

Ruth Meinzen-Dick

# **Property Rights and Maintenance of Irrigation Systems**



**Division 45**  
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Ruth Meinzen-Dick

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## 1. Introduction<sup>1</sup>

Property rights play a central role in the management of resources, conveying authority and shaping the incentives of both users and system managers. This has been widely accepted in both research and policy-making in the case of land, and there is growing consensus regarding the importance of defining users' rights over forest resources. Property rights play an equally important role in the management of irrigation systems. In fact, there may be even more need to address property rights in irrigation systems because, in addition to determining use patterns and allocation of benefits from the resource (notably water), irrigation also requires provision of infrastructure (Ostrom, Schroeder, and Wynn 1993), including ongoing maintenance, and these are also influenced by property rights. However, in the case of irrigation, issues of rights have often been overlooked, or not received the attention they deserve, in part because of the complex nature of rights in irrigation. Furthermore, assigning rights to users is sometimes seen as threatening to state power and control.

This paper examines the linkages between property rights and maintenance of irrigation systems.<sup>2</sup> It begins with a general definition of property rights and application to the case of irrigation. Rights in irrigation systems are complex, and concepts of simple "ownership" often do not apply. This paper therefore explores the different bundles of rights that should be examined in irrigation systems, and how they apply to rights to land, system infrastructure, the water itself, and other resources associated with irrigation systems. The paper examines why property rights are important for maintenance, with particular attention to their role in shaping incentives for management. Explicit attention is given to how rights and claims on resources can derive from many different sources, not just statutory law. We then turn to an examination of how people acquire rights, and the implications for who will be involved in irrigation decision-making and maintenance. Practical and political constraints to establishing property rights are then explored. The concluding section looks at how recognition of property rights can be expanded, and what issues need to be further addressed.

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<sup>1</sup> Walter Huppert has provided many valuable insights and comments on this paper through many stages of its development. Waltina Scheumann and Anna Knox have also provided helpful comments. While their contributions are gratefully recognized, responsibility for any errors rests with the author.

<sup>2</sup> The paper deals specifically with irrigation systems, not drainage systems.



## 2. Defining Property Rights

Property rights can be defined as *“the capacity to call upon the collective to stand behind one’s claim to a benefit stream”* (Bromley 1991:15, emphasis in original). Thus, property rights involve a social relationship between the right holder, other people, and an institution to back up the claim.

In most cases in industrialized societies, the institution backing the claim is the state (or statutory) legal system. However, this is not the only source of property rights, especially in the case of water and irrigation system assets. In addition to statutory law, most societies and religions have devised varying forms of rights and rules pertaining to who may use what kinds of water in what ways. Local norms and accepted practices may differ from all of the other types of "law", and irrigation project regulations may provide another basis for property rights. Thus, customary and religious institutions, local society, or even irrigation projects may be the backing “institution”. All of these may not be consistent with one another, which adds to the complexity of property rights, but also allow for dynamic change, as discussed below.

All property rights inherently involve relationships between people (the holder of the right and others who recognize that right), but this is particularly the case for water, because of the high level of interdependence between users. Building on the work of John R. Commons, Ostrom and Ostrom (1972) point out that the inverse of one person’s right is the duty of others to uphold that right. Who are the “others”? All those bound by the institution backing a right.<sup>3</sup> In the case of a statutory right, the “others” are all who acknowledge state authority; in the case of a customary right, it is all who acknowledge that authority. Their duty includes, at a minimum, not interfering with the right-holder, and may also include helping to enforce the right, such as by reporting or sanctioning violators.

The degree to which others uphold a right depends on the strength of the institution that backs the right. Strength of the institution can come from a number of different sources. It may involve coercive enforcement power, such as hiring guards and creating fear among any that attempt to take unauthorized water or break structures, or it may come from widespread acceptance and internalization of the rules, such as norms regarding

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<sup>3</sup> If institutions are defined as the “rules of the game” (North 1990), then those bound by an institution are those who subscribe to the “game” and agree to abide by its rules. Moore (1978) refers to these as “social fields” to which individuals belong. Where these social fields have the power to generate and enforce rules, they are referred to as “legal fields” (Spiertz 2000).

sharing of water for domestic use or animals. Such acceptance of rules is a key aspect of legitimacy of property rights.

This means that *a property right is only as strong as the institution that stands behind it*. Often it is assumed that state law is the ultimate authority, but where the government's presence is weak, local definitions of rights may have more relevance, legitimacy and enforcement than statutory definitions.

Another aspect of the link between rights and duty in relationships is that the holder of the right generally also has certain duties that must be met in order to maintain the right. In the case of irrigation systems this may include membership in a user group, payment of fees, and even maintenance of at least part of the system (e.g. keeping watercourses in good repair). Failure to observe these duties can result in forfeiting of rights. Again, the extent to which right-holders fulfill their duties is an indicator of the strength of the institution.

### 3. Bundles of Rights

Property rights involve much more than simple concepts of "ownership" as defined by state law. The concept includes various types of bundles of rights, with conditionality and overlapping rights held by different individuals and groups.

"Ownership" is often taken as having complete control and rights over a resource. If we consider only state law relating to irrigation, we often find that the state claims ownership of the water resources and of the irrigation infrastructure in government-built systems. Land is more likely to be "owned" by individual users (especially in Asia), although farmers in many government-run irrigation systems in Africa are officially designated as "tenants", with the government retaining ownership of the land.

But if we look at particular bundles of rights, it is easier to identify specific rights that can be or are already held by users, either individually or collectively. There are several ways to identify relevant types of rights. One classical way, based on Roman law (see also Eggertsson 1990 and Alchian and Demsetz 1972), is:

- rights to *use* the resource (*usus* rights)
- rights to *derive income* from a resource (*usufructus* rights)
- rights to *change* the resource (*abusus* rights)
- rights to *transfer* the resource to others (*alienation* rights)

Schlager and Ostrom (1992) disaggregate the bundles of property rights into:

- **use** rights, including *access* (to enter the resource domain, e.g. the right to cross a piece of land, go into a forest or canal) and *withdrawal* (to remove something, e.g. to take water, fodder, or fish); and
- **control** rights, including *management* (to modify or transform the resource, e.g. by planting trees or shrubs, enlarging a canal, or restricting what can be harvested), *exclusion* (to determine who else may use the resource), and *alienation* (to transfer rights to others, either by inheritance, sale, or gift).

Different bundles may be held by individuals, user groups, service agencies, and the state, even within the same system. For example, recreational users might have (nonconsumptive) access rights, livestock keepers have differing withdrawal rights, farmers have withdrawal and some management rights, while an irrigation agency has management and exclusion rights, but the state has alienation rights.



## **4. Rights in Irrigation Systems**

One reason that property rights have not received sufficient attention in irrigation systems is that the resource base itself is complex. Thus one important question is “property rights over what?” In the case of irrigation systems, it is essential to consider rights to land, to system infrastructure, and to water itself. Other resources such as the trees or fish in an irrigation system can also be important.

### **4.1 Rights to Land**

Of the resources in irrigation systems, rights to land are generally the most well established. Land resources also often provide a clear illustration of how different bundles of rights can be held by different parties. In many parts of sub-Saharan Africa land may not be fully individualized, but held under a variety of customary tenure systems where the lineage or other group owns the land, but individuals have use rights (that are often transferable to their descendants). However, rights to land irrigation systems are generally recorded or more clearly established than for other types of land, in part because irrigation raises the value of the land, creating pressure for clear property rights.

Tenancy is a relatively common situation in which ownership and use rights are separated, and this has particular importance for irrigation system maintenance. Under either sharecropping or fixed rent tenancy, the tenants have use rights and the owner has alienation rights and the right to earn income from the land.<sup>4</sup> Tenants have the most immediate stake in water deliveries, but owners generally have more security and longer duration of tenure and benefit from increases in land values due to irrigation, so they may have a greater incentive to keep the system up in the long term. This leads to important questions of who should decide on, authorize, and pay for maintenance of irrigation systems. Many systems specify that land owners are responsible for payments and are members of any water users’ associations. While this is appropriate in view of the fact that they have the long-run stake in the system and benefit from its upkeep, tenants have a greater stake in immediate performance of the system. Especially where landlords are absent or not involved in farming, tenants may need a voice in decision-making on maintenance.

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<sup>4</sup> While land owners are usually other individuals, in many state-run irrigation systems in Africa (e.g. Zimbabwe) the state owns the land in the irrigation system, and cultivators are state “tenants”, subject to eviction if they fail to cultivate the land, pay fees, or perform other requirements satisfactorily.

In most cases, rights to use water and access system infrastructure in irrigation systems are linked to rights to land within the defined command area of an irrigation system. However, this is not always the case, and even where they are linked it is useful to examine each type of rights separately.

## **4.2 Rights to Infrastructure**

The second type of property rights that have received attention in irrigation development and management programs are the rights to infrastructure of the system. Whoever builds a system establishes a claim on that system, and determines who can and cannot enter the system, or otherwise work to protect the facilities. In many cases in developing countries, government agencies have built the systems, but have been ineffective in protecting the infrastructure against ongoing deterioration or careless use. Thus, there are often calls for farmers to develop a "sense of ownership" over the irrigation system. However, users are unlikely to feel a sense of ownership unless they have real rights over the system. Recognizing this, many irrigation management transfer programs (e.g. Philippines, Dominican Republic) have also included turnover ceremonies in which formal ownership of the system is transferred from the government to a users' association, often when the association has met certain criteria, such as payment (of a portion) of the costs. Even when this is done, it is often unclear what rights the users have over the infrastructure, especially as regards transforming the infrastructure. What happens if people do not maintain it? Can or will the government step in again and do deferred maintenance in the name of "rehabilitating" the system?

The holders of rights may also vary at different points in the irrigation system. For example, in a large-scale system with joint management between government agencies and users, the government may have rights to the infrastructure and water in the system headworks and main canals, the user groups have rights on a minor, and individual farmers have rights to the watercourses and fields. In such a system, the state may have alienation rights over water, the agency holds control rights of exclusion and management, and the farmers hold use rights. Rights may also change over time, as exemplified by farmer-managed irrigation systems when government agencies step in to rehabilitate the system and then claim ownership of the system, and also when management transfer programs formally recognize the rights of user groups where the government had claimed responsibility and rights over (parts of) the system.

### **4.3 Rights to Water**

It may seem that rights to infrastructure are the most important to focus on from the standpoint of irrigation system maintenance. Unfortunately, a narrow focus on infrastructure does not get at the incentives of various parties, especially water users, regarding system maintenance. Rights to infrastructure are a liability, rather than an asset, unless there are also rights to water (and land).

Although water is arguably the most important resource in irrigation systems, water rights have generally received the least explicit attention in irrigation development programs. One reason is that, compared to fixed land and infrastructure assets, water is mobile over space and variable over time, making a more difficult resource to assign rights to. When water is mobile, its boundaries tend not to be clear, and therefore it is more difficult to defend rights. Information asymmetries also arise, e.g. tail-enders often may not be aware of head-ender behavior.

In many cases the lack of attention to water rights is also because the government claims sovereignty over water resources and is reluctant to "cede" or acknowledge the rights of users. This is based on the assumption that the state holds all rights - an assumption that is highly questionable. A closer examination often indicates that water rights of at least irrigators are linked to land rights in the command area, and other users may have some form of rights based on customary use or official water allocations and permits.

### **4.4 Rights to Other Resources**

Rights to trees, fish, and other resources related to irrigation systems have been the most neglected. This partly relates to the tendency to see irrigation systems in terms of a narrow, sectoral view, as only producing water for field crops, rather than recognizing the many different uses and users of irrigation systems (Bakker et al. 1999). Thus, the trees, fish or other assets are not noticed by irrigation policymakers. In addition, many of the other resources fall under the domain of other sectoral agencies, such as forestry, fisheries, etc. Rights to these other irrigation-related assets are often not held by the same individuals or organizations as the irrigation system or water. Even where the government holds all the rights, a different department may hold the rights over fishing, trees, or roads.

#### 4.5 Resource Characteristics and Rights

The nature of the resource has consequences for property rights. Resources are often characterized by the degree of subtractability (rivalry in consumption) and costs of exclusion. Use of land for cultivation is often very subtractable - one person's use of the land reduces availability to others, but costs of excluding other users is relatively low. Resources meeting these criteria are often appropriate for private property rights. Infrastructure has less subtractability or separability of consumption: all eligible beneficiaries can use the facilities jointly, without reducing the benefits available for other farmers.<sup>5</sup> Due to the fact that the irrigation infrastructure is jointly used by many irrigators (non rivalry), rights to infrastructure are assigned to either the state or user groups/associations, not to individuals (with the exception that one canal supplies one individual only). For water, one person's irrigation use of the resource makes less available for others.<sup>6</sup> Thus use rights are usually individualized, but if exclusion costs are high, control rights may be held collectively as common property.

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<sup>5</sup> Livestock or human domestic uses of water can erode canal banks or otherwise reduce the availability of infrastructure for conveying irrigation water.

<sup>6</sup> There are non-consumptive uses of water, but in many cases even these affect the availability of water for others, either in terms of quality, location, or timing.

## **5. Links between Property Rights and Maintenance**

The arguments for attention to property rights as relevant to irrigation system maintenance can be summarized as: 1) property rights offer incentives for management; 2) property rights give the responsibility and necessary authorization and control over the resource; and 3) property rights can provide resources for maintenance. On the other side, maintenance activities (especially rehabilitation or modifications of the systems) can have a major impact on property rights, especially to water.

### **5.1 Incentives for Maintenance**

First, property rights over system resources provide incentives for people to maintain the system 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. This means that property rights lengthen users' time horizons by increasing their expectations that they will have access to the resource in the future. As a result, holding property rights provides a strong incentive for management. In other words, because individuals or groups have expectations that they will get benefits from a system, they have an interest in its maintenance, but if they are insecure about their rights in the future, e.g. because the supplies are irregular or water may be taken away for other users (another irrigation group or growing municipal or industrial use), they will be less interested in whether the facilities are maintained. Conversely, the threat of losing rights to the resource if they do not fulfill their duty in terms of maintenance (or paying for maintenance) provides an important check against free riding behavior on the part of users.

Where the government holds the rights to irrigation infrastructure and water, it may be in the public interest to maintain the system, but the agency staff charged with doing the work may still lack incentive to keep the assets in good repair. This is often because rights to the infrastructure and water do not provide a benefit stream for the agency staff, or even for the agency (at least according to the formal rules). Water and irrigation systems are clearly valuable resources, but they do not yield benefits to the agency because irrigation fees are often very low, and in many countries, the fees which are paid go to the general treasury, rather than to the agency responsible for its management.<sup>7</sup> Thus, the “public ownership” of these assets does not create strong incentives for either the agency or users to maintain the system.

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<sup>7</sup> Rent-seeking behavior by agency staff can be seen as attempts to capitalize on control over infrastructure and water to create a benefit stream.

## 5.2 Duty and Authority for Maintenance

Property rights convey a responsibility toward the resource. As mentioned above, the reciprocal side of a right is generally some form of duty towards the resource (and/or toward the institution that supports the right). Such a duty may be for directly maintaining the system, or for paying a service delivery agency (either government, user group, or private) to do maintenance. Such duties are very clear in farmer-managed irrigation system. But if an irrigation system (water and infrastructure) is seen as the government's, then users often feel it is the government's duty to do all maintenance and investment. This includes not only undertaking major construction, repairs, or modifications to the resource base, but also guarding it against unauthorized use.

Even if users, a government agency, or other party has the desire (incentive) to maintain the resource, without property rights over infrastructure, they do not have the authority to do so. This means that they cannot sanction those who break facilities and are unlikely to be an effective deterrent. If the government cannot exert control over the use of a resource and turns to local communities or groups of users to do so, it is difficult or impossible for the latter to control usage if they do not have recognized rights over the resource, and backing from the state in the case of encroachment. Even among the members of the group, if rights to the resource are held by the state or individuals, the group will have much more difficulty in setting and enforcing rules governing resource use than if common property rights are vested in some collective management entity.

Moreover, those without control rights over infrastructure and water will not have the authority to make changes to the system, which are inherently required for any rehabilitation, but also for most ongoing maintenance.<sup>8</sup> Thus, whatever entity is expected to maintain the system must have commensurate rights of control over the infrastructure and water, and conversely, whoever has management rights will be expected to maintain the system.<sup>9</sup>

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<sup>8</sup> Exceptions could include repairs to channels when they are breached, or minor desilting of canals down to originally specified levels.

<sup>9</sup> The question of which rights are required is discussed in more detail below.

### 5.3 Resources for Maintenance

Property rights can sanction one's ability to generate income from a resource, which can then be used to maintain it. Therefore, vesting control over resources, including the right to earn income from them, in the management entity provides resources that can be used to maintain irrigation systems. In the case of government-managed systems, there is often not a direct link between the taxes or irrigation service fees from an irrigation system and the expenditures on maintenance. This means that the agency does not hold the right to derive income from the resources. Maintenance resources are therefore dependent on the whims of a government budget, rather than on the performance of the irrigation system. Small and Carruthers (1991) argue that making a direct link between the agency and the fees for services, i.e. creating "farmer-financed irrigation", will lead to a stronger link between service provider and clients, and hence build a service orientation in the agency.

If maintenance responsibility is transferred to user groups, in addition to ensuring their technical capacity to do the maintenance, it is critical that rights to infrastructure, water, and associated resources (e.g. fish, trees) will be conveyed to them, as well. Governments can operate at a deficit, but user organizations cannot. They therefore need a source of revenue to cover their expenses, which include not only labor and materials for maintaining infrastructure, but also patrolling to ensure rule compliance, as well as substantial transaction costs. For such organizations to raise money through irrigation fees, they must have some recognized rights to the infrastructure and water (though, as noted below, those rights may derive from the state, or be locally recognized rights). But there are often other resources associated with irrigation systems, such as trees or other usufructs. In some cases, the association might even have land or shares of water that it can auction.

Rights over such "auxiliary resources" can provide a significant source of income, and make the organizations less dependent on membership fees and labor contributions or on subsidies from the government or external NGOs.<sup>10</sup> Fees are difficult to collect in early stages of organization, and are always difficult to collect if they are too high relative to the value of the resource, while subsidies are often not certain over the long run.

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<sup>10</sup> Wade (1994) provides examples of how village communities in India auction rights to certain trees, fishing, and even liquor licenses to finance collective activities.

A recent study of tank irrigation systems in Tamil Nadu, India, found that revenue from tanks may go to the forestry department, fisheries department or fisheries cooperatives, village government panchayats, informal village associations and even to the department of mines (!). None is paid directly to the public works department which is responsible for tank maintenance, and even what is paid to the state revenue department (which passes it to the state exchequer, which in turn allocates funds for tank maintenance) is only 7 percent of the total revenue mobilized by fees, taxes, penalties, and other collections from tank resources (Palanisami and Meinzen-Dick 1999).

In China there is explicit use of income from fishing, recreation, river pearls, and tourism to cross subsidize maintenance activities for irrigation (Gitomer 1994; Svendsen and Changming 1990). While this substantially reduces the need to raise funds for system maintenance exclusively from irrigated farmers (a task that is increasingly difficult in systems producing staple grains, given the falling real prices of output), it has also been criticized for deflecting attention of the management authority from irrigation to other, more profitable, sideline enterprises. Yet as the price of many irrigated crops such as rice and wheat remains constant while the cost of maintenance increases, such cross-subsidization of system maintenance from other irrigation-related assets may become increasingly important to ensure that adequate resources are available for proper maintenance.

#### **5.4 Effects of Maintenance on Rights**

It is not only that property rights have such a strong influence on maintenance provision, but also that maintenance activities have a potential impact on property rights. As noted above, where right-holders have a duty to contribute to maintenance, failure to contribute can forfeit one's rights. Conversely, there are cases in which people participate in maintenance through work or payment of fees as a means of establishing their claim on the system infrastructure and water.

In addition to these formal rules, maintenance can have strong effects on de facto property rights that are often overlooked. If regular maintenance is not done it can interfere with rights to water. For example, if desilting is not done or leaks are not repaired, tail end farmers may not be able to get water, and hence will be denied the exercise of their water rights. Improper maintenance therefore gives head enders stronger de facto rights to water than tail enders, even when water allocation per unit area is supposed to be constant across the whole command. This can also create vested interests among head enders to keep poor maintenance (unless waterlogging

becomes a problem).

Rehabilitation or "improvement" of irrigation systems can have an even more pervasive effect on property rights. Laying out new canals requires acquiring rights of way (land) and even appropriating water from individual farmers. Extending the system involves giving water rights to new users, who may or may not be accepted by the original group of farmers. Pradhan and Pradhan (1996) and Coward (1990) give examples of how this has been problematic in cases where the original farmers built the system with their own contribution, and the new farmers received water through a government-financed extension of the system. Changes to proportioning structures will also affect water rights. Ambler (1990) demonstrates that water rights are often embedded in the physical infrastructure, especially in proportioning weirs or other devices that distribute water between parts of a system. Sutawan (2000) describes how a project to improve Balinese subaks changed the design of proportioning structures, and was therefore rejected by farmers.

The maintenance requirements in farmer-managed irrigation systems also affect the cohesiveness and bargaining power of different groups for water rights. Temporary headworks or those that wash out periodically lead to periodic renegotiation over distribution of water. Furthermore, where head enders need the labor contributions of farmers throughout the system to rebuild or regularly repair the headworks, they have greater incentive to see that tail enders get water (Lam 1998). Replacing the headworks with more permanent structures therefore often leads to uneven water distribution, i.e. weaker effective water rights for tail enders.

Modifying the headworks of a system can have even wider repercussions throughout a river basin (see Sutawan 2000). Many traditional brush or stone weirs allow water to seep through, and this seepage water is important for downstream systems. Replacement with concrete weirs that do not allow water to seep through can therefore interfere with the water rights downstream. Creating a common headwork structure serving two or more irrigation systems also affects water rights, forcing the two groups to negotiate over the allocation of water between their areas. If users are also expected to maintain the systems, the new headworks will also require that the two groups negotiate over their respective obligations to patrol and repair the structure.

Even more extensive reconstruction of irrigation systems may even require reallocation of land within the system. In Burkina Faso, van Koppen (2000) shows how insufficient external understanding of local land and water rights, and insufficient involvement of the predominantly women farmers, led to misallocation of land and a fall in productivity after

"improvement" of the *bas fond* irrigation systems, until the system of land allocation was modified to take more account of the original distribution of rights.

## 6. General Patterns

In terms of the links between property rights and irrigation system maintenance, we find the following general patterns:

- Incentives for maintenance require at least use rights or rights to derive income from the resources, or both.
- For providing authority to maintain a system, control rights of management and exclusion over infrastructure and water are necessary.
- To provide resources to maintain a system, the right to earn income from a resource is critical. This applies at both the individual user level and at the level of the management entity.

When there is a single “owner” who holds all rights, then as long as the benefit stream from the resource exceeds the costs of managing it, presumably that owner has the incentive, authority, and resources to maintain it. But except for irrigation systems contained on a single farm, this is rarely the case for irrigation. In most cases, farmers who use irrigation systems also derive income from using the water, but they may not have the right to sell or rent out that water. Irrigation agencies, on the other hand, may not be users, but if they earn their income from supplying water, they would also have an incentive to maintain the resource.<sup>11</sup>

Thus for the users, water supplies are the *primary service*. Users have an interest in having good irrigation service, i.e. reliable deliveries. However, if they do not have long-term rights and rights to manage the resource, they will not necessarily have an incentive for maintenance. As Ostrom (1992:5) points out: “Farmers on large-scale projects face perverse incentives associated with their lack of control over water availability and substantial temptations to refrain from contributing resources to maintenance.”

For those with use rights alone, maintenance is only a *secondary service* that helps assure they get water. The main incentive for long-term maintenance then depends on the holder of long-term rights to the system (especially the infrastructure and water). Maintenance is a primary service for the holder of control (and income) rights to

infrastructure. Their incentive to maintain as well as their resources to do so depend on whether they derive enough benefits in the form of service or irrigation fees.

Even where rights are split between users with use rights and an agency with control rights, strong use rights for farmers can create an incentive for the agency to maintain. If the users have strong rights to certain primary services such as water deliveries on a certain schedule, and those rights are enforceable by sanctions against the agency if water is not delivered, this will create an incentive for the agency to do required maintenance. This illustrates the necessity of a regulatory mechanism, or an institution, to back up rights, if they are to be effective.

Where use rights are not as strong and enforceable, the agency's right (and need) to derive income from the system can still provide an incentive for the agency to maintain the system. If users do not derive enough benefits from an irrigation system, they will not pay irrigation service fees or donate their labor, time, and other resources for its upkeep, unless coercive measures are employed. If the user group or management entity does not derive income from the system, it will not be able to pay for its activities. That income may come from individual users' payments or from rental or sale of various assets. The examples of income from fishing, trees on canal banks, or other irrigation-related activities has already been mentioned. In some farmer-managed systems, e.g. in Balinese subaks or Philippines zanjeras, the management entity holds certain water rights, which it can auction to pay for maintenance services or allocate to leaders as compensation for their roles. Many irrigation tanks in India before British rule were endowed with certain tank lands (often at the tail end of the command), which were given to an individual who was responsible for tank maintenance. An early British traveler in the area noted that such tanks were notoriously better managed than those without such endowments (Buchanan 1807), illustrating how vesting of a combination of land, water, and infrastructure rights in a single entity brought together the responsibility, authority, incentives, and resources for maintenance.

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<sup>11</sup> This assumes that the income they receive is conditional on their maintenance performance, which might be enforced by formal mechanisms or (as often occurs), by users withholding payment if water services are inadequate.

## 7. Sources of Property Rights

Besides disaggregating the bundles of rights, we need to recognize that not all property rights derive from the state, or belong to the government, to be "transferred" to the users. The anthropological literature on legal pluralism has much to offer in understanding this complexity of legal frameworks and the effects on the ways people use water. Legal pluralism begins from a recognition that multiple legal and normative frameworks coexist. For example, government, religious, and customary laws, project regulations, and unwritten local norms may all address who should receive water, from which sources, for what purposes, and with what obligations.<sup>12</sup> Legal pluralism goes beyond dualistic opposition between "formal state law" and "local customary law" to look at the tensions and contradictions within and between interacting repertoires. Even within state laws, there may be contradictions, especially when different government agencies are involved in issuing regulations. Just as state laws cannot be assumed to be the only source of water rights, local or "customary" rules do not operate in isolation from state legal history, but instead the two are intertwined in complex ways. As a result, recommendations based on statutory rights alone - or on customary practices alone - do not adequately address the combination of technology and institutions which might contribute to improving water allocation in practice.

In many cases users have strong claims on the resource based on customary rights, usage over a long period of time, and/or substantial investment in developing the resource. This is especially true in farmer-managed irrigation systems, but also where farmers have been irrigating in a system for a long time, claims may be staked by whoever created the system. Many religions also have laws or strong norms relating to water, which need to be taken into account. For example, Islamic hadiths relating to the "right to thirst" for animals may dictate that livestock cannot be denied access to water. Unless this is taken into account in the system design, livestock entering the canals or reservoirs may weaken the banks. In much of South Asia, considerations of religious pollution may prohibit women from taking part in irrigation maintenance activities, making it difficult for female-headed households to fulfill their obligations to maintain their rights in a system.

While it is important to recognize that there may be multiple bases of property rights that are considered legitimate, actual practice may not accord with any of these. For example, head-enders in an irrigation system may take more water than their allotted share, year after year, without this being legitimized, or agency staff may act as though

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<sup>12</sup> For applications of legal pluralism to water rights, see Benda-Beckmann, Benda-Beckmann and Spiertz, 1997; Guillet, 1998; Meinen-Dick and Bruns, 2000; and Spiertz, 2000.

they “own” the system, taking payment for water, even though they are not authorized to do so. Thus, there are often multiple bases of de jure rights, but de facto practice may still differ.

## 8. Security of Tenure

In addition to looking at the types of rights and sources from which they derive, it is important to consider the security of the rights. Security of tenure includes:

- excludability, i.e. the ability to prevent others from using the resource, or more than their authorized share. This can be especially problematic in the case of water, because of the nature of the resource and the number of potential claimants.
- duration, i.e. the expected time horizon. Rights that are accorded on an annual basis are not as secure as those that are recognized in perpetuity, or over longer periods.
- robustness, i.e. the number and strength of the bundle of rights that are held. Control rights are generally more secure than use rights.
- assurance, or strength of those rights, i.e. the degree to which they can be defended (see Place, Roth and Hazell, 1994; Roth, Wiebe and Lawry, 1993). This is especially important in the case of water resources, because the available supply, as well as the demand, fluctuates from year to year. Stronger rights will apply even during periods of scarcity - dry seasons and drought years, while weaker rights may be denied when water is scarce.

Going back to the definition of property rights, we note that it is "the capacity to call upon the collective" (Bromley 1991:15) that is critical. This means that property rights are only as strong and legitimate as the institutions that stand behind them (Meinzen-Dick and Bruns, 2000). Property rights must be embedded in property rights regimes, the set of rules, decision-making arrangements, and enforcement mechanisms which accompany the rights. If state institutions (e.g. government agencies, police, courts) have no capacity to enforce, then it matters little what is written in the statute books, then customary or local law<sup>13</sup> may be more effective. Conversely, where customary management institutions have been weakened, customary rights may no longer be enforced or observed. In practice, neither state nor local law are all-powerful in a given context, nor do they operate in isolation from each other. Rather, property rights are the outcome of a complex interplay between various types of legal frameworks.

But though the state is not the sole source of legitimacy for property rights, it is still important for governments to address the rights to resources. Formal state recognition validates user rights. When state recognition is accompanied by an enabling framework for enforcing user rights, it can strengthen the group's rights, particularly against outside challengers like other irrigators' groups or other types of water users (see Lindsay 1998). State recognition of users' rights can increase tenure security, creating greater

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<sup>13</sup> Local law refers to the dominant local interpretations of customary law, religious law, and other relevant normative and legal frameworks. See Benda-Beckmann, Benda-Beckmann, and Spiertz (1996).

incentives for users to participate in management and invest in the resource. Furthermore, addressing rights helps to clarify expectations between the agencies and users. For the government to explicitly acknowledge the rights of user groups creates the basis for a more egalitarian relationship between the users and agency staff, and can contribute to better service relationships in maintenance.

## 9. Who holds Property Rights?

Governments claim ownership of many natural resources, especially water, on behalf of society at large or "the nation." Because water is of vital importance to a country, and their management has important environmental and economic externalities for others (both in the country and internationally), legitimate questions are raised about why a particular group of users should be given property rights over those resources. Indeed, the Public Trust Doctrine (which applies in most countries with legal traditions deriving from Roman Law) holds that some aspects of water resources are held by the state as an inalienable right of sovereignty. This doctrine has been invoked in many environmental cases, as a basis for arguing that the state cannot assign full ownership of water to individual users or even user groups. However, assigning specific types of property, e.g. use rights or long-term tenancy is often possible, provided that third parties are not affected.

The question of why some individuals or groups should have rights and others not goes to the heart of the relationships over property, and fundamental questions of equity and legitimacy. Meinzen-Dick et al. (1997) identify a number of "pathways" for acquiring rights over resources:

- investment in improving the resource;
- government assignment of rights;
- use over a period of time;
- purchase;
- inheritance;
- gifts;
- membership in a community.

Investment in constructing irrigation systems is perhaps the most common means of establishing rights to irrigation infrastructure, as well as the water, and even auxiliary resources such as trees and fish. Where the government makes the investment, it has generally held the control rights to all these resources, and assigns only use rights to individuals or groups.<sup>14</sup> But there are also many cases in which groups of users have made the investment of labor or cash, and use that as a basis of claiming both the rights to the infrastructure and the water. Coward (1986) argues that the process of investing together forms a "social glue" among irrigators, which provides the basis for collective maintenance of systems in the future. Thus, the process by which a system is

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<sup>14</sup> In some cases in Africa, where the government has built an irrigation system, it also assumes land rights, and only assigns tenancy, or use rights to the land itself.

constructed or rehabilitated lays the foundation for both property rights and future maintenance.

Use over a period of time has been a frequent means of establishing a property right. This is one of the most widely recognized bases for water rights, both in statutory and much local law.

The government also assigns rights over irrigation-related assets to users. The assignment of use rights is common in many government-managed irrigation systems. Some irrigation rehabilitation/management transfer projects have also included formal transfer of rights to infrastructure to users, usually in recognition of at least partial contribution to the system. But in areas where some irrigators have established a claim on water and infrastructure based on past investment and/or or use over time, and the government assigns rights to new irrigators, it can cause tension between old and new right-holders. The difference in means of acquiring rights can challenge the legitimacy of the rights, with old irrigators refusing to acknowledge the rights granted by the government (see Coward 1990).

Purchase, inheritance, and gift are more common means of acquiring rights to land or other individual property. Where water rights can be separated from land, water rights can also be acquired in this manner. In the case of well irrigation systems, purchase or inheritance are also common means of acquiring rights to infrastructure.

Finally, membership in a community is an important pathway to acquire rights, especially to common property resources. Rights to irrigation may be limited to a subset of the community, but other members of the community may have rights (especially from local law) to use the system for domestic purposes, bathing, or livestock. Recognizing such rights can be important for irrigation system design and maintenance, as specialized bathing steps, cattle wallows, or other facilities may be required, and water may need to be supplied year-round for these purposes, not just during the main cropping season.

Although users' land rights in irrigation systems are often quite secure, many governments have been reluctant to acknowledge the rights of users to the water, infrastructure, or other assets of irrigation systems. This is understandable in light of the public trust issues over a critical resource like water. Where the government has made the investment in irrigation systems, there are also legitimate questions of why some farmers should get the benefit and not others. A further reason is that, if control rights over infrastructure are accorded to user groups, there is a loss of control on the part of

government agencies, and a perceived risk that the users will fail to maintain the facilities to “proper” engineering standards.

However, because the government often lacks the capacity to enforce state property rights or regulations on irrigation, public property has, in effect become open access. Under this situation there is no management, and any who can exploit the resource do so, leading to overuse and resource degradation. This has been the basis for programs to devolve maintenance responsibility from government agencies to user groups. Transferring of rights corresponding to such responsibilities has often not been addressed in developing management transfer programs. As a result, insecurity of water rights has emerged as an important second-generation issue in irrigation system transfers, because they affect the users' time horizon and incentives to take care of the systems (Svendsen 1997).

It is not only the government that may have limited ability to maintain systems under public property. User groups may also be unable to formulate maintenance decisions that meet the needs of all members, especially when there are significant differences in the interests of various groups, e.g. head and tail enders, or may be unable to enforce rules. Vesting rights in user groups will not lead to effective maintenance of irrigation systems unless there are strong common property regimes that involve rules, decision-making processes, resource mobilization, and enforcement capacity. Experience has shown that it is difficult to prevent free riding behavior (whereby some members feel they can benefit without contributing to maintenance) in common property systems. The empirical literature demonstrates that there are a wide range of rules and institutional arrangements that can be effective for farmer management of irrigation infrastructure and water as common property, with monitoring and sanctions for those who break the rules and do not contribute. A common and effective arrangement to prevent free riding is to link rights to water with contributions for maintenance, underscoring the links between rights to infrastructure and to water. Thus, attention needs to be paid to the strength of the institutions that stand behind any rights system, whether public, common, or private.

A reasonable guideline for irrigation programs is to ensure that the rights of each party (including user groups, government agencies, and others) are commensurate with their responsibilities in managing the resource. “Commensurate” implies both a match between the magnitude of rights and responsibilities and their location. Those with greater responsibilities will need a more complete bundle of rights, higher returns to supply the necessary resources, and the rights should apply to the same level of the system (from field channels to headworks) as the responsibilities.

This implies that cases of "community-based resource management" (where users take over more of the maintenance function) would have stronger rights for users than cases of joint management, where the state retains an active role in maintaining the system (Meinzen-Dick et al. 1997). However, even in the case of joint or co-management, some official affirmation of the users' rights may be required to coalesce or strengthen local collective action for maintenance, and to place users on a relatively more even footing with the agency staff. The intra-household and intra-community bargaining literature has shown that those with more assets (especially property rights) are treated better and are better able to negotiate than those without assets (Agarwal 1997; Haddad, Hoddinott, and Alderman 1997; Quisumbing 1994). This principle also applies to negotiations and interactions between the users and agencies in comanagement situations: users with recognized rights are more likely to have a say in decision-making, to be the arranger, rather than just consumer, of services. In terms of service provision, users with stronger property rights will have a better bargaining position with service provision agencies.

## 10. Implications of Property Rights for Irrigation System Maintenance

Dealing with property rights is a complex and politically charged issue. Why, then, should practical people concerned with irrigation maintenance be concerned with these issues? The answer is because property rights play a central role in both incentives and authority for maintenance activities.

Those with long-term rights to the benefit stream which irrigation makes available have a stake in keeping the system functioning effectively. The more secure those rights are, and the larger the benefit stream, the greater the incentive. This applies particularly to irrigators, who presumably should be receiving substantial benefits from the combination of water, infrastructure, and land. But it also applies to service provision agencies: if they receive income from the irrigation assets, it is in their interest to keep those assets in good condition. This income stream can be in the form of irrigation service fees and/or fishing rights, trees along canal banks, etc. The important point is that the flow of benefits should be somehow related to the quality of the water delivery service, which is supported by good maintenance.

Thus in anticipating the interests, authority, and resources for carrying out maintenance, it is useful to examine *who* holds *what rights* to *each type* of irrigation asset: infrastructure, water, land, and fish, trees, roads, etc. For assessing security of tenure, it is also important to look at the expected *duration* of the rights, and to identify what *institution stands behind* the right.

Proper alignment of property rights and maintenance responsibilities can create better incentives for maintenance. Long-term rights to derive income from a resource not only give individuals or agencies a strong stake in the system, but also provide the financial resources necessary to undertake the maintenance. This applies in many farmer-managed systems, where the group of irrigators can claim ownership of the infrastructure and, in many cases, has a strong claim to the water resource itself. If this is effectively backed, either by the state or by local institutions, then the irrigators will have both the authority and the incentive to keep the system operating. By contrast, in many agency-managed systems, the government claims ownership rights to the infrastructure and water, while the farmers have rights to the land, but minimal or unclear rights to the water and infrastructure. But whereas the government may claim rights to irrigation assets, the agency charged with maintenance may not have the right to derive income from them, especially when irrigation fees are paid into a central treasury, rather than to the service agency. Further, if the government does not have

effective ways of sanctioning those that do not pay for irrigation, then the right to derive income from the irrigation assets becomes worthless.

Irrigation management transfer programs and reforms to create financially autonomous irrigation agencies can therefore be understood as an attempt to shift closer to the farmer-managed irrigation model, with users having greater control rights, and therefore a greater stake in maintaining the system. The ability to determine the service provider and level of maintenance service can be seen as one of the important control rights. Thus the arranger of service effectively holds control rights over the infrastructure.

In assessing whether incorrect alignment of property rights contributes to poor maintenance, it may be useful to ask the following series of questions:

1. Who is responsible for providing what kind of maintenance service (for each responsible party, then ask the following questions)?
2. Incentive check:
  - (a) Do they receive a direct benefit from the system, e.g. in production (use rights)?
  - (b) If not, do they receive income from the system (usufruct rights)?
3. Resources check:
  - (a) Are the returns from the irrigation system that are received by the management entity (users or agency) sufficient to carry out adequate maintenance?
4. Authority check:
  - (a) Do they have the authority to do the work, change the system (management rights)?
  - (b) Can they exclude or sanction those who use the system in inappropriate ways (exclusion rights)?
5. Accountability check:
  - (a) Are service providers accountable to users, e.g. through recall or other sanctions if they do not comply with their agreed maintenance duties?
  - (b) Can users be sanctioned, e.g. through loss of rights, if they do not uphold their responsibilities?

This series of questions can be a useful guide. However, it is important to look not only at “official” rights, but to “effective” rights, i.e. rights that are acknowledged by local parties, and can be enforced, the “rules-in-use” (Ostrom 1992).

While it may be tempting to focus on rights to infrastructure, infrastructure alone does not deliver a benefit stream. It is therefore necessary to look also at who holds what rights to allied resources. Of these, water rights is generally the most important. It is also likely to be the most complex and controversial. While the government may insist on state “ownership” of water rights, there is still considerable potential to affirm use and even control rights over water. Rights to other resources such as fish or trees can provide important contributions to maintenance resources, and therefore merit attention.

Careful study of property rights acknowledges that there are multiple sources of property rights. What does this imply for policies regarding property rights? In many cases, project regulations can change rights (or at least one of the bases for claiming rights). Projects therefore have considerable scope to change rights, but also a serious responsibility to look at the implications of changes for property rights. It also means that, if state law is not the sole source of rights, changing a law does not automatically change rights. However, changes in statutory law will have an influence on rights, by providing a different base for people to appeal to, and by giving some level of government backing to the rights.

There is no single prescription for property rights over irrigation assets that will be appropriate in all situations. However, in developing effective institutional arrangements for provision of irrigation maintenance services, property rights, and the social relationships that back them up, merit careful attention. Neither users nor service provision agency, nor the state need hold all rights. Rather, arrangements that assign different bundles of rights to use, control, and derive income from the resources are likely to lead to more effective comanagement arrangements.

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