

Water Rights in Farmer Managed Irrigation Systems in India: Equity, Rule Making, Hydraulic Property and the Ecology

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Abstract

Water rights in farmer managed irrigation systems in India have been studied in different ways, using different concepts and approaches, relating to the different purposes of the studies. The four ways in which water rights have been understood are: 1) as a right to water, focusing on the equity and social justice aspects of water rights; 2) as rules, constituting the 'mechanics' of irrigation management; 3) as 'hydraulic property, that is, materialisation, emphasising the technological dimension of water rights; and 4) in their ecological aspect, by showing that ecological relations are inherent to the definition of land and water rights. The first two readings are typical social science readings, fully focused on the behavioural and institutional dimension of property rights. The third and fourth reading provide a socio-technical and a socio-ecological perspective on rights by specifying their material dimensions. The presentation of these four perspectives constitutes an argument for adopting a multidimensional, interdisciplinary understanding of the concept of water rights.

Keywords

Water rights, farmer managed irrigation, India, equity, rules, hydraulic property

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Introduction

The category 'farmer managed irrigation system' (FMIS) in this paper refers to those irrigation systems of which the management, and to a considerable degree mostly also the governance, is in the hands of the users of those systems. The category refers to relatively small surface irrigation systems, supplied by small reservoirs (called tanks in South India), river diversions, and sometimes pumping-stations lifting water from rivers or lakes. Palanisami (2000:11-13) reports that the three South India States of Tamil Nadu, Karnataka and Andhra Pradesh have about 150,000 tanks.¹ The area irrigated by tanks is a significant, though declining part of total irrigated area. Palanisami (ibid.:17) reports that at all-India level the share of tanks in total irrigation has declined from 18.5% in 1960-61 to 6.8% in 1990-91. Apart from their physical and economic importance, FMIS have been given great developmental importance, as being the potential harbingers of local self-governance and grassroots, bottom-up human development processes.² FMIS stand in contrast to government managed irrigation systems, in India meaning canal irrigation systems particularly, in which governance and management are largely in the hands of government agencies (notably irrigation departments). Excluded from the FMIS term are, for the purposes of this paper, private (individual) and collective groundwater-based lift irrigation schemes. The reason for this exclusion is that they have a rather separate set of issues associated with them as regards water rights (Saleth, 1996; Shah, 2008).

Though the term FMIS denotes a reasonably clear type of irrigation systems, all words that compose the notion of farmer managed irrigation systems can be questioned. Even when a system of water infrastructure has irrigation of crops as its main purpose, users of the system are not only farmers. The multipurpose nature of the South Indian tanks is well known and documented for instance (Ludden, 1978, 1985); Palanisami, 2000:119-125). In addition, within the activity of crop irrigation, there are other interested parties than farmers, agricultural labourers for instance, while farmers are differentiated as a category along several lines. Management is not an unproblematic term, particular if understood in relation to governance. User governed/managed irrigations systems have complex and changing relations with the state (cf. Mosse 2003). Whether 'corporate organisations' manage the systems in a 'robust' manner, or a 'syndrome of anarchy' or 'chaotic management' prevails is an open question. Lastly, the notion of system needs to be taken with care. For instance, when the water bodies of tanks are understood in relation to their catchment area, and in their groundwater recharge functions, boundaries of the 'system', as well as who counts as a 'user' become a complex question, particularly because functions (and users) change over time. Furthermore, FMIS can be a component of government managed systems, like tanks that have been incorporated in canal irrigation systems, and tube wells are appearing in the irrigated areas of tanks and other groundwater recharge structures on a large scale. The three categories discerned, FMIS, canal irrigation and groundwater irrigation are thus not always separate management units, and are hydrologically integrated at the level of watersheds or basins even when they are operated as separate management units.

These issues are not the main focus in this paper. The categorical enquiry mainly serves to sketch some of the important features of the types of irrigation systems that the category FMIS refers to

¹ Karnataka 36508; Tamil Nadu 39200; Andhra Pradesh 76663. For Andhra Pradesh government statistics show that between 1955-56 and 1986-89 the number of tanks has increased from 58518 to 76663, while irrigated area has declined from 1076992 ha to 989666. The number of tanks irrigating an area of more than 40 ha has declined from 8817 to 7743. Palanisami (2000) also discusses the methodological problems in counting tanks and tank irrigated area. These basic statistics suggest important dynamics in the function of tanks in the past decades. Also see Palanisami and Easter (2000).

² A comprehensive vision statement in this regard is DHAN Foundation (2004).

and that are the subject of this paper.³ This paper discusses FMIS in terms of the question how researchers have conceived of 'water rights' in such systems. In that discussion some of these categorical complexities play a role, but they are not the subjects of discussion *per se*. The main question this paper addresses is how the concept of 'water rights' has been differentially understood in analyses of the functioning of such systems. The category of water rights plays an important role in the analysis of FMIS, in India as elsewhere, but different dimensions of it have been emphasised by different scholars. Many analyses emphasise one particular understanding of water rights, and thus tend to theoretically exclude other dimensions. This paper is a review of how water rights have been 'read' in different types of research on the functioning of Indian farmer managed irrigation systems. The review constitutes an argument for adopting a multidimensional, interdisciplinary understanding of the concept of water rights.⁴

The paper discerns four ways in which water rights in FMIS in India have been looked at: 1) in relation to the question of equity and social justice; 2) as rules governing management; 3) in their intimate relation with infrastructure; and 4) how the ecology and the landscape can be part of the conception of water rights. In the discussion of each of the four different 'readings' of water rights, I discuss one or two examples, rather than attempting a covering review and assessment of the available literature. The objective is to present a general conceptual argument, rather than an argument engaging with specific substantive findings of the literature on water rights in Indian FMIS.

I. Water rights, equity and social justice

Analysis of water rights often takes the form of arguments about the right to water. The focus on the 'right to water' derives from the existence of inequity in rights and in access to water. Water rights in such accounts are primarily related to the question of social justice.

This reading of water rights very forcefully comes through in a collection of papers published in the South Asian journal *Water Nepal* in 2003 in a special issue called 'Water, Human Rights and Governance'.⁵ In the editorial article the authors write that their search is for the "basic human rights associated with water management" (Moench et al., 2003:1). Problems regarding the fulfilment of basic human rights are associated with competition over water, the cost of water, health issues related to substandard drinking water supply and sanitation, displacement of people through the building of water infrastructure, privatisation of rights, and several other factors. The question then becomes "What 'rights' should society retain when, in response to practical management needs or the pragmatic recognition of power relations in society, water rights are allocated to specific users?"

³ Furthermore, renaming the category to for instance user managed irrigation systems, peasant managed irrigation systems, local irrigation systems, traditional irrigation systems, and/or replacing 'irrigation' with 'water', 'water use', 'water control' or 'water management', yields terminology that is uncommon, awkward or unclear, while each alternative category has its own conceptual complexities. I stick to 'farmer managed irrigation systems' as it is a term commonly used in the literature. The reader is kindly requested to keep relevant caveats in mind.

⁴ For those familiar with FMIS, the focus on India may be found somewhat of a random delimitation in the South Asian context, and also in the broader Asian context. There is, for instance, a very elaborate literature on FMIS in Nepal, probably richer than that on India as far as water rights are concerned (cf. Pradhan and Pradhan, 1996; Benda-Beckmann et al., 1997). Some of the important insights on water rights in FMIS have been developed in research on East Asian situations, notably Thailand, Indonesia and the Philippines. Outside the Asian context there is a lively and rich debate on water rights in FMIS in Latin America, particularly the Andean region, including a strong focus on gender relations, as there is in the African context. However, this paper is part of a broader interest of the author to explore academic and policy discourses on water resources management in India specifically – hence the delimitation. I do use some literature not referring to Indian cases also.

⁵ *WaterNepal. Journal of Water Resources Development* Vol. 9/10, No. 1/2, July 2001-July 2003, 422 pp. URL: [http://www.i-s-e-t.org/Water%20Nepal%20\(HRG\).pdf](http://www.i-s-e-t.org/Water%20Nepal%20(HRG).pdf) (accessed 30 January 2008)

Furthermore, if public or individual ‘non-right holder’ rights remain, how should they be protected and given voice?” (ibid.:2) The question of (access to) water as a human right is thus related to the question who holds water rights, and which privileges and obligations are associated with it. “Rights are meaningless unless practical mechanisms exist to ensure they are recognised.” (ibid.:20) These mechanisms are the rights people hold combined with the capacity to voice and defend them. “This is an issue of governance – the processes and structures through which decision-making, implementation, and enforcement occurs in society.” (ibid.:2)

In this discursive construct fundamental human rights (and basic needs) are related to specific rights of people over natural resources (notably water) and people’s decision-making rights (participation in governance on a level playing field). It is probably no exaggeration to say that this basic needs and human rights perspective has dominated South Asian public debate on water (related) rights. How strong that perspective weighs on the public debate is nicely illustrated in the editorial article just quoted. The authors state “(...) participants [of the conference at which the papers in the collection were discussed, PPM] were selected to ensure that currently dominant and polarised debates over human rights and large dams did not overwhelm or dominate the meeting or its products.” (ibid.:3) Though only a few of the papers in the collection discuss Indian situations, the statement on the dominance of a polarised debate around the large dams issue certainly applies to India (cf. Mollinga, 2004).

Menon (1999) is an example of a distributive justice perspective on community based natural resources management. The main target of the paper are ‘common property studies’, and their, in the author’s view, unsatisfactory way of conceptualising (distributive) equity. Menon puts forward a ‘rights based approach’ that he states could do a better job in addressing distributive concerns. The paper provides an interesting overview and critique of the natural resources (community) management literature, by dividing it into three strands: 1) historical studies that counterpose the pre-colonial and the colonial situation; 2) studies discussing conditions for successful collective action; 3) studies that highlight the importance of common property resources for the livelihood strategies of rural communities (ibid.:52-53). In this review he refers several times to examples of inequity in access to water in farmer managed irrigation systems. My main concern for the present analysis is, however, Menon’s conceptualisation of rights in relation to equity. He states as follows.

As Amartya Sen has argued, debates around distributive justice are as much about equality of what as they are about equality per se. For example, utilitarian theories are concerned about equality of utilities, welfare theories about equality of welfares, income theories about equality of incomes and rights theories about equality of rights.” (Menon, 1999:64)

Analytically, and politically, the main focus of such a perspective on rights becomes who has the rights (ibid.:66), and subsequently who can get access to the benefit streams associated with these rights.

In the literature on Indian FMIS, explicit case study analysis of water rights and equity as outlined above is, surprisingly, rare⁶ Most of the FMIS literature focuses on the institutional performance of FMIS, that is, looks at rights from a rules perspective as discussed in section 3 below. Poverty and livelihoods concerns are present in such analyses, but mostly in quite general terms of rural poverty and overall social stratification. Menon’s criticism that in this literature equity and distributive justice are not conceptualised very rigorously, seems to be correct (also see Blair, 1996; Lélé, 1998). The existence of equity and distributive justice problems comes through in several publications, either in

⁶ In contrast to, say, the Latin American literature on the subject. See for instance Boelens and Davila (1998) and Boelens and Hoogendam (2002). For India, the ‘water rights, equity and social justice’ perspective is strongly present in a recent collection of papers on water conflicts (see Prakash and Sama, 2006; Rajagopal and Jayakumar, 2006; Lele and Patil, 2006). Also see Upadhyay (2002).

more broadly cast analyses of rural transformation (see for instance Harriss, 1982; Athreya et al., 1990; Pandian, 1990) or as descriptive inventory of deprivation (see Rajagopal et al., 2002). The most explicit articulation of a rights based perspective as proposed by Menon in the context of water resources management are the dam building and watershed development related struggles in Maharashtra as described in Phadke and Patankar (2006), but that is outside the domain of FMIS as discussed in this paper.⁷ Shah's (2003) analysis of tank irrigation in Karnataka, though not employing a rights vocabulary, comes close to this perspective. She states that her central concern is "to understand how democratic the water utilisation practices in tank-irrigated areas are" (ibid.:260) and sketches, among other things, the reproduction and transformation of the social and economic power of rural farming elites engaged in tank irrigation (ibid.:chapters 5-8)

In this first, political and ethical reading, of water rights in FMIS, these rights would thus be analysed from the perspective of how they enhance or hinder the fulfilment of basic human rights. In other words, the central concern and perspective would be whether, how and to what extent FMIS function in an equitable, socially just and human development-enhancing manner. Given the gross inequities in resource access, including access to water, in FMIS as in other domains, emphasis on this distributive justice/equity perspective is more than justified. However, it is one of several ways of looking at (water) rights, and one that does not give much insight in the concrete working of local rights. The equity/distributive justice perspective looks at who owns the rights and who benefits from them, but does not look at the rights themselves very closely. The latter is the core focus of the second perspective on water rights discussed in the next section.

2. Water rights as rules

In the international discussion on natural resources management the 'rights as/and rules' perspective is undoubtedly the most well known. As part of the 'CPR debate' Elinor Ostrom's work on *Governing the Commons* (Ostrom, 1990) and the subsequent work on how to craft self-governing irrigation systems (Ostrom, 1992; Ostrom and Gardner, 1993) have been very influential in academic as well as policy thinking on irrigation management. Equally influential has been the new institutional economics 'rights as rules' perspective, for which the work of Douglas C. North (1990a, b) has become the standard theoretical reference. This perspective looks at irrigation management and governance from a transaction costs perspective. A third cluster of perspective that looks at rights, rules and norms very closely are analyses of collective action (Wade, 1988) and legal pluralism (Benda-Beckmann and Van der Velde, 1992) with a strong sociological and anthropological flavour.

Though these approaches are very different in some respects, they have in common a focus on concrete analysis of the institutional arrangements that 'make rights work'. In an engineering metaphor, they are all interested in the 'mechanics' of management, collective action and decision-making. For FMIS this translates into detailed studies on how, in Ostrom's terminology, use rights and control rights are concretely operationalised in the management and governance activities in irrigation systems. Two examples in the Indian context that combine elements of these different approaches are Palanisami's analysis of tank irrigation in Tamil Nadu (Palanisami, 2000), and Sengupta's analysis of tank (*ahar*) and diversion (*pyne*) irrigation in Bihar (Sengupta, 2000).⁸

⁷ For an example in the domain of groundwater irrigation, see Prakash and Ballabh (2005).

⁸ Other sources describing and analysing institutional arrangements for management and governance of FMIS, focusing on tank systems, include Shankari (1991), Janakarajan (1993), Sivsubramanian (1997), Sharma and Selvaraj (1999), Selvaraj and Vasimalai (1999), Janakarajan (1993), Venkateshwarlu and Srinivas (2001), Sakthivadivel et al. (2004), Jyotishi and Rout (2005), Menon et al., 2005, and many others.

Palanisami's (2000) focus is on understanding collective action in tank systems. He observes problems in tank management, through neglect of the tank technology and other factors, and aims at tank 'revival for prosperity', the subtitle of the book. His analysis maps out the different types of rights over tank water and water based resources (ibid.:117ff). Quoting Singh (1991) he defines property as "a benefit (on income) stream from any tangible or intangible objects and (or) circumstances" and a property right "as a claim to a benefit stream that is recognized and respected by people conventionally, legally or otherwise" (Palanisami, 2000:119). He distinguishes, from a legal perspective, several types of rights: natural rights, customary rights, positive & negative rights, individual & group rights, and riparian rights. Informing his analysis is the perspective that "property rights have a critical bearing on the management and sustainability of tank systems by creating expectations on how people will act; generating incentives for use, protection, and investment in the systems; and conveying the resources and authority to manage the resource." (ibid.:120) Subsequently he analyses the bundle of rights that governs the multiple uses of tank resources in a sample of 80 tanks in Tamil Nadu. Palanisami looks at the complexity of rights, including competing and conflicting claims, by operationalising, following Schlager and Ostrom (1992), the bundle of rights as follows (ibid.:121).⁹

Use rights:

1. *Access rights*: the right to enter a defined property of a tank system and enjoy non-subtractive benefits.
2. *Withdrawal rights*: the right to obtain the benefits from the property of a tank system by taking out or utilising some portion of it.

Control rights

1. *Management rights*: the right to regulate use patterns and transform the resources of a tank system, potentially altering the stream of benefits from that resource.
2. *Exclusion rights*: the right to exclude/keep out the non-right holders from the property of a tank system, and to decide how access rights can be transferred.
3. *Alienation rights*: the right to sell, lease or bequest control rights to the resource of a tank system.

Mapping who holds which rights to the different uses of the tank resource (irrigation, fishing, social forestry, watering livestock, domestic use, and other uses) Palanisami concludes that:

... [a]lthough various state government departments and the Panchayat Unions are formally vested with control rights (...) of most tank assets, in practice they do [not]¹⁰ have the local institutional presence to exercise these rights effectively. Such public property degenerates into open access, subject to degradation through overuse, unless local management institutions step in. (Palanisami, 2000:126)

This conclusion supports the perspective that the (colonial and modern) state may have assumed authority (and ownership) over tanks, but in practice the systems remain predominantly user managed and governed. This configuration creates serious problems.

In many cases local tank management institutions are less effective than in the past, eroded by the government claiming some rights on one hand, and by well owners and other critical stakeholders ignoring the local tank authorities as alternative water sources become available. (ibid.:126)

⁹ See Schlager (2005) for detailed discussion of this perspective.

¹⁰ The original text does not have the [not], but from the context it is clear this is an omission and that the absence of local presence is the intended statement.

But Palanisami also observes that

[i]n terms of modern principles of water management, a basic criticism against customary law i[s] that they seem to acknowledge no national obligation superior to internal obligations between laws or castes. It becomes possible, hence for one caste to dominate the various productive uses of water and either to exclude others or to admit them only at a price. (ibid.:118)

This sketches the basic dilemma of how state-tank users relations could or should be shaped. Palanisami also maps which rights are well specified and enforced, and which less so. He finds that access, withdrawal and management rights are usually more strongly specified than exclusion and alienation rights. This suggests that tank communities may find it difficult to adapt overall governance arrangements even if they are quite effective in day-to-day management of the system. He also finds that collective action, that is efforts at community level to enjoy and maintain the multiple benefit stream of the tank system through resource mobilisation, joint resource management and conflict resolution (ibid.:130), is at a low level in more than half of the tanks investigated, pointing at the prevalence of conflicts (among farmers, between user groups, between managers and users) in the tank systems (ibid.:136ff).

The purpose here is not to discuss the details of the substantive analysis Palanisami provides, but to outline the type of approach adopted for the analysis of water rights. The emphasis is on the mapping of (multiple and complex) rights. The objective is to formulate conclusions on how the performance of tank systems could be improved in term of higher productivity of the land and water resources for sustainable livelihoods (ibid.:147). The perspective taken is that the state needs to create clear legal and financial frameworks for local organisations (Water Users' Associations) with full autonomy – clear rights generating clear incentives for effective performance. This reflects the institutional economics perspective from which the analysis is undertaken.

The case of tank and diversion irrigation in Bihar analysed by Sengupta (2000)¹¹, in contrast, takes a more sociological and negotiation oriented perspective than the more economic and instrumentalist perspective of Palanisami's analysis, by concentrating on the *contestation* of (water) rights in tank systems.¹²

Sengupta makes the important observation that “the colonial government left most natural resources with poorly defined property rights” (Sengupta, 2000:138). The post-independence government, though very present in rural areas and in resource management has not done much to change that situation. As a result, processes have ensued in FMIS, as in other forms of local resource management, of spontaneous self-organization through ongoing conflicts and negotiations. A second important observation Sengupta makes is that we have to be very careful with calling the FMIS *traditional* irrigation systems. They no longer exist in their ‘traditional’ social and physical settings, and have transformed their internal working over time (ibid.:138). Rigid concepts of (customary) rights make no sense in situations of ongoing negotiation of rights, even when some principles may be enduring.¹³

¹¹ Also see Sengupta (1980).

¹² A recent collection of papers on water property rights issues from a sociological and anthropological perspective focussing on the plurality of rights and the social relations of power that are part of irrigation management is Roth et al. (2005). It has no case studies of FMIS in India.

¹³ Sengupta's paper also illustrates the importance of history in studying (water) rights in FMIS, something that also characterises Mosse's work (see for instance Mosse, 2003) One aspect of colonial history is that the tanks (*pyne*) systems of Bihar went unrecorded, in contrast to those in South India, and are therefore relatively unknown to irrigation and other scholars.

In the Bihar systems diversion canals (*pynes*) take water from rivers and convey the diverted water to local storages/tanks (*ahars*). The systems are complex because the canals branch out and interconnect, multiple tanks are fed by the canals, and there have been infrastructural changes through government building weirs, new irrigation systems and other infrastructure that has affected the working of the systems, with the government being largely ignorant of the of the potential of the indigenous systems (ibid.:152). Not surprisingly, the system of water rights in the systems is also complex, and confused – reflecting this situation and history.

The case study describes the negotiations over water rights that take place in detail. One important theme is the mismatch between formal legal decision making in courts on water rights conflicts, and the practicalities of the local situation to which it has reference. For example, in one case an existing record of *pyne* rights was not admitted because it was considered to express a private property right. The position taken by the court was that no one has any right to obstruct the flow of a natural watercourse, effectively making most indigenous irrigation practices illegal (ibid.:153). This leads to strategic presentation of cases to the court so that they become admissible, and a resort to negotiated local arrangement between parties without formal legal standing. Sengupta observes that “[i]f at present a party seeks adjudication, it is not for mediation but to harass the opponent and to bring them to terms.” (ibid.:154) This is a clear example of using law as a resource and of forum shopping, two central themes in the social anthropology of law (Benda Beckmann and Van der Velde, 1992), but they are hardly a constructive contribution to water resources management in this particular case. The law does not help to settle the rights but lends strength to different sides in the negotiations, with access to the law being highly skewed, as the transaction costs of using it are high. “[T]he net effect of law is that conflicts linger in civil courts for decades, with manipulative juggling of explanations and a smattering of criminal cases, ultimately being resolved primarily through self-organization by the users outside the ambit of the legal system.” (Sengupta, 2000:155)

The local situation is that:

[d]istinct individual rights to water supply simply do not exist: they are secured only by being a member of a particular corporate group or ‘community’. Most members who own land in a particular command area also belong to the same caste and reside in the same hamlet. They have to follow somewhat uniform agricultural and water application practices. These are not demanded explicitly or even consciously. The very functioning of the system is such that one cannot take advantage of the full benefit if one differs in one or the other of the community attributes. (ibid.:155).

Local water distribution is more or less ‘automatic’ – conflicts seem to emerge primarily between communities.¹⁴ Local water management thus requires little explicit decision making. Another aspect is that landholding is fragmented and spread in this region and that as a result most or all would similarly experience the effects of water scarcity in a command area, as there is no clear ‘head-tail’ pattern in land distribution. The land use pattern is flexible also in the sense that when there is a drought the farmers do not use the gravity irrigated command area, but the tank bed. This flexibility is possible Sengupta report because farmer successfully lobbied against consolidation of land owned by each farmer in this part, that is against the individualisation of land rights in this part of the system (in contrast to the situation in South India as regards tank bed cultivation).

The point in the context of this paper is that in Sengupta’s term ‘imaginative property rights’ exist at the local level. These rights and rules serve to structure local water management practices, often quite effectively, though they should also not be idealised. State agencies have great difficulty to recognise, in both senses of that word – actually observe them, and acknowledge these local rights and rules. According to Sengupta, the “imaginative property rules were beyond the grasp of the

¹⁴ This is not dissimilar to my own finding in canal irrigation that conflicts between tertiary units (outlets) along a canal abound, but conflicts in the distribution within outlet command areas is often not explicit (see Mollinga, 2003).

technocrats” and the bureaucracy “often have a warped sense of rights” (Sengupta, 2000:158). The prerequisite for meaningful negotiation “that both parties are willing learners” is not fulfilled (ibid.:158). This is part of the broader challenge to find “the appropriate balance between government coordination, and incentives for local management.” (ibid.:159)

The two examples in this section were chosen to illustrate that the ‘mechanics of water rights’ in FMIS can be studied using different approaches and from different standpoints. An approach primarily grounded in a new institutional economics frame associated with a state policy standpoint, was discussed next to an approach with a historical, sociological and political angle on FMIS, from a users and contestation standpoint. However, comparison also shows that the developmental concerns that inform the analysis and the direction into which change and transformation is sought are not too different. There is no one-to-one relation between politics and method. On a broader plane, the analysis of ‘rights as/and rules’ is characterised by increasing intermingling of perspectives, as well as a narrowing gap between research and policy (cf. Bruns et al., 2005; Meinzen-Dick and Di Gregorio, 2004).

What remains to be developed more systematically in the Indian, and possibly the South Asian, context of FMIS analysis is what could perhaps be called a ‘political economy of rights as/and rules’. This could take its cue from the observation that in addition to a theory of rights, a theory of access is needed (Ribot and Peluso, 2003). Such an approach would combine the first and the second reading of water rights in FMIS as presented in this paper into a single framework.

3. Technology as water rights: hydraulic property

The two perspectives on water rights discussed so far, the equity/social justice and the rules perspectives, could be labelled as truly *social* perspectives. Their subject matter is the social relations that are part of irrigation management, and the meaning and impacts of these on individuals and groups of human beings. The technical and ecological dimensions of irrigation are little more than the setting and background of the analysis – they can be enabling or constraining, can be positively or negatively impacted, and can provide resources and be instrumental for human social action, but they do not play much of a role by themselves. The first two perspectives are strongly human behaviour and institutions oriented.

In his analysis of FMIS in Thailand, Indonesia and the Indian Himalayas, Coward (1986a, 1986b, 1990) analyses the intimate relations between the social relations of water management and the technical infrastructure (the irrigation facilities). The basic argument he puts forward is that “(...) creation of irrigation facilities establishes among the creators property relations.” (Coward, 1986b:227) Naturally, “[n]one of this property can be sustained over time without frequent renewal through the investment of labour and capital.” (ibid.:225) Therefore “the basis for [the] social action [of the community irrigation group] is the common relationship they have with regard to property objects which they have created.” (ibid.:225)

This means that the creation and upkeep of irrigation infrastructure go hand in hand with the (transformation of the) social relations through which that infrastructure is used: they co-evolve and are each other’s expression as ‘hydraulic property’.¹⁵

¹⁵ To my knowledge, Coward first used the ‘hydraulic property’ category in this meaning. Soils and canals also have ‘hydraulic properties’ in a material sense as physical or technical characteristics (the hydraulic conductivity of soils and the rugosity of canals for instance). Coward and those who have developed the concept further show that the technical (including the hydraulic) properties of the irrigation facilities do matter for the relations of hydraulic

Coward develops the insight in a paper on property rights arrangements in FMIS in the Kangra valley of Himachal Pradesh (Coward, 1990). The water rights in these diversion schemes were recorded in the colonial 'settlement' of land rights in the second half of the 19th century. Whether that process only consolidated existing rights, or also transformed some of these and created new rights, is not totally clear, but the rights that were recorded structure local irrigation management and governance to the present day.¹⁶ Coward notes that

[i]ncluded in this description of rights is detail regarding the materials that can be used to construct each diversion structure. The right to build a diversion structure with both stone and mud plaster rather than only stones, for example, really is a statement of rights since the former structure will capture a larger volume of water. (ibid.:81)

For one of FMIS cases he discusses he states that “[t]he irrigation rights of the water users in this network were implemented through a complex set of irrigations structures and distribution rules. (ibid.:81)

The division structures involved are devices that are capable of proportionally distributing the water. Water rights are defined as shares of a flow (which may be varying in different parts of the season for different operations, and between seasons). The device thus expresses this definition of the right.¹⁷

In the Banuri areas there is a permanent division structure that divides the flow in the main canal with half going to Banuri and half to Band Bihar, Either just before or just after the weeding (depending on the water supply), water distribution in the reconstituted Bharul network is switched to a continuous flow delivered in an amount proportional to the area being served. This arrangement is achieved by installing simple proportioning structures (here called thelu) at each (or most) location[s] where a junction occurs in the canal system. (...) The width of the openings created by the thelu is measured in 'fingers' depending upon the area of land to be served by a given turnout. (...) the thelu is a simple but effective device by which the abstract water rights of individuals can be translated into calibrated water flows. (ibid.:83)

The reproduction of water rights happens through the contribution of labour for maintenance of the system.

The maintenance tasks (...) are not equally distributed among the water users in the network. In Bharul kuhl the principle used to organize labor for maintenance reflects a general rule recorded in Palampur's Riwaji-abpashi [the record of irrigation customs, PPM] – the 'last' village is responsible for maintenance and repair. (...) In theory, the labor needed for performing these tasks is provided by water users in relation to the size of their irrigated area; those with larger areas are to provide more labor than those with small units. However, there was no evidence in Bharul that this rule is closely followed or that records are kept regarding participation in maintenance functions. (...) The lower zone people (...) reproduce their water rights in the Bharul network even though the costs to them are considerably higher than those incurred by the upper groups. (ibid.:84)

property, and vice versa. Such phrasing easily causes confusion when the two senses of 'hydraulic property' are not clearly understood and distinguished. That both are observed and recognised is not self evident – neither for engineers nor for social scientists. As Coward notes, “[t]he untrained observer can easily fail to extract from the rude weirs and rough canal structures the sometimes intricate property relations which (...) prior investments have created.” (Coward, 1986b:226)

¹⁶ Coward's case study in the Indian Himalayas provides a case study where water rights were meticulously recorded in the colonial 'settlement' process (and perhaps new rights were created), while in Sengupta's Bihar case these rights, and even the systems themselves went unrecorded because of the way the 'settlement' was done. To my knowledge there is no systematic analysis available of such diversities in FMIS history and practice in India. Agarwal and Narain (1997) is an impressive descriptive inventory of traditional water harvesting system in India. However, the approach to water rights remains confined to the 'equity' perspective (ibid.:325, 330-331).

¹⁷ Time shares are also used in the systems discussed.

Several additional points can be derived from this extract. Firstly, the observed reproduction of rights through investment of labour does not necessarily happen in an equitable manner. Secondly, the 'precision' with which rights are realised and rules are implemented differs from case to case. This reinforces the point made in the previous section that apart from analysis of rights, the analysis of access mechanisms is important.

The hydraulic property perspective on irrigation management and technology is a nice example of effective conceptual capture of the hybrid, sociotechnical nature of irrigation.¹⁸ Though developed independently from social construction/shaping of technology and actor-network approaches (see for instance Bijker and Law, 1992; Hughes, 1987), the hydraulic property insight fits within such frameworks very well and can be further developed by means of it. Shah (2003) is a constructivist approach to the analysis of tank irrigation in Karnataka. Shah starts her book with a quotation from Bruno Latour that very adequately expresses the overall theoretical point about the co-evolution of technology and institutions.

The great import of technology studies to the social science is to have shown, for instance, how many features of the former society, durability, expansion, scale, mobility were actually tied to the capacity of artefacts to construct, literally and not metaphorically, social order (...) They are not 'reflecting' it, as if the 'reflected' society exists somewhere else and was made of some other stuff. They are in large part the stuff out of which the socialness is made." (Latour, 2000:109, quoted in Shah, 2003:1)

Shah investigates resource utilisation patterns in tank irrigation in Karnataka from this perspective. She suggests, "the design principle of a labour intensive construction method of embankments carries the imprint of the historical era that rested on a rigidly built, hierarchical social order which exerted a considerable degree of control over labour." (Shah, 2003:261) This is supported by the observation that in the present situation, with expanded market relations, decentralisation policies and a general loosening of social rigidities, rural elites find it increasingly difficult to mobilise labour for tasks like canal cleaning, sluice operation and field-to-field irrigation from lower caste labourers. They turn to the state for investment in maintenance and management. (ibid.:262-263) "This push and pull – the push that rural elites are increasingly less inclined to invest in tank resources and the pull that traditional social arrangements to mobilise lower caste labour cannot be reproduced in their entirety – has created a crisis in terms of management of tank resources." (ibid.:263) An example of field level irrigation practices she gives is how the field-to-field irrigation method favours head-end farmers by materialising a certain order of irrigation (ibid.:269-270). Shah casts here analysis in the language of 'social relations of power' rather than in that of 'property rights', but the evidence she is able to provide on the technology-social relations linkage strongly suggests that the 'hydraulic property' concept could be further developed by incorporating a constructivist analysis of technology into it.

Apart from, or maybe because of, being an analytically powerful concept, the hydraulic property concept has significant policy implications. The intimate relationship between the social relations of management and governance and its technical infrastructure means that both external infrastructural intervention and external institutional intervention may unbalance an irrigation system and lead to ineffective management. For example, a government programme replacing temporary diversion weirs made of brushwood and stones by permanent, concrete weirs may undermine the water rights of tail-enders in the system when these reproduce their water rights by providing labour for the seasonal weir reconstruction. When a government programme assumes ownership rights of an FMIS and establishes a water users association to implement state policies, the user investment in system maintenance may reduce or stop and the infrastructure deteriorates.

¹⁸ On the sociotechnical approach to irrigation, see for instance Bolding, Mollinga and van Straaten, (1995); Vincent (1997); Mollinga (2003); Bolding (2004).

Coward (1990:86-87) discusses examples of such interventions for one of the FMIS he studied in the Himalayan region. He gives both successful and unsuccessful examples of infrastructural intervention by government agencies. The success or lack of it depended on the maintenance of a 'matching' relationship between the institutional arrangements and the infrastructure. He also observes that external intervention often overlooks this relationship and thereby easily unbalances the functioning of the systems.¹⁹ Studies in many parts of the world have supported and elaborated this argument, but detailed discussion of these examples is outside the scope of this paper.²⁰

To conclude this section, that water rights take on a material form in the characteristics of the infrastructure of the systems in and for which they exist, and that the activity of infrastructure creation and upkeep is a process of property rights creation and upkeep, are the two theoretical ideas captured in the concept of hydraulic property. This is the third 'reading' of water rights in FMIS, and the first of two interdisciplinary readings. The second interdisciplinary reading is a similar insight as regards the ecology, which is discussed in the next section.

4. Ecological relations as water rights²¹

The fourth reading of water rights in FMIS can be regarded as an elaboration of the previous discussion of the 'hydraulic property' concept. It broadens the scope from water rights and technology (infrastructure) to water rights and the ecology (landscape). In her study of the interaction of pond (tank) and canal water management in a watershed in the Palakkad region of Kerala, Krishnan (2008) links the ecological characteristics of the landscape to the (land and) water rights that govern its use.²² She documents how ecological relations were historically part of the definition of land and water rights in a way that achieved ecological sustainability. When land and water rights were changed without being cognisant of their ecological meaning, an, again, uninformed bureaucracy wreaked havoc rather than achieved its stated objectives of equitable development. The case is that of post-independence land reform and irrigation development in a landscape where ponds (small tanks) captured runoff and groundwater from forested uplands, to irrigate paddy in the lowlands. The land used to be owned by landlords (*janmis*) who rented them out to tenants through intermediaries (managers). Those cultivating land in the command area of a pond (tank) had a water right attached to it, involving access rights to the pond (tank) water, access to the upland forested area for forest products for their own use, while there were also arrangements for pond (tank) maintenance. The *janmi* undertook regular desilting of the pond (tank), through the supervisor appointed by him. Day to day activities like cleaning run off channels in the catchment (necessary to

¹⁹ This conclusion is very similar to that of Sengupta discussed above. However, Coward observes positive 'matching' also, where Sengupta hardly found this.

²⁰ For example from Nepal, see for instance Ostrom (1992); on Bali, Indonesia, see Lansing (1991) and Horst (1996); on the Andean region, see Boelens and Hoogendam (2002). The literature on South Indian tank irrigation rehabilitation also provides evidence for this point (Shah, 2003).

²¹ I thank Jyothi Krishnan for commenting on and correcting this section.

²² I have searched for other papers (on Indian farmer managed irrigation systems) presenting a similar argument about ecological relations internalised into property rights arrangements. I haven't found them, though I would not want to claim my search has been exhaustive. Wade (1988) is an exploration of the role of ecology in societal organisation, and Mosse (2003) wants to develop a social ecology of water with South Indian tank irrigation as the main case (Mosse, 2003: 3 ff.). I can only speculate about the reasons for the absence of an explicit ecological perspective on water rights as discussed in this section. A clue may lie in statements by Mosse like the following: "Ultimately, ecology and history will be shown to be inseparable (Mosse, 2003:6) and "...it is impossible to separate out the facts of property - land and water - from political or kinship structures through which they are represented." (ibid.:21) It seems to me that the analysis of Krishnan, while acknowledging, like in Mosse's perspective, that ecology and history, ecology and social relations, have heavily intertwined development trajectories, constituting each other, shows that analytical separation has its merits.

fill the tank), and other regular tasks, were undertaken by permanent labourers who worked for the concerned tenant(s).

The Kerala government decided to implement a land reform and distribute the landlord owned land to the tillers, to achieve equitable access to land. Around the same time the vesting of privately owned forests with the government was implemented. The time lag between the promulgation of the forest act and its final implementation enabled landlords to dispose of the valuable trees, resulting in deforestation of the uplands. Landlords also made sure that they maintained access to the valuable valley lands by strategic registration of plots. When the uplands and lowlands were redistributed under the land reform process, only land rights were consciously redistributed. The government overlooked the water rights linked to land rights. Some land kept the water rights attached to it, other land did not. Many former tenants who obtained small plots of land remained without water rights.

In parallel a government irrigation system was constructed and implanted on the landscape without taking cognisance of the pond/tank systems already extant. The water supplied through the government canals to a significant extent ended up filling ponds/tanks, whose original function changed from capturing runoff and groundwater to capturing canal water. The public water provided by the government system was privatised the moment it entered the ponds/tanks, and became accessible only to those with water rights to the tank. Krishnan (2008) documents graphic examples where among adjacent plots one gets ample water for paddy irrigation from a tank (originally being canal water) because the owner has part of the original water rights attached to his land right, while the next plot is drying up because the owner has no water rights to the tank connected to his land right, and can only acquire water at great cost (by investing in pumping for instance) or by depending on the mercy of his neighbour.

The point in the context of this paper is that land and water rights were originally connected, and, most importantly, consolidated the demarcation of paddy cultivated lowlands and forested upland that allowed the tanks to be refilled, regulated the access to and extraction of forest products from the uplands, and included labour arrangements for the reproduction of the water management system. In the process of land redistribution land and water rights got disconnected, leading to the undermining of the ecological integrity of the landscape. The area is now a region suffering from water scarcity, while having a yearly rainfall averaging around 1500 mm. The irony is, of course, that ecologically sustainability was achieved under a system with feudal characteristics, while ecological degradation ensued when land reform was implemented on welfarist principles driven by a communist party political agenda. Put in a more nuanced manner, had the need for water (rights) reform in addition to land reform been realised and taken up, and would the ecological importance of the forested uplands have been recognised, there would have possibly been other (ecological) landscape management options. The process that did happen has produced new forms of social inequality combined with ecological degradation. The recently started decentralised planning seems to be able to do little so far to remedy the situation.

Apart from the depressing outcome of this rights reform and development process, the conceptually interesting point for this paper is that ecological relations were part of the definition of the land and water rights. How rights are defined shapes the landscape, and the reproduction of certain landscapes requires specific property rights arrangements. The parallel with the 'hydraulic property' concept seems evident, even when an appropriate phrase is still lacking – 'ecological property' or 'landscape property' sound awkward (as yet).

The inherence of ecological relations in land and water rights concepts, for better or for worse, that is, enhancing either ecological integrity or degradation, is the fourth and last reading of water rights in FMIS, and the second interdisciplinary one.

Conclusion

This paper has presented four ways in which water rights have been understood in analyses of Indian farmer managed irrigation systems: first as a right to water, emphasising the equity and social justice aspects of water rights; second as rules, constituting the 'mechanics' of water distribution and other aspects of irrigation management; third as materialisation, emphasising the technological dimension of water rights; and fourth in their ecological aspect, by showing that ecological relations are inherent to the definition of land and water rights. The first two readings are typical social science readings, fully focused on the behavioural and institutional dimension of property rights. The third and fourth reading provide an interdisciplinary perspective on rights by specifying their material dimensions.

The argument following from this is that these different perspectives do not exclude each other, but rather should be seen as identifying different and complementary dimensions of a single phenomenon. That is, water rights (and property rights in natural resources more generally) are a multidimensional concept. In the literature on Indian FMIS the first two readings have, by far, received most attention; the third and fourth play a small, if not marginal, role in the debate on water rights. This is not a problem so much because it implies the dominance of social reductionist analysis of water rights²³, but it is primarily a problem because of the very substantial developmental and policy implications of ignoring the technological and ecological dimensions of property rights – as the disaster stories referred to above have hopefully illustrated. There, thus, is a case for attempting to develop a comprehensive, interdisciplinary framework for the analysis of water rights, in FMIS as in other situations. The first step is to recognise and acknowledge the different dimensions of water rights, the second to understand their interrelationship. This paper has attempted to provide a convincing account for the first step. The second step involves developing further a 'landscape approach' to irrigation and water rights (Coward, 2005; Mosse, 2003: chapter I). This is a project that remains to be completed, both at the analytical and at the practical level.

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²³ This is not meant to be a statement on the contributions discussed in the paper; these are among the most multidimensional analyses of water rights in FMIS, even when for the purposes of this paper they are discussed under one heading only.

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