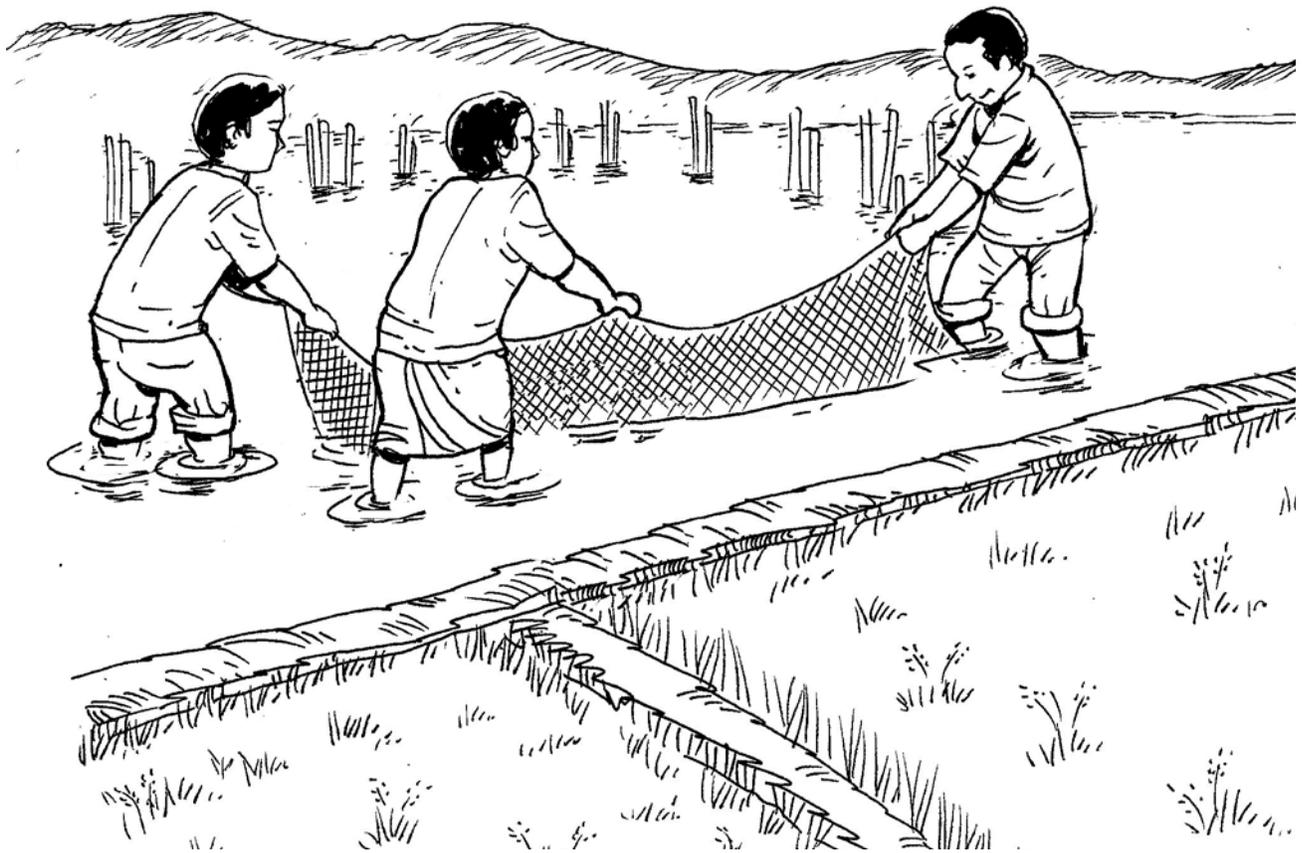


Agroecosystem Analysis Methods to Support Decision-Making for Water Allocation



Cambodia is the fourth largest producer of freshwater fish in the world (Keskinen 2003) with an estimated total catch of approximately 400,000 tons per year (t/yr) (van Zalinge and Nao 1999). Fish and fish products are an important source of nutrition, livelihood and income for the entire country, especially in the rural areas (Ahmed *et al.* 1998 in Keskinen 2003).

In the Tonle Sap area, in particular, fishing-related activities play a very important role. In villages bordering the lake, fishing naturally forms the major livelihood activity of many people. Even in

the floodplain, in areas not adjoining permanent water bodies or small rivers or streams, fisheries often play a critical role in terms of subsistence. For instance, during flooding or wet season, fishing takes place in flooded forest areas and rice fields (Keskinen 2003). Moreover, it appears that in the dry season, people from many communes (communes are subdivisions of the districts in Cambodia) migrate to the floodplain area from their villages and engage in fishing. Since rice cultivation alone is inadequate to obtain income for daily subsistence, especially during certain times of the year, farmers have diversified their livelihood

activities to engage in fishing. Thus, fisheries and farming systems are closely interlinked in Cambodia. The preservation and enhancement of both systems and the contributions that these can make to the livelihoods of the poor require a comprehensive and integrated approach.

Agroecosystem analysis: application to Cambodia's needs

Agroecosystem analysis (AEA) is a methodology for analyzing of agricultural livelihood systems and for planning and prioritizing research and development activities. It was developed in the late 1970s and has since been used for research and extension planning in a range of locations and environments. In Cambodia, the AEA at the

commune level was initiated in 2001; in 2004, this approach was officially adopted as a national policy for agricultural development, with the Department of Agriculture and Extension (DAE) of the Ministry of Agriculture, Forestry and Fisheries (MAFF) as the executing agency. Commune agroecosystem analysis (CAEA) is used by the DAE for agro-ecological analyses at the commune level and is the primary need-assessment and planning tool for the agriculture sector. By mid-2010, a CAEA had been conducted at least once in more than 500 of the 1,621 communes nationwide. CAEA uses multi-disciplinary investigation and participatory analysis to understand and describe the major farming systems practiced in each commune and to identify and prioritize the most important problems facing the farmers. Systems analysis is then conducted to plan interventions to address problems and identify opportunities.



Bringing fishery dimensions into CAEA

Until 2008, CAEA had focused mainly on agricultural issues, but problems of the fishery sector that are closely interlinked to agriculture in Cambodia were not adequately addressed. Moreover, the existing data collected were insufficient to encompass the range of variables required to address the combined use of water by fisheries and agriculture and development interactions. As a result, significant uncertainties were creating a bias or impeding effective decision making on the management of water for co-existing agriculture and fishery systems. CAEA users recognized this weakness and were in agreement that the water and fishery component should be strengthened.

In this regard, the CGIAR Challenge Program on Water and Food (CPWF) project, entitled “Commune Agroecosystem Analysis to Support Decision-Making for Water Allocation for Fisheries and Agriculture in the Tonle Sap Wetland System”, was undertaken. The main aim of the project was to improve fisheries considerations in the CAEA process. This would facilitate better planning at the commune level in addition to identifying institutional and policy considerations. This included not only the biophysical aspects of fisheries but also the socio-economic, livelihood and governance aspects as well to ensure a holistic view of the main issues that need to be taken on board.

The revised CAEA adopted a more holistic approach through incorporation of fisheries variables and looking at land, water, livelihood and institutional issues that influence commune development planning.

A number of changes to the CAEA tools were made and subsequently field-tested in the four pilot CAEA exercises (in two communes that had an earlier CAEA report and two communes that had not).

Changes were of two main types. First, entirely new tools were introduced to address important water resource, fishery and livelihood issues not covered by the original CAEA tools. Second, existing tools were modified to better address key issues in a more complete or comprehensive manner.

Methodology development process

The methodology adopted in the project was based on a three-stage process:

- ◆ Stage one – screening and scoping
- ◆ Stage two – field-testing of the revised CAEA tools and methodologies
- ◆ Stage three – finalizing revision of the CAEA and highlighting management and policy implications

Each stage included a number of key activities.

Screening and scoping

Key variables and existing data collection systems in the context of the CAEA were reviewed and the range of additional fishery parameters needed to be considered in the CAEA were determined. The review was essentially of fishery parameters organized in the context of four components: (a) land and water resources; (b) fishery biology; (c) livelihood and governance and (d) integration across the first three sectors and disciplines.

The integration of all revised outputs led to the first revision of CAEA to enhance the integration of fisheries into agroecosystem analysis.

A stakeholder workshop was held to present the first results of the project and recommendations for integrating fisheries in agroecosystem analysis, in particular at the commune level. Workshop outputs further contributed towards refining the CAEA revisions proposed. The workshop participants were mainly government officials from the departments of Agriculture, Fisheries, Environment and Water Resources, NGOs, and the project partners and team.

Field-testing of the adapted CAEA

Selection of suitable sites was carried out using the following key criteria:

- ◆ Coverage of a wide range of agroecological zones
- ◆ Significance of fisheries in the commune
- ◆ Pairs of sites 'with vs without' implementation of CAEA.
- ◆ At least one site with significant irrigation development.

On the basis of the above criteria, four communes (in two provinces) were selected: Chamnar Krom (with CAEA) and Samproch (without CAEA) in Kampong Thom Province and Sna Ansar (with CAEA) and Sya (without CAEA) in Pursat Province.

To undertake a comparative analysis of the old and revised methodology, two of the communes selected had an earlier CAEA report and two did not. Both sites (where the adapted CAEA was implemented for the first time) were closely comparable with and had conditions similar to those of the communes where an original CAEA was carried out.

After each pilot testing in a commune, the CAEA manual was revised, incorporating the lessons learned during data collection and analysis. Revisions and recommendations were made on both the CAEA tools and the process.

After pilot testing was completed in the first two sites, a 'mini-stakeholder' workshop was held to reflect further on the revisions made in the first two rounds of testing and to discuss and obtain feedback from key stakeholders before proceeding to field-testing at the third and fourth sites that did not have an earlier CAEA report. Two key aspects were covered in this workshop: a review of the CAEA tools and the CAEA process.

Finalizing the revision of the CAEA and highlighting management and policy implications

A final stakeholder workshop was held, its main objective being to present and discuss the results from the CAEA field-testing in the four communes and discuss the revised CAEA manual. The extent of benefits to the commune planning processes, through the revised CAEA approach was explored. Steps to improve the institutionalization of the CAEA results in the commune development planning process were also discussed.

Tools and methods with emphasis on land, water Resources and fisheries

A number of spatial and temporal tools were applied during the RRA stage of CAEA to gather

information on land, water resource and fisheries at the commune level. In certain cases, a number of new tools were introduced. In other instances, existing tools were modified to better address key issues in a more comprehensive manner. The tools are:

Spatial analysis

- ◆ Maps and overlays
- ◆ Water-body attribute analysis matrix
- ◆ Fish species assessment table
- ◆ Water resource use matrix
- ◆ Flow diagrams
- ◆ Transect diagram

Temporal analysis

- ◆ Land and water resources management strategies
- ◆ Historical profile
- ◆ Seasonal calendar

Maps and overlays

In the old CAEA manual, true-to-scale sketch map layers for overlaying of administrative boundaries, land use, soil types, water resources, etc. were used to identify AEA zones. It was based more on diagrams and schemas than on maps. In the revised CAEA manual a specific checklist is provided with rivers, streams, boeungs (natural ponds or small lakes) and other important water resources (including main fishing grounds, places for fish refuge, feeding and breeding - thus showing much utility for fisheries considerations) and irrigation systems (functioning systems and those in disrepair) identified.

Water resource use matrix

This tool is used to improve understanding about the use of different water sources in the commune at different times of the year. It was included in the old 2007 CAEA manual but was not applied under this matrix form in the original commune reports. In the revised CAEA manual, a new template was used, with additional parameters on resource characteristics (water quantity, quality, productivity, reliability, equitable access) that are explicitly linked to the water body attribute analysis matrix (WBAAM) through water body types.

Flow diagrams

Flow diagrams are used to describe the flow of materials, money, information, labor, etc., between the different zones in the commune. In the old CAEA Manual, a range of visual representations were suggested, with a note that these are “equally valid, and selection should be made according to the preference and familiarity of the participants.” Minimal information on fisheries were included in these diagrams. In the revised CAEA manual, the flow diagram was split into two separate diagrams and color coding was introduced to present the up-down system hierarchy, flows into and out of the commune and zone-to zone interactions, including fish migration in wet and dry seasons.

Transect diagrams

Transect diagrams are used to describe and compare agroecosystems based on a list of physical and socio-economic parameters. Digital photos can be used to illustrate the ecosystems. Before the project, this tool included fisheries in terms of both land use and opportunities, but fisheries were only associated with the water resource zone

where wild fish were identified as a resource (not in other zones). Several issues and opportunities pertaining to this zone were identified, but other opportunities in other zones were possibly overlooked.

Land and water resources management strategies

In the old CAEA manual, land management strategies were developed for agroecological zones by using a template of land type, land use, strategy and technical elements by zone. The strategies were not provided in this form in reports; only identification of issues/questions/innovations was mentioned. In the revised CAEA manual, strategies for managing of water and fishery resources were added separately.

Conclusion

It is clear from the project results and analyses that the project has significantly improved the way fisheries, water resources and livelihoods are now addressed by CAEA. When comparing the new CAEA outputs and previous CAEAs conducted in the two control communes, it is apparent that the revised CAEAs reflect an emerging recognition of

the importance of awareness-raising and capacity development at the community level as compared with the previous narrower focus solely on agricultural production systems.

The insights gained by addressing fisheries, water resources and livelihood issues in the commune in a more comprehensive manner and the potential value of the knowledge gained in commune planning were key lessons. Awareness-raising and capacity development at the community level proved to be a key contributing factor, especially in the context of early endorsement and buy-in of the revised tools by national partners who then promoted these revised tools for use in other projects, that they were involved in.

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Key Reference

Sellamuttu, S.S., S. Mith, H. Chu Thai, R. Johnston, E. Baran, M. Dubois, M. Soeun, I. Craig, S. Nam and L. Smith 2010. *Commune agroecosystem analysis to support decision making for water allocation for fisheries and agriculture in the Tonle Sap wetland system*. CPWF Project Report. Colombo, Sri Lanka: CGIAR Challenge Program on Water and Food.
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