Integrated water resources management: the case of the Panama Canal Basin

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BACKGROUND

Panama, in the southern part of Central America, is a narrow land bridge connecting North America and South America. The Panama Canal basin (PCB) extends over the narrowest part of the isthmus, covering almost 334 000 ha. The manmade canal is the only waterway in the world draining into two oceans (Colley & Illueca, 2009). One of the world's richest biodiversity areas, the basin provides a variety of habitats for numerous biological resources, particularly forests and macroscopic fauna (CICH, 2007a). About 1.5 million people, almost half of the country's population, live immediately adjacent to the basin in the cities of Panama and Colon and in nearby areas, being directly dependent on the PCB for freshwater, hydroelectricity, flood control, etc. (TetraTech, 2010). In this area, the inter-oceanic transit of ships and conglomerate maritime services generated about 36.4% of Panama's GDP in 2000 (ACP, 2006a).

The PCB's hydrographic network is intricate, with about 47 rivers and three artificial lakes: Alhajuela, Gatun, and Miraflores – the last two are part of the navigation channel. PCB water is used for drinking water supply (7%), navigation (58%), power generation (2.5%), farming, industrial production, fishing and recreation, and scientific research (the remaining percentage). The estimated average annual volume of water stored in the Canal Basin is 4390 Mm^3.

The volumes used by the three main activities are:

(a) Navigation. The canal handles about 37 lockages daily, each requiring 191 000 m^3. This is approximately equivalent to about 7 Mm^3/day or 2580 Mm^3/year. This represents 58% of the average annual water production.
(b) Drinking water. There are seven water treatment plants: three in the province of Panama and another four in the province of Colón. These use about 325 Mm^3/year, just over 7% of total production in the PCB. In 2010 a water treatment plant in La Mendoza was completed and put into operation, to benefit about 200 000 people in the district of La Chorrera. This plant in its first phase has a capacity of 152 000 m^3/day; for 2017, it will increase to 227 000 m^3/day.
(c) Power generation. Power is produced in hydroelectric plants at Gatun and Madden dams. They use on average 115 Mm^3/year.

The remaining water is used in other activities or is discharged by spillways at Gatun and Miraflores (CICH, 2007a).

PCB management responsibility was assigned to the Panama Canal Authority (ACP) in 1997 (ACP was established in 1997; before that time, the Canal was administered by the USA's federal entity called the Panama Canal Commission, PCC). According to the National Constitution and Article 6 of ACP Organic Law, ACP is responsible for the administration, maintenance, use, and preservation of the water resources in the Panama Canal basin; as well as for the approval of strategies, policies, programmes and projects that may affect this area, and to coordinate the conservation of its natural resources. In 2000, an Inter-institutional Commission for the Panama Canal Basin (called CICH by its acronym in Spanish) was established. Its mission is to coordinate efforts and resources to promote sustainable development in the PCB, with the participation of stakeholders.

CHALLENGES

By the year 2000, ACP and CICH had available almost 100 years of hydrological data – most of which was registered under the USA's administration of the Panama Canal for strictly engineering

purposes (that is managing water quantity for lockages and energy generation). At the same time, PCB became part of the International Hydrological Program's cross-cutting initiative "Hydrology for the Environment, Life and Policy" (HELP). To fulfill their legal responsibilities regarding PCB management and sustainable development, ACP and CICH needed to complement high quality hydrological information with other available data, such as the baseline data gathered from 1996 to 1999 on forest cover, vertebrates, water and soils, and population issues. These research efforts were carried out through the Panama Canal Basin Natural Resources Monitoring Project (known as PMCC in Spanish) by the Smithsonian Tropical Research Institute (STRI), the National Institute of Renewable Natural Resources (known then as INRENARE, now the National Environmental Authority), and the auspices of the United States Agency for International Development (USAID) (PMCC, 1999). The project was extended into the year 2000, with administration of the Louis Berger Group to complete some sub-programmes initiated during STRI administration, regarding water, environment, social, and economic fields; and development of planning/implementing/evaluating tools.

Through several studies, priority issues were identified; they ranged from poverty, rapid growth of water demand for different uses to the absence, juxtaposition or contradiction in the legal framework, as well as the absence of long-term management planning and the lack of stakeholders' participation in water governance and decision-making processes.

In addition, it is worth mentioning that around the year 2000, the ACP also embarked in thorough studies to design the largest project in water use and management in the country: the Panama Canal expansion, a project of about US$5200 million, to allow the transit of Post-Panamax vessels. The term "Panamax" refers to the largest ships that can pass through the Panama Canal. Since the Canal works only with freshwater, management of the water resources is a central aspect in this project (ACP, 2006b).

WATER MANAGEMENT APPROACH

A PCB adaptive and collaborative approach to water management was designed, taking into account the priority issues stated above, the legal framework; the available hydrological information; the institutional structure established; and the local, national, regional and institutional conditions to:

(a) analyse the problems of a multidisciplinary nature to be resolved, while maintaining a systemic approach;
(b) formulate plans aimed at concentrating efforts and resources where the greatest impact can be produced on the PCB system;
(c) seek the co-ordination of public and private bodies in the co-funding of basin management projects;
(d) secure the active involvement of the community, aware of its own development, from the formulation right through to the execution of basin management projects; and
(e) establish mechanisms for follow up, evaluation, and continuous improvement in PCB management.

RESULTS

As of 2010, some results from efforts made include: establishment of a community participation structure; design of sub-basins' participatory assessments and implementation of short-term action plans; development of pilot sub-basin management programme in priority areas (CICH, 2007b); and design of a long-term sustainable development and integrated water management plan for the PCB (CICH, 2009) (see Fig. 1).

In advancing the IWRM at the PCB, key lessons learned to date include (Colley & Illueca, 2009): (i) an appropriate governance structure for effective coordination and cooperation is essential to achieve sustainable integrated basin management, and cooperation is fundamental to

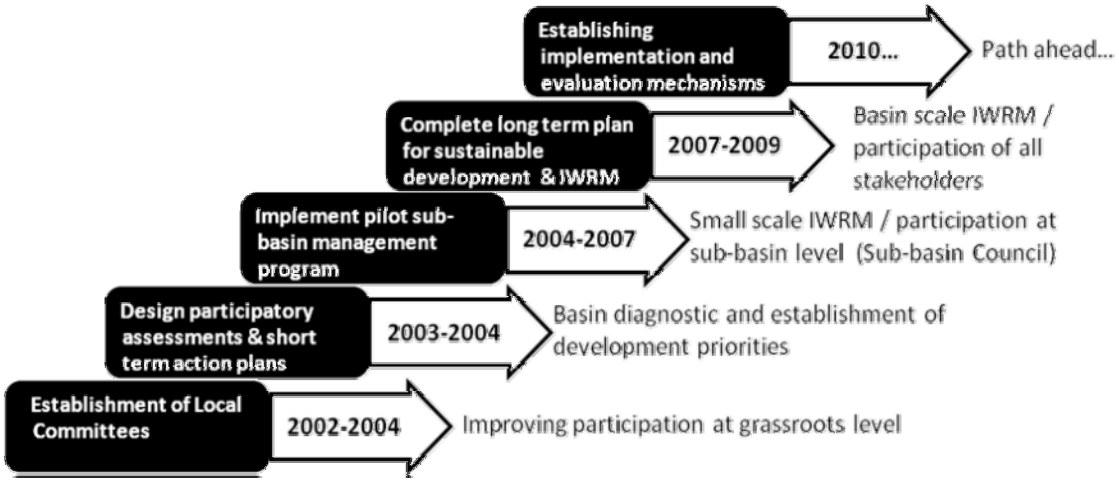

Fig. 1 Integrated Water Resources Management approach at the Panama Canal Basin.

creating synergies and avoiding undesired duplication of efforts; (ii) political will to establish governance over freshwater resources is essential, with policies and projects given governmental priority being in a much better position to succeed; (iii) sustainable basin management plans can only succeed if implemented and adjusted based on local experience; (iv) institutional behavioral change is generally a slow process achieved only with time and persistent effort; (v) a solid diagnostic study of the status of a basin, based on reliable scientific and technical information and data, is critically important for designing a solid, ecologically sound integrated basin management plan and strategy; (vi) protection of existing, intact, vegetative basin cover remains the best, lowest-cost option for any management programme; (vii) actions with direct financial or material benefits to key players will be most likely to succeed; (viii) best practice is to implement integrated management plans at the sub-basin level and build on small successes; (ix) it is necessary to monitor and evaluate the effects of an integrated water management plan, using a clear set of environmental indicators designed to determine whether actions are achieving their goals; and (x) IWRM must be based on principles that link the basin strategy to broader development goals, and national and regional development planning processes that aim at alleviating poverty.

CONCLUSIONS

The Panama Canal basin is a complex territory upon which most of the social and economic well-being of Panamanians rely, as well as about 5% of the world maritime commerce (ACP, 2006b). Ensuring its permanence and sound use of its resources is a critical task that must be accomplished by all stakeholders; from water managers and policy-makers, to the scientific community and local inhabitants. To fulfil such responsibility, a collaborative–adaptive approach to IWRM has aided shaping the Panama Canal strategy through 10 years. Since 2000, most significant transformations in the Panama Canal basin reflect the advancement in attaining integrated solutions that endorse the HELP principles (HELP, 2010): making scientific knowledge a tool for designing, implementing, measuring and sharing user-driven solutions (policy, plans, programmes, projects, etc.), tailored to local conditions.

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