THE ALLOCATION OF WATER RESOURCES IN THE BOGOTÁ SAVANNA REGION: CASE STUDY

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Abstract

The Bogotá Savanna is a fertile Andean plateau located in the central region of Colombia. It is an important agricultural region, and the most industrialized and densely populated area of the country. In this region, human consumption demands most of the available water; the development of the agricultural, energy, and industry sectors is highly dependent on water availability. Water scarcity is prevalent in some rural areas of the region and becomes more severe during the months of January, February, July and August. Therefore, decisions related to water allocation are of the large economic importance. Since the sixties, a series of regulations and institutional arrangements were devised to allocate water among the different users in this region. However, the efficiency, transparency and equity of those institutional mechanisms and regulations leave much to be desired. This is case study illustrates this situation by applying the analytical framework of the World Development Report (WDR) 2003.

Key words: water, regulation, institutions, Colombia

JEL classification: N5, O13, Q20

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ASIGNACIÓN DE LOS RECURSOS HÍDRICOS EN LA SABANA DE BOGOTÁ: ESTUDIO DE CASO

Resumen

La Sabana de Bogotá es una planicie andina localizada en la zona central de Colombia. Es una región de importancia agrícola; y concentra la mayor actividad industrial y densidad poblacional del país. El consumo humano demanda la mayor parte de los recursos hídricos de la región y el desarrollo de los sectores agrícola, energético e industrial es altamente dependiente de la disponibilidad de agua. En algunas áreas rurales se presenta escasez de agua y esta es más severa durante los meses de Enero, Febrero, Julio y Agosto. En consecuencia, las decisiones relativas a la asignación del agua son de la mayor importancia económica. Desde los años sesenta se adoptaron una serie de regulaciones e instituciones para asignar el agua entre los distintos usuarios de la región. Sin embargo, la eficiencia, transparencia y equidad de esos arreglos institucionales y regulaciones dejan mucho que desear. Este estudio de caso ilustra esa situación mediante la aplicación del marco analítico del Informe sobre el Desarrollo Mundial 2003 del Banco Mundial.

Palabras clave: agua, regulaciones, instituciones, Colombia

Clasificación JEL: N5, O13, Q20

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Introduction

This case study analyzes the allocation of water resources between the different stakeholders in the area of the Bogotá Savanna of Colombia, and the corresponding policy and institutional implications. It describes how although the government was able to prevent water scarcity for the large water users of the region, primarily through a series of supply side engineering solutions, current institutions and regulations do not respond to the realities and needs of small water users. In general, those institutions and regulations cannot guarantee equitable access to water to small rural users such as farmers. Likewise, they cannot guarantee the protection of their water rights nor their participation in relevant decisions. In addition, the prevalent framework does not provide mechanisms for the resolution of their water conflicts.

The first section of this case study describes the Bogotá River watershed, provides a brief historical perspective, a description of the relevant institutional and legal framework and the current processes of water allocation in the region. Following the framework of the World Development Report (WDR) 2003, the second section of this document analyzes how society becomes aware of water allocation problems, and the mechanisms that have generated decisions to face them. The second section also discusses the mechanisms which have been in place to balance legitimate, competing social interests, and the means by which the adopted solutions are executed. Finally, the third section of this document presents a series of lessons and recommendations.

1. Description of the Case

1.1 The Watershed

The Bogotá Savanna is the most industrialized and densely populated region of Colombia. The Bogotá Savanna generates 27% of Colombia’s GNP, including 72% of the industrial output. This region houses the city of Bogotá; Colombia’s capital. This city has a population of about 6,789,122 and an annual growth rate of 2.08%. The city of Bogotá is surrounded by 19 municipalities also located over the Bogotá Savanna. Those municipalities have a total population of 882,699. During the last two decades industrial production has grown faster in those

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6 Departamento Administrativo Nacional de Estadísticas – DANE. www.dane.gov.co  
7 La Calera, Sopó, Tocancipá, Zipaquirá, Cajicá, Chía, Cota, Gachancipá, Tabio, Tenjo, Subachoque, El Rosal, Funza, Mosquera, Madrid, Facatativá, Bojacá, Soacha and Sibaté.  
municipalities than in Bogotá\(^9\). About 15% of the national population lives in Bogotá.

The Bogotá Savanna is also an important agricultural region. It produces 2.2 million litters of milk a day\(^{10}\) with an annual value of US $ 136 million, and 85% of the national flower production with an annual value of $ US 600 million\(^{11}\). In addition, the Bogotá Savanna is the country’s main producer of fresh vegetables\(^{12}\). As the waters of the Bogotá River drop from the high Savanna to the lowlands of the Magdalena watershed, they are used for the generation electric energy.

The Bogotá Savanna is a fertile Andean plateau with an altitude of 2560 m above sea level\(^{13}\). It has a total area of 421,852 hectares. It is drained by the Bogotá River along 185 kilometers.

\(^9\)4.4% for the surrounding municipalities Versus 2.3 % for Bogotá.
\(^12\) Censo Hortícola de la Sabana de Bogotá. 2002. DANE, Ministerio de Agricultura. Bogotá
\(^13\) www.ideam.gov.co
The average annual precipitations in this region vary from 700 per year in its drier areas to 1941 mm in the rainier ones. The drier areas of the region are the central area and the northern and southern extremes. Chart one presents monthly rainfall distribution at the El Dorado Airport where average annual rainfall is bellow 800 mm per year.

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15 http://bart.ideam.gov.co/cliciu/bogota/tabla.htm
Water yields in the watershed of the Bogotá River vary between 10 and 25 L/s/Km². Seventy percent of the area of the watershed presents a negative water balance\textsuperscript{16}. Water scarcity in the rural areas of the region becomes more severe during the months of January, February, July and August.

The groundwater resources of the Bogotá savanna are mainly located under the alluvial valleys of the Bogotá, Subachoque, Chicú Riofrio, Tuesacá and Checua rivers. There are two main aquifers in the region. The “Aquífero de la Sabana” and the “Acuífero Guadalupe”. The fist of them is the most superficial. It reaches a depth down to 400 meters and it can yield 5 L/s. This aquifer produces nearly eighty percent of the underground water resources of the region. The “Acuífero Guadalupe” is located at depths between 800 and 1300 meters and can yield 20 L/s.

### 1.2 Historical Perspective

By the late 1940s, there were signs of water scarcity in the city of Bogotá and the administration of the city realized that it needed to identify new sources of this resource\textsuperscript{17}. The administration of Bogotá decided that additional water should be brought form be upper basin of the Bogotá River\textsuperscript{18}. In accordance, an aqueduct and a treatment plant (Tibitoc) were built on the upper basin of the Bogotá River.


By 1959, the new infrastructure was in operation under the administration of Aqueduct and Sewerage Company of Bogotá - Empresa de Acueducto y Alcantarillado de Bogotá. With this new infrastructure, the Aqueduct and Sewerage Company had the capacity to deliver additional 3 m³/s of drinking water to a growing population of up to 1.4 million. However, the Aqueduct and Sewerage Company envisaged that given current demographic trends, additional water would be needed by 1970, and that the watershed of the Bogotá River and its tributaries did not have the capacity to provide the necessary quantities. In addition to the Aqueduct and Sewerage Company of Bogotá - Empresa de Acueducto y Alcantarillado de Bogotá there were additional water demands from two main users: The Energy Company of Bogotá - Empresa de Energía de Bogotá and the La Ramada Irrigation district.

The Energy Company of Bogotá - Empresa de Energía was the owner of a series of hydroelectric power plants which had been built sequentially along the lower basin of the River during the first half of the 20th century. Those plants generate hydroelectric energy as the Bogotá River leaves the Savanna from the South and drops to the lowlands of the Magdalena River. As a part of this energy generating system, the Energy Company of Bogotá - Empresa de Energía built the Tominé reservoir in 1967, in the upper basin of the Bogotá River. This reservoir was built to control the flow of water to the lower basin where energy was generated. Until 1985, when the El Guavio hydroelectric complex was inaugurated and the national electricity market was created, the economy of the Bogotá Savanna was critically dependent of this energy.

The La Ramada Irrigation District is the only irrigation district of the region. It has been administrated by the Regional Autonomous Corporation CAR since its creation in 1961. This Corporation distributes the water among its users, and has always made provisions to ensure that the irrigation district does not face scarcity problems. This district of 6.215 hectares is located on the western flank of the Bogotá River, in front of the city. It takes 3 m³/s from the Bogotá River before

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19 Created in 1955 by the City Council (Acuerdo 105), after the closing of the “Acueducto Municipal” that was administered by the municipal government.

20 The capacity of this plant was latter expanded to 6 m³/s

21 While Colombia’s urban population during the early fifties represented 39% of the total population, it was nearly 70% by the mid eighties.

22 This facility uses water from the Orinoco Watershed.


24 There are 34 of these corporations in Colombia. They are public institutions that regulate and administer the environment at the regional level. They are decentralized entities that operate under the supervision of a Board of Directors composed by municipal mayors, local NGOs, organizations of the private sector, ethnic groups and the delegates of the Ministry of the Environment and of the President. The Board of Directors appoints the Director of the Corporation for renewable periods of three years and approves the Corporation’s strategies, programs and projects. According to Law 99 of 1993 they should act under the general coordination and guidelines of the Ministry of the Environment, Housing and Regional Development.

converging with the *El Salitre* River\textsuperscript{26}. The beneficiaries of that district are principally dairy farms of high economic value. Most of the water needs of the flower industry are provided by underground resources and are outside of this irrigation district.

In 1966, following technical evaluations conducted by the Aqueduct and Sewerage Company, with the support of a consulting firm\textsuperscript{27}, potential new sources of water were identified in the *Guaitiquía*, *Chuza* and *Riofrío* Rivers. These rivers, which are located in the east mountainous region of the Bogotá Savanna, belong to the watershed of the *Orinoco* River. The *Chingaza* System was built to divert water from those newly identified sources to the Bogotá Savanna. In 1985 the system began operation. This system presently supplies 8 m$^3$/s to the domestic users of the Bogotá Savanna. This corresponds to about two thirds of the water production of the Aqueduct and Sewerage Company (*El Acueducto*)\textsuperscript{28}\textsuperscript{29}. Therefore, the Aqueduct and Sewerage Company - *El Acueducto de Bogotá* - currently takes waters not only from the Bogotá River and its tributaries, but also from rivers of the *Orinoco* watershed. It distributes them not only to the City of Bogotá but also to eleven municipalities located in the same Savanna surrounding the capital of Colombia.

### 1.3 Relevant Regulations

The main regulations relevant to water allocation are the Code of Natural Resources (Decree 2811 of 1974), Law 99 of 1993 and Decree 1541 of 1978. According to Law 99 of 1993, the Ministry of the Environment\textsuperscript{30} is responsible for approving national policies and regulations related to water use. The Regional Autonomous Corporations and the urban environmental authorities are responsible for the administration of water resources\textsuperscript{31}. According to the Code of Natural Resources and to Decree 1541 of 1978 these environmental authorities should allocate water according to the following order of priorities: human consumption, preservation of fauna and flora, agriculture, animal husbandry, recreation, industry, and transportation. The Code of Natural Resources does not take into account that in a diverse country like Colombia where the economic value of water and the

\textsuperscript{26} Distritos de Riego La Ramada y Bojacá – La Herrera Área Actual y Proyecto de Ampliación. 1995. CAR. Bogotá.
\textsuperscript{27} Ingetec. S.A.
\textsuperscript{28} The Aqueduct and Sewerage Company of Bogotá - *Empresa de Acueducto y Alcantarillado de Bogotá* was restructured and renamed in 2003.
\textsuperscript{29} Asesoría Técnica para el Trámite de Concesión del Río Bogotá con la CAR Planta Tibitoc. 2003. INGETEC. Informe de Consultoría. Acueducto de Bogotá.
\textsuperscript{30} The Ministry of the Environment was reorganized and given a new name by Decree 216 of 2003: *Ministerio del Ambiente, la Vivienda y el Desarrollo Territorial* (MAVDT): The Ministry of of\textsuperscript{30} Article 31 of law 99 of 1993.
\textsuperscript{31} Article 31 of law 99 of 1993.
social preferences can change from one region to another, priorities of water allocation may also change.

This could be inconvenient because, for example, while the allocation of water for the manufacturing sector might generate important social benefits in industrial regions such as the municipality of Soacha to the south of Bogotá, and the allocation of water for irrigation could be considered a social priority in the fertile agricultural region of the Bogotá Savanna.

Decree 1541 of 1978 regulates the procedures to obtain water permits and their associated rights and conditions. According to this regulation the rights to divert water from a superficial source or to draw it from underground deposits are granted by the local environmental authorities through water concessions. The procedures to obtain a water concession might take several years. This could be attributed to the cumbersome nature of the procedures of Decree 1541 of 1978. The fact that the procedures are largely centralized might also contribute to the delays. In the rural areas and in the municipalities of the Bogotá Savanna water concessions are granted by CAR. Inside the city of Bogotá they are granted by DAMA. Those concessions are granted for up to ten years. Water concessions can only be transferred to another beneficiary with the authorization of the environmental authority, and the original conditions of the concession can not be changed.

The Code of Natural Resources and Decree 1541 of 1978 do not indicate what the practical implications of the legally determined order of priorities for water use should be. In consequence, the government officials responsible for water allocation are left to make their own interpretations. When several users of different sectors demand the same water resource, the allocation among those users ultimately becomes a discretional decision of the responsible government official.

Until December of 2003, based on Acuerdos approved by the Regional Autonomous Corporation, this institution charged a fee for the use of the water. This corporation began to charge this water fee in 1999 in the area of the Bogotá Savanna. This fee had its legal origin in the Code of Natural Resources. However this Code did not provide criteria for the definition of water fees. Consequently they were autonomously determined by the Regional Autonomous Corporation, CAR. The CAR charged water fees to the Aqueduct and Sewerage

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32 Interviews with Mr. Hernando Amado employee of CAR responsible for the technical evaluation of water permits.
33 In cases of public interest such as aqueducts or public infrastructure concessions could be granted for up to 50 years.
34 Interviews with Mr. Hernando Amado and with Mr. Hernando Niño employees of CAR responsible for the technical evaluation of water permits and for the coordination of the Hydrologic Committee, respectively. Bogotá. March 2004.
35 Acuerdo 8 of 2000.
36 Article 159; Decree 2811 of 1974.
Company – *El Acueducto* - and to the small agricultural irrigation systems of the region\(^{37}\). Nevertheless, the Corporation did not charge water fees to the beneficiaries of *La Ramada* Irrigation District under its own administration. The reasons for this differential treatment could not be explained by those CAR officials responsible for charging water fees. Apparently, this resulted from the large influence exerted over the Corporation by the users of the irrigation system\(^{38}\).

Water fees in the rural areas of the Bogotá Savanna have been independent of the user. However, these fees vary widely according to the socio-economic conditions of the area and with water availability\(^{39}\). While in the Municipality of Subachoque the water fee for irrigation was Col $ 12 /m\(^3\), the fee paid by Aqueduct and Sewerage Company – *El Acueducto* - varied between Col $72/ m\(^3\) for water taken from the Bogotá River to Col $ 127 / m\(^3\) for water taken from the *Teusacá* River\(^{40}\). The fees paid by the *El Acueducto* corresponded to between 10 and 18 percent of the price of drinking water in the Bogotá Savanna. The value of the fees is adjusted annually to inflation.

In 2003 CAR collected US $ 5.2 million in water fees. About 83% of that sum was paid by the Aqueduct and Sewerage Company of Bogotá. This Company has sued the CAR for all its payments related to water fees. It has also sued some of the Corporation’s decisions related to water allocation\(^{41}\).

Until December of 2003, based on *Resolución* 259 of 1997, DAMA charged a fee for the use of underground water within the city limits. Like the water fees charged by CAR, this fee had its legal origin in the Code of Natural Resources\(^{42}\). This fee varied between Col $ 148 and Col $ 305, depending on the depth of the resource\(^{43}\). Water fees collected by DAMA in 2003 amounted to US $700.000\(^{44}\).

In 2003 the Colombian Farmers’ Society (*Sociedad de Agricultores de Colombia*) sued the water fees that, based on article 159 and 160 of the Code of Natural Resources, some Regional Autonomous Corporations had been charging since 1984. In December of 2003, the Constitutional Court declared those articles of the Code of Natural Resources no longer applicable. It was the opinion of the Court


\(^{38}\) This is the opinion of the author

\(^{39}\) *Acuerdo* 8 of 2000.

\(^{40}\) Interview with Mr. Hernando Niño; a CAR employee responsible for the Coordination of the Hydrologic Committee. Bogotá. March 2004.

\(^{41}\) In 2003 *El Acueducto* took to court the decision of CAR to order to transference of 2 m\(^3\) per second form the *San Rafael* Reservoir to the Bogotá River to ensure a flow of good quality water for the *La Ramada* irrigation district. To this date the Court has not made a decision.

\(^{42}\) Article 159; Decree 2811 of 1974.

\(^{43}\) The fee decreased as the depth of the resource increased. This is related to the increasing availability of underground water with increasing depth, and with the higher risk of underground water pollution caused by extraction at lower depths.

\(^{44}\) Information provided by DAMA.
that they had been replaced by article 43 of Law 99 of 1993. Consequently, water fees could not continue to be charged using the legal bases provided by the Code of Natural Resources. According to the Court specific regulations based on article 43 of Law 99 had to be approved before those fees could be charged again.

During 2002 and 2003 the Ministry of the Environment held a series of meetings in which the regulated sector made different proposals with respect to new water fee regulations which developed Article 42 of Law 99. The mining and manufacturing industries, the aquaculture, water, oil, and agriculture sectors, the Corporations, the Waterworks Company - El Acueducto of Bogotá, and the National Parks Unit, all contributed with ideas and proposals. Other social groups such as communities and NGO's did not participate in the processes that led to the approval of the new water regulations. Based on the proposals made by the participating stakeholders the Ministry of the Environment recently approved new regulations (Decree 155 of 2003 and resolución 240 of 2004).

Decree 155 of 2003 and resolución 240 of 2004 were approved by the Ministry of the Environment to develop article 42 of law 99 of 1993. According to Decree 155 of 2003 and to Resolución 240 of 2004 issued by the Ministry of the Environment, the minimum price for a cubic meter of water in Colombia is Col $ 0.5 and the maximum is Col $ 3.5 pesos. This maximum fee represents 2.75% of the water fee that the CAR had been charging for water coming from the Teusacá River up until 2003. It represents about 1.5% of what DAMA had been charging for the use of underground water resources. This new fee approved by resolución 240 of 2004 is between a hundredth and a thousandth of the marginal value of water for the industrial sector of Colombia; it corresponds to 1.5% and 6.5% of the marginal contribution of water to the production of potatoes and peas in one municipality of the Bogotá Savanna. The new lower water fees could be attributed to the wide representation of the regulated sector in the process that led to the approval of the new regulations, and to the absence of other relevant stakeholders such as NGO’s and communities. Quantitative studies relative to the social value of water were not used by the Ministry of the Environment to determine the price of water. Presently the Regional Autonomous Corporation - CAR, is doubtful that the collection of the new water fees can be justifiable from a financial point of view.

1.4 Water Allocation

There is a complex system of water reservoirs, tunnels, gates, canals, aqueducts and valves to allocate water among its various possible large users. A series of

\[\text{\textsuperscript{45}}\text{decision C-1063 of 2003}\]
\[\text{\textsuperscript{46}}\text{Memorias del Taller Conjunto para la Reglamentación de las Tasas de Uso de Agua. 2002. Ministerio del Medio Ambiente. Bogotá.}\]
\[\text{\textsuperscript{49}}\text{Interview with Mrs. Gloria Lucía Álvarez; Director of CAR. July 2004. Bogotá.}\]
reservoirs (Tomine, Neusa, Sisga, Tbitoc, San Rafael, and La Regadera) are used to store and regulate the flows of water along the course of the Bogotá River, and to allocate water among large users.


Diagram one presents a simplified version of the main hydrologic structures of the region. The flows of water to the watershed can be controlled by gates at the Sisga, Tomíné, Neusa, San Rafael, and La Regadera reservoirs. The Sisga and Tomíné reservoirs control the flow of water to the Tbitoc treatment plant in the upper basin of the Bogotá River. Gates at the San Rafael and La Regadera reservoirs control the flow of water to the aqueduct of the city of Bogotá. Additional water flows can be made available to the La Ramada irrigation district through the Neusa and San Rafael reservoirs. As indicated in diagram one, the overflow from the region is used to generate electricity along the lower watershed as the river drops form the Bogotá Savanna to the lower Magdalena Valley.

Water is allocated among large users through the operation of this system. In some cases, the water that is made available to one user can not be later re-used by others. For example, the waters of the upper basin of the Bogotá River that are

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50 Taken form the Geographic Information System of CAR.
diverted to the city of Bogotá at the Tbitoc treatment plant are no longer available for the La Ramada irrigation district. Likewise, the water delivered from the San Rafael reservoir to the La Ramada irrigation district is no longer available for human consumption or for the generation of electricity in the lower basin.

On the other hand, the residual waters of the city of Bogotá are used for electricity generation\textsuperscript{51}, but are heavily polluted for human consumption and for ecological, recreational and agricultural purposes. Additionally, the demands of water by the electricity generating plants of the lower basin of the Bogotá River are higher at night. Those higher demands do not always coincide with the water flows available for electricity generation. Those flows depend mainly on the production of residual waters by the city of Bogotá.

Table one summarizes the information\textsuperscript{52} available with relation to superficial and underground water consumption in the Bogotá Savanna.

Table One: Main sources and demands of water in the watershed of the Bogotá River.

<table>
<thead>
<tr>
<th>Sources</th>
<th>Mean Flow m(^3)/s</th>
<th>User</th>
<th>Uptake m(^3)/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunjuelito River a tributary of the Bogotá River\textsuperscript{53}</td>
<td>4.4</td>
<td>Aqueduct and Sewerage Company – El Acueducto</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Small users*</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mining</td>
<td>Unknown</td>
</tr>
<tr>
<td>Bogotá River\textsuperscript{54}</td>
<td>9</td>
<td>Aqueduct and Sewerage Company – El Acueducto**</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>La Ramada Irrigation District</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agricultural users</td>
<td>Up to 4.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>La Ramada Irrigation District</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other users</td>
<td>0</td>
</tr>
<tr>
<td>Small Superficial Currents\textsuperscript{55}</td>
<td>Unknown</td>
<td>Small users*</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Municipalities</td>
<td>Less than 1.5\textsuperscript{56}</td>
</tr>
</tbody>
</table>

\textsuperscript{51} The system has a maximum generating capacity of 1150 Mw
\textsuperscript{52} Information of this table was provided by Water and Sewage Company (El Acueducto), The Regional Corporation (CAR) and the Environmental Department of Bogotá (DAMA).
\textsuperscript{53} Information provided by the Water and Sewage Company (El Acueducto)
\textsuperscript{54} Information provided by CAR
\textsuperscript{55} This includes the following watersheds: Salto – Soacha, Muña, Soacha, Balsillas, Tunjuelito, Cerros Orientales, Chicú, Río Frio, Teusacá, Negro, Neusa, Sisga- Tbitoc, Tominé, Sisga, Río Alto Bogotá.
\textsuperscript{56} Information provided by CAR
Sources | Mean Flow m$^3$/s | User | Uptake m$^3$/s
--- | --- | --- | ---
Underground Bogotá$^{57,58}$ | Unknown | Industrial sector | 0.14
 | | Small industries and services | 0.02
Underground Rural Areas | Unknown$^{59}$ | Flower Industry | $0.84^{60}$
 | | Municipalities | Unknown$^{61}$
 | | Others | Unknown

* Agriculture, cattle fisheries.
** This includes 0.6 m$^3$ of water sold by El Acueducto to the municipalities of the Bogotá Savanna: Tocancipá, La Calera, Chía, Soacha, Gachancipá, Funza, Madrid, Mosquera, Cajicá, Sopó.

Evidently, the larger water user in the region is the city’s Water and Sewage Company and this company does not face water scarcity. However, table one indicates the existence of important information voids in relation to water availability and use in the region. The voids are particularly evident in the case of the water consumption by small users. Information relative to underground and smaller superficial water resources is also incomplete. CAR information related to the hydrology of small rivers and creeks is deficient or inexistent$^{62}$. Information regarding the number of water permits granted by CAR and their flow in the area of the Bogotá Savanna has not been consolidated and unavailable.

With regards to underground sources, CAR estimates that there are about 3500 wells in the Bogotá Savanna$^{63}$. According to this Regional Corporation, the levels of the aquifers of the region are descending between 0.36 and 1.97 meters per year. These descents are indicative of overexploitation. In addition, CAR has detected traces of pesticides in underground waters.

On the other hand, DAMA has an inventory of 306 active or potentially wells inside the city of Bogotá. Eighty five percent of the underground water resources used

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59 The Regional Corporation (CAR) estimates that in the upper basin of the Bogotá River, this inflow is 0.77 m$^3$/s. However, the Japanese Cooperation Agency (JICA) estimates that it is more than 20 times greater.
61 According The Regional Corporation (CAR) there are municipal 40 wells in the Bogotá savanna. However, their total outflow has not been estimated.
63 Information provided by CAR based on information of 1990. More recent information is not available.
within the limits of Bogotá is allocated to the large industrial sector\textsuperscript{64}. The remaining 15\% is allocated to small industries and services such as car washers. According to DAMA, the water levels of the aquifers inside the city do not evidence overexploitation. However, fecal coliforms have been detected in underground waters inside the city.

The total consumption of drinking water in Bogotá and its surrounding municipalities declined by 16\%, between 1998 and 2002. This decline was attributed to the economic crisis of the late eighties and early nineties, fiscal adjustments, and increased tariffs\textsuperscript{65}.

Table two summarizes the current roles of the main institutional actors that are relevant in the process of water allocation and use in the Bogotá River watershed.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|}
\hline
\textbf{Institution} & \textbf{Functions} \\
\hline
The Regional Autonomous Environmental Corporation of Cundinamarca (CAR) & \begin{itemize}
  \item Allocates water among its different users inside the Bogotá Watershed.
  \item Manages and controls the use of the region’s natural resources.
  \item Charges fees for water consumption.
  \item Grants environmental licenses and permits for the use of water resources.
  \item Administers the irrigation district (La Ramada).
\end{itemize} \\
\hline
The Department of the Environment of Bogotá DAMA & \begin{itemize}
  \item Allocates underground water within the urban area of Bogotá.
  \item Manages and controls the use of the city’s natural resources.
  \item Charges fees for water consumption.
  \item Grants environmental licenses and permits for the use of underground water resources.
\end{itemize} \\
\hline
Water Utilities of Bogotá (El Acueducto) & \begin{itemize}
  \item Provides drinking water to Bogotá and to 11 municipalities of the Bogotá Savanna.
  \item Administer the sewerage system of Bogotá.
  \item Conserves strategic ecosystems for the provision of water and for the functioning of the regional hydrology (Páramos, wetlands and watersheds).
  \item Is responsible for flood prevention and control in the city of Bogotá.
\end{itemize} \\
\hline
Energy Company of Bogotá, EMGESA. A private company. & \begin{itemize}
  \item Generates and buys energy mainly for Bogotá and its neighboring municipalities.
\end{itemize} \\
\hline
Municipalities around Bogotá & \begin{itemize}
  \item Buys water and energy from the water and energy utilities of Bogotá.
\end{itemize} \\
\hline
\end{tabular}
\end{table}


<table>
<thead>
<tr>
<th>Institution</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The La Ramada Irrigation District</td>
<td>• Uses water from the Bogotá River, mainly for milk and vegetables.</td>
</tr>
<tr>
<td>Other rural users (aquaculture, cattle ranchers, recreation, NGOs)</td>
<td>• Use water from superficial and underground sources.</td>
</tr>
<tr>
<td>Unit of National Parks</td>
<td>• Administers the Chingaza National Park where the main water resources of the region originate and where the Chuza reservoir is located.</td>
</tr>
</tbody>
</table>

The responsibility of assigning available water has traditionally been a responsibility of the Regional Autonomous Corporation - CAR. In order to coordinate decisions related to water allocation among large users and the management of the water storage and distribution system (reservoirs, valves, gates, etc.), an Acuerdo of the Board of Directors of CAR created a Hydrologic Committee of the Bogotá Savanna in 1967, as its advisory body. This type of body does not have a legal basis in current national legislation, such as the Code of Natural Resources, Law 99 of 1993 or Decree 1541 of 1978.

The Hydrologic Committee of the Bogotá Savanna was established 18 years before water was brought to the region from the Guaitiquia and Chuza rivers of the Orinoco watershed in 1985. At that time the water and the infrastructure available within the watershed of the Bogotá River were not sufficient to satisfy all the needs of the large users in the region. The creation of this Committee is an example of how institutions develop when there is a social need for them. As indicated in numeral 1.2, during the sixties, three large users demanded the water resources available in the region: the Aqueduct and Sewerage Company of Bogotá - Empresa de Acueducto y Alcantarillado de Bogotá, the Energy Company of Bogotá - Empresa de Energía de Bogotá and the La Ramada Irrigation district. The Committee is composed by the Regional Autonomous Corporation of Cundinamarca (CAR) and the Energy and Water companies of Bogotá. Other users such as stakeholders, communities, municipalities and small farmers were not included, and are still not part of the Committee.

The Hydrologic Committee of the Bogotá Savanna acts a consultative body in which the CAR is informed about the needs of the different large users. However, in accordance with its legal attributions, CAR makes its decisions in an autonomous manner. As indicated in section 1.3, the Code of Natural Resources had ranked national priorities for water allocation, giving priority to human consumption, followed by ecosystem’s conservation. Nevertheless, this Code and Decree 1541 of 1978 did not regulate the decision making process when water

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conflicts arise. Consequently, government officials responsible for water allocation are left to make their own interpretations.68

“Until 1985 the meetings of the Hydrologic Committee were very frequent and often tense.”69 This is because before that year, when additional water resources were brought to the region from rivers of the Orinoco watershed, the water and infrastructure available was not sufficient to supply all the water needs of the large users. Frequent meetings were needed to discuss the allocation of the available resources. While the Aqueduct and Sewerage Company strived to obtain large flows to the Tíbito treatment plant, the Energy Company pressured to maintain high flows at timely hours for electricity generation. On its part, the Regional Corporation defended the interests of the irrigation district under its management. On the other hand, the Environmental Department of Bogotá (DAMA) has jurisdiction only within urban limits of the city of Bogotá. It does not participate in decisions related to the use of water and other natural resources in the rural areas of the Bogotá Savanna. However, DAMA grants water permits, primarily from underground sources inside the city

As a result of the chain of events and of the infrastructure, legal and economic developments that took place along the 20th century, the city of Bogotá and its surrounding towns can currently satisfy their energy and water requirements. Although the water supply for large users is satisfied, this committee stills meets regularly. However, the interests of some of its participants have changed or declined. This is the case of the Energy Company - Empresa de Energía de Bogotá. This organization became part of a private company in 1997. CODENSA,70 the new private company sells and buys energy in the national electricity market. After 1997, the businesses of this new company do not depend on the seasonal flows of the Bogotá River.

Similarly, with the Chingaza System bringing more than two thirds of the water that the Aqueduct and Sewerage Company needs form the Orinoco watershed, the dependency on the flows of the Bogotá River is lower. An important interest of CAR in relation to the Hydrology Committee was the need to ensure sufficient water for the La Ramada irrigation district under its administration. The water needs of this irrigation system (1 m³/s) are guaranteed, even during the drier seasons of the year, by a discharge of 2 m³/s that is transferred by the Aqueduct and Sewerage Company from the San Rafael reservoir (diagram one).

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68 Interviews with Mr. Hernando Amado and with Mr. Hernando Niño employees of CAR responsible for the technical evaluation of water permits and for the coordination of the Hydrologic Committee, respectively. Bogotá. March 2004.
70 Integrated by the ANDESA form Spain, ENERSIS and CHILECTRA form Chile and the Energy Company of Bogotá - Empresa de Energía de Bogotá.
One important remaining function of this Committee is to coordinate actions related to the management of the reservoirs during periods of extreme rain conditions, when the risks of floods increase. Some neighborhoods of Bogotá are particularly vulnerable to frequent floods, particularly those located closer to the course of the Bogotá, Salitre and Tunjuelito rivers (see map 2). The institution responsible for flood prevention and control in the city of Bogotá is the Aqueduct and Sewerage Company (El Acueducto de Bogotá). As a member of the Hydrologic Committee, this institution and CAR coordinate decisions related to the management of the reservoirs that control water flow to the Bogotá River watershed. DAMA has no direct responsibilities related to flood prevention and control.

Map 2. Vulnerabilities to floods in the city of Bogotá

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71 Interview with Mr. Hernando Niño; a CAR employee responsible for the Coordination of the Hydrologic Committee. Bogotá. March 2004.
72 www.sire.gov.co
73 www.sire.gov.co
CODENSA, the electricity company, has proposed to transfer the decisions and the costs related to the administration of its water reservoir (Tominé) in the upper basin of the Bogotá River to CAR and to the Aqueduct and Sewerage Company. The argument is that this reservoir which is no longer critical for energy generation is socially important for disaster and flood prevention, which are beyond the realm of a private company.

Water allocation to small water uses in the rural areas of the Bogotá Savanna is the responsibility of CAR. However, the Hydrologic Committee does not have responsibilities in relation to small water users. In fact, the Hydrologic Committee traditionally operated as a mechanism to ensure water allocation to large users without considering the water needs of smaller users.

It is estimated that more than 70% of small users do not hold water permits and there is no information regarding their water consumption. However, occasionally, the sum of the permits granted is superior to the capacity of the source. This could be related to several causes: the cumbersome procedures established by Decree 1541 to obtain a water concession, the centralization of the process, the lack of sufficient specialized human resources of CAR, and the limited enforcement and control capacity of this Corporation. In addition, the fact that water fees are only charged to the holders of water concessions does not contribute to promote the legal use water. According to previous and present water regulations, water fees are only charged to those who hold permits; no fees are charged to those who use water without permits.

Conflicts that are currently of lesser importance but that have a tendency to grow are those among the Aqueduct and Sewerage Company – El Acueducto de Bogotá and the local governments of the small municipalities, from where water has been brought to the Bogotá Savanna. Local authorities and communities of those municipalities have manifested that the water resources of their regions have been diverted towards the Bogotá Savanna without their consent and that compensation is due. The diversion of water from distant watersheds to the Bogotá Savanna did not require the Environmental Impact Assessments or public consultations that became obligatory after the approval of Law 99 of 1993. To this day, the regulation does not include provisions to secure balanced and equitable mechanisms for the solution of these type of conflicts.

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74 Interview with Mr. Hernando Niño; a CAR employee responsible for the Coordination of the Hydrologic Committee. Bogotá. March 2004.
78 The Guatiquía, Chuka, Frio and Teusacá rivers in the municipalities of San Juanito, El Calvario, Villavicencio, Junín, Guasca, Fómeque, La Calera Choachi.
The Ministry of the Environment and the Office of the General Attorney do not play a role in securing water rights at the local level. There is no vertical coordination between the Ministry and other Control Units such as the Office of the General attorney in matters of water allocation\textsuperscript{79}. The solution of local water issues and conflicts in the rural areas of the Bogotá Savanna is a responsibility of the central administration of CAR. However, this Corporation does not have the capacity to enforce water regulations in its vast rural jurisdiction\textsuperscript{80}. The processes to apply sanctions to the illegal use of water are long and cumbersome\textsuperscript{81}, and sanctions are seldom effectively applied\textsuperscript{82}. Under those circumstances, the protection of the water rights formally obtained by formal small users cannot be ensured.

In addition, there is no delegation or horizontal coordination with municipalities, local authorities or organizations for the allocation and control of water resources. Occasionally, local police get involved in the solution of water conflicts between small users. However, this institution does not have the capacity to allocate water and to provide definite solutions. Occasionally, illegitimate and violent means are used to resolve local water conflicts\textsuperscript{83}.

On the other hand, DAMA exercises a closer monitoring and control of the underground water resources under its jurisdiction. By year 2002 this institution had closed 102 illegal wells\textsuperscript{84}. This institution frequently visits those wells to ensure that they remain closed. Conflicts related to the use of underground water resources between water users have not been reported within the urban limits of the city of Bogotá\textsuperscript{85}.

It is extremely difficult to have access to public information related to the availability and use of water in the different currents and watersheds of the region. This is particularly true in the case of CAR. This could be partially related with deficiencies in the management of this type of information\textsuperscript{86}. In addition, water regulations do not include specific provisions to secure the public availability of this type of information.

Finally, the Chingaza National Park was created in 1977 to protect the Andean forest and páramo ecosystems that regulate the water resources of the region. This park has a total area of 76.600 hectares and it is administered by the Unit of

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\textsuperscript{79} Interview with Mrs. Adriana Guillén head of the Environmental Unit of the General Attorney’s Office

\textsuperscript{80} Interview with Mr. Hernando Amado CAR employee and responsible for the technical evaluation of water permits. Bogotá. March 2004.

\textsuperscript{81} Decree 1594 of 1984

\textsuperscript{82} Interview with Mr. Gustavo Guerrero Secretary General of CAR. June 2004.

\textsuperscript{83} Interview with Mr. Hernando Amado CAR employee and responsible for the technical evaluation of water permits. Bogotá. March 2004.


\textsuperscript{85} Interviews with Mr. Manuel Felipe Olivera, and Mrs. Julia Miranda; formers directors of DAMA.

\textsuperscript{86} Interview with Mr. Germán Camargo Subdirector CAR. March 2004. Bogotá.
National Parks. The CAR and the regional corporations Orinoquía and of Guavio, are responsible for the protection of the high cloud forest and páramos located outside of the national park. The protection of the riparian ecosystems inside Bogotá is a responsibility of the Sewerage Company of Bogotá.

2. Application of the 2003 WDR framework

In this section, the case of the allocation of water in the region of the Bogotá Savanna are discussed and analyzed following the framework of the WDR 2003. The following aspects are addressed:

1. How, and to what extent, society at large became aware of the water problems in the region of the Bogotá Savanna.
2. The mechanisms that generate the decisions to undertake action.
3. The mechanisms that are in place to balance legitimate, compelling social interest.
4. The means by which the adopted solutions are executed and the sustainable (long term) nature of the commitment.

2.1 How, and to What Extent Society Became Aware of the Water Problems in the Region of the Bogotá Savanna.

During the 20th century the administrative institutions of the city of Bogotá made efforts to foresee future water needs by large users and to take action to prevent severe water shortages. The water and electricity companies of Bogotá, foreseeing future water and electricity demands, built ambitions infrastructure projects that prevented severe shortages during the 20th century. In 1985, as a part of this planning tradition, water and electricity were brought from the Orinoco watershed, beyond the limits of the Bogotá Savanna, to the Bogotá watershed. Large investments were made to prevent future potential deficits. The solutions were implemented by local institutions developing preventive strategies and supported by technical information. Likewise, there is no evidence that the industrial sector considers water availability, water price or water quality to be limiting factors for the development of their activities. There is no evidence or discussion regarding the relocation of industries in the Bogotá Savanna due to water related issues.

The situation of small water users in rural areas is different. As opposed to the case of the large water users (electric company, El Acueducto and La Ramada Irrigation district), the long term solution of the problems of small water users has not been a priority for local, regional or national environmental authorities. The information relative to water availability and demands in the smaller watersheds of

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87 www.parquesnacionales.gov.co
the region is generally non-existent. The processes to obtain a water concession\textsuperscript{88} are centralized, long, cumbersome and costly for small water users at the local level. Public participation at the local level in the processes of water allocation among small users does not exist. The processes to sanction illegal water use are also centralized, long and complex. Consequently, the illegal use of water is frequent and the water rights of legal users can not be protected.

The citizens of Bogotá have become aware of problems related to water supply primarily through the occurrence of events that have threatened or limited the availability water or electricity. In 1992 there was an energy crisis that affected the entire country. Aside from its institutional causes,\textsuperscript{89} this energy crisis was also related to the lower availability of water that resulted from the “El Niño” phenomenon during that year. On that occasion, the inhabitants of the region at large realized that there was a connection between water availability and electricity supply. In 1997 the availability of water to Bogotá and its surrounding towns was threatened by the collapse of one of the tunnels that conducts water form the \textit{Chuza} reservoir in the \textit{Chingaza} National Park\textsuperscript{90}. On that occasion, the city’s administration and the Aqueduct and Sewerage Company – \textit{El Acueducto} promoted a mass media campaign to promote self – control in water use, in which they widely explained the functioning of the complex system of reservoirs, tunnels, valves etc. that are involved in the provision of water to the Bogotá Savanna.

A valuation study was conducted during the first semester of 2003\textsuperscript{91}, in order to have an economic approximation of the social value of the \textit{Chingaza} National Park, as the main source of water for the City of Bogotá. According to that study, the mean willingness to pay of Bogotá households to ensure the conservation of the natural resources of the Park and its protection against terrorist attacks was US $ 1.2 per month\textsuperscript{92}. Given the facts that the coverage of the water and electricity services in Bogotá are complete and that water and electricity are seldom in shortage, that willingness to pay reflects social awareness in relation to the importance of those resources.

Although, social awareness regarding the importance of ecosystem and water conservation has increased during the last years, the present availability of water for large users, which resulted form a long term planning process, seems to have created a sense of water abundance among large water users and among urban dwellers and industries. This sense has limited the need for social debate and for the definition of more developed water allocation institutions and regulations. The

\textsuperscript{88} Decree 1541 of 1978
\textsuperscript{92} Taking into account that the city has about one million homes, the aggregate willingness to pay of the city for the conservation and protection of the Park is about US $ 1.2 million a month.
most affected by this situation seem to be the small water users. For them, the present legal and institutional framework does not facilitate the access to water under transparent and equitable conditions. It does not secure the maintenance of water rights and it does not provide an effective mechanism for the resolution of water disputes.

2.2 The Mechanisms that Generate Decisions Relative to Water Allocation

Institutions and regulations for water allocation seem to be more suitable for the large users which provide services to the urban centers than for the small rural users. While large users have been able to secure sufficient water by long term institutional planning and by the allocation of additional resources from the Orinoco watershed, small rural users face scarcity every year during the drier periods (January, February, July, August). This is particularly true in the northern central southern rural regions of the Bogotá Savanna where annual precipitation is lower than 800 mm per year. While an institutional mechanism was devised to allocate water among large users (Hydrologic Committee), the processes to obtain a water permit by a small user are long, centralized, cumbersome and costly. While large water users have easy access to the judicial system to solve their disputes, small users do not have appropriate mechanisms at the local level.

Public information relative to water availability and demand is necessary for the transparent allocation of water among small users. However, the Regional Autonomous Corporations does not have sufficient information related to the dynamics and availability of water in the smaller watersheds of the region which are the main source of water for small water users. In addition, the information that the Corporation has relative to water availability and supply is not made public and is extremely difficult to access. These circumstances, added to the lack of decentralized mechanisms for public participation in the processes of water allocation at the local level, indicate that there is much room for improving transparency.

The proportion of water that is used outside the formal allocation process is unknown. However, CAR estimates that more than 70% of the water used by small users is used illegally. As indicated before, the presumably large percentage of illegal water use could be related to the fact that the processes to obtain a water concession are long and complex for smaller users. In addition, water fees are only charged to those who do hold those concessions. This situation was not corrected by Decree 155, approved in December of 2003, which regulates the new water fees system. After the approval of Decree 155 of 2004, the incentives to obtain legal access to water remained negative. As indicated before, this Decree was the

93 Decree 1541 of 1978.
result of a series of consultations with the regulated sector, in the absence of other stakeholders.

2.3 The Mechanisms to Balance Legitimate, Competing Social Interests

In the case of smaller rural water users, there are no decentralized institutional mechanisms for the allocation of water, the control of its use, the vigilance of local agreements and the protection of water property rights at the local level. The allocation of water and the control of its use are a responsibility of the administration of CAR. However, this institution does not have the capacity to follow and enforce relevant regulations and its decisions. The role of the Ministry of the Environment is the approval of national regulations and policies. This institution does not participate in local matters of water allocation and use. New regulations are needed to create decentralized mechanisms that allow for social participation in the definition of water allocation criteria and for protection of water property rights.

Often, the police participate in the solution of local conflicts that arise surrounding water allocation between small users. However, this institution does not have the capacity to make decisions related to water allocation and use. Therefore it can not provide final solutions. In some cases these conflicts are eventually brought to the knowledge of the Regional Corporation which, after a long and centralized process, makes decisions which it can not follow or enforce locally. The corporation can take several years to make decisions in cases of water conflicts. There have been cases where, in the absence of legitimate means to resolve water conflicts, illegitimate and violent means have been used.

In 2003, the Colombian Society of Farmers (Sociedad de Agricultores de Colombia) sued the water fee system and the Constitutional Court declared these charges to be unconstitutional. Based on the proposals made by several of the regulated agents, the Ministry of the Environment recently approved new water charge regulations. As indicated before, those regulations significantly lowered the new maximum price of a cubic meter of water in Colombia. Consequently, the power of this economic instrument to contribute to the efficiency of water allocation

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98 According with decision C-1063 of 2003 of the Colombian Constitutional Court, articles 159 and 160 of the Code of Natural Resources were replaced by article 43 of Law 99 of 1993. Since specific regulations for the application of article 43 of Law 99 had not been approved, those fees could not be charged.
99 Decree 155 of 2003 and resolución 240 of 2004
has diminished. Finally it is worth noting that besides the government and the representatives of the regulated agents, no other stakeholders participated in the process that led to the approval of the new water charge regulations. NGO’s, social organizations, indigenous groups, and other groups were not included in this process. The absence of these actors hampered the transparency of the regulatory process. This closed process of regulatory design could help explain the definition of water fees that are so low, that they might not be worth collecting\textsuperscript{100}.

It is interesting to note that although the Regional Autonomous Corporation knows the location and the water consumption of each of the farms of the La Ramada Irrigation District, it has never charged them water fees\textsuperscript{101}. This contrasts the agricultural water users in other areas of the Bogotá Savanna that have obtained water concessions and that consequently had to pay those fees. The objective motives for this discriminatory treatment were not technically validated. Apparently, the Corporation has been captured by the beneficiaries of the valuable lands of the La Ramada irrigation district, who have also benefited from the administration, construction and expansion of the district by the Regional Autonomous Corporation.

The judiciary system has played a role in the solution of water disputes among large water users. This system has been used when the Hydrologic Committee has not been capable of facilitating agreements between its participating agencies\textsuperscript{102}. In those cases the decisions of the CAR relative to water allocation have often been challenged in court by its members. The origin of most of these Court disputes lies in the legal indefinities regarding the economic criteria that should guide decisions related to water allocation\textsuperscript{103}. Although relevant water regulations (Code of Natural Resources and Decree 1541 of 1978) ranked priorities for water allocation, they did not indicate what the practical implications of that ranking should be in cases of water conflicts.

In addition, the fact that water availability has increased during the last few years for large users, might explain the reduced importance of strong regulations and institutions for water allocation. However, the main victims of the long term weaknesses of the water regulations and institutions have been the smaller water users. As indicated previously, water scarcity is an important issue for these groups during the drier periods of the year, and the access to water rights is cumbersome and lacks transparency. Furthermore, there are no public participation mechanisms at the local level to secure equitable and transparent

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\textsuperscript{100} Presentation of the Director of CAR to the Board of SDirector of the Corporation. March 2004.
\textsuperscript{101} Interview with Mr. Hernando Amado CAR employee responsible for the technical evaluation of water permits. Bogotá. March 2004.
\textsuperscript{103} This is the opinion of the author.
water allocation and use, and the institutional mechanisms to protect water rights are deficient and ineffective.

On the other hand, the judiciary system has played a minor role in the solution of conflicts related to water allocation among small water users. Although CAR does not have information available as to the number of legal actions related to water use by small users, “they are very infrequent”\(^{104}\). This could be related to the lack of familiarity of most Colombians with their legal rights and to their lack of access to the judicial system\(^{105}\).

### 2.4 The Means by which the Adopted Solutions are Executed

The Hydrologic Committee of CAR has been a useful mechanism for the coordination of decisions related to water allocation among the electricity and water companies and the *La Ramada* irrigation district. However, the enforcing capacity of this institution has been limited and its decisions have been often taken to court. In addition, the conflicts of interest of the Regional Corporation in relation to the irrigation district and the absence criteria for water allocation in cases of water conflict have affected its capacity to make objective recommendations. As a result, the sustainability of the Committee’s decisions with relation to water management and allocation in the Bogotá Savanna has been menaced by legal disputes. In fact, the water fee system, a central component of the water management strategy of the Regional Corporation, was declared unconstitutional after it was sued by the Colombian Association of Farmers.

The Regional Autonomous Corporation has played an important role in *La Ramada* irrigation district. The district has been under its administration since 1961. Since then, the Regional Corporation has maintained and expanded the irrigation district. In addition, this Corporation is also responsible for water allocation in the region. Potential conflicts of interest could arise as this institution has limited its capacity to allocate water without evaluating the effects of its decisions for the irrigation district under its own administration. After Law 99 of 1993 was approved, there is no legal basis for this type of intervention by the Corporation. CAR. However, the Regional Corporation is presently involved in the financing of an expansion project of the irrigation district\(^{106}\).

According to relevant legislation\(^{107}\), the Regional Corporation is the only authority with the capacity to grant water rights in the rural areas of the Bogotá Savanna.

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\(^{104}\) Interview with Mr. Gustavo Guerrero, General Secretary of CAR. June, 2004.


\(^{106}\) [www.car.gov.co](http://www.car.gov.co)

This is true even for small water users such as farmers around small creeks and water springs. Given the centralized nature of the Regional Corporation and its consequently limited capacity to efficiently allocate and control water use at the community level, its decisions are not always adopted by local actors and the water rights assigned are not always respected. This is the situation of the farmers of the Subachoque River in the Bogotá Savanna. In this case, because of the illegal use of water in the upper watershed, farmers with legal permits in the lower basin have no access to water. Upon the absence of a decentralized institutional arrangement which can ensure the efficient allocation of water at the local level, the vigilance and control of water use and the protection of water rights at the community level, water conflicts between farmers are frequent. However, there are not local and socially legitimate mechanisms for their resolution.

3. Lessons and Recommendations

The following are the main lessons and recommendations derived from this case study:

- During the last decade, large water users of the region have perceived a sense of water abundance. As a result, the importance of the Hydrologic Committee of the Bogotá Savanna declined as did their interest in generating stronger and more developed water allocation institutions and regulations. However, the present legal and institutional framework does not facilitate water access to other water users such as farmers, the flower industry, cattle ranchers, recreational uses, ecological needs, etc. In addition, this framework does not secure the maintenance of water rights, and does not provide an effective mechanism for the resolution of water disputes.

- In some of the rural areas of the Bogotá Savanna, water becomes seasonally scarce for small users and for ecological protection. However, there is an absence of local and decentralized authorities or organizations with the legal power and social legitimacy to allocate water among them, to protect their water rights and solve their conflicts. Consequently, illegal use of water and water conflicts among small water users are frequent.

- The La Ramada irrigation district has been administrated, maintained and expanded by the Regional Autonomous Corporation since 1961. This has created conflicts of interest, as this Corporation is simultaneously responsible for water allocation while it demands water for this district. This conflict of interest decreased the independence and the enforcing capacity of the regional Corporation’s Hydrologic Committee. There is a need to resolve these types of conflicts of interest.

- Current water legislation (mainly the Code of Natural Resources and Decree 1541 of 1978), ranks the priorities for water use. However, it does not indicate
what the practical implications of that ranking should be in cases of water conflicts. This legal void has been at the origin of several legal disputes between large water users.

- Water and electricity supplies were occasionally limited during the last twelve years, by events such as El Niño drought (1992), the collapse of water delivering tunnels (1997) and terrorist attacks to the water infrastructure (2002). These publicly visible events seem to have contributed to increase social awareness about the importance of water and ecosystems conservation in urban areas.

- Legal and institutional reforms are needed in Colombia. The new instruments should:
  
  o Ensure appropriate stakeholder participation in all relevant decision-making processes related to the design of water policies and regulations.
  
  o Create efficient and transparent procedures to facilitate the access to water rights, including groundwater, especially to small users.
  
  o Create local, participatory and decentralized mechanisms for the efficient allocation of water resources and protect water rights, especially of small users.
  
  o Create decentralized, equitable and efficient mechanisms for the resolution of water conflicts.
  
  o Include principles of economic efficiency.
  
  o Create local and decentralized mechanisms for the enforcement of water regulations and for the vigilance and control of water permits.
  
  o Ensure the collection and public disclosure of information related to water availability and water demands.
  
  o Create appropriate coordination mechanisms among different institutions to secure the development of equitable and economically efficient water regulations and their effective implementation.
  
  o Resolve and prevent the development of the potential conflicts of interests that could arise as environmental authorities participate in the development of sector projects such as irrigation, water supply and sanitation.
  
  o Ensure that the economic value of water is adequately reflected in water fees. Those fees should include the costs associated to the conservation
of the natural ecosystems which regulate water flows and the protection of the wetlands and riparian ecosystems that control water floods.

- Strengthen the capacity of control agencies such as the General Attorney’s Office and of other local agencies and communities to ensure the enforcement of water regulations.

The development of this new institutional and legal framework would require the complementation and modification of current legislation. A reform of Law 99 might be needed. This would be necessary to prevent future conflicts of interest as the regional environmental authorities undertake sector projects, as well as to create greater levels of decentralization and delegation in local communities and agencies, in matters relative to water administration. Likewise, the Code of Natural Resources and Decree 1541 of 1978 would also have to be modified with the main objective of creating a more flexible, equitable and economically efficient framework for the administration of water resources.