



Payments for hydrological Ecosystem Services in the Gil González Watershed – A Public-Private-Partnership Case Study

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1. What was the problem?

The Gil González watershed is located in the southwest of Nicaragua, forming part of the Rio San Juan Basin, the largest basin of Nicaragua. The Gil González flows from west to east with a length of about 25 km ending at the Lake Nicaragua, which represents the greatest freshwater reservoir of Central America. The watershed has a moderately high population density (about 65 inhabitants per km^2 ; INIFOM, 2011), that are unequally distributed through the whole watershed. While the lower part is more densely populated and agricultural production is more intensive, the upper part is characterized by dispersed settlements of mainly poor farmers, few infrastructural development and predominantly subsistence agriculture. In the last decades, large parts of the upper watershed area have been deforested predominantly by small farmers who cultivate corn, beans and rice on a subsistence level. Extensive cattle ranging is practiced as a means to diversify farm income. The more fertile lowland areas are cultivated by richer farmers who cultivate sugarcane, rice and plantains. This translates into a situation where the more disadvantaged part of the population is forced to cultivate in the upper watershed areas due to higher land prices in the lowlands. Thus, fragile soils and ecosystems of the upper watershed areas are damaged resulting in reduction of infiltration rates and therefore reduction of river discharge and lowering of the groundwater table, soil erosion, and contamination of river system by animal faeces.

Any introduced change in existing production systems of poor farmers to more sustainable system would result in additional costs for a largely marginalised population group. Empirical data, based on hydrological assessments of individual watershed areas with different land uses and measurements of water tables of local

wells (CIRA-UNAN, 2007; Hack, 2010; Hack, 2011), indicate the observed forest conversion in the upper watershed area has decreased river discharge and deteriorated water quality.

2. Which ecosystem services were examined and how?

When examining the ecosystem, the project considered the provisioning services of freshwater in terms of water quality, quantity and especially timing of flow. The water has the highest value at the end of the six month long dry season. In this context, especially the role of shrub vegetation, secondary forests and dry tropical forest cover for water infiltration into the ground and as a regulator for torrential precipitations in the rainy season was investigated.

This initiative evolved in the frame of the process to update the strategic development plan of the municipality of Belén (Department of Rivas) incorporating elements of participatory land use planning and watershed management. In one of the first methodological steps, the existing river systems and watershed areas were prioritized regarding its importance for the rural and urban population for drinking water and agricultural production. Also their ecological function regarding the Nicaragua Lake was taken into consideration. As a result of the process, the Gil González watershed system was chosen as the most important mainly due to the fact that the urban population of Belén derives its drinking water supply from this river system. Furthermore the Gil González provides agricultural plantations, sugar cane and rice producers with irrigation water.

In this second step, using GIS technology, a satellite image from 2005 was interpreted to determine land use in the municipal territory on a scale of 1:50,000 (INTELSIG, 2008). Additional information on land uses in the recent three decades was retrieved from aerial photographs of the project site. This land cover information was overlapped with soil type information, hang slopes and geological features in order to determine land use conflicts. These materials were used to identify and classify hydrologically critical areas of the watershed. The source areas of the headwaters as well as riparian areas of the main stream and its tributaries were prioritized for protection. Within the Gil González watershed, also areas of moderate and severe land use conflicts were determined which would be the areas where conservation, land cover recuperation and soil conservation measures should be implemented in order to promote future rainfall infiltration rates.

Parallel to this process the Centre for Aquatic Resources (CIRA –UNAN) was involved in establishing a baseline for the monitoring of river discharge volume and water quality (CIRA-UNAN, 2007).

The identified areas in the Gil González watershed with land use conflicts, allowed the rapid identification of rural community settlements and farmers who work on these overused areas. Within the selected local community a broader participatory land use zoning process was initiated and norms of sustainable use were agreed upon. Finally the concept of a payment for hydrological ecosystem services scheme was introduced with the support of the local municipality (Flores Barboza et al., 2011).

In conclusion, the project approached the development of the payment scheme with the question how much money they would have to pay to recuperate over-used land

in the upper part of the watershed area and how much has to be paid to protect the still intact dry forest remnants and gallery forests.

Together with the local population the price to pay for each soil and forest conservation measure was negotiated. The project orientated the payment scheme on the opportunity cost each farmer would incur if he left out of production 1 ha of his farmland. Or, put otherwise: how much money would a farmer receive if he rented out a 1 ha big land parcel to another farmer for agricultural production. A study executed in Belén to determine land prices concluded that the medium land rental price per ha in the middle and upper watershed is US-\$ 36/ha/year.

The following table shows the list of interventions for which farmers received remuneration in cash and remuneration in kind:

Conservation measures	Description of measure	Payment / remuneration
Conservation of existing forest		36 USD/ha/year
Recuperation Measures		
Expansion of existing forests		36 USD/ha/year
Expansion/recuperation of gallery forest	In a period of 4 years every farmer had to plant annually at least 300 trees in a 50 meter stretch from the river bed until a 200 meter broad stretch was reached (established by the Environmental Law to protect forests along rivers)	36 USD/ha/year
Establishment of complex fences	The participating farmer had to dispose the vegetative material and establish the living fences.	The National Forest fund paid an additional 0,5 USD for each tree established. In addition every farmer received: a) barb wire in order to protect forest from cattle grazing b) different type of fruit tree seedlings
Additional Measures Required to receive full payment:	Establishment of fire protection lines around forests ("Rondas") Removal of dead wood material in forests in order to avoid forest fires Participation of land users in technical workshops with topics demanded by farmers	

Table 1 – Summary of conservation measures and respective remunerations

Every farmer who wants to take part of this payment scheme arrangement had to sign a formal contract, in which the mutual agreements and obligations were formally established. Participating farmers only received payments after a technician of the technical project committee had visited and evaluated the accomplishment of the agreements.

The focal groups with the local communities resulted in a very high demand to participate in the payment scheme. However due to a limited financial volume of the fund initially, the project had to limit the number of signed contracts to those farmers who still had forest areas on their farmlands, and focus on those who were working in areas which required an urgent regeneration of vegetation cover.

At the beginning of the implementation of the payment scheme it was required that interested farmers must present registered land titles (legal property rights) since a legal treaty between service buyer and service provider had to be signed to ensure mutual commitment. This circumstance limited participation of land users as service providers to a certain extend. However, the Nicaraguan land tenure scheme is more than complex due to the Agricultural Reform in the 1980s and the confiscation of lands to former land owners. After 1990 land owners from before the Agricultural Reform are to be remunerated for these land confiscations. The Agricultural Cooperatives who received the confiscated lands never received formally and legally registered land titles. After 1990, many agricultural cooperatives disintegrated and many cooperative members started to sell their part of the land to other farmers. In cases where the original land owners who have not been financially compensated by the national government, reclaim their lands from the cooperative members or the farmers who bought these lands from them, the situation becomes legally rather complex and conflictive. Due to this situation, the project had to switch its strategy. Initially it achieved with the number of farmers with registered land titles only 105 ha, far too low in order to have a considerable impact on water production. Therefore, the project decided for a more flexible model in which farmers who presented a formal statement from the cadastral department of the municipality that no land claims from third parties exist, were able to take part. After 2008 the number of participating farmers increased continuously.

The following table reveals how the number of participants and conservation area increased since 2008 (first year of payments):

	2008	2009	2010	2011	2012	Total
No. of contracts	29	-1	+10	+60*		98
No. of farmers	29	-1	+10	+55*		93
Male farmers	21	-1	+ 8	+45		73
Female farmers	8		+ 2	+10		20
Ha of conservation forest	105	+ 3	+72	+332	-5	507
Km of complex fences	0	0	+36	0	+3	39

Table 2 – Evolution of project participants and conservation measures from 2008 - 2012

*Some farmers submitted different land areas to the payment scheme. That is why one farmer can sign for several contracts.

The deteriorated water quality has negative economic consequences for the downstream water users, particularly for the privately owned sugar company CASUR. The company cultivates sugarcane on 54 km² along the shore of the Lake of Nicaragua from which it produces sugar, molasses and energy. It is the biggest water user of the region. (INIFOM, 2011). 10 km² of the total cultivation area are located within the lower part of the Gil González watershed. About half of the sugar

production is exported (<http://www.casur.com.ni>; last accessed on 28th September 2012). With 1,600 direct and several thousand indirect employees, the company is also an important employer for the region. The sugarcane production is strongly dependent on the water available for irrigation during the dry season.

The increasing water scarcity, the decreasing river flow and groundwater tables, together with the deterioration of water quality and the possibility to improve its image as an environmentally and socially responsible firm, were convincing arguments for the company’s board of directors to invest in the upper part of the Gil González watershed to improve the hydrological service provision. This investment resulted in the establishment of a payment for hydrological ecosystem services scheme, arranged as a Public-Private-Partnership (PPP) project between the German Development Cooperation (GTZ, now: GIZ), the Local Government of Belén and the private sugar company CASUR.

3. Did the examination of ecosystem services generate impacts on decision-making or policies and, if so, how?

The payment scheme and funds are supervised and monitored by a multi-stakeholder management committee, which is composed of representatives of the local farmers who participate actively in the payment scheme (service providers), the service buyer (Sugar company CASUR and the municipality of Belén) and the German Development Cooperation (as facilitator or honest broker). With the engagement of service providers and buyers as part of the management committee a greater ownership, transparency between different actors and the general public as well as increased trust among the stakeholders could be achieved (Flores Barboza et al., 2011). The service buyer, at the moment only the sugar company, pays annually a fix amount for the use and conservation of the hydrological service into a project fund and service providers receive an annual payment for taking their formerly cultivated land out of production and instead reforest and conserve the forest. At the moment 200 hectares are under protection and payment amount is about 36 US-\$ per hectare and year. An annual average rent of land on a per hectare basis as described above was used as reference to define the initial amount of the payments. The municipality of Belen, another service buyer (the drinking water of the urban center of Belen depends on the intactness of the Gil González watershed), contributed an amount of 12,000 (2008 and 2009) and 9,741 (2010 and 2011) US-\$ per year which was provided by the instrument of local subsidies of the German Development Corporation (see table below for financial contributions to the project).

Year	CASUR	Municipality of Belén	GIZ	FONADEFO (Governmental forest fund)	INAFOR-FAO-Facility	Total
2008 and 2009	48,000	12,000	52,000	0	0	112,000
2010 and 2011	30,000	9,741	35,000	20,000	10,500	105,241
2012	33.139,02	7826	8175,63	350	-	-
Total	111.139	29.567	95.176	350	20000	10500

Table 3 - Financial contributions of water users and donor agency (US-\$)

The Payments for Ecosystem Services (PES) process was an important means to initiate a dialog among different public and private actors at local and regional levels such as up- and downstream land users, people in rural and urbanized areas and the local government. Before, no open dialogue existed between the municipality and the sugar cane producer. Mental blockades on both sides had to be dismantled in order to create a constructive negotiation bases. The sugarcane company CASUR had to struggle before with a negative image regarding environmental standards due to the practice of burning harvest residues and cutting trees in order to fuel their sugar production process.



Figure 1 - Session of the management committee

After having discovered common interests on the side of the stakeholders involved, the continued moderated dialog made an institutional arrangement between the stakeholders finally possible. The management committee for the watershed was constituted and plays now an important role in the development and implementation of sustainable land management plans that consider protection and cultivation zones. Also, the committee structure guarantees the selection of participating farmers based on scientific criteria (e.g. farmers possess land in areas formerly identified as hydrological sensitive and are willing to apply corresponding conservation measures) avoiding the introduction of political elements and allows for a transparent monitoring of farmer's compliance with the signed contracts since all participating stakeholder are equally represented.

A main factor that makes the PES scheme work was the concrete demand of CASUR, who recognized the importance of ecosystem services as well as the resulting costs due to their deterioration and had the will to invest in protection and restoration of the ecosystem. In addition, CASUR gained a positive recognition from society through the initiative, which was also an incentive to participate on the scheme. On the other side, land users in the upper part of the watershed were willing to change their land use in order to comply with the service provision requirements. A certain awareness to reverse ecosystem degradation encouraged their participation, even though the payment does not fully compensate their opportunity costs.

Another important factor consists in the acceptance of the initiative within the local population as well as their participation in the planning and management process.

4. Lessons learned

Until now, the initiative contributed to the conservation of an important area of the upper part of the watershed ecosystem, raised considerably public awareness regarding the costs of ecosystem degradation and the interconnection of ecosystems in the uplands and lowlands. Furthermore, due to the high level of public awareness and the success of direct payments to farmers, farmers now participate much more actively in the municipal council meetings in which the municipal budgetary lines for

next year's investments are agreed upon. In these meetings, farmers now fiercely defend the municipal financial contribution to the PES fund and even demand the increase of financial contributions to this fund.

Due to the fact that the selection of participating farmers was based on scientific criteria the selection was not influenced by local politics. The PES process changed people's perceptions on water, which is now considered as a finite and vulnerable resource, gaining economic importance. These changed perceptions were expressed during a field survey and at several workshops which formed part of the systematization process of this project experience (Flores Barboza et al., 2011). Sustainable and therefore water friendlier land uses can now better compete with non-sustainable ones. Furthermore, people recognize the benefits of ecosystem conservation.

Though, before a conservation area can be established, some further obstacles must be overcome. Until now only 200 hectares of the projected 800 hectares are under protection and are reforested. Furthermore, reforestation is advancing only slowly, and at the same time illegal logging of trees on local farms is still going on due to the high poverty level of farmers who are submitted to economic pressure by illegal logging companies. Also, the actual improvement of service provision remains still uncertain since longer monitoring is necessary to be sure about the conservation effects. Another important challenge is the introduction of water conservation measures to improve water quality, since until now activities were addressed primary to water quantity. Although the conservation measures applied to improve available water quantity possibly have also a positive impact on water quality (e.g. reduced soil erosion and agrochemicals) there still remain sources of water quality deterioration unaddressed (e.g. problems with coliform bacteria introduced by animal feces). Finally, a better understanding of the relation between land uses and their impacts on hydrological services would contribute to implement more effective conservation measures.

The introduced payment scheme for environmental services is very positively perceived by participating farmers as a secure and continuous income source over the negotiated contract period of one year. In addition, farmers value future benefits from reforestation such as fruits, fuel wood and an increase of land value. About half of the beneficiaries would include more land into the payment scheme and there is a high interest to participate in the project as a service provider. Thus, the amount of payments does not fully cover the economic losses if land is completely taken out of production for reforestation. At the same time, the maintenance of reforested areas is labor intensive and does not imply additional reward. Therefore, it is necessary to diversify conservation and restoration measures to generate additional income. The biggest challenge regarding the sustainability of the payment scheme consists in the need to include further service buyers (water users) in order to raise more financial resources and ensure long term and better payments. A very important additional service buyer downstream could be the water supply company, as well as commercial plantain producers. Their ability to pay differs from each other and possible effects on end users of their products should be considered.

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