

# Indigenous Irrigation Organizations and the Formation of Social Capital in Northern Highland Ecuador

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## Abstract

Recent debates on the role of social capital in development are of relevance to nature-society analysis within geography because they highlight the ways in which forms of social organization can increase the effectiveness, equity and efficiency of natural resource management strategies. Through a case study of irrigation management organizations in the Northern Andes of Ecuador, this paper addresses the ways in which this form of social capital has been created as a result of both relatively recent development interventions and longer term political economic processes. The study also discusses the impacts that this has had on natural resources and rural livelihoods. The paper suggests possible indicators for assessing social capital formation, and draws conclusions regarding the conditions under which social capital is most likely to be created and most likely to have positive impacts.

## Introduction

Since the 1993 publication of *Making Democracy Work: Civic Traditions in Modern Italy* by Robert Putnam, researchers and practitioners concerned with Third World development have become increasingly preoccupied with the concept of social capital—defined by Putnam as the "stock" of "norms of reciprocity and networks of civic engagement"—and its implications for development theory and practice. Putnam's findings that long-standing civic traditions in Italy influence significantly economic performance and political accountability have inspired attempts to gauge the influence of social capital on development elsewhere. Indeed, social capital has already proven to be a valuable theoretical concept for Third World development theory, especially as regards the notion of state-civil society synergy (Evans 1996; Fox 1996; Lam 1996; Ostrom 1996; World Bank 1996).

These writings say far less about the ways in which social capital might be created or induced. This, indeed, is a key difficulty with the concept, for while showing the importance of social capital for more inclusive, accountable and vigorous patterns of development, Putnam (1993) also argues that this social capital is the result of social and cultural relations constructed over centuries. If this is so, we may wonder what can be done to promote its formation in other locations within a shorter time-scale, or within a socio-political context in which civic organization has historically been suppressed (cf. Fox 1996). Here it seems we know far less. Yet the question of how to build social capital is a critical one if we are to respond to recent implicit and explicit calls to construct development geographies (see Peet and Watts 1996) and sociologies (Booth 1994) that better link theory and practice to the goal of strengthening the capacity of civil society to forge alternative forms [end p. 1] and outcomes of development. This is the concern of our paper.

While social capital is not the same as social organization, civic organizations seem to be an important manifestation of social capital (World Bank 1996; Putnam 1993). Certainly in Latin America, strong social organizations have helped to keep both state and market more responsive and even inclusive (Bebbington 1997; Lehmann 1990). In understanding how it may be possible to foster this organized form of social capital in contemporary development strategies, it is necessary to consider the historical role of development interventions and outside actors and to ask 'in what ways have past actions and interventions within a given region or social group influenced contemporary forms of organization?' What mixes of interventions have been most successful in building social capital. To what extent may these interventions be reproduced in other contexts so as to foster the development of social capital?

In this paper, we address these questions through an analysis of the organizational history of indigenous water-users associations in the northern highlands of Ecuador. Earlier authors have examined irrigation systems in the Ecuadorian highlands in both pre-Hispanic (Knapp 1991; 1987) and contemporary contexts (Mothes 1987; Cornick 1983). However, while these studies provide excellent analyses of the physical and social structures involved in Andean irrigation, they do not address social capital formation as such. The present study involves an assessment of the extent to which the interventions of two non-governmental organizations (NGOs), the Centro Andino de Acción Popular (CAAP) and subsequently the Instituto de Ecología y Desarrollo de las Comunidades Andinas (IEDECA), helped to build social capital in the form of the Junta de Agua de Porotog, a membership organization of eleven indigenous communities concerned with the management of irrigation water.

The political-economic history of the region, as well as the history of development intervention, provides us with an opportunity to evaluate the interaction of external actors, state agrarian policies, and internal organizational processes in the formation of social capital. By providing a 'thick description' of this historical context, along with an analysis of the organizational capacity and performance of the *juntas de aguas*, the paper sheds light on ways in which social capital formation can be promoted by external actors. It also illuminates the potential political and economic vulnerability of indigenous organizations, illustrating that social capital formation must be viewed as development strategy within a broader political and economic context (Fox 1996).

The paper opens with a theoretical discussion of social capital and its connections to the study of indigenous irrigation organizations. We then introduce the study area and the organizations under consideration, and discuss the social history of the Cayambe region. Following that, we analyze the formation and functioning of social capital in the study case. The paper closes with conclusions regarding the link between social capital formation and local development in Cayambe and about the conditions under which social capital is most likely to be created, and most likely to have a significantly positive impact on rural livelihoods and natural resources.

## Social Capital and Irrigation

### *Social capital and social relations*

While the conceptual roots of social capital can be found in the classical works of Durkheim, Marx and Weber, its rebirth in the writings of more recent social theorists may be seen as part of a broader reinvigoration of the discourse of civil society (Cohen and Arato 1992). James Coleman (1990, 300-21; 1988) provided the first detailed, theoretical elaboration of the term. He defines social capital as the functional value of social relationships: the ways in which bonds of trust and accepted allocations of rights and responsibilities establish norms of behavior and values. This is most evident within the formal organizations (e.g. marketing cooperatives, choral societies, labor unions) and informal networks (e.g. neighborhood groups, community crèches, friendship networks) of civil society. Of central functional importance here are reciprocity and obligation, as well as the collectively understood threat of effective social sanctions if trust or obligations are betrayed.

Of particular relevance to development theory is Coleman's understanding of social capital in terms of stocks of resources: "... social organization constitutes social capital, facilitating the achievement of goals that could not be achieved in its absence, or could be achieved only at a higher cost" (Coleman 1990, 304). Thus, as with natural, human-made, or human capital, social capital can be built and stored, and drawn upon for productive ends (Bebbington et al. 1997; World Bank 1996; Serageldin and Steer 1994; Coleman 1988). Unlike human-made capital (but importantly, like human capital), social capital increases with use, [end p. 2] and decreases with disuse (Coleman 1988). Social ties are strengthened through increased interaction, provided that trust, reciprocity, and mutual obligation remain constant. The benefits of social capital spread widely throughout society. Strong bonds of trust and reciprocity may translate into safer communities or to better functioning markets. These benefits may accrue to individuals who do not participate in collective functions or who participate only indirectly. Putnam (1993) drew on Coleman's definition of social capital in his detailed study contrasting civic traditions in northern and southern Italy. While Putnam's discussion has been criticized for its romanticized and undifferentiated treatment of civic organizations (Goldberg 1996; Sabetti 1996; Myers 1995), it still remains the most influential discussion of the practical meaning of social capital--how it develops, the various forms it takes, and its implications for economic and political performance.

It is essential to recognize that social capital in and of itself is not an unmitigated good, nor is its development necessarily unidirectional. The clientelistic ties that mark political relations in southern Italy, as well as the reciprocity and obligations which characterize crime networks, are as much forms of social capital as are inclusive civic associations. Additionally, Fox (1996, 1092) emphasizes that different forms of social capital can be simultaneously created and destroyed:

Regional collective action may be necessary to offset the power of authoritarian elites, but these are precisely the kind of movements most likely to be targeted for repression. ... [H]istorical legacies of horizontal organization are necessary but not sufficient to accumulate social capital. The scale of horizontal organization matters as well, and this is in turn conditioned largely by the political opportunity structure (which determines the availability of external allies to provide support and to offset the threat of repression) .

The crucial lesson seems to be, then, that historical, social, economic, and political variables and questions of scale need to be considered in any analysis.

In terms of the geography of development, however, these analyses raise many questions. How may social capital be strengthened in positive ways over a shortened time horizon? What is the linkage between social capital, local-level organizations, and political-economic outcomes? And of particular relevance to development among indigenous groups in Latin America, what is the relationship between social capital and cultural identity?

The latter question has been addressed by Fernández Kelly (1994), who links social capital to the creation of shared meaning and expression which contribute to the construction of identity. She argues that the production and usage of social and cultural capital are contingent upon parameters of space and place:

Because people derive their knowledge from the locations where they live, they also expect that which is probable in their nearby environment, and they recognize as reality that which is defined as such by members of their social network occupying proximate spheres of intimacy. For that reason, social and cultural capital are .... dependent on physical and social location (Fernández Kelly 1994, 89).

Although Fernández Kelly is discussing social capital formation in an urban ghetto in the United States, her argument is no less salient in the context of indigenous agricultural organizations in Latin America. In this view, social networks must not be viewed apart from their physical locations, nor from the spatial parameters which constrain and contextualize them. Social capital, as a function of social relations, is necessarily embedded within a spatial and locational context. Consequently, while it is important to seek certain generalizations about the formation of social capital across spatial and social contexts, the importance of locality must also be recognized. In this regard, then, Fernández Kelly's argument carries important warnings for the conceptual use (and abuse) of social capital in development practice.

### ***Social capital in irrigation and water-users' associations***

Several aspects of irrigation make it appropriate for case studies in social capital formation and institutional capacity. First, irrigation projects and management organizations are spatially, socially, and functionally bounded, and are thus relatively easy to evaluate (Tang 1992, 28). Unlike many other development initiatives, which may be spatially diffuse and therefore logistically difficult to analyze, irrigation projects occur in a finite and clearly demarcated area. Although certain irrigation systems may be quite expansive, the various components of the irrigation network (canal inlets and channels, reservoirs, irrigated fields) are distinct, making analysis relatively straightforward. Irrigation systems are also socially bounded in that they involve a finite [end p. 3] number of recipients, with membership generally restricted by location, ability to pay, or other clear criteria. Additionally, management roles of water users' associations (in the present case study, the *junta de aguas*) are clearly defined. Irrigation projects (and organizations) are functionally bounded in that they tend to focus their efforts exclusively on the provision and management of irrigation water and directly related issues. Other functions, such as the provision of seeds and fertilizers or the marketing of crops, are generally left to other organizations.

The second aspect of irrigation projects which makes them appropriate for case studies of this sort is the fact that they entail a heterogeneous mix of inputs. Irrigation projects involve a mix of *human-made capital* such as the construction of canals, reservoirs, and valves; *human capital* in the form of training for water management, financial accounting, and leadership ability; and *social capital* in the form of community organization for maintenance of physical infrastructure and coordinated distribution of water. This in turn occurs in particular conditions of *natural capital*: the inherent qualities of the local environment that structure productive and other options. The mix of both human-made capital ('hardware' inputs) and human and social capital ('software' inputs) inherent to irrigation provides an opportunity to view the mixing of various types of capital under different management regimes (see also Lam 1996; Subramanian et al. 1995; and Tang 1992).

Thirdly, while irrigation development and management may take a variety of forms, and may therefore be difficult to evaluate, the success or failure of irrigation projects is relatively easy to assess. This makes it easier to ask questions about the impact of social capital on livelihoods. Simple criteria may be followed to judge the effectiveness of an irrigation project: are farmers receiving sufficient water? Is water equitably allocated? Is physical infrastructure adequately maintained? Numerous factors contribute to the success or failure of a given irrigation project, and certainly these need to be taken into account. Moreover, many forms of success are not easily quantifiable. Among these may be the strengthening of social networks or the sense of empowerment gained from successful organization. Even when projects may 'fail', there may be residual positive effects in the form of increased human or social capital (Hirschman 1988). Nonetheless, unlike many other development initiatives, the outcomes of irrigation projects are generally tangible and clear.

Of particular importance for this paper is also the emerging emphasis on social, as opposed to technical, aspects of water management and service delivery (Lam 1996; Ostrom 1992; Tang 1992; Uphoff 1986a, b). This shift has come as development workers, investigators and international lending institutions alike have recognized the inefficiency or outright failure of many irrigation projects in which greater emphasis is placed on building dams and canals rather than on "crafting institutions" (Ostrom 1992). Furthermore, as Meinzen-Dick et al. (1995) have asserted, water users' organizations may "facilitate the attainment of social goals such as democratization and the empowerment of women," and may "increase an area's 'organizational density.'" This may in turn lead to the emergence of other forms of social organization, and with them the strengthening of trust and cooperation. Thus, water users' organizations can contribute strongly to the what Fox

(1996) calls the 'thickening' of civil society.

### ***Assessing social capital in irrigation organizations***

In rural Latin America, formal civic organizations and the informal social networks linking these organizations with the state and the market constitute important dimensions of social capital (Bebbington, 1997; forthcoming). Insofar as they constitute social relations built on trust, reciprocity, obligation, and mutual values, these organizations and networks are examples of productive (i.e. 'positive') social capital. Thus to assess how such organizations and networks have been built for the specific case of irrigation is also to assess how social capital has been strengthened in a particular context. By what criteria might this strengthening be assessed?

As a first step in identifying these criteria, we might distinguish between internal and external aspects of organizational capacity as follows:

1. The *internal aspects* of institutional capacity are the structural and social conditions internal to the operation of the institution: for example, the level of democratization and participation among members of the group; the ability to effectively manage resources, including financial resources; the transparency of resource management and decision making; and the accountability of the group's leadership to the group's members. Of similar importance is the ability of the organization to deliver services to its target beneficiaries in an efficient and cost effective manner.
2. The *external aspects* of institutional capacity are the relations which the group [end p. 4] forms with actors external to the group: for example, with private funding agencies, state agencies, indigenous federations, or local-level community groups. Important in this regard is 'voice' (Hirschman 1970): the ability of the organization to make effective demands on other actors and institutions.

As a second step, we can identify more specific indicators of internal and external capacity. Uphoff (1986a, 10) identifies four basic organizational functions that offer a framework for such indicators: (1) decision making and planning; (2) resource mobilization and management; (3) communication and coordination; and (4) conflict resolution. These functions necessarily overlap, and in many ways reinforce one another. Nonetheless, for each function, we can develop indicators to assess capacity. Thus, ***decision making and planning*** involves the ability of irrigation organizations to strategize and plan for the future. This in turn involves the ability to perceive and analyze challenges, to confront them in an organized, systematic way, and to plan for the resource use needs of communities, including financial planning.

***Resource mobilization and management*** includes the ability of the irrigation organizations to acquire necessary resources—sufficient water to supply the communities; materials for construction of canals and reservoirs; technical advice to construct and manage these 'hardware' inputs; and the financial resources (externally and through member contributions) necessary to support their work. This also includes service delivery (the distribution of water to communities and families in an equitable and sustainable manner); financial management; and the efficient and equitable management of labor. Communication and coordination includes the less tangible aspects of water management: accountability to community members and the fostering of democratic participation. Additionally, this includes the ability of the irrigation association to organize community members for communal work, to communicate effectively with community-level organizations, and to forge ties and alliances with outside organizations such as indigenous federations, municipalities, NGOs etc.

Finally, ***conflict resolution*** involves the ability of the organization effectively and consistently to resolve conflicts between communities and families regarding use of irrigation water. This requires the imposition of sanctions and the enforcement of agreed-upon norms. This factor also involves the ability of the irrigation association to resolve conflicts between its members and outside actors—as in cases where these outside actors may attempt to take water from the irrigation system.

These indicators thus give us a framework for assessing how far the organization has been able to perform the general functions identified by Uphoff (1986a). On the basis of this assessment we can then say something about how far social capital has been built. Using this framework, we now move to the case study in Northern Ecuador, analyzing the processes through which irrigation organizations have emerged, and the extent to which they have developed internal and external capacities in these four basic functions.

## **THE HISTORY AND PROCESS OF SOCIAL CAPITAL FORMATION IN CAYAMBE**

### ***Study Area and Historical Context***

Our study focuses on the organizational history and capacity of the Junta de Agua de Porotog, an indigenous irrigation federation located to the south of the city of Cayambe in the northern Ecuadorian Sierra. Of central importance to the study is the relationship between the junta de agua and the NGO, IEDECA, which supports indigenous irrigation associations in the area. The Junta de Agua de Porotog is a representative body elected by the eleven indigenous communities (and one private property owner) which receive irrigation water from the Porotog canal, one of eight canals in the Zona Cangahua-Ascázubi supported by IEDECA (Figure 1). The junta de agua oversees the distribution and management of irrigation water, and works with community organizations and farmers, IEDECA and, to a lesser extent, the state irrigation agency, the Consejo Nacional de Recursos Hídricos (formerly the Instituto Nacional Ecuatoriano de Recursos Hídricos, INERHI) (Cisneros 1996).

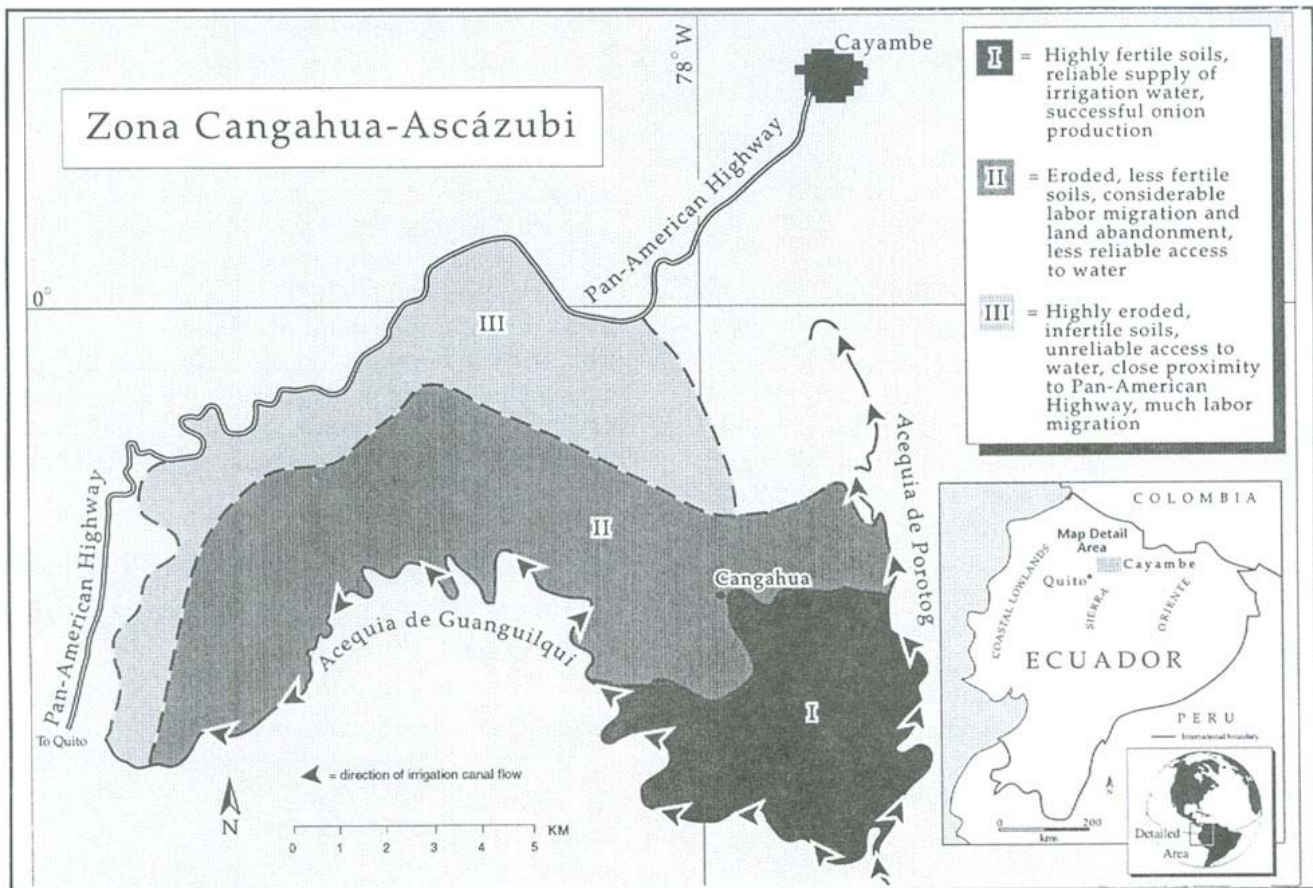


Figure 1. Case study Location

The Zona Cangahua-Ascázubi is mountainous, ranging in elevation from 2,846 m.a.s.l. in the town of Cayambe up to 3,600 m.a.s.l. in the communities of Larcochaca. This factor influences agro-ecological constraints and access to water. In this area, the eight canal systems service a total of 53 communities, 11 haciendas, and two other property owners. Of the eight canal systems, by far the two largest are the Guanguilqui system, at 43 km long and serving 30 distinct communities and 6 haciendas, and the Porotog system, at 20 km, which serves 11 communities [end p. 5] and another, separate, property owner (Cisneros 1996,52). The history of these canals is inextricably linked, though they are now managed as distinct entities.

Communities higher in elevation, and therefore closer to the sources of water (i.e. 'headenders' --Uphoff 1986b, 38), have always had better access to water, and therefore greater success in agricultural production than communities lower down on the canal (i.e. 'tailenders'). Today, the communities served by the Porotog canal, all relatively high in elevation, depend largely on onion production to generate cash. This strategy has been highly successful, and the area has become a major onion-producing region for the domestic market. However, onion production requires large amounts of water, a fact which increases the communities' dependence on a generous and reliable supply of water.

Following a number of site visits and interviews between 1994 and 1997, in-depth field work was conducted during February and March, 1997. Semi-structured individual and group interviews were conducted with IEDECA personnel, as well as with members of the Junta de Agua de Porotog and representatives of other organizations active in the area. Participant observation, including attendance of community meetings, was carried out in several communities which receive water from the Porotog canal. Additionally, we analyzed numerous documents that were gathered with the assistance of IEDECA personnel.

#### **Organizational History**

To understand better the formation and function of social capital in these organizations, it is important to consider the process of organization among indigenous communities in the region—a history intimately linked to the hacienda system and Ecuador's agrarian reform—as well as the history of development intervention by external actors. Here we provide a historical account of the process of organization among communities of the Guanguilqui and Porotog canal systems. The account is divided into three historical phases which constitute important moments in the formation of social capital in the area (Figure 2). These phases also correspond to [end p. 6] three types of social action and three different sets of institutional relationships in the region.

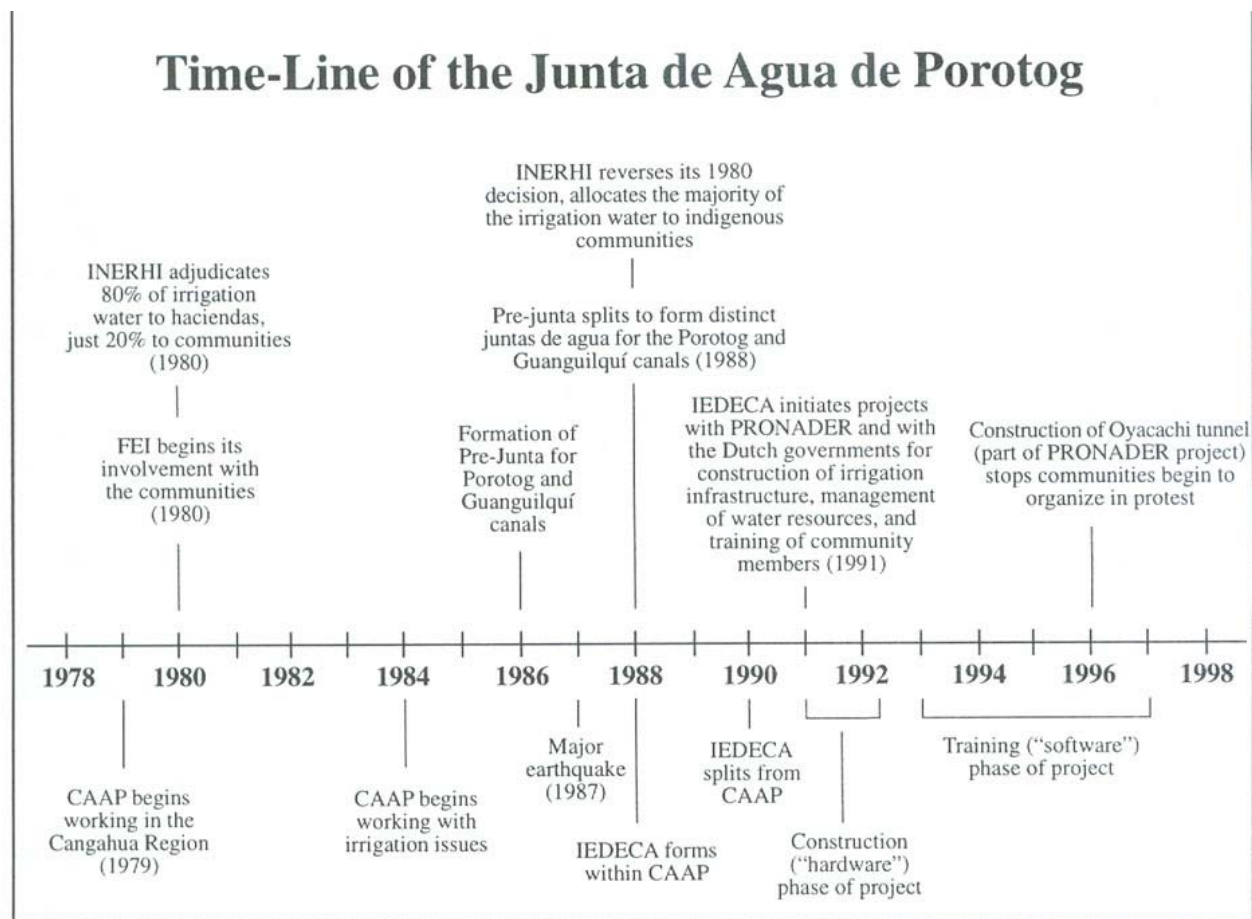


Figure 2. Time-Line of Social Capital Formation in Cayambe-Cangahua.

### Early Organizational Processes: Land Conflict and Social Capital Formation

Beginning in the 1930s, the Cayambe area was a center of organization among socialists and indigenists. This process of mobilization included alliances between landless mestizos and indigenous peoples (Ramón 1997, 1987). Thus, calls for agrarian reform began early here and had an especially radical tone. During this time, there were two distinct types of indigenous communities. *Huasipungo* communities were tied to haciendas, and thus had no land rights or autonomous organizational structure. So called "free communities" existed outside the hacienda system and had their own land claims and leadership structures. The tradition of *minga*, or communal labor, existed within the free communities for their own benefit. On the other hand, among the *huasipungo* communities, *minga* was organized solely by the hacendado, and solely for the benefit of the hacienda—no independent tradition of communal labor organization was permitted.

Following the 1964 and 1973 agrarian reforms, some hacendados sold lands directly to indigenous communities as a way to avoid what was perceived to be the inevitable divestiture of lands by the state. In the majority of cases, however, IERAC (the now defunct Instituto Ecuatoriano de Reforma Agraria y Colonización—the state agency for organizing the disposal of lands under the agrarian reform) was involved in such transactions. This occurred by one of two methods: either the hacienda lands would be sold to IERAC, which would then re-sell them to indigenous families, or hacendados would sell land more directly to indigenous families, in a transaction facilitated by IERAC (acting in this instance as a [end p. 7] broker). Most commonly, community representatives would negotiate with IERAC for lands, but this process was aided by labor unions or indigenous federations which negotiated on behalf of the communities.

One such union was the Federación Ecuatoriana de Indios (FEI), which began its involvement with the communities of the Guanguilquí and Porotog canals during the period 1980-81. Considered by many in the communities to be a 'radical' organization, FEI was known for its confrontational style and indigenist politics. Essentially, FEI and its followers favored land occupations and direct conflict with hacendados. This situation led to inter-communal conflicts, as well as open confrontation between indigenous communities and haciendas. Even if they were sympathetic to its radical politics, many community members opposed the confrontational tactics of FEI, which they saw as counter-productive to the objective of obtaining land, and felt that they stood a better chance of obtaining land through negotiation and purchase. To some degree this split is rooted in the particular history of relations between indigenous communities and haciendas.

Whereas some communities were grossly abused by the hacienda system, others, while clearly exploited and oppressed, were relatively favored by location and economic circumstances. Additionally, the ideological predilections and personal experiences of community leaders influenced the alignment of different communities. Furthermore, serious splits grew between communities which received land from the agrarian reform, and those which did not. Whatever the origin, serious conflicts emerged between various communities, the ramifications of which continue to persist.

Following the period of alignment with FEI, many communities changed their affiliations to the Federación Nacional de Organizaciones Campesinas (FENOC), which provided the communities with a lawyer and assisted in negotiating with the hacienda owners. With the assistance of FENOC, the communities began to purchase land according to the *Ley de Tierras* (the 'Land Law', which provided for the sale of unused hacienda lands to former *huasipungos* at subsidized rates). Cultivable lands were distributed to families, whereas *páramo* lands (which are used for pasturing cattle and sheep) are held communally. Additionally, irrigation

water is a common property resource, as it is delivered to communities (*not* individual families), and is then distributed equitably among community households.

However, although the indigenous communities had gained access to land, their access to water resources remained inadequate. The great majority of the water in the old canals (originally built to serve the haciendas) was still adjudicated to the hacienda lands. This situation was reconfirmed in a 1980 decision by INERHI which assigned 80 percent of the water to just six haciendas, with the remaining 20 percent to be divided among 16 indigenous communities (Cisneros 1996). Since the 1970s, with the consolidation of communities and the acquisition of lands following agrarian reform, considerable water theft had occurred, in which water from the main canals was illegally diverted onto fields in indigenous communities. However, the provision of water by this method was always tenuous, and could not be relied upon to deliver an adequate supply. Furthermore, the communities lacked not only the legal right to increase their water supply, but also the capital and organizational capacity to construct additional infrastructure.

The importance of obtaining a reliable source of water, and the vulnerability of the communities in its absence, was further highlighted by a major drought in 1985. At this time, the communities began the fight for the legal right to water.

### ***The Fight for Water: The Emergence of Irrigation Organization***

In 1984, the Centro Andino de Acción Popular (CAAP), an Ecuadorian NGO working in the area, began to study associated legal issues as well as the actual needs and uses of water among the indigenous communities. CAAP personnel became interested in redeveloping the old canals for use by the communities, and they proposed an alliance between the communities and the remaining haciendas which they argued, would strengthen the ability of the communities to obtain and manage water resources. Two years later, CAAP conducted a census of population, agricultural production, and the uses of land and water, which demonstrated definitively the discrepancy between the communities' need for water and their legal access to it. According to this census, the haciendas actually needed just 12 percent of the water from the principle canals. In 1986, with the assistance of CAAP, a 'pre-junta' was formed among the communities served by the Guanguilquí and Porotog canals. At this time, the two canals were treated as a single system, and the pre-junta represented communities from both. The pre-junta was the forerunner to the formation of legal *juntas de agua* and it represented the first formal organization [end p. 8] among the communities dedicated to the acquisition and management of water.

The 'pre-junta' served principally as an organizational structure to pressure INERHI for access to water for irrigation and to explore both legal and logistical ways to get water to the communities. Additionally, the pre-junta had the responsibility to repair the canals, which had been damaged by years of neglect, animal grazing, and vandalism, and to establish a system of fines and sanctions in order to prevent further damage to the canals. While the Porotog canal was in reasonably good condition, the much longer Guanguilquí canal needed major reconstruction. This, then, represented a major organizational step for the communities. The functions of the pre-junta, charged with advocating for the legal right to water, finding ways to enhance irrigation infrastructure, reconstructing the damaged canal infrastructure, regulating canal use, and imposing effective sanctions in cases of water theft, presaged the functions of the legal *juntas de agua* that would emerge from this process. Furthermore, already present in the responsibilities of the pre-junta are the basic functions of organizations as discussed by Uphoff (1986a): decision making and planning; resource mobilization and management; communication and coordination; and conflict resolution (these are discussed in more detail below). In carrying out these responsibilities, the pre-junta had the authority (and the ability) to organize *mingas* and to impose effective sanctions. It had effectively established its authority within the communities.

A major earthquake in March 1987 severely damaged many canals, proving a considerable setback to construction. However, the earthquake served to focus the attention of international aid agencies on much needed reconstruction, as well as to sharpen CAAP's commitment to improving irrigation infrastructure in the region. One outcome of the earthquake which proved to be of major importance to the development of irrigation in the communities was the emergence of a split within CAAP regarding its role in the area. CAAP had always been primarily a research-oriented organization, with only limited involvement in pro-active development work. Following the 1987 earthquake, a number of CAAP personnel favored a more active role for the organization in development and public service functions. Partly as a result of this debate, in 1988 a group of volunteers working within CAAP, all of whom were from the Cayambe area, formed the Instituto de Ecología y Desarrollo de las Comunidades Andinas (IEDECA) as a water service organization. The mission of IEDECA from the outset has been to focus specifically on the development of irrigation systems and the provision of water to indigenous communities in the area.

That same year, in a decision known among the indigenous communities simply as '*La Sentencia*', INERHI granted to the communities the legal right to the majority of the water from the canals. With this legal right assured, the pre-junta transformed into two distinct *juntas de agua* with separate administrative jurisdictions: one for the Guanguilquí canal and one for the Porotog canal. This split was made according to the Ecuadorian Ley de Aguas, which stipulates that each main canal must have its own water users' association. With the support of IEDECA, the two *juntas de agua* began to systematize the regulation and use of water, as well as the rights and responsibilities of the water users.

### ***IEDECA and the Contemporary Processes of Social Capital Formation***

IEDECA separated from CAAP in 1990 and began its own work with the communities. In 1991-92, IEDECA received two major contracts to develop irrigation systems in the communities of the Cangahua-Azcáubi region. The first of these contracts was with PRONADER, the World Bank-funded national rural development program. This project is now on hold, as the World Bank cut funds following accusations of government mismanagement. One consequence of this is that a trans-basin water diversion tunnel (the *travase Oyacachi*), which was to deliver water to the Porotog and Guanguilquí canals, has remained unfinished, with both the World Bank and the state refusing to finance the completion of the project.

IEDECA's second contract has met with much more success and is currently in its final phases. The Dutch government has provided money to fund the construction of irrigation infrastructure, training to the *juntas de aguas*, and support for agricultural production. The two principle phases of the project, the provision of material infrastructure and the education and training of community members, form the crux of IEDECA's development ideology: the fundamental integration of the material (e.g. management of natural resources, canals, reservoirs) with the social (e.g. organizing farmers, capacity building, consciousness raising). The synergy of these two aspects is emphasized by IEDECA personnel, who argue that many attempts to develop irrigation infrastructure focus too narrowly on engineering and physical infrastructure, while ignoring less tangible [end p. 9] elements such as human capital and organizational capacity. Such projects do little to promote sustainable development of natural resources, and in some cases actually create divisions and community conflicts. Such was the case with a PRONADER effort at constructing a sprinkler irrigation system in one of the communities. In this instance, construction was done on technical grounds alone. State engineers built infrastructure (and thus provided water) only where hill slopes would ensure an optimal distribution of water. This approach left half of the community's landholders with no access to irrigation, creating obvious conflict. IEDECA eventually corrected this problem, constructing canals to supply water to those community members with less than ideal holdings.

To distribute water IEDECA works directly with the base organizations of each community, as well as with the *juntas de aguas*. Water is distributed according to payment of dues (*cuotas*) and participation in *mingas* organized by the *junta de aguas*. The allocated amount of water is delivered to the community as a whole, and then distributed by the community base organization to each family on an equitable basis. This system of water allocation was developed cooperatively by IEDECA and the base community organizations.

# EVALUATING SOCIAL CAPITAL FORMATION

## *Scoring social capital formation*

To evaluate the extent to which social capital has developed during these processes of intervention, we examined the institutional capacity of the Junta de Agua de Porotog and its relations both with the eleven communities that it represents and with IEDECA. We applied the analytical framework discussed above and the associated set of indicators for each of the organizational functions.

### *1. Decision Making and Planning:*

As we have seen from the history of the organizational process presented here, the Juntas de Agua of both the Porotog and Guanguilqui canal systems have throughout their existence responded to challenges strategically. In fact, their very existence may be seen as a strategic response on the part of the indigenous communities of the region to a shortage of water for agricultural production and to the structural inequities inherent in the dominant agrarian structure. The ongoing ability to plan and act strategically is evident in the way the two juntas de agua are working together to address two major threats to their water sources. The first of these threats is the work stoppage on the Oyacachi tunnel, which, if completed, would bring an additional 250 liters per second to the two canals. The second threat is the construction of a canal inlet (*bocatoma*) by the Quito water company (Empresa de Agua Potable de Quito, EMAPQ) in the páramo above an existing canal inlet used by both the Guanguilqui and Porotog canals. In response to these threats, the juntas de agua for both the Guanguilqui and Porotog systems have organized roadblocks to prevent EMAPQ from accessing its work site and to prevent the construction company that was working on the tunnel from removing its equipment. Further, they are pursuing legal action on both fronts on the ground that their legal rights to water are not being met. In March 1997, the juntas de agua also organized a 'field trip' of community members to the sites of the tunnel and a proposed bocatoma above that of EMAPQ to allow residents to see for themselves the threats to their water supply, as well as to educate them further regarding their rights. Both the tunnel and the proposed bocatoma are high in the páramo above the communities (roughly 3,900 meters) and are accessed by rough dirt roads, which in places are barely passable. The juntas succeeded in transporting between 50 and 60 community members to the sites in trucks and buses in an event reminiscent in mood and purpose of a *minga*.

### *2. Resource Mobilization and Management:*

The juntas de agua have been quite successful in acquiring and managing resources. *Bocatomas*, canals, valves, and reservoirs are well-constructed and maintained. A dependable water supply is delivered successfully to each community, to be divided by community members among constituent households. Dues are regularly collected and trained treasurers (elected on a yearly basis) manage the finances. Books are open to community members (though rarely are they inspected) and financial accounting is transparent.

Two qualifications are necessary here, however. First, it is important to note that the Porotog system has been considerably more successful than the Guanguilqui system. While there are various possible causes for this discrepancy, the principal explanation is one of greater complexity in the case of Guanguilqui. The Porotog system involves only eleven communities plus one additional small property owner). Moreover, all of the communities are ethnically indigenous and relatively confined spatially. All of the communities are engaged in onion [end p. 10] production (albeit to varying degrees) as their principal market crop and as head-end communities (relative to the Guanguilqui communities), they have more reliable access to water. On the other hand, the Guanguilqui system involves thirty communities and six haciendas, and a far greater mix of indigenous and mestizo users. The communities are much more spread out and cover a wider elevational range than the communities of the Porotog system. As a result, many of the lower and therefore more tail-end communities have unreliable water supplies. Furthermore, the communities on the Guanguilqui canal have poorer, more sloping and more eroded soils. In addition, the communities of the Guanguilqui system, particularly those lower in elevation (and therefore with the least reliable water supply), are relatively close to the Pan-American Highway that leads into the city of Cayambe. As a consequence of poor water supply and proximity to larger labor markets, these communities experience relatively high labor migration on a daily and seasonal basis.

The second qualification is that the juntas de agua have no funding or formal institutional relations other than those with IEDECA. Thus, the juntas de agua are entirely reliant upon IEDECA's ability to obtain funds and allocate resources. In constructing irrigation infrastructure, IEDECA has supplied the materials (cement, lumber) as well as the engineering expertise, while the communities have provided the manual labor (in the form of *mingas*, organized by the juntas de aguas). Additionally, IEDECA has provided all training for junta de agua personnel. This arrangement has worked quite well, but raises questions of institutional sustainability. Were IEDECA to lose its funding, the ability of the juntas de agua to obtain construction materials, training, or advice is uncertain. While it is likely that the Junta de Agua de Porotog would meet with more success than that of the Guanguilqui system, for reasons specified above, the resiliency of the irrigation systems remains in question until there are additional institutional linkages and a shift in the municipal government in Cayambe, which at present appears unable or unwilling to assist the communities.

### *3. Communication and Coordination:*

As has been seen, the juntas de agua have met with considerable success in internal coordination. They have organized communal labor, asserted their rights to water and encouraged democratic participation (junta de agua officials are elected yearly and are held accountable to community assemblies, which are similarly elected). *Mingas* are organized yearly to clean and repair canals. Communities are obliged to send one person for each family in the community, and are assigned a given length of canal to clean according to the amount of water the community receives. In this organizational capacity, the juntas de agua have been consistently successful.

However, as has been mentioned, the juntas de agua have been less successful in forging alliances with external organizations apart from IEDECA. While most of the community base organizations have formal relations with indigenous federations (for instance, the Unión de Comunidades Indígenas de Cangahua, UCIC, or the Unión de Organizaciones Campesinas de Cayambe, UNOCC), the juntas de agua have no formal affiliation with indigenous federations.

### *4. Conflict Resolution:*

Again, we have seen that the juntas de agua have been quite successful in developing systems for conflict resolution. The juntas de agua have the recognized authority to impose effective sanctions on communities in cases of water theft, damage to canals, or non-payment of dues. Additionally, the juntas de agua serve as a sort of 'court of appeals' to settle disputes between communities (disputes between individuals or families are brought to community base organizations). One community within the Porotog system is currently enduring a particularly extreme sanction—a year without irrigation water—as collective punishment for severe transgressions. The successful imposition of this sanction demonstrates the recognized legitimacy of the junta de agua as an authoritative body. It also clearly demonstrates its ability to enforce even long-standing and highly unpopular sanctions.

Capacity for conflict resolution is similarly evident in the ability of the juntas de agua to organize community members in defense of their water rights against the uncompleted Oyacachi water diversion tunnel and the water claims of EMAPQ. Conflicts remain between communities, and are likely to continue. It is unreasonable, however, to expect the juntas de agua to resolve all of these problems. What is important is that the juntas de agua have a structure of sanctions in place to enforce agreed-upon rules of water delivery and that they possess the recognized legitimacy and autonomy from special interests that is needed to carry out and enforce decisions.

Beyond these indicators of process, it is important to note indicators of the impact of this social capital formation. Investments in infrastructure (e.g. canals), human capital (e.g. training) and financial capital (e.g. crop investments) in the area have led to notable intensification in the production of [end p. 11] marketable crops (in particular, onions) and have increased family income. However, this livelihood impact, and its relatively equal spread across the communities of the Porotog system, reflects the parallel investment in social capital in the form of the junta de aguas. The presence of the junta de agua has ensured relative fairness in water distribution and effectiveness in maintaining an irrigation system. It has increased the returns to these other forms of investment. Indeed, it has allowed a degree of cooperation that is particularly important in irrigation projects, in which the level of coordination and scale of labor is beyond the capacity of individual farmers (Ostrom 1992, 12; Uphoff 1986a, 7-8).

## CONCLUSIONS

### *The formation of social capital and its impacts in Cayambe*

The history of external development interventions in the Cayambe area has been extensive. Since the 1930s, the region has been a center of organizing by the Left, a process that continued through the period of agrarian reform and into the 1990s. It has also been a center for state (PRONADER) and NGO (CAAP and IEDECA) agrarian and rural development programs. These interventions have clearly influenced the process of social mobilization and organizing within the region's indigenous communities. Similarly, such external influence has contributed to the formation and strengthening of social capital in the Cangahua area.

Drawing on the definitions of social capital as presented by Coleman (1990) and Putnam (1993) discussed above, we can see that the process of acquiring lands (assisted by FEI and FENOC) and the formation of the juntas de aguas (assisted first by CAAP, and then by IEDECA), has increased relations of trust, interdependence, and obligation. Moreover, the formation of the juntas de agua has allowed the communities to achieve ends that would otherwise have been unlikely or impossible (cf. Bebbington et al. 1993). This response has been partly induced by Ecuadorian water law, which requires the existence of legally recognized water-users associations for the cooperative management of water. However, it also has been made possible by what Hirschman (1988) has called the 'conservation and mutation of social energy': the relations of trust, interdependence, and cooperation necessary for the achievement of communal goals. These relations were created during the struggles for land, and have subsequently found a new manifestation in the management of water.

As a further dimension of this 'mutation' of preexisting social energy, 'modern' organizational forms, such as irrigation associations, have been overlaid upon traditional social networks based on obligation and reciprocity (Ramón 1997, 1987). These networks or *redes*, of which the leaders of the juntas de agua in the Cangahua region are also the leaders, link both individuals and communities and may be more important than 'modern' organizations for coordinating cooperative ventures, organizing communal labor, and fostering ties of trust. This 'traditional' form of social capital also has been translated into considerable economic and political success in other cases in Northern Ecuador, as in Otavalo where indigenous communities have been extraordinarily successful at building textile production and marketing networks. Otavaleño marketing networks, based on personal- and family-based *redes* rather than formal, 'modern' organizations, span South and North America and Europe.

The case study also shows the importance of political economic processes in influencing the success and livelihood impacts of social capital formation. These processes can have a positive effect: the land struggles of prior decades created a base upon which contemporary social organization has been erected. But effects can also be negative. In recent years, for instance, the production of flowers for export has come to dominate the economies of northern Pichincha and southern Imbabura provinces (among other regions in Ecuador). The floral industry is both capital and labor intensive. It has attracted migrants from many indigenous communities in recent years, weakening communal networks. More seriously, there is a proposal currently in the Ecuadorian congress to privatize water rights (currently, Ecuadorian water law recognizes the inherent right of every citizen to water, regardless of ability to pay). With such privatization, which is supported by commercial agricultural interests, the floral industry could probably outbid indigenous communities for their water.

### *Limits on social capital*

The success of the Junta de Agua de Protog is, then, consistent with the argument that "islands of sustainability" in the Andes are more likely to be found among communities or organizations that have combined agricultural intensification, production for specific markets, the creation of networks of contacts and relationships at different geographical scales, and the organizational capacity to manage resources effectively in each stem of production and marketing [end p. 12] (Bebbington 1997). However, it is important to put boundaries around the argument for social capital, in part because the sustainability of what has been achieved in Porotog is far from assured, but also because Guanguilquí has not seen the same successes as Porotog. Indeed, contrasting the two cases can help us say something about the conditions under which social capital formation is more likely to occur and to have positive impacts (see Bebbington 1997).

First, the natural capital endowments of a region, in both an ecological and locational sense, influence the impact of social capital building interventions. Indeed, the success of the Porotog system has much to do with structures of space and place. Located at the head-end of the system, these communities have a more reliable water supply than do those in Guanguilquí, which, coupled with Porotog's better soils, has allowed for the successful production of onions as a major market crop. As a result, the region has emerged as the major center for onion production in the highlands, supplying a large domestic market. Furthermore, the distance of the Porotog communities from the Pan-American highway, and thus from larger labor markets, has discouraged labor migration and encouraged farmers to remain working the land. Therefore, Porotog communities display relative social and cultural cohesion. In the absence of such favorable geographical factors, it would have been more difficult to foster local organization and for this organization to have had an impact on livelihoods. Indeed, Guanguilquí's poorer soils and its proximity to the highway have led to higher rates of out-migration and weaker local organizations.

Secondly, the historical underpinnings of place are also critical in structuring possibilities. While social conflict and land reform led to property redistribution throughout the region, thus creating the possibility of more viable livelihoods, the pattern this took differed among the two locations. In Guanguilquí, the land around the canal is owned by both indigenous people and mestizos, thus complicating the possibility of strong group formation in the junta de aguas. Conversely, the social structure of Porotog is more ethnically and socioeconomically homogeneous, thus endorsing Evans' (1996) tentative conclusion that social capital formation is more likely in more egalitarian social structures.

Thirdly, as a result of the quite specific characteristics of irrigation, it is potentially easier to build social organizations around irrigation systems than around other natural resources and activities. The livelihood impact of irrigation is clearer than that of most other natural resource-based interventions, thus increasing the incentives to organize. The resource is also tightly spatially defined, facilitating monitoring and administration. And critically, irrigation water is exclusive: it is clear to all who is and who is not a beneficiary and therefore who should and should not pay and participate. This echoes other work on economic *campesino* organizations that similarly suggests the more exclusive the organization, the stronger it is likely to be (Bebbington 1996).

The implication, then, is that appropriate strategies for, and the possibilities of, fostering social capital formation will vary geographically (Fernández Kelly 1994). More specifically, they will probably vary among higher and lower potential environments, among areas with different social histories (e. g. as regards prior levels of social mobilization), and according to the natural resource or economic activity involved. Similarly, attempts to reproduce new organizational forms in the absence of appropriate prior forms of cultural capital (such as Andean *redes*) may lead to failure and frustration on the part of both community members and development organizations.

Finally, it is important to note two threats to the sustainability of the two juntas de aguas. One serious problem is the over-dependence of both the Porotog and Guanguilquí juntas on IEDECA for resources and for networks of relationships that go beyond Cayambe. Should IEDECA lose its funding, change its organizational priorities, or lower the quality of its services, there is no apparent substitute to take its place, and it is not clear that the juntas de agua are capable of functioning independently without external assistance (though the Junta de Agua de Porotog, with its greater social homogeneity and more productive agricultural base, would likely fair considerably better than the Junta de Agua de Guanguilquí). Thus, although the juntas de agua have been successful in facilitating agricultural intensification, locating markets, and managing resources, their sustainability as autonomous organizations remains in question.

Additionally, both juntas are threatened by potential changes in the wider political economic [end p. 13] environment. In this case, the threat is not one of reduced freedom to associate or of persecution of social organizations (Fox 1996), but rather one of a change in economic and water tenure policies. Privatization of Ecuador's water resources may lead to a decrease in the capacity of indigenous communities to access water and thus to produce market crops such as onions. This, in turn, may lead to increased labor migration, even among distant communities. The potential push-pull forces of inadequate water supply and attractive labor opportunities elsewhere may be the greatest threat to the long-term viability of even the most economically successful indigenous communities of the Cangahua region. If livelihood strategies such as onion production fail, the future of these communities, and with them their organizational structures and cultural traditions, would certainly be at risk.

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## RESUMEN

Los debates sobre el papel del capital social en el desarrollo tienen relevancia para los análisis de la relación sociedad-medio ambiente, porque demuestran cómo las diferentes formas de la organización social puedan mejorar el manejo de los recursos naturales en términos tanto de efectividad como de equidad y eficiencia. A través de un estudio de caso de las organizaciones de regadores en la sierra norte del Ecuador, este artículo analiza el impacto en la formación de capital social tanto de las intervenciones recientes de actores externos como de los procesos político-económicos de largo plazo. El estudio considera las implicancias que esto ha tenido para el manejo de los recursos naturales y las estrategias de vida en la región, y sugiere posibles indicadores para la evaluación de la formación del capital social. Finalmente, el estudio elabora unas conclusiones en cuanto a las condiciones que favorezcan tanto la formación de capital como su impacto positivo en las estrategias de vida. **[end p. 15]**