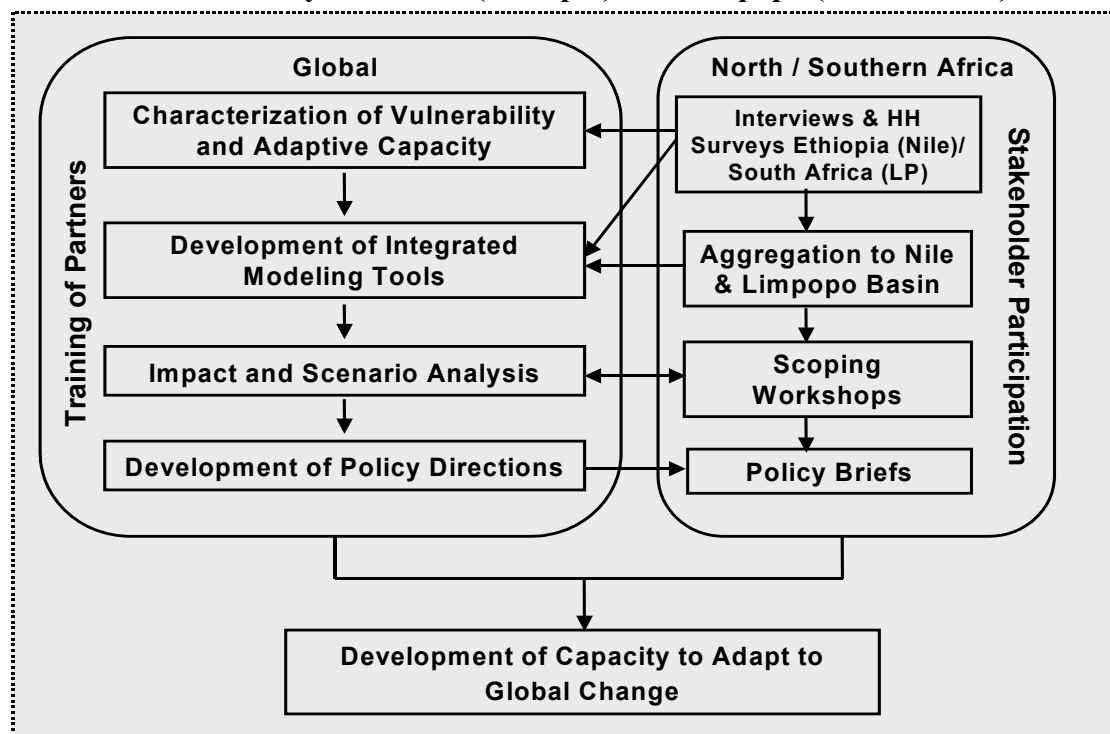
Annex 2. Conceptual Frameworks of Theme 5 and Related Projects

PN 48: Scenario Analysis for Indian River Basins to 2025/2050

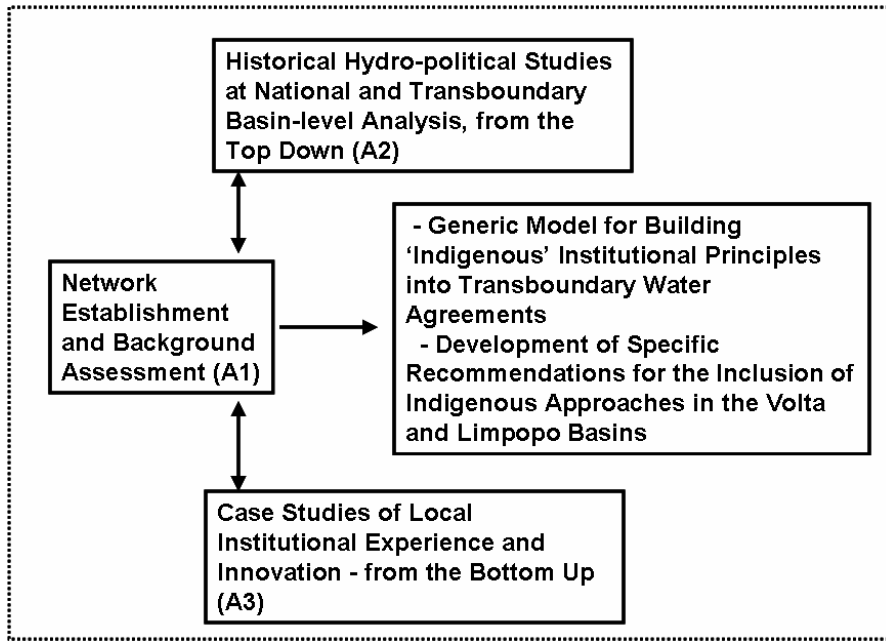


Note: Developed by Theme 5 leader [needs to be vetted through project 48 team]

PN 53: Scenario Analysis for Nile (Ethiopia) and Limpopo (South Africa) to 2025/2050

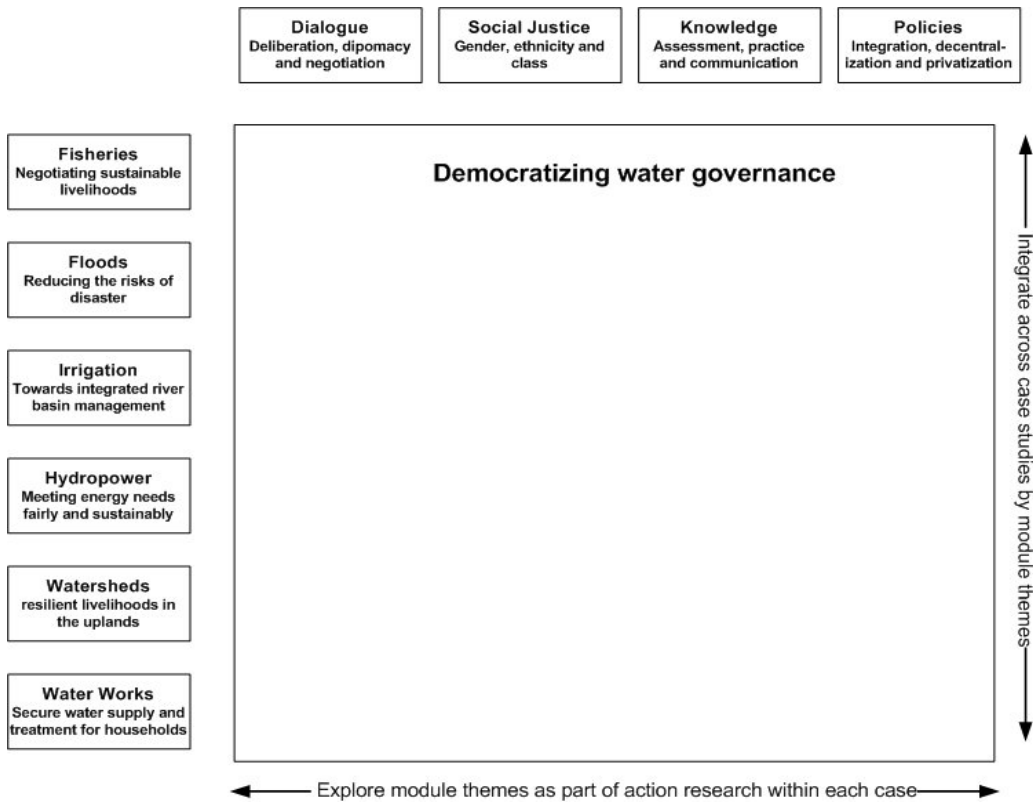


PN 47: Framework for the Inclusion of Indigenous Principles: Participatory Research

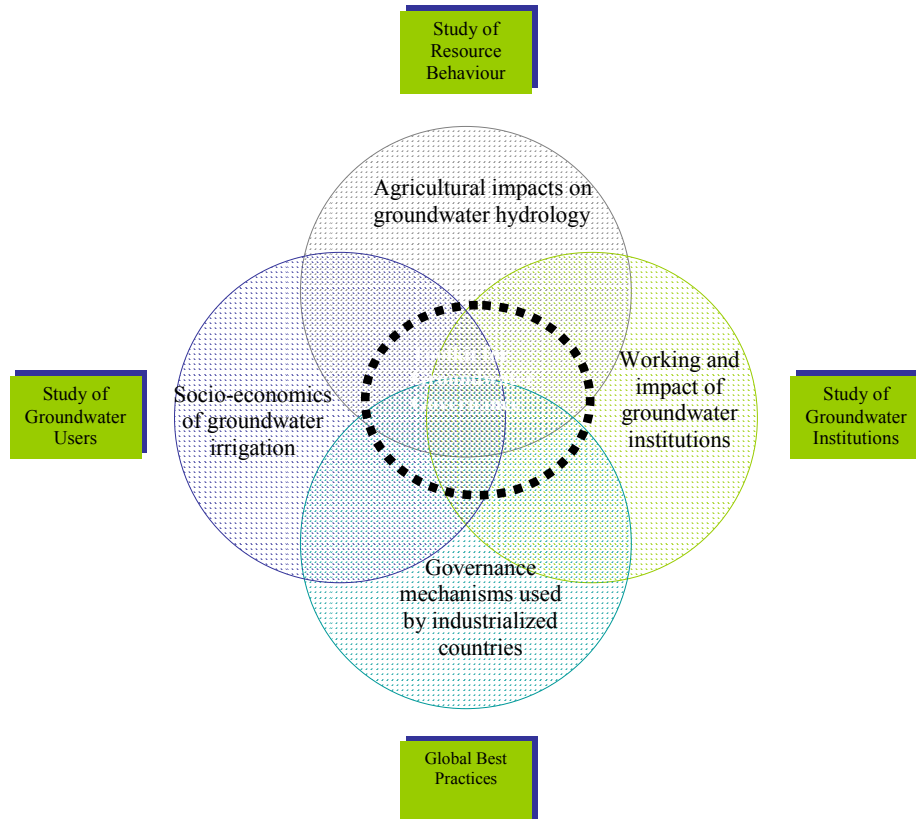


Note: Developed by Theme 5 leader [needs to be vetted through project 47 team]

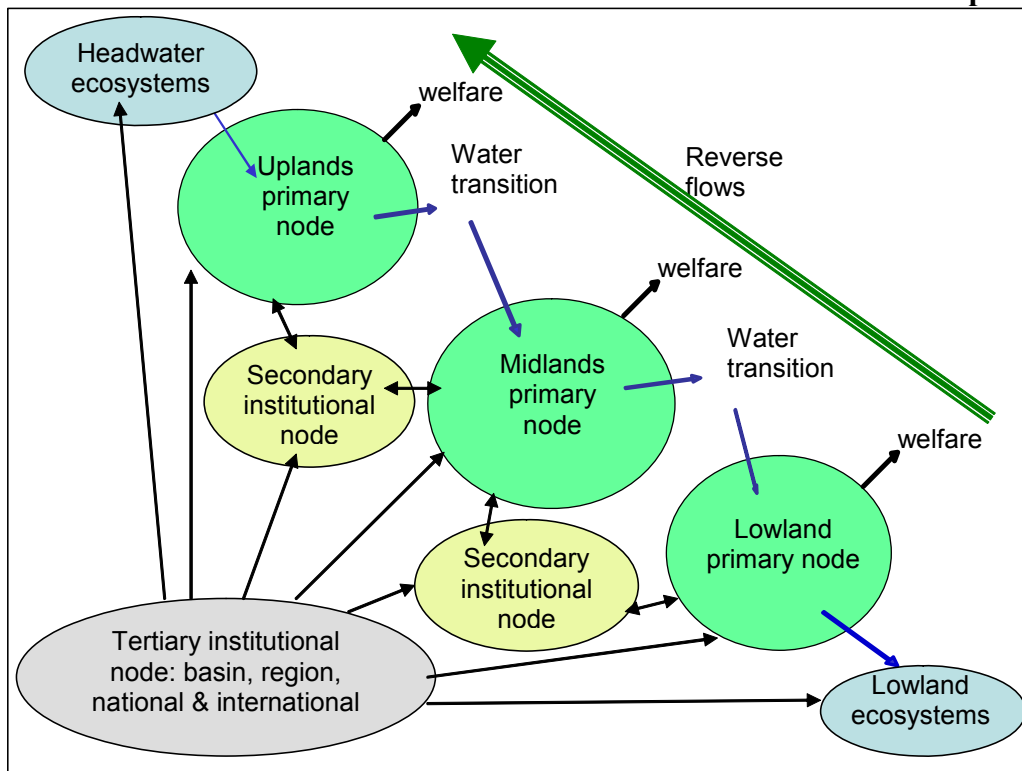
PN 50: Framework for Democratizing Water Governance: Participatory Research



PN 42: Framework for Groundwater Governance: Participatory Research cum Capacity Building



PN 20: Framework for Multi-scale Interactions in Watersheds: Participatory Research



Annex 3. Discussions at Workshop Globalization and Trade: Implications for Water and Food Security

Participants argued that forces outside of the water sector will lead to more changes in water management over the next 20 years than occurred in the past 2000 years. Experts showed that bilateral, regional, and international trade and investment arrangements impact significantly on developing country water availability and uses. Among international agreements, the WTO, particularly the GATS and the liberalization of trade in environmental goods, stand out in terms of potential impact on developing-country water and food. Experts showed moreover that the impact on water availability and food production occurs mostly through non-water sector liberalization, for example, through foreign direct investment agreements in the industrial or agricultural sectors. Corruption in such arrangements is widespread and constitutes direct losses for society to obtain the full benefits from globalization and trade.

Researchers agreed that water privatization has not proven to work out in most cases and has also not been a significant source of new funds. For example, every single water privatization in Argentina has been or is subjected to at least one international investor arbitration. In such cases, international arbitration tribunals are taking over from national courts in deciding on cases that indirectly impact domestic water and thus food security. However, while globalization impacts upon the water sector, most domestic water problems were present before and independent of globalization.

Despite globalization and international financial flows, there is insufficient investment in both water supply and irrigation development. This is due, in part, to the fact that water is a hidden and under priced element, which impedes or misdirects investment and innovation. Estimates show that the water sector is in need of US\$180 billion annually during 2000-2025, particularly for wastewater, followed by irrigation. While garnering investments for irrigation, including dam construction, is extremely difficult, raising funds for wastewater disposal and sanitation in developing countries is even more challenging. Governments and other international agencies need to help mitigate the foreign exchange risk to make water sector financing more attractive. Financing for the water sector will continue to stem mostly from public sources, but there is a need to consider a sub-sovereign level of financing, as is used successfully in the United States. Other important financing sources include revolving funds, pooled funds, and pension funds. Good governance and a separation of political processes from management of the water sector are crucial elements for water supply development to succeed.

Climate change will also significantly impact upon water availability and food security in several ways. With the number of extreme events increasing over time, rainfed production, particularly in Sub-Saharan Africa, will fail more often compared to the recent past. This will pose an increasing burden on irrigated agriculture to secure future food supplies and calls for a new review of the roles of both small and large dams for food security. Autonomous adaptations will not be sufficient to maintain the current water and food security levels, and certainly not to ensure water and food for all.

With the demand for more food of higher quality growing with populations and economic prosperity, questions increasingly arise about the role of virtual water trade in solving growing water scarcity problems in regions such as the Middle East or North Africa. According to the research papers presented, trade saves irrigation water, but water use would only be 6 percent higher without virtual water trade. Globally, about 20 percent of total cereal trade might be related to water scarcity. Thus, water scarcity currently plays a modest role in trade patterns. Another study found no relation between water endowment and level of trade – instead other factors, like subsidies and trade arrangements, determine trade outcomes – although this could change in the future.

Experts identified several bright spots from globalization for water and food security: while there appears to be free-riding on water quality in transboundary river basins, research shows that there are also positive effects from trading – countries that trade with each other tend to improve their water quality in transboundary river basins. Also, as a result of new technologies and freer trade, global trade in fisheries products has shown the fastest growth among all water-related trades in terms of value. Moreover, to date, there is no evidence that fisheries exports have led to declining nutritional status of poor local consumers.

Discussions throughout the workshop led to the identification of several areas on which future research efforts should be focused. Researchers called for a new model for bilateral, regional, and international investment agreements from a sustainable development perspective. More research is also needed to address the linkages between declining water quality levels and trade and economic liberalization, and between falling groundwater tables and trade. As of yet, there is little data and information on the water intensity of foreign direct investment and its changes over time. Such information is necessary to better manage and regulate the impact of globalization and trade for developing countries. At the global level, the level of subsidization of water compared to the subsidization of agricultural commodities and its implications should be further analyzed.

Important avenues for policy reform were identified in several areas: As globalization tends to favor commercial farmers, measures need to be taken to ensure that small-scale producers are part of the increasingly internationalized supply-chain management. This includes arrangements within the agro-industrial sector, such as linking small shrimp producers with processing companies, with successful cases in Indonesia. Moreover, the rationalization of HACCCP and other safety requirements will be required for smallholders to participate in fish and other agricultural commodity trade.

Integrated watershed management, linking the micro, macro, and meso levels, as advocated by CATIE, can help enhance water and food security with and without globalization. More needs to be known about the role of payment for environmental services (PES) in mitigating the impact of globalization and climate change. Similarly, new management tools are needed to deal with uncertainty as a result of climate change.

Countries that embark on international investment agreements or privatization of water services need to first develop sufficient regulatory capacity, regulatory frameworks, and the capacity to enforce regulations. Sequencing of these steps is crucial prior to privatization. Issues to be considered include the possible formalization of customary/traditional rights and the timing of contractual arrangements, both of which are important to ensure that weaker parties are not locked in unfavorable arrangements. The possibility of privatizing sub-components of publicly managed water supply systems, for example, only the maintenance and billing system, is another avenue worth exploring. Furthermore, research on privatization of the water sector should look beyond the municipal and industrial sectors to include research on privatization in irrigated agriculture. The role of institutions, including governance, property rights, and contracts, is one of the most important factors to consider not only in water privatization, but in all areas of globalization that impact the water sector.

Cutting across all of these specific issues is a need for continuing education on water issues and the importance of having a broader interdisciplinary perspective when looking at these issues. Many solutions for growing water scarcity problems are outside the water sector in agricultural research and rural infrastructure development. Finally, researchers need to give more thought to how to apply analytical information from these global analyses on the ground when working with farmers and policymakers.