Property rights and sustainable irrigation: A developing country perspective

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A B S T R A C T

While the role of secure property rights contributing to sustainable natural resource management is increasingly recognized, translating that into practice is more challenging, especially in developing countries. This article presents a framework for understanding the role of property rights for effective irrigation systems and then explores the complexity of property rights to land, water, and infrastructure and their underlying institutions. Understanding property rights in practice requires acknowledging legal pluralism—the coexistence of many types and sources of law, which can be used as the basis for claiming rights over the resources. Property rights do not necessarily imply full ownership, but are composed of different bundles of rights that may be held by different claimants—the state, user groups, families, or individuals. These rights are critical for the authority, incentives, and resources for irrigation operation and maintenance. As resources become more scarce, property rights systems need to adapt to reduce conflict and provide incentives for saving water. However, efforts to improve irrigation by changing property rights systems have often failed because they have not recognized the difficulty of transplanting property rights systems from one place to another. Institutional change needs to be seen as an organic process, building on existing norms and practices, rather than as an exercise in social engineering.

1. Introduction

Experience with the past 30 years of irrigation has shown that technology alone is not sufficient to ensure productivity gains, let alone sustainability. In many cases, the technologies were not adopted or maintained, or the poor, women, and other marginalized groups were excluded from the benefits of technologies. Appropriate institutions are needed to accompany technologies for sustainable irrigation.

Among these key institutions, property rights play a particularly important role. When resources are abundant, there is little need to define property rights, but as the resource becomes more scarce, users of the resource compete and even come into conflict. In such contexts, there is pressure to define property rights over the resource, to clarify expectations, and assign both rights and duties (Otsuka and Place, 2001; Young, in press).

While the contribution of secure property rights to sustainable natural resource management is increasingly recognized in calls for policy reforms, translating that into practice is more challenging (Deininger, 2003). This applies to almost all natural resources, including land, forests, and fisheries, but even more so to water, which is a mobile and often fugitive resource, difficult to measure or control, with many different uses and values, both economic and noneconomic (Rogers et al., 1995). Efforts to “improve” irrigation by changing property rights systems have often failed because they have not recognized the difficulties involved in institutional change, especially of property rights.1

While water rights, and especially water rights reforms, are complex in any context, the challenges are particularly severe in developing countries.2 A major reason for this is the frequent lack of state capacity to carry out the reforms as envisaged (as described by Garduno, 2005 for Mexico or Schreiner, 2013 for South Africa). However, customary water rights are also likely to be particularly strong in developing countries, often varying from one context to another, and differing from state law (von Benda-Beckmann et al., 1998). Moreover, as North (1990) notes, institutional change is path dependent: it is inherently shaped by the history of a particular place. This means that transplanting property rights systems from

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1 For a review of some of these challenges in property rights change, see Libecap (1998).
one place to another will not yield the same results, as shown by Solanes (2013) in his analysis of efforts in the 1990s to pass a water law in Peru that was modeled after Chile’s legal framework of highly privatized water resources.

Thus while property rights can play a crucial role in sustainable irrigation in developing countries, any reforms to achieve this aim need to be based on a sound understanding of property rights to land, water, and infrastructure and their underlying institutions. Of these, land rights have been dealt with most extensively, both in scholarship and in policy (see, for example, Deininger, 2003 or FAO, 2012). The focus of this article is therefore on rights to water and secondarily irrigation infrastructure. However, rights to all three of these key resources are inextricably intertwined (see Hodgson, 2004).

This article presents a framework for understanding the role of property rights for effective irrigation systems and then explores the complexity of these property rights, with particular reference to conditions in developing countries. Applying the framework helps to identify the situations in which institutional issues of coordination and property rights are likely to be important for sustainable irrigation (and where, conversely, they are less likely to require much attention). Subsequent sections of the article discuss some of the institutional complexities, particularly of property rights, and their implications for programs seeking to improve the sustainability of irrigation systems.

2. Key institutions for sustainable irrigation

Institutions are the “rules of the game” that govern behavior in society (North, 1990:1). Fig. 1 illustrates the importance of two types of key institutions for irrigation and agricultural water management: those that provide coordination and property rights. The vertical axis illustrates the spatial scale of a technology, from an individual plot, through a whole farm, to one that covers several farms, a village, to a region. All approaches that are above the scale of the individual farm require some form of coordination—either by local organizations, the state, or the market. For example, a drip irrigation kit may be adopted by an individual small farmer, by his or her self. Even a well may serve just one farm, but where holdings are very small and tubewells have large capacity, farmers may join together to buy and operate a tubewell, or the state may install and operate it, or one farmer can install it and sell water to neighbors. As we move up the spatial scale, a small check dam may serve a group of farmers. A watershed management program may serve several communities. Canal irrigation systems and reservoirs can serve up to thousands of farmers, and even cross provincial lines. Finally, transboundary river basins cross national boundaries. In each case, some form of coordination is required to govern provision and expropriation: to ensure that the infrastructure is built and maintained, and to allocate and distribute the water among users of the same source, and settle disputes. The greater the spatial scale, the higher the level of coordination that is needed, as indicated by the corresponding arrow on the right side, to balance the spatial arrow on the left. That coordination may be provided by the state or by collective action (or, in some cases, even by the market).

Similarly, the lower horizontal axis indicates the permanence of a technology or approach, or the time frame between when an investment is made and its returns are realized. The longer the temporal scale, the greater the need for property rights to provide authorization and incentive to make the investment (Knex et al., 2002). Even a tenant or a wife without independent land rights can install a drip kit, but may not be allowed to install a treadle pump or tubewell, because she does not have the decision-making (management) rights over that land, and she may not have the incentive to install and maintain terracing or drainage systems for salinity control. The arrow on the upper horizontal axis indicates that secure property rights become more important as the time frame of irrigation practices increase. Even those with decision-making rights may not have the incentive to make long-term investments unless they have secure tenure, to know that they will benefit from the investment. Although security of tenure is often thought of in terms of rights to the land, people may not be willing to invest in irrigation systems if they do not also have secure rights to the water that will give them the returns. This has been the problem with many irrigation management transfer systems, where farmers were expected to bear the costs, without secure rights to the water from the systems.

While the exact location of any type of irrigation on Fig. 1 would depend on the size of the farms and the scale, as well as the cost/return ratio, of the particular technology, this framework provides a useful starting point to ask which institutions are likely to be critical. As water uses increase, even seemingly “independent” water users will be affected by, and have an impact on, other water uses and users. For example, Asquith (2006) describes how immigration and more intensive land use upstream had impacts downstream in the Los Negros Valley of Bolivia. This increasing interaction between uses within basins calls for better institutional arrangements to coordinate water uses (as described by Asquith, 2006). Property rights are important in this regard because they clarify who can use and manage the land, water, or infrastructure, and what responsibilities they have toward the resource and toward others. Coordination institutions help to set and enforce those rules about the allocation of water and responsibilities. These issues are most apparent in surface water flows and irrigation, but also applies to groundwater irrigation. The following sections provide more details on the institutions for coordination and property rights, with special attention to their implications for sustainable irrigation.

3. Coordination institutions

The example of the tubewell cited above illustrates that coordination functions can be provided by the state (a public tubewell that supplies many farms), collective action (farmer group) or markets (farmer selling, buying or trading water). How well each of those institutions functions will determine whether farmers receive adequate and timely water supplies. For example, in the 1970s and 1980s there were numerous state-run tubewells in India, Bangladesh, and Pakistan that should have allowed economies
of scale by using large-scale pumps to irrigate many surrounding farms. These large pumps offer greater potential technical efficiency over small-scale pumps. But these potential technical efficiency gains were often not realized because of poor operational performance of the government agencies running and maintaining the pumps. Instead of government-operated tubewells, a group of smallholder farmers may get together to make the investment in drilling the well, installing a pump, and operating it (collective action coordination), or an individual farmer may install and operate the well, and sell water to neighbors. Shah and Raju (1988) argue that groundwater markets are much more effective than state tubewells in serving farmers’ water needs in India. Meinenz-Dick (1996) compared the performance of shared tubewells and groundwater markets in Pakistan, finding that smallholder farmers were quite well served by groundwater markets, but when the water became very scarce, the well owners would deny water to water purchasers, who had little recourse against more powerful well owners.

Which institution is most appropriate depends on the particular conditions—e.g. scale, technical sophistication of the technology and the farmers, cultural factors (social capital, market orientation), and state capacity. In general, the advantages of the state are greatest at the largest scale, and collective action at more localized levels (although there are exceptions). Markets are highly variable in whether they provide effective coordination among smallholders, but seem to come in where machinery is involved, where it is relatively easy to measure whether deliveries and exclude those who do not pay (as from a tubewell or piped system), and where users have alternative solutions so that there is competition and they are not dependent on one provider.

If group-based (collective action) approaches are selected by programs for water management or technology dissemination, it is important to look beyond the formal rules and membership roles to see whether the group is actually acting collectively: too many water user organizations exist only “on paper” and do not actually work together. Moreover, it is important to consider who is included and excluded from active membership and decision-making. This means asking about women as well as men, land owners and tenants, farmers and other water users (e.g. fishers, livestock keepers, home gardeners, domestic users, other enterprises). There may be formal as well as informal barriers to participation, different motivations and returns to be considered. There are indications that organizations with active participation of men and women may be more effective than single-sex organizations in managing resources like water because they draw upon the skills and resources of both, but establishing active mixed organizations is also more difficult than for single-sex organizations, especially where there is high gender segregation in the society (Pandolfelli et al., 2008). All of these factors should be considered in relation to the objectives of the program when identifying the appropriate strategy for establishing or working with groups for irrigation. Unless there is a strong basis of collective action, group-based approaches may require significant investment of time and facilitation to build up the necessary social capital to be effective.

Unless the groups are relatively homogeneous with active participation of men and women, further investment may be required to get diverse groups to work together. Where poor literacy and numeracy exist, adult education programs may be needed to support group functioning as well as increase overall human capital for poverty reduction.

Many irrigation management transfer programs that have sought to use farmer organizations for water management (Garces-Restrepo et al., 2007). One clear lesson from this and other irrigation management reforms is that there are no universal formulas or blueprint approaches; rather there is a need for adaptation to local conditions, and as they change over time (Merrey et al., 2007). The triangles on the right-hand side of Fig. 1 are not only an indicator of the broad comparative advantages of state and collective action institutions at each level, but also as a reminder of the overlap of both types of institutions, and the need for them to work together, as in co-management approaches. Instead of the state crowding out collective action, or local groups having to develop all technical capacity on their own, it is preferable to seek collaboration. For example, state agencies may provide technical backstopping, but recognize that farmers have important knowledge of local conditions, or state agencies may facilitate access to external resources or help resolve disputes. This is the premise behind a growing number of catchment forums (as in South Africa) and other multi stakeholder platforms. But even this is not straightforward: as Komakech and van der Zaag (2013) indicate in their study of catchment forums in Tanzania that a detailed study of local institutional arrangements is needed as a starting point, with attention to power structures, including whether large farmers, hydropower, or other influential actors will (or will not) participate.

Similarly, there are options for combining market mechanism with user groups and the state. In identifying the potential for water markets, Rosegrant and Binswanger (1994) recognize the importance of user groups to provide coordination among smallholders involved in water trades above the very local level, and overall state regulation. Similar combinations of market, collective action, and state institutions are also seen in payment for environmental services or watershed management programs that compensate upstream users for changing their water use patterns to improve the flow, quality, or timing of water downstream (e.g. Asquith, 2006; Swallow et al., 2002, 2006). Because the coordinating institution will need to have at least some control over the infrastructure and even the water itself, the choice of coordinating institution (or institutions) also has strong implications for property rights. The implications of this are discussed in more detail in the following section on property rights.

4. Understanding property rights

There are numerous definitions of property rights, including: “the capacity to call upon the collective to stand behind one’s claim to a benefit stream” (Bromley, 1991:15), “the claims, entitlements and related obligations among people regarding the use and disposition of a scarce resource” (Furubotn and Pejovich, 1972:1139–1140), or “the social institutions that define or delimit the range of privileges granted to individuals to specific assets, such as parcels of land or water...” (Libecap, 1998:77).

Key elements in these definitions are that property rights are social institutions: relationships among people with regard to resources. They entail recognized claims and obligations, rights and duties or responsibilities (Commons, 1968). To be valid, rights must be accompanied by a duty of others to respect those rights. The second set of duties or responsibilities are the responsibilities of the right-holder, which may be related to use or provision: to use the resource in certain ways (e.g. without polluting the water), or to provide for the construction or maintenance of facilities (e.g. irrigation infrastructure).

Ribot and Peluso (2003) distinguish between access to resources (e.g. being physically able to get water) and rights (entitlements). A tail end farmer may have a right to water, but might not be able to get access because those upstream take too much. A farmer may also have access due to physical location, force, or even stealth, even if he or she does not have a right to the water. Many water users do not have formalized rights to the water they depend on for their livelihoods. Pradhan and Pradhan (2000) provide an example of this distinction between access and rights from the hills of Nepal, in which irrigators from one system would allow farmers from another area to use water under what may be referred to as “tolerated use”, as long as the farmers from the second system did not
claim rights over that water. However, this access was not enough for the latter farmers, who used a range of strategies to claim rights over that water. Pradhan and Pradhan (2000:201) find that this has broader applicability to many farmer-managed systems:

Wherever possible they divert water from new (uncontested) sources, and if this is not possible they try to acquire water from sources used by others by negotiating, disputing, ‘stealing’ water on the sly, or forcefully acquiring water, often using political or administrative connections. The farmers are not satisfied with just acquiring water; their long-term goal is to legitimize their access to the water source, that is, to establish rights to the water...to get their claims to a share of the water from a water source accepted by other users and competitors.

With regard to irrigation systems, there are three types of property rights that are important: to the land, the infrastructure, and the water. All three of these resources are necessary for productive use of the water, and how rights over these resources are distributed will affect both the amount and distribution of benefits.

Recognizing property rights to water (as well as irrigation infrastructure) often requires going beyond simplistic, legalistic, or externally-imposed assumptions. When discussing water rights with government officials, I have often heard “There are no water rights here” or “The State owns all water.” Both of these statements derive from a very narrow understanding of property rights. Conventional images of property rights often derive from images of unencumbered land rights, with fixed boundaries, within which the individual “owner,” backed by a state-issued title, can do whatever he (or more rarely, she) chooses with the resource. Those boundaries are seen as rigid and unchanging, dividing people between those on the inside and outside. Certainly these conditions rarely apply to water, particularly in developing countries.

But this view of property rights is flawed, even for land. As noted above, property rights are above all, social institutions, which define relationships among people. They connect more than they divide. Rights are never unencumbered. Instead of “ownership” that implies rights to do whatever one wants to the resource, it is better to think of “bundles of rights” that may be held by different claimants, including individuals, households, water user groups, communities, and the state. Indeed, the inter linkages between these different claimants on the resource can even be conceptualized as a “web of interests” (Arnold, 2002). Furthermore, all rights do not derive from the state: there may be many different sources of property rights. Each of these aspects apply, to some extent, even to immobile property in industrialized countries. But they are especially relevant to property rights in developing countries, and especially to rights over a fluid and often fugitive resource such as water. The following sections provide more detail on legal pluralism and bundles of rights, as they pertain to irrigation systems.

4.1. Legal pluralism

Understanding property rights in practice requires acknowledging legal pluralism—the coexistence of many types and sources of law, which can be used as the basis for claiming rights over the resources or regulations on what can be done with them. This is often thought of in terms of “statutory” and “customary” law, but it is more complex than that. State law itself may be plural, with different—and even inconsistent—laws issued for different types of water use. Komakech et al. (2012) describe how water use permits are interpreted and enforced differently by various administrative units in Tanzania. Customary law is yet more diverse, differing between communities (however defined) and, because it is often unwritten, even within a community. Moreover, although “custom” is often interpreted as being rigid and unchanging, in fact “customary” law changes, often quite rapidly, to the extent that they may be referred to as “living law” instead (Ehrlich, 1936).

Beyond this conventional dichotomy there are international laws and treaties, such as the Ramsar Convention governing wetlands, 5 or international treaties governing shared watercourses. Each irrigation project generates its own regulations, such as which parts of the command area are authorized to receive water in each season, from which date, and what the water users are required to do (and are prohibited from doing). Water users’ associations generate their own rules regarding the manner in which different people may draw water, and what each needs to provide for the system. Because of the fundamental importance of water for life itself, religious laws and rules also create the basis for water rights, as illustrated in Islamic water law (Faruqui et al., 2001) or the Balinese subak irrigation systems, which derive much of the authority for their detailed system of water rights from a series of temples, from the local field channel up to the whole watershed (Lansing, 1991). Even local norms and sayings can become the basis for claiming water rights. For example, in Kenya Onyango et al. (2007) relate how a local proverb that “even the hyena has a right to water” is the articulation of a norm that no one should be denied water, therefore anyone should be allowed to cross even private property to access water.

These different bases for property rights do not exist in isolation. Rather, the various forms of laws or rules overlap, interact, and influence each other. A change in international law may change state law to bring the latter into compliance; a change in national law may end up affecting custom; but also, customary or religious rules may shape statutory law.

However, property rights are only as strong as the underlying institutions—whether state, community, religious, or other—that shape, endorse and enforce the rights. Rights that are not widely known, recognized, or enforced, have little meaning. Meinzen-Dick and Nkonya (2007) describe these overlapping frameworks as “force fields” of varying strength. In the capital city, among a highly educated population that can call upon the courts or other government officials to enforce it, state law is generally stronger than in the hinterland, where even the officials—let alone the general public—are often unaware of the provisions in statutory law. Each type of property rights has associated bearers of the law, such as state authorities, elders, religious leaders, or irrigation system officials. The strength of their authority certainly affects the strength of the property rights that they enforce. However, none of these have the ability to be everywhere and govern every water use or every act to maintain (or damage) an irrigation system. Property rights and obligations also have to be known by those immediately involved, which requires internalizing the rules.

This has important implications for the sustainability of irrigation systems. For any type of property rights to provide security and incentives for careful management of the water or infrastructure, the rules need to be clearly understood as well as enforced. Four of Ostrom’s (1990) well-known “design principles” for the governance of irrigation systems relate to this: clearly defined boundaries, monitoring, graduated sanctions, and conflict resolution mechanisms. These principles were developed from a review of many studies of irrigation systems (as well as other types of common property). Cox et al. (2010) validated these principles

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3 These notions can be traced back to English common law, notably to Blackstone (1766).
4 For a more complete review on legal pluralism and property rights, see Meinzen-Dick and Pradhan (2002), Meinzen-Dick and Nkonya (2007).
5 See www.ramsar.org.
based on many more such studies and found that it is important not only that the resource and its use are monitored, but that the monitoring be done either by the users themselves or by someone who is accountable to the users.

4.2. Bundles of rights

As noted above, property rights to any resource almost never convey total rights, as is conjured up in notions of “freehold” or “ownership.” Rather than holding that up as a standard, it is better to look at the different particular rights that different stakeholders have, which vary enormously, not only between different societies, but also between users within a particular locale. For comparative purposes, these are often identified as bundles of rights, but even how these bundles are defined varies. Schlager and Ostrom (1992) define these bundles in terms of use rights of access and withdrawal, and decision-making (or control) rights of management, exclusion, and alienation. Others, following older Roman tradition, group the bundles as: usu rights to use the resource; usufructus rights to derive income from a resource; abusus rights to change the resource; and alienation rights to transfer the rights to others (see Eggertsson, 1990; Alchian and Demsetz, 1972; Scott, 2008). Combining the two classification systems, the following provide examples of the bundles of rights that are particularly relevant for sustainable irrigation.

- **Access** refers to rights for non consumptive use. The “right to ramble” or cross someone’s land for a walk is a classic example of such access. Swimming in a reservoir would be another such example. Although access rights should be non consumptive, there may be crowding effects or wearing down of infrastructure if too many people access land or water resources.
- **Withdrawal** refers to rights to take resource units, such as consumptive uses of water or taking produce of the land.
- **Usufructus** rights to earn income from the resource are not included in the Schlager and Ostrom (1992) framework, but can be important where the state charges a water licensing fee.\(^6\)
- **Management** covers rights to make rules and modify the resource, notably setting water delivery patterns or conducting maintenance.
- **Exclusion** refers to rights to determine who can use the resource, and the transfer of those rights. In the case of irrigation, the right to decide who can draw water for irrigation, and whether other users can also access the water, infrastructure, or adjacent land are all crucial exclusion rights.
- **Alienation** refers to the rights to transfer management and exclusion rights to others, such as by sale or lease.

“Ownership” or “complete property rights” are often interpreted as holding all of these bundles of rights. If the term “water rights” conjures up these images, then it is quite understandable that the concept would not seem to apply to water, especially in developing countries.\(^7\) This is especially true if one looks only for formal rights issued by the state. Recognizing this, Hodgson (2013) argues for a focus on **tenure** rather than **rights**:

A key advantage of couched the issue of water allocation in terms of tenure, rather than simply in terms of water rights, is that it facilitates recognition of the fact that a complex range of different, yet inter-linked, types of relationship exist between people with respect to water resources. More specifically, the question of water tenure goes beyond water rights and water law (Hodgson, 2013:1).

This is a useful reminder that the focus needs to be on the institutional arrangements, rather than on specific formulations of what is recognized as property rights.

5. Discussion: Property rights and irrigation management

Attention to property rights in developing country irrigation systems came to prominence in the 1980s and 1990s in response to concerns with irrigation system maintenance and water scarcity. This section analyzes the policy debates and trends around each of these areas, and the factors that influence security of tenure.

5.1. Maintenance

Many irrigation systems have been developed by government agencies, but the performance of these systems has often been far below expectations. With the fiscal crisis of the state in the 1980s, funding for system maintenance was often scarce, causing further deterioration of systems. At the same time, studies of farmer-managed irrigation systems showed that in many cases these performed better than state-managed systems, because the farmers themselves undertook maintenance and irrigation staff were responsible to the farmers (Lam, 1998; Ostrom, 1992; Tang, 1992; Uphoff, 1986).

Irrigation rehabilitation projects have identified one of the causes of these problems with government-managed irrigation system as being the tendency of the irrigators to feel that the responsibility for maintenance of the systems rested with the government, but the government agencies lacked the resources of capacity to do adequate maintenance. In order to deal with this, many government officials and donor-assisted irrigation programs have called for farmers to develop a "sense of ownership" over the irrigation systems so that they will take care of them (e.g. Vermillion, 1987).\(^8\) Coward (1986) explicitly recognized the link between property rights and management, but focused on the effect of creating and maintaining property together as creating the “social glue” that would strengthen irrigator groups to maintain their irrigation.

Three reasons why property rights are important for maintaining irrigation systems can be summarized as authority, incentives, and resources (Meinzen-Dick, 2002).

- **Authority:** Unless farmers are recognized as having management rights over the infrastructure and water, they do not have the authority to make any changes in the irrigation systems, including maintenance.
- **Incentives:** Property rights, especially use and usufructus (income) rights, can provide incentives to maintain irrigation systems because they create confidence that the holder of the rights will reap the future benefits of investment and careful maintenance, and bear the losses incurred by misuse of the resources.
- **Resources:** Control over water, land and infrastructure, including usufructus rights to earn income from them, can generate resources (cash or labor) for maintaining irrigation systems.

In most government irrigation systems the state claims the rights of management, exclusion, and earning income, and

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\(^6\) While usufructus rights may be seen as embedded in the exclusion or alienation rights, for understanding property rights in irrigation systems it is useful to identify this as a separate right.

\(^7\) However, this is almost never found, even for so-called “freehold” land ownership in the industrialized countries; there are almost always residual claimants who restrict what one can do with that land, especially where that impinges on others. Zoning regulations or bans on dumping waste are examples.

\(^8\) Note that a “sense of ownership” has often been promoted by organizations that are reluctant to transfer “real” ownership. It is rarely sufficient without real rights held by the water users.
irrigators only have recognized use rights, often upon payment of an irrigation fee that is then supposed to fund operation and maintenance. However, there is often no direct link between the fees paid by irrigators and the budgets available for the irrigation agency, so the resources are not made available to sustain the irrigation systems. At the same time, farmers lacked the authority to undertake maintenance, and often had little incentive to do so. Recognizing these problems, a number of irrigation management transfer programs have included ceremonies for transferring “ownership” of the infrastructure of surface irrigation systems from the government to farmers’ organizations (Vermillion, 1997). However, without rights to the water as well, the infrastructure itself is of little value, and even is a burden to maintain. The water rights are key assets, because they determine both the level and distribution of benefits from irrigation.

This is not to imply that secure property rights will necessarily lead to adequate maintenance. If the holder of the rights (farmers or the state) has the authority but not the technical expertise, if the returns to irrigation are not high enough to provide incentives, or if the costs of maintenance exceed what the usufructus rights can generate, having the rights will not be sufficient. However, the role of property rights merits greater attention than it has received in most discussions of irrigation maintenance or programs to improve irrigation maintenance.

5.2. Water scarcity

As noted above, as water becomes scarce, it brings users into greater competition with each other. Even relatively water-abundant systems may have scarcity at some times, whether during a dry season or drought year, or as water use increases. Clear property rights define allocation rules for who may use how much water, in what ways, at what time and place. By clarifying expectations, these rules can help reduce conflicts. But a further reason for attention to water rights in the context of scarcity is to provide incentives for efficient use and water conservation. Rosegrant andBinswanger (1994) argue that tradable property rights would create incentives for irrigators (and other water users) to conserve water, because what they did not use could be sold to other uses (including to the environment). Thus, rather than requiring some users to give up water, which often causes opposition, this would allow voluntary transfers from less efficient users to those who could use it more productively, with those who give up water receiving payment. It is beyond the scope of this paper to review empirical experiences with water markets,9 but it is important to note that tradable water rights hinge upon vesting the right to transfer water to others in the water users, rather than in the state. While irrigation management reform programs in many countries have been willing (albeit sometimes reluctantly) to transfer to the users the use, usufruct, management, and exclusion rights, vesting alienation rights in the users has been even more controversial.

Some farmer-managed irrigation systems, as in Nepal and Bali, have developed water rights systems in which proportions of the flows are separable from the land itself. In these cases, farmers have the incentive to use the water efficiently to irrigate as much land as they can with their shares of water. Zekri and Al-Marshudi (2008) describe proportional water rights systems in centuries-old falaj systems in Oman that even reserve a share of the water rights to be auctioned to support the system operation and maintenance—thereby combining resources for sustaining the system and tradable water rights in a context of water scarcity.

The question of how water rights systems can adapt to growing scarcity, either through proportional allocations, tradable water rights, or other mechanisms, is likely to become increasingly important with increasing water use and climate change. Sharing ideas from one place to another can assist in adaptation, but copying systems of water rights is not likely to succeed, because it does not account for the variations in the physical and institutional environment. For example, Chilean water law, with tradable water rights, has been promoted as a model for other countries, but Bauer (2004) shows that the Water Code was shaped by the particular history and conditions of Chile, that are not found elsewhere, and even within that context, the Chilean water law has key shortcomings as well as strengths that need to be understood.

5.3. Security of tenure

It is not only the content of the rights that matter, but the security with which they are held. Especially the strength of incentives to sustain irrigation systems depends on how confident right-holders can be that they will hold that right in the future. Key aspects of tenure security include the expected duration of the right and its robustness.

Duration of water rights are complex because of the inherent fluctuations of the water cycle; these are becoming more severe and uncertain with climate change. Thus, it is difficult to know, from one year to another, whether a water right can be realized the next year. Here infrastructure can increase water tenure security, by providing storage (reservoirs or groundwater) to buffer against short-term fluctuations.

Robustness of property rights refer to their ability to withstand challenges. Some of these challenges come from the physical environment (e.g. weather fluctuations or landslides that destroy infrastructure). Other challenges, however, come from the institutional environment. For example, immigrant communities may begin using water from the same source as other right-holders, with some basis for claiming that right. Or the state may decide to extend an irrigation system, creating new claimants, often to the detriment of existing users.

In some cases, robustness of property rights comes from being able to resist such challenges (e.g. by exercising exclusion rights to prevent new claimants from taking water away from the original right-holders). State recognition can play an important role in creating tenure security, especially where the state has enforcement capacity. Yet in many parts of Africa, in particular, even land is held in customary tenure without formal state recognition, and the costs of developing full cadastres and titling programs are very high, often prohibitively so because of the cost of demarcating property, registering it, settling disputes, and then keeping any registries up to date. It is even more expensive and difficult to develop registries of water rights, especially for millions of smallholder farmers, fishers, or other small-scale water users (van Koppenet al., 2007). Hodgson (2013) notes that many minor uses of water are exempt from requirements to register, especially for basic livelihood needs. But this can also create insecurity because it denies those users of state protection. This is particularly an issue in cases where so-called “land grabs” by outside investors have also become “water grabs”, taking water away from existing users. For example, Bues and Theesfeld (2012) analyze how large-scale farms in Ethiopia took water away from farmer-managed irrigation systems, because of the outside investors’ greater power and ties to the state.

Robustness also comes from being able to adapt to new situations, particularly changes in the hydrologic regime. Formalized state-issued rights may provide less adaptive capacity than systems in which farmers are able to play a greater role in setting and modifying the rules, i.e. when users have management rights.

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Both infrastructure and institutions can play a role in increasing security of tenure, especially over water. The role of storage (infrastructure) in helping people respond to droughts has already been mentioned. Pipes that reduce transmission losses can increase confidence that users will receive the water they are entitled to. Meters and information technology (e.g., monitoring others’ water uses) can increase users’ confidence that if they follow the rules, others will as well because all will be monitored and can be caught if they break the rules. But these technologies do not work on their own. Someone has to operate the reservoirs, read the meters, or provide the information; hence institutional arrangements are needed to ensure the infrastructure delivers.

South Africa’s experience with the National Water Act (RSA, 1998) is instructive of the challenges of developing an equitable water rights system that responds to water scarcity, giving due priority to environmental and basic domestic water uses. Despite active consultation in developing the law, implementation has proved a challenge, especially with limitations of state capacity to monitor and enforce (Schreiner, 2013), continuing resistance by powerful water users who stand to lose from the reforms, and limitations on the ability to redress power asymmetries through water alone, without also addressing land rights (Kemerink et al., 2011).

Rather than looking for any prescriptions for property rights reforms, it is more realistic to recognize that changes are likely to be a process of what Cleaver (2001:26) refers to as: “institutional bricolage, a process by which people consciously and unconsciously draw on existing social and cultural arrangements to shape institutions in response to changing situations.” An important aspect of this understanding of institutional change—whether in property rights or coordination institutions—is that people themselves are actors, shaping the outcomes, with outsiders (including the state) playing variable roles.

6. Conclusions

The development of irrigation systems that serve more than one farm require coordination systems and some form of property rights to at least identify who has what rights to use, manage, and exclude others from the associated land, infrastructure, and water. Even for individual wells and rainwater harvesting, as more and more people start to irrigate, they impact other users in the watershed, and some form of coordination and rules governing water use can help prevent conflicts and give users some assurance that their investments in irrigation will be sustainable.

However, the state is not the only source of coordination and property rights; collective action through customary institutions, newly developed user groups, and even market mechanisms can all play a role. Nor do property rights need to include complete “ownership”: particular bundles of rights can be held by the state, user groups collectively, or different individual users. Use rights of access and withdrawal, as well as usufructus rights to earn income from the resources can provide incentives for investing in and maintaining irrigation systems; management and exclusion rights provide authority to do so; usufructus rights provide revenue for operation and maintenance. Alienation rights that are transferrable, either seasonally (rental) or in perpetuity (sale), can provide incentives for those with existing water rights to conserve their use because they can gain income from transferring the unused water to others.

What matters is the security of these rights—the confidence that they provide that others will fulfill their duty to respect those rights. Rights are only as strong as the institutions that stand behind them. Where the state has very little effective capacity – as in remote regions or when the state is weak – then customary rights are often stronger, especially if their legitimacy is reinforced by widely held norms with internalize self-enforcement so they do not have to be explicitly enforced by others. But customary rights alone may not be secure in contexts where the state decides to reallocate water (or land) to other users.

As resources become more scarce, property rights systems need to adapt. Irrigation development projects inherently change property rights, whether explicitly assigning water and land rights, or implicitly by generating rules about who can do what with the water and infrastructure, or simply by creating new “facts on the ground,” of where and when water is available, which forces changes in property rights. Many irrigation management transfer projects have included formal ceremonies to confer on the farmers rights over the infrastructure (frequently only the onerous duties to maintain the infrastructure without real rights over its actual use and disposal), but rarely the water. The creation of transferable property rights, as in Chile or Australia, have been discussed but rarely implemented in developing countries (beyond informal markets for groundwater in South Asia).

Recognition of the need for coordinating institutions and property rights for sustainable and efficient management of irrigation is an important step. But identifying the important institutions is relatively easy compared to ensuring that these are in place. Efforts to improve irrigation by changing property rights systems have often failed because they have not recognized the difficulty of transplanting what is seen as clear property rights systems from one place to another. Rapid reforms can be counter-productive. They are unlikely to be fully implemented as planned, and create uncertainty and resentment in the process. Negotiation with stakeholders, looking for ways to compensate those who might lose out, leads to more legitimacy of the reforms.

Institutional change is possible, but it needs to be seen as an organic process, building on existing norms and practices, and recognizing that local people will be active in adapting – or even resisting – external interventions. Analogies of “social engineering” have been misplaced, because they imply a mechanistic approach. What is required is a more nuanced approach, which may involve adaptation to the physical and institutional environment. A good strategy is to start with people’s experiences with water—how they access it, what claims they make for their different water uses. This will help to identify the relevant legal frameworks to address. Then an intervention can work to strengthen the claims of poor people for their important water uses. In many cases, water rights become operationalized through user organizations. Ensuring that women, smallholders, livestock keepers, or other poor and marginalized water users are represented in these organizations is an important step to strengthening their water rights, but is often difficult, because of overt resistance from those who do not want to share water rights and decision-making, or because of social challenges of including marginalized groups in local organizations.

Officially-recognized rights also help ensure that their holders have a “seat at the table” in discussions about further water development or land use changes that may impinge on their rights. Joint planning and modeling of water resource development with government agencies and different user groups helps to put this into practice, but it may require strengthening the capacity of both the agencies and the users. There is no single, optimal property right system for irrigations systems—in developing countries or elsewhere. Rather, we need a range of options and the understanding necessary to be able to tailor them to their (ever-changing) physical and institutional context.

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