A FORWARD LOOK: WATER GOVERNANCE FOR AGRICULTURE AND FOOD IN ACP COUNTRIES

Synthesis Report of the 2012
ACP-EU Think Tank on S&T for ACP Agricultural and Rural Development
Partnerships for Research, Capacity Building, Innovation and Foresighting: Managing Water for Agriculture and Food in ACP Countries

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by
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The ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA) convened the 2012 meeting of the ACP-EU Think Tank on Science and Technology on '***Partnerships for Research, Capacity Building, Innovation and Foresighting: Managing Water for Agriculture and Food in ACP Countries***' as a side-event of the **Second Global Conference on Agricultural Research for Development (GCARD2)** in Punta del Este, Uruguay. This brought together a range of contemporary experiences in African, Caribbean and Pacific (ACP) countries for utilizing the increasingly scarce and ever-more crucial resource of **water** within **agricultural production systems**.[1] While water is a fixed or finite resource, its more ***efficient use*** can, in effect, expand its ***supply***. Similarly the ***more productive*** use of water can ease the ***demand*** or ***need*** by giving farmers 'more crop per drop'. Thus, ***effective*** supply can be expanded by purposeful activity.

Water constraints can be addressed from either the supply side or the demand side through making gains in efficiency and/or productivity, these being two sides of the same coin. These constraints must in any case be dealt with because water is the most ubiquitously important element in all forms of life, both plant and animal, ranging from microbes to human beings. Its importance is now more keenly appreciated because of dwindling supplies and the uncertainties and constraints being imposed by climate change.

Relative water scarcity is growing at an alarming rate, and the agricultural sector, by its nature, is the ***most dependent on water***. In turn, humans are crucially dependent on agriculture for their food supply. Appropriately, it is the efficient and effective **management** of water that must help countries in Africa, the Caribbean and the Pacific (ACP) cope with any scarcities or surfeits of water. In the ACP Group of States, agriculture is still primarily rain-fed, and this will become increasingly challenging in a changing climate as annual rainfall is expected to be inconsistent and droughts more frequent.

Water management involves a number of different components. It can be functionally disaggregated in terms of: (i) its ***acquisition*** as a physical resource from various natural sources, (ii) the ***allocation*** of rights and claims to water, (iii) its ***distribution*** according to these norms and criteria, and (iv) whenever necessary, its ***removal*** or ***drainage*** when the amount of water is too much or its quality too degraded

[1] http://knowledge.cta.int/en/Media/Multimedia/Programme-CTA-WUR-GCARDII-Side-Event-Managing-Water-for-Agriculture-and-Food-in-ACP-countries

(Uphoff, 1986). Possibly ***storage*** can be considered as another functional requirement; however, this can also be subsumed under the first function of acquisition. The ACP countries have accepted the principle of integrated land and water management but this has become challenging.

The standard, hard-focus view of water, as an object to be managed in its own terms and in the broader context of land management and ecosystem sustainability, suggests the need for a paradigm shift. What became clear from the presentations and discussions during the ACP-EU Think Tank side-event, and from other presentations and discussions during GCARD2, was that when dealing with the requirements for greater efficiency and productivity of water use in agricultural systems, there is need for a softer focus, with less clear-cut boundaries and with a broader conception of **both water and agriculture**, moving beyond conventional thinking about the integrated **management of water**. To be sure, more and better management of water is needed. But a key message is that water for agriculture needs to be **governed**, not just managed, and this needs to be assessed and utilized in broader contexts in order to assure future agricultural production to achieve green economic growth in a changing climate.

At the side-event, six presentations reported on experiences from Africa, the Caribbean and Pacific nation states:

- '**Greening Rural Development and Growth** in Sub-Sahara Africa – Benefits from discussing Green Economic Growth to support Paradigm Changes and Integration' by ***Jochen Froebrich***, Wageningen University, the Netherlands, reporting on work of the EAU4Food Cooperative Research Project in South Africa (http://www.eau4food.info/);
- 'Toward **Efficient Water Management for Agriculture** in a Changing Climate: The Caribbean Context' by ***Adrian Trotman***, Chief, Applied Meteorology and Climatology, Caribbean Institute for Meteorology and Hydrology, Barbados, reporting on the Caribbean Water Initiative (CARIWIN) (www.mcgill.ca/cariwin) and the Caribbean Agro-meteorological Initiative (CAMI) (www.cimh.edu.bb/cami);
- '**Women and Youth**: The Untapped Agents for Sustainable Water Resource Management in the Green Economy' by ***Olivia Mchaju Liwewe***, Managing Director & Consultant, Social Transformational Management Consulting Services (SOTMACS), Malawi, showcasing the Malawi experience in implementing its national water policy and national water development programme, in order to gather insights on engaging women and youth in improving water resources management;
- 'Integrating **Agro-ecological Crop Management** within Integrated Water Resource Management: Lessons from Experience with the System of Rice Intensification (SRI)' by ***Norman Uphoff***, Senior Advisor, SRI International Network and Resources Center (SRI-Rice), Director of the Cornell Institute for Public Affairs, Cornell University, USA, covering experience across 51 countries of Asia, Africa and Latin America (20 of them ACP) as reported on the SRI website: (http://sri.ciifad.cornell.edu);
- 'Innovative **On-Farm Water Management** for Increased Food Production in Jamaica' by ***Leslie A. Simpson***, Natural Resources Management Specialist, Caribbean Agricultural Research and Development Institute (CARDI), Jamaica, covering the introduction of rain-water harvesting and small-scale irrigation system in a rural farming community in Jamaica that traditionally relied on using crop residues as soil cover to reduce water loss; and
- '**Green Growth, Climate Change, Food Security and Water** in Pacific Island Countries' by ***Viliamu Iese***, Research Fellow, Future Climate Change Leaders Project, Pacific Centre for Environmental and Sustainable Development, University of the South Pacific, Fiji.

These respective powerpoint presentations have been posted by CTA on the internet.[2] In their reporting on concrete experiences, all looked ahead toward next steps, with the four themes of GCARD2 frequently exemplified in the case studies: **research, capacity building, innovation and foresighting.**

The conclusions have been summed up by Judith Francis of CTA in a short paper: '*Key Messages from CTA-Wageningen UR ACP/EU Think Tank GCARD2 Side Event on Partnerships for Research, Capacity Building, Innovation and Foresighting: Managing Water for Agriculture and Food in ACP Countries*'. (http://knowledge.cta.int/en/content/download/34877/471927/file/Key+Messages+CTA-WUR+ACP-EU+Think+Tank+on+Science+Technology+-+GCARD+2.pdf)
This paper addressed the relevance of the side-event's topic of:

(i) **Foresight**, with anticipation of future constraints taking a larger, landscape perspective;
(ii) **Innovation**, with a focus on novel business opportunities to create jobs as well as wealth for local people within a 'green growth' framework;
(iii) **climate change** responses and anticipations, with early warning systems;
(iv) **research** to deal with water constraints, nutrient depletion, agro-ecological opportunities, and other subjects, with a trans-disciplinary and farm-level approach;
(v) **capacity building** for new knowledge and new paradigms; and
(vi) **partnerships**, including local, national, regional and international organisations.

In keeping with the theme of Iese's presentation 'Green Growth, Climate Change, Food Security and Water', this paper undertakes to build on experiences reported at the side-event, to ***think ahead*** about the nexus between **water for agriculture and food** (its management, sufficiency, scarcity, distribution, productivity, etc.), on one hand, and **governance** on the other, pushing forward on the side-event's overarching topic.

Expanding Focus: Most of the presentations and discussions tended to gravitate toward **the more encompassing rubric of *governance***. 'Management' is a perfectly respectable and operational term; however it tends to be more ***micro*** than macro, more ***top-down*** than participatory, and more attuned to ***efficiency*** within given or accepted confines. The term tends to assume certain objectives, values and limits that define a situation rather than to address, critique, revise and refine them. Governance involves more complex considerations, with ***effectiveness*** as its overriding concern. Efficiency is important, but secondary to effectiveness. One can be efficient in pursuing wrong, misleading or inadequate objectives. It is important, therefore, especially for such a crucial factor as water, that all actors - from international organizations to individuals - are looking beyond efficiency or narrow productivity. This makes '**governance**' a better framework for thinking and action than 'management'.

This relates to a second conceptual and programmatic thrust that came out in several of the presentations, one that was even more extensively and explicitly addressed in the GCARD2 parallel session on 'Land, Water, Forests and Landscapes: the Need to ***Look Beyond the Farm or Enterprise Unit of Analysis and Action*** to Position Policy and Management Decisions **within the Larger Context of**

[2] http://knowledge.cta.int/en/content/download/34951/473173/file/Froebrich_121028.pdf; http://knowledge.cta.int/en/content/download/34953/473199/file/Trotman_121028.pdf; http://knowledge.cta.int/en/content/download/34952/473186/file/Liwewe_121028.pdf: http://knowledge.cta.int/en/content/download/34950/473160/file/Uphoff_121028.pdf; http://knowledge.cta.int/en/content/download/34954/473212/file/Simpson_121028.pdf; http://knowledge.cta.int/en/content/download/34949/473147/file/Iese_121028.pdf

Landscapes and Watersheds'. This is the equivalent of avoiding being 'penny-wise but pound-foolish', to borrow an old English expression, which mirrors the 'efficiency vs. effectiveness' distinction made above.

As a general proposition, the message coming from the various presentations and discussions was that for planning and implementing effective and efficient uses of water for agriculture and food (and other sectors), ***there is need to think bigger*** rather than in narrow, reductionist terms, and to ***have a softer focus*** in deliberations and decisions, not a hard focus on just a few selected or familiar elements.

Ultimately, making the best and most sustainable use of water resources requires very specific decisions and actions to deal with a vital resource. Alternatives, criteria, complementarities, etc. can be framed in rather limited and limiting terms, or they can be construed and constructed more broadly. There is no need to **start** within a constricted framework simply because one needs to come to sometimes narrow and concrete decisions. This seemed to be a repeated theme in the ACP-EU Think Tank side-event and in the ensuing GCARD2 proceedings.

Kinds of Water: One of the most powerful new ideas to come into the policy and scientific discourse on water is **the distinction between 'blue water' and 'green water'** (Falkenmark and Rockström 2006). This categorization is more important for the agricultural sector than for any other.

- **Blue water** refers to water that has collected or is collected in water bodies: oceans, lakes, rivers, streams, reservoirs, even underground aquifers. The name comes from such aggregations of water being able to reflect the colour of the sky and thus appear blue, even though water has no colour.
- **Green water,** like blue water, comes from rainfall; but instead of running off the soil and gathering somewhere, it is absorbed into the soil and becomes stored therein, or it gets taken up into plants (and to a lesser extent, animals) but particularly into the soil biota, the vast number and mass of organisms living below-ground distributed across uncountable numbers of species. Green water, integrally part of the stuff and substance of ecosystems, gets taken up by plants from their rhizospheres (i.e. the zones of soil around their roots), to meet their needs.

Most thinking (and investment) for agriculture has focused hitherto on blue water: on capturing, conveying and applying water from exploitable sources especially to meet crop needs. This has been done at great expense and usually with substantial losses in the process of provision and also in plant uptake and transpiration.

The implication is that the present understanding of '***water for agriculture***', which is generally assessed in terms of rainfall and/or irrigation water (either pumped or gravity-flow), **needs to be expanded**. It needs to include the intermediate domain of green water, not only rainfall or blue water, and increasingly also an additional category.

- **Grey water** is water that has been reduced in quality, though not quantity, through agricultural, industrial and/or domestic uses. As the supply of purer water from rainfall or from above/below ground sources gets scarcer or more unreliable, the economics of *recycling* and/or *purifying* water of degraded quality will become more favorable.

As rainfall becomes less ample and less reliable in the years ahead, and irrigation for various reasons becomes more expensive or limited, there will be need for a more differentiated understanding of what constitutes 'water', paying more attention to these categories of 'green' and 'grey'. Creating conditions for green water collection and use can be more individual, less dependent on government actions than have been investments over millennia for providing 'blue' water through irrigation. Affecting both the

availability of, and balance among, these several kinds of water is clearly a matter for 'governance' that goes well beyond current thinking about 'management'. There will also be need to look at water availability within the whole catchment in space and time.

Agricultural Success – Expanded Vision for Water: Just as thinking about **water** for agriculture will need to evolve in the decades ahead, as population demands for water increase, so too will thinking about **agriculture** itself. Superficially it may appear that we need to 'go back' to some farm management practices that were widespread in previous centuries. But as we now have better, deeper scientific understanding of various plant-soil-water-nutrient-soil biota interactions, the use and refinement of biologically-based revisions of 'modern agriculture' will reflect not traditional practice so much as an informed grasp of how to harness the genetic potential and inter-species synergies for agricultural success. Simpson, in his presentation during the side-event, emphasized that "improved farm management is critical to the future survival of agriculture in the Caribbean."

- **Managing evapotranspiration** is more complicated than just maintaining windbreaks, something that many preceding generations of farmers have appreciated and provided for, almost by instinct. It is well-known that plants transpire water as a by-product of their processes of photosynthesis. However, transpiration is also a function of the force and volume of wind and air currents that flow through plant canopies and of the temperature and humidity in the air around plants. For the past century, farm size in many countries has trended upward toward larger and larger units to facilitate the mechanization of production and reduce labour requirements. With this trend have come quite radical reductions in windbreaks, lines of trees, shrubs and other vegetation that affect the sweep of winds across fields and through plant canopies.[3] In unshielded fields, the loss of water through evaporation and from plant transpiration is much increased, though almost never considered or measured. But this has been one of the unseen factors cutting into the productivity of 'modern agriculture'.

  In many other countries, of course, where there is rapid population growth on a fixed arable land base, there has been the opposite trend, with farm sizes declining due to subdivision rather than growing from the aggregation/consolidation of holdings. But this process too has been accompanied by adverse effects on evapotranspiration. As production on small holdings has expanded to their very edges, with similar removal of trees, shrubs and other vegetative growth, there has been a loss of **microclimates** that resist desiccation and favour crop growth and health.

  In either case, it is seen that **attention to beneficial microclimates** should increase if the management of water for agricultural production is to be enhanced, and if efficiency in water use is being sought. The technical and economic factors that have favoured large field operations are shifting now as 'economies of detail' (Onyemelukwe 1981) become more competitive with economies of scale in agriculture, as land and water availability per capita diminishes. Often the best way to manage water is to **manage other factors than water**. This is one way, for example, in which a landscape perspective, mentioned above, is important, looking

[3] The land reform in Cuba and mechanization of its agriculture led to cutting down of millions of trees that created windbreaks along property lines. Greater efficiency was sought from larger-scale, mechanized production, but no consideration was given to the concomitant increases in evapotranspiration that contributed to declines in soil fertility as well as loss of soil moisture, impairing agricultural productivity when dramatic gains were being sought.

beyond just the field. The ACP-EU Think Tank recognized the need for more research on ACP agricultural systems within the various microclimates to make more informed decisions.

- **Maintaining soil cover** is similarly important for improving the management of water for agriculture. 'Modern agriculture', with its premium for monocropping and its phobia for weed growth, in displacing previous polycropping and even crop rotation (which is one way to control weeds), has led to denuded soil. This has been countered in recent decades by the movement toward ***conservation agriculture*** (CA) (http://www.fao.org/ag/ca/). In addition to reducing or eliminating mechanical tillage, CA promotes maintaining vegetative cover on the soil along with rotation of crops. The benefits of this strategy were reported on in Sub-Session P2.2 by Ivo Mello, president of the Brazilian Federation of No-Till Associations. In the ACP-EU Think Tank's side-event, Simpson reported that Guinea grass (*Panicum maximum*) was previously used as soil cover, prior to the introduction of small-scale irrigation, but that while there were significant advantages, a major disadvantage was pest infestation.

  Soil cover has multiple benefits in addition to reducing the loss of soil moisture through evaporation. It suppresses weed competition, and its shading reduces the heating up of the soil by (especially tropical) sunlight, which reduces the populations of beneficial organisms in the soil. Further, it can add nutrients to the soil and also improve soil structure as the organic matter decomposes and gets incorporated into the soil by various soil fauna. This again makes the point that improved 'water management' may be achieved by the management of other factors like optimizing crop residues. Agricultural cropping practices are therefore just as important for improving water management, for farming success and sustainability.

Economic and Legal Considerations: Water at any particular time and place is a limited commodity, but this is always more relative than absolute. The adequacy of supply depends upon demand and on alternative uses. This is where governance becomes even more important.

- **Water pricing or allocation** is something controversial, since in most cultures, water is regarded as a gift from God or from Nature, and thus as something that need not be paid for. While water may in principle be considered free, good-quality water whenever and wherever people want it, is not. Sufficient water – and certainly good-quality water – is no longer in abundance in most places. Making water available at no cost is becoming more difficult to sustain without some means for allocating or rationing. Without a price mechanism or some other system, overuse and wasteful uses are invited, making bad situations even worse.

  Some measures have been introduced to make water a marketized commodity, giving some public or private interests control over water and instituting market pricing. This has often been met with opposition and resistance, even violence in some instances. Finding acceptable solutions that are economically viable and socially acceptable as well as technically realistic will be a huge challenge.

  Governments at all levels, in consultation with civil-society institutions and the private sector, and with direct engagement of communities and households, need to be taking initiative to find tenable ways to 'allocate scarcity' among the various claimants, agricultural producers being an important set of them but not the only set. Finding efficient, fair and sustainable ways to assign rights to water, whether by quotas, pricing, subsidized access or whatever, is something that has to be approached as a matter of governance.

For this to work, there need to be well and correctly informed assessments of water supply, over time as well as over space, among seasons as well as between years. Assessments of water stocks (especially sub-surface) are difficult enough, but assessments of flow and availability over time are needed, with different regimes agreed in advance for coping with periods of particular shortage and stress. Humankind has been able to avoid such problem-solving in most times and places in the past, but the foreseeable situations in most places around the world mean that cultural change as well as institutional capacity need to be socially engineered.

- **Maintaining water quality** also becomes a greater challenge in a more heavily populated world, and one that seeks the benefits of industrial processes, which are less 'natural' than those with which humankind and other species evolved. The increasing threats of diminished water quality are dramatized by events like chemical spills or oil-rig or tanker accidents, but in general, water supplies are threatened by many hazards which degrade what supply is available. For centuries, humans and their livestock and crops could coexist with minor or infrequent degradation. Economists could analyze these abstractly as 'negative externalities', while legislators passed usually-mild restrictions or penalties. The current situation requires more serious and stern efforts to ensure that water quality is protected, and that ***polluters pay***! This too is a matter for governance more than management, and it applies to agriculture as well as other sectors, including health, tourism and industry, and especially to what amounts to 'unregulated' and 'industrial' agriculture.

  Water quality is not just a terrestrial matter; it involves also **marine environments**, as the side-event presentation by Viliamu Iese from the University of the South Pacific made clear. Many ACP island countries are already experiencing the bad effects of damage to their surrounding reefs, mainly due to changes in marine water temperatures and chemical composition.

  Further, governance for maintaining water quality should not be a matter only for national government ministries or central water authorities. It needs to be on the agenda for all levels of government and also for civil-society, community and private organisations, universities and research organisations, and even at the level of family units. Considerations of water ***quantity***, and of deficits therein, are increasingly commanding attention and may in some sense trump those of water quality. Everyone needs to be concerned with maintaining or restoring water ***quality***.

Looking Forward - Water in the Context of Climate Change and Green Economic Growth: These considerations reinforce the argument advanced at the beginning of this report: that both 'management' and 'water' in this 21st century need to be recast from the more limited, circumscribed, and often mechanistic thinking of previous eras. The concept of governance should come to the fore, with management subsumed thereunder for addressing more micro and repetitive activities. Similarly, water should be considered as a finite, fixed resource only in some absolute, almost metaphysical sense. There are many ways in which the uses and priorities for water can enhance productivity and increase efficiency so that water is, in effect, 'created'.

Better, smarter uses of water can make it a ***positive-sum*** rather than a ***zero-sum*** resource. The System of Rice Intensification (SRI), which was reported on at the ACP-EU Think Tank GCARD2 side-event, has shown in many countries that by changing the way plants, soil, water and nutrients are managed, in the process mobilizing the services and protection of beneficial soil organisms, gains can be achieved ***through increased yield with reduced input of water***, and of seeds, of fertilizer, and often even of

labour. As the EAU4Food research project has demonstrated, water availability must be considered within the framework of the whole catchment in terms of space and time, and optimization of resources requires open innovation processes which benefit the community. The CAMI and CARIWIN projects, as presented by Trotman, demonstrate that national water information systems and drought and precipitation monitoring are crucial decision support tools which must be supported by research and capacity building.

Conclusion: This is not a complete analysis of the situation and of available alternatives; rather it is a disquisition prompted by ideas and experiences that were circulated at the CTA ACP-EU Think Tank on S&T side-event and in subsequent GCARD2 discussions. Most countries, and particularly ACP countries, are foreseeing growing water scarcity in the decades ahead as their populations continue to grow and their water supplies decrease, or at least become less reliable and less sufficient to meet demands. The ideas and institutions for 'integrated water and land management' that served fairly well, if not perfectly, in the latter half of the 20th century are due for considerable alteration and expansion along the lines of the discussion above.

Water governance, which embraces the perspectives of landscapes, watersheds and catchments, needs to be considered as the way forward. Deeper scientific understanding of various plant-soil-water-nutrient-soil biota interactions, crop models within various micro-climates, and the use and refinement of biologically-based revisions of 'modern agriculture' that integrate and build on traditional practices and involve farming communities will support a more informed grasp of how we can better take advantage of genetic potentials and inter-species synergies for agricultural success. Green economic growth and ecosystem sustainability in a changing climate requires foresight, open innovation processes, investments and more focused research, interlinked thinking, capacity building, partnerships and well-resourced decision-support tools and systems.

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