

Is External Assistance Needed for Adaptation? An Assessment of Government Intervention in Local Water Management in the Colombian Andes¹

F. Murtinho², H. Eakin³, D. Lopez-Carr⁴

ABSTRACT

This article explores the impacts of different financial strategies on Water User Associations' ability to adapt to water source degradation. The article addresses the debate regarding whether and in what form communities need external support for adaptation to environmental change.

In the Andean region of South America, understanding how communities fund their projects is particularly important for water management as many rural communities must decide by themselves if and how they will protect their watersheds and distribute their water. In many cases, communities depend on government financial support to implement their adaptation strategies, requiring them to participate in clientelist political systems that can crowd-out their efforts to adapt. In the Fúquene watershed in the Andes of Colombia, there is evidence that communities have invested time and financial resources to implement adaptation strategies. Local governments in the region have also invested in these strategies by supporting communities' projects requests and through a top-down investment approach.

In this article, we use quantitative and qualitative methods to assess how different financial strategies influence communities' initiative to adapt. Findings suggest that despite communities' efforts to use their own internal resources, in the long term, external support is needed to finance their adaptation strategies. However, a key aspect for the sustainability of communities' initiatives to adapt is the nature of the external financial intervention. Results show that government unsolicited help increases the likelihood of crowding out their efforts to adapt. In the other hand, in cases where communities request government help to fund their own project initiatives, external intervention crowds in communities' efforts to adapt.

Keywords: Environmental Change, Community Based Organizations, Financial Sustainability, Clientelism, Crowding out

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1 INTRODUCTION

In the Andean region of South America, understanding local governance is particularly important for watershed management as many rural communities must decide by themselves if and how they will protect their watersheds and distribute their water. In many Andean communities of Colombia, autonomous water associations have emerged in the absence of outside intervention to solve conflicts of water distribution due to increasing water demand and water shortages in the dry seasons (Peña, Reyes, and García 2007). In 2005, water associations provided drinking water to almost half the Colombian rural population (approximately 4.5 million people) (Colmenares and Mira 2007).

The water management decisions of these associations may be pivotal in determining whether Andean communities will have continued access to freshwater. Given changing demographic, economic and environmental conditions, and the relative autonomy of water management in many Andean regions (Murtinho 2010), a critical concern for international development policy is whether communities are able to address water source degradation by themselves, and what should be the role of external intervention.

In regions with relatively high vulnerability and poverty levels a key factor to facilitate adaptation is the local access to financial resources (Smit and Pilifosova 2001; Eakin 2005; Smit and Wandel 2006). Poor regions tend to have less diverse and more restricted entitlements (Kelly and Adger 2000), so it is harder for communities to invest in adaptation strategies with their own funds. In the Colombian Andes, Murtinho (2010) shows that one of the key factors that influence communities capacity to adapt to water scarcity is the ability of the Water User Associations (WUAs) to get external support to finance their adaptation strategies. Although some WUAs are able to finance their strategies with internal funds (collected from their water users), others must look for funds from local governments, where political connections are required to obtain the funds. The goal of this paper is to dig deeper into the impacts of these different financial strategies on the WUAs ability to adapt. Specifically we study the sustainability implications of these financial strategies in the context of a clientelist political system, where external support is commonly exchanged for votes or other favors (Schedler 2002).

Many development scholars have discussed the risks of external financial intervention to promote communities' behavioral changes and poverty alleviation. Studies show that external financial intervention can increase paternalistic relations between governments and communities (de Wit and Berner 2009; Bardhan 1996). Paternalistic and clientelist systems, like those found in Colombia (Flórez 2005), may have positive functions for the poor as they provide some access opportunities for poor communities in the short term, but they also sustain exploitation and slowly undermine democracy (de Wit and Berner 2009). Bardhan (1996) argues that communities' external dependency diminishes the efficiency of the financial support, and raises inequality issues as some people get more benefits from the external support depending on their resources and political connections. In addition, vertical financial patronage relations can weaken individuals

motivation to innovate, diminishing the capability for long term development (Bunch 1999).

In the case of common-pool resource management such as water resources, which requires cooperation to manage collectively the resource (Meinzen-Dick 2007), a particular risk of external financial intervention is that it can undermine local prospects for collective action in cases of weak self-organized communities (de Wit and Berner 2009). Particularly, there is a potential negative effect if external intervention from the government reduces, or crowds-out, the likelihood of water user associations to engage in local processes to cooperate and invest their resources to solve their water problems by themselves. For example, economists using common-pool resources field experiments show that external intervention crowds out individuals' altruistic and reciprocal motivations and reduces cooperation to manage the resource (Vollan 2008; Cardenas, Stranlund, and Willis 2000). Furthermore, Vollan (2008) suggests that after cooperative behavior is crowded out, it takes some time to re-establish trust and reciprocity, so external intervention become very costly and have long lasting negative implications.

An important aspect of the crowding theory is that differences in the nature of the external intervention (i.e. controlling or supportive) could determine the outcome of the intervention. Frey and Jegen (2001) explain the role of these different types of intervention and the psychological conditions under which crowding-out effect could emerge: first, external interventions crowd out intrinsic motivation if the individuals affected perceive them to be controlling. In that case, both self-determination and self-esteem suffer, and the individuals react by reducing their intrinsic motivation in the activity controlled. And second, external interventions crowd in intrinsic motivation if the individuals concerned perceive it as supportive. In that case, self-esteem is fostered, and the individuals feel that they are given more freedom to act, which enlarges self-determination (Frey and Jegen 2001).

In this paper, we explore the role of Water User Associations' strategies to fund their projects to adapt to water source degradation in the Fúquene Watershed in the Andes of Colombia. The study has important implications for the ongoing debate on the right form and the degree of involvement of governmental or non-governmental organizations in common-pool resource management (Vollan 2008). We argue that despite their efforts to use their own internal resources, in the long term, external support is needed to finance WUAs adaptation projects. However, a key aspect for the sustainability of WUAs initiatives to adapt is the nature of the external financial intervention. Results show that government unsolicited help increases the likelihood of crowding out their efforts to adapt. In the other hand, in cases where WUAs request government help to fund their own project initiatives, external intervention crowds in WUAs efforts to adapt.

In the following section, the article presents the context of this study, including a description of the governance context of different WUAs' funding sources and how WUAs are implementing adaptation strategies to cope with water scarcity changes in the Fúquene watershed in Colombia. This is followed by a methods section presenting

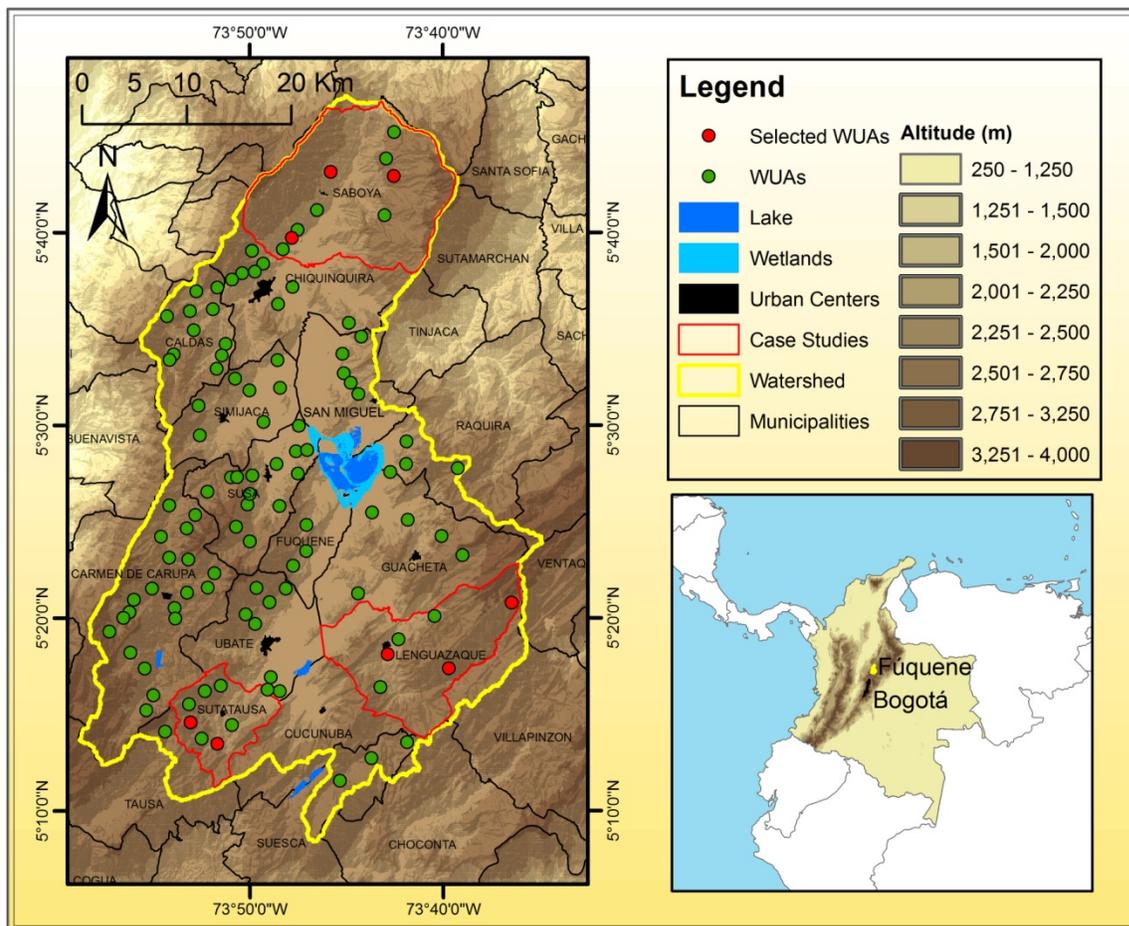
the selected case studies for the analysis. Later, in the results and subsequent discussion, there is an analysis of the implications of external intervention and internal funding on WUAs' initiatives to adapt.

2 CONTEXT: WATER SCARCITY CHANGE AND FUNDING SOURCES FOR WUAS' ADAPTATION

2.1 The region

The study site is located in the watershed of the rivers Ubaté and Suárez in Colombia, known generally as the "Fúquene watershed". Fúquene, has an area of 198,000 ha and is located in the northern part of the eastern mountain range of the Andes, about 100 Km north of Bogotá (see figure 1).

Figure 1: Fúquene watershed location



The lower part of the watershed, where the valley and a lake are located, has an elevation between 2400m and 2500m above sea level. Mountains surround this valley reaching their highest point at 3,750m (see figure 1). The average rainfall in the watershed is 905mm a year. It has a bi-modal rainfall regime with 6 months of relatively

drier season or "summer" (32% of total annual rainfall). As most Andean regions in Colombia, the watershed is not high enough to have glaciers or snowpack to store water in the dry seasons. Rainfall is not equally distributed in the watershed. The northern part of the watershed has higher rainfall in both wet and dry season than the southern region. However, rainfall distribution along the year is less homogenous in the northern part. In 2005, only 16,9% of the Fúquene territory was covered by native and partially intervened ecosystems (Murtinho 2009), including strategic water regulators such as páramos and forests (Buytaert et al. 2006; Harden 2006).

Fúquene has 16 municipalities. The rural population of these municipalities is approximately 115,000 inhabitants; this represents 55% of the watershed's population (DANE 2005). The inhabitants are distributed in 147 communities or *veredas*, with an average rural population density of 49 habitants/Km² (CAR, 2006). The main economic activity of the region is dairy farming, agricultural activities and small scale coal mining. As in other regions of the Colombian Andes, land is privately owned, however, there are great differences in land distribution that are associated with historical process of colonization (Flórez 2005). The most productive land is located in the irrigated systems in the valley; land is concentrated in a few families and is owned mostly by people from Bogotá. In contrast, land in the upper areas is where most of rural inhabitants live. This study focuses in these upper areas, where the land is the least productive with no irrigation systems, and it is owned by local families that usually have no more than 2 Ha (pers. comm., Fundación Humedales, 2007; Flórez 2005). Poverty levels (measured as percentage of rural population with "Unsatisfied Basic Needs - NBI") in 2005 varies across the watershed from 25% of the population in some southern municipalities to more than 50% in the north and east of the watershed (DANE 2005).

2.2 Governance and funding sources for water management in Fúquene

In Colombia, water distribution is traditionally administered by municipal public water utilities. Due to lack of technical and financial resources, however, public utilities generally provide water only to urban centers and the urban periphery (Colmenares and Mira 2007). In 2005, 92% of the urban population had access to a public water distribution system in contrast to just 22% of rural population (USAID and MAVDT 2005; Colmenares and Mira 2007). For this reason, 41% of the rural population have created their own communal water distribution systems (Colmenares and Mira 2007). In Fúquene, the purpose of these relatively autonomous associations is to distribute water for household consumption, although in most cases without the appropriate water purification systems. WUAs' operational activities and in some cases infrastructure investments are funded by households' water consumption fees. In other cases, local governments support WUAs' investments.

Several governmental agencies, operating at different jurisdictional scales, are responsible for water conservation in the Fúquene watershed (see table 1). At the regional level, the Regional Autonomous Corporation (CAR) is the agency in charge of implementing the national environmental policies in the Fúquene watershed. Some of CAR responsibilities include: provision of water use permits and regulation (including sanctioning) to prevent deforestation and contamination activities. Although small local

projects have been implemented, there are not enough financial resources and political desire to fully implement the watershed management plans (pers. comm., Fundación Humedales, 2007).

Table 1. Governance characteristics in Fúquene

	Water Management	Environmental Management	Financial Resources
National Gov	Designs policies	Designs policies	National Budget
Regional Gov (CAR)	- Water permits (should monitor appropriate use of water)	- Implement policies - Watershed management plan - Should monitor and sanction	CAR Budget and National transfers
Local Govs (16 Municipalities)	- Urban: water distribution - Rural: support WUAs with water infrastructure investments	- Should coordinate with CAR to implement national policies/watershed plans	Mostly transfers from national government
Communities (128 Water User Associations - WUAs)	- Water distribution to households - Should follow policies - Autonomous operational decisions	- Should follow policies - Autonomous operational decisions	- Operational activities: households fees - Infrastructure: households and municipality

Source: Regional officials, municipal officials, and WUA leaders' interviews (Murtinho, 2010)

At the local scale, municipal authorities are in charge of coordinating efforts with the CAR in order to protect water resources (see table 1). In addition, they have to invest in rural development, including investing in water management infrastructure, usually by supporting WUAs' needs (water tanks, distribution networks, etc.). In Colombia, most of local government financial resources come from transfers from the national government. The amount of these transfers depends on the municipality fiscal efficiency and their socio-economic characteristics (DNP 2008). In Fúquene, rural investment levels varies among municipalities, from a 5-year average of US\$74,000 in the northern part of the watershed, to more than US\$390,000 in other regions (DNP 2008).

As many other areas in Colombia, local government investments are distributed based on a clientelist basis inside each municipality (Flórez 2005). Municipalities assign their financial resources by 1) funding WUAs' water projects initiatives, or 2) directly investing in water projects with a top-down approach. In the first case, WUAs request for external support is usually not enough to find municipal resources; political affiliation or connections with local authorities may be needed to negotiate financial resources. Some WUA leaders report that they usually support one of the candidates in the municipal elections, and in exchange they receive financial resources for communities' water projects (pers comm., WUA leaders 2008). In other cases, leaders state that they requested external funds to local authorities, but they did not want to establish direct contact with them. They state that they preferred to be "outside of politics" or

avoid possible corruption problems, even though they recognize that it greatly reduces their chances of finding support for their projects (pers comm., WUA leaders 2009). In the second case, municipalities invest in water projects without asking WUAs needs. With these gifts or unsolicited help, municipality officials also look to gain electoral support from communities.

Besides financial resources for infrastructure investment, there is not much support to WUAs in Fúquene. Most of the associations have not received water management training (or informal education) from the government, and none of them have had any training from nongovernmental organizations (NGOs).

2.3 WUAs adaptation strategies to water scarcity change in Fúquene

In Fúquene, many WUAs are trying to adapt to water source degradation with the objective of sustaining water flow during the summer season and in some cases, to improve or sustain the quality of the resource. Currently, 51% of WUA leaders perceive that there are medium, high or very high water scarcity problems in the summer.

The scarcity problem is getting worse for most WUAs. According to 63% of WUAs, currently there is less water available compared to previous decades. They state that there are three main causes of the higher water scarcity: land cover changes, rainfall changes and higher water demand due to population increase (Murtinho 2010).

Facing these changes, WUAs in Fúquene are implementing three types of strategies to deal with water sources degradation (see figure 2): micro-watershed management (trying to conserve and restore native ecosystems close to the water sources with the goal of protecting the water resource), supply management (trying to increase or keep constant the safe-drinking water supply), and demand water management (trying to decrease the waste of water).

3 METHODS AND STUDY SITES

This article is based on data gathered in 12 months of fieldwork between 2007 and 2010 using different quantitative and qualitative methods. Socio-economic information includes: municipal public investment data from 2000 to 2006 and demographic census data for 2005 (DANE 2005; DNP 2008), semi-structured interviews to key informants, and structured interviews to the 111 WUA leaders of the watershed⁵. In addition, in order to collect household information eight WUAs were selected. For each of the eight WUAs there was approximately 15 households' surveyed or 12% of the total households for each WUA (for a total of 111 household surveys). Households were selected from the lower, middle and higher part of the water distribution system for each WUA in order to capture possible differences of water scarcity due to the location of the

⁵ 17 water associations were not included in the analysis: in 8 cases it was not possible to do the interviews. In 9 cases association were exceptional cases (they did not use superficial water sources or they were exceptionally big - more than 1300 users) that made adaptation strategies difficult to compare.

household inside the water distribution system. In addition to the socioeconomic information, environmental information was gathered, including: land cover-land use maps from 1987 and 2005 (scale 1:100,000) (IAvH 2007) and daily rainfall data between 1962 and 2006 for 13 stations inside the watershed (CAR 2008).

In this study, adaptation is defined as a conscious process or action in a system in order to respond to a current or predicted environmental, socio-economic or institutional disturbances⁶ (Murtinho and Hayes 2008; Ford et al. 2007; Nelson, Adger, and Brown 2007; Smit and Wandel 2006). This definition implies that the strategies implemented by WUAs in Fúquene, in order to be categorized as an "adaptation" has to be conscious investments specifically to solve water scarcity problems. In addition, in order for a strategy to be an "adaptation" it is required that the WUA had the initiative and participated in the process of implementation (even if financial sources came from the government). However, unsolicited help, donations or gifts are not categorized as adaptation strategies since there is no WUA initiative and involvement in the process of implementation.

In order to analyze the implications of the different financial sources on the WUAs' initiative to adapt we divide the analysis in 4 sections: first we explore the relation between total municipal investments over WUAs' initiative to adapt. Later we desegregate this municipal investment and we analyze the implications of solicited and unsolicited help on WUAs' initiatives. Finally we explore the potential risks of low external intervention in WUAs ability to adapt.

To conduct the analysis we grouped WUAs according to the level of adaptation and their funding sources. We classified as high levels of adaptation those WUAs that are equal or above four adaptation strategies (the median for the whole watershed). In addition, we divided the high-adaptation WUAs in two groups, those that had higher number of strategies funded by external sources, and those that have higher number of strategies funded by internal sources. To avoid ambiguities, we excluded from the analysis those WUAs that had the same number of strategies funded by external and internal sources. In order to test differences from these three WUA groups, high-adapt (external), high-adapt (internal) and low-adapt, we used SPSS v18 to run bi-variate statistical tests including T-test, continuity correction test and likelihood ratio test.

3.1 Study sites

The goal of selecting a few case studies is to analyze households' perceptions and characteristics from WUAs with high and low levels of initiatives to adapt. Trying to reduce the variability of the different regions of the watershed, the case studies were selected from just three of the 16 municipalities of the Fúquene watershed, which have very different levels of municipal water investment. The objective of differentiate among

⁶ Adaptation strategies at least should be intended to be successful or reduce present and future vulnerabilities, although there is no guarantee that the actual outcome will achieve this goal. The strategies that WUAs have implemented in the Fúquene watershed have not being evaluated in economic, social or environmental terms.

different levels of water investment is to control for differences in the level of municipal support that Water User Associations might have to implement adaptation strategies. The three selected municipalities are: Sutatausa in the southwest of the watershed with the highest rural water management investment of the watershed (a 5-year average of US\$55 per person), Saboyá in the northern end with the lowest investment (13 US\$/hab), and Lenguazaque in the southeast has a mid level water investment (30 US\$/hab) (see table 3 and figure 1).

From the 27 WUAs located in these three municipalities, we selected 8 WUAs. After ordering them from high to low number of adaptation strategies implemented, we randomly selected 4 from the higher group, and 4 from the lower group. Table 2 presents the 8 WUAs selected, ordered by the number of implemented adaptation strategies.

Table 2. Main characteristics of selected case studies

WUA_Id	Municipality	# adaptation strategies	Adaptation category & financial strategy	WUA Years of experience	# of Users	Users' main livelihood	Water Scarcity Perception
SAB_03	Saboyá	6	High-Adapt (Internal)	27	150	Farming	Med/High
LEN_01	Lenguazaque	6	High-Adapt (External)	15	575	Mining	Med/High
SUT_03	Sutatausa	5	High-Adapt (Internal)	6	43	Farming	Low
SUT_04	Sutatausa	4	High-Adapt (Internal)	27	120	Farming	Low
SAB_15	Saboyá	3	Low-Adapt	8	112	Farming	Med/High
SAB_08	Saboyá	2	Low-Adapt	18	104	Farming	Med/High
LEN_04	Lenguazaque	2	Low-Adapt	29	66	Mining	Med/High
LEN_06	Lenguazaque	2	Low-Adapt	8	150	Mining	Med/High
<i>Median for 111 WUAs</i>		4	<i>High-Adapt</i>	18	86	<i>Farming</i>	<i>Med/High</i>

Source: WUA leaders' interviews

From the four WUAs with high level of initiative to adapt, three rely predominantly on internal funding (from user contributions) and one relies on external support from the government to finance their investments. The eight WUAs sample have similar key characteristics to the whole 111 WUA population in terms of the years of experience distributing water, users' main livelihoods and water scarcity. The average number of users of the selected sample is higher than the 111 WUA population, since it includes LEN_01, the biggest WUA in the watershed.

4 RESULTS

Some WUAs in Fúquene are implementing adaptation strategies to cope with increasing water scarcity. In most cases, these strategies are implemented by WUAs' initiative. Although municipal intervention is very important to fund WUAs' adaptation strategies, at the aggregated level municipal water investment is not a good predictor of adaptation. If, however, we distinguish between solicited financial support and

unsolicited support (a municipal top-down approach to invest the resources), there is clear evidence of the influence of municipal resources in WUAs' initiative to adapt. Municipal water investment positively influences WUAs' initiative to adapt when the investment responds to a request from the associations, while it has a negative influence when it is a top-down approach. In other cases, WUAs decide to fund their adaptation strategies with communities' own resources with relative low external intervention; however, this strategy increases the risk of losing support from the water users.

4.1 Total municipal water investment in Fúquene and WUAs' financial strategies

Municipalities are investing in water management trying to support communities' water necessities. However, the level of total municipal water investment is not a good predictor of the number of adaptation strategies that WUAs are actually implementing, so it is necessary to dig deeper in the nature of this external intervention.

According to estimates between 2000 and 2006, 16% of the municipalities' rural investment in the Fúquene watershed was invested in water management. Table 3 shows a comparison of these municipal investments and WUAs adaptation strategies for the three selected municipalities (with the highest water investment of the Fúquene watershed, the lowest and an average investment). For example, Saboyá, despite having the lowest investment of the 16 municipalities, does not have a low average of adaptation strategies implementation. These findings were confirmed in a multi-level model with the 111 WUAs, where municipal water investment was not statistically significant to predict WUAs' initiative to adapt (Murtinho 2010).

Table 3. Municipal investment vs. WUA adaptation strategies

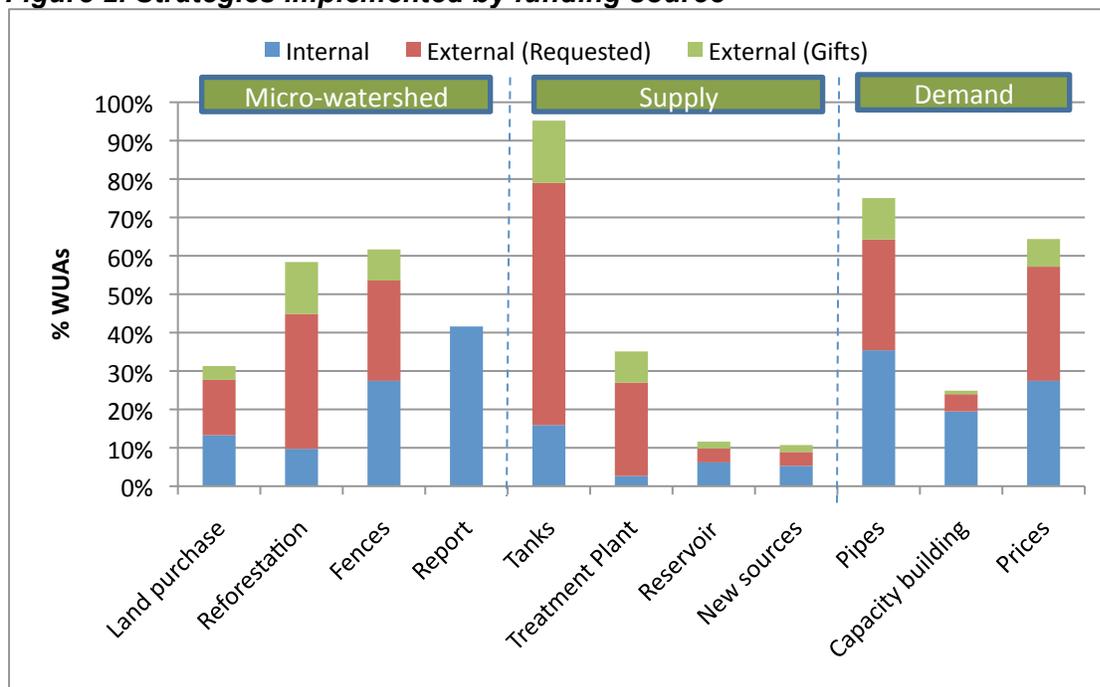
Municipality	Water Investment Avg 2000-2006 (US\$/hab)	Avg # of WUAs' adaptation strategies
Sutatausa	54	4.5
Lenguazaque	30	3.3
Saboyá	13	4

Source: WUA leaders' interviews and estimations from DNP 2008

Since at the aggregated level municipal water investment is not a good predictor of adaptation, to better understand these investments and their influence on WUAs' initiatives, we disaggregate WUAs' funding sources in solicited external help, unsolicited external help (gifts or donations), and internal funding. As seen in figure 2, most of the strategies have been implemented by the initiative of the WUAs. Forty one percent of the strategies have been executed with WUAs' internal funds (through households' contributions) and 45% have been implemented by WUAs' initiative but with external financial support. The remaining 14% of the strategies have been putted into operation by the government itself, as donations or gifts, without WUAs involvement. As can be seen in figure 2, the most common government support (either from WUAs request or as a gift) is water tanks. According to WUA leaders' water tanks are not the most effective way to deal with water scarcity problems, however, politicians favor this type of

strategy since they are relatively visually attractive, so it is publicity to gain votes from the communities.

Figure 2. Strategies implemented by funding source



Source: WUA leaders' interviews. See Murtinho (2010) for details of each adaptation strategy.

In order to analyze the influence of these different funding strategies on WUAs' initiative to adapt, in the following sections we analyze the effect of external solicited help, later the influence of municipal unsolicited water investments and finally the implications of low external involvement on WUAs decisions to adapt

4.2 Implications of solicited external intervention on WUAs' initiatives to adapt

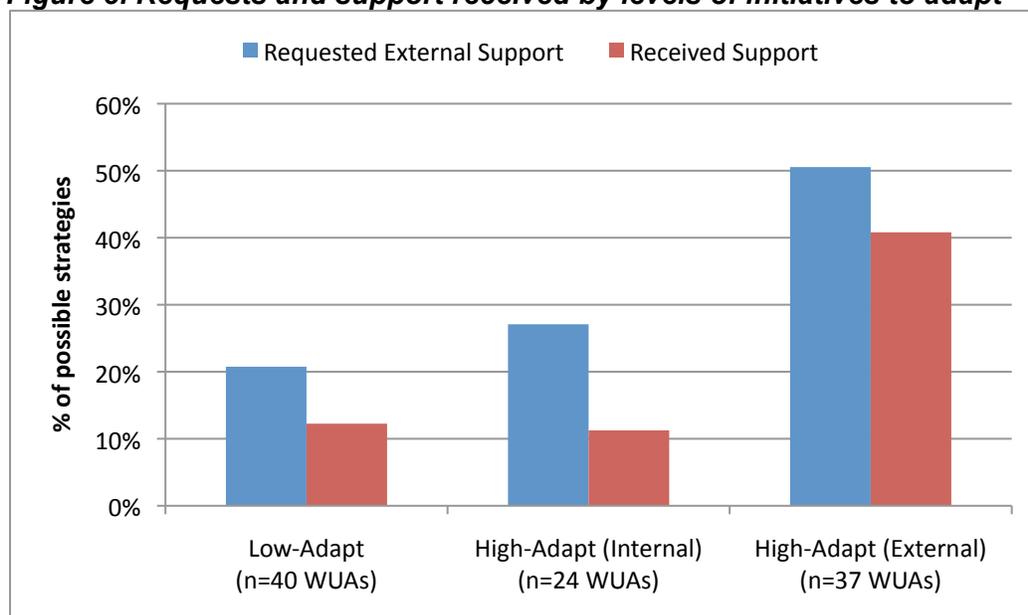
In the first case, when external intervention is solicited by WUAs, results show that WUAs that request and receive more external funds have a relatively high number of adaptation strategies implemented, in contrast to the WUAs with low number of adaptation strategies.

Figure 3 presents the differences in WUAs support requests and the actual support received according to the levels of adaptation (low or high) and financial strategies used by the WUAs (predominantly financed with internal vs. external resources). As shown in the figure, WUAs that have lowest levels of funds requested also have the lowest levels of adaptation. According to interviews with WUA leaders, requesting funds is a complicated bureaucratic process that requires relatively high levels of organization. The figure also shows that 24 WUAs rely mainly in internal sources of funding. This group of WUAs despite being well organized receive support in less than half of the projects they requested funds. According to interviews usually these WUAs lack the

political connections needed to get the external funds and in other cases they try to avoid getting involved in the local political system (pers. comm., WUA leaders 2009). Finally, the 37 WUAs that rely in external funding for implementing their strategies have the best rate of success finding support for their projects (thanks to their well established political connections). Although usually WUA leaders complain that government investments are not enough for their community needs, they find that these resources are extremely important to support their adaptation strategies (pers. comm., WUA leaders 2009).

These findings were confirmed with regression models with the 111 WUAs, where both variables, request external support and political connections, are positively and significantly related to the number of adaptation strategies implemented (Murtinho 2010).

Figure 3. Requests and support received by levels of initiatives to adapt

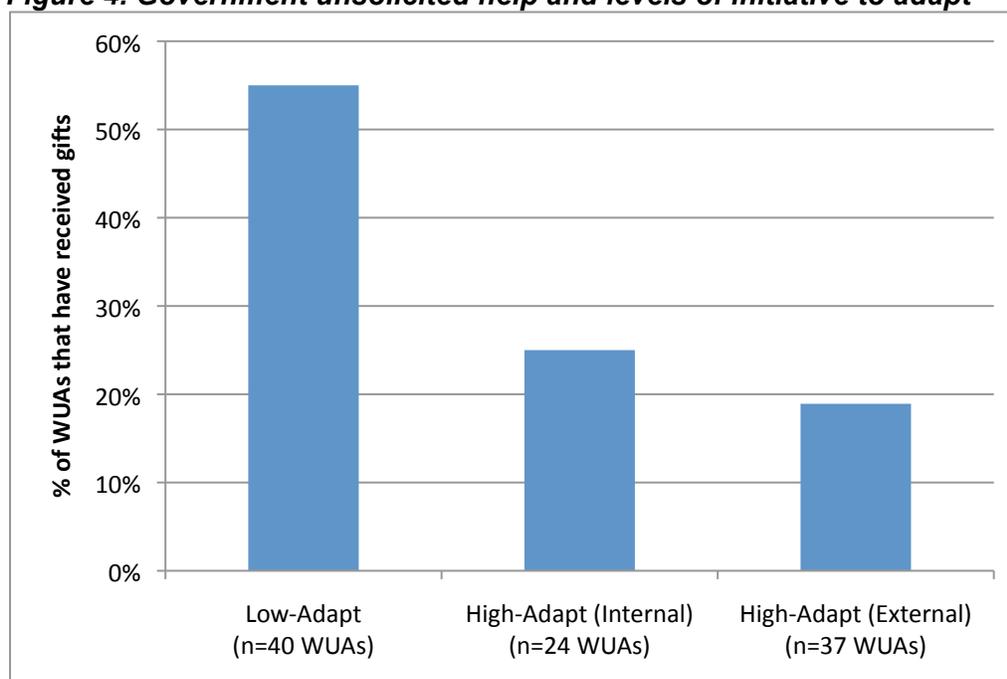


4.3 Implications of unsolicited external intervention on WUAs' initiatives to adapt

The second type of external involvement is when municipalities invest directly in water management with a top-down approach, where municipalities decide how the funds should be invested. In these cases, WUAs perceive the investment as political donations or gifts which have the negative effect of decreasing their initiative to adapt and their efforts to self-organize to request funds for new projects.

Figure 4 presents the percentage of WUAs that have received gifts from the government. More than 50% of WUAs that have implemented relatively low number of adaptation strategies have received one or more gifts, compared to less than 25% of WUAs with high number of adaptation strategies.

Figure 4. Government unsolicited help and levels of initiative to adapt



Differences are statistically significant (Likelihood ratio=4.51, $p=0.105$, $n=101$)

The effect of this municipal unsolicited help is also related to the differences among WUAs in their levels of organization. When WUAs receive unsolicited help, they reduce their effort to request funds for new projects. While 58% of WUAs that did not receive gifts made the effort to request new funds, just 14% of those that get gifts made the effort (continuity correction 17.521 $p=0.000$, $n=108$). Furthermore, although not statistically significant, those WUAs that have received gifts are less likely to have a registry to be legally recognized as community based organization (a proxy of their level of organization).

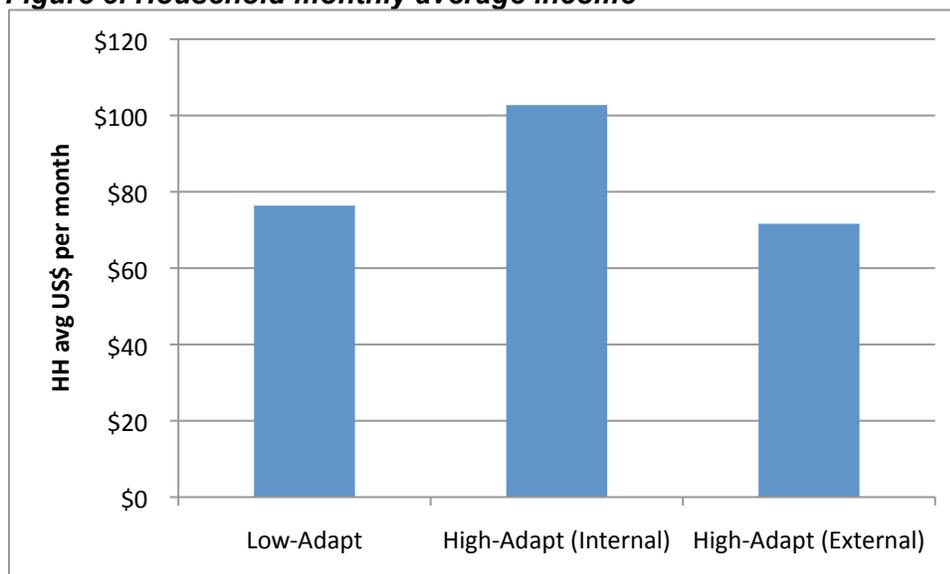
Finally, it is important to mention, that municipalities investing with a top-down approach, are not necessarily investing in those regions that need more help to cope with water scarcity. For instance, a quarter of those WUAs with high water scarcity have not received unsolicited help or gifts, while more than 40% of those WUAs with low water scarcity levels have received gifts (continuity correction 2.897 $p=0.089$, $n=108$).

4.4 Implications of low intervention on WUAs' initiatives to adapt

In addition to relying on external financial support, the alternative strategy for some WUAs (usually those with higher income) is to fund most of their initiatives to adapt with resources from their own water users contributions. This financial strategy has the benefit of not depending on external financial sources to implement adaptation strategies; however it increases the risk of losing support from their own water users.

Some WUAs have the ability to use internal resources to fund their initiatives to adapt. This group of WUAs has users with relatively higher household income, which allows WUAs to finance their adaptation strategies with user fees and contributions. Based on household information from the eight selected case studies, figure 5 shows these differences in household income among the three groups of WUAs.

Figure 5. Household monthly average income

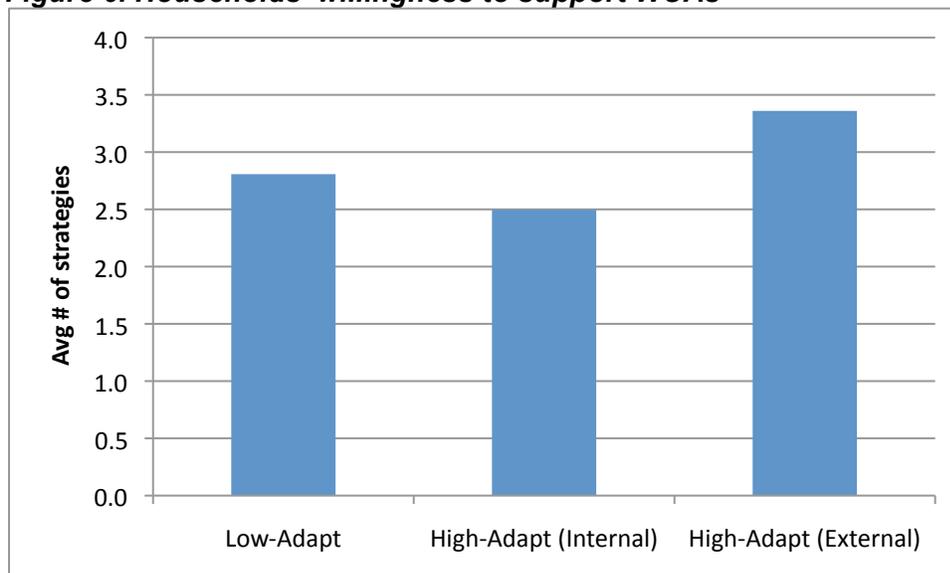


Differences are statistically significant between adapt-internal and other groups ($T\text{-test}=-2.098$, $p=0.038$, $n=107$)

These WUAs are usually well organized but do not have the political connections to get funds from the government. According to leaders of the WUAs that rely predominantly on internal funding, they perceive that having a relative independence from the government is an advantage since they do not have to get involved in clientelist practices and are not obliged to return favors to local politicians, although they recognize that it would be easier to finance their projects with help from external funds (pers. comm., WUA leaders 2009).

However, this relative WUA independence in the political system comes with the potential cost of losing support from their water users. Figure 6, shows that water users are willing to financially support more WUAs adaptation strategies in those WUAs that receive government support. In contrast, households that belong to WUAs that rely on internal funding, despite having higher income, they are willing to financially support fewer number of strategies. According to interviews to several households from WUAs that rely on internal funding, they are tired of investing their personal resources to solve water problems (pers. comm., households in Saboyá and Sutatausa, 2009).

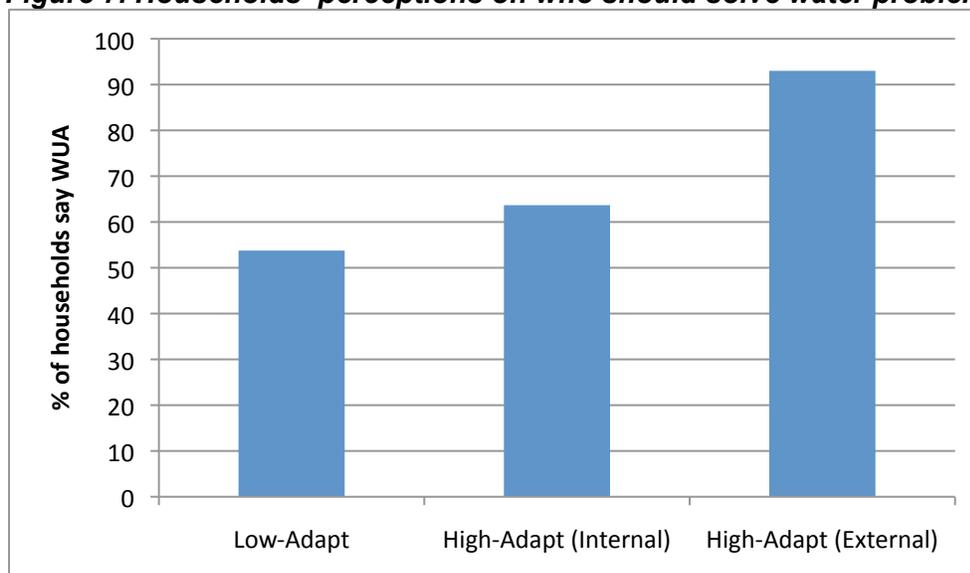
Figure 6. Households' willingness to support WUAs



Differences are statistically significant (Likelihood ratio=11.11, $p=0.004$, $n=102$)

The relatively lack of household willingness to financially support WUAs' adaptation strategies is reflected in their perception of who should solve water problems in their community. Figure 7 shows that less than 65% of users from WUAs that rely on internal funding perceive that their water association is the agency that should solve their water problems. Instead, these households perceive that the government or each user individually should solve water problems. These perceptions contrast to users from WUAs that rely predominantly in external funding sources, where more than 90% of them believe that the water association is the appropriate agency to solve water problems.

Figure 7. Households' perceptions on who should solve water problems



Differences are statistically significant (Likelihood ratio=9.43, $p=0.009$, $n=106$)

5 CONCLUSIONS: LONG TERM SUSTAINABILITY OF EXTERNAL INTERVENTION ON ADAPTATION

The analysis of funding for adaptation amongst the Water User Associations (WUAs) provides empirical evidence of how different external interventions may influence communities' initiatives to adapt. The communities experiences illustrate three different possible funding models (1) solicited intervention; (2) unsolicited intervention; and (3) no, or low, intervention. The different models illustrate the importance of designing external funding that support communities' adaptation strategies.

The experiences of WUAs decisions in the Andes of Colombia, provides important insights into how communities fund their adaptation strategies and the impacts of external support for adaptation to environmental change. First, the analysis shows that total government investment in water management is not a good predictor of the influence of external intervention on communities' initiatives to adapt. Rather, results show that in order to understand external intervention effects on adaptation, it is necessary to distinguish among two very different types of government water management investment: solicited and unsolicited external intervention.

In the context of Colombia, both types of government intervention operate under the same clientelist and paternalistic system where government investments are commonly exchanged for votes or other favors (Florez 2005). However, communities perceive the external intervention in different ways, supportive or controlling, depending on the government approach. These different types of intervention, as predicted by Frey and Jegen (2001), lead to complete different outcomes in terms of their initiatives to adapt. In the first case, when government investment responds to communities financial requests, communities perceive the external intervention as supporting. The analysis of WUAs' initiatives to implement adaptation strategies show that in this case, government intervention crowds-in their efforts to adapt, fostering the association self-efficacy to keep working to solve collectively their water problems. This finding is similar to common-pool resource field experiments in southern Africa, where supportive external intervention does not decrease the likelihood of cooperation (Vollan 2008).

In contrast, when local governments use a top-down approach to allocate their water investments, communities perceive the external intervention as controlling. In this case, results show that there is a crowding-out effect and WUAs decrease their initiative to adapt. Self-determination suffers, and WUAs reduce their efforts to self-organize. Furthermore, WUAs reduce their efforts to request funds for new projects, and they engage in a dependent relation where they wait for more government gifts or donations to solve their water problems. This result is similar to field experiments in Colombia, where controlling external intervention crowds-out cooperation (Cardenas, Stranlund, and Willis 2000). In addition, similar to Bardhan findings (1996), the study shows that this type of external intervention is inefficient as governments choose to finance not the most effective strategies nor those communities that suffer higher water scarcity.

In other cases, there is low or no government intervention in WUAs' projects, so WUAs use internal resources to fund their adaptation strategies. In these cases, well organized communities with relative higher household income fund most of their initiatives to adapt with resources from their own water users contributions. These communities are excluded from government projects or they decided to not get involved with the government. In the first case, some communities are excluded from external funding since they lack the appropriate political connections with local politicians. This situation exhibits the inequality issues of external intervention in a clientelist system (Bardhan 1996). In the second case, and similar to other regions in Latin America (Schedler 2002), some communities don't like to get involved in the clientelist system, and they prefer to be "outside of politics" or avoid possible corruption problems, even though they recognize that it greatly reduces their chances of finding support for their projects.

Using internal funding and staying away from the clientelist system might seem a sustainable approach for communities to solve their water problems. However, the study shows that a relatively high number of household members of these WUAs are not willing to continue funding WUAs' investments. For instance, a high number of these households perceive that WUAs are not longer the appropriate organization to solve their water problems and more households perceive that the government should intervene. This implies that in the long term this funding strategy might jeopardize their current high level of adaptation strategies implementation. According to interviews, WUAs are losing support due to the relatively high costs of adaptation investments in the context of poor rural communities, so they wish for government intervention. However, these perceptions might also be influenced by a long history of dependency relations with the government (Florez 2005).

The results here suggest that the bottom up model may be more successful than the top down. Second, the results find that absence of intervention however may not be sustainable in the long-term. The results suggest that policymakers pay careful attention to the conditions under which external interventions are structured as they may be pivotal to the sustenance of the WUAs and their ability to adapt to changing water conditions.

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