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The water and its social and economic relations. Proposed Payment for Environmental Services in the Ravelo River Basin

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Abstract

One of the regions of Bolivia, which suffers most from water scarcity is its capital Sucre, whose main source of water supply is the Ravelo River Basin that is being affected by a significant process of degradation of its environment by anthropic action of the inhabitants, with the consequent danger of a decrease in the amount of water. The objective of the research is to establish a payment mechanism for Hydrological Environmental Services through an agreement between families of the city of Sucre and community members of the Basin, which will guarantee the water supply. Using the Contingent Valuation Method, we identified and calculated the willingness to pay (DAP) of the families of the city of Sucre for the conservation of the Ravelo river basin, applying surveys whose results establish the willingness to make a payment for conservation of Basin. The Disposition to be Compensated (DAC) of the community members of the basin was determined, working in meetings-workshops with the participation of approximately 53% of the total of families, identifying that they are willing to receive compensation for conserving the basin. Based on the determination of the DAP and the DAC, a payment scheme for environmental services was proposed.

Payment for Environmental Services, Willingness to Pay, Willingness to be Compensated, Conflict for water, Shortage of water

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Introduction

According to the Vice Ministry of Watersheds and Water Resources (VMCRH) of Bolivia, the country has a high availability of water, but unfortunately its poor spatial distribution generates scarcity of this resource in several regions, to which extreme seasonal events due to the change are added climate, as well as, a gradual deterioration in the quality of water bodies. One of the regions suffering from water scarcity is the city of Sucre[1], whose main source of supply is the Ravelo River basin that provides approximately 90% of the liquid element. Both now and several years ago, not all the city of Sucre receives water in regular and continuous conditions; in the high and peripheral areas, there are several neighborhoods where the service is irregular.

Only a little more than fifty percent of the population of the city of Sucre lives with drinking water in a sustained manner, the other half must wait for the night shift, or the tank car, or go to a ravine or nearby well to get water. drinkable and with contamination problems. Although the balance in water sources shows that there is still no deficit, in a very few years, due to the population growth that will bring with it a higher demand volume of water, there will be a significant deficit, and even worse if we observe that in the Ravelo river basin, there is a significant process of degradation of soil, water and vegetation resources, which have been and continue to be preyed upon by the anthropic action of the inhabitants, who, besides not taking sufficient awareness of this process, they do not perform significant practices that allow stopping and / or reversing the process of ecological imbalance that has been taking place.

In such a situation, a payment system can be created that generates an income stream that contributes to the preservation of the sources and to encourage, mainly to the agricultural producers of the Ravelo river basin, to change degrading practices by conservative land practices and water, taking into account their different organizational structures. The PSAH is included within a water management framework that allows building a virtuous circle in which the willingness to pay (DAP) of the users feeds a fund of investment and conservation, which in turn, will maintain the quality of service by the one that the plaintiffs are really willing to pay.

The PSAH modality could represent an alternative to address the problem, allowing the different social actors (claimants, service providers and institutions) to be involved in co-responsibility in actions that allow conserving the ecosystems that provide water.

Therefore, it is important to establish and suggest the ideal instrument through which the PSAH will be effective, applying in this case a fee for water conservation. This environmental canon has an ethical, educational and financial nature that would motivate users to use water efficiently, discouraging excessive use or spending and encouraging the conservation of the environment and the basin ecosystem at the same time.

The investigation will allow to collect on the one hand the perception or revealed preferences of the population of Sucre before the problem of the shortage of the water that lives constantly, determining its Disposition to Pay (DAP) for the Hydrological Environmental Services that it receives and will receive; and on the other hand, it will allow knowing the willingness of the communities to receive a payment as compensation (DAC) in exchange for the management, conservation and restoration activities of the Ravelo River basin.

[1] The city of Sucre is located in the Oropeza Province of the Department of Chuquisaca and is the Capital of the Plurinational State of Bolivia.

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From the above, the following question arises that will guide the investigation in a general way:

Is it possible and valid to establish a payment mechanism for Hydrological Environmental Services where users participate in the internalization of negative externalities and in their possible improvement / reduction in the future?

The general objective is: Establish a Payment System for Hydrological Environmental Services (PSAH) through an agreement between families of Sucre and community members of the Ravelo River Basin to ensure the supply of potable water to the city of Sucre

For this, the availability to pay (DAP) of the families of the city of Sucre and the Disposition to Accept Compensation (DAC) of the community members of the Ravelo River Basin should be determined.

The main hypothesis states that: A Payment System for Environmental Services will allow the improvement of the management of the environmental services (soil, water and forest resources) existing in the Ravelo River Basin and will contribute, through substantive improvements both in the offer as in the demand, to recover the sustainability of drinking water for the city of Sucre, involving suppliers, beneficiaries and institutions, based on the economic valuation of the SAH.

At the same time, for the establishment of a payment mechanism for environmental services, it is expected that water users in the city of Sucre would be willing to pay to reduce the shortage of drinking water by protecting and conserving the environmental services already mentioned. .

To achieve an integrated operation of compensation / provision of water resources, it is expected that the community members of the Ravelo River Basin would be willing to receive a payment or compensation in exchange for the protection and conservation of the basin for the provision of Hydrological Environmental Services within of their different organizational and productive structures that they have, incorporating institutional arrangements between the Municipalities of Ravelo and Sucre, private users and ELAPAS within established, consensual and well-defined legal norms.

Methodology

To identify the willingness to pay (DAP) of the users of the city of Sucre for the Hydrological Environmental Services provided by the suppliers of the Ravelo river basin, the Contingent Valuation Method was used, which is used when there is no market information or surrogate values about the preferences of individuals (willingness to pay or accept) with respect to certain natural resources or environmental services.

Through this method, individuals are presented with hypothetical situations (contingent to) and asked about their possible reaction to such a situation.

This method allows us to find out, through the direct question, the valuation that people give to the changes in the well-being produced by the modification in the supply conditions of an environmental asset not traded in the market.

The fact that the assessment finally obtained depends on the opinion expressed by the person based on the information received is what explains the name given to this method (Barzev, 2002: 60).

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420 surveys were applied to families in the city of Sucre using simple random sampling.

The municipality of Sucre has 59,845 families in its five urban districts; their three rural districts were not taken into account because they do not receive water from the Ravelo river basin.

The questions were organized into three groups: the first group refers to the contextualization of the problem of water scarcity in Sucre; the second group is related to the willingness to pay (DAP) and the third group of questions focuses on important socioeconomic aspects to determine the correlation of these with the DAP.

The variables analyzed in each group of questions were:

1. Variables related to domestic water: water quality, quality of service, hours that receive water a day, how water is supplied (mains pipe, well, cistern, etc.), how to save the use of water, importance of water for the development of their daily activities, importance of the forest in the supply of water in quantity and quality.

2. Variables related to the DAP: how much you pay for the service, willingness to pay, reasons why you are not willing to pay, proper institution to receive payment and function as an intermediary in the PSA, who must ensure the conservation of the basin.

3. Characteristics of the interviewees: Sex (% and WTP according to sex), age (WTP according to age), etc., education, number of family members, income.

For the determination of the Disposition to be Compensated (DAC), the population inhabiting the Ravelo river basin, composed of approximately 1,830 families in 27 communities and corresponding to the sub-centers, was taken into account[2] of Pampas de Ravelo (includes the town of Ravelo), Challuma, Sasanta, Sauce Mayu, Yurubamba and the Patoqa community of the Moroto Sub-center.

Applying a participatory methodology in workshop meetings in the communities, valuable information was obtained about the situation of the Ravelo river basin and the possibility of receiving compensation for the conservation works carried out was determined.

Different areas of the basin were visited, agreeing with the leaders to carry out the workshops that would be carried out in each community. Only in Pampas de Ravelo, it was agreed to hold the workshop in an extended meeting with the participation of six communities, for the ease of holding the event in the town of Ravelo with the participation of families and the closeness of the member communities.

Subsequently, the communities with which they worked directly with all their members were selected through workshop meetings, applying the instruments for collecting information and data in order to determine the DAC. For the selection of the sample of communities, two criteria were taken into account: 1) the strategic location of the same within the basin and 2) its importance to contribute with water sources to the basin.

[2] The Subcentralías are organizations more functional than territorial, and these in turn are composed of several communities that are territorially defined.

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In the 11 workshops carried out, 16 of the 27 member communities of the basin participated, that is to say that 59% of the communities that represent 75% of the total families of the basin worked with:

- Six communities of the upper basin: Sauce Mayu Centro, Sauce Mayu Norte, Teja Huasi, Tanga Tanga, Mojón and Chillcani.
- Six communities of the middle basin: Pampas de Ravelo, Pista Loma, Ampasuyuc, Surihuana, Chuñuchaca and Chullpas.
- Four communities of the lower basin: Socorro, Sasanta, Yurubamba Centro and K'uchu Yurubamba.

On average, in each meeting-workshop, between 60% and 70% of the representatives of the total families of each community participated, which means that they worked with approximately 45% to 53% of the population of the entire basin.

This aspect provides great reliability regarding all the information obtained, since it is a representative majority of the families, in addition to evidencing that the different communities are very homogeneous in the socioeconomic, political, environmental, organizational and cultural aspects.

The workshop meetings were carried out through participatory techniques and tools with motivating questions that allowed the work to begin and then gave way to other complementary questions to obtain the desired information.

In each workshop we worked directly with all the attending community members and the initial distrust and suspicion was changing as the workshops were developed, showing great interest, especially at the time of working the "talking maps" identifying the water sources existing in each community and speaking of its natural resources.

The inhabitants of the Ravelo river basin speak the Quechua language, although approximately 30% of the inhabitants are bilingual (Quechua-Spanish), however, they prefer to communicate in their mother tongue.

The willingness to pay (DAP) of the families of the city of Sucre

The city of Sucre

It is located in the Oropeza Province of the Department of Chuquisaca and is the Capital of the Plurinational State of Bolivia. Its climate is temperate with an average environmental temperature of 18°.

It is located in the south central part of the country with an O Longitude of 65º 14' and Latitude S of 19º 02', at an average altitude of 2,780 meters above sea level, on the border between the valleys of the middle lands and the descent to the lands lowlands of the plains of the great Bolivian Chaco, in the hydrographic division of the Amazon and the basin of Plata.

1. Shortage of water in Sucre

The results of the study show the shortage of drinking water in the city of Sucre and the different problems that the population has due to this situation:

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Water supply: Only slightly more than half of its inhabitants (52.2%) receive water in a sustained manner 24 hours a day; the other half of the population receives water only a few hours and only during some days of the week, suffering constant rationing in its supply.

The greatest shortage of water occurs in the second semester, especially during the quarter from July to September. In contrast, during the first semester, water rationing is lower, with the April-June quarter being the one with the greatest scarcity; in May the dry season begins.

Importance of water sources: 91.8% of families recognize the importance of forests and vegetation for water sources.

Other aspects considered as important for the provision of water to the city, but to a lesser extent, are: population growth, poor distribution of water by areas, poor management of the local water distribution company in Sucre (ELAPAS) the lack of infrastructure and resources for investment and the lack of maintenance of infrastructure,

Water saving in Sucre: An effort is appreciated by the families of the city of Sucre to save water, thus 93.5% of the families maintain in good condition the system of pipes, taps, tanks, etc. performing the corresponding maintenance.

The cases in which water is most frequently wasted are: Vehicle washing with hose, where approximately one third of the families that have a vehicle (30.6%) still follow this practice.

Almost half of the families that have a garden (47.2%) still irrigate with hose, and only 52.8% use sprinklers and sprinklers to perform this task and not waste water.

In the subject of body hygiene, two thirds of families (67.2%) do not have the habit of using a glass of water to wash their teeth, keeping the tap open while doing this activity; or closing the shower tap while soaping, thus incurring one of the most common ways of wasting senseless water. The World Health Organization (WHO) recommends that the shower should be limited to 5 minutes for sustainable use of water and energy, however, in Sucre the shower lasts between 10 to 20 minutes, especially in the younger population.

Highlights that 72.6% of families reuse water from washing clothes to wash their vehicle, floors, walls and others. In the rainy season, 4.2% of families collect rainwater in containers, especially for cleaning purposes; This situation occurs in the high areas of the city where water rationing is greater.

2 Willingness to Pay for Environmental Services

Monthly payment for drinking water (In Bs.)[3]: Approximately 90% of users pay monthly between Bs. 10 and 170 while approximately 8% pay between Bs. 170 and 300. Finally, 1.3% of consumers pay between Bs. 300 and 500 and .6%, between Bs. 500 and 780.

Willingness to Pay: 77% of respondents are willing to pay for the conservation of the Ravelo river basin and only 23% do not want to do so. The former hope to have access to water of adequate quality and quantity if they make that payment.

The estimation of the DAP was made under the probit model using the STATA software. The amount obtained was: DAP = Bs. 8.2987.

[3] Bs Moneda Nacional Boliviana. Tipo de cambio 1 $US. = 6.96 Bs

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That is, on average, the families of Sucre are willing to pay $ US monthly. 1,20. Therefore, taking into account that in total there are approximately 60,000 families in the five urban districts of the municipality of Sucre, a fund could be set up for the conservation of the Ravelo river basin with an income of close to $ US. 72,000 each month and $ US. 864,000 a year.

This DAP of $ US. 1,20 is very significant if we compare it with results in other regions of the world and it is not correlated with the level of income or with the level of education, but above all with the need of the population to be able to count on sufficient quantity and quality of water. as to meet their needs and is also linked to the awareness of the population about this problem.

Institutionality for the Administration of Funds of the DAP: The majority of the people would like to make the payment by means of the water bill (76.2%); while 20.2% would prefer the issuance of a special receipt; only 1.7% want this payment to be made through the electricity bill; 1.4% through the gas bill, and only 0.6% through another means.

There is confidence of the population in the Local Company of Drinking Water and Sewerage Sucre (ELAPAS), since more than half of the people want this institution to be in charge of the administration of the payment funds for the conservation of the river basin Ravelo (52.8%), while a significant percentage (31.5%) prefer that a special institution created to administer the fund take charge of it. The percentages corresponding to the Mayor's Office of Sucre, the Government of Chuquisaca and NGOs are very small with only 3.6%, 2.2% and 5.5%, respectively, a fact that shows the little confidence that exists on the part of the population in these institutions for the management of these funds.

Reasons not to make the Payment for Environmental Services: Of the total of people who are not willing to pay for environmental services, ie 23% of the sample, a third (33.3%) indicates that they can not pay because "their situation economic does not allow it "; 21.1% indicate that "the government should pay" and 11.4% indicate that "it is the Municipality of Sucre who should pay"; finally, 2.6% of these interviewees commented that "it is the community members of Ravelo who must conserve their watershed". On the other hand, 11.4% "do not believe that this payment works"; 9.7% say "do not agree with the proposal" and 6.1% express their fear that "these funds may be diverted".

According to Riera (1993), there are answers that do not reflect the fact that people assign a market price of zero to the good but, rather, as in our case study, to the belief that the national government should be, the government municipal or the own comunarios who should pay.

These types of responses are called "protest or rejection responses" and in our case, they are around 10% that share this perspective, and it is a percentage that is within the parameters that are usually considered acceptable.

The "protest or rejection responses" identified in the study were:

- It's the government that should pay.
- Is the municipality of Sucre who should pay.
- Are the community of Ravelo who must keep their basin.

The Disposition to be Compensated (DAC) of the community members of the Ravelo River Basin

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Municipality of Ravelo- Ravelo River Basin

The Ravelo Municipality is located northeast of the Department of Potosí in Bolivia. The town of Ravelo is the most important town and is only 46.5 km from the city of Sucre. The territorial extension of the Ravelo section is 1,268.00 km2 and its surface is formed by mountain ranges, hills, mountains, slopes, foot hills, terraces, rivers and streams, with reliefs that change sharply determining the ecological floors. The existing water sources in the Ravelo Municipality are generally rivers, streams and springs (pujyus). The basin of the Ravelo River within the territory of the Municipality of Ravelo, covers an extension of 245.81 Km2 and belongs to the River Basin of La Plata.

Ravelo is made up of Subcentralías that are more functional than territorial organizations, and these in turn are composed of several communities that are territorially defined. The Ravelo River Basin is composed of five (5) Subcentralías: Pampas de Ravelo, Challuma, Sauce Mayu, Yurubamba and Sasanta, additionally only the Patoqa community of the Moroto Sub-center is part of the basin.

The results:

The five motivating questions used in the questionnaire during the workshop meetings and the rest of the questions incorporated allowed us to collect valuable information to determine the DAC of the community members of the Ravelo River Basin.

1 Economic activity

The main economic activities of the basin are agricultural and livestock production. The main product that is grown is the potato in its different varieties, becoming its main source of economic income; next in importance are wheat, corn, oats and quinoa.

The tarhui, the broad bean and the papalisa are also cultivated on a smaller scale. These products are destined in the first place to the commerce and later to the family consumption, with the exception of the oats that are used mainly as fodder.

Within the livestock activity, the main species reared are cows, sheep, pigs, donkeys and chickens; their destination is self-consumption, mostly.

Oxen and donkeys are also used as a working tool. Women and children are responsible for carrying out this activity throughout the year and are concerned that the animals have pups so that this resource is not lacking in the home.

The average payment of the work wage fluctuates, in the communities between Bs. 50 and 60 (US $ 7.18 and 8.62, respectively). However, the payment is not always in cash since, in most cases, it is canceled in product; This varies according to the crop in which the work is carried out: that is, if a person worked in the potato crop, he is paid between 2.5 arrobas to 1 quintal (4 arrobas) of this product and if the work was made in the cultivation of wheat or corn is canceled with 1 or 2 arrobas of the same product.

In some communities, other types of customs are still practiced, such as family ayni: it is an economic-social system that the Aymara and Quechua cultures practice from pre-Hispanic times to the present, with some modifications, to live in harmony and balance in order to community.

It consists in the reciprocal and complementary work in the agricultural activity in which several members of the community sow the lands of a companion along with it; the beneficiary must "pay" his ayni by sowing the lands of the people who worked with him.

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2 Natural resources available to the community

Water resources: The communities of the headwaters of the basin are those that contribute the most to feed the Ravelo River with rivers, springs, water features and streams. The communities of the middle part of the basin also contribute to the flow of the Ravelo River, but to a lesser extent than the previous ones and the communities of the lower basin are those that in a lesser proportion contribute to the flow of the Ravelo River in comparison with the communities of the Upper and middle basin.

In many cases, the community members do not know the name of their slopes or rivers that normally take the name of the place or community, such as: Teja Huasi River, Mayu Mill, Chillcani River, Mojón River, Ishu Kollu River, Chaka Stream Pampa and Inti Cancha river; all of them feed the Ravelo river flow, name that adopts the main watercourse from the town of Ravelo.

Conflict for water: Interestingly, the importance of the issue of the water supply of the upper basin is reflected in the thinking of its community members who believe they are "owners of the water" that is born and runs through its territory; they also indicate that the communities of the lower basin, especially Sasanta and Yurubamba, are only areas of water passage.

A strong position was observed in considering that the community owns the water resource: the community members indicate that if they would make the decision not to supply the city of Sucre with water, they could do so at any time. They expressed their annoyance indicating that, being the "owners of the water", they do not receive any benefit or incentive from Sucre institutions and families.

They note that the Local Company of Drinking Water and Sewerage Sucre (ELAPAS) is not supporting the communities to be able to conserve the basin, and that they should have a representative in the directory of that institution, for being "owners of the water". This position about the idea of water ownership is much stronger in the communities of the headwaters of the basin, where the community members emphasize that they have more rights than others because they are the ones who take care of the water: therefore, they should receive Benefits.

It has identified two conflict situations that are latent and could be activated at any time, causing serious problems. The first conflict situation arises between communities of the upper basin in relation to the communities of the middle basin and especially those of the lower basin (Sasanta and Yurubamba), because these last two were negotiating on their own a series of benefits and compensations for the construction of a dam in its territory by ELAPAS to improve the supply of drinking water to the city of Sucre. Due to this fact, there is a strong resentment on the part of the communes of the upper basin towards those of the lower basin and unfortunately this manifest conflictivity is also unloaded towards the city of Sucre, because they were not taken into account in these negotiations.

The second situation shows a strong current of conflict between the communities of the middle and lower basin with respect to the city of Sucre, especially because all the negotiations and offers made for the construction of the dam did not reach any agreement, to the extent that ELAPAS decided not to build the dam in the Sasanta area of the department of Potosí, but in a place in the department of Chuquisaca called Tumpeca. In most of the communities, several positions were heard on the subject, some of them very worrying, such as:

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- Wherever you make the dam, the water is still from Potosí.
- The peasants could rise up and there would be no water for Sucre.
- The water leaves the Ravelo basin and we receive nothing.
- All the water that Sucre receives comes from the basin, but nevertheless we do not benefit from anything, and we should even have the right to have a Director in the ELAPAS Directory, because they own the water.

Therefore, this issue must be treated with great care and it is vital to find a solution before this latent conflict that exists in the communities of the Ravelo river basin explodes and reaches extremes that could harm all families in the region city of Sucre.

Forest resources: The communities do not have forests, there are only small extensions of land with eucalyptus plantations, pines and native species such as alder, oak, chijri, thola that are used to obtain firewood and commercialize them as wood in some cases.

In all the communities an annoyance was expressed because in past years, some institutions and the Mayor's office of Ravelo motivated the community members to carry out eucalyptus plantations that little by little were drying some water sources existing in the area and caused the disappearance of some plants native of the place.

However, today despite being aware of the problem that this generates, some families still continue with this practice, although a majority no longer performs these plantations.

The community of Teja Huasi stands out within the basin, because it has many sectors that were forested with pines and alders, work carried out with a project with the Foundation against Hunger (FHI).

In this community no one is currently carrying out eucalyptus plantations and a greater degree of awareness and awareness of environmental care is observed, an aspect that helps to develop water conservation practices.

In the entire basin, firewood is scarce, due to the deforestation caused by the community members and the non-replacement of the native trees, which causes problems due to the use they give to this resource as an energy source.

Pollution: The community members of the upper Ravelo river basin indicate that they do not pollute the water sources; on the contrary, they would be taking care of them and they assure that the communities of the middle basin, from the town of Ravelo, and those of the lower basin, are the cause of water pollution, generating a large amount of garbage that includes waste of the town's sewage system. This fact was recognized by the inhabitants of Ravelo, indicating that the wastewater from their sewage system was evacuated directly to the river.

A workshop participant in Ravelo stated categorically: "Ravelo's sewage system directly contaminates the river. We pollute and then we take that in Sucre. "

On the other hand, in the lower basin, although the community members of Socorro and Sasanta assure that their communities do not pollute the rivers, the presence of garbage and contamination of the waters and farmland, as well as in the surroundings of the housing (plastic bags, paper, disposable bottles, insecticide containers, etc.).

In turn, Yurubamba community members did recognize that they pollute the waters of the Ravelo River, especially with plastic bags and dead animals that they throw themselves into the river.

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Erosion: In all the communities, the lands are very eroded and this process is presented with increasing force.

The soil is in the process of degradation and the lands that used to be cultivable now are no longer.

The community members are aware that one of the causes of pollution comes from the excessive use of chemical fertilizers in potato production and also the presence of garbage, at the same time ensuring that changes in the intensity of rainfall and winds make that the earth becomes unproductive.

They indicate that now, the rains are too strong and they take the land, "washing" the land and letting out the rock or the slab; therefore, agricultural production becomes very difficult if not impossible.

The same happens with the strong winds that also take the fertile land: "Before you could cultivate the land with pure oxen, but now the earth has become hard as cement and even with a tractor it can be plowed," the community members say concern.

Right of property of water: Within the communities, the villagers assure that nobody owns the water: everyone has the right to it. Those who live on the banks of rivers are only considered owners of the land.

The lands where the springs are born have an owner: they are private properties, but when someone requires this liquid element, then everyone has the right to take advantage of it.

The following opinions expressed in the workshops confirm this situation:

- The water belongs to everyone.
- Everyone uses water.
- Decisions are made in the family about firewood, but it is the community over the water.

This situation of community water law within the communities, in which "water belongs to everyone", contrasts with the idea of the same communal water rights in relation to the right of the families of the water. city of Sucre, because they no longer consider that "water belongs to everyone", but that "water belongs to us, and Sucre uses it without us benefiting".

In this regard the New Political Constitution of the State approved in 2009 (NCPE), establishes guidelines on the rights and obligations in environmental matters of citizens and authorities or organizations, as well as the ownership of natural resources.

Irrigation: It is striking that most communities do not have an irrigation system. In the case of those that do have this system, much of it captures water from sources that do not feed the Ravelo River; therefore, they do not harm its flow, nor compete with the use that is given to it in the city of Sucre.

It is evident that there are very few communities that take advantage of the waters of the basin for their irrigation systems.

One example is the community of Teja Huasi that has undertaken a micro-irrigation project using the waters that go down to the Ravelo River, where a dam and an irrigation system for the community are under construction; this fact will mean a reduction of the flow that descends from the community of Jailluwa through Teja Huasi and that feeds the river Ravelo.

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3. Changes in the time of natural resources

The community members assert that there are too many changes in their water resources. In past years, the flow of the rivers was greater and there were other slopes in the area, but now, those are dry. Before, they were not hit by so many natural disasters and their production did not require the use of agrochemicals to be able to bear good fruit. Nowadays, they do not have good production if they do not use these inputs. They are aware that all the changes they are experiencing come from pollution and bad agricultural practices that have been increasing.

Affirmations such as the following, expressed by the community members, reflect the existing changes:

- The climate changed completely, it rains when it should not rain and there is a lot of drought, climate change is affecting the agricultural calendar.
- This is caused by the pollution of large factories in cities, the use of chemicals in the production cycle and the bad habits of people to generate and throw garbage everywhere.
- In past years there were greater sources of water.
- Little by little the water is decreasing.
- The pujyus (eyes of water) dried up, a lot of eucalyptus.
- The time has changed.
- It is not like it used to be: it does not rain or it rains a lot and the water takes away the land, leaving the fields pure slab. The production is ruined.
- There is a lot of wind that also takes away the earth.
- It is very hot.
- Before you could cultivate the land with pure oxen, but now the earth has become hard as cement and even with a tractor you can not plow.
- No more original trees such as alder, thola.
- No firewood, no more trees.

Also, there is a strong position that water will not increase, no matter how much preventive measures are taken, they even consider that they will disappear, but they also say that we must try to avoid this situation.

4. Organization and decision making on the use of natural resources

When any natural resource of the community is available, the decision is made in conjunction with the family that owns it, if the resource is located on private property, then at the level of the community in general and then at the community level subcentralía

There is no organization exclusively dedicated to caring for natural resources in the communities, in some cases there is a portfolio in your union organization, but without significant significance in its actions; all the decisions that are made in this regard are at the family level. It is the owners who determine or authorize the use or exploitation of trees and grass among others, but the water is for the use of the whole community and the community members express it this way:

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- Decisions are made in the family about firewood, but it is the community over water.

- Decisions of the entire community.

5. The Disposition to be Compensated DAC

What do they do in the communities so that the water does not run out and still have water: Despite being aware of the problem of water shortage and how much this represents in their lives, the community members do not take preventive action to guarantee the resources natural for future generations. Only the community of Teja Huasi is the exception, since it is dedicated to caring for and preserving the existing water eyes.

The following expression summarizes the situation regarding the total lack of actions to conserve the basin and the need of the community to do something about it: "We do nothing; We need help".

Disposition to be compensated: The possibility of receiving compensation in exchange for carrying out conservation work in the Ravelo river basin was accepted positively by the community members, since they see the possibility of being able to benefit in the medium and long term. They are also willing to give part of their land to plantations on the banks of the rivers, if necessary.

The response was positive in 14 of the 16 communities; only in two there was some resistance, not precisely against the proposal, but rather because of too much distrust and susceptibility because, previously, the community members were deceived by institutions, according to the testimony provided by some community members of Sasanta and Sauce Mayu North.

In the case of Sasanta, this susceptibility and distrust was generated due to the fact that they spent a long time negotiating compensations and benefits as compensation for the lands that were going to be affected by the construction of the dam by ELAPAS, and for this a survey was carried out. of information; but in the end this institution decided to leave this project aside and implement it in another place, downstream, not in the territory of Potosí but in Chuquisaca.

According to the perception of the community, "everything was nothing" and they lost time. Despite this position, it could be seen that there was a group of people who agreed with the proposal but did not dare to express their opinion.

On the other hand, in Sauce Mayu Norte, the community members stated that they consider that this compensation could take away their property rights over water and land. It is feared that, even with the passage of time, they will not be allowed to approach the water sources.

The community members are susceptible because they believe that, when receiving money or another type of compensation coming from the city of Sucre, little by little they would be selling the property and the slopes that would change ownership and pass into the hands of the municipality of Sucre. Here, as in Sasanta, they finally expressed that they were not completely denying the proposal and that, if the majority of the communities of the sub-center accepted it, they would submit to that decision and also participate.

In conclusion, we can indicate that the communities are willing, for the most part, to accept compensation in order to conserve the Ravelo River basin, establishing agreements with the families of the city of Sucre.

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Form of payment for the works of conservation of the basin: The comunarios although they accept a payment in cash, they would prefer that the funds were destined to projects and emprendimientos that could benefit the whole community, putting as examples the following: improvement of houses, pig farm, micro-irrigation, dairy cattle breeding, fish farming, beekeeping: "This would be a good opportunity to diversify our productive and work alternatives," they say.

They also suggest that works should be carried out as cut-offs (technique by which rainwater runoff, or water from other sources, is stored in ponds dug in the ground), dams, wells, ponds, among others, in communities, in addition to receive training in conservation and preservation of the environment.

A community member stated the following: "Only if you have a healthy environment and with sufficient natural resources will families be able to live with dignity."

Institutional organization: According to the community members, the organization for the management of the funds to be collected for the conservation works of the Ravelo river basin should be made up of different institutions and social organizations such as: ELAPAS, the municipal governments of Sucre and Ravelo, the communities involved, the provincial central office and the sub-centers.

However, the fact that in several of the communities, it is not desired that the municipal government of Ravelo participates in this point and even in a community, the opinion was very strong regarding this issue, expressing its community members the following:

- The City Hall of Ravelo does not help at all.
- Many times, the mayor reports that projects have been carried out in our name and nothing has ever happened to us.
- So they are always those of the Mayor's Office: they deceive us.
- Where will the money they say reach the community go?

The Government of Potosí, nor the ONG, showing that there is little credibility towards public institutions and institutions that worked with them for a long time without achieving positive results.

Calculation of the amount of the Disposition to be Compensated: For the calculation of the DAC took into account two components: The first refers to the payment in wages that the community members would receive for their work, that is to say, the community members will receive an economic compensation to use its approximately 60 free days during the year to be able to devote itself to the work of conservation of the basin; the second component is the income that the community will fail to perceive by departing their working land, which are on the banks of rivers and ravines, to work of conservation and preservation.

Number of families in the basin	(1)	1,830
Daily wages in *Bs	(2)	50
Quantity of daily wages	(3)	60
Total DAC in Bs =	(1) x (2) x (3)	5,490,000
Total DAC in $US (1 $US = 6.96 Bs)		**788,793**

*DAC Amount to be compensated

*Bs Bolivian currency

Table 1: *DAC Calculus (daily wages)
Source: Own elaboration based on data from workshops in the Basin. 2014

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Table 1 shows the calculation for the first component of the DAC, taking into account the 60 days of work at Bs. 50 per day and considering one member per family of the 1,830 existing in the basin, making a total of 5,490,000 Bs .which is equivalent to 788,793 US Dollars.

Potato yield *tn/ha	5.4
Potato yield *kg/ha	5400
Potato yield @/ha	476.19
Number of families in the basin	1,830
Average possession per family in *Ha	3
Total of land used to work in the basin (Ha)	5,490
% land close to river	5%
Total of land to work close to river (Ha)	274.5
10% land contributed to be conserved (Ha)	27
Potato price per @ in Bs	25
Quantity of potato in @ without production	13,071
Total incomes not earned in Bs.	326,786
Total incomes not earned in $US (1 $us = 6.96 Bs)	**46,952**

*tn Ton
*Kg Kilogram
*ha hectare

Table 2: DAC calculus (land contributed to be conserved)
Source: Own elaboration based on data from workshops in the basin. 2014

Table 2 shows the calculation made for the other component of the DAC, that is to say, the income that was left to be received for carrying out work on working lands on the banks of rivers. For this we consider an average working landholding per family of 3 Ha, there are 5,490 Ha in the entire basin taking into account the 1,830 families, of this total of working land, approximately only 5% is on the banks of the rivers in the basin, that is 274.5 Ha, of which it has been estimated to contribute 10% to be allocated to conservation works in the basin.

On the other hand, if we take into account that the average potato production per hectare is approximately 5 tons equivalent to 476.19 @, we have a total production of 13,071 @ potatoes that would stop producing on arable land on the banks of the rivers of the basin.

Therefore, if the arroba (@) of potato has an average price of Bs. 25, the total amount of income left to be received would be Bs. 326,786 (US $ 46,952).

Currency	DAC (daily wages)	DAC (contributed land)	TOTAL DAC
Bs	5,490,000	326,786	**5,816,786**
$US	788,793	46,952	**835,745**

Table 3. DAC Calculus (daily wages + contributed land)

If we add the amounts of the two components of the calculation of the DAC, that is to say the 46.952 $ US. of income not received for assigning working lands to the conservation of the basin and the 788,793 $ US. for the wages dedicated to carrying out conservation work in the basin, there is a total for the DAC of 835,745 $ US per year.

DAP vs. DAC: In table 5, comparing the annual amount of the DAP of $ US. 864,000 with the annual amount of the DAC of $ US. 835,745, it is appreciated that the compensation is sufficient to cover the opportunity cost of alternative use in conservation work of the wage of the community members and the land use of the lands on the banks of the rivers, leaving a positive difference of $ US. $ 28,255; that is, the amount that the families in the city of Sucre are willing to compensate the community members for the SA, is enough to cover the amount that the latter would be willing to receive as compensation for the conservation of the Ravelo River basin.

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Currency	DAC	DAP	Difference
In Bolivianos (Bs)	5,816,786	6,013,440	196,654
In Dollars ($US) (1 $US = 6.96 Bs)	835,745	864,000	28,255

***DAP amount to be paid**

Table 4. DAC vs *DAP

Then, the implementation of a PES scheme is viable, allowing the conservation of the Ravelo River Basin, in such a way that the necessary Hydrological Environmental Services are provided to have potable water in the city of Sucre in sufficient quantity and quality.

Institutionality

Given the interpretation and susceptibility on the part of the community members of the term "payment" included in the concept of PES, in the sense that this fact could in the future imply the transfer of the right owner of their lands where the water sources are, to In favor of the families of the city of Sucre, which are those who would make these payments, it is proposed to change the use of the term of Payment for Environmental Services (PSA), for the Recognition and Compensation for Environmental Services (RCSA).

In accordance with this denomination, it is also recommended to use the term Disposition to Recognize and Compensate (DARC) instead of the well-known term Disposition to Pay (DAP), keeping the other term of Disposition to be Compensated (DAC). In this way, problems that could arise with the community members in the implementation of the compensation scheme due to the terminology used will be avoided.

Within this line of thought, and some authors like Herman R., Kandel S. and Dimas L. (2004) following Born (2002), avoid talking about Payment for Environmental Services, referring to Compensation schemes for Environmental Services (CSA).

RCSA outline design:

The Recognition and Compensation for Environmental Services (RCSA) schemes require an institutional infrastructure for their proper functioning, in order to guarantee the capture of the economic resources paid by the beneficiaries of the Environmental Services.

For the conformation of the institutional framework that will take charge of the management of the funds, it is important to rescue the opinion both of the families in the city of Sucre and those discharged by the community members in the basin, highlighting the confidence of the population in ELAPAS for the administration of these funds.

On the other hand, although there is little confidence on the part of the families of Sucre and the basin in favor of the participation of the Municipal Governments of Sucre and Ravelo, as well as of the Governorates of Potosí and Chuquisaca, it can not be ignored, take them into account, as their participation is essential to achieve institutional sustainability of the RCSA scheme, giving it the corresponding legal backing.

Therefore, in the institutional framework of the RCSA scheme, the following institutions and organizations must necessarily be involved:

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1) Sub-centers of the Ravelo River Basin; because its members (community members) are the direct beneficiaries of receiving funds from the RCSA scheme and those responsible for providing the SA. In each Subcentralía a Committee of Conservation of the Basin with five (5) members must be organized: President, Secretary General, Treasurer and two vowels, who are in charge of the money management of the RCSA Fund and to guarantee the fulfillment of the activities within of the established agreements.

2) Neighborhood Boards of the city of Sucre; because they are a representation of the families of the city of Sucre that will make the payments for the SA in order to guarantee the provision of potable water in sufficient quality and quantity.

3) Municipal Government of Ravelo; because all the actions of conservation and preservation of the basin takes place in the territory of the Municipality of Ravelo.

4) Municipal Government of Sucre; because the beneficiaries of the SAH are the families of five Districts of the Municipality of Sucre. It is responsible for the provision of drinking water to the population of Sucre through ELAPAS.

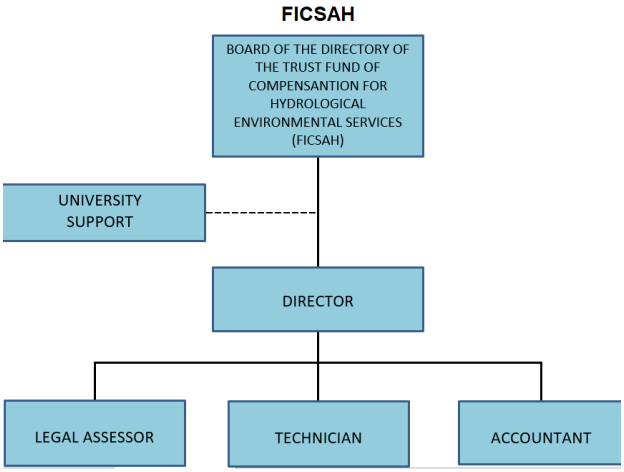
5) ELAPAS; because it is the decentralized public company of the Municipal Government of Sucre, responsible for managing the water resources of the Ravelo River basin, transporting the raw water from its sources, making it drinkable and distributing it to the population of Sucre.

6) Governorate of Potosí: because the territory of the Municipality of Ravelo, of which the Basin is part, is part of the Department of Potosí and therefore is also the responsibility of its Government.

7) University: because the training of the community members is necessary, as well as actions of supervision and monitoring of the proposed actions. He will be responsible for the formulation of the projects that they require in each community and that will be executed with the funds of the proposed compensation scheme.

The Governorate of Chuquisaca would not participate in the structure, because when carrying out all the conservation actions in the Department of Potosí, it does not have sovereignty over that territory.

Compensation Trust for Hydrological Environmental Services (FICSAH): Within the proposed institutional framework, the creation of an entity responsible for the administration of funds called the Compensation Trust for Hydrological Environmental Services is proposed. The organizational structure of **FICSAH** will be as follows:



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FICSAH Board: Will be integrated among stakeholders or interest groups indicated above and will be composed of eight members as follows:

- Two representatives of the sub-centers of the Ravelo River Basin
- A representative of the Municipal Government of Sucre
- A representative of the Municipal Government of Ravelo
- A representative of Gobernación Potosí
- A representative of ELAPAS
- Two representatives of the Neighborhood Councils of Sucre

The FICSAH Board will ensure compliance with both the general guidelines under which the proposed compensation scheme will work, as well as the commitments and institutional contributions of those who are part of the institutional framework.

The operative part will be in charge of:

- Director: Contribution of the Municipal Government of Sucre. Responsible for the administrative, technical and financial management of the funds of the Recognition and Compensation of Environmental Services (RCSA).
- Legal Advisor: Contribution of the Municipal Government of Sucre. It draws up contracts with communities and community members.
- Accountant: Contribution of the Municipal Government of Sucre. Prepares the financial information of the RCSA funds. Design information systems (accounting and management).
- Technician: Contribution from the Government or Municipal Government of Ravelo. It will be responsible for the management or technical management of the scheme.

Financing mechanism: The financing will be based on the payments made by the users of drinking water in the city of Sucre, which will be included in the drinking water bill prepared by ELAPAS. This amount of money will go directly to compensate the community members of the basin on the one hand collectively for the work developed in conservation and on the other hand as a compensatory payment to each family that provides working lands on the banks of rivers for reforestation and other works of conservation of the basin.

Additionally, for the proper functioning of the RCSA scheme, it is proposed to take advantage of the resources of the Government within a project that has already been approved with a budget close to 7 million dollars and which is called "Integral Management of the Ravelo River Basin", Whose actions are compatible with the proposals of the RCSA scheme allowing the provision of seedlings, barbed wire, meshes, etc. For its part, the Municipal Government of Ravelo will also contribute with resources defined in its Annual Operations Program for the conservation of the basin. Similarly, the resources contemplated for the Management and Conservation of the Sucre III Project Basin (Dam Construction) formulated by ELAPAS and financed by the KfW Kreditanstalt für Wiederaufbau (Credit Institute for Reconstruction) can be used.

These three sources of financing, the Governorate of Potosí, the Municipal Government of Ravelo and ELAPAS through the Sucre III Project, would be the ones that finance the part of materials and seedlings necessary for all the conservation works required in the Ravelo River basin.

Mechanism of payment: Most people would like to make the payment by means of the water bill (76.24%), this being the proposed medium.

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The amount collected will be deposited or transferred monthly to a specific bank account in the name of the institution created to manage the funds.

The contracts: Necessarily contracts must be drawn up, according to which the users guarantee the payment by the SA, but also the suppliers (community members) ensure the continuity of the provision of the SA. The rights and obligations of both parties will be detailed, the actions that will be implemented to maintain or increase water environmental services. The terms of the payments, their frequency and the transfer mechanism must be established. In addition, clauses will be clearly established establishing the corresponding sanctions in case of breach of contract by the parties.

The proposed canon

Consumption of drinking water

To propose the application of a canon for water conservation, which allows the creation of a fund for the management of SA (soil, water and forest resources) of the Ravelo River Basin, an analysis of the total drinking water consumption has been made and per inhabitant in the city of Sucre, analyzing at the same time the tariff structure applied by ELAPAS for the payment for the service of drinking water supply to the population.

There are five categories of consumption:

1. Domestic Category (Family consumption: Includes a Solidarity Category when family consumption barely reaches 10 m3 per month).
2. Commercial Category (Consumption of commercial premises).
3. Industrial Category (Consumption of productive units).
4. Social Category (Consumption of social establishments such as homes, homes, hospitals, etc.).
5. State Category (Consumption of public institutions, markets, schools, etc.).

The Home Category in the total consumption of drinking water is the most important with a percentage of 83%, meanwhile the Commercial Category has a 4% participation, the Industrial Category is the one that has less incidence in the total consumption of drinking water, with only 1%, the Social Category also maintains an average percentage of 6% and the State Category with the same 6% share in consumption.

Allowance per capita for urban housing (L / hab.día)

The National Regulation of Domiciliary Sanitary Facilities of Bolivia establishes reference values for the per capita allocation for urban housing. In the case of the city of Sucre (located in Valle), the daily per capita drinking water supply must be between 80 - 100 liters and ELAPAS effectively complies with this provision.

The drinking water consumption information per inhabitant day, shows how this consumption rarely passed the 100 liters a few months, this situation only being presented during the 2010 management, however as of 2011 no month the consumption increased from 100 liters per inhabitant.

The per capita consumption of drinking water in the city of Sucre is below 100 liters, being within the recommended international parameters, and well below the daily consumption per inhabitant of other cities in the world.

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A very interesting aspect is the behavior of consumption per month during the year, highlighting the months of July and October as those with the lowest consumption of drinking water per inhabitant day, and the months of January and November as the most consumed.

Rate structure

The tariff structure of ELAPAS for the potable water service of the city of Sucre includes five categories (the Solidarity is part of the Domestic) and includes differentiated rates for consumption ranges separated by 10 m^3 up to 50 m^3, then there are two ranges separated by 25 m^3 and finally there is the consumption range greater than 100 m^3.

In addition, all categories have a fixed rate independent of the volume consumed in m^3, which is the amount of the column that establishes the first consumption range = a 0 m^3.

RATE STRUCTURE
(In Bolivianos Bs x m3)

CATEGORY	= a 0 m3	1 a 10 m3	11 a 20 m3	21 a 30 m3	31 a 40 m3	41 a 50 m3	51 a 75 m3	76 a 100 m3	> a 100 m3
SUPPORTIVE	11.93	1.243	0	0	0	0	0	0	0
DOMESTIC	18.00	1.932	4.025	5.870	11.504	15.646	18.620	21.572	24.541
COMMERCIAL	89.56	15.667	15.667	18.647	18.647	21.608	21.608	24.574	24.574
INDUSTRIAL	149.19	21.608	21.608	21.608	21.608	24.574	24.574	24.574	24.574
SOCIAL	18.00	7.605	7.605	7.605	7.605	7.605	7.605	7.605	7.605
STATE	18.00	16.389	16.389	16.389	16.389	16.389	16.389	16.389	16.389

Table 5. Rate Structure
Source: ELAPAS

The proposed canon

With the information on drinking water consumption and the tariff structure applied for its endowment in the city of Sucre, the canon that is proposed to apply to each of the consumption ranges is calculated an amount that allows the creation of a fund of allocated resources. to the conservation of the Ravelo River Basin.

For the calculation of the rate of the canon to be applied, two variables were taken into account, the first the rate by consumption ranges charged for drinking water in Sucre, the second the Average Consumption of drinking water l / day.

With both indexes added was applied to the amount paid on average by each user in each of the ranges of consumption in the Domestic Category, thus obtaining the amount in Bs that must be paid on each bill for the potable water service provided ELAPAS.

To avoid the handling of cents, the amount of the canon is adjusted to the next higher value and added to the average monthly payment made by each user in the different consumption ranges.

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FEE CALCULATION															
Rank from.. . to...	Category	Number of users	Volume (m3)	RATE		Average consumption *L/habdia	USER'S MONTHLY PAYMENT	RATE 1 (RATE)	RATE 2 (AVERAGE CONSUMPTION PER MONTH)	TOTAL RATE (RATE 1 + RATE 2)	FEE (Bs)	ADJUSTED FEE (Bs)	USER'S MONTHLY PAYMENT RATE + FEE	INCOME PER FEE (In Bs)
				FLAT	VARIABLE									
= a 0 M3	D-SOL	3,349	0	11.93	0		11.93	0.00	0.00	0.00	0.00	0.00	11.93	-
1 a 10 m3	D-SOL	19,184	1,330,878	11.93	1.243	38.54	19.12	0.01	0.01	0.02	0.44	0.50	19.62	115,104.00
11 a 20 m3	DOM	14,155	2,450,012	18	4.025	96.16	55.11	0.04	0.03	0.07	3.67	4.00	59.11	679,440.00
21 a 30 m3	DOM	5,329	1,581,487	18	5.870	164.87	105.34	0.06	0.05	0.10	10.96	11.00	116.34	703,428.00
31 a 40 m3	DOM	1,777	778,961	18	11.504	243.53	211.39	0.11	0.07	0.18	38.32	39.00	250.39	831,636.00
41 a 50 m3	DOM	651	360,300	18	15.646	307.48	347.06	0.15	0.09	0.24	83.20	84.00	431.06	656,208.00
51 a 75 m3	DOM	371	285,913	18	18.620	428.14	672.55	0.18	0.12	0.30	203.84	204.00	876.55	908,208.00
76 a 100 m3	DOM	70	71,659	18	21.572	568.72	1,095.68	0.21	0.16	0.37	407.49	408.00	1,503.68	342,720.00
> a 100 m3	DOM	42	124,894	18	24.541	1,652.04	5,039.98	0.24	0.47	0.71	3,579.87	3,580.00	8,619.98	1,804,320.00
MESTIC TOTAL		44,928	6,984,104	-	103.021	3,499.48	7,558.15	1.00	1.00	2.00	4,327.79	4,330.50	11,888.65	6,041,064.00
abitants per day														

Table 6. Fee Calculation

As can be seen in the table, the income generated by the payment of the fee reaches the sum of Bs 6,041,064 equivalent to $ US. 867,968.97., -

This canon is progressive, since it is applied more to those who consume more drinking water and pay more for that consumption on a monthly basis, being these families the ones with the highest economic income.

Surely it draws attention that in the last range of consumption> 100 m3 there are only 42 users and yet the amounts that come to pay are higher than the rest of the users.

This is because it is not really a single user who will pay a fee of 3,580 Bs, but in this range there are condominiums and apartment buildings and they only have one potable water connection, but nevertheless there are several families, arriving for example in the biggest apartment buildings even to live 50 families or more. In that case each family would come to pay a fee of just 71,60 Bs.

Conclusions

In the city of Sucre only slightly more than half of its inhabitants (52.2%) receive water in a sustained manner during the 24 hours a day, while the other half of the population suffers constant rationing in their supply, receiving water some hours and only during some days of the week.

Sucre is facing a situation of deficit of drinking water supply, which, according to the projections made, will continue during the next few years, if urgent measures of adequate management of the Ravelo River Basin are not taken, efficiency in the consumption, as well as in the works of catchment, conduction and distribution of the water to the users.

Urgent measures are required not only to maintain the flow of the Ravelo River, but also policies to save drinking water in the city of Sucre, which allow consumption to remain between 90 and 100 liters / day / inhabitant, thus allowing consumption per capita. sustainable capita.

The problem of water supply to the population of Sucre is not only due to the scarcity of natural sources, but also to the unsustainable use of water in general by economic, social and institutional factors, that is, not only the problem of the anthropic degradation of soils, vegetation and environment, but also that of the bad distribution and administration of the demand.
Surprisingly, most families recognize the importance of forests and vegetation for water sources, assigning a scale between important and very important.

The results of the study show that the population of Sucre is willing to pay for the conservation of the Ravelo river basin, as long as that guarantees the sufficient quantity and quality of water for its use and consumption.

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The calculated Payment Disposition is US $ 1.20; This sum, multiplied by the approximately 60,000 families of the municipality of Sucre, gives a total of $ US 72,000 that could be collected each month, reaching an amount of $ US 864,000 per year.

When there really is a problem of water scarcity, such as that of the city of Sucre, the level of income or education, are determinants for the willingness to pay by families, but most importantly the conscience awakened by the real need to have water in sufficient quantity and quality to meet the needs. Therefore, the study shows a very significant DAP of $ US. 1,20.

The community members of the Ravelo river basin are willing to accept compensation for carrying out conservation work in the basin and prefer that this payment be concretized in projects and ventures that benefit all communities instead of individual payments by family.

The community members would accept a payment in cash, but prefer that the funds be allocated to projects and ventures that benefit all communities, giving as examples the following projects: housing improvement, pig farm, micro-irrigation, dairy cattle breeding, fish farming, beekeeping and others that may develop in the basin.

The annual DAP of $ US. 864,000 is enough to cover the opportunity cost of the alternative use in conservation work of the wage of the community members and of the land use of the lands on riverbanks calculated in $ US. 835,000; that is, the amount that the families in the city of Sucre are willing to compensate the community members for the SA, is enough to cover the amount that the latter would be willing to receive as compensation for the conservation of the Ravelo River basin.

There is a latent conflict between communities of the upper basin and those of the lower basin that originated in the lack of compliance in the agreements and negotiations between the communities of Sasanta and Yurubamba with the company ELAPAS in which no communities of the headwaters of basin.

On the other hand, there is another conflict between the communities and the city of Sucre that could reach truly worrying and irreversible levels at any moment if they are not found and apply solutions on time.

The implementation of a scheme of Recognition and Compensation of Environmental Services (RCSA) for the conservation of the Ravelo River Basin, in such a way that the necessary Hydrological Environmental Services are provided to have drinking water in the city of Sucre in the quantity and quality enough, it is viable.

Recomendations

Coinciding with the opinion of the community members, it is proposed that the organization for the management of the funds to be collected for the conservation works of the Ravelo river basin should be made up of different institutions and social organizations such as: ELAPAS, the municipal governments of Sucre and Ravelo, the communities involved, the provincial central office and the sub-centers.

Within the proposed institutional framework, the creation of an entity in charge of the administration of funds called the Compensation Trust for Hydrological Environmental Services (FICSAH), which would be integrated among stakeholders or interest groups with the participation of eight members, is proposed.

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Apply the proposed canon for drinking water consumption categories, as an instrument to collect income for the FICSAH labeled to conserve the Ravelo River Basin. This has the characteristic of imposing a greater burden on users who use and consume more liters per day, thus constituting a restrictive element to the greater consumption of drinking water and its subsequent contamination.

Compensation schemes for environmental services must be carried out in areas of interest and conflict, as is the case of the Ravelo River Basin, and must be governed by participatory and sustainability criteria, combining the efforts of municipalities, governorates, central government and organizations of base (community members in the basins and neighborhood councils in the cities), in addition to the participation of the universities for the corresponding technical support.

It is necessary to prepare and approve specific legal regulations that support and strengthen the application of instruments such as payment schemes for environmental services.

As a matter of urgency, the Municipal Government of Sucre and the Governorate of Chuquisaca must have a plan to raise awareness among the population about the rational, sustainable use, economic value and importance of water and the need to conserve and protect it. Encourage the culture of payment, that is to say that families assume costs related to the protection and conservation of the watersheds to which they are related.

As a very important additional measure to restrict water use, a seasonal tariff system should be applied, imposing higher water prices during the months of the dry season (in our case from April to September).

This would mean establishing a tariff system that takes into account the situation of relative scarcity of water resources.

ELAPAS must draw up a plan to improve the distribution of drinking water by zones, at the same time build storage tanks in the high areas to avoid water shortages, especially during critical hours during the day.

At the same time, it is necessary that the Municipal Government of Sucre elaborate and approve an Ordinance of Management and Efficient Use of Water in the City of Sucre.

ELAPAS must urgently carry out infrastructure works to meet the growing demand for potable water in the city of Sucre, such as:

- Expand the capacity of capture, conduction, treatment and distribution of water to the city of Sucre.
- It must improve its efficiency in the collection, conduction and distribution of water.
- Build storage tanks with sufficient capacity to satisfy especially the high and peri-urban areas of the city of Sucre.

On the other hand, in the long term, you should seriously think about other alternatives of water sources taking into account studies and projects such as the Cachimayu project or the wells around the city of Sucre.

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