

Water Rights and Poverty Alleviation: Inclusion and Exclusion of Resource-Poor Women and Men as Rights Holders in Externally Supported Irrigation Development

Barbara van Koppen¹

ABSTRACT

Poverty alleviation is the ultimate aim of external agencies supporting irrigation development. However, information on processes by which resource-poor women and men are included or excluded as legitimate rights holders to irrigation water is still scattered. This paper attempts to systematize existing evidence of interventions in both public and private irrigation. This evidence reveals that in public irrigation, vesting water rights in household heads and allocation on the basis of formal, registered land rights tend to exclude the resource-poor, especially women. On the other hand, allocation to individual producers based on former land and water rights and/or on participation in construction work is likely to vest water rights in the resource-poor, provided these legal arrangements have already crystallized before the construction phase or turnover starts. In private irrigation, water rights accrue to the owners of infrastructure. Ownership is only within the reach of the resource-poor if appropriate infrastructure and financing facilities are available. On private water markets smallholders have access to water as buyers too. Groups of landless men and women can obtain a direct income from irrigation as water sellers.

INTRODUCTION

Core Issues

Poverty alleviation is the ultimate aim of most governmental and nongovernmental agencies supporting irrigation infrastructure development and management (cf. World Bank 1990; IIMI

¹Department of Irrigation and Soil and Water Conservation, Wageningen Agricultural University (after September 1998, Coordinator, Gender and Water Program, IWMI). The author is grateful to Keebet Von Benda-Beckmann, Doug Merrey, and Margreet Zwarteveen for their comments on an earlier draft of this paper.

1996). In this light there are four relevant questions within the core competence of these irrigation agencies.

1. *Does external support improve access to water specifically for smallholders, enabling them to improve their agricultural production, incomes, and food security?*

Improved production, incomes, and food security during a longer period of the year are essential aspects of poverty alleviation for smallholders, the world's largest group of resource-poor (cf. Jazairy, Alamgir, and Panuccio 1992; World Bank 1990).

2. *Are opportunities to strengthen access to irrigable land for the resource-poor optimally used?*

Access to land, and especially high-value irrigable land, is a primary condition for sustainable poverty alleviation (cf. World Bank 1990; Agarwal 1994).

3. *Do women's access to water and land, and women's incomes, get priority?*

Women are a priority group in poverty alleviation efforts for several reasons. They represent 70 percent of the poor in the world (UNDP 1995). Moreover, the absolute number of women below the poverty line has increased by 47 percent in the two decades before 1988, whereas for men this is 30 percent (Jazairy, Alamgir and Panuccio 1992). Women's incomes are crucial for the well-being of their households. In poor male-headed households, men's incomes alone are not sufficient. In the poorest households in Bangladesh, for example, women contribute one-third to half of the household income (Safilio and Mahmud 1989). Moreover, a larger share of women's incomes than men's benefits their dependents, as reported in Asia (cf. Agarwal 1994; Safilio 1991) and in Africa (cf. Safilio 1988). Female-headed households depend even more upon women's incomes. These may constitute up to one-third of rural households and are generally among the poorest. Lastly, women's improved economic status is strongly related to lower fertility rates (Safilio 1986).

4. *Are indirect benefits for landless people from external irrigation support optimal?*

Fully landless people have no functional access to land, not even informal or temporary access. By definition this second largest group of the world's resource-poor (Jazairy, Alamgir, and Panuccio 1992) has no opportunity to use water for its own production. However, landless men and women can benefit indirectly from irrigation mainly by on- and off-farm employment generation (cf. Chambers 1994) and relatively lower food prices (cf. Mellor and Desai, eds. 1985).

This paper attempts to assess what answers have been found to the first three questions on a global scale in the last three decades. It explores whether a body of 'generic' knowledge has become available by now. Second, it identifies working hypotheses to orient future research to 'help the world's poorest people to make lasting improvements in their lives' (IIMI 1996). The fourth question is only partly dealt with here, though it remains important.

The review demonstrates, above all, that in the mainstream literature there is a startling lack of empirical data to confirm the claims of agencies that their support alleviates poverty. In the first place, data on the composition of the farmers in a scheme and their access to water are rarely differentiated according to class, gender, and ethnicity. Instead, the water user is often thought to be a man, or a more abstract 'universal farmer.' Equity considerations in water distribution usually refer to equal distribution of a limited quantity of water among as many people as possible, both the head enders and the tail enders. No attention is paid to the social characteristics of these users.

Second, there are only a few empirical studies that assess the relationship between access to water and irrigable land and sustained increases in incomes of the resource-poor (Hanger and Morris 1973; Illo et al. 1988). Poverty alleviation has never been operationalized as a performance indicator in the literature on irrigation performance. As long as that analysis is lacking, one just does not know if the other conditions needed for poverty alleviation, like access to markets and inputs, are fulfilled. Given the lack of data, this paper takes access to water and irrigable land as a proxy for poverty alleviation.

A third omission in the mainstream literature is that projects' choices to vest one group with water rights and not another, are rarely a subject of public debate, and even less documented. In reality, however, such choices are always made. This paper explains how. Although the empirical evidence on the relationship between external irrigation support and access to water and land by the resource-poor is still limited, scattered, and fragmented, some patterns, main issues of concern, and needs for further research emerge. These generic insights and working hypotheses are presented below. The next section highlights the general ways in which external support agencies influence who is getting access to water and who is excluded. Public and private irrigation are distinguished. The following sections discuss public irrigation by elaborating respectively the five main allocation principles emerging from the literature, and the projects' planning procedures. The penultimate section deals with poverty issues and intervention options in private irrigation. Conclusions and needs for further research are summarized in the final section.

VESTING OF WATER RIGHTS IN EXTERNALLY SUPPORTED IRRIGATION DEVELOPMENT

Vesting Water Rights

Access to water is a vague expression referring to multiple aspects of water rights, or 'a bundle of water rights.' One aspect is the vesting of water rights, the basis on which one person, group, or institution obtains a right and becomes eligible to exert claims on a benefit stream of water and to participate in the system, and another not (Von Benda-Beckmann et al. 1996; Ostrom 1994). This paper focuses on processes by which the resource-poor are included or excluded as legitimate rights holders according to the prevailing pluralistic legal systems (Von Benda-Beckmann 1991). Legitimate rights holders have a stronger bargaining position in situations of water scarcity than persons without rights. The difference is usually critical, and will in-

creasingly be so, but there may be other interacting factors and exceptions (Zwarteveen and Neupane 1996).

There are multiple dimensions of water rights, which specify the precise contents of a claim. Thus there are the rights to use water; to construct, operate, and maintain the scheme; to decide on scheme affairs and to represent the scheme to third parties; to formulate and change regulations on use and management; to enforce rules; and to occupy a position of water authority (Von Benda-Beckmann et al. 1996). These other aspects also entail important class and gender dimensions. For example, women may have water use rights, but they are excluded from the boards of water user organizations that govern the collective water source (Meinzen-Dick and Zwarteveen 1998). Very few empirical data are available on these aspects. Another important issue, which cannot be dealt with here, is the realization of rights one has. Especially for resource-poor women and men, having rights is only one step. They may encounter considerable obstacles in realizing them. For instance, they may only get the night turns.

Public and Private Irrigation

Investments in infrastructure are crucial for water rights. Water in the form in which nature offers it has little use value for humans, except as rain on the fields. In virtually all other situations infrastructure is needed to bring water in the right quantity and quality at the right moment to the right spot. Throughout history rights to water conveyed by infrastructure are primarily vested in those who invest in and maintain this infrastructure. Either the agency or the farmers can be the main investor. This paper distinguishes two types of irrigation development accordingly: public and private irrigation.

Public irrigation is irrigation in which the external agency bears most of the costs of investments in the construction or rehabilitation of infrastructure. As the main investor, the agency has a strong stake in the definition of the water rights. This concerns the division of rights and obligations between agency and users, on the one hand, and (our concern here) the necessity to define and implement water rights of potential users, on the other. This allocation of water rights to users occurs in two ways. Physical site selection, layout, and division structures of the infrastructure largely determine which land can be irrigated and how well. Those with former or potential access to that land become the potential water rights holders. All persons beyond the command area are excluded. This allocation is indirect and can be called 'hardened' allocation. Within selected command areas further allocation choices are made by selecting particular groups of potential land users, and not others, as rights holders. From the literature five grounds emerge on which water rights are vested in a certain category of potential rights holders. They are: class and gender characteristics; former land and water rights; productivity; type of land rights; and co-investments in the infrastructure.

Two types of public irrigation need to be distinguished. In the most common type only water rights are allocated. The agency does not interfere directly in land tenure, although gradual changes over time are likely to occur with increasing land value. In particular cases, on the other hand, irrigation development is accompanied by expropriation and reallocation of the whole command area. Drastically improved farming possibilities, opportunities for re-allotment, and technical necessities to change plot boundaries warrant such project-steered, radical changes in land tenure. The world's settlement schemes and also small-scale irrigation schemes in West Africa are examples. Usually, the new land rights automatically imply

rights to the water, so land-cum-water rights are allocated. Other project services, such as inputs, credits, marketing facilities, and extension are often linked to these land rights too.

Water rights or land-cum-water rights are basically defined at two moments in public irrigation. The moment at which water is planned to become available in new ways is the very moment to define the rights to this water, or to the water and land. Hardened allocation through the physical design and further allocation based upon social characteristics largely take place before construction starts. Design and construction are 'technical' phases only, as mainstream literature may suggest. During the use phase, after handover, changes in water rights are relatively minor. The other important moment for (re-) defining water rights is during irrigation management transfer and privatization (cf. Seckler 1993). Public irrigation is further discussed in the next sections.

Unlike public irrigation, there is no dichotomy between investor and user in private irrigation. Private farmers construct or pay, own the infrastructure, select the site which obviously is their own land, and obtain the rights to the water conveyed. In practice, such private owners abstract and dispose of the water as they consider best, at least in regions where regulations for water abstraction are still absent or ineffective. Small-scale mechanized pump irrigation is the most important form of private irrigation nowadays. In the past, larger-scale investments in, for example, canals to take water from distant sources in mountains or in dikes to protect polders were often private initiatives too. Currently, the upgrading of these latter schemes is typically financed by external agencies, and is seen as public irrigation here. Agencies supporting private irrigation can improve the access to water for the resource-poor by facilitating the availability of appropriate technology, financing facilities, and training. Institutional measures to regulate technology use may also be warranted. Private irrigation is further discussed below.

ALLOCATION PRINCIPLES IN PUBLIC IRRIGATION

From the empirical evidence on public irrigation worldwide it appears that allocation criteria adopted in interventions are combinations of five basic allocation principles. Allocation principles are defined as legally and socially accepted justifications to endow particular potential users (and not others) with water rights. These five grounds are the following:

1. *To the resource-poor to alleviate poverty.* Agencies select the resource-poor a priori, directly and explicitly, as the persons to be vested with rights to the water conveyed by planned infrastructure.
2. *To former rights holders to respect the pre-project situation.* In the rights to newly available water or improved land pre-project claimants or elements of pre-project claims are incorporated.
3. *To efficient producers to increase production.* Water rights are allocated to those farmers who, given the social production relations, are able and motivated to make productive use of the irrigation water and other services rendered.

4. *To land rights holders to link water rights to land rights.* Water rights are vested in land rights holders in the command area. In cases in which the whole command area is expropriated and reallocated, land-cum-water rights are allocated. Alternatively, if tenure in the command area does not change drastically under infrastructure development, the existing land rights are the basis to vest water rights under this allocation principle.
5. *To participants in construction to link water rights to investments.* Participation in the construction of the infrastructure, and in later maintenance and/or payment of water fees, is the basis for rights to the water conveyed by the infrastructure.

All five principles may be valid in a specific intervention, but their relative importance differs. Only the first principle is explicit in targeting the resource-poor. In the other four, the selection of rights holders is implicit and the inclusion or exclusion of the resource-poor has to be made explicit. Below, specific cases are discussed under the most dominant principle.

Allocation principles are at the heart of the contents of title criteria in any public irrigation project. In each time- and site-specific project the definition of title criteria, their implementation and realization are highly dynamic processes. The forum of decision makers, the structuring of the process of decision making on the allocation criteria, and their implementation strongly shape the outcome. Therefore, the inclusion of resource-poor women and men in the planning procedures during initiation, plan formulation, and implementation is also critical for poverty alleviation.

ALLOCATION TO THE RESOURCE-POOR

The Principle

Under the principle of direct allocation to the resource-poor, agencies select the beneficiaries from the very start and straightforwardly as the persons to be vested with rights to the water conveyed by new infrastructure.

Such direct and explicit targeting of agency's services to the resource-poor occurs when NGOs set admission criteria for general membership; when governmental and nongovernmental agencies decide to implement women-only irrigation schemes; when the selection of the target group is based on maximum landholdings; or when a gender-balanced representation is required. Targeting infrastructure to people implies that first the people are selected and organized, and only then the physical characteristics like site, layout, and institutional aspects are decided upon. In larger settlement schemes, or in land reclamation, however, selection criteria for settlers may also be based on poverty characteristics (Merrey, D., personal communication).

Empirical Evidence

This principle of direct allocation to the resource-poor is increasingly applied not only by nongovernmental organizations but also by state agencies. Cases are elaborated in detail under land-cum-water rights, participation in construction, and planning procedures. This evidence confirms the potential to reach resource-poor men and especially women, once the nongovernmental or the governmental agency decides to do so. Long-term impacts are difficult to assess because most of these interventions are recent. However, the nominal inclusion of resource-poor women or men by the better-off to gain access to external support, or over-optimistic feasibility studies at field level to satisfy central instructions, are current but poorly documented phenomena. The influence of the agency and the proneness of its own procedures to such behavior are largely a black box.

Research Issues

It is hypothesized that explicit targeting to the resource-poor is the most effective allocation principle for poverty alleviation. More systematic comparative research should identify the success factors of these approaches and assess to what extent results can be generalized. Focus should be on the long-term effectiveness of the agency's own procedures.

ALLOCATION TO FORMER RIGHTS HOLDERS

The Principle

Under the principle of allocation based on former rights, names of pre-project claimants and elements of pre-project claims are incorporated into the rights to newly available water or improved land. Pre-project water or land rights can be never fully reproduced in the new arrangements because the very purpose of infrastructure development is to change water flows and to improve potential production on specific sites. The change from the old to the new can roughly vary between endowing those who already have resource rights with more rights, maintaining existing divisions of rights, and redressing existing divisions towards more equality. In general, the latter will contribute most to poverty alleviation.

As already mentioned, pre-project claims on land in the selected command area are an important condition to be able to benefit from the newly available water, in case the intervention does not change tenure directly. If the command area is expropriated, on the other hand, the new rights depend upon the expropriation and reallocation or on compensation arrangements. Expropriation and forms of compensation are also important with regard to pre-project claims on water downstream or the same water reservoir. Expropriation of these rights is intrinsic to the construction of new infrastructure and to a lesser extent to rehabilitation. Construction also requires the expropriation of land on which the land-bound infrastructure is constructed. A specific form of expropriation occurs when water is used for multiple purposes before an intervention but reallocated for irrigation only. This renders these other uses, as far

as the new physical infrastructure still allows for those, formally illegal (cf. Meinzen-Dick and Jackson 1996).

It is noted that most state agencies are formally empowered to implement any form of expropriation because statutory law has declared water as state property. Similarly, changes in land tenure in command areas for the purpose of agricultural development are normally justified in statutory law.

Empirical Evidence

Expropriation issues have not received much attention yet in public irrigation, except when massive displacement was required. In the majority of cases there are no data on the resource's rights expropriated, let alone any legally recognized registration. Local legal systems may even be considered illegal. Expropriation is especially delicate for the resource-poor who have no means to contest and negotiate compensation, either as new rights or otherwise. The available evidence confirms this vulnerability, especially for women. Women often lose substantive land rights while the new land-cum-water rights are allocated to men (see below). Moreover, while local law used to endow women with water rights through participation in construction work, women are reported to have lost these rights under intervention (see below). A later section describes the social organization of such expropriation, and also procedures to incorporate former rights. In most cases reported, even existing divisions of rights of women deteriorate. Only one case is reported in which the agency challenged existing norms in favor of the resource-poor (see below).

With regard to indirect allocation by site selection and layout, it is commonly known that the well-off who have more contact with the implementing agencies are also better able to influence decision making on these design aspects to include their own land.

Research Issues

It is hypothesized that in public irrigation projects, currently, the resource-poor tend to lose more rights and receive less compensation than other social categories and that, therefore, projects tend to skew existing inequalities in resources rights even further. This risk will increase with growing water and land scarcity. For poverty alleviation, therefore, all existing rights, both formal and informal, should be recognized. These rights should be incorporated into the site selection and layout and in the further allocation arrangements. This approach is still conservative. More study on proactive site selection in favor of the resource-poor and on practices in which current norms are challenged provides a basis for an approach that empowers the resource-poor relatively more than other people.

ALLOCATION TO EFFICIENT PRODUCERS

The Principle

Under the principle of allocation based on production relations, water rights are allocated to those farmers who, in the given social production relations, are best able and motivated to make productive use of the irrigation water and other services rendered. This supposes that these persons are farm managers who have at least use rights to land, decide on cultivation and irrigation, and mobilize the inputs needed. They also control the output, so they are most motivated to improve this output. Producer-based allocation is strongly adhered to by irrigation interventionists. This is the direct implication of another main objective of irrigation intervention, which is improved production.

Empirical Evidence

Whether this allocation principle as such includes or excludes the resource-poor depends upon their relative productivity. There is considerable evidence from South Asia and elsewhere on the inverse relationship between land productivity and farm size, including after the introduction of irrigation (Jazairy, Alamgir, and Panuccio 1992; Boyce 1987; Hossain 1989; Lipton 1992, cited in Agarwal 1994). In all these situations allocation of water and land rights would be to smallholders, if in reality allocation were based upon productivity considerations as projects claim.

Numerous studies have also highlighted women's roles in agricultural decision making both in their own productive units and as substantive contributions to irrigation and irrigation-related farming on men's fields (cf. Safiliou 1988, 1991; Bruins and Heijmans 1993; Hulsebosch and van Koppen 1993; Zwarteveen 1995, 1997a; Zwarteveen and Neupane 1996; PATA 1996). In de jure, and the increasing number of de facto, female-headed households women are the only farm managers. These studies also indicate that female smallholders are as responsive as men to prices and market opportunities to invest in increasing production. More realistic concepts to understand the social organization of agriculture have been developed, such as the classification of farming systems into male, dual, and female farming systems. As a corollary, this concept distinguishes women's and men's autonomous but interrelated productive units within the farm household. Each household member responsible for a productive unit tries to 'get the best deal' for his or her own unit through exchanges and negotiations with other household members managing their productive units (Safiliou 1988). Further, comparative studies on women's and men's productivity on own irrigated plots underline women's productivity. In Burkina Faso, both land productivity and labor productivity are higher when both women and men have their own irrigated plot compared to households where only men get a plot (Zwarteveen 1997b). In Senegal, women's schemes appear to be cultivated more intensively and crop diversification is greater than in men's schemes (Deuss 1994). A related issue is the capacity for collective organization of water management if technical services are limited, for example if the number of outlets is less than the number of small individual plots. In Senegal schemes, women's organizations are reported to be effective (De Fraiture 1991). The motivation of women to invest in profitable agricultural enter-

prises to improve their own income is strong, due to the relative lack of other opportunities for them. So substantial evidence would also support women's inclusion under the principle of allocation of water rights to those who can and are willing to make productive use of the water.

If women or men smallholders are found to be less productive than larger farmers, this is likely to be due to their relative lack of access to water, other inputs, and marketing facilities. Instead of targeting the larger farmers, agencies can conceive accompanying measures to solve these problems.

In spite of these empirical findings, in mainstream irrigation intervention, hardly any traces can be found of preferential inclusion even of resource-poor men under this allocation principle. Women are found to be explicitly excluded. In the large majority of irrigation interventions planners assume that only men are agricultural decision makers and this has justified allocation of water and land rights only to men. This occurred even in the wetlands in southwest Burkina Faso where rice cultivation is almost exclusively a female cropping system, while men's farming interests are in upland cultivation. For example, the project *Opération Riz* assumed that men are main decision makers in rice cultivation or should become so (van Koppen 1990). Many other cases are described in the next sections. Thus 'being female' has become the exclusion criteria from legitimate water and land rights *par excellence*.

The concept of the farm household as a unity represented by the male head who decides on all pooled family resources and output has been most instrumental in this biased image of agricultural production relations and 'household-based' allocation of rights. By adopting this model, agencies redefine social exclusion along gender lines, and generation lines as well, as a so-called private and culturally embedded intra-household issue beyond their responsibility. The persistency of this household concept in allocating water rights is also due to the tendency of state bodies to vest water rights in groups rather than in individuals, such as tertiary units, blocks (cf. Bolding, Mollinga, and Van Straaten 1995), or in whatever collectivity (cf. Sengupta, forthcoming). One member, almost always a man, is considered to be the group's representative. Vesting water rights in group or household representatives rather than in individuals seems to simplify organization and administration for centralized water providers.

In all regions female-headed households are grossly underrepresented when men as assumed household heads are taken as the norm. The position of these women in decision-making bodies is often weak and in many situations they have to send male relatives as their representatives (cf. *Projet Sensibilisation* 1993; Zwartveen 1995; Lynch 1991).

Research Issues

It is hypothesized that poverty is alleviated and production is increased by allocating independent rights to resource-poor women and men producers. More research on the conditions under which this hypothesis is valid, or not, is needed, taking into account access to inputs, markets, and other institutions. The necessity to abandon the unitary household concept to understand production relations and to avoid women's blunt exclusion from independent water and land rights has been conclusively proven. Instead, allocation should be producer-based. More realistic concepts of gendered production relations need to be developed, based upon substantive empirical research into the intra-household organization of production and the intra-household division of rights and obligations, for both irrigation and control over the output.

More insight into current and potential technical and institutional solutions of water delivery to multiple small plots has to be generated.

ALLOCATION OF LAND-CUM-WATER RIGHTS TO NEW LAND RIGHTS HOLDERS

The Principle

Under the principle of allocation of land-cum-water rights, water rights are vested in the people who obtain new land rights after expropriation of the command area. Given the large changes steered by the agency, the feasibility to include resource-poor women and men in the new property regimes is optimal.

Empirical Evidence

In reality the potential to establish equal access to water and land is hardly used. On the contrary, opposite impacts are reported. In India, both small farmers and women have lost their multiple rights to land and other natural resources in large-scale irrigation schemes (Agarwal 1994). Worldwide, women smallholders have been especially marginalized because planners rigidly adopted the model of the unitary household as the basis for allocation. Dramatic loss of land rights without compensation has affected women in matrilineally inherited rice lands in West-Africa (Dey 1990; Carney 1988; van Koppen 1990) and the normally bilaterally inherited land in the Mahaweli Ganga Scheme in Sri Lanka (Kumar 1987; Schrijvers 1985). In all these schemes land was almost exclusively reallocated to males as the head and only household member eligible. Similarly, among the farmers who entered settlement schemes or small-scale irrigation schemes as new producers only male heads of households got land rights. Original land use rights of women settlers were ignored, as in the Mwea scheme in Kenya and the Office du Niger settlement scheme in Mali. In the latter, 11,842 male tenants and 68 female tenants were registered in 1995. Most of these 68 women are (ex-) government employees. Two have been registered because their husbands could not pay the water fees (Klaver and van Koppen forthcoming). In about fifty small-scale rice schemes in central Burkina Faso, less than one percent of the irrigated land is allocated to individual women (Projet Sensibilisation 1993). However, in that same region up to 20 percent of the land in rain-fed agriculture is farmed independently by women (Burkina Faso, Ministère de l'Agriculture et de l'Elevage 1989). It was only in one of these village schemes that women obtained 11 percent of the plots. These women had former land rights and participated in construction. The active support of the agency's field workers explains this exception (Projet Sensibilisation 1993).

Women's motivation to work on men's fields in the new schemes where they do not control the output is limited. So whenever alternative employment is available for women, they are reported to withdraw their labor power once they have fulfilled their culturally defined obligations on men's fields (Carney 1988; Dey 1990; Jones 1986). Women even returned

to their original villages from the Mwea scheme in Kenya (Hanger and Morris 1973). Evidently, this has reduced scheme productivity.

Producer-based allocation of irrigable land to individual women, irrespective of their marital status, is still very rare. Only where allocatable irrigated land is not scarce have women obtained plots in their own names. It is also reported in female cropping systems (van Koppen 1990; Dey 1990) and sometimes in dual farming systems in Africa. Among the Wolof and Soninke in the delta and upstream in Senegal both women and men obtained own irrigated plots, but women's plots are only half the size of men's (Diemer 1990). As a reaction to the criticism against exclusive allocation of land-cum-water rights to men, some mainstream agencies started small-scale schemes targeted explicitly to women in countries like The Gambia (Carney 1994), Senegal (Deuss 1994), Burkina Faso (van Koppen 1990), and Kenya (Povel 1990).

Joint land rights to husband and wife are allocated by the Swamp Reclamation Project in Rawa Sragi in Sumatra, Indonesia. In the prevailing local land tenure system, women have certain land rights, though weaker than men's. Initially the project registered new land rights exclusively in the names of the men, but changed them to joint rights later. Women welcomed this change (Van Hussen, personal communication). However, joint land rights rather than independent rights may still limit women's say on land use choice and control over output and on land division with divorce and inheritance (cf. Agarwal 1994).

In projects other than those in which land is expropriated and reallocated, land tenure is likely to change in more gradual and spontaneous ways after the introduction of irrigation. Irrigation agencies or land reform agencies can strengthen the land rights of the resource-poor in several ways. Lower land ceilings for irrigated land in India, for example, would release land for distribution. This is at least to a certain extent used by the poor, although the better-off still gain more, according to an example in Karnataka, India (Epstein 1973 in Chambers 1994). On formerly barren land at the foot of the mountains in Tanzania, lowland schemes are constructed. They attract increasing numbers of farmers. In these schemes the Traditional Irrigation Improvement Program supports women's groups in their negotiations with local governments for land rights (TIP 1993).

Research Issues

It is hypothesized that infrastructure development accompanied by expropriation of the command area and reallocation of land-cum-water rights provides the best opportunity for agencies to achieve unconditioned allocation of new irrigable land to the resource-poor and to women, the same extent as of men. With better documentation of the few positive cases they can serve as examples for new schemes in which this potential needs to be realized. In existing schemes the possibilities to redress the former skewed situation during rehabilitation, scheme extension or management transfer need to be explored. Opportunities for the resource-poor to gain access to irrigable land when changes are more gradual need to be identified more systematically.

ALLOCATION TO EXISTING LAND RIGHTS HOLDERS

The Principle

Under the principle of allocation based on existing land rights, water rights are vested in land rights holders in the command area while the irrigation agency does not interfere directly in these land rights. This linking of water rights to land rights is sometimes unavoidable. For example, in the case of the 'PATA Project of Integrated Agricultural Development' in Pakistan (PATA 1996), property rights to the newly installed small-scale irrigation pumps could only be vested in the formal landowners. Here irrigated agriculture was new and tenants had only started to settle in the region. Water rights can also be intrinsically linked to land rights through the payment system, for example, if water fees are paid via land taxes. However, in most other situations there is no need to link water rights to land rights, and allocation can be based on participation in construction, or on de facto cropped land, whatever land rights the water user has.

Land rights are often taken as the criterion to vest water rights in statutory law or centralized regulations and bylaws, as in parts of India or Pakistan (Byrnes 1992). The gap between formal, paper regulations and reality may be wide. The people concerned may even ignore the existence of formal rules, as noted in Pakistan (cf. Byrnes 1992). Formal rules are also reported to be ignored in factual decision making in the Tungabhadra Left Bank Irrigation Scheme in India. Here tenants have a strong de facto say in water distribution although they are not formally recognized (Mollinga, personal communication). However, in the longer term, the formal rules will increasingly steer water allocation.

The critical issue under this allocation principle is that allocation of rights on the basis of assets tends to exclude the asset-poor. This concerns both the type of land rights and the relation between the quantity of water one is entitled to and the size of the land.

Empirical Evidence

With regard to the type of land rights that are the condition to obtain water rights, exclusion of the resource-poor takes place if only formal, registered, and longer-term ownership rights are recognized. This excludes those whose land rights are temporary, informal, and unregistered. These are typically resource-poor tenants and sharecroppers. Women's land use rights in their husbands' clans, or their inherited rights or the rights they obtained otherwise, also easily remain unrecognized (Agarwal 1994; Deere and León 1997). For landowners, registration requirements may still entail another bias against the resource-poor, especially women (Agarwal 1994).

This exclusion is disadvantageous for farmers with temporary land rights because they could benefit from longer-term water rights by exchanging or selling the water rights, until they need the water again for their own production once they inherit land, buy it, or sharecrop it in. Such evidence of allocation of water rights to landless people comes from traditional systems in Portugal (Van den Dries, Hoogendam, and Portela 1996). In some villages near Chandigarh in Haryana, India, the Sukhomajri Project intervened. Here the equity principle also allowed landless families to get equal access to small surface reservoirs. They gained

by sharecropping land and using their own water, or selling their water or otherwise trading or giving it for goodwill or other benefits (Malhotra 1982 in Chambers 1994). Investments by landless people to secure water rights for future land acquisition are also reported in Ecuador (Krol 1994). The Small Scale Irrigation Program Dodoma in Tanzania also encouraged equal allocation of water rights in quantities sufficient for one acre, to both men and women, regardless of ownership of land. Now landless women and men hire land for irrigated agriculture from landowners (SNV Tanzania 1996). Last, in Mexico, users of a local scheme with limited land resisted successfully the new statutory law in 1966 that linked water rights to land rights. By the proposed extension of right-holdership to large landowners, these water users would not only lose their opportunities to exchange or sell water which they themselves had in surplus, but also the power to enforce advantageous sharecrop arrangements with these large landowners, because the tenant provides the water (Nederlof and Van Wayjen 1996). Thus, having longer-term water rights not only provides an income as such, but it also strengthens access to land. The latter, however, may also invoke tenant eviction. The case of inverse tenancy, on the other hand, needs more study. Here disconnecting water and land rights may lead to accumulated control over water among large farmers and further induce inverse tenancy and the selling of land by the resource-poor.

The second bias against the resource-poor concerns the relationship between the water quantity to which one is entitled and land size. Access to a relatively large quantity of water in relation to land size can be used for more intensive cropping, as many resource-poor farmers are reported to be doing. It gives more assurance against water scarcity and helps to avoid such things as night irrigation (Ambler 1990). Water scarcity is likely to occur when the few large landowners consume all the water they are entitled to under proportional allocation. In India, the principle of proportional allocation has been challenged since the eighties and a water rights reform is proposed. This implies that quantities allocated to larger farmers would be relatively smaller and bound to a maximum quantity sufficient for, say, five acres (2 ha) as reported for the West Banas Project in Rajasthan (Chambers 1994). Such implementation of equal or progressive allocation rather than proportional or even disproportional allocation (Chambers, Saxena, and Shah 1989) is still rare. The complications in the enforcement of ceilings are well known for land reform. In Bolivia, an NGO also tried to introduce ceilings to the quantities of water per farmer to prevent a few larger farmers from accumulating water rights. However, these farmers circumvented the measure at least to a certain extent by putting rights nominally in the names of family members (Prins 1996).

Research Issues

It is hypothesized that poverty is alleviated by linking water titles and upper limits to the quantity of water given to an individual land user, whatever precise land rights he or she has. More research is required to assess the advantages and the feasibility of disconnecting land and water rights under different forms of irrigation, payment systems, and tenancy.

ALLOCATION TO PARTICIPANTS IN CONSTRUCTION

The Principle

Under the principle of allocation to participants in the construction of infrastructure, the investments in the infrastructure are the basis for rights to the water conveyed by that infrastructure. Investments in labor or cash are linked to rights. Either one carries out work himself or herself or a laborer works in the name of someone else who is the rights holder. During the use phase these rights are confirmed by participation in maintenance and fee payment. Such water rights remain, in principle, independent from land rights. This way of vesting water rights has been practiced throughout history in local schemes in the Andean regions, Africa, and Asia (cf. Coward 1986). According to the very limited evidence available, this regulation is equally open to women in countries like Ecuador with bilateral inheritance of water rights to both sons and daughters (Krol 1994; Noordholland de Jong, personal communication), and Bolivia (Prins 1996). In the mountainous areas in Tanzania, however, women are hardly allowed to vest water rights in this way (Kitunga 1989).

The same principle of linking rights to investment is applied by irrigation agencies that delegate part of the investments in labor or cash to the farmers, either as the only principle or in combination with other allocation principles. Other agencies delegate construction work to farmers and compensate both in cash or kind and in future water rights. In projects accompanied by expropriation and reallocation of the command area, participation in construction gives land-cum-water rights instead of water rights only. By arranging users' investments and compensating these with water rights, the purpose of minimizing public expenditures is served at the same time. In a third form, agencies compensate laborers for construction work merely in cash or kind.

Empirical Evidence

External irrigation agencies are found to exclude women from establishing water rights through participation in construction work, even in regions where women used to obtain independent rights in this way in prevailing local law. The following cases report women's triple exclusion. Agencies either forbid women to participate in construction work, or do not link women's work to rights as they do for men. The latter occurs by not counting women's work, or by counting it in their husbands' names, or by counting it in their own names but ignoring this as a basis to vest rights.

Women's exclusion from participation in construction work is fostered by middle-class stereotypes of women's inability to carry out construction work properly or the low status for women attached to construction work. These stereotypes are widespread and may even be adhered to in official government policy as in the Philippines (Illo et al. 1988). Local governments may also have them. For example, the village government in Malolo, Tanzania, suddenly decided to prohibit women to continue maintaining the canals as they used to do. Now women state that they can hardly protest anymore when they do not get their water turn (Van der Grift 1991).

Agency-steered limitations on women's participation in construction work also weakened women's former water rights in the Laka-Laka small-scale irrigation scheme in Bolivia.

In this region independent land and water rights for women are socially accepted traditionally. Moreover, male out-migration has substantially increased. When people were mobilized for the construction of a new irrigation reservoir, women came in large numbers. The Direction of the new water user association, which was just created under the instigation of the project team and with the strong voice of this team in it, feared that too many people would claim water rights. They therefore decided that women with capable male relatives who could do construction work or who could finance paid laborers from off-farm employment, as well as youngsters under sixteen, would be excluded from construction work. The women protested in vain (Prins 1996).

Exclusion also took place in small-scale schemes of the *Projet Sensibilisation et Formation des Paysans autour des Barrages* in Burkina Faso. Here land-cum-water rights could be obtained by construction work. Women were often not informed about this possibility, in the first place, or their labor contributions were counted in the name of their husbands. Or, as the author observed in 1989 in Gaskaye, women's individual labor contributions were registered, but then the project suddenly decided not to apply the rule to women and allocated only half the land they were entitled to.

The biased linking of women's investments to benefits compared to men was also noticed in the Bauhara Scheme in Nepal. Women contributed 70 percent of the construction work. However, initially women were absent from the decision-making bodies like the Construction Committee and Water User Committee. Only after some months did the male members start to stimulate women to increase their informal involvement in the management for smoother operation of the scheme (Bruins and Heijmans 1993).

Lastly, it is common that agencies adopt a much narrower definition of labor contributions than is done by local women, and often by local men too. In these local definitions labor almost always includes the provision of food and drink and child care on the construction site, for example in Nepal (Pradhan 1989), Tanzania (SNV 1996), and in regions in Peru (Lynch 1991).

As a result of the growing criticism against these practices, some recent projects adopting this principle have been better adapted to local reality. Construction projects in Latin America have started to incorporate prevailing local allocation principles. In the Licto Project in Ecuador about 80 percent of all construction activities are carried out by women in working groups (*mingas*). These activities have been registered and new water certificates will be in the names of the investors, mainly women. Pregnant women also obtain water rights, but they are granted dispensation from carrying out construction work (Noordholland de Jong, personal communication).

There are very few projects that include women in construction work and vest water rights in them where such a principle does not prevail in local law. As mentioned, such exclusion used to prevail locally in the mountainous regions in Tanzania where land pressure is high. Recently, the Traditional Irrigation Improvement Program introduced women's inclusion in construction there. It is expected, but this has to be validated in the future, that as a result of this participation women will be able to cultivate their own plots and intermixed crops more effectively. Intensive legal training on women's existing land rights is already given (Van der Grift 1995). Moreover, women's intra-household bargaining position on the use of crops cultivated on men's irrigated fields but with substantive labor input from women, is likely to improve too, especially in *de facto* female-headed households (Mallya et al. 1996).

An issue that remains unclear in the literature concerns the so-called 'household representation' in construction and maintenance duties on the one hand, and in decision making on the fruits obtained, on the other. If each household is reported to be obliged to send one member to fulfill the duties, this suggests that water rights are vested in households in the sense that women can exert claims on the water on the basis of investments by their male relatives, and vice versa. Remarkably, this is not referred to as 'joint title.' The study of the Aslong Irrigation Scheme in the Philippines by Illo et al. (1988) is one of the few studies that analyzes its meaning in-depth. In this scheme the National Irrigation Administration had imposed the one-member-per-household criterion and had stipulated that this representative should be male. Although men accepted to do the construction work, several male farmers' associations tried to convince the irrigation community organizers of the National Irrigation Administration that their wives should also become members of the irrigators' associations, or at least represent them there as proxies (Illo et al. 1988). Household representation by one member is also reported where women do most of the construction work. In Nepal, women claimed this would enable their husbands to work elsewhere in paid jobs. It is not clear what rights, if any, women get in this way (Vos 1994).

In all the case studies cited above labor was compensated by water rights. Often, construction labor under public irrigation is fully paid by the agencies, and water rights are allocated in other ways. In principle, this form of employment is also open to the landless. However, both women smallholders and landless women are largely excluded from this paid employment, or wages for women are substantially lower than for men. In countries like Bangladesh this is changing now for landless women. These experiences also confirm that women perform as well as men in construction work (Duyne 1994; Jordans 1991). It is an unexplored issue whether smallholders who carry out paid construction work also exert claims on water and land on this basis, without the agency being aware. If so, this would be another reason to include women smallholders in paid construction work.

Recently, a combination of paid employment which also entitled participants to membership in the water user association was experimented with by the pilot project of tertiary unit development in the Tangerang Region in Indonesia through the Cidurian Upgrading and Water Management Project. Since 1992, both men and women have been invited for construction activities and later water user associations. Women responded positively (Van Dok, Putri, and Zulaicha 1993).

Investments in construction are mainly made in the form of labor, but contributions in cash are also common in construction, maintenance, or water payment. With increasing privatization these cash contributions will become more important. In most cases, irrigated agriculture is profitable and cash contributions are generated by increased production. Therefore, this does not exclude the resource-poor, unless prefinancing is required.

Research Issues

It is hypothesized that the principle that investors should benefit from the fruits of their investment, substantially supports the resource-poor in obtaining and realizing water and land rights, provided the link between investments and rights is guaranteed. The opportunity to invest in construction work should explicitly be opened up to women too, whether this is already current in local law, or not. Their willingness to carry out this work and their performance should be assessed empirically. Definitions of contributions should include all labor

provided. Intervention procedures to that end need to be developed, studied, and tested. More insight is needed at intra-household level in the links between investments, vested water rights, and intra-household negotiation on the benefits from these rights. This will clarify the gender and age dimensions of so-called household representation in the fulfillment of obligations. If cash payment is required, appropriate payment arrangements and loan provisions should be designed for the resource-poor.

INCLUSIVE PLANNING PROCEDURES

Planning Procedures

The inclusion and exclusion of the resource-poor as legitimate water rights holders in public irrigation according to five allocation principles have been discussed in the foregoing sections. This section complements these insights from the dynamic perspective of the process of negotiations in the specific projects. Negotiations on allocation criteria, their implementation, and the possibilities to enforce the rights one has obtained, depend on project planning procedures. These procedures, first, influence the composition of the forum of decision makers and, second, structure the timing of decision making during the subsequent plan formulation, plan realization, and reaping of the benefits from the investment. This happens whether the procedures are well-formulated and transparent, or not. Forum composition and timing are especially considered more in-depth below.

In any intervention process, specific people at local level organize and invest their time and other resources to become informed, to discuss, contest, endorse, or change project plans, and to arrange the works needed for implementation. Often, these same people have a strong stake in the local organization for water distribution during the subsequent use phase. This more or less structured communication network at the interface of agency and potential water users for major endorsement of project's plans and decision making at local level is called a 'forum' here. Basically, recognition as rights holder starts with the inclusion in the local fora of decision makers on project matters between the project and local people. Inclusion of the resource-poor as rights holders implies their effective inclusion in this forum.

Agencies strongly influence the composition of this forum by contacting and organizing some local people and not others. Depending upon a project's structuring of this network in a given social context, fora can vary from small groups of male political elite that decide in untransparent and authoritarian ways, to democratic bodies with effective representation of priority target groups.

Inclusion of the resource-poor should start from the very first contacts between the project and local people. The importance of early inclusion follows from the logic of collective investments, which is that claims on the fruits of investments are negotiated before the investments are made. This is most evident if allocation of water rights is based on participation in construction work. Definitions of allocation criteria and procedures for implementation need to be clear before construction starts. The importance of the design phase is also clear if the infrastructure is designed in a participatory way (cf. Vermillion 1990). Local participants establish their own future water claims in the 'hardened' form by influencing the

site selection, layout, and water distribution devices of the infrastructure. However, the simultaneous establishment of future claims simply by participating in a process of investments may be even harder. Obviously, the arrangements of expropriation and compensation of resource rights require an early inventory of existing rights and further arrangements for implementation.

The need for early inclusion of the resource-poor also follows from another logic of collective investments. This is that the investors tend to exclude others more and more when their own investments are accumulating, unless political or social favors can be negotiated in return. The scarcer water and irrigated land are, and the more precious the fruits of investment in irrigation infrastructure, the stronger the tendency to exclude others. The vaguer the agency itself is on the precise allocation of water rights among the users and the stronger its announcement of the withdrawal of most of its staff after construction, the stronger the local fora will act on their own. The agency may not even be aware of this.

The implication of the above is that democratic local fora and sound planning procedures are especially important for poverty alleviation. If water rights of the resource-poor are not transparently and explicitly on the agenda of local fora in the design phase before the investments, it is too late: the resource-poor have no other means to claim access to water later.

Empirical Evidence

The importance of early inclusion of the resource-poor in fora is confirmed by past experiences. Exclusion of the resource-poor was due to project field staff who contacted exclusively the male elite and used them for a minimal acceptance of the project construction plans, for quick expropriation, and for paid or unpaid labor mobilization. In the Jahally Pacharr project in The Gambia, for example, the male elite was persuaded to sign the lease of the land to the state and free it for construction activities. At that moment many women with land rights were not even informed about the project nor about the fact that expropriation of those rights had already been endorsed by this elite. Later, land allocation committees were dominated by the same elite. Although an objective of the project was to respect women's land rights, the plots, designed by the engineers as 'household plots' (sic), were only allocated to men until they were satisfied (Verkruysse 1991).

The expropriation of women's rice land in the first two schemes of the already mentioned project Opération Riz in southwest Burkina Faso, where rice cultivation is a female cropping system, was implemented as follows. During the design and construction phases the agency and the male elite raised false expectations among the women who formerly owned the rice lands, but they kept final decision making on allocation in suspense. Just before finalizing construction works the agency proposed to allocate land-cum-water rights to men, in a small forum of male elite and male paid-construction workers. These men accepted the proposal (van Koppen, forthcoming).

In both the Jahally Pacharr project and Opération Riz, and in other construction projects as well, the projects primarily aim at quick implementation of their construction plans. Indeed, funds have already been allocated on the basis of tight construction schedules. It is easily assumed that allocation issues can be postponed until the so-called 'technical' construc-

tion phase is almost over. At handover, allocation arrangements are also easily left to 'the village,' which, in reality, is just this forum.

On the other hand, if agencies include the resource-poor in a democratic forum at the start of a planning process, it does not necessarily require much time; it enables further planning and saves really time-consuming misunderstandings and conflicts later. Three cases given below illustrate such inclusive planning. It is noted that in all these cases representation is producer-based and not household-based.

The actual planning procedures of the project *Opération Riz* in Burkina Faso are one example. These new procedures crystallized in later schemes bottom-up by the initiatives of field staff, male elite, and women rice cultivators. Nowadays, in each new scheme the project starts to organize extensive meetings to inform all producers in rice valleys that are planned to be improved, about the project's plans and expropriation and allocation procedures. Then a detailed inventory of existing producers and their land rights is made in the field and cross-checked with the male and female local land chiefs. Improved plots are first allocated to the producers with former land rights. If the project has designed more plots, any farmer can submit a demand. Among the new candidates male cultivators are still a minority, unless in places where soil fertility in the uplands where men grow their crops, has strongly declined (van Koppen, forthcoming).

The eighteen-step Scheme Development Process of the governmental 'PATA Project of Integrated Agricultural Development' which installs groundwater pumps in Pakistan, is a second example. PATA rejects requests for assistance, unless three conditions are met: the group consists predominantly of smallholders; men accept women's inclusion during the whole process; and there is no political interference. Men are reported to accept women's inclusion in the process, women's suggestions on domestic water uses, women receiving agricultural training, and even women's visits to other schemes, provided an elder man accompanies them. This approach is compatible with the strong cultural norm that women should not talk to strange men (PATA 1996; Zigterman 1996).

Another way to create an equitable forum which reflects production relations, was developed by the Provincial Irrigation Unit, Nyanza Province in Kenya. In this region, women contribute over 60 percent of all hours spent in rice farming, including irrigation, and manage 64 percent of all plots (Hulsebosch and van Koppen 1993). A minimum of 50 percent attendance by women at the preparatory meeting of new water user organizations is required. Parallel to this, women are organized in women-only groups and trained to articulate their interests and to participate effectively in meetings that were formerly dominated by men. Women's attendance in the preparatory meetings and committees improved. Furthermore, their knowledge of project matters increased, as well as their relative participation of women in project activities. Performance of women leaders is similar to that of male colleagues (Hulsebosch and Ombarra 1995). The Small-Scale Irrigation Program Dodoma in Tanzania also starts activities only if the target composition of 50 percent women and 50 percent men is reached (SNV Tanzania 1996).

Research Issues

It is hypothesized that inclusive planning procedures which allow resource-poor women and men to plan investments, establish expropriation arrangements, and define title criteria are

pivotal for their improved access to water. More knowledge on inclusive planning procedures and democratic fora will contribute to agencies' expertise on time-saving structuring of local decision making in which the investments of the resource-poor optimally lead to their rights to the water. Indicators for such early inclusion of the resource-poor in local fora need to be developed.

ACCESS TO WATER BY THE RESOURCE-POOR IN PRIVATE IRRIGATION

In small-scale private irrigation the owners of infrastructure are automatically entitled to the water, so ownership of equipment is the primary condition for the resource-poor to have access to water. Such ownership is mainly steered by the availability of technology and energy sources that fit the specific needs and potentials of the resource-poor (cf. Chambers, Saxena, and Shah 1989; Shah 1993; Kahnert and Levine 1993; van Koppen and Mahmud 1996). Current technology for private ownership tends to be biased towards the scale, cropping pattern, and financial means of larger farmers. Under state-supported development and distribution of equipment these larger farmers have better access to the government too. In regions of water scarcity the equipment is more expensive and, hence, ownership of equipment is increasingly skewed. It is noted that water scarcity itself can be the result of disproportional water abstraction by these better-off owners of equipment. For example, owners of deep tube wells may lower groundwater tables to a level at which the lower level technology of the resource-poor, like hand pumps, becomes ineffective. Most legal restrictions on technology use, such as siting or licensing, are not effective yet, or exclude the later entrants, who are often the less well-off. In this situation, external agencies can decrease this intrinsic bias of private irrigation against the resource-poor, especially via the technology. The main conditions of such external support for poverty alleviation are the following (cf. Mandal and Parker 1995; van Koppen and Mahmud 1996):

- The equipment should fit the crops and scale of farming systems of resource-poor men and women. Mobile equipment such as low-discharge pumps to be used with cheap wells, and use of bamboo pipes bring mechanized equipment within the reach of tenants and sharecroppers.
- Distribution channels of pumps and spare parts should reach the resource-poor, especially women. Distribution via NGOs and the private market is performed better than through government agencies, at least in Bangladesh.
- Last but not least, equipment should be low-cost. As financial investments often remain substantial, middle- and long-term loan facilities are crucial. The loan conditions should assure the resource-poor against the risks involved.

Private owners of infrastructure dispose of the water as they want and they may sell excess water. This is yet another way to get access to water: as water buyers in private water

markets. Such markets have developed in Bangladesh, India, and Pakistan. The water interests of the pump owners themselves generally prevail (cf. Strosser and Meinzen-Dick 1994). Increasing competition in the offer of water, however, often leads to low water prices and adequate service. This is in the interest of all water buyers, but especially of small and marginal farmers who cannot afford their own equipment (Shah 1993).

This commercial demand for water under private irrigation also makes direct access to irrigation water attractive for landless people who have no fields of their own to use it on. They can sell it and generate an income in this way. In Bangladesh, where groundwater is readily available, there are reports of some successful experiences of such NGO-supported male (Wood et al. 1990) and female water selling groups (van Koppen and Mahmud 1996).

In these NGO programs in Bangladesh, representation of the household by one member, but now the woman, is increasing rapidly. Women mediate credits and other services to their husbands especially if the credits are used for the productive units of their male relatives such as dry-season irrigated rice cultivation. This role of mediator may slightly increase women's status. But if the NGO's aim is that women themselves become owners and managers of private irrigation equipment, this can only be realized if the whole package of credits, irrigation training, and organizational support is directed explicitly at women as individual producers or entrepreneurs, in other words, when allocation is individual- and producer-based rather than household-based. Women who are heads of households benefit under both conditions (van Koppen and Mahmud 1996).

CONCLUSIONS

The evidence reviewed in this paper suggests the overall working hypothesis that rural poverty is alleviated by:

- explicit targeting at the resource-poor as individuals, not as households
- protecting them against expropriation without compensation, and aiming at more equality in resource rights
- improving their access to inputs, markets, and other institutions
- linking water rights to the land user and strengthening the rights to irrigated land of the resource-poor
- linking water rights to investments, and, in the case of private irrigation, providing appropriate equipment and financing facilities
- including the resource-poor in planning procedures from the start

Further needs for research and action can be summarized as follows:

- The impact sought by agencies, poverty alleviation, needs to be explicit and operationalized, for example through performance indicators.
- The assumed positive effect of improved access to water and land on smallholders' incomes, food security, and other factors of well-being need to be verified empirically.
- Best practices, in which projects realize their potential contribution to poverty alleviation, need to be studied in-depth and compared.
- Insight into the consequences of project actions requires at least the systematic monitoring of:
 - gender, class, and ethnic characteristics of beneficiaries,
 - their access to irrigated land, and
 - the level of water service provided to them.
- Systematic research is needed on gender- and class-differentiated production relations in irrigated agriculture and irrigation management worldwide and on the conditions under which the resource-poor are either more or less productive than other social categories.
- Insights into processes that include or exclude the resource-poor as legitimate rights holders need to be complemented by insights into the different contents of the rights and their possibilities to realize the rights. The pluralistic legal-normative perspectives (Von Benda-Beckmann 1991) of the different actors need to be taken into account. Further, systematic study of intra-household negotiations on obligations and rights, and of transfer of rights, such as inheritance practices, is urgently required.

Irrigation agencies have an important contribution to make to poverty alleviation, but mainstream irrigation intervention agencies, policy, and research have not used their opportunities yet. The socio-political space to realize this potential will only decrease with growing water scarcity in the near future. Therefore, opportunities that continue to be missed, are likely to be missed forever.

LITERATURE CITED

- Agarwal, Bina. 1994. *A field of one's own. Gender and land rights in South Asia*. South Asian Studies 58. Cambridge, Great Britain: University Press.
- Ambler, John S. 1990. The influence of farmer water rights on the design of water-proportioning devices. In *Design issues in farmer-managed irrigation schemes*, ed. Robert Yoder and Juanita Thurston. Proceedings of an international workshop of the farmer-managed irrigation systems network held at Chiang Mai, Thailand December 1989. Colombo, Sri Lanka: International Irrigation Management Institute.
- Bolding, Alex, Peter P. Mollinga, and Kees van Straaten. 1995. Modules for modernisation: Colonial irrigation in India and the technological dimension of agrarian change. *Journal of Development Studies*. 31(6):805-844. London: Frank Cass.
- Boyce, James. 1987. *Agrarian impasse in Bengal. Institutional constraints to technological change*. The Library of Political Economy. New York, United States: Oxford University Press.
- Bruins, Bert, and Annelies Heijmans. 1993. *Gender-biases in irrigation projects. Gender considerations in the rehabilitation of Bauraha Irrigation System in the district of Dang, Nepal*. Kathmandu: SNV Nepal.
- Ministère de l'Agriculture et de l'Élevage. 1989. Direction des Etudes et de la Planification Burkina Faso, Ministère du Plan et de la Coopération, Centre Régional de Production Agro-pastorale Centre-Nord. 1989. *Analyse de l'enquête d'envergure campagne agricole 1986-1987*. Kaya, Burkina Faso: Ex-ORD du Centre-Nord.
- Byrnes, Kerry J.. 1992. *Water users associations in World Bank-assisted irrigation projects in Pakistan*. World Bank Technical Paper no. 173. Washington D.C.: The International Bank for Reconstruction and Development.
- Carney, Judith 1988. Struggles over land and crops in an irrigated rice scheme: The Gambia. In *Agriculture, women and land. The African experience*, ed. Jean Davison, 59-78. Boulder, Colorado: Westview Press.
- Carney, Judith. 1994. Gender and the sustainability of irrigated farming in The Gambia. In *Gender and environment in Africa. Perspectives on the politics of environmental sustainability*, ed. I. Yngstrom, P. Jeffery, K. King, and C. Toulmin. Edinburgh: Centre of African Studies, University of Edinburgh.
- Chambers, Robert. 1994. Irrigation against rural poverty. In *Socio-economic dimensions and irrigation*, ed. R. K. Gurjar. Jaipur, India: Printwell.
- Chambers, Robert, N. C. Saxena, and Tushaar Shah. 1989. *To the hands of the poor. Water and trees*. London: Intermediate Technology Publications.
- Coward, Walter E. Jr. 1986. State and locality in Asian irrigation development: The property factor. In *Irrigation management in developing countries: Current issues and approaches*, ed. K. C. Nobe and R. K. Sampath. Proceedings of an Invited Seminar Series sponsored by the International School for Agricultural and Resource Development (ISARD), Studies in Water and Policy Management, No. 8. Boulder and London: Westview Press.
- Deere, Carmen Diana, and Magdalena León. 1997. Women, land rights and the Latin American counter-reforms. Paper prepared for presentation at the XX International Congress of the Latin American Studies Association (LASA), Guadalajara, Mexico, April 17-19, 1997.
- De Fraiture, Lot. 1991. *Evaluation de la conception des jardins maraîchers des groupements des femmes sur L'Ile à Morphil*. Document de travail. The Netherlands: Department of Irrigation and Soil and Water Conservation, Wageningen Agricultural University.
- Deuss, Marleen. 1994. Do women's gardens hold water? Gender relations and the introduction of irrigation systems at the Ile a Morphil in Senegal. M.Sc. diss. for the Department of Irrigation and Soil and Water Conservation Wageningen Agricultural University and Third World Centre University of Nijmegen. Occasional Paper 42. Nijmegen: Third World Centre. Catholic University of Nijmegen.

- Dey, Jennie 1990. *Gender issues in irrigation project design in Sub-Saharan Africa*. Contribution to: International Workshop Design for Sustainable, farmer-managed Irrigation Schemes in Sub-Saharan Africa. The Netherlands: Department of Irrigation and Soil and Water Conservation, Wageningen Agricultural University.
- Diemer, Geert. 1990. *Irrigatie in Afrika*. Boeren en ingenieurs, techniek en cultuur. Ph.D. diss. Amsterdam: Thesis Publishers.
- Duyne, Jennifer. 1994. *Embankment maintenance groups: A comprehensive assessment of their technical, economic, social and institutional implication*. System Rehabilitation Project Technical Report No. 43. Bangladesh: Euroconsult and Bangladesh Water Development Board, Government of Bangladesh.
- Epstein, Scarlett. 1973. *South India: Yesterday, today and tomorrow*. London: Macmillan. Cited in Chambers. 1994.
- Hanger, Jane, and Jon Morris. 1973. Women and the household economy. In *Mwea: An irrigated rice settlement in Kenya*, ed. Robert Chambers and Jon Moris. Munchen: Weltforum Verlag.
- Hossain, Mahabub. 1989. *Green revolution in Bangladesh. Impact on growth and distribution of income*. International Food Policy and Research Institute. Dhaka, Bangladesh: University Press Limited.
- Hulsebosch, Joitske, and Barbara van Koppen. 1993. *Increasing women's benefits from irrigation development: Smallholder irrigation in the Kano Plains, Kenya*. Network Paper 24. June 1993. Irrigation Management Network. London: Overseas Development Institute.
- Hulsebosch, Joitske, and Doris Ombara. 1995. Towards gender balance in irrigation management: Experiences in Kenya South-West Kano Project. *Irrigation and Drainage Systems* 9:1-14. The Netherlands: Kluwer Academic Publishers.
- Illo, Jeanne Frances I., Susan E. Leones, Grace C. Ignacio, Karen H. Jacob, and Victoria R. Pineda. 1988. The Philippine Communal Irrigation Program. In *Gender issues in rural development*, ed. Jeanne Frances I. Illo. A workshop report. Institute of Philippine Culture. Quezon City: Ateneo de Manila University.
- International Irrigation Management Institute. 1996. *IIMI 96 - An overview*. Colombo, Sri Lanka: International Irrigation Management Institute.
- Jazairy, Idriss, Mohiuddin Alamgir, and Theresa Panuccio. 1992. *The state of world rural poverty. An inquiry into its causes and consequences*. International Fund for Agricultural Development. London: Intermediate Technology Publications.
- Jones, Christine W. 1986. Intra-household bargaining in response to the introduction of new crops: A case study from North Cameroon. In *Understanding Africa's rural households and farming systems*, ed. J. L. Mook. Boulder, Colorado, USA: Westview Press.
- Jordans, Eva. 1991. Survival at a low ebb: Women farmers and water development in Bangladesh. M.Sc. diss. The Netherlands: Department of Irrigation and Soil and Water Conservation, Wageningen Agricultural University.
- Kahnert, Friedrich, and Gilbert Levine (eds). 1993. *Ground water irrigation and the rural poor. Options for development in the Gangetic Basin*. A World Bank Symposium. Washington D.C.: The World Bank.
- Kitunga, Demere. 1989. *The role of women in traditional irrigation in Same and Mwanga districts*. Research Report. Dar-es-Salaam: Traditional Irrigation Improvement Programme.
- Klaver, Dieuwke, and Barbara van Koppen. Forthcoming. Changing alliances between the state, male tenants and female farmers. The struggle for land in the irrigation scheme 'Office du Niger' in Mali. Unpublished.
- Krol, Marjon. 1994. *Irrigatie is mannenwerk*. Genderverhoudingen in een kleinschalig irrigatieproject in de Ecuadoriaanse Andes. Doctoraalscriptie voor de Vakgroepen Vrouwenstudies in de Landbouw en Irrigatie aan de Landbouw Universiteit Wageningen.
- Kumar, Shanti P. 1987. The Mahaweli Scheme and rural women in Sri Lanka. In *Women farmers and rural change in Asia: Towards equal access and participation*, ed. N. Heyzer. Kuala Lumpur, Malaysia: Asian and Pacific Development Centre (APDC).

- Lipton, Michael. 1992. Land reform as commenced business: The evidence against stopping. Draft paper, Institute of Development Studies at the University of Sussex. Cited in *A field of one's own. Gender and land rights in South Asia*, ed. Bina Agarwal (1994). Cambridge, Great Britain: University Press.
- Lynch Deutsch, Barbara. 1991. Women and Irrigation in Highland Peru. *Society and Natural Resources* Vol 4.
- Malhotra, S. P. 1982. *The warabandi system and its infrastructure*. Publication No. 157. New Delhi: Central Board of Irrigation and Power. Cited in: Chambers. 1994.
- Mallya, Emil, Barbara van Koppen, Suleiman Chambo, and Kees van der Poort. 1996. *Towards sustainability*. Formulation document for Phase III of the Traditional Irrigation Improvement Programme TIP Tanzania, 1997-2002. Arusha/Dar-es-Salaam/Utrecht.
- Mandal, M. A. S., and D. E. Parker. 1995. *Evolution and implications of decreased public involvement in minor irrigation management in Bangladesh*. Short report series on locally managed irrigation, no. 11. Colombo, Sri Lanka: International Irrigation Management Institute.
- Meinzen-Dick, Ruth, and Lee Ann Jackson. 1996. Multiple uses, multiple users of water resources. International Food Policy Research Institute. Paper presented at International Association for the Study of Common Property Meetings. June 1996. Berkeley, California.
- Meinzen-Dick, Ruth, and Margreet Zwarteveen. 1998. *Gendered participation in water management: Issues and illustrations from Water Users' Associations in South Asia*. This volume.
- Mellor, John W., and Guntant M. Desai (eds). 1985. *Agricultural change and rural poverty. Variations on a theme by Dharm Narain*. Published for the International Food Policy Research Institute. Baltimore and London: The John Hopkins University Press.
- Nederlof, Marc, and Eric van Wayjen. 1996. Religion and local water rights versus land owners and state. Irrigation in Izúcar de Matamoros (west bank Mexico). In *Crops, people and irrigation. Water allocation practices of farmers and engineers*, ed. Geert Diemer and Frans Huibers. London: Intermediate Technology Publications.
- Ostrom, Elinor. 1994. *Neither market nor state: Governance of common-pool resources in the twenty-first century*. IFPRI Lecture Series. Washington: International Food Policy Research Institute.
- PATA (Project Integrated Agricultural Development). 1996. *Land and water use programme. Participatory irrigation scheme development process guide book*. PATA publication 108. Islamic Republic of Pakistan Government of NWFP, Department of Planning and Development; Ministry of Foreign Affairs, Directorate-General for International Cooperation, The Netherlands; IWACO, The Netherlands and DHV Consultants, The Netherlands. Saidu Sharif: PATA.
- Povel S. A. M. T. 1990. *Participatory development of a women's irrigation scheme case: The Nyandusi women horticultural scheme Nyanza Province, Kenya*. Contribution to the International Workshop "Design for Sustainable Farmer Managed Irrigation Schemes in Sub-Saharan Africa." Department of Irrigation and Soil and Water Conservation. The Netherlands: Wageningen Agricultural University.
- Pradhan, Naresh. 1989. Gender participation in irrigation system activities in the hills in Nepal. In *Proceedings of second annual workshop on Women in Farming Systems*, September 1989. Kathmandu, Nepal: Institute of Agriculture and Animal Science. Rampur and USAID.
- Prins, Djura. 1996. La dinámica de los derechos de agua en el contexto de la intervención 'el Proyecto Múltiple Laka Laka' en Bolivia. Un estudio sensitivo hacia el papel de la mujer en la intervención. M.Sc. diss. The Netherlands: Department of Irrigation and Soil and Water Conservation Wageningen Agricultural University.
- Projet Sensibilisation et Formation des Paysans autour des Barrages. 1993. *Attribution des parcelles aux femmes dans les périmètres en aval des barrages: Possibilités et limites*. Ouagadougou, Burkina Faso: Ministère de l'Agriculture et des Ressources Animales.

- Safilidou, Constantina. 1986. *Agricultural strategies and programmes, the status of women and fertility. Background paper for the International Seminar on Women in Agriculture and Rural Development in Asia*. Huangxian, China (FAO/ESH/A86/3).
- Safilidou, Constantina. 1988. Farming systems and gender issues: Implications for agricultural training and projects. Ministry of Agriculture and Fisheries of the Netherlands and the International Agricultural Centre. Unpublished.
- Safilidou, Constantina, and Simeen Mahmud. 1989. *Women's roles in agriculture. Present trends and potential for growth*. Agricultural Sector Review sponsored by the United Nations Development Programme and Unifem. Dhaka, Bangladesh.
- Safilidou, Constantina. 1991. Gender and rural poverty in Asia: Implications for agricultural project design and implementation. *Asia-Pacific Journal of Rural Development* 1 (1). July.
- Schrijvers, Joke. 1985. *Mothers for life: Motherhood and marginalization in the north central province of Sri Lanka*. Delft, The Netherlands: Eburon.
- Seckler, D. 1993. *Privatizing irrigation systems*. Discussion Paper 12. Center for Economic Policy Studies. USA: Winrock International Institute for Economic Development.
- Sengupta, Nirmal. forthcoming. Negotiating with an under-informed bureaucracy. The case of water rights on system tanks of Bihar. In *Negotiating water rights*, ed. Bryan Bruns and Ruth Meinzen-Dick. Unpublished.
- Shah, Tushaar. 1993. *Ground water markets and irrigation development. Political economy and practical policy*. Bombay: Oxford University Press.
- SNV Tanzania. 1996. *Gender review and operational strategy*. Volume 1. Dar-es-Salaam: SNV Tanzania.
- Strosser, Pierre, and Ruth Meinzen-Dick. 1994. Ground water markets in Pakistan: An analysis of selected issues. In *Selling water: Conceptual and policy debates over ground water markets in India*, ed. M. Moench. Vikram Sarabhai Centre for Development Interaction (VIKSAT), Pacific Institute for Studies in Environment, Development and Security. Natural Heritage Institute.
- Traditional Irrigation Improvement Programme (TIP). 1993. *Rights are won; not given. TIP training on legal issues and gender*. 18-20 October 1993. Resource person: Betty Minde (KWIECO, Moshi). Report compiled by Eveline van der Grift. TIP WID North. Dar-es-Salaam: SNV Tanzania.
- United Nations Development Programme (UNDP). 1995. *Human development report 1995*. New York: Oxford University Press.
- Van den Dries, Adri, Paul Hoogendam, and José Portela. 1996. Effects of a technical intervention programme on water distribution and water use. In *Crops, people and irrigation. Water allocation practices of farmers and engineers*, ed. Geert Diemer and Frans Huibers. London: Intermediate Technology Publications.
- Van der Grift, Eveline W. 1991. Gender relations in traditional irrigation in Malolo, Tanzania. M.Sc. diss. Department of Irrigation and Soil and Water Conservation. Wageningen Agricultural University in collaboration with SNV Tanzania.
- Van der Grift, Eveline W. 1995. *Rights are won; not given: TIP training on legal issues and gender*. Traditional Irrigation Improvement Programme. Dar-es-Salaam, Tanzania: Traditional Irrigation Improvement Programme.
- Van Dok, Yvette, Kurnia Saptari Putri, and Avianti Zulaicha. 1993. Women in tertiary unit development. An experience from Indonesia. In *15th Congress on Irrigation and Drainage*. Transactions Volume 1-C Question 44. 1,203-1,218. The Hague, The Netherlands: International Commission on Irrigation and Drainage. Fifteenth Congress.
- van Koppen, Barbara. 1990. Women and the design of farmer managed irrigation schemes: Experiences provided by two projects in Burkina Faso. In *Contributions to the international workshop on design for sustainable farmer-managed irrigation schemes in sub-Saharan Africa*. February 1990, Wageningen, The Netherlands: Wageningen Agricultural University.

- van Koppen Barbara, forthcoming. Negotiating water rights in public irrigation: The case of rice valleys in Burkina Faso. In *Negotiating water rights*, ed. B. Bruns and R. Meinzen-Dick. Unpublished.
- van Koppen, Barbara, and Simeen Mahmud. 1996. *Women and water-pumps: The impact of participation in irrigation groups on women's status*. London: Intermediate Technology Publications.
- Verkruysse, B. 1991. Gender en grondenrechten in irrigatie-ontwikkeling. Een literatuuronderzoek naar het belang van toegang tot land voor vrouwen, de benutting van irrigatietechnologie en de rol van planners en technologen in het Jahally-Pacharr project in Gambia. M.Sc. diss. The Netherlands: Department of Irrigation and Soil and Water Conservation Wageningen Agricultural University.
- Vermillion, Douglas L. 1990. Second approximations: Unplanned farmer contributions to irrigation design. In *Design issues in farmer-managed irrigation schemes*, ed. Robert Yoder and Juanita Thurston. Proceedings of an international workshop of the farmer-managed irrigation systems network held at Chiang Mai, Thailand December 1989. Colombo, Sri Lanka: International Irrigation Management Institute.
- Von Benda-Beckmann, Keebet. 1991. Development, law and gender skewing: An examination of the impact of development on the socio-legal position of women in Indonesia, with special reference to the Minangkabau. In *The socio-legal position of women in changing society*, ed. LaPrairie and Els Baerends (guest editors). Journal of legal pluralism and unofficial law. Numbers 30&31/1990-1991. Groningen, The Netherlands: Foundation for the Journal of Legal Pluralism.
- Von Benda-Beckmann, Keebet, Mirjam de Bruijn, Han van Dijk, Gerti Hesseling, Barbara van Koppen, and Lyda Res. 1996. *Women's rights to the natural resources land and water*. Literature review for The Special Program Women and Development of the Ministry of Foreign Affairs, Department of International Cooperation. The Hague: Ministry of Foreign Affairs.
- Vos, Jeroen. 1994. Participative design unravelled. A case study on interventions in small scale irrigation schemes in the hills of Nepal. M.Sc. diss. The Netherlands: Department of Irrigation and Soil and Water Conservation. Wageningen Agricultural University.
- Wood, Geoffrey D., Richard Palmer-Jones, Q. F. Ahmed, M. A. S. Mandal, and S. C. Dutta. 1990. *The water sellers. A cooperative venture by the rural poor*. Connecticut, USA: Kumarian Press.
- World Bank. 1990. *World development report*. Washington D.C.: Oxford University Press for the World Bank.
- Zigterman, Erik. 1996. The difficult development process of a participatory irrigation scheme development process. The PATA project case. In *Proceedings and conclusions of the seminar on sustainable development of irrigation schemes*. March 1996. Islamabad, Pakistan. Government of Pakistan: International Irrigation Management Institute.
- Zwarteveen, Margreet Z. 1995. Gender aspects of irrigation management: Rethinking efficiency and equity. In *Irrigation management transfer*. Selected papers from the International Conference on Irrigation Management Transfer, ed. S.H. Johnson, D.L. Vermillion, and J.A. Sagardoy. September 1994. Wuhan, China. Rome: International Irrigation Management Institute and Food and Agricultural Organization of the United Nations.
- Zwarteveen, Margreet Z. 1997a. Water: From basic need to commodity. A discussion on gender and water rights in the context of irrigation. *World Development* 25(8):1335-1349.
- Zwarteveen, Margreet Z. 1997b. *A plot of one's own: Gender relations and irrigated land allocation policies in Burkina Faso*. Research Report No. 10. Colombo, Sri Lanka. International Irrigation Management Institute.
- Zwarteveen, Margreet Z. and N. Neupane. 1996. *Free-riders or victims: Women's nonparticipation in irrigation management in Nepal's Chhattis Mauja Irrigation Scheme*. Research Report No. 7. Colombo, Sri Lanka: International Irrigation Management Institute.