CDRI – Cambodia's leading independent development policy research institute

Policy brief

2011, No. 01

Working with Hydrological Knowledge of Catchments to Improve Irrigation Management[1]

CHEM Phalla[2], SOMETH Paradis[3], Philip HIRSCH[4] and Jessie CONNELL[2]

KEY MESSAGES

- Water is an abundant resource in Cambodia; however, many dry season farmers experience water shortages due to:
  - insufficient irrigation storage infrastructure
  - lack of knowledge among farmers and managers about hydrological systems
  - lack of coordinated water allocation.
- Crucial roles are played by Farmer Water User Communities (FWUCs) and the Provincial Department of Water Resources and Meteorology (PDOWRAM) in managing local (individual) irrigation schemes, but management is not integrated at a catchment level.
- Currently, access to water varies between different irrigation schemes depending on the season and geographical location, creating intense competition over water for rice cultivation, especially between upstream and downstream users.
- The spatial integration of irrigation management and local participation in collecting, interpreting and applying hydrological information is vital to improve water allocation.
- More capacity building activities related to spatial integration management are needed to assist FWUCs and PDOWRAM to manage irrigation in its catchment context more effectively.
- High quality basic hydrological data are also needed to support decision-making about water allocation, especially between upstream-downstream irrigation schemes.
- Effective governance arrangements are essential to make use of hydrological information, including mechanisms for planning, managing, negotiating and allocating water at a catchment level.
- Participatory Integrated Catchment Management (PICM) is an effective multidisciplinary approach adopted in many countries, including Australia.
- In the Cambodian context, PICM could be implemented by establishing a committee at the provincial level, drawing on knowledge generated from research and expertise from a range of sectors, including agriculture, fisheries, environment and social development.
- Further research is needed to document good methods that may be replicated in other catchments in Cambodia to address similar problems.

THE PROBLEM

Rice is a staple food for Cambodia's population, eighty-five per cent of whom live in rural areas. Increasing rice production has been identified, at national and international levels, as a rapid means to reduce poverty and increase food security in Cambodia. Although water is abundant in the country, many farmers who grow dry season rice lack access to reliable irrigation. The move away from rain-fed cultivation to irrigated farming

1 This policy brief is based on a CDRI working paper, *Use of Hydrological Knowledge and Community Participation for Improving Decision-making on Irrigation Water Allocation,* by CHEM Phalla and SOMETH Paradis. The working paper presents the results of the Physical Component research of the Water Resources Management Research Capacity Development Programme (WRMRCDP), a five-year project funded by AusAID, aimed at improving the use and governance of water resources to increase agricultural production and the sustainable use of natural resources in Cambodia.

2 Natural Resource and Environment Programme, CDRI.

3 Department of Rural Engineering, Institute of Technology of Cambodia.

4 Australian Mekong Resource Centre, School of Geosciences, University of Sydney.

systems combined with population growth has increased the demand for irrigation throughout the year.

Irrigation development in Cambodia has occurred in a situation of fragmented decision-making, on the basis of poor hydrological knowledge, and with little involvement of water users in planning. Many problems have arisen from this ad-hoc development, including ineffective scheme operation, sub-optimal benefits, and conflict. Irrigation development requires a more integrated, informed and participatory approach.

Participatory Integrated Catchment Management (PICM), in principle, involves engaging all stakeholders to establish and participate in management mechanisms at catchment level. In Cambodia, challenges remain for meaningful stakeholder engagement that brings together Farmer Water User Communities (FWUCs), commune councils, district and provincial authorities, provincial technical departments and related ministries.

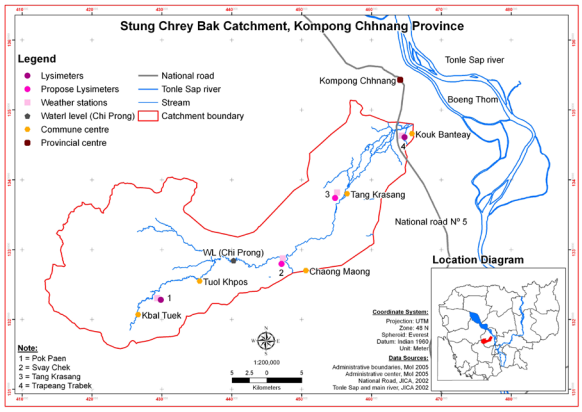
THE CASE STUDY

This policy brief presents the key findings of a case study conducted in Stung Chrey Bak catchment (SCBC) in Kompong Chhnang province (KCH). The study aimed at generating knowledge about the interaction between water uses, policy, physical systems and institutional frameworks that support catchment management in the context of irrigation development.

Stung Chrey Bak catchment (SCBC) is a sub-catchment of the Tonle Sap Basin. The Chrey Bak stream flows into the Tonle Sap River. Four irrigation schemes were built during the Khmer Rouge years and then rehabilitated between 1989 and 2005. Three of them were developed for supplementary wet season rice irrigation. Only one scheme, which is located downstream in the Tonle Sap River's floodplain, was developed for dry season irrigation as the irrigable area is flooded during the wet season. With increasing double cropping in the upstream areas, water has become scarce during the dry season. This has severe consequences for downstream farmers.

Five years ago, little physical information was known about the Stung Chrey Bak catchment. Through the Water Resources Management Research Capacity Development Programme (WRMRCDP), a hydrological monitoring network has now been set up. This network generates high quality data to support catchment planning and management.

Figure 1: Stung Chrey Bak Catchment



KEY FINDINGS

Fragmented catchment management

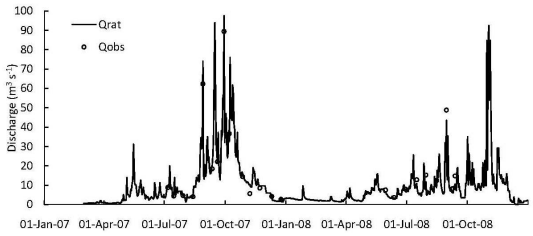
There is a lack of coordinated catchment management, including inadequate community participation, leading to a focus on irrigation schemes at individual level rather than on cooperation between upstream-downstream irrigation schemes. The Ministry of Water Resources and Meteorology (MOWRAM) is the leading institution responsible for catchment management. FWUCs are expected to play key roles at scheme level in the operation, maintenance and provision of irrigation services to beneficiaries, water allocation decision-making and the coordination of stakeholders. PDOWRAM officials provide technical and managerial support to the FWUCs. In reality, the FWUCs and PDOWRAM struggle to manage the complicated irrigation schemes and the FWUCs have no mechanism to coordinate schemes to achieve the spatial integration of irrigation management. Unequal distribution of water is the source of intense conflict, especially between upstream and downstream farmers.

PDOWRAM has attempted to resolve conflicts arising from dry season water shortage by reviewing water availability in each scheme to readjust the flow. With limited infrastructure, financial and technical support, PDOWRAM has not been able to assist the FWUCs effectively and in a timely manner. Many farmers still have limited irrigation access and the benefits derived from irrigation are often lost due to a lack of coordination between different stakeholders.

Improved hydrological information needed

There is a lack of necessary hydrological information available for managers to make effective decisions about water allocation, especially knowledge about the spatial and temporal distribution of stream flows.

Figure 2: Stream-flow Hydrograph



Knowledge of catchment hydrology, gained through the recording and monitoring of stream flows, is vital for effective water management. Water flow in the catchment links many communities who share this water into a complicated relationship (Knox *et al.* 2001). In SCBC, as elsewhere, small changes in hydrological processes impact on stream flows which are often felt by downstream users. Irrigation, in particular, consumes large amounts of water, potentially causing water scarcity downstream.

The hydrological information gathered for this study makes it possible to identify potential catchment water availability and an increase in demand for irrigation during the dry season. Annual runoff is about 284 million cubic metres. The peak flow usually occurs in September–November, accounting for about 85 percent. The lowest monthly flow observed in March accounts for less than two percent and severely impacts on dry season cultivation in downstream areas. This raises the question of water allocation and sharing during the peak demand in February-March, when the stream flow is at its lowest.

After allowing for water needed for environmental flows, it is estimated that the potential water withdrawal in SCBC in the wet season is about 190 million cubic metres. In the Tonle Sap floodplains, crop water requirements (for 105 days) range from 560 mm for clay soils to 990 mm for sandy loam soils (Someth *et al.* 2007, 2009). The potential irrigated areas could be from 19,000 to 34,000 hectares for the 105-day variety.

Local involvement in generating and using hydrological information

Institutional and individual stakeholders in catchment management have limited access to hydrological data and relevant analytical skills. Because of competing demands on time, it is difficult to get communities involved in irrigation infrastructure rehabilitation and management without financial incentives. The limited capacity of the FWUCs and PDOWRAM to manage catchments, as well as the low levels of understanding of hydrological processes at local level creates weaknesses in coordination across irrigation schemes.

Existing infrastructure has insufficient water storage capacity

The infrastructure in SCBC has limited capacity to store water for irrigation. The hydrological analysis suggests that increasing storage capacity could solve water shortages. Initiatives to enlarge irrigation reservoirs have failed because this often requires the use of land currently occupied by farmers. FWUCs also have minimal revenue for the operation and maintenance of schemes.

A previous attempt to integrate an irrigation scheme expansion plan into the Commune Development Plan was vetoed by commune development committee members. This is because it involved using the commune development budget to finance the expansion of a scheme that would only benefit one area.

POLICY IMPLICATIONS

The economic impacts of water vulnerability and poor catchment management in Cambodia are substantial and are the focus of another working paper by CDRI.[5] Coordinated catchment management is recognised at policy and legislative levels; however, implementing this approach is not straightforward. The Law on Water Resources Management, adopted in 2007, embodies the overarching principles of Integrated Water Resources Management (IWRM). It stipulates that resources shall be managed by taking into account: (a) all aspects of water resources; (b) linkages between water resources and other components of the natural environment; and (c) water requirements for humans, environment and other sectors (Article 4). The rights of downstream users are also protected under the law (Article 11).

Existing legislation needs to be supported by effective governance structures which facilitate the implementation of a participatory integrated catchment management approach.

5 *This paper and a related policy brief will be published in early 2011 as part of the economic component of the WRMRCDP.*

CDRI – Cambodia's leading independent development policy research institute

56 Street 315, Tuol Kork, Phnom Penh, Cambodia
PO Box 622, Phnom Penh, Cambodia
(855-23) 881-384/881-701/881-916/883-603/012 867-278
(855-23) 880-734
E-mail: cdri@wicam.com.kh
Website: http://www.cdri.org.kh

Participatory Integrated Catchment Management

Participatory and Integrated Catchment Management (PICM), a subset of IWRM, is an approach that takes into account the physical, social, economic and cultural linkages between water users in the catchment (German *et al.* 2006). It involves engaging all stakeholders, including local communities, to participate in identifying problems and planning solutions from inception to implementation. Participation needs to occur during planning and decision-making around water allocation. Integration should happen through multidisciplinary planning, involving experts representing different disciplines that relate to water resources management (e.g. agriculture, fisheries, forestry, environment, and social development).

Key actions that the Cambodian government can take to realise the potential of PICM include:

1. Strengthening governance arrangements to employ hydrological information

- Develop a rehabilitation programme involving all stakeholders, including MOWRAM, Ministry of Agriculture, Forestry and Fisheries (MAFF), Ministry of Environment (MOE), Ministry of Interior (MOI), provincial and district authorities, commune councils and the National/Provincial Committee for Decentralisation and De-concentration (N/PCDD), Ministry of Public Works and Transport (MOPWT), Ministry of Health (MOH), Ministry of Economy and Finance (MOEF), and FWUCs;
- Establish a catchment management working committee comprising relevant provincial technical departments, district and commune councils and FWUCs;
- Increase financial and technical support to PDOWRAM and FWUCs.

2. Facilitating the participation of local communities and increasing local knowledge of hydrological processes

- Strengthen local expertise through on-the-job and academic training efforts, including participatory action research involving researchers, government officials and farmers and collaboration across national, regional and international academic institutions.

3. Improving hydrological data and infrastructure

- Continue collecting hydrological and meteorological data for stream flow analysis and infrastructure planning;
- Develop a catchment water balance analysis model to support catchment planning and water allocation decision-making;
- Document good methods that may be replicated in other catchments in Cambodia to address similar problems;
- Rehabilitate irrigation infrastructure for storing water and in some areas carry out new construction.

REFERENCES

German L., Mansoor H., Alemu G., Mazengia W., Amede T. and Stroud A (2006), *Participatory Integrated Watershed Management: Evolution of Concepts and Methods*, Working Paper No. 11 (Kampala: African Highlands Initiative (AHI))

Knox A., B. Swallow, N. Johnson (2001), "Conceptual and Methodological Lessons for Improving Watershed Management and Research, *Collective Action and Property Right (CAPRi)*, Policy Brief No. 3, February pp. 1-4

MOWRAM – Ministry of Water Resources and Meteorology (2007), *Law on Water Resources Management of the Kingdom of Cambodia* (Phnom Penh: MOWRAM)

Someth, P., Kubo, N., Tanji, H. (2007), "A Combined Technique of Floodplain Storage and Reservoir for Paddy Rice Cultivation", *Paddy Water Environ*, pp. 101-112

Someth, P., Kubo, N., Tanji, H, Ly S. (2009), "Ring Dyke System to Harness Floodwater from the Mekong River for Paddy Rice Cultivation in the Tonle Sap Floodplain in Cambodia", *Agricultural Water Management*, Vol. 96 pp. 100-110