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Water and Poverty in Two Colombian Watersheds

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ABSTRACT: Watersheds, especially in the developing world, are increasingly being managed for both environmental conservation and poverty alleviation. How complementary are these objectives? In the context of a watershed, the actual and potential linkages between land and water management and poverty are complex and likely to be very site specific and scale dependent. This study analyses the importance of watershed resources in the livelihoods of the poor in two watersheds in the Colombian Andes. Results of the participatory poverty assessment reveal significant decreases in poverty in both watersheds over the past 25 years, which was largely achieved by the diversification of livelihoods outside of agriculture. Water is an important resource for household welfare. However, opportunities for reducing poverty by increasing the quantity or quality of water available to the poor may be limited. While improved watershed management may have limited direct benefits in terms of poverty alleviation, there are important indirect linkages between watershed management and poverty, mainly through labour and service markets. The results suggest that at the level of the watershed the interests of the rich and the poor are not always in conflict over water. Sectoral as well as socio-economic differences define stakeholder groups in watershed management. The findings have implications for policymakers, planners and practitioners in various sectors involved in the implementation of integrated water resources management (IWRM).

KEYWORDS: Watersheds, poverty dynamics, multi-stakeholder platforms, participatory poverty assessment, Colombia

INTRODUCTION

Watersheds, especially in the developing world, are increasingly being managed for poverty alleviation as well as for environmental conservation objectives (Tennyson and Zingari, 2006; FAO, 2006). This is a positive development since past investments in watershed management often overlooked the social and economic impacts of the technologies they promoted (Pretty and Shah, 1999). In some cases, the poor even bore the costs associated with watershed management while the rich reaped the benefits (Kerr, 2002).

The actual and potential linkages between land and water management and poverty are, however, complex and likely to be site specific and scale dependent (Swallow et al., 2006). Empirical evidence on the relationship between watershed management and poverty is relatively limited. Many reviews have documented adverse impacts of past watershed management on small farmers and the poor. However, the fact that poorly-designed projects harmed the poor does not necessarily imply that well-designed programs will lift them out of poverty, especially where alleviating poverty is understood to mean moving households across a threshold from poverty to prosperity rather than simply having a marginally positive impact on their livelihoods (Carter and Barrett, 2006). This is an important distinction since funds for both development and conservation in most developing countries are scarce and need to be targeted to where they will have the biggest impact.

This paper examines the relationships between poverty and watershed management in two watersheds in the Colombian Andes. Poverty is defined and measured using a participatory methodology that looks at changes in poverty levels over time and the reasons behind the changes at the household level (Krishna, 2004, 2006; Krishna et al., 2004a, 2004b, 2006). These reasons are then examined in the context of the economic and environmental dynamics to identify where and how watershed management interacts with livelihood strategies of the poor. The implications for policymakers and planners are discussed.

WATERSHED MANAGEMENT, LIVELIHOODS AND POVERTY

Until the 1990s, watershed management was viewed as an engineering problem, and technical solutions for controlling erosion, reducing runoff and flooding, and enhancing groundwater recharge were often designed and implemented with little regard for their impacts on the livelihoods of people, on farm profitability, or on social equity (Pretty and Shah, 1999; Johnson and Knox, 2002). As a result, many programs were unsuccessful, and technologies and practices were often abandoned by farmers as soon as they stopped being forced or paid to adopt them. Reviews of watershed experiences in the 1970s and 1980s identified the lack of attention to farmer objectives and farmer knowledge as important reasons for these failures. In contrast, where user participation was incorporated, performance of the watershed projects improved (Kerr, 2002).

As a result of these lessons, many participatory watershed development interventions were designed and implemented with explicit involvement of users and sought to address their livelihood concerns as well as environmental conservation issues. Building on the lessons from community-based natural resource management (CBNRM) network, the projects took into consideration the needs of local resource-dependent communities as their starting point, paying attention to the social and institutional issues that are fundamental to building collective capacity to manage resources and empowering communities to set the agenda and take a lead role in its implementation (Tyler, 2006). While few rigorous evaluations of this experience exist, case studies suggest that their performance has been better, at least in terms of governance and technology adoption (Tyler, 2006; Hinchcliffe et al., 1999; Perez and Tschinkel, 2003; Grewel et al., 2001). Focusing watershed interventions more directly on the needs of local communities is likely to make their outcomes more pro-poor. However, where local institutions and power structures are inequitable, the problem of the elite capture of benefits will still exist, with the beneficiaries being local elites rather than outsiders (German et al., 2007; Siagian et

al., 2006). Another challenge has been to maintain the local focus while at the same time addressing watershed management problems at a scale at which real change is possible (Rubiano et al., 2006).

After the year 2000, watershed management programs sought to embed the local participatory planning processes initiated as part of the participatory watershed initiatives within broader social and political processes more explicitly (FAO, 2006). The focus shifted from working directly with local groups on land and water issues to supporting multistakeholder negotiation platforms to address a range of issues including but not limited to natural resource management. Compared to past efforts, more emphasis is placed on conflict resolution and linking social, institutional and hydrological scales. Where earlier projects promoted the participation of stakeholders – and often focused specifically on local communities – more recent projects seek to foster collaboration between different types of stakeholders and stakeholder groups (FAO, 2006; Hermans et al., 2006).

In Latin America, market-oriented approaches towards financing watershed management emerged in the form of payment for environmental services (PES) schemes. In countries such as Colombia, Venezuela, Costa Rica and Guatemala, hydroelectric and municipal water supply companies are mandated to reinvest in watershed conservation (Hernández Becerra, 1991), and a variety of other schemes are in place on a pilot basis to promote the quantification and valuation of ecosystem services generated in upland areas and their compensation either directly by downstream users or indirectly through the government or non-governmental organisations (NGOs). While PES as an approach to finance conservation in poor countries has spread beyond Latin America, there are still concerns in Latin America about the viability of PES mechanisms over the long term, as well as the fundamental premise of using a market-based approach to allocate resources such as water (Kosoy et al., 2007). Bolivia and Uruguay, for example, are cases where the model has been rejected in favour of the 'water as a human right' approach (LASC, 2009). Evidence to date suggests that while PES in a watershed context may have a positive impact on conservation, it is not likely to have large positive impacts on the poor (Pagiola, 2005; Scherr et al., 2007).

While natural resources continue to be important livelihood assets for the poor – even the landless poor (Jodha, 1986, 1995; Dei, 1992; Cavendish, 2000; Beck and Nesmith, 2001; Fisher, 2004) – the livelihood strategies of rural households are increasingly diverse. Even in rural areas, households do not depend exclusively on agriculture or the extraction of natural resources. Off-farm income from sale of labour or commercialisation of products and services is important for household welfare of the rural poor (Bryceson and Jamal, 1997; Reardon, 1997; Barrett and Reardon, 2000). While motivation for diversifying livelihood strategies may be either positive (pull factors) or negative (push factors), a growing number of studies suggest that such strategies do have unambiguously beneficial effects on rural livelihoods (Shivakoti and Thapa, 2005; Block and Webb, 2001; Lanjouw et al., 2001). Therefore, the impacts of environmental, industrial, transportation and other policies that often come under the ambit of modern watershed management may have significant implications for the welfare of the poor.

While the broadening of the watershed management agenda may be beneficial to the poor because of their diversified interests, the emphasis on negotiating outcomes in multi-stakeholder forums could be problematic for poor, politically and socially marginalised stakeholders. Academic discourse is highly polarised between an idealised view of negotiations as equitable and inclusive and a more critical view of such forums being dominated by the entrenched political and social power dynamics (Saravanan et al., 2008). Many watersheds are very heterogeneous, with high levels of political and economic inequality. Further, the danger of elite capture can be especially high in watershed interventions since there is often a void at the intermediate scale – for example, regional and provincial – between communities and higher level government institutions where these issues should be addressed and where the poor might fare better (FAO, 2006). While the influence of existing power structures should not be underestimated, in some cases, the poor, especially when they are organised, do have ways of influencing other actors, not only through formal legal processes but also by invoking social obligation or customary practice (Swallow et al., 2006). Further, by addressing areas where the poor may be

particularly unprepared to take on the more powerful sectors – such as access to information or ability to engage in public debate – imbalances can begin to be addressed (Candelo et al., 2008).

DESCRIPTION OF THE STUDY SITES

Lake Fúquene watershed¹

Fúquene Lake watershed (Fúquene) encompasses the valleys of Ubaté and Chiquinquirá in the states of Cundinamarca and Boyacá, respectively, in Colombia. Fúquene is located about two hours from the Colombian capital, Bogotá, on a good all-weather road. It covers an area of 187,200 ha, including 17 municipalities,² and a population of 229,000, about 59% of which is rural (DANE, 2005). The altitude ranges from 2300-3300 metres above sea level (masl), with an annual rainfall between 700 and 1500 mm. For the municipalities in the watershed, the 2003 Living Condition Index, a measure of welfare, ranged between 'very low' and 'high' (Sarmiento et al., 2006), reflecting the socio-economic heterogeneity in the zone.

The largest land use in the watershed is pasture (59%), followed by agriculture (26%), forest (4%), *páramo*³ (2%) and lake (2%) (Rubiano et al., 2006). Land degradation is a serious concern, with 13,000 ha classified as severely eroded and 40,000 ha classified as moderately eroded. In the past, major investments were made in soil conservation activities. However, aside from stabilising fragile areas, the impact of these investments on productivity has not been rigorously assessed yet. Conservation tillage was widely promoted. However, its adoption was limited until recently when it was promoted under a PES-type scheme (CONDESAN, 2009).

The principal economic activities in the watershed are agriculture (cropping and dairy) and mining. The medium- and large-scale dairy operations, located in the lower part of the watershed along the shores of the lake, are high input and highly productive. Land values in this area are among the highest in the country, and many *hacienda* owners are wealthy and politically well connected. Others received land as part of a land reform process that redistributed land that was reclaimed as lake levels dropped.

Crops are grown mainly in the upper and middle parts of the watershed. Land ownership in the upper and middle parts of the watershed is generally by smallholders. However, in the higher areas appropriate for potato cultivation, land is often rented out to large-scale producers who are more capable of taking the risks associated with this high risk-high reward crop. Despite the fact that it is against environmental regulations, significant cultivation occurs in the *páramos*, which are ecologically fragile and play a key role in maintenance of the ecosystem function, especially supply and regulation of water flow (Rangel, 2006).

Lake Fúquene,⁴ located at the bottom of the watershed, is at the centre of an environmental controversy. The health of the lake, mainly for biodiversity but increasingly as a provider of environmental services such as tourism, urban water supplies, and flood control, is currently driving change in the watershed. The national government and the regional environmental authority have placed high priority on resolving the problems of Fúquene, prompted in part by massive floods in 2006 that focused nationwide attention on the issue (DNP, 2007).

¹ For more information see www.infoandina.info/andean/index.shtml?apc=Ba1e1-&s=B&e=h (accessed 13 January 2009)

² The municipalities that belong to the Fúquene watershed are Carmen de Carupa, Ubaté, Tausa, Sutatausa, Cucunubá, Suesca, Villapinzón, Lenguazaque, Gacheta, Fúquene, Susa and Simijacá in Cundinamarca and San Miguel de Sema, Ráquira, Caldas, Chiquinquirá and Saboyá in Boyacá.

³ A *páramo* is a grassland ecosystem that occurs above the timberline in the Northern Andes.

⁴ See

www.globalnature.org/docs/02_vorlage.asp?id=12716&domid=1011&sp=E&addlastid=&m1=11089&m2=28219&m3=11178&m4=12716 (accessed 15 January 2009)

The environmental authority for the Fúquene watershed, the Corporación Autónoma Regional de Cundinamarca (CAR),⁵ is responsible for developing and implementing the watershed management plan, and there is widespread discontent with their inaction. Local municipal governments have some responsibility for resolving water conflicts and undertaking water conservation activities. While some are more active than others, they are limited in what they can achieve given their purely local scope. There are few NGOs or civil society organisations working in Fúquene. Fundación Humedales has been doing research and conservation around the lake, and is interested in moving its efforts upstream, given that many of the lake's problems originate there. Local universities and international organisations have a research presence, but until very recently, little had been done in terms of mobilising communities to address issues at the watershed level, politically (Candelo et al., 2008).

Within communities there are examples of people coming together to manage water resources collectively, and there have even been cases of collective action to defend legal rights to water from springs when landowners have attempted to limit access. However, attempts to manage upstream-downstream issues in the watershed via local collective action have not been successful. Despite the relatively good accessibility within the watershed, communication between people in different areas is limited, which makes it difficult to achieve a collective vision of the watershed and an understanding of the challenges facing it (Cardenas et al., 2008).

Coello river watershed

The Coello river watershed, located in the state of Tolima in the central Andean Cordillera covers an area of 190,000 ha, ranging from 280 to 5300 masl. Annual rainfall ranges from below 1000 mm to more than 3970 mm. The watershed includes ecosystems ranging from dry forest to *páramo* to snow-capped peaks, and is home to national parks and private reserves. The watershed contains some or all of eight municipalities⁶ with a population of 622,395 in 2005, including the city of Ibagué (population 425,770). Including the city of Ibagué, only 16% of the population is rural and even without Ibagué urbanisation rates are above 50%. The Living Conditions Index for municipalities in the Coello watershed range from 'medium low' to 'medium high', a slightly narrower range than for Fúquene, with urban municipalities scoring higher than rural ones (Sarmiento et al., 2006). The Pan-American Highway passes through the watershed, generating economic activity but at a cost of soil erosion and pollution.

The principal economic activities in Coello include agriculture and livestock. The upper parts of the watershed are mainly forested. However, land is increasingly being converted for livestock, coffee and horticultural crops. In the middle altitude areas, sugarcane and fruit trees are common; this region accounts for 30% of Colombia's fruit and vegetable production (Fujisaka, 2007). The lower parts of the watershed include 30,000 ha of large-scale, irrigated rice, cotton, and sorghum as well as beef cattle. Rice demands the largest share of water channelled through the rivers and irrigation systems (500 million m³) followed by fruit (41 million m³) and coffee (1.5 million m³) (ibid).

Colombia's internal conflict between the government and guerrillas has a greater impact on Coello than it has on Fúquene. Fúquene is very safe. However, in Coello, guerrilla groups are present in the upper parts of the watershed, and as a result many families have had to flee the zone.

Traditionally, water has not been scarce in Coello. However, there is growing awareness that inappropriate land use in the upper parts of the watershed combined with the growing demand for irrigation, domestic water and hydroelectric power in the lower parts of the watershed are rapidly leading to a situation that is not sustainable. Water quality is also an issue as contamination is increasing due to agrochemical use, and domestic and industrial waste. High sediment loads – from soil erosion throughout the watershed – are not only threatening the irrigation scheme, but also possibly

⁵ See www.car.gov.co (accessed 13 January 2009)

⁶ The municipalities that make up the Coello river watershed are Ibagué, San Luis, Rovira, Cajamarca, Espinal, Flandes, Valle del San Juan and Coello.

reaching the Rio Magdalena, Colombia's major and navigable river. This has been identified as a national problem, and one that may now be affecting ports in Central America (Fujisaka, 2007).

As in Fúquene, the driver for change is the environment. However, in Coello, the process is 'top down' in the sense that it focuses on conserving the upper parts of the watershed whereas in Fúquene the main emphasis was on the lake at the bottom of the watershed. The World Wide Fund for Nature (WWF), Semillas de Agua and other NGOs are working to preserve the *páramos*, and in doing so they are seeking to link with downstream stakeholders who are benefiting or could benefit from the environmental services provided by the *páramos* (Candelo et al., 2008).

The environmental authority responsible for the Coello watershed is the Corporación Autónoma Regional del Tolima [CorTolima, www.cortolima.gov.co (accessed 13 January 2009)]. Progress on a comprehensive plan has been slow. There is a wider range of actors with a continuing presence in Coello than in Fúquene. Nonetheless, there is no articulation in terms of addressing watershed problems, and the same lack of a collective vision and understanding of problems that is present in Fúquene is also evident in Coello.

THE DYNAMICS OF POVERTY IN FÚQUENE AND COELLO

Methods

To identify the poor and understand the role of water in their livelihoods, we used the Stages of Progress (SOP) methodology (www.pubpol.duke.edu/krishna/methods.htm accessed 13 January 2009). SOP was developed to assess both the dynamics of poverty and the causes behind them. While national-level poverty rates are often slow to change, poverty is not a static situation. It changes as a result of seasonality, climate variability, household-level shocks (such as illness, death or divorce), life cycle changes, and public policies. In addition, the number of poor people is itself constantly changing as individuals and households either escape from poverty or descend into it. Looking at the same households over time provides a better understanding of the conditions that keep people in poverty and those that move them out, in order to identify the general patterns and assist in policy targeting to maximise protection and support for the most vulnerable without pulling back those who are escaping (for example, Carter and Barrett, 2006).

SOP is a participatory methodology that relies on the community definition of poverty at a household scale. The poverty level of each household in the community is assessed, and explanations are sought for changes in the poverty status over time. The method takes its name from the stages or steps that a household passes through as it makes its way from poverty to prosperity. To define the stages, a representative group of community members must first come to agreement on a definition of poverty, based on a shared conception of the 'poorest family in the community'. Once this is done, the group successively answers the question "What would this family do with additional resources?" until they reach the point at which the household would be considered prosperous. Because they are defined locally and with reference to a particular poor family, the stages vary by community and reflect the specific conditions and values of the community.

Once the stages are identified, the group then assigns each family in the community – based on a census which must be obtained or constructed – to the stage where they currently are and the stage where they were at some point in the past, usually 10, 20 or 25 years ago. After they have been assigned to stages,⁷ tabulation is done to categorise them as follows:

- A – Poor in the past, poor now
- B – Poor in the past, not poor now

⁷ It is important to note that the categorisation is done by the stage and not by the poverty category, which reduces the extent to which the groups are directly classifying households as poor or non-poor.

C – Not poor in the past, poor now

D – Not poor in the past, not poor now

For a randomly-selected subsample of families, the community then identifies the reasons behind changes in poverty status. The final step in the methodology is to conduct follow-up interviews with a sample of families to confirm the results of the community analysis and to gather more information on specific issues. In the case of this study, interviews included questions on water use, conflicts, and management at the household and community scale.

The SOP was selected for this study for two main reasons. First, we wanted a participatory method that allowed communities to define poverty and its determinants, so that we could explore all possible linkages between watersheds and livelihoods, without restricting ourselves to a predefined set of potential linkages. Second, because the poverty analysis was implemented as part of a watershed intervention aimed at strengthening community capacity to co-manage resources, we wanted to use a method that would build community capacity. In SOP, the community determines the results in a transparent process, and the main results in terms of poverty trends and key reasons behind them are obtained in the course of the focus group, so that the group has the opportunity to react to them and to offer its own analysis and interpretations.

While we felt that these advantages justified the use of SOP for this analysis, we recognise that the method has some disadvantages – for example, a strong focus on the material aspects of poverty and an inability to address broader structural determinants of poverty (Harris in Addison, Hulme and Kanbur, 2008), lack of direct comparability across sites (Peralta et al., 2007; Krishna, 2007), and methodological issues about quality of recall data and the handling of time periods (Krishna, 2007) – which limited our ability to look at some aspects of poverty.

RESULTS

In 2005, the SOP methodology was applied in 13 communities (*veredas*) in six municipalities in the Fúquene watershed, and in 10 communities in five municipalities in the Coello watershed (table 1). A total of 1061 households were classified. Sites were purposively selected in the upper, middle and lower parts of the watershed, on the basis of prevalence of poverty and the expected intensity of water conflicts. Site selection was based on available secondary data and on interviews with key informants. Information gathered in each community consisted of quantitative data from the SOP methodology – including movements in and out of poverty and their main causes – as well as qualitative data from interviews held with households and key informants, and from observations by project staff in the field.

Table 1. Sites where the SOP methodology was implemented.

Watershed/state	Municipality	Population	Communities surveyed
Fúquene/ Cundinamarca	Tausa	7715	Ladera Grande, Rasgata Bajo
	Sutatausa	4742	Chipaquin, Palacio, Peñas de Cajon
	Gacheta	11,517	Gacha, La Isla, La Puntica
	Fúquene	5214	Centro y Guata, Chinzaque, Nemoga
	Cucunabá	7013	Chapala
	Carmen de Carupa	8491	Apartadero
Coello/Tolima	Cajamarca	19,789	La Leona-APACRAQ, EL Rosal, La Alsalcia, Mini-distrito La Leona
	Ibagué	498,401	Coello-COCORA, San Cristobal, Honduras
	Espinal	76,226	Dindalito
	Coello-COCORA	9017	Potrerrillo, Chaguala Adentro
	Rovira	21,665	La Ocera

Definition of poverty and stages of progress

The poorest families in the communities were identified as landless day labourers who lacked quality housing, health care and other services, and who were unable to send their children to school. The non-material dimensions of poverty were also mentioned, even though they could not be incorporated into the stages of progress explicitly. In both watersheds, non-participation in community activities was considered to be an indicator of poverty. Half of the communities in Coello included this in their definition of the poorest family. In Fúquene, participation in community activities was considered to be a component of well being. The fact that communities mixed the material and non-material aspects of poverty in an exercise based around material ranking suggests that the two sets of indicators are highly correlated and identify the same people as poor. These findings, especially regarding participation, have significant implications for the potential equity impacts of participatory, multistakeholder negotiation processes.

The number of stages that communities defined ranged from seven to 24, and the number of stages below the poverty line ranged from three to ten. As expected, acquiring basic necessities such as food, education, clothing and housing were the most common early stages in nearly all the communities (table 2). This is consistent with the findings from other applications of SOP (Krishna et al., 2004, 2006). As household welfare increased, the items mentioned in the stages began to diverge with some communities focusing more on agriculture-related investments, some on services (water and electricity) and others on durable goods (Peralta et al., 2007).

Table 2. Stages below the poverty line, by order of importance (n=26).

Description	Order	Frequency
Food	1	23
Education	2	20
Clothing	3	15
Housing	4	18
Small animals	5	18
Land	6	8
Services (water and electricity)	7	9
Appliances	8	10
Health	9	6
Crops	10	4
Other	11	2
Transportation	12	2
Savings/investment	13	2
Recreation	14	2

Out of 26 communities, 23 mentioned access to water as a stage, either by itself or as part of 'services' (water and electricity). Only in one community (Chinzaque in Fúquene) was agricultural use of water specifically mentioned. While acquiring water usually means getting a household connection to a potable water system, domestic water is used for productive, income-generating activities as well. In Fúquene, for example, small-scale cheese processors must have access to piped water in order to get certification to sell their products.

In nine communities (31%), water appeared in categories below the poverty line. In the remaining communities it was either not mentioned or was a stage above the poverty line. One reason that water may be above the poverty line is due to the fact that in many cases households have good access to water from natural sources such as wells or springs or from shared taps. Thus, a home connection is somewhat of a luxury. Where water appears above the poverty line, improving access would improve

livelihoods but would not reduce poverty per se. In three communities (12%), water was included in the stage just below the poverty line, which means that improving access could literally get households out of poverty. Ranked from most to least demanding, the three communities where water was the last stage before getting out of poverty occupied 5th, 15th and 20th places. This suggests that there is no pattern between the importance of water and other elements of the overall well being of the community.

What this means in terms of how many poor households could actually be helped by better access to water in these communities, depends on how many still do not have it. According to the data, 13% of households are without water in communities where lack of access to water is an indicator of poverty. Of these households, 4% are at the limit where getting access to water would push them over the threshold from being poor to non-poor. Keeping in mind that these data come from communities purposively selected because of poverty and water problems, the results would likely overstate the potential impacts for the watershed as a whole.

These results suggest that opportunities for reducing poverty through increased provision of water in these study communities are relatively limited. There are specific cases where poor households and communities would benefit significantly from improved access to water. However, in general, this is not the case. As Table 2 suggests, interventions to improve access to food, education, clothing, housing, small animals or land would be better targeted towards helping the poor. This conclusion is consistent with the results of another SOP analysis, carried out in 40 communities in two regions of the Peruvian Andes, in which water access was not mentioned among the stages of progress (Krishna et al., 2006).

These results are somewhat surprising given past research on the importance of water, especially small-scale irrigation, in many rural Andean communities and problems caused by inequitable distribution of water, land and other resources (for example, Boelens and Davila, 1998). Other participatory analyses have identified inequities between the poorest and better-off households in upper parts of the watershed in Peru and Ecuador in terms of access to irrigated land. However, they did not look at poverty dynamics, so it is not clear what role these assets have played as pathways out of poverty (Gómez et al., 2005; Chapalbay et al., 2007). The importance of off-farm income in the better-off households is consistent with what was found in the SOP analysis.

While examples of such cases can be found in these watersheds, the results of the SOP analysis suggest that they are not as common as is often assumed, especially at the level of the whole watershed (as opposed to just the upper parts of the watershed), and over time. Another explanation is that by focusing on poverty and the characteristics of the poorest households, some important livelihood issues did not emerge in the analysis because they are more relevant to the slightly better-off *campesino* households.

Poverty dynamics and causes of change

According to the results of the categorisation of families (table 3), poverty declined in nearly all communities over the last 25 years. In 1980, approximately 70% of families in both watersheds lived in poverty. Between 1980 and 2005, 30% of the families in Fúquene escaped poverty (category B), while only 3% fell into poverty. In Coello, the results are even more dramatic; 59% of families got out of poverty while only 3% became poor. These results clearly show that people in rural communities perceived important advances in their quality of life in recent decades. Nonetheless, over 40% of families in Fúquene and 10% of families in Coello were poor in 2005.

For each family in the sample, up to three causes were identified to explain the change (or lack thereof) in poverty category between 1980 and 2005. A total of 25 different causes were identified (table 4). Among the causes that were mentioned in first place for each family, the most common was off-farm employment (20%), followed by inheritance (17.2%), help from family and friends (9.4%), day labour (7.8%) and help from the government (7.5%). These results are consistent with the diversification of rural livelihoods away from agriculture.

Table 3. Changes in poverty status from 1980 to 2005 (% of families per category).

Community (<i>Vereda</i>)	Number of households	Category				
		A (Poor-poor)	B (Poor-not poor)	C Not poor-poor	D (Not poor-not poor)	E (New arrival)
Fúquene						
Ladera Grande	53	66	8	17	4	6
Rasgata Bajo	41	24	22	2	5	46
Chipaquin	32	34	41	13	13	0
Palacio	59	37	47	0	2	14
Peñas de Cajón	69	17	61	0	0	22
Gacha	81	38	26	6	28	1
La Isla	92	40	30	3	25	1
La Puntica	90	39	32	0	4	24
Centro y Guata	82	90	1	0	1	7
Chinzaque	39	23	46	3	28	0
Nemogá	119	13	29	4	46	8
Chápala	86	83	13	0	0	5
Apartadero	43	30	70	0	0	0
TOTAL	886					
Coello						
Apacra	13	0	31	0	69	0
El Rosal	13	0	77	8	15	0
La Alsacia	14	21	57	0	21	0
Minidistrito La Leona	11	45	55	0	0	0
Cocora	18	6	22	0	44	28
Dindalito	26	15	46	8	31	0
San Cristobal-Honduras	19	5	47	5	42	0
Porterillo	31	0	100	0	0	0
Chaguala	14	29	57	7	7	0
La Ocera	16	6	75	0	19	0
TOTAL	175					

Table 4. Principal causes of change in poverty status, both study sites.

Cause	Mentioned as first cause, % of families (n=361)	Mentioned as second cause, % of families (n=284)	Mentioned as third cause, % of families (n=133)	% of all causes mentioned (N=778)
Help from the government	7.5	4.9	14.3	7.7
Help from family and friends	9.4	16.2	8.3	11.7
Unexpected loss	0.3	0.0	0.8	0.3
Unexpected benefit	0.3	0.0	0.0	0.1
Education/training	1.9	3.5	8.3	3.6
Off-farm employment	20.0	20.1	8.3	17.0
Day labour	7.8	9.9	5.3	8.1
Small or low quality landholding	0.8	0.7	0.8	0.8
Credit	0.6	2.5	3.0	1.7
Illness/accident	3.6	1.8	2.3	2.7
Large family	1.4	0.7	0.8	1.0
Small family	0.0	1.1	3.0	0.9
Newly established family	3.9	1.1	0.8	2.3
Agriculture	6.1	7.7	11.3	7.6
Livestock	1.7	3.2	8.3	3.3
Good money management	0.6	2.1	0.8	1.2
Bad habits	3.3	2.1	0.0	2.3
Legal or family problems	3.0	1.1	1.5	2.1
Inheritance	17.2	6.3	6.8	11.4
Savings/investment	3.3	10.6	9.8	7.1
Old age	0.8	0.4	0.0	0.5
Pension	4.4	2.1	2.3	3.2
Community work/collective action	0.6	1.4	3.0	1.3
Fishing	0.8	0.7	0.8	0.8
Migration	0.8	0.0	0.0	0.4
Total	100	100	100	100

The results are similar for Fúquene and Coello, with the important exception being that smallholder agricultural production was much more important in Coello than in Fúquene, which is consistent with the much better quality of land held by small farmers in the former compared to the latter (tables 5 and 6). In Coello (table 6), agriculture (14.5%) is the most frequently mentioned first cause, followed by off-farm employment (10.9%) and day labour (13.4%) as the second and third causes for change in poverty status.

Table 5. Principal causes of change in poverty status, Fúquene.

Cause	Mentioned as first cause, % of families (n=251)	Mentioned as second cause, % of families (n=187)	Mentioned as third cause, % of families (n=71)	% of all causes mentioned
Help from the government	6.4	4.8	7.0	5.9
Help from family and friends	8.4	15.0	9.9	11.0
Unexpected loss	0.0	0.0	1.4	0.2
Education/training	1.2	2.1	4.2	2.0
Off-farm employment	23.9	23.5	11.3	22.0
Day labour	7.2	8.0	4.2	7.1
Small or low quality landholding	0.4	1.1	1.4	0.8
Credit	0.0	0.0	4.2	0.6
Illness/accident	4.0	1.6	4.2	3.1
Large family	1.6	0.0	1.4	1.0
Small family	0.0	1.6	4.2	1.2
Newly established family	5.6	1.6	1.4	3.5
Agriculture	2.4	4.3	5.6	3.5
Livestock	0.8	3.2	8.5	2.8
Good money management	0.4	1.6	0.0	0.8
Bad habits	3.6	2.7	0.0	2.8
Legal or family problems	2.0	0.5	0.0	1.2
Inheritance	18.7	9.1	11.3	14.1
Savings/investment	3.6	14.4	14.1	9.0
Old age	1.2	0.5	0.0	0.8
Pension	6.0	3.2	4.2	4.7
Community work/collective action	0.4	0.0	0.0	0.2
Fishing	1.2	1.1	1.4	1.2
Migration	1.2		0.0	0.6
Total	100.0	100.0	100.0	100.0

Among the secondary causes, off-farm employment and help from family and friends continue to be important. However, other causes such as agriculture, and savings/investment were also mentioned. Help from the government and agriculture were the most important third causes.

In general, households with more causes were better-off than households with fewer causes (table 7). This is also consistent with the diversification hypothesis and with findings from other studies.

As expected, in the majority of cases, specific causes are associated with either progress or poverty. Regressing cause dummy variables (1, if cause was mentioned for the household, 0, if not mentioned) on a dummy for whether the household was poor in 2005, we can see the contribution of each cause to poverty reduction (tables 8 and 9). According to the results, the probability of being poor in 2005 was reduced for families with off-farm employment (-37%), agriculture⁸ (-35%), help from the government (-30%), pension (-27%), help from family and friends (-23%), livestock (-23%), savings/investment (-22%)

⁸ In Coello, no agricultural households were ranked as poor in 2005. As a result, this analysis could not be done for each watershed separately.

or inheritance (-17%). The probability of being poor in 2005 was increased by legal or family problems (+62%), illness/accidents (+37%) or for newly established families (+25%).

Table 6. Principal causes of change in poverty status, Coello.

Cause	Mentioned as first cause, % of families (n=110)	Mentioned as second cause, % of families (n=97)	Mentioned as third cause, % of families (n=61)	% of all causes mentioned
Help from the government	10.0	5.2	5.2	7.1
Help from family and friends	11.8	18.6	18.6	15.8
Unexpected loss	0.9	0.0	0.0	0.4
Unexpected benefit	0.9	0.0	0.0	0.4
Education/training	3.6	6.2	6.2	5.1
Off-farm employment	10.9	12.4	12.4	11.8
Day labour	9.1	13.4	13.4	11.6
Small or low quality landholding	1.8	0.0	0.0	0.7
Credit	1.8	7.2	7.2	5.0
Illness/accident	2.7	2.1	2.1	2.3
Large family	0.9	2.1	2.1	1.6
Agriculture	14.5	14.4	14.4	14.5
Livestock	3.6	3.1	3.1	3.3
Good money management	0.9	3.1	3.1	2.2
Bad habits	2.7	1.0	1.0	1.7
Legal or family problems	5.5	2.1	2.1	3.5
Inheritance	13.6	1.0	1.0	6.2
Savings/investment	2.7	4.1	4.1	3.6
Pension	0.9	0.0	0.0	0.4
Community work/collective action	0.9	4.1	4.1	2.8
Total	100.0	100.0	100.0	100.0

In spite of being an important cause, day labour did not significantly affect the probability of being poor in either watershed. This may be explained by the fact that where families depend on day labour as a primary livelihood strategy, it seems to be associated with poverty. Where day labour is a complementary livelihood option, it can contribute to progress.

Table 7. Number of causes by poverty category (% of families in category).

	A	B	C	D
1 cause	100	100	100	100
2 causes	62	89	48	84
3 causes	18	49	8	37

Pearson Chi Sq significant at =.000

Table 8. Impact of major causes of change in poverty status on whether household was poor in 2005 (n=359).

Cause	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]		Mean
Fúquene	0.8294	0.2606	3.18	0.001	0.3185	1.3402	0.6953
Help from the government	-0.7866	0.2522	-3.12	0.002	-1.2809	-0.2923	0.1662
Help from family and friends	-0.8534	0.2246	-3.8	0	-1.2935	-0.4133	0.2521
Education/training	-1.2576	0.4380	-2.87	0.004	-2.1161	-0.3992	0.0776
Off-farm employment	-1.2735	0.1983	-6.42	0	-1.6621	-0.8849	0.3934
Illness/accident	0.9861	0.4466	2.21	0.027	0.1108	1.8615	0.0582
Newly established family	0.6794	0.4182	1.62	0.104	-0.1402	1.4990	0.0499
Agriculture	-1.8283	0.3797	-4.82	0	-2.5725	-1.0842	0.1634
Livestock	-1.0400	0.4285	-2.43	0.015	-1.8799	-0.2001	0.0720
Legal or family problems	1.7996	0.7036	2.56	0.011	0.4207	3.1786	0.0443
Inheritance	-0.5756	0.2077	-2.77	0.006	-0.9827	-0.1684	0.2465
Savings/investment	-0.8336	0.2399	-3.48	0.001	-1.3037	-0.3635	0.1773
Pension	-1.3996	0.4045	-3.46	0.001	-2.1925	-0.6067	0.0693
Constant	0.3137	0.2703	1.16	0.246	-0.2162	0.8435	

LR Chi Sq (13) 205.8; Log likelihood = -128.48344, Pseudo R₂ = 0.4447

Table 9. Influence of cause on probability of being poor.

Cause	Delta P (Poor2=1) without cause (i) – P(Poor2=1) with cause (i)
Off-farm employment	0.3650
Agriculture	0.3503
Help from the government	0.3041
Pension	0.2666
Education/training	0.2569
Help from family and friends	0.2343
Livestock	0.2310
Savings/investment	0.2182
Inheritance	0.1673
Fúquene	-0.2368
Newly established family	-0.2517
Illness/accident	-0.3706
Legal or family problems	-0.6243

Illness/accidents were relatively rare among families in both watersheds, indicating that families were not as vulnerable to external shocks as might be expected. Rather, their challenge is to find and take advantage of opportunities. In Coello, failure to progress was almost exclusively due to bad habits or family problems.⁹ This contrasts with the SOP results from other countries, as mentioned in section 4. Though consistent with the relatively higher living standards in Colombia, such explanations should

⁹ In Coello, there were cases of families who had fled the zone due to political violence, but, because they were no longer in the community, they were not considered in this analysis.

always be interpreted with caution since they may constitute a superficial explanation for deeper problems that would not be recognised by the community. Lack of importance placed on illness suggests that indirect links between poverty and water quality via health are not significant in these watersheds.

Again, the results demonstrated the importance of off-farm activities in successful livelihood strategies. Off-farm employment, including by stable jobs and pensions, were by far the biggest cause of poverty reduction. Also consistent with the diversification of livelihoods is the importance of help from family and friends, which may reflect the importance of contacts and social networks in obtaining off-farm employment. The importance of education/training as a cause of poverty reduction may also be related to the higher skill levels required to get off-farm jobs. In an SOP analysis in India, Krishna (2006) failed to find a relationship between education/training and poverty reduction and interpreted it to mean that in countries where institutional channels for providing information are weak, most of the off-farm jobs are obtained via personal contacts. In Colombia, it seems that formal institutions are more developed. However, informal contacts still play an important role.

While community participation was considered a critical aspect of well being in both watersheds by the communities when they defined poverty in the first stages of the SOP analysis, community work/collective action was mentioned by just a handful of households as a reason for poverty or progress and was not significant in the statistical analysis. This is consistent with the relative lack of importance of natural resource management issues in the livelihood strategies of households. It may also reflect the underdevelopment of institutions for articulating local collective action with higher scale decision making. Others have observed this lack of intermediate institutions in watershed management (FAO, 2006) and have hypothesised that such institutions may be critical to overcoming poverty traps more generally (Barrett and Swallow, 2006; Swallow et al., 2006).

Thus, far into the analysis there is little evidence to show that the kinds of activities carried out within a watershed management program would have much potential to alleviate poverty. Improving the quantity or quality of water available to poor households – within ecological realities – would not, except in a few cases, make it more likely that they could engage in the livelihood strategies associated with prosperity. In other words, few win-win opportunities seem to be available.

Trade-offs may be more likely. In the case of Coello, if limits were placed on cultivation of steep slopes to reduce erosion and associated agrochemical runoff, poverty could actually increase since small-scale production was a major escape from poverty for many households in Coello. Similar regulations in Fúquene may not increase poverty levels per se since many of the small farmers engaging in agriculture are already among the poorest, as are the day labourers who work on the potato farms in the *páramos* of Fúquene and the ranches, and on the large-scale irrigated farms in Coello. While not increasing the poverty headcount, it could make the plight of the poor more difficult and thus deepen poverty.

In both Fúquene and Coello, off-farm income was the major way in which households escaped poverty, and most of the sources of off-farm employment are in agriculture or natural-resource-based industries within the watershed. In Fúquene, mining was a very important source of employment, as was the large-scale dairy sector which generated jobs ranging from farm administrators to milkers. One of the surprises in the follow-up interviews was the high number of female-household heads who got their families out of poverty by milking cows on the dairy farms.

Small- and medium-scale agro-enterprises based on the production of value-added dairy products such as cheese and yogurt were also common in Fúquene. The sale of services such as the renting of machinery to farmers and the commercialisation and/or transportation of agricultural products such as fruits, coffee or livestock, were common in Fúquene and Coello.

Taken together, what these findings suggest is that while the poor are unlikely to obtain large benefits directly from improving watershed management, they could be hurt, at least in the short run, if changes in the rules governing how land and water are managed and used reduces the profitability of the agricultural and natural resource-based industries that generate employment and provide markets

for products and services. It would be important to target these groups for safety nets that would help them to adjust to change without increasing poverty.

An implication of this finding for participatory watershed management programs is that interest groups may form along sectoral – mining, dairy, etc. – lines as well as by socio-economic class. The concern that the poor will be doubly marginalised by being both geographically remote and disconnected from decision making may not be entirely warranted in these watersheds. The poor are not concentrated in the remote upper reaches, nor are their interests always opposed to those of the better-off on some issues. Similarly, the interests of the poor are not homogeneous, especially between upstream and downstream communities. While not the focus of this study, the results imply that the same could be said for the better-off households.

Given that the rich and poor within a sector may differ on how they would approach, for example, the need to make their industry more environmentally sustainable, it would be risky to recommend that the poor allow the rich to represent them in negotiations. While they may have similar interests in terms of environmental issues, they may differ on other policy or technology issues such as taxes or labour-saving mechanisation. The poor need to be able to participate in multi-stakeholder negotiations with other groups, and to do so they will require a sophisticated understanding of the issues that are most important to them, and how to identify and use potential allies most effectively.

DISCUSSION

This paper looked at the role of water in the livelihoods of the poor in two Colombian watersheds, with the goal of identifying how poverty can be alleviated via better watershed management. The results suggest that while water is obviously a critical resource for any household, rich or poor, the opportunities to alleviate poverty by improving the quantity or quality of water available to poor households via better management of watershed resources may be limited. In terms of poverty reduction, the most successful livelihood strategies for getting households out of poverty over the last 25 years have been related to livelihood diversification and off-farm employment. Interventions that increase the access of poor households to human and, especially, social capital will likely have a bigger impact on poverty than those that focus exclusively on natural or physical capital.

The study did find evidence of important indirect linkages between poverty and watershed management. The industries that generated employment for the poor also contribute to the environmental problems of the watershed. Thus, there is a potential for poverty-environment trade-offs rather than win-win situations. Policymakers, planners and others who seek to intervene in watershed management in these watersheds need to be aware of the indirect linkages between poverty and the environment via labour, product and service markets, so that they can design programs that contribute to poverty alleviation where possible but, equally if not more important, do so without harming those who have managed to escape poverty, even if it was at the expense of the environment. This could be done through the design of environmental regulations themselves, or by the targeting of safety nets to help the poor bear short-term costs of policy change.

Colombian legislation allows for stakeholder participation in watershed management decisions. While it is increasingly recognised that stakeholder participation is an important part of integrated water resources management (IWRM), effective participation presumes a good understanding of the issues, especially the socio-economic and biophysical linkages within watershed systems. Results from studies such as this one can contribute to improving the community knowledge base, and, therefore, to helping stakeholder groups better identify the issues that are important to them, and their potential allies in reaching their goals. The results of this study suggest that in some cases such interests may follow sectoral divides, spanning the deep socio-economic and cultural divides that often exist in Andean watersheds. As such, they could be an important entry point into dealing with other more divisive issues.

Even though these results suggest that the poor are not a homogenous group whose interests are necessarily opposed to those of better-off groups, the way that communities defined poverty does suggest that one thing the poor do have in common is that they tend not to participate in community-level processes. Participation is considered to be a component of well being, and in many communities the poor are identified as being those who do not participate. Building on the willingness and capacity of the poor to participate will not only improve the equity outcomes of participatory multi-stakeholder negotiation processes around watershed management, it could also have a direct impact on the welfare of the poor.

In terms of directions for future research, it will be important to validate the findings of this study in other sites. Given the complexity of the relationships between water and well being and the critical importance of process, action research approaches would be particularly appropriate for exploring how the poor fare in multi-stakeholder watershed negotiations. The SOP methodology was useful because it provided a cost-effective way of getting what is essentially a panel data set, incorporated qualitative and quantitative data, and involved the community in a way that promotes the shared reflection on the results. As such, it is a useful approach to use at the start of an intervention, which was the way that it was used in this case. An evaluation of the intervention, which was designed to build the capacity of communities to use the legal and policy tools available to them to hold public and, in some cases, mixed (public-private) institutions accountable for fulfilling their obligations with regard to watershed management, documented impacts on a broad range of areas including the ability of communities to interact and negotiate with more powerful stakeholders (Candelo et al., 2008).

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