Livelihoods in conflict: disputes over water for household-level productive uses in Tarata, Bolivia

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Abstract

In Tarata (Cochabamba, Bolivia) disputes came to a head in 2002 over the rights to use water for urban agriculture from a multiple purpose water supply system (Laka Laka). The Laka Laka dam was planned to provide water for a large irrigation scheme and to meet the basic needs of domestic users in the town, but not specifically for productive water uses within the urban area. When the urban population demanded the right to also use water for cultivation around homesteads, there were violent conflicts with farmers from the irrigation scheme who were determined to protect their irrigation water rights.

Almost 5% of the estimated reservoir yield (or 10% of the storage capacity) was originally allocated for urban water supply, but this could not be used for drinking water supply due to the poor water quality and high costs of treatment. The urban community organised to utilise this water, on the basis of advice they received from local government supporting their proposals, for irrigation of '*huertas*' (small plots close to homesteads) instead. An organisation was formed to develop the project and infrastructure to supply this water to *huertas*.

The paper reports the findings of a case-study to investigate the nature and causes of the conflict. It addresses the multiple uses of water and sources for domestic supply, urban agriculture and field-scale irrigation, and the potentially complex legislation, institutional arrangements, rights and expectations associated with these different water uses.

Key words

conflict, dams, domestic water supply, integrated water resources management, irrigation, urban agriculture

The conflict in Tarata

In late 2002, Tarata was the scene of violent confrontations between *regantes* (irrigators) from Arbieto and inhabitants of the nearby town of Tarata (*Tarateños*). Both groups damaged infrastructure

associated with the Laka Laka multi-purpose project: a dam and associated pipelines, canals and treatment facilities to supply domestic water to Tarata and irrigation water to Arbieto.

A direct factor in the escalation of the conflict was the construction of a new pipeline by the water supply utility *Servicio de Agua Potable y Alcantarillado Tarata* (SEAPA-Tarata), and the *Asociación Agropecuaria Tarata* (AGROTAR), to convey water from the dam to irrigate *huertas* (homestead gardens) in the town. In order to supply water to irrigate these gardens, SEAPA-Tarata reclaimed its share of water from the Laka Laka dam, an allocation that it had not used for the previous four years. This decision resulted in intense discussions between the *regantes* and the *Tarateños* over the regulations governing the allocation of the water from the dam. When the *Prefectura de Cochabamba* (the departmental government) failed to live up to perceived promises, *regantes* decided to take matters into their own hands. This led to two cycles of violent confrontations with the *Tarateños*.

At the end of September 2002 the *regantes* hit the streets, protesting that compromises reached with the authorities were not being implemented. Shortly afterwards in October, the *regantes* decided to destroy the pipeline of SEAPA-Tarata and AGROTAR that ran from the water treatment plant by the dam to the *huertas* in Tarata. *Regantes*, however, mistakenly destroyed the domestic water supply pipeline that runs between the water treatment plant and storage tanks. The mistake was made because, unknown to the *regantes*, the system of pipelines from the water treatment plant had recently been modified.

In an article in the newspaper Opinión on 6 November 2002 the municipal authorities of Tarata declared that the *regantes* had destroyed approximately 2000 meters of drinking water piping to the town of Tarata, and that the inhabitants had thus been left without drinking water. In reaction the *Tarateños* destroyed a part of the primary irrigation channel. However, the original vandalism did not actually severely affect the main domestic water supply. As we will see later, this supply comes from groundwater and not the dam.

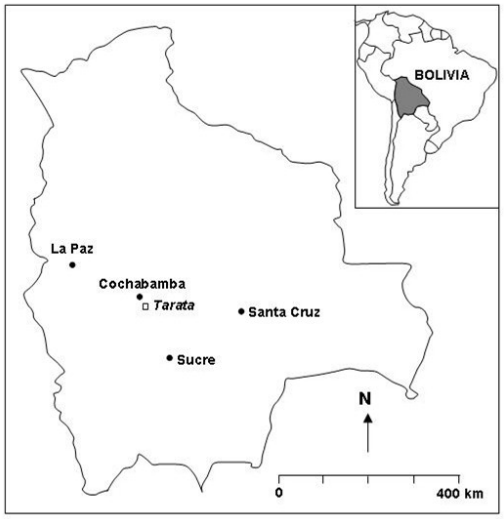
The conflict escalated again in December 2002 after promises from the *Prefectura* were not kept, according to the *regantes*, to remove the pipeline constructed by SEAPA-Tarata and AGROTAR for irrigation of the *huertas*. The *regantes* again took away part of the piping for drinking water supply, making the same mistake as in October. This was probably because they thought that the *Alcaldía de Tarata* (the municipal authorities) did not tell the truth about them having damaged the wrong pipes in order to mobilise the inhabitants of Tarata. This led to further confrontations between the *regantes* and the *Tarateños*, and the threat of reprisals (Los Tiempos, 28 Dec 2003).

The resulting damage to the water supply system led, the next day, to the blockading of roads by both the *regantes* and the *Tarateños*. Police managed to prevent the violence escalating. The *regantes* protested to protect their water rights, but also because of their disaffection with the actions of the *Prefecto* (head of the *Prefectura)*, and to demand the freedom of the seven *regantes* who were imprisoned after their perceived participation in the original acts of vandalism (Los Tiempos, 29 Dec 2003).

Background

Tarata is located 35 km from the city of Cochabamba in central Bolivia (Figure 1). At the edge of the Andes, the area falls within the upper part of the Amazon basin. The dam and catchment area are located in the municipality of Tarata which is in the province of Esteban Arze in the department of Cochabamba. The nearby downstream irrigated areas actually fall within the neighbouring municipality, Arbieto. This is a productive valley, with an important agricultural tradition.

Figure 1 Location of Tarata in Bolivia



The area around Tarata has a long history. The first known inhabitants, *Tiawanacota*, were pre-inca. Later, *Aymara*- and *Quechua*-cultures prospered. During the colonial period, from the late 16th century, the area became an important supplier of food for the mining area of Potosí, and Tarata became an important religious centre (Vargas, 1999). Arbieto was founded during this period. Products were made for regional and international markets, and today the area is still known for producing fireworks, pottery, crystal bottles and soap.

The climate is mild, but relatively dry (Table 1), and irrigation thus has a huge impact on agricultural production. Or as one farmer said: ¡*Cuándo no hay agua no hay una vida*! (without water there is no life). Most rain falls between December and February (Salazar & Soto, 1995). Traditionally wheat, maize, alfalfa and potatoes have been the most important crops. The height of the land and access to irrigation dictate which crops are grown, with potatoes important in the upper catchment, and wheat in lower areas. In Arbieto especially, higher value tree crops like peach, pear, apple and prune, flowers and vegetables are increasingly important. Most landholdings are individually owned, and vary between 0,5 and 10 ha.

Besides cultivation and livestock keeping, the most important economic activities in Tarata are making and selling *chicha* (a maize drink), ceramic pottery and fireworks. Around Lake Agostura in Arbieto a lot of families fish, which they sell in Cochabamba city. The gastronomic kitchen and other forms of tourism are an important source of income in Arbieto (Alcadia de Arbieto, 1998).

Relatively low returns from the main sources of livelihood in the area - 88% of people work mainly in agriculture, livestock raising or traditional craftworks – have resulted in high levels of both temporary and permanent migration. In the Chapare (the lowlands to the north east) there is work in agriculture, around Santa Cruz new developments employ seasonal labour, and in Argentina many migrants found better wages before the recent economic crisis. From Arbieto many families have relatives in countries like Israel, the United States and Argentina (Salazar & Soto, 1995).

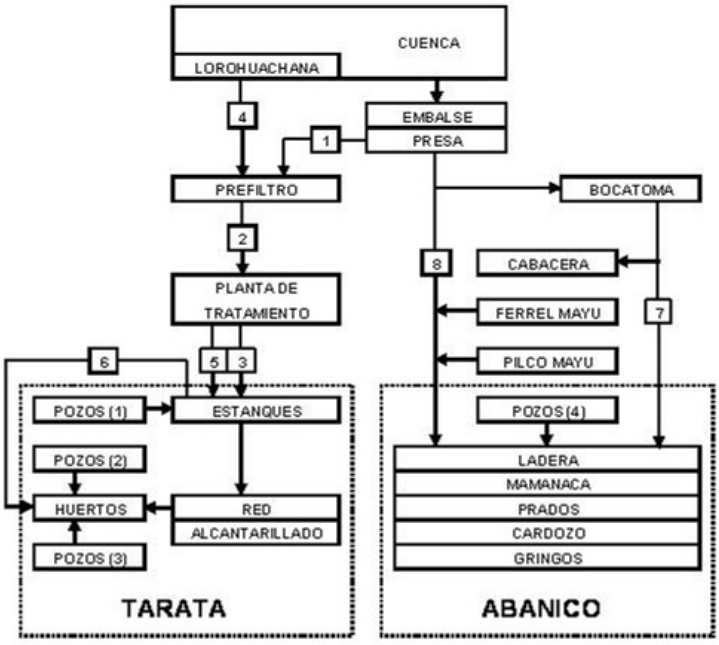
History of water development

Figure 2 shows a schematic illustration of the main features of the existing irrigation and domestic water supply systems. There are two main areas of water use: the irrigation scheme in Abanico (around Arbieto), and the town of Tarata. In the following sections, the development of systems for field-scale irrigation, domestic water supply, and

Table 1 Key background statistics for the study area

Pop. – Tarata municipality (1996)	7,881 (urban 3,786)
Pop. – Arbieto municipality (1992)	7,816 (urban 970)
Pop. density (province, 2000)	25.7 persons per km^2 (national 5.8)
Pop. growth (province, 1976-2000)	0,16% (national 2,75%)
Annual income per person (province, 1994)	637 US$ (urban 1211, rural 577)
Mean temperature	12 – 18°C (Sep-Mar)
Average annual rainfall	478,5 mm
Pot. evaporation (at Lake Angostura)	1,883 mm
Altitude	2750-3500 metres

Figure 2 Schematic illustration of irrigation and domestic water supply infrastructure



for urban agriculture (the *huertas*) are each considered.

Field-scale irrigation

Waters from the Calicanto River were utilised for irrigation before construction of the Laka Laka dam, albeit on a smaller scale, and in fact this was an early source of problems for the project. The preliminary proposal for the scheme failed to recognise the rights of traditional water users and these were only considered after protests. Irrigators with traditional rights to use water from the rivers that would supply the dam formed a *Comité Opositor* to lobby against the project.

But one of the main aims of the Laka Laka multi-purpose project (Box 1 and Table 2) was to provide increased water for irrigation in the valley downstream and roughly 95% of the available yield was set aside for this purpose. Irrigation water from Laka Laka is supplied to Cabecera (22 ha) in Tarata municipality and the various *suyus mayores* (major irrigation scheme units) of Abanico: Ladera (88 ha), Cardozo (82 ha), Mamanaca (203 ha), Prado (184 ha) and Gringo (324 ha). Within each *suyu mayor* irrigation water is divided between *suyus menores* (smaller units).

From the dam a lined primary channel (4 km long and with a capacity of 560 ls^{-1} [7]) conveys irrigation water to Abanico where further lined secondary channels divide the water (controlled with movable gates) between *suyus mayores*. The Calicanto River (Wasamayu River in Abanico) [8], Ferrel Mayu River and Pilcomayu River also convey additional water during the rainy season and are used for traditional irrigation. Wells also provide additional water within the irrigated areas during the dry season.

Box 1: The construction of the Laka Laka multi-purpose project

The first goal of the multi-purpose project was to augment the domestic water supply for Tarata which suffered in the dry season when wells that supplied the town would fail. The second goal was to improve the supply of irrigation water for Abanico. The construction of a dam and associated irrigation project near Tarata had been long talked about, since 1941 at least. In 1977, a cooperation agreement was signed between the Bolivian and Canadian governments to finance various projects and in 1984, CIDRE (*Centro de Investigacion y Desarollo Regional*) and CORDECO (*Cooperacion de Desarollo de Cochabamba*)

Table 2 Key statistics for the Laka Laka multi-purpose project

Height of dam	32 m
Capacity of reservoir	2,600,000 m^3
Catchment area	59 km^2
Yield of reservoir[1]	c. 6, 120, 000 m^3
Allocation for domestic water supply	270,000 m^3 (equivalent to 195 lpcd based on 1996 urban pop.) i.e. 4.4% estimated yield
Allocation for irrigation	5,850,000 m^3 (in 1994; equivalent to 648 mm/ ha irrigated area) i.e. 95.6% estimated yield
Irrigated area	903 ha

Notes: [1]Under 'normal' conditions at construction based upon nominal allocations for domestic and irrigation uses. Yield is declining rapidly due to sedimentation of reservoir.

investigated the feasibility of development projects in the region Laka Laka. In 1985 a first preliminary design for the dam was completed. Club 2/3, a Montreal-based Non-Governmental Organization (NGO) then became involved in the project and in 1988, CIDRE and Club 2/3 negotiated the financial cooperation to be provided by the Canadian International Development Agency (CIDA). A project was designed in two phases.

The first phase of the project from 1989-92 was executed through Club 2/3 and CIDRE, and involved a study of the project-area and, together with CORDECO, the construction of principal infrastructure including the dam, domestic water infrastructure for Tarata, and infrastructure to supply irrigation water to Cabecera and Abanico. The Laka Laka Dam was opened in April 1993 by the Canadian ambassador and the Bolivian minister of agriculture, after expenditure of 6.1 million US$. The *Asociación de Regantes del Complejo Multiple Laka Laka* and SEAPA-Tarata were established to manage the scheme.

The second phase of the project from 1992 then focused on institutional development to manage, operate and maintain the systems, efforts to optimise production and marketing, completion of infrastructure, and improving food security and nutrition among the local urban and rural population particularly women and children. In 1993 there were three *largadas* (periods of water supply when the dam is opened) to test the infrastructure and rules for operation. Modifications were made like deciding to only irrigate during the day and changing responsibilities for operation, and there were experiments with different crops. In 1997 the system was finally handed over to the *Asociación de Regantes del Complejo Multiple Laka Laka* and SEAPA-Tarata.

Sources: Northwest Hydraulic Consultants, 1995; Prins, 1996; Ricaldez Flores, 1996

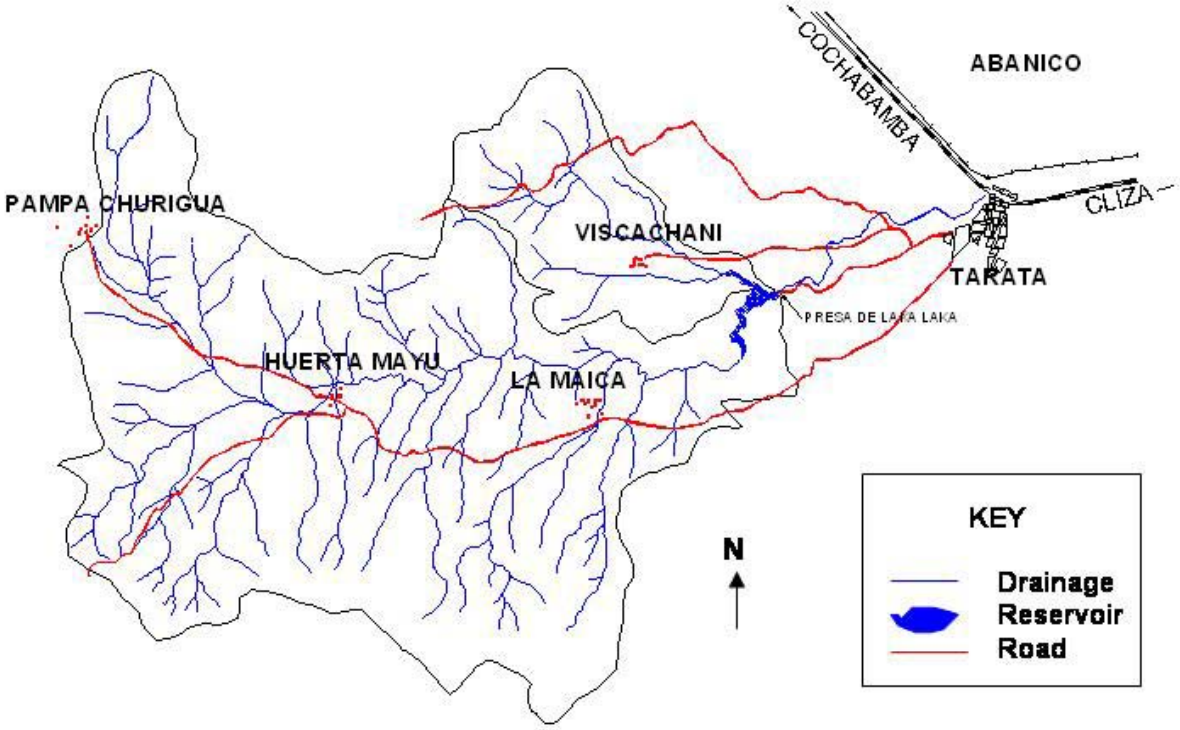
Domestic water supply

Although only around 1000 out of 1720 households in Tarata are connected to the main domestic water supply, these households do have access to a daily, 24-hour water supply with household connections. The supply is better than many other urban centres in Bolivia, and most households don't need additional water storage to cope with variations in supply. Households that don't have domestic water from the main system, rely upon wells or their neighbours.

Two domestic water supply storage tanks near Tarata can be filled from: the reservoir (via pipelines with a capacity of 12 ls^{-1} [1,2,3]; from two wells [pozos1] owned by SEAPA-Tarata (with a combined capacity of 13 ls^{-1}); or from a third source, a pipeline (capacity 3 ls^{-1} [4]) from the River Loro Huachana. This is a tributary of the Calicanto River upstream of the reservoir where the river has a lower sediment load. From the storage tanks, water then flows by gravity into the domestic water reticulation network. This reticulation system consists of three circuits (Central, Convento and Jarkapampa) and three lines (Mañaseria and Coheteria, Norte A and Norte B, and Ladera) (Zegarra, 1997).

Treating water to drinking water standards from the reservoir was found to be too expensive (0.2 Bolivianos per m^3) due to the high sediment load. Although the cost of water to consumers supplied from the two wells, which have been the main sources for the past four years, is much higher, 1 Boliviano per m^3. In practice only the two wells are used for the main domestic supply, and water from both the Laka Laka reservoir and the Loro Huachana is instead used for irrigation in the urban area.

Figure 3 Map showing catchment area of Laka Laka dam and the location of Tarata and the main irrigated area (Abanico)



Urban agriculture

In Tarata a lot of families cultivate *huertas*, sometimes more than one in different parts of the town. Typically these are at the back or around the family home, and may be between a few square metres and 2 ha in size. Common crops grown include maize, potato and wheat, fruit trees like peach and orange, vegetables like beans and peas, and alfalfa for livestock – either for home consumption or for sale. Not all households have *huertas*, but the number did increase significantly after the Laka Laka dam was built. Prior to construction of the dam, the *huertas* were irrigated with water from the domestic water supply system or family wells.

In the town there is now a system of pipes and earth canals to transport water by gravity to the *huertas*. There are also two pipelines (with capacities of 20 ls^{-1} [5 & 6]) from the treatment plant at the dam to supply water to the *huertas* in Tarata. These were not part of the original project design. This system is managed by AGROTAR. Irrigation water from the reservoir supplied to the *huertas* costs urban farmers 0.28 Boliviano per m^3. There are five main areas of *huertas*: Khara Khara (Convento), Convento, Señor de Romasa, Jarkapampa / Estación Ferrocarril and Mañaseria / Coheteria. There are now also five different sources of water for the *huertas*: 1) the reservoir; 2) Loro Huachana; 3) the main domestic water supply system supplied by SEAPA's wells; 4) two wells belonging to AGROTAR, [pozos2] but currently these wells don't function; and 5) individual wells [pozos3] of the owners of the *huertas*

The use of water for urban agriculture and other productive uses at the household level is discussed further in a companion paper by Bustamante *et al.* (2004).

Sedimentation of the reservoir

After construction of the dam, a major problem emerged. Very high sediment loads turn the water in the reservoir dark red during the rainy season. As well as ruling out the use of the reservoir for 'drinking' water supply because of the high treatment costs, sedimentation means that the lifespan of the dam will be short and the availability of water will decline rapidly. During the 1990s the capacity was estimated to have been reduced by 25%, compared with a normal expected rate of around 10%. Attempts to flush out the sediments have not been successful (Laboratorio de Hidráulica, 2001). From an estimated supply of 5,850,000 m^3 for irrigation in 1994 it is likely that by 2016 the available water for irrigation will be reduced by over half to only 2,550,000 m^3 (Salazar, 1996). And in order to meet the allocation for 'domestic' water supply year round, none of this irrigation water will be available in the dry season after 2016.

Causes of conflict

The conflict in Tarata in 2002 centred on the supply of water from the Laka Laka reservoir for urban agriculture. In this section, the main causes of the conflict are examined in detail including: the definition of what water supply for 'domestic' use meant to different stakeholders, the sale of water rights, motives of key actors in the conflict, and weaknesses in the enabling environment in Bolivia. In Table 3, the objectives and roles of key actors are also summarised.

What are 'domestic' uses of water?

Domestic water uses are commonly understood to include the water needs of families for drinking, cooking, washing and sanitation. But what about other water uses at the household level? Are small-scale productive uses like irrigation of small gardens, keeping a few livestock or home-based micro-enterprises like beer-making, also 'domestic' activities? And if so, at what scale do these kinds of productive activities become not 'domestic' but rather agricultural or industrial or commercial activities? Differences on these definitional issues were a key factor in the conflict at Tarata.

It is clear that SEAPA-Tarata does supply water from both the Laka Laka dam and from the Loro Huachana for the irrigation of *huertas* in parts of Tarata. According to SEAPA-Tarata, the water it abstracts from the dam may be used, not only for human consumption and a narrow range of domestic activities, but also for urban agriculture. A letter from the *Consejo Municipal de Tarata* (the city council of Tarata) and the *Alcalde de Tarata* (the mayor of Tarata) in the newspaper Opinión supports this view:

> '... SEAPA-Tarata will use with the goal of human consumption and for urban activities, meaning whatever use that can be given in the form of drinking water within the city limits of the town of Tarata (the *centro poblado* of Tarata) and other necessities of the inhabitants, which means that the water can be used for the industry, tourism, human consumption, livestock rearing, and for irrigation of pitches, gardens, pasture or land for the cultivation of crops...' (Opinión, 6 Nov 2003).

Table 3 Analysis of roles of key actors

Actor	Brief description	Objectives	Role in conflict
Regantes (irrigators)	Farmers in irrigation scheme in Abanico supplied from the dam cultivating cereals, fodder and increasingly higher value fruit tree and other horticultural crops. Formally represented by *Asociación de Regantes del Complejo Multiple Laka Laka.*	Determined to protect rights to irrigation water from the dam, over which they feel a strong sense of ownership having been involved in the construction. Concerned that water use for urban agriculture would reduce availability of water.	Initiated demonstrations to protest against water use from the dam for urban agriculture in Tarata, and took direct action damaging water supply infrastructure to the town.
Tarateños	Residents of Taratas some with huertas and involved in urban agriculture, some without.	Secure domestic water supply, also water supplies for productive activities.	Mobilised in demonstrations, and involved in damaging irrigation infrastructure.
Servicio de Agua Potable y Alcantarillado Tarata (SEAPA-Tarata)	Autonomous but publicly-owned utility supplying domestic water and sewerage services.	Involved in Laka Laka project from outset, and contributed to cost in order to get additional water. Later decided not to treat Laka Laka water to drinking water standard due to the high cost of treatment. Sold water rights for peri-urban irrigation to improve revenue flows.	Decided to promote creation of AGROTAR and promote use of 'domestic' water from Laka Laka for urban agriculture revitalising the traditional practices of irrigation of huertas.
Asociación Agropecuaria Tarata (AGROTAR)	Association promoting urban and peri-urban agriculture.	to develop irrigation facilities for urban agriculture, and provide agricultural extension services	Constructed pipeline to convey water from Laka Laka reservoir to Tarata that sparked the conflict
Alcaldía de Tarata	Local government responsible for development and administration in the municipality (urban and rural) of Tarata run, by elected officials and a mayor usually with strong political ties. Instrumental in establishment of AGROTAR and ultimately responsible for SEAPA-Tarata.	To implement programme as set out in annual (POA) and five-year municipal development plans (PDM).	Mobilised the Tarata community under the premise that domestic water supply was threatened by conflict with *regantes.*
Prefectura de Cochabamba (Unidad Departamental de Riego)	Government level between national and local. Formal owners of infrastructure including the dam.	To implement national policies at regional level especially through major development projects that are too big for individual municipalities.	Mediation, including formation of multi-sectoral commission in December 2002 (assisted by *Centro de Investigación y Desarrollo Regional* (CIDRE) and Canadian International Development Agency (ACDI / CIDA)) to resolve the conflict, made up of representatives of both the r*egantes* and the *Tarateños*.
Federación Departamental de Cochabamba de Regantes (FEDECOR)	Federation of irrigation associations in Department of Cochabamba.	To represent the interests of member irrigation associations.	Organised discussions and negotiations, mobilised *regantes* in demonstrations, represented views in press and worked for agreements reached to be implemented.
Ministerio de Agricultura, Ganaderia y Desarrollo Rural	National level ministry responsible for agriculture and rural development.	To develop and implement national policies for agriculture and rural development.	Legal advisor defined that urban activities could include irrigation of crops.

This view is contested by the *Regantes* who point to the ministerial resolution of 1993 regarding water distribution between the *Asociación de Regantes del Complejo Multiple Laka Laka* and SEAPA-Tarata. This resolution states that:

> 'With the goal of human consumption and the established urban activities in the town of Tarata (the *centro poblado* of Tarata), a volume of 270,000 m^3 of water per year will be given, which will be administrated by the Servicio de Agua Potable y Alcantarillado de Tarata (SEAPA-Tarata)' (Resolución ministerial no.064/93 del Ministerio de Asuntos Campesinos y Agropecuarios).

This ministerial resolution does not clarify exactly what can be considered an 'established' urban activity. Not resolving whether urban agriculture was an 'established' urban activity has clearly been a key issue in the conflict. Can a once traditional activity that had declined (cultivation of *huertas*) be described as 'established'. SEAPA-Tarata aimed to revitalise these *huertas* to create more employment and generate more income for the *Tarateños*.

Sale of water rights, and of water that does not exist

As we heard before, to use the water from the Laka Laka dam (and from Loro Huachana) for the irrigation of *huertas*, the inhabitants of Tarata organised themselves in the *Asociación Agropecuaria Tarata* (AGROTAR) who developed an irrigation project for the *huertas* with help from the municipality and SEAPA-Tarata (Opinión, 6 Nov 2003). The creation of AGROTAR and the subsequent construction of the irrigation system in Tarata, was itself possibly a violation of the regulations for the multi-purpose project. The ministerial resolution of 1993 prescribed that there were to be only two organisations in charge of the administration of the water from the Laka Laka dam, the *Asociación de Regantes del Complejo Multiple Laka Laka* and SEAPA-Tarata.

SEAPA-Tarata sells water from the Laka Laka dam to AGROTAR. Subsequently, AGROTAR has sold *acciones* (shares giving a right of access to water) to *Tarateños* with *huertas*. Furthermore, some of these *huertas* are situated outside the city limits (the *centro poblado*) and are owned by people who did not work in the construction of the dam. The only *Tarateños* who should receive water from the Laka Laka dam are the ones who live within the city limits or who laboured in the construction of the dam. The project regulations state that SEAPA-Tarata would administer water from the dam within the city limits. However, following the construction of the dam the town has grown significantly. The *centro poblado* has even grown beyond the limits of the watershed of the Río Calicanto. According to the *Regantes* these parts of Tarata do not have a right to water from the dam, whilst it is clear that AGROTAR is selling water in these parts.

During the period when SEAPA-Tarata did not utilise water from the dam the *regantes* had more available water, and had started to sell rights to water that could only be fulfilled whilst SEAPA-Tarata did not utilise their share. Now that SEAPA-Tarata once again abstract from the dam there is less water available for irrigation in Abanico. The *regantes* have run into problems as they no longer can supply water to all the farmers to which they have sold rights or shares. A number of *regantes* thus do not receive irrigation water anymore even after they bought shares. Each year the amount of water available in the reservoir is also declining due to sedimentation, whilst demands on the side of the *regantes* have increased.

It is actually prohibited for both SEAPA-Tarata and the *Asociación de Regantes del Complejo Multiple Laka Laka* to sell water from the dam to persons who did not work in the construction (although rights are transferred in land and house sales). However, as well as SEAPA-Tarata and AGROTAR selling rights to water, it seems clear that the *Asociación de Regantes del Complejo Multiple Laka Laka* is also selling water in violation of these rules. In Abanico, farmers without shares can still buy water from the *Asociación* for approximately US$ 5-7 dollars per turn. It has

been said that the Laka Laka dam was constructed for the irrigation of 400 hectares of land, but today are closer to 1000 hectares are being irrigated despite uncertainty over the true figures. This may be a result of sales of extra water by the *Asociación de Regantes del Complejo Multiple Laka Laka*, and because some *regantes* obtain more water than they are supposed to be allowed. In reality while an irrigation turn may allow half an hour of irrigation, in practice the plot is irrigated until it is deemed sufficient. Some farmers also 'steal' water to irrigate extra land. Water shortages are also aggravated by the fact that the available irrigation water is not used very efficiently.

Motives, interests and entrenched positions

Why don't the *regantes* want water to be supplied for urban agriculture in Tarata? And, why is urban agriculture so important in the town? The *regantes* are strongly opposed to the supply of water from the Laka Laka system to Tarata for irrigation of *huertas*, even though this represents a small amount of water (around 5%) compared to total availability. There are several reasons for this situation. First, the *regantes* feel that they have more rights to the water from the reservoir since SEAPA-Tarata had not used the water for 4 years and urban water users did not participate in construction and maintenance of the system to the same degree. Participation in construction of irrigation facilities by providing labour is a normal way of creating rights over a system and the water. Added to the perceived loss of rights, the *regantes* are concerned that in the future the town's demands for water for urban agriculture will increasingly threaten their interests. As sedimentation further reduces the yield of the reservoir, year round use in Tarata will also have an increasingly severe impact on the amount of water remaining for the irrigation scheme especially during the dry season. In addition to these water resources issues, there are also strong historical rivalries between the town of Tarata and surrounding rural communities that date back decades to clashes between peasants and the landowning classes.

Weak overarching legislation, and institutional frameworks

As noted above, the content of water rights associated with the Laka Laka scheme (specifically whether domestic use in the town should encompass irrigation of *huertas*) are unclear and contested. Confusion over the specific understanding of water rights, typical of other water resources conflicts in Bolivia, is largely a result of a vacuum in policy, legislation, decision-making and regulation for water management. A common situation in such circumstances is that irrigation farmers seek to create their own rules for water rights, such as linking these to investments made in construction or maintenance. In this vacuum, schemes such as Laka Laka struggle to find their own local solutions. And when water resource conflicts do arise there are not clear norms and procedures for institutions such as municipalities or the *Prefectura* to resolve the conflict. In such an environment, water users tend to seek support through other institutions and channels often depending upon the mobilisation of political support.

Conclusions and lessons

The use of water from the Laka Laka reservoir for urban agriculture was in the opinion of the *regantes*, against the agreed rules for operation of the multiple purpose scheme. The construction of a pipeline to irrigate *huertas* in the town and renewed use of the water from the dam by the town after a gap of four years was a direct cause of the conflict, aggravated by the lack of overarching legislation and norms, and the historic rivalry between the municipalities of Tarata and Arbieto.

The declining yield of the reservoir due to severe sedimentation is likely to lead to further pressures on the scarce water resources in the area, and potentially continued or more serious conflict, unless strong institutions are able to manage the diminishing resource and resolve the conflicting interests. Potential solutions to help minimise or resolve the existing conflict in Tarata could include better

information sharing between key stakeholders (including reliable information on declining future water availability due to sedimentation), more transparency in the operations of the institutions (SEAPA-Tarata, AGROTAR, the *Asociación de Regantes del Complejo Multiple Laka Laka* and local government), general strengthening in institutional capacities to deal with conflicts, and in the irrigated areas especially, measures to introduce incentives to use water more efficiently.

Although every conflict over access to contested resources has many local characteristics, some more widely applicable lessons can be learnt from the disputes in Tarata:

- Improved domestic water supplies, in this case following construction of a reservoir and associated infrastructure, will in certain cases lead to increased water use for urban agriculture and productive uses,
- Productive water uses at the household level are, as in Tarata, rarely considered in planning. These needs should be properly considered in the project design for improved water supplies and multi-purpose projects, and the rights to water for these uses should be clearly negotiated and agreed in multiple-purpose projects.

Whether urban agriculture, or other productive uses of water around homesteads, should be explicitly encouraged within domestic or multiple-purpose water supply projects should amongst other factors be based upon: an assessment of local needs; comparisons of the efficiency, benefits and costs of productive water uses; assessment of contributions to (or disadvantages for) cost recovery and sustainability; and an understanding of whether there are particular benefits for the poor. Follow-up research based upon detailed household-level studies in Tarata has been initiated to address these wider questions.

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