Challenge Program on Water and Food: Volta Basin Development Challenge

Management of Rainwater and Small Reservoir for multiple uses

2012 Annual Reflection Report

CGIAR Challenge Program on WATER & FOOD
Andes • Ganges • Limpopo • Mekong • Nile • Volta

Volta

Background

The Challenge Program on Water and Food (CPWF) applies a research for development (R4D) approach to address its global agenda in six selected river basins including the Volta Basin. At the core of this approach is the scientific research projects which collectively respond to a defined basin development challenge. The Volta Basin Development Challenge (VBDC) has been formulated with the goal of ***"Improving rainwater and small reservoir management to contribute to poverty reduction and improved livelihood resilience while taking account of downstream and upstream water users including ecosystem services".***

The VBDC program combines institutional, socio-economic and technical solutions to maximize water for food (including crop, livestock, fisheries) and ecosystem services. Hence it integrates different disciplines, involves several organizations (local, national and international) and operates at different scales of intervention (farm household, community, watershed, and basin) to contribute to a wide range of expected outcomes.

The following research questions are being addressed by four technical projects, V1, V2, V3, and V4 in field sites in northern Ghana and Burkina Faso; and a coordination and change project V5 to facilitate learning and change across all projects:

- What constitutes the key drivers for successful smallholder agricultural water management in the basin; where in the Volta basin can successful cases be scaled out; and which institutional and policy environments and links to specific crop and livestock value chains are needed to ensure adoption by farmers; (V1, V2)
- What are the effects of best-fit integrated rainwater management in mixed crop-livestock agro ecosystems on different aspects of farm productivity and profitability, livelihoods, hydrology, ecosystem services, and vulnerability of people and the environment? And what tools and indicators do we need to assess these effects to come up with targeted solutions? (V2)
- What management options will enhance efficient and sustainable use of small reservoirs (SRs) for multiple purposes within given biophysical, social, and economic contexts at the local level? (V3)
- At the watershed level, what processes govern the shaping of Integrated Water Resources Management (IWRM) policies, practices and research in the Volta basin? (V4)
- How do we integrate and orient VBDC research towards impact? How is the VBDC research leading to change, and what innovations are involved? (V5)

The expected development outcomes of interest for specific target groups are that:

a) *Local farming communities* apply new knowledge and skills to improve rainwater management and enhance crop and livestock productivity
b) Community-level institutions manage small reservoirs effectively, maximizing the benefits from multiple uses.
c) *Government policy and extension officials* at different levels (district, regional and national) and from relevant ministries and departments use research results and recommendations on improved rainwater and small reservoir management options for planning, design, and implementation of small reservoirs for multiple uses.
d) *IWRM policy makers* use participatory approaches in their policy development and implementation for enhanced watershed management.

e) *Development agencies* gain knowledge and skills to use the up-scaling decision support tool (developed) to better target investments in agricultural land and water management initiatives in appropriate locations in the Volta basin.
f) *Researchers* have increased capacity in planning and implementing integrated, multi-disciplinary research for development projects.

Reflection Meetings

As a program designed for bridging research to development outcome, the CPWF considers regular reflection, learning and adaptive management as crucial elements in the implementation of the basin programs. Reflection implies that the project teams and key stakeholders take stock of what is going on in the project in terms of the science and the process and revisit basic assumptions that underpinned their research. Such reflection provides opportunities for the learning which directs adaptive management.

Reflection in the VBDC takes place first within the project teams. Project teams hold meetings to reflect, and adapt their research accordingly, based on the increasing understanding of challenges and opportunities to address them. Minutes of these reflection meetings are often documented. Beyond project level reflection, the basin team comes together periodically to further assess progress with regards to the evolution of research questions being addressed, the strategies being employed (e.g. scientific methodology, contextualization of the research, etc), emerging results, and the overall project relevance to achieving the basin development challenge.

In 2011, the first reflection meeting for the basin team took place in Accra in May 2011 as the Inception Workshop. During this meeting, we captured lessons learned in the inception phase, especially drawing on new information gained, and on-the-ground realities. We also planned how these lessons should shape project implementation in the following phase**.** Proceedings were documented and necessary changes were made to project milestone plan and outcome pathways.

In 2012, basin level reflection took the form of a Field Tour, Learning Events, and a Science Workshop, held between 29 June and 5 July.

Objectives and Process

Field Tour:

The specific objective for the field tour was three-fold:

- To gain a better understanding of key issues, opportunities and on-going research at the project locations.
- To capitalize on the collective knowledge and field experiences of the participants, review the appropriateness of our research interventions, and identify opportunities for integration across the VBDC
- To make recommendations for the second half of the program with new insights and lessons for the project teams

Field tour participants included project researchers, CPWF management team members and a representative of the media. This group visited Bapla and Diebougou in the Bougouriba watershed (V4), Boura (V3), and Koubri (V2), all in Burkina Faso. At each site, the project team explained the main -

challenges and opportunities for the project, the project's interventions, and the emerging results. Local stakeholders, including local administrators, extension agents, and producers, gathered to receive the Field Tour group. Accompanied by fishermen and farmers, the Field Tour group visited reservoirs, and asked these members of multi-stakeholder platforms questions about their use of the reservoirs and . They met with four different groups of stakeholders to discuss project interventions, and held internal discussions on emerging issues.

Learning Events:

Before the commencement of the three-day science workshop, each project held separate learning events on 2nd July. They reflected on work done so far and consolidated their presentations for the basin-wide reflection meeting, the Science Workshop. Project V4 organized a learning event for selected IWRM stakeholders during which they demonstrated some of the participatory tools that have been developed and used in the CPWF to support and accompany policies for IWRM in the Volta Basin.

Science Workshop:

The specific objectives for the Science Workshop were to:

- Reflect on the scientific content and how we are accomplishing the research that should yield development outcomes.
- Reflect on progress towards achieving development outcomes as stated in the projects' documents.
- Assess research integration in the VBDC and how the combination of project outputs together will contribute to overall development outcomes

Science Workshop participants included VBDC researchers and students; agricultural water management stakeholders (representatives of national, regional and donor organizations, governmental and non-governmental) as well as a review panel of experts specifically invited for the meeting. Thus, the science reflection involved (a) an internal peer assist among members of the basin research team and (b) critiques and feedback from a review panel of experts. The review panel consisted of:

- Dr. Larry Harrington: CPWF Research Director, System Agronomist
- Dr. Tim Williams: IWMI Director for Africa / CPWF Management Team Lead for the Volta, Agricultural Economist
- Dr. Barry Boubacar: West Africa Science Centre for Climate Change and Adapted Land use (WASCAL), expert in agricultural water management and agro -hydrological modelling
- Dr Robert Zougmoré: ICRISAT/CCAFS Regional Director, soil and water use management specialist
- Dr. Paschal Atengdem: University of Ghana, expert in gender and development evaluation

The science workshop involved ten different sessions, with a mix of power point presentations, small group discussions, brainstorming on specific issues and plenary discussions. The main project presentations covered research problems and methodology as well as emerging results and outcomes. The first day of the workshop was devoted to presentations on community level research actions (V2 and V3) while day two of the workshop focused on watershed and basin level research actions (V1, V4 and V5). On the third day, we looked at cross cutting topics including discussion on M&E, Volta Storylines and Scenarios as well as resilience framing in the VBDC. During a significant part of the 3rd day

we listened to feedback from the experts. Lastly, project teams met in their work-groups to plan the way forward and reported these plans back to the plenary.

Emerging results from the projects

1. V1 research has distinguished three main **'success stories' of AWM** (agricultural water management) interventions that have occurred in the Basin over the last 50 years: soil-water conservation structures (e.g., zai, halfmoon), small reservoirs, and the use of small pumps. While farmers have been slow to adopt soil-water conservation measures, uptake of small pumps has been rapid and spontaneous, with demonstrated improvement in producers' incomes. Several factors explain a fair amount of AWM successes in the basin, including culturally and gender sensitive approaches, consultations with relevant stakeholders at the start/during/end of a project, transparency of project implementation, effective and timely project management. 'Success' and 'failure' stories occurred at every level of technological complexity, from rainfed interventions to full scale irrigation schemes in both Burkina Faso and in Ghana. The prototype decision support tool being developed by V1 is already available for testing with key stakeholders.
2. A review, by members of V2 and V1, of the evolution of AWM interventions in **rainfed crop-livestock systems** of the Volta Basin showed that between 1970 and 2009, 195 bilateral and multilateral AWM projects were implemented in Burkina Faso, corresponding to an investment of US$ 641million. In Ghana, only 46 projects of this kind were implemented, for a total of US$ 258 million. While these projects yielded numerous technical solutions, their actual impact on livelihoods is controversial which raises the question of the return of investments on water availability, food security and livelihoods would be of particular interest for donors. The following recommendations for research-for-development interventions have been reported:
    - When promoting AWM strategies, projects should carefully study the available information on factors triggering adoption, and should concentrate on how to leverage the factors limiting adoption and enhancing system productivity while maintaining healthy ecosystem services.
    - Participatory management of water infrastructure should be carefully planned, including integration of maintenance costs into the project budget, capacity building of actors towards assumption of more responsibility, and ways to deal with turnovers within management committees.
    - Programs and projects need a multi-scale, landscape perspective in order to understand ecological, landscape processes and trade-offs between ecosystem services derived from and affected by AWM strategies adoption across different scales.
    - Moreover, an institutional perspective is required to facilitate management of AWM structures. A system perspective will help to improve water-crop-livestock interactions, develop off-season cultivation options and market access, and balance the distribution of gender benefits. A long-term perspective will enable programs and stakeholders to choose the best strategies for climate change adaptation and to manage risk in the variable environment of the Volta Basin. Farmers' capacity building is key for the improvement of risk management and constant adaptation to new, unpredictable conditions.
3. Albeit not without some challenges, **Innovation Platforms** (IPs) seem a good approach to improve agricultural production and livelihood through stakeholder participation in identifying problems, designing of action research and translating IP decisions into value chain (VC) outcomes. The V2

project team have found that, in their communities, constraints along the VC are largely institutional rather than technical and local producers have high expectations for the IPs. Nevertheless, the IPs have enhanced collaboration among actors on the commodity value chain.

4. The V3 team identified four key groups of users of **small reservoirs**: crop farmers, livestock farmers, fish farmers and domestic users. Each user group faces unique challenges in harnessing the available water from SRs. In terms of SR hydrology, water levels vary from month to month with, for example, about 30% of water remaining in the Boura reservoir at the end of the dry season. The team is investigating further if this water could be used without compromising the hydrological performance of the infrastructure, as well as how it could be used by which user group(s) without generating conflicts among the various uses. The on-going implementation of Z*onAgri* participatory modelling of SR water uses will help to estimate the amount of water required yearly in order to meet the demand of various uses. In response to producers' concerns over poor rice yields, INERA began collaborative pilot experiments using improved rice varieties with the community farmers at Boura, Burkina Faso.

5. In terms of the **ecology of SRs**, V3 has discovered a simultaneous dominance of cyanobacteria in the phytoplankton pool and the invasion by macrophyte (*Ceratophyllum submersum)* in the Boura reservoir. These two observations suggest an advanced status of eutrophication in this reservoir. Preliminary experiments have confirmed the allelopathic potential of *Ceratophyllum submersum*, and bring new research perspectives to the project: gaining understandings of the cumulative effects (i.e. antagonistic, synergistic etc) of both allelopathic metabolites and phytosanitary by-products on the aquatic productivity and diversity, and the effects of both phenomena on the growth performances of irrigated crops. These understanding will allow researchers and stakeholders to better understand the nexus linking agricultural intensification and ecosystem resilience, and guide researchers in making practical recommendations to the community on how to manage resulting problems.

6. Project V4 set out to understand the processes that govern **IWRM policy-making, practices and research** in Ghana and Burkina Faso so as to identify demand-driven opportunities for the management and the governance of rainwater and small reservoirs at the watershed level. This is being achieved via a participatory approach based on Companion Modelling methodology. Emerging results show that the two countries present two different IWRM cases which called for different research approaches.

   - In Ghana, the project facilitates the emergence of a shared watershed vision so as to trigger collective decision making over water resources. Hence, the IWRM process of the project emphasizes connecting people to explore practical options for management strategies on a tripartite issue: erosion-siltation-flooding. The study of erosion-sedimentation-flooding dynamics within the framework of IWRM revealed that 90% of the sub-basin water resources are from upstream sources, which signals implications for upstream-downstream collaboration on IWRM issues. When project members complete the flood hazard modelling, already far advanced, the generated hazard maps will inform land use planning in the study catchment and help reduce vulnerability to flooding disasters. Results from sedimentation and flood modelling inform multi-stakeholder platforms for policy and IWRM interventions.

   - In Burkina Faso, the project focuses on the operationalization of the Local Water Committee (CLE, structures for IWRM implementation in the country). Here the emphasis is institutional formation with a pilot study on one CLE (Bougouriba 7) which will generate lessons and outcomes through multi-layered engagement to national dialogue on regional IWRM. The CLE platform, set up by

the national government, has not yet been appropriated by all actors. The links between the CLE and the sub-basin agency (Mouhoun sub-basin) is still very weak. The CLE is also not sufficiently inclusive of the diverse users in the watershed; hence a necessity to strengthen links with other important water users such as those in the agricultural sector. The operationalization of this one CLE in a watershed will be difficult to upscale to the whole country as the complexities of issues that form the bases for stakeholders' collaborations vary from sub-basin to sub-basin with different hydrographies, topographies, and geologies, as well as political and socio-economic environments.

7. In order to trigger and influence **change** in our target beneficiaries through our research for development projects, V5, sought to understand how and why research and policies in agricultural water management (focusing on IWRM, soil and water conservation and small reservoir development) are framed in the Volta Basin by investigating the multiple discourses and actors that coalesce around policy processes. The project discovered that the discourses that characterize the agricultural water management sector in the Volta Basin have evolved little over the last 40 years. The Volta BDC is deeply embedded in these discourses, but while other policies and investments tend to focus on 'best-bets' (translated in the discourse as large scale investment; development of agro-entrepreneurship), VBDC research focuses on diffuse socio-environmental dynamics (which are more difficult to pinpoint and articulate) in 'mosaic-landscapes'. This shift in focus creates opportunity by generating new knowledge, but it also entails the challenge in that it may not attract the policy attention that research on 'hot-spots' could have yielded. This requires that the project set up solid partnerships with key actors in the AWM sectors, as well as detailed actors' analyses, which are currently in progress. Similar challenges in actor relationships on policy processes have been observed in both Ghana and Burkina. These include:
   - a disconnect between 'water institutions' and agricultural socio-professional groups;
   - a decision-making process dominated by national and regional administrations with a lack of downward accountability;
   - challenges to the participation and effective representation of water users in decision-making arenas.
8. The story of VBDC **innovations** from both researchers' and local stakeholders' points of view is being documented through ethnographic research. This involves on-going interviews of researchers and the stakeholders and participation and observation in project activities. The process of particular changes and possible innovations in specific case studies will be analyzed holistically to tell how and why they occurred, and what they might mean for the future in the basin and elsewhere.
9. The several **communication** tools and channels developed by V5 and the other projects are being used to facilitate exchanges within the VBDC, with stakeholders in the basin, and with partners outside the basin. These include but are not limited to a wiki, website, contact database, calendar of events, Yammer, Slideshare, newsletters, brochures, press articles, and posters. V5 with the other Vs have developed project and basin level monitoring plans, and some project researchers have participated in capacity development programs on field research experimentation, modelling, participatory GIS, M&E and effective communication of research for development.
10. Project teams understand and are addressing **resilience** in diverse ways as relevant for their context and scales of intervention. This includes studies on crop-livestock diversification, linking agricultural intensification to aquatic ecosystems as well as studying resilience of institutions. All these various studies will feed into a proposed study on ecosystem services in the Volta Basin

11. The VBDC research projects started with clear goals and objectives, and a lot has been done to strengthen project linkages and to integrate the overall program. While full **integration** will be challenging giving the diverse contexts of the projects, further identification and strengthening of cross project linkages is a continuous exercise. An example being the **Volta Storylines and Scenarios** (VSS)that provides a framework of *sets of possible narratives based on previous and on-going research as well as farmers' feedback*. From these narratives *a compelling set of outcomes can be compiled in order to have better informed decisions on potential AWM interventions for improved livelihoods in the basin.* This integrating effort weaves different strands of results from the projects into a coherent comprehensive storyline for the Volta Basin.
12. Several VBDC projects have adopted top-line methodological approaches coupled with participatory approaches that allow producers and other key stakeholders to contribute to the research that is being conducted. The VBDC also contributes to the capacity development of the next generation of young researchers in the sub-region. Student participation has been remarkably active in the program with more than 15 graduate students of which 12 (4 PhD, 8 M.Sc.) participated with presentations at the workshop.

Recommendations (mostly from the review Panel)

- In using a decision support tool for identifying scaling out opportunities for successful, innovative AWM interventions, V1 should also take into account policies that have enabled the adoption of successful AWM interventions. Moreover, they should unpack the various aspects of the technology as innovation can take many forms within a single technology. For example, in SRs, innovation might occur with the construction of new reservoirs, rehabilitation of SRs, or management of water quality of existing SRs, etc. V1 can potentially apply its tool to identify outscaling opportunities in crop-livestock systems being studied by V2.
- Crop-livestock systems are the mainstay of livelihoods in the Volta basin; hence the Innovation Platform (IP) approach used by V2 to explore best-fit rainwater management strategies is pertinent. It should be noted that members usually adhere to IPs to benefit from the "scale economy of association", that is, to draw more benefits as a group. V2 should take advantage of this and ensure that all IP members benefit from their activities. V2 should use market access and new opportunities that farmers can tap into for supplementary income as drivers for the IPs. Modelling in V2 should include inputs from the other Vs (V1 in particular), and should involve not only biophysical aspects but also economic variables.
- It should be noted that farming as currently practiced in the irrigated areas of the Boura reservoir is not making full use of available water. For that reason, any information on the optimal allocation of the reservoir water will be very useful to farmers. Those are "low-hanging apples" that V3 team can look at to increase the impact of their research on the livelihoods of Boura's community.
- Understanding policy and governance processes is a great start but such understanding must be for a purpose, to reach an end. It should be intrinsically linked to the technological aspects of agricultural water management. The process where participants are learning together in V4 is interesting tool, but needs further investigation and high-level stakeholder engagement. Moreover, there is need to strengthen the capacity of policy makers for sound decision-making. The V4 project requires (a) an M&E of the processes to ensure a two way communication between policy makers and actors on the ground and (b) M&E to demonstrate the efficacy of the process approach to justify what the project obtains at the end in terms of the resources (time and money) put into it.

- A very strong plank of V4's activities involves the ability to use the CLE as a mechanism to influence policy and to change attitudes. The team needs to look at how the CLE's cascade their own views of the problems to local stakeholders, as well as the feedback loop from the local actors to CLE members themselves.
- V5 should systematically collect and analyse information about progress with the outcome targets. Participation and innovation seem to be hallmarks of the VBDC research. Understanding the why, how and when of participation will help to unfold different types of outcomes. Innovation should be perceived as a system: with farmers, extension agents, researcher, etc., each a subsystem belonging to a larger system. Any work towards change should consider the complexities of the people involved and their interrelationships. We should also accept the fact that change can be unplanned, positive, negative, tangible, and intangible, for a person or an institution.
- Any measurement of change should start with a benchmark, and in order to tell the story of moving from the benchmark to project end, local people should be involved in documenting the happenings. Even if they cannot read or write, they can at least see and record.
- Given that most VBDC research activities revolve around modelling, a good data management strategy is recommended for the program. Cross-cutting issues such as gender should be further integrated into ongoing VBDC research activities.

Emerging new research issues for a next phase

Researchers were urged to look beyond current project timeframes and take advantage of emerging research questions to develop new activities for the next research for development phase that will respond to the challenges faced by the smallholder farmers. Some emerging issues that cannot be addressed in this current phase but worth exploring further are:

- How do interactions between the private sector and smallholder farmers accelerate uptake and outscaling of AWM technologies? What are the most successful of such alternative processes (unlike the current focus on governments)?
- Best practices in AWM ('due diligence') identified by V1 needs to be more rigorously verified: what do they mean? Who is carrying them out? What are the associated costs and impacts?
- What are meaningful spatial information layers of social and institutional factors that determine success and failures of AWM?
- Might development investments and uptake of AWM technologies mostly ensure supporting more livelihoods, without necessarily enabling these same livelihoods to take a step out of poverty and vulnerability?
- There is a substantial knowledge gap on actual status of water and land resources (as on actual livelihood systems) in the basin above). Are the water and land resourcesdegrading at an accelerating pace? How are these processes evidenced?
- We need to test the upscaling and targeting tool developed by V1 for the V2, V3, V4 AWM cases in the Volta and in nearby basins in the region, e.g. the Niger. We need strategies for regular updating of the tool and testing with new successful cases in the basin. This will help the upscaling tool take on a life of its own, so that it can guide investment decisions within the basin
- Linkages between surface water and groundwater in the Volta Basin remain unstudied.

- In SRs, the quantity and quality of available water resources, sedimentation of SRs, assessment of the health status of aquatic ecosystems can be assessed using a series of different proxies based on their physical, chemical and biological properties. This had been proposed by V3 but the budget cut and delay in funding precluded this research.
- A study of the geographical diversity of SRs by clusters of reservoirs along the Nakanbé/White Volta and Mouhoun/Black Volta basins, both in Burkina Faso and in Ghana would consider possible links between their watersheds' status and their historical evolution (land use, population dynamics). The whole catchment (sub-basin perspective) and buffer areas of different radii around reservoirs should be considered as a continuum.
- Optimization of SR use would benefit from research into more efficient dry season irrigation, and market opportunities and value chains for producers of SR-based produce, including crops, livestock and fish.
- Mapping of 'zones de competence du CLE' (in the Nakanbé and Mouhoun Basin) and main water sources (lakes, small reservoirs, irrigated schemes, etc.) would enhance implementation of CLE in Burkina Faso.

Annexes

1. Field Tour report
2. Science workshop proceedings
3. Workshop Presentations
4. List of participants
5. 2012 Annual Reflection ToR