Case study titled
Panama: Restoration and Integrated Management of the Rio Zarati sub-basin

Description
Ecosystem restoration processes have been made possible through the strengthening of social organizations as well as through changes in attitudes with regards to local environmental issues. These processes include the restoration of degraded areas, primarily of those located in recharge areas for water infrastructure (potable water plants and rural aqueducts), environmental investments, environmental businesses and environmentally-friendly practices in the sub-basin's productive activities which serve as a tool for integrated water resource management.

Some of the lessons learned include that bottom-up methodologies with a participatory focus such as the Participatory Rural Diagnostic (Diagnóstico Rural Participativo -DRP) empowers the communities and allows them to take ownership of project execution processes while also allowing them to become familiar with the socio-environmental problems in the intervention area; Solutions which offer environmental goods and services as a business opportunity helps to awaken community interest, because aside from conserving and restoring, these activities can generate income in order to improve the population's quality of life. The impact of a campaign increases if it is followed by concrete action, which can be, for example, the installation of biodigestors, which reduce the contamination of water sources after a clean production campaign.

The case is important for IWRM because it considers active participation by the community and local authorities. Key local actors have identified their problems, proposed possible solutions and routes to follow, and have implemented environmentally friendly practices for the conservation and restoration of the sub-basin in order to achieve integrated water resource management.

Primary tools:
C5.2 Consensus building, C8.2 Raising public awareness

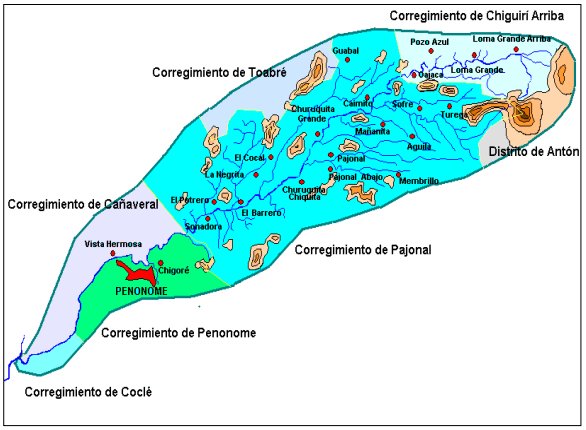
Key words: *Basin management, community participation, basin restoration*

Case Introduction

The Rio Zaratí sub-basin is part of the Rio Grande basin, Basin 154, which has a drainage area of 138.3 Km^2 and a maximum elevation of 1,173 meters over sea level; it is located on the Pacific drainage system, in the Coclé province, within the Penonomé district. The sub-basin is experiencing a gradual degradation process in its soils and environmental quality, generated by o intervening areas which generate accelerated erosion and carry sediment towards water course, thus contaminating them.

According to the 2000 population census, the sub-basin has a population of 22,475 which is dedicated primarily to agricultural and cattle-raising activity, poultry-keeping, pig-raising, and the production of handicrafts.

The sub-basin is of vital importance for the Coclé region, constituting one of the primary water supply sources utilized for human consumption and for agricultural, cattle and agro-industrial activities. It is made up of the Cañaveral, Penonomé, Pajonal, Toabré, Chiguirí Arriba and Coclé provinces in the Penonomé district, and the San Juan de Dios and El Valle provinces in the Antón district.



Río Zaratí sub-basin
Source: Autoridad Nacional del Ambiente, Dirección de Gestión Integrada de Cuencas Hidrográficas.

The Project of Integrated Management of the Rio Zaratí Sub-basin (Proyecto Manejo y Gestión Integrada de la Subcuenca del río Zaratí) was initiated in 2006 and is made up of the following modules: Reforestation and basin restoration, community organizing, cleaner production, local capacity strengthening, agroforestry and farm improvement.

The project goals are to contribute to the regulation of water flows and to the conservation of good quality water in the sources, which supply the rural aqueducts, the water treatment plant and the irrigation systems.

In its low areas, the Rio Zaratí supplies water demand for the mighty city of Penonomé and its surroundings, which include more than 30,000 inhabitants. This is accomplished through the modern water-treatment plant, which began to operate on September 2, 2006. In the high areas, the small water courses that flow into the Rio Zaratì and the Rio Zaratí itself supply the area's communities, which include more than 20,000 inhabitants.

The Zaratí sub-basin has been the scenario for the struggle of the communities to secure their water sources. This has resulted in the creation of the Cerro Turega Water Reserve and the Cerro Cucuazal Water Reserve by means of a municipal decree. These reserves protect the water sources of the aqueducts that supply the local communities.

Due to the interest expressed by communities on water topics and the need to guarantee water for the city of Penonomé and irrigation systems for agricultural and cattle-related activities using sub-basin waters, the implementation of the Project for the Restoration and Integrated Management of the Zaratì Sub-basin has been launched under the leadership of the National Environmental Authority, the communities, the local government, educational centers and business sectors in the region.

2. The problem

The increase in the population's vulnerability in terms of their productive and recreational activities that use Rio Zaratí waters is the central problem to be resolved in this important basin of the Republic of Panama.

In fact, the Rio Zaratí is widely used by the city of Penonome's population as a water source for municipal use. The river is also nationally and internationally recognized by Las Mendozas, which is visited by thousands of bathers, especially during the dry season and in the celebration of the traditional aquatic carnivals of Penonomé. The latter provides important income to the municipality and local communities.

The waters of Rio Zaratí have ample importance in local and national agricultural production since they supply irrigation waters for the production of many horticultural products, basic grains and local cattle production. Waters south of the sub-basin are located in an agricultural region, which includes "LLanos de Coclé", which is made up of extensive plains dedicated to rice production, cattle ranching and sugarcane cultivation. The LLanos de Coclé makes up a traditional agricultural region of excellence, which receives waters from the Rio Zaratí, which flows on to the Rio Grande. This is where the impacts of management and environmental problems of the Zaratí sub-basin are evident.

However, the Rio Zaratí's extraordinary importance for the economy and regional social development is subject to a slow and accumulative process of water contamination as well as the alteration of the basin's water discharge regimen. This is evidenced by the sequence of extreme risings during the rainy season and acute reductions in water levels during the dry season.

As an example, the Hidrométrica Murcielaguero station, which registers the Río Zaratí water volumes, relies on a 22 year-old printed information registry (1968-1990). In this period, the station registered an instantaneous maximum volume of 391 m^3/s in October 1975, and a minimal instantaneous volume of 0.446 m3/s in April 1987. The average volumes registered are of 6.19 m3/s which generate an annual volume of 195,2 million m^3.

The slow contamination of Río Zaratí is caused by sediments, residual solids, residual waters and agrochemical substances which originate in places where human activity is carried out without effective measures or practices to control erosion and properly manage the disposal of residuals in their diverse forms. All of this together has led to the loss of the river's water quality and the alteration of its seasonal water volume cycles.

As a result of studies carried out by the Universidad Tecnológica de Panamá, UTP, the levels of contamination are higher than acceptable limits. In some critical parts of the sample, bacterias such as *Citrobacter intermedius*, *Edwarsiella tarda* and *Escherichia coli* were found, among others. This contamination is worse in the lower part of the river where residual waters from Penonomé are directly discharged.

The production of chickens and eggs, pigs and small-scale cattle, along with fruit trees and vegetables and nurseries, which use agrochemicals in abundance, also increase the contamination of the soils and surface and subterranean waters.

It should be noted that the users of the Rio Zaratí low waters, including those in the city of Penonomé and the LLanos de Coclé region, are located climatologically in the *"Arco Seco"* area of the Panamanian isthmus. This is a sub humid region with rainfall less than a thousand millimeters annually which is plagued by recurring seasonal droughts. The various episodes of "El Niño" caused serious shortages of water to the communities, which also resulted in losses for the bovine population, and substantial decreases in agricultural production.

Decisions and actions

In the surroundings of the Cerro Turega and Cucuazal, where several water sources that supply the water systems originate, a strong battle for the conservation of water sources was fought.

The population was mobilized in face of uncontrolled and irresponsible deforestation carried out by some of the inhabitants in the outskirts of these hillsides. In anticipation of the imminent extinction of these springs, they requested the intervention of municipal and national authorities

on repeated occasions in order to preserve the forests adjacent to the water recharge areas of this important water courses.

This mobilization brought its results and one of the initial actions taken was legal protection in the recharge zones for these water sources, which supply water to communities in the high area of the Zaratí sub-basin. With the municipality's support, local NGOs and the Autoridad Nacional del Ambiente (ANAM) helped create two Water Reserves: the Cerro Turega Water Reserve, with 602 hectares and the Cerro Cucuazal Water Reserve with 294 hectares. This was accomplished through the Municipal Agreement number 003 reached on March 31, 2005 and the Gaceta Oficial number 25,297 formalized on May 12, 2005 by the Municipal Council of Penonomé.

In support of the activities taken at the local level, the ANAM developed a diagnostic study and a project proposal for the protection of the Río Zaratí sub-basin. On January 30, 2006 the mayor of Penonomé presented a request to the President for a restoration and integrated management project for the Zarati sub-basin, which would respond to the necessity to protect this river that has economic significance and is an integral part of the historical and cultural patrimony of this region.

After the creation of the water reserves and the inauguration of the new potable water plant for the city of Penonomé, the relationship and activities among the local forces intensified around the topic of the Zaratí basin's conservation.

The protection and rescue of the river is precisely the goal that a group of men and women have decided to achieve. In concrete terms, this means that regional organizations integrate their efforts in order to reverse the river's degradation level. These include the Autoridad Nacional del Ambiente (ANAM), the Alcaldía de Penonomé, the Martínez Hermanos, S.A. (MARHESA) group and the Ángel María Herrera School that contribute to this effort through their own independent actions.

Nursery in the El Guabal community

The National Environmental Authority, with the support of the communities, carried out a situational participatory diagnostic of the sub-basin and launched awareness-raising activities for the population on the topics of conservation, self-management and sustainable development.

In 2006, the Restoration and Integrated Management Project of the Río Zaratí sub-basin was started with the goal of contributing to the improvement of the water resource both in quality and quantity in the water sources that supply the water systems and the potable water plant.

Upon completion of the Restoration and Integrated Management Project of the Rio Zaratí sub-basin, the conditions will be established such that water supply and collection areas in the rural aqueducts will be reforested and protected. This will affect the regulation of water volumes and result in substantial reduction of sediment flows to the river.

The adoption of clean production practices that ensure water quality will be promoted throughout the project.

3 Results

Expected results and actions:

Below are some of the achieved results:

- 60,000 hectares have been reforested with native species and fruit trees along water sources, individually owned farms and in gallery forests.
- The inhabitants from the high, middle and low regions of the sub-basin have been trained in agroforestry practices, nursery management, the elaboration of organic fertilizer, marketing and development of projects, gender and environment, the development of flour products, production of bamboo in nurseries and the construction of bamboo furniture.
- The establishment of the Zaratí environmental cooperative for multiple services in which members of the Project from 4 communities participate (Sofre, Caimito, Oajaca, Guabal).
- A biodigestor has been installed in the Caimito School which will help save electricity and gas while at the same time serving as a learning tool for the local communities and other national and local organizations.

Among the expected results are:

- To protect the sub-basin with the use of environmentally-friendly practices.
- To achieve local consciousness in the sub-basin population regarding their rights and responsibilities as citizens and protectors of the sub-basin.
- To promote the importance of joint work and integral, participatory and a gender equity approach decision-making process.
- To promote the participation and the support of governmental institutions, private industry and organizations based on IWRM.

Theory and practice training about parcel reforestation with bamboo

In order to initiate the actions in the sub-basin a Participatory Rural Diagnostic was carried out and was applied in the high, middle and low sub-basin region. 1,000 questionnaires in homes within the entire sub-basin were conducted with the objective of becoming familiar with the area's problems.

The results highlighted the lack of base organizations, a lack of communication among the sub-basin actors, and a lack of knowledge about environmental regulations, among which is Law 44, which established the creation of the basin committees.

In light of these results, awareness raising workshops were held along with workshops on leadership, motivation, organization, community organizing, environmental laws, cleaner production, gender and environment, business administration, business and environmental investment, *Guadua angustifolia* production and guadua furniture building, among others. Trips and meetings with producers were also carried out on different successful projects, which have conducted work with biodigestors and organic fertilizer production.

Partial view of the Río Zaratí. A basin inhabitant with the traditional "sombrero pinta'o"

At the same time, a logical framework and action plan was developed which prioritized the reforestation of gallery forests, the installation of pipe connections and the improvement of farms with more than 60,000 types of native and fruit species in the El Guabal, Caimito, Oajaca and Sofre communities, among others.

An important result to date has been the creation of the "Cooperativa Agroforestal de Servicios Múltiples del Zaratí" COOMUZA, made-up of sub-basin community members. Its principal objective is to

produce and market environmentally-friendly products. This will achieve the unification of small agricultural and artisan communities with an environmental consciousness in a company that hopes its products expand beyond local and/or national borders.

Since they are artisans, they have been trained in the cultivation and construction of guadua (*Guadua angustifolia*) bamboo furniture. In the same manner, training has been carried out for the making of fruit preserves and local products depending on the area's agricultural conditions.

In the training and cooperative organizing actions, other institutions have become involved such as: the Instituto Autónomo Cooperativo (IPACOOP), Autoridad de la Micro y Pequeña Empresa (AMPYME), the Ministerio de Desarrollo Agropecuario (MIDA) and the Ministerio de Educación. These have helped achieve the interaction of other institutions in IWRM.

Among the factors that facilitated the results achieved is the community interest in protecting the basin. This was demonstrated through their struggle to create the water reserves (Reservas Hídricas) and through the cohesion of the local artisans in the production and conservation of their raw materials as well as in the commercialization of their crafts. The institutional interest in the conservation of the basin through the Penonomé city potable water plant was also important.

Another contribution was the support of the ANAM technicians, who, for two years, sustained a working relationship with the communities involved in the project.

Among the primary barriers is the fact that there is no territorial regulation or basin management plan to guide basin management interventions and also an absence of socio-environmental studies focused on the area. The work was carried out through the accumulated years of local experience among the technicians in the Autoridad Nacional del Ambiente. This generated confidence in the community people and facilitated the development of the activities. Some institutions became more involved and worked on agreements in order to achieve success in the project.

Among the other limitations identified are: The absence of community-based organizations oriented towards environmental conservation and the absence of dialogues and communication among the basin stakeholders. In addition to these limitations were the lack of knowledge related to environmental regulations and natural resources as well as the lack of conceptualization of the water basin as a planning and work unit for the area's protection.

As a result, the work that lies ahead is to consolidate actions and continue with the development of agreement on a work plan, which will be the result of participatory planning by its members. This will be based on the region's reality and with an IWRM approach.

In order to be able to take action, the community's will to contribute to the efforts was key, along with the previous work experience with communities and the local technicians' expertise in the development of participatory processes and the implementation of activities approved by the community.

To date, important objectives that were initially proposed have been met. These include the implementation of reforestation activities in the high basin communities and the development of skills among community inhabitants through theoretical and practical courses related to furniture-making, baking, confectionery, etc. The goal of these activities is reducing the pressure for the use of natural resources in the aquifer recharge area.

Due to the initial interventions in the high area of the Zaratí, the Autoridad Nacional del Ambiente has developed a project for basin and water resource management. In this project, an area profile has been developed to ensure the project's continuity and the management of resources for additional interventions.

This action, which was initially led by the communities and the Autoridad Nacional del Ambiente, currently receives institutional support from the Instituto Panameño Autónomo de Cooperativas, IPACOOP, Ministerio de Desarrollo Social, MIDES, Ministerio de Desarrollo Agropecuario, MIDA, Ministerio de Economía y Finanzas, MEF, Autoridad de la Mediana y Pequeña Empresa, AMPYME, Universidad Tecnológica de Panamá, UTP, la Universidad de Panamá, UP and the Ministerio de Educación, MEDUCA, among others.

All sectors have benefited from the actions that have been implemented. Among these are primarily the sub-basin community's inhabitants, the artisans, the city of Penonomé and neighboring population centers and the farmers and cattle ranchers of the basin area and of the basin's low waters. However, the city of Penonomé's community leaders and recreation area land owners should become more deeply involved in the execution of the project.

The project's financial resources come from the Central Government. $183,200 U.S. dollars have been invested in the three years the project has been active. This is an average of $61,000 dollars per year.

External funds have not been identified for the development of the project although they are needed.

Considering the participation of inhabitants in the Project execution areas, including their work in the preparations and nursery management for reforestation activities, we believe that the resources have been used efficiently.

4 Lessons learned and replicability

The lessons learned through the experiences in the Zaratí sub-basin are:

- It is necessary to establish institutional collaboration mechanisms with communities that have a priority to develop IWRM-related activities.
- It is necessary to create institutional collaboration and coordination mechanisms with the municipalities and local governments, which have a priority to address problems related to IWRM.
- The IWRM activities should be harmonized with the needs and productive activities of the community and basin users so that local actors accept them.
- The implementation of IWRM activities is facilitated by the participatory development of a basin management plan.
- Community participation in the development of work plans and diagnostics prior to the execution of the Project has been key to achieving results.

In order to implement the IWRM focus, it is important to integrate all actors who have activity within the sub-basin, since, without this, an authentic integration of actions is not possible. This can be achieved in the region through community activities which encourage promotion and

agreement-building actions and through the definition of actor responsibilities according to their needs, aspirations and interests.

When work is carried out diligently, efforts to improve quality of life are more effective to assisting the achievement of the defined objectives. In the high areas of the Río Zaratí sub-basin, the interest in conserving water has helped its inhabitants to conserve existing vegetation cover and also implement reforestation activities, etc. This has promoted a greater environmental consciousness in other topics such as the protection of raw materials for the creation of crafts, for soils, etc. With this basis, technical support by institutions with environmental responsibility in the area has become more efficient.

The actions in the upper part of the Zaratí basin have resulted in the development of an agreement and coordinated work model in the area. One example is the creation of the Cooperativa de Servicios Múltiples del Zaratí, through which these efforts have been highlighted at national and local level.

The historical, environmental and socio-cultural similarities in the sub-basin have facilitated the joint participation of the communities. The implementation of the actions was based on participatory methodologies for integral planning within a local context, in order to identify problems and priorities and to visualize opportunities for future action.

Each of the trainings and actions that are carried out are based on the consensus with community groups where other actors were involved. These include the authorities and small local businesses with which existing differences were able to be reconciled and which could work together to resolve environmental problems. This facilitated the creation of environmental businesses such as the production of organic fertilizers and agroforestry farms.

The fact that women, men and their children participate in workshop seminars and proposed work shows that gender matters on this topic.

The case of the Zaratí sub-basin is seen across the continent. Many communities cry out for a solution to their water supply problems, especially since “financing resources are scarce”, other priorities exist and the institutions do not support them.

The case of the Zaratí sub-basin is an example of what can be achieved with IWRM with a low budget when affected communities, local government and institutions with environmental responsibilities join forces.

The Río Zaratí experience is replicable in other regions where their inhabitants have a genuine interest in the conservation of their water sources and have the consciousness for the need to protect and conserve raw materials for the generation of income. The minimum condition necessary to reproduce this experience consists of the inhabitants’ ability to organize themselves in order to protect and conserve their water and production resources. It also requires the institutional and local government disposition in order to address, accompany and resolve the population’s requests.

- **The importance of this case study to IWRM**

This case is important to IWRM because it is based on the joint work of the communities, institutions with responsibilities related to the environment and water issues, educational centers and local government.

The case shows that these joint efforts create the possibility of regulating environmental degradation which many times is considered irreversible. This includes the advance of deforestation in ecologically critical areas such as in water recharge areas (Cerro Cucuazal and Turega). This example has also contributed to the increase in vegetation cover in the community's water recharge areas.

Despite the fact that each of the actors involved has their own interests, the case suggests that there is a need to act in harmony and in agreement. This is done by defining common activities for basin conservation and providing equitable access to opportunities through environmentally-friendly practices, which affect the population's quality of life.

The case is important for IWRM because it considers active participation by the community and local authorities. Key local actors have identified their problems, proposed possible solutions and avenues to follow and have implemented environmentally-friendly practices for the conservation and restoration of the basin within a social water culture, which embraces integrated water resource management.

5 Contacts, references, organizations and people.

Author:
Jaime Johnson, consultant, Panama, Panama City (507) 6695-5923,
jjohnson04077@yahoo.com.

References and websites

- *mensual.prensa.com/mensual/contenido/2005/08/20/hoy/nacionales/314161.html* La Cruzada por el río Zaratí.
- *burica.wordpress.com/2007/12/03/rechazan-hidroelectrica-en-rio-**zarati**/ - 70k -* Rechazan Hidroeléctrica en el río Zaratí
- *www.lacoctelera.com/**zarati**/post/2006/06/19/leyenda-del-**zarati** - 27k -* La Leyenda del Zaratí;
- *mensual.prensa.com/mensual/contenido/2007/01/05/hoy/nacionales/850455.html –* Autoridades investigan la tala de árboles en el Zaratí;
- *es.video.yahoo.com/watch/772783/3301190 - 77k – Río Zaratí Erosión;*
- *www.gwptoolbox.org/index.php?option=com_case&id=215&Itemid=41 - 23k -* Panama: Restoration and integrated management in the Zaratí river;
- *pollos.conectate.gob.pa/servlet/SBReadResourceServlet?rid=1221577799578_1703207976_308&partName... - 9k -* Carnavales Acuáticos;
- *cathalac.org/index.php?option=com_search&searchword=iniciativas - 44k -*

Centro del Agua del Trópico Húmedo para América Latina y el Caribe.

Organizations and people

- Mr. Genoveva Quintero, Coordinator, Zarati Sub-basin Integrated Management Project, ANAM, Direction of Hydrographic Basin Integrated Management, (507) 500-0868; g.quintero@anam.gob.pa Building 804, Albrook, Panama.
- Mr. Pablo Medina, President, Cooperative of Multiple Services, COOSMUZA
- Mr. Sabino Morán, Vice President , COOSMUZA, Oajaca community.
- Mr. Silverio Ovalle, inhabitant of the Sofré community, Penonomé, Coclé Province.
- Mr. Olmedo Apolayo, inhabitant of El Guabal community, Penonomé, Coclé Province.
- Mr.Juan Jaén, Coordinator, Hydrographic Basins, ANAM. Coclé Province, tel.(507) 997-98 05; juanjaen@hotmail.com
- Ms. Marta Ramírez, Head of Water Resources, ANAM. Coclé Province, tel. (507) 997-98 05; m.ramirez@anam.gob.pa
- Mr. Pablo Medina, President, COOSMUZA .

Contact
Ing. Genoveva Quintero g.quintero@anam.gob.pa