

WORKING PAPER 38

Do Equal Land and Water Rights Benefit the Poor?

Targeted Irrigation Development: The Case of the Andhi Khola Irrigation Scheme in Nepal



Jacobijn van Etten, Barbara van Koppen
and Shuku Pun

Working Paper 38

Do Equal Land and Water Rights Benefit the Poor?

*Targeted Irrigation Development: The Case of the Andhi Khola
Irrigation Scheme in Nepal*

*Jacobijn van Etten
Barbara van Koppen
and
Shuku Pun*

International Water Management Institute

IWMI receives its principal funding from 58 governments, private foundations, and international and regional organizations known as the Consultative Group on International Agricultural Research (CGIAR). Support is also given by the Governments of Ghana, Pakistan, South Africa, Sri Lanka and Thailand.

The authors: Jacobijn van Etten is an Associate Expert and Barbara van Koppen is a Senior Researcher, at the International Water Management Institute. Shuku Pun is a Research Consultant.

van Etten, J. ; van Koppen, B. ; Pun, S. 2002. *Do equal land and water rights benefit the poor? Targeted irrigation development: The case of the Andhi Khola irrigation scheme in Nepal.* Working Paper 38. Colombo, Sri Lanka: International Water Management Institute.

/ water / water rights / poverty / irrigation systems / water resources / land ownership / land reform / landlessness / food security / hydroelectricity schemes / farmer managed irrigation systems / water allocation / water management / land productivity / gender / equity / policy / irrigation intervention / poverty alleviation / water market / water users' associations / Nepal /

ISBN 92-9090-483-6

Copyright © 2002, by IWMI. All rights reserved

Please send inquiries and comments to: iwmi-research-news@cgiar.org

Cover photographs by Jacobijn van Etten show a cross section of poor farmers in the Andhi Khola area.

Contents

Units of Measure	iv
Abbreviations	iv
Acknowledgements	v
1. Research Aim, Questions, and Methodology	1
2. Background and General Benefits from the Andhi Khola Irrigation Project	2
2.1 Poverty characteristics of the project area	2
2.2 Scheme layout	3
2.3 General Benefits from the Andhi Khola Irrigation Scheme	4
3. The Initial Phases of the Andhi Khola Irrigation Project	5
3.1 The Initiative	5
3.2 The Design of the Allocation of Land and Water Rights	6
3.3 AKWUA	7
3.4 Household Survey, Adaptation of the Technical Design, and Construction	8
4. Land Redistribution	9
4.1 Design of the Land Redistribution	9
4.2 Implementation	10
4.3 Conclusions and Recommendations	12
5. Allocation of “Water to the People”	12
5.1 Design of the Allocation principle of “Water to the People”	12
5.2 Acquisition of Shares during Construction	13
5.3 “Equality” in Acquisition and Registration of Water Shares	14
5.4 “Inequity” in Factual Water Allocation and Distribution	15
5.5 Conclusions and Recommendations	17
6. Conclusions: Do Equal Land and Water Rights Benefit the Poor?	18
Bibliography	21

Units of Measure

Anna	Unit of area (equal to 31 m ²).
Ropani	Unit of area equal to 0.05 hectare. (1 ropani is 16 annas).

Abbreviations

AKWUA	Andhi Khola Multi-purpose Water Users Association
BPC	Butwal Power Company Limited
NORAD	Norwegian Agency for Development Cooperation
UMN	United Mission to Nepal
VDC	Village Development Committee
WUA	Water Users Association

Acknowledgements

This research was part of the Poverty, Gender, and Water Project of the International Water Management Institute. It was made possible thanks to the generous support of the Ford Foundation, New Delhi and the Government of the Netherlands. The support given by Mr. Khem Raj Sharma, Chief of the Research and Technology Development Branch, and Mr. Ram Prasad Bhandari of the Research and Technology Development Branch of the Department of Irrigation in Nepal is much appreciated. The authors also thank Franz and Keebet Von Benda-Beckmann for their valuable suggestions during the design of this study and Ian Curtis for his comments on the earlier draft. The support provided by Krishna C. Prasad and Rajendra Shilpakar of IWMI Nepal, was equally essential for this project. Last but not the least, the authors express their gratitude to Mr. Padam Ayal, General Manager of the Andhi Khola Water Users Association Scheme, and other farmers for the warm hospitality and ample time given to them.

1. Research Aim, Questions and Methodology

Irrigation development contributes most effectively to poverty alleviation if rights to the newly developed water resources and irrigated land are vested in the poor (Chambers et al. 1989). In this way, benefits of irrigation investments accrue primarily to the poor. If irrigation infrastructure is developed on sites of small and large landowner farmers, the largest part of the benefits of water is for the larger landowner farmers, because division of benefits more or less follows inequities in land distribution. The landless poor are altogether excluded from direct gains, although increased wage employment opportunities and higher food availability may improve their well-being indirectly. Thus, irrigation development risks being biased towards those who already own land.

The acknowledgement of this fact has stimulated irrigation investors to uphold poverty alleviation as their primary aim and to develop irrigation in such a way that it redresses inequities in resource rights. For example, targeting the poor was achieved by prioritizing infrastructure development in sites owned by poor people (PATA 1996). In some countries such as Tunisia, Kenya, and Sri Lanka another major way of reaching the poor was effected through the implementation of a distributive land reform in the command area (Jazairy et al. 1992). In smaller schemes also irrigation development was accompanied by a distributive land reform, as done in Peru (Martinez 1998).

Another option to ensure less unequal benefits for the poor is by allocating water rights equally among all landowners, tenants and landless people. In these cases, water is not only used to irrigate own plots but also for exchange and sale, which opens up new possibilities for those with little or no land. This allocation principle of “water to the people” is claimed to be more pro-poor than the common principle of “water to the land” by which water is allocated to landowners in the command area, proportional to their land size. In South Asia, the principle of “water to the people” has been implemented, for example, in tank irrigation in Sukhomajri, Haryana (Sarin 1996), in tubewell irrigation in the Pani Panchayat projects in Maharashtra (Chambers et al. 1989), and through Landless Irrigation Groups in Bangladesh (van Koppen and Mahmud 1996). However, especially in canal irrigation, there is little or no empirical evidence to show whether this option of allocating equal water rights does actually benefit the poor.

The present research aims to fill this latter gap by analyzing the experiences in the Andhi Khola Irrigation Scheme in the hills of west central Nepal. The United Mission to Nepal (UMN), in collaboration with the Department of Irrigation of His Majesty’s Government of Nepal, initiated this project in 1982. An area of 282 hectares of which only small portions received water from seasonal streams came under year-round irrigation. A distributive land reform policy was implemented in this area according to which larger farmers had to sell part of their land for resale to the landless. Moreover, the project designed and implemented a water allocation system in which everyone could earn tradable water rights (shares) through participation in construction work. In 1997, the scheme was finalized and handed over to the Andhi Khola Water Users Association (AKWUA).

The research focused on the following questions:

- How was the land redistribution designed and implemented, and what are the effects for different categories of farmers and landless people?
- How was the allocation of equal water rights designed and implemented, and what are the effects for the different categories of farmers and landless people?

- What are the overall benefits of the Andhi Khola Irrigation Project for poor farmers?
- What lessons and recommendations for successful targeting of irrigation investments at the poor are to be retained for replication elsewhere?

Answers to these questions were sought through open interviews among male and female water users, irrigation leaders, project staff, and other informants; observation of major events; and review of literature and project documents. This allowed an ex-post reconstruction of the project design and implementation. For the impact assessment, structured interviews were held. Respondents to the questionnaires were purposely selected from different social strata to include both men and women from the poorest strata as well. The household poverty status was defined according to land-holding size of irrigated and rain-fed land, per capita agricultural production, and off-farm incomes. Four socioeconomic categories were distinguished—poorest, poor, middle and better off. In total, 35 men and 48 women in 53 households were interviewed. Ten households were female-headed households.

The 53 sample households were spread over different socioeconomic groups as follows:

- *4 Households: Better-off:* 0.8–1.25 hectares of irrigated land per household, food surplus, often with off-farm employment.
- *19 Households: Middle:* 0.35–0.8 hectare of irrigated land per household, food self-sufficient, some have off-farm employment.
- *7 Households: Poor:* 0.15-0.35 hectare of irrigated land per household, food deficiency for less than 6 months per year, limited wage work.
- *23 Households: Poorest:* less than 0.15 hectare of irrigated land per household, most of them are wage workers.

2. Background and General Benefits from the Andhi Khola Irrigation Project

2.1 Poverty characteristics of the project area

The project area, a low ridge located between the Andhi Khola river in the north and the Kali Gandaki river in the south in the southern part of the Syangja district, is poverty-stricken. Population density is as high as 370 persons per square kilometer. The total population consists of approximately 15,000 people, of which 75 percent are Hindus (Westborg 1989). Eighty-two percent of the households own less than half a hectare of land (Poppe 1983). The cultivation of the arable land is intense but risk-prone because of unsteady soils and landslides. Few farmers have access to irrigated land; their plots are less than 0.5 hectares. Only less than 3 percent own more than 1.5 hectares of irrigated land. About 70 percent of the households cannot reach food self-sufficiency in this area (NSAE 1997:3). Most families try to increase their income by taking up temporary jobs in or outside the area. Consequently, half the men between 20 and 40 years are away from their families in search of additional income for their families (Poppe 1983). The most important income-generating sectors are agriculture, construction work, the army, and some business activities.

Figure 1. Siphoning of water from the main irrigation scheme to the Asardi sub-scheme in the Andhi Khola Irrigation Scheme.



Maize, pulses and millet are the main food crops on the rain-fed land on the upper slopes of the hills. Grass for fodder is grown on the steeper slopes. Before the Andhi Khola irrigation project was launched, some fields in the flat areas near the rivers were irrigated all year round (Poppe 1983). Other fields only received canal water supplied by flows during the summer (monsoon). If there was sufficient water, three crops per year were grown: rice, wheat and maize. After the implementation of the irrigation project, this became the most predominant cropping pattern throughout the command area.

2.2 Scheme layout

The Andhi Khola river, which is the main water source for the Andhi Khola Irrigation Scheme, is fed by melted water and rain. The discharge of the Andhi Khola river measured at the headwork of the irrigation system strongly varies: from 1.8 to 362.2 cubic meters per second (NSAE1997: 6). Water is scarcest in the spring months from February to April. The headwork is located at Tallo Galyang Bazar of Jagatradevi Village Development Committee. From the Andhi Khola river, water is diverted to the surge tank of a power plant of the Butwal Power Company (BPC) and to the irrigation system. The power plant requires a discharge of 2,700 liters per second to generate power on full capacity. For irrigation, discharges of 0-600 liters per second are required depending on the crop, the crop stage, and on additional rains.

The altitude of the command area ranges from 380-625 meters above sea level (NSAE 1997: 4). Seventy-three percent of the irrigated lands are flatter than 8 degrees, but other parts include sloping lands up to 30 degrees. Immediately downstream of the head-intake, the canal splits into the eastern and western main canal. The eastern main canal is a contour canal of 5.1 km and has eight secondary off-takes (E1-E8). The eastern main canal is lined with soil cement and its capacity is of 642 liters per second at the head and of 17 liters per second at the tail. The alignment of this main canal passes through numerous drainage crossings that have been provided with pipe siphons.

Figure 2. Overview of Andhi Khola irrigation project area.



Photograph by Jacobijn van Ertten

By doing so, the steep slopes remain stable. The eastern main canal serves 180 hectares of land. The eastern canal also supplies the Asardi Pipe Canal System (2.42 km long), to feed the slopes on the other side of the valley. The outlet of the pipe is built at the highest point of the Asardi village, from where four tertiary canals irrigate another 85 hectares of land.

The western main canal is 1.5 km long. It supplies 17 hectares of land through two branches. The capacity of this canal is 45 liters per second at the head end and 14 liters per second at the tail end. Up to the first crossing the main canal is a buried pipe, after that it continues as a contour canal. There are two earthen unlined branch canals, W1 and W2.

The tertiary system consists of earthen canals running down the slopes. Designed discharges vary from 15-10 liters per second, and areas served vary from 6-44 hectares. Necessary drop structures and flumes with stilling basins are constructed to dissipate excess energy and prevent erosion. Distribution boxes in the branches make it possible to distribute water proportionally, even if it concerns only small quantities (NSAE, 1997:11).

Because of the one kilometer hard rock tunnel, the siphon to the Asardi sub-scheme, and other devices, the scheme is relatively expensive.

2.3 General Benefits from the Andhi Khola Irrigation Scheme

Before implementation of the project in the selected sites, natural springs irrigated 57 hectares. The new scheme that covers this area also includes formerly rain-fed and fallow land, totaling 282 hectares. The land distribution in the formerly rain-fed and fallow land was less skewed than in the irrigated part, so the new Andhi Khola Irrigation Scheme includes relatively more small landowners than in the formerly spring-irrigated area.

As reported by the respondents, farm households that gained access to irrigation through the project benefited considerably. Households in the command area increased production from two to three crops per year and achieved higher yields, which improved their food security and income.

The number of livestock grew because of the increasing wealth in the area and the need for more compost on the intensively cultivated fields in the irrigation system. Larger landowners who lacked labor for this type of cropping intensification started to lease out more land, to the benefit of land-poor farmers. Cropping intensification has also increased employment opportunities for paid laborers.

However, the burdens of these benefits were gender-biased. Women's tasks in the family farm increased more than men's because tasks traditionally handled by women such as weeding, transplanting and harvesting increased when rain-fed agriculture was replaced by irrigation. Furthermore, the growing number of livestock required more labor to collect fodder, a task that was usually done by women.

The water provided by the Andhi Khola Irrigation System is not only used for irrigation. All families interviewed used the canal water for washing, bathing and cleaning also, while a large majority (89%), uses it for watering livestock. Three households have a brick factory and one household has a mill for which canal water is an important resource.

The above-mentioned benefits are typical for most irrigation projects in command areas, where poor households occupy at least some of the land. However, non-poor households benefit relatively much more. The following sections will discuss the question as to how the project's specific policies of pro-poor land redistribution and allocation of "equal water rights to all" were initiated, designed and implemented, and whether this further enhanced benefits for the poor.

3. The Initial Phases of the Andhi Khola Irrigation Project

3.1 The Initiative

The first demand for irrigation development in the Andhi Khola dates back to 1958. Driven by poverty, the local leaders requested irrigation facilities to intensify agriculture on 1,000 hectares of land. The request was made to the late King Mahendra during his visit of the Western Region (Pokhara) in 1958, and reiterated to King Birendra when he visited Pokhara in 1976. In the early 1960s, the Government of Nepal requested the UMN to develop a technical training institute in Butwal. The Butwal Technical Institute (BTI) and the Butwal industries were started as a training program for the 14–18 year olds. The first hydro project was a 1 MW scheme close to Butwal and the electricity from this supported the development of the institute, the industries and the town. Around 1980, once the BTI was fully operational the UMN initiated a hydropower production project in Andhi Khola. However, the UMN wanted this to become a developmental project. Thus, the project combined hydropower production and rural electrification with non-formal education aimed at women in the area. It also included water supply and sanitation, agricultural extension and an irrigation project. In addition there was also a savings program for everyone working on the hydro project. One of the objectives was to reduce poor people's indebtedness to the moneylenders.

The Andhi Khola Integrated Rural Development Project was thus initiated. The initial focus was on hydropower development and a rural electrification program, accompanied by other activities, including irrigation, drinking water and sanitation, agricultural extension, enterprise development, and non-formal education. All these efforts would serve as a catalyst for the general development in the area. In 1982, His Majesty's Government of Nepal and the UMN signed a Memorandum of Understanding for the construction of a 5 MW power plant and a rural electrification pilot program. The construction of the hydropower plant was funded by the

Norwegian Agency for Development Co-operation (NORAD). The UMN complemented this with the integrated rural development program.

3.2 The Design of the Allocation of Land and Water Rights

Acting upon the request of the local leaders, the UMN realized that a mainstream irrigation development approach would first and foremost benefit landowners, while those who had smallholdings or who had no land at all would benefit less. The UMN, however, strived for an irrigation development by which all, landowners and the landless, would benefit equally. Therefore, in December 1982, the UMN held a meeting with 300 community members to explain its conditions and negotiate the possibilities of a more equitable irrigation development. The participants supported the UMN project principles of equitable benefits for both the landed and landless members of the community. During this meeting, the People's Irrigation Committee, which later was transformed into the Andhi Khola Multi-purpose Water Users Association (AKWUA), was also formed. This committee was responsible for working out the project methodology (Thiessen 1983:17).

During 1982-1984, prior to the construction of the Andhi Khola project a "Motivational Campaign" was undertaken. A great deal of time was spent on discussing the principle of equitable benefits with community leaders and government officials (but less with poor beneficiaries themselves). As an example, the farmer-managed irrigation system in Chherlung in the neighboring Palpa district was discussed during these meetings. In this system all community members could obtain equal benefits from their labor contributions in construction and maintenance of the system. In addition, some study tours were organized for farmer leaders to other irrigation systems such as Chherlung, Chhattis Mauja in Rupandehi district and the Sukhomajri project in India.

Eventually, the UMN left the options to the local leaders: either the rights to the land or the rights to the newly developed water should be divided equally among the inhabitants of the Andhi Khola area. Farmers present were not in favor of a complete land reform and rather preferred to divide the water equally. The principle, which UMN and the farmers agreed upon was, first, that the water rights would be divided among the beneficiaries living in the area, based on the labor contributions during the construction of the scheme and not on the amount of land one owned. Water would be allocated to all who would earn or purchase shares. This kind of water allocation would provide financial incentives for efficient water management and expansion of the area served (Thiessen 1983:13). Second, the resource base of landless and land-poor people, who had earned access to water, would be ameliorated by giving them access to land. In order to do so, all households that had more land than strictly needed for subsistence would be obliged to sell 10 percent of their surplus land. These lands were then to be resold to landless and land-poor people (Thiessen 1983:13). The land redistribution was justified by the fact that 78 percent of the lower caste people (artisans) do not own irrigated land at all, while only 9 percent of the high castes do not have irrigated land (Pope 1983:18).

These resource allocation principles were consolidated and submitted in a Feasibility Study in 1983. Other important conditions at the outset of the project included a higher participation of the community in construction, full understanding and support for the principle of equitable distribution of benefits by the community, and low maintenance costs of the system. The Feasibility Study also investigated the technical and economic feasibility of the Andhi Kola Irrigation Project. About 600 hectares of severely water-deficient lands were marked for irrigation, covering the area of eight Village Development Committees. This would require a workload equaling 80,000 water shares. The overall benefit-cost ratio of the project exceeded three.

3.3 AKWUA

The Andhi Khola Multi-Purpose Water Users Association (AKWUA) was set up to provide a coordinating function between the UMN and the users (UMN 1997:10). It was registered at the office of the Chief District Officer in Syanja in December 1984 under act 2034. In doing so, it became the first registered local Water Users Association in Nepal.

AKWUA would co-implement the project and manage the funds. The following responsibilities were defined:

- Be the direct partner of the UMN during design and construction of the scheme.
- Organize local participation through group meetings and awareness raising.
- Be responsible for the household survey, mobilization of labor, and mobilization of local building materials.
- Organize the land reallocation by purchasing “surplus” land and resale of the land to the poor with water shares.
- Distribute the “tickets” (preliminary water share receipts).
- Keep records and take charge of administration.
- Take over the ownership, operation and maintenance of the irrigation scheme after its construction.

An organizational structure was adopted, whereby the General Assembly was the highest decision-making body. A Board of Directors was responsible for daily governance. A General Manager (GM) was responsible for day-to-day management of the irrigation system; he reported to the Board of Directors. Two advisory bodies were established: the Evaluation Committee (to evaluate applications for land and advise the Board) and the Land Distribution Committee (to redistribute land). Shareholders were organized into Branch Committees to manage the concerned branch. Maintenance and fee collection were part of their tasks.

Initially, membership of the AKWUA was not restricted: everybody registered as resident (living in the area for at least three months a year) in the project area which covered eight Village Development Committees (VDC) and who paid an entrance fee of NRs1¹ could become a member. In 1989, ownership of shares was added as a condition for membership.

According to AKWUA’s constitution, each member had the right to:

- Earn up to four shares per household member, either through provision of labor, or through direct payment, during the construction phase of the scheme. In 1989, this was amended to enable farmers who were willing to contribute more labor to earn more shares. The maximum number of shares a person could obtain was increased from four to ten.

¹NRs 25 equaled US\$1 in 1988.

- Dispose a part of the water flowing out of the head gate at any given time, provided one had registered the required shares before each season and paid the water fee. The amount of receivable flow depends on the number of shares a person has registered.
- Lease out shares to other people. This should be done before the start of the new cropping season.
- Dispose shares to any person who is not forbidden to purchase shares in AKWUA.
- Vote at General Meetings.
- Have priority over non-members in receiving offers of any paid labor for extension or maintenance of the irrigation system.

Each member was obliged to:

- Offer a sale of 10 percent of “surplus” land to AKWUA.
- Contribute labor for construction of the scheme to earn water shares.
- Pay water fees and contribute to maintenance.
- Respond without fail to the General Manager’s call for labor in case of an emergency.

AKWUA also signed an agreement with the Butwal Power Company (BPC) in 1987, to share diverted water for their respective use. Under normal circumstances, AKWUA could obtain a maximum of 687 liters per second of water at the headwork. However, when there was insufficient water for both the irrigation system and the power plant, priority was given to the power plant. Nevertheless, there is a provision in the agreement to release water during one week in the dry season to make maize cultivation possible.

3.4 Household Survey, Adaptation of the Technical Design, and Construction

In 1984–1985, the household survey was implemented in the eight Village Development Committees of the project area. In this survey, land size was measured in relation to family size to determine first, which families had to sell how much “surplus” land, second, which families would be eligible for land allocation, and, third, how many inhabitants of the project area would be allocated a ticket to earn water shares.

The technical design underwent considerable changes before construction started in 1989. In 1988, a new Memorandum of Understanding was signed between His Majesty’s Government of Nepal and the UMN. By then, the command area was reduced to 400 hectares. In a new feasibility and geo-technical assessment study in 1989, the command area was further reduced to 282 hectares, covering three Village Development Committees: Tulsi Bhanjyang and Jagtradevi in Syangja district and Hungi in Palpa district. The unstable soil condition made most of the planned stretch of the western canal unfeasible (Westborg 1989). In this study the benefit-cost ratio dropped to 1.9. Farmers were hardly involved in the technical design.

This new technical design required re-estimating the workload for the construction and linking this to shares of water available at the intake. The earlier estimate of 80,000 shares was re-adjusted

to 25,000. Based on the designed total discharge of 642 liters per second in the main canal, the discharge per share was calculated: about 0.025 liters per second on continuous feed. To irrigate one hectare, about 80 shares would be needed.

The project was planned in two phases. The budget for the construction and land distribution in the first phase was NRs 15 million (US\$600,000). NORAD (Norwegian Agency for Development Cooperation), through UMN, gave this to AKWUA, partly as a grant of NRs 5.4 million (US\$216,000) and partly as a loan of NRs 6.1 million (US\$244,000). In addition, the beneficiaries contributed NRs 3.5 million (US\$140,000) through labor. The grant for the second phase was NRs 4.4 million (US\$176,000). The loan was to be repaid, but repayments would be kept as an emergency and repair fund by AKWUA.

In 1989, construction started near the village of Lalayangin. The whole scheme was finalized in 1996. In 1997, the system was formally handed over to AKWUA. In the hand-over agreement, AKWUA signed three contracts that arranged first, the repayment of the outstanding loan by AKWUA, second, AKWUA's commitment to completing the land reform, and, third, the further sale of the water shares that UMN had earned itself. The outstanding loan amounted to NRs 3.8 million, which meant that each farmer had a debt of NRs 100 per share. This was to be paid back during five years with two seasons per year. Thus, the debt is NRs 10 per season per share, to be deposited in the emergency and major repair fund of AKWUA. Since the handing over of the system to the AKWUA, the role of UMN has been very limited.

Following up on the household survey, the land redistribution was implemented during the construction and even the use phase. This process and its impacts on land-poor and landless farmers are discussed in section four. The acquisition of water shares through participation in construction work and the implications of allocation of "water to the people" during the use phase are discussed in section five.

4. Land Redistribution

4.1 Design of the Land Redistribution

At the start of the project, the UMN and village leaders agreed upon the principle that all households in the project area that had more land than strictly needed for subsistence were obliged to sell 10 percent of their "surplus" land to AKWUA as the intermediary land bank. The level for subsistence was set at 11.5 *annas* (0.036 ha) irrigated land per person, which is considered to equal 2 *ropani* (0.1 ha) rain-fed land, or 5 *ropani* (0.25 ha) fallow land (Poppe 1983). Thus, a landless family of seven could apply for 0.25 hectare irrigated land. Landless and land-poor people were given the opportunity to buy the "surplus" lands that AKWUA had bought from the larger farmers. Claimants could buy land from AKWUA if they fulfilled the following criteria (Westborg 1989):

- Being a shareholder, having earned or bought water shares.
- Being a Nepali citizen and 16 years or older and living in the project area.
- Having less than 11.5 *annas* irrigated land per household member.
- Attaching the land certificate, if any, to the application.

- Providing a recommendation letter from the *ward* chairman.
- Abiding by the rules and regulations of the Water Users Association.

First, the Evaluation Committee would select the beneficiaries and send their names with a recommendation letter to the Land Distribution Committee. The Land Distribution Committee in consultation with the Board of Directors of the Water Users Association would make the final decision. Female-headed households were given priority. AKWUA's constitution also stated that land purchased by AKWUA should be allocated to beneficiaries within 6 months and that the land redistribution should be implemented prior to commencement of the canal construction. AKWUA also promised to sell land to landless farmers at the same price at which they purchased it. To minimize land speculation, land acquired from AKWUA could, during the first 10 years after acquisition, only be sold or mortgaged in any form to a third party after having obtained approval of the Board of Directors.

The UMN had provided a loan to AKWUA to buy the land. AKWUA, in its turn, provided a loan to the selected applicants to purchase the land. The new landowners had to repay the loan in instalments that would be kept as an emergency and repair fund.

4.2 Implementation

The first step in the land redistribution process—the purchase of land from the “larger” farmers—was implemented, but with a long delay. The “larger” landowners accepted to sell because, first, the price for the lands sold was quite high and, second, the value of the remaining lands that would be irrigated if UMN's condition of land redistribution were accepted would increase. However, the larger farmers tried to sell mainly scattered, low quality land. This meant un-terraced land or land near forest, which was prone to attacks from monkeys. AKWUA asked neighboring farmers who had to sell part of their land to select adjacent parts to sell, so that the plots to be bought by AKWUA were at least 4 *ropani* in extent. In most cases, however, these farmers could not come to an agreement as to which part should be sold. Other farmers, whose land was already fully or partially irrigated by natural streams, objected to their land being included as “surplus” land. Further, farmers disagreed with the classification of their land. The price of the land depended upon the slope (NRs 2,000 for flat land, 1,800 for land with a slope up to 20% and 1,600 for a slope up to 30%). Farmers, for example, in the units E6 and E7 refused to sell for this price, arguing that their land had a higher value because it was flat and fertile. Nevertheless, eventually, only three of the larger farmers did not sell the mandatory part of their “surplus” land. By 1999, 12 hectares (232 *ropani*) of land had been purchased by AKWUA.

The process of land allocation started in 1993, when eligible landless and marginal farmers from the eight Village Development Committees (VDCs) of the project area applied for land. In total 66 landless candidates and 71 marginal landowners applied, of these 120 were men and 17 women. The factual allocation of land started in 1995. By the end of 1999, a total of 12 hectares land had been allocated to 53 (of the 137) farmers, which is an average of 0.23 hectares per family. Of the 53 allocated land titles, 23 were in the name of landless farmers and 30 in the name of marginal farmers. Initially no land was allocated to women, but after 1999, 18 women were allocated land. In 10 cases, AKWUA considered the husbands who had applied for land not eligible because of irresponsible behavior (drunkards), migration, or lack of investment power to use the land productively. Therefore, AKWUA allocated to the women who were supposed to invest their

own *pewa* (a woman's own property, gifted from her parents, her husband, or her husband's family). Six households had women as their heads.

A problem in the land allocation phase arose when a shopkeeper, who was considered a rich person, was allocated land. He did not possess land in the project area, which was the main criterion for eligibility. However, he did have land in the *Terai*, the low plains in southern Nepal (NSAE, 1997:15). Although the constitution and by-laws made this allocation possible, it was not the intention of UMN to allocate land to better-off people. Solving this issue not only blocked the land allocation for about 2 years, but also discouraged farmers who were willing to sell.

The major problem was the huge delay in implementing land distribution in the Andhi Khola area, in spite of the household survey of landholding sizes and family sizes of all families in the project area being completed in 1984–1985. This considerably reduced the benefits for the poor. In spite of the agreement at the start of the project, the purchase of land started only in 1989, simultaneously with the start of construction, and went on till 1994. The allocation process was also delayed. Thus the portion of land to be sold to AKWUA was based on the family size as determined back in 1984. In some cases, family size changed between 1984 and 1989 due to migration and other demographic reasons. Those farmers, who could have kept more land due to an increase in family size, were reluctant to sell the whole portion of land based on the calculations made in 1984. On the other hand, the delay proved advantageous for some of the original landowners who had sold land to AKWUA but whose land was still in the name of the original owner instead of AKWUA. The original owner could use this land sold to AKWUA, which was not yet attributed to landless farmers. This person had to pay only a minimal rent (of NRs 2 per season) to AKWUA.

Most importantly, the delay in the purchase of land affected the price of the land. During 1989–90, 3.5 hectares (70 *ropani*) of land was sold to AKWUA at slope-dependent rates of NRs1,600–1,800–2,000 per *ropani*. However, in 1990/91 the purchase price of AKWUA was increased to NRs 2,600–2,800–3,000. Since this price change did not have any retrospective effect, this decision was strongly regretted by farmers who had already sold their land. When land was finally sold to the eligible farmers, construction had almost been finished and the land was already considered to be irrigated land. The Land Revenue office, therefore, objected to the sale of land to the poor at the prices set by AKWUA. Even though AKWUA had promised the former landowners that AKWUA would sell at the same price as when they bought the land, the selling price of the land had to be raised substantially. This made the venture considerably less profitable for the poor allottees and reinforced complaints among the earlier sellers.

The ultimate benefits for poor farmers were further curtailed in two other ways. First, at the moment of land transfer, the land buyer had to pay a royalty of NRs1,500–3,000 to the Land Revenue Office. Poor farmers were not able to pay this amount cash-down and had to take a loan. This was only available from informal moneylenders. Second, the newly acquired land that was still fallow and often un-terraced, needed high investments to make it cultivatable. Not all beneficiary farmers could afford these extra investments. Especially the lower caste people, who had had jobs outside agriculture before, lacked the farming experience. As a result, in some cases the land was left fallow and there are no returns on the investments as yet. Hence, several farmers could not repay the loan installments for their land. Up-to-date, no sanctions have been imposed on these farmers.

A factor that undoubtedly contributed to the slow progress of implementation and relatively high land prices, favoring the larger landowners, was the composition of the Evaluation Committee and Land Distribution Committee of AKWUA, which implemented the land redistribution process.

While landowners selling part of their “surplus” land were represented in these bodies, poor, landless and marginal farmers were not. An implication of the delay was that during most of the construction phase of the new scheme, landless and land-poor farmers lacked any guarantee that they would obtain land in the new command area. This discouraged them to earn shares, as elaborated in the next section.

4.3 Conclusions and Recommendations

The events in the Andhi Khola Irrigation Scheme confirm that land redistribution set by agencies as a condition for irrigation investments and for which they provide a loan, is effective in enhancing benefits for landless and land-poor people who, otherwise, would have been excluded from the benefits of irrigation. However, the gains for poor farmers would have considerably improved if this valid concept had been effectively implemented. To that end, agencies who seek to replicate the distributive land reform should:

- Include the beneficiaries in the planning and implementation process of the land distribution from the very inception onwards.
- Implement clear, valid, and credible criteria for those who are obliged to sell land and those eligible to purchase land.
- Finalize the purchase of land from the larger landowners before construction starts and sell land at the same low price it was purchased.
- Set a price for the land to be transferred that takes the quality of the land in consideration (e.g., slope, former cultivation, adjoining plots, fertility, and terracing) so as to avoid low-value land from being sold.
- Provide loans or subsidies to purchase land and to pay transaction costs.
- Include relevant institutions like the Land Revenue Office in the process from the very beginning.
- Prioritize poor farmers who are motivated to undertake irrigated agriculture and who are prepared to make the necessary initial labor investments.
- Ensure that people can use the resources they obtain by providing adequate extension support and loans for land improvement and cultivation.

In order to enforce these conditions, funding agencies could, for example, release funds for construction only after finalization of the agreed steps in land reform.

5. Allocation of “Water to the People”

5.1 Design of the Allocation principle of “Water to the People”

When the construction of the Andhi Khola Irrigation Project started in 1989, the following water allocation system had been designed and agreed upon by the UMN and the farmers:

- Water shares can be earned either by supplying labor for the construction of the scheme or by payment. This right is explicitly open to all household members in the project area, regardless of sex or land title.
- A “ticket” is allocated to each household member in the project area. This entitles the holder to acquire four water shares by contributing four times 5 days of labor in construction of the scheme. In other words to hold four shares an individual has to put in 20 days of labor and this would entitle him/her to get sufficient water to irrigate one *ropani* of land (0.05 ha).
- Farmer leaders can earn extra shares by supervising other farmers during construction: supervising 100 farmers during one day is equivalent to 7 days labor.
- Each shareholder disposes of the proportion of water that his or her share permits.
- Shares can be traded, which means that those who are entitled to more water than they actually use, can sell their surplus shares to those in need of extra water. So, farmers with small landholdings and landless people can sell (part of) their shares to farmers with relatively large landholdings. Selling and leasing out shares is expected to generate a stable source of income for landless and land poor farmers (Westborg 1989).
- Every season (twice a year) farmers have to register with AKWUA as to how many shares they want to use in the coming season.
- Water distribution in the main canal and distributaries is fully regulated according to the number of shares registered for that part of the command area. (The physical infrastructure of the irrigation scheme incorporates sophisticated division boxes that allow the required diversion of water in different directions and in different [even very small] quantities).
- The water service fee is based on the number of registered shares. This fee has to be paid at the end of the cultivation season for which the shares were acquired. It is only after this payment is made that shares can be registered for the next season.
- Farmers are obliged to contribute labor for canal maintenance. Depending upon the Branch canal, labor obligations are either proportional to number of shares registered, or the same for each household. In case of non-participation, a fine must be paid.

5.2 Acquisition of Shares during Construction

The first part of the implementation of this water share system was the acquisition of shares during the construction phase. Implementation started in 1984 with the allocation of one ticket to each household member in the project area, which entitled them to earn water shares for 1 *ropani* (0.05 ha) of irrigated land. However, the total number of tickets that were distributed was based on the originally projected infrastructure covering about 600 hectares. Later, this was reduced to 282 hectares, which required a lower labor input. The reduction of future benefits disappointed the people, while the cancellation of a part of the already distributed tickets caused confusion.

Another problem was that the participation of landless people was much below expectation. Only 450 of the 17,739 farmer-earned shares were gained by poor people who were not irrigating

yet, while the whole objective was that this group should gain 50 percent of the shares. Apparently, the “Motivational Campaign” had failed to convince them. With the delay in the implementation of the land reform, they were not convinced that they would ever be in the position to buy land, nor were they convinced of the (future) use of the shares. Most landless people who ultimately gained access to land bought shares after the construction phase.

Although there was not always work available at times convenient for people, and there were not always people available at times the project needed them, farmer participation in construction work was generally adequate till 1994. After 1994 mostly hired laborers undertook the construction work. This was partly because farmers had already earned enough shares to cover their water needs and partly because more complicated structures like the siphon bridge to Asardi were built. Moreover, the UMN was pressurized by the government to speed up the implementation and also to pay for the labor, rather than demanding it for free. Hence, the UMN used hired labor for the last 2 years of construction. By doing so, the UMN itself earned over 7,000 water shares. The UMN handed out some of these shares to the physically weak and poor people. AKWUA also sold its shares. Those who bought the shares were mainly larger farmers who wanted more shares than they could earn during the construction phase (each household member was allocated only one ticket and thus four water shares). This way, those larger farmers no longer had to depend on poor farmers and the landless to buy shares. The expected scarcity in shares among better-off households that would lead to their demand for water from the poorer households and the emergence of a water market remained unrealized.

5.3 “Equality” in Acquisition and Registration of Water Shares

Once the scheme started functioning farmers had to register the number of water shares they intended to use for the coming season with AKWUA. The number of registered shares determined the amount of water services fees to be paid. In the cultivation season of 1996/1997, the water service fee was NRs 17 per share.² Thus, per hectare of irrigated land (which equals 20 *ropani* and requires 80 shares), a farmer had to pay NRs 1,360 per season. For comparison, in a run-of-the river system rates of NRs 60 per season per hectare are normal; for pump systems this is NRs 400 (IWMI 1999). The high service fee is partly due to the large debt component, but even disregarding the debt component the water service fee is still NRs 560 per hectare per season. This is extremely high for a gravity irrigation system in Nepal.

In the 53 sample households of different socioeconomic groups, the number of shares acquired during the construction phase and the number of shares registered in 1999 were assessed. In Table 1 the average number of shares acquired and registered by a socioeconomic group is compared with the number of shares required based on the size of the irrigated land, assuming that shares/water requirements are proportional to land size.

Table 1 shows that especially the poorest households have earned more shares than required according to their land size. They earned in average 24 shares per household, while they needed only 14 for their limited land sizes. Moreover, the rule that a farmer should register water requirements proportional to land size (so four shares per *ropani*), is not consistently implemented. Especially the “poorest” households tended to acquire more shares than required. “Poor”

² The fee per share is made up of the following components: administration costs, NRs 2.; headwork maintenance cost, NRs 2, to be remitted to Butwal Power Company Limited; operation and maintenance cost of AKWUA, NRs 3; loan repayment, NRs 10, as indicated in section 3.

Table 1. Required, acquired, and registered shares by socioeconomic group (averages per household).

Socioeconomic Group	Average land size per household (ha)	Required shares based on land size*	Acquired shares during construction	Registered shares in 1999
Better-off n=4	1.0	82	31	33**
Middle n=19	0.59	47	21	19
Poor n=7	0.25	20	23	22
Poorest n=23	0.17	14	24	16

Note: *0.05 hectare land = 1 ropani = 4 shares

**The number of registered shares can be higher than the number of shares acquired during construction because farmers can buy shares.

households on an average acquired and registered number of shares that is in accordance with their land size. There are also cases, for example, of a poor household with 0.23 hectare of irrigated land (4.5 *ropani*) that had registered and paid for all of their 32 water shares in 1998, whereas it would have been enough for them to register (4.5 times 4) 18 shares only. It is likely that the poorer households are not well informed and not fully aware of how the share system works. However, it could also be a deliberate attempt on their part to secure their access to water.

Above all, the allocation of “equal water rights” benefited the “middle” and especially the “better-off” who obtained considerably less shares through labor or purchase, than they would actually need to irrigate their larger plots. Moreover, both the “better-off” and the “middle” group farmers registered considerably less water shares than required for the size of their land, and therefore, also paid considerably less. The differences between the poor and non-poor lie in their ability to exploit rules stipulating equality. This sometimes leads to situations where poor farmers cultivate 2 *ropani* land with 20 water shares registered, while others, especially the better-off, cultivate 25 *ropani* land with the same number of water shares.

While, ironically, there is “equality” in fulfilling obligations, the key question remaining is whether poorer farmers who are theoretically entitled to relatively more water receive these quantities in reality and whether they can valorize their water rights in other ways.

5.4 “Inequity” in Factual Water Allocation and Distribution

The field study found that the theoretical rights based on the registered shares failed to play any role in factual water distribution and allocation. For example, field staff could not indicate how many shares corresponded to a certain quantity of water in a distributary canal. Farmers along the same tertiary canal did not even know the number of shares registered by their peers with whom they compete for water. Several poor farmers complained explicitly that they received less water than what they were entitled to according to their shares. Twenty of the eighty-three farmers in the sample survey were reported to suffer from water theft. Most of them were from the poor and poorest socioeconomic group. Reportedly, powerful farmers were still able to take water according to their requirements. Or as one poor farmer expressed: “They can afford it to change the hot water on the field for fresh cold water from the canal.” A woman from the low *Damai* caste lost her water turn during the paddy transplanting time to a *Brahmin* male farmer. He recognized it was her turn, but he told her that she could wait, because the problems in his big field were much more important than her concerns for her small field. She had to cancel the laborers who were to help her, but still had to pay for their cost. This woman had over-registered:

she had registered 28 shares, while 16 shares would have been enough for her 4 *ropani*. Although in her distributory, E6, rules had been set that those who take someone else’s water turn have to pay fines to the Branch Canal Committee, this rule was never applied. According to other respondents, the Branch Canal Committee is not in a position to control the better-off farmers because the Branch Canal Committee itself is controlled by larger farmers.

This was a general observation: poorer farmers were underrepresented in the AKWUA organization. As table 2 shows, middle and better-off male respondents participated more regularly in formal meetings of AKWUA than poorer men. None of the people from the poorest strata of society is represented in a Committee.

Table 2: Current participation of the sample male farmers in formal meetings.

<i>N= 35</i>	<i>Never</i>	<i>Sometimes</i>	<i>Always</i>
<i>Poor and poorest men</i>	6	8	6
<i>Middle and better off men</i>	0	0	15
<i>TOTAL men</i>	6	8	21

Hence, even factual water allocation was biased against the poorer farmers, in spite of their relatively stronger abstract rights. The implementation of the allocation principle of “water to people” also resulted in the common inequities observed elsewhere in access to water to the detriment of poorer farmers.

The separation of water rights from land rights could have improved the bargaining power of tenants or women, who without landownership titles could have gained from their own independent water rights. However, neither tenants nor women were actually found to benefit from the implementation of the allocation principle of “water to the people.” Landowners remained independent from tenants’ water rights because they already had their own shares or were able to access water, as they wanted, without holding shares or paying proportional fees. Moreover, cash and labor contributions that tenants had to make continued being registered in the name of the landowner, as before. Only where long-term contracts such as pawning (mortgage) was concerned, the contributions of the cultivators were registered in the tenants’ own names, but this had been the practice even before the commencement of the project. Thus, the project failed to bring about any significant change for tenants.

Similarly, the new allocation principle failed to favor women. Although some women irrigated alone or jointly with their husbands, water shares were commonly registered in their husbands’ names. Husbands also arranged transactions like the renting out or selling of water shares. Women were often uninformed about the number of shares and transactions made. While in one- third of the sample households women participated in maintenance activities, their contributions were typically registered in their husbands’ names. Thus, the early suggestion by the UMN to register women’s labor contributions in their own names had not been implemented (Westborg 1989:14). In AKWUA’s constitution, daughters’ inheritance of water rights were recognized, provided they married in the Andhi Khola command area; sons would inherit anyhow. However, in reality, inheritance was still primarily governed by the prevailing inheritance laws, which categorically forbade daughters to inherit water shares. This is illustrated by the case of a daughter who settled in the command area after marriage. She had claimed her shares several times from her family, but her father still “has to discuss with her brothers to decide if she also should get shares.” In

two similar cases, two (landless) daughters were waiting in vain for their family to hand over their shares so they could apply for land from AKWUA.

Women's exclusion from resource rights was perpetuated by their exclusion from decision-making bodies of AKWUA, especially since the departure of the UMN. A study of 11 Branch Canal Committees showed that there were only two women representatives in all the 11 branches. Among 48 women interviewed, only one woman attended meetings, that too only sometimes. Among the men, three-quarters attended meetings either always or sometimes. Women complained that they were not informed about decisions taken at the meetings regarding water distribution, but that they were only informed about canal maintenance. In short, as most land titles were also registered in men's names, water shares ended up being vested in the same person as the land rights. The UMN's lofty goal of separating land and water rights for the benefit of cultivators without landownership remained unfulfilled in reality.

5.5 Conclusions and Recommendations

In the Andhi Khola Irrigation Scheme, allocation of equal water rights to all, irrespective of land size and landownership status, effectively led to the envisaged situation in which marginal landowners acquired many more shares per unit of land than the larger landowners. The "middle" and especially the "better-off" farmers acquired and registered considerably less number of shares than required. This, however, did not deter them from irrigating most or all of their fields, even if they directly deprived smaller farmers of water during times of scarcity. Shares, even the relatively high numbers of shares registered and paid for by marginal farmers, did not give the least protection against inequities in water distribution. The better-off dominated in the Water Users Association Committees. Poor people are dependent upon these households for their livelihoods. This makes it difficult to enforce regulations or correct the behavior of the offenders. Since no sanctions were imposed, there was even less stimulus for the offenders to allow the poor to take water, let alone to lease it out or buy shares from the poorer groups

Thus, the water market that was planned to emerge as a result of the share system did not materialize. As a result, the poor could not capitalize on the surplus water shares they had earned with their disproportionate labor and cash contributions. The larger farmers now benefit from the larger quantities of water that they use for their land at almost similar investment costs as the smallholders, who use far less water. Hence, the concept of "water allocation to the people" itself appeared invalid: there was too much focus on equality in obligations, without adequate emphasis on equality in rights.

Projects that still wish to consider allocation of equal water rights for more equity can avoid the pitfalls encountered by the Andhi Khola Irrigation Project, if they:

- Ensure that rights become more equal, while obligations remain at least proportional to real benefits, if not relatively less.
- Secure poor male and female farmers' effective participation in decision-making over water rights and obligations. This not only concerns participation in formal and informal meetings, but also participation in the various Committees. By doing so, poor farmers can better represent their interests in setting rules and enforcing rule compliance.

- Ensure that a water market emerges in which the poor find clients to whom they can sell their water rights and moreover in which the position of the poorest is strong enough to enforce compensation of sold water rights.
- Inform smallholders about their rights and obligations and prevent them from registering more shares than required for the portion of land that they intend to irrigate.
- Encourage the registration of women's and tenants' labor contributions in their own names.

Not only was the allocation principle of “water to the people” inappropriate—because it focused too much on obligations neglecting rights—but its implementation was also accompanied by problems. Projects that consider the creation of resource rights through investments in construction should:

- Develop a clear technical design, including size of the command area, available water sources, and total labor requirements. Procedures for implementation should be consistent throughout the construction period. If that is not feasible, for example because of external pressure by the government, it is better for projects to employ poor women and men in construction work and pay wages.
- Inform all stakeholders about the realistic benefits of the project. On such a basis, everyone can make an informed judgment as to whether or not it is worth participating in the project. If considerable changes in the projections have to be made, this should also be well communicated.
- If applicable, finalize land redistribution in the command area before construction and before the earning of water shares is launched. In this way, new entrants in the command area will be secure of their land rights and, hence, more motivated to contribute to the construction work.

6. Conclusions: Do Equal Land and Water Rights Benefit the Poor?

The distribution of benefits from irrigation development is more or less proportional to land distribution, which is often highly unequal. Under such conditions irrigation development is a blunt tool to alleviate poverty. Even an agency as strongly committed to changing this situation as the UMN, was only partially successful in better targeting the benefits of irrigation investments to the poor. More equality in land rights, as the UMN successfully proposed initially, appeared a valid concept for poverty alleviation. However, the delay in implementation of the concept diluted the positive impacts for the poor. The most opportune moment for the land transfer, well before construction, was lost. This rendered the land price for the poor high and it benefited larger farmers willing to sell. Inequalities remained substantive. Moreover, the support for small farmers to make productive use of the newly acquired resources was also inadequate.

While the concept of more equal land rights was valid, the assumption that equal water rights (with equal obligations) would benefit the poor proved to be an invalid concept. Water only generates benefits if it is input in a self-managed enterprise or if water can effectively be exchanged with others who need water and are willing to compensate. The assumed possibilities for the poor

to sell water to the non-poor within a gravity irrigation scheme—even though fine-tuned water distribution is physically possible—appeared unrealistic. Thus, poor smallholders’ only gains from water were with respect to their own irrigated plots. As their plots are small, their water needs are also small, and so would their obligations be if they were proportional to the quantity of water used. However, the principle of “water to the people” led to poor people’s rather equal contributions to fulfill obligations. Fulfilling disproportionate obligations was no help at all in negotiations over water. The more powerful farmers continued contesting even the small amounts of water that small farmers needed on their small plots. In Andhi Khola, the only equality achieved as a result of the allocation principle of “water to the people,” was that non-poor farmers’ got away with fulfilling equal obligations for much higher quantities of water. The concept that equal water rights-cum-obligations benefit the poor is debatable indeed.

Perhaps the most important lesson learnt from the experiences in Andhi Khola is that the core of any concept of pro-poor intervention should have agencies that directly communicate with the poor themselves, inform them, consult them, and empower them vis-à-vis the non-poor, throughout the project cycle. If poor farmers and landless people, men and women, had effectively been included and listened to by the AKWUA from the planning phase, their contribution to the conceptual design of equal land and water rights would most certainly have led to sounder and more realistic concepts. Moreover, their active and well-informed participation in the implementation would have enabled the AKWUA to pursue and enforce implementation of the land reform as conceived, and strengthen its poorest members’ bargaining position to effectuate access to water at reasonable, proportional costs.

Bibliography

- BPC (Butwal Power Company) Hydroconsult. 1996. Geotechnical investigation of landslides on the Main Canal East. Kathmandu, Nepal: United Mission to Nepal.
- BPC (Butwal Power Company) Hydroconsult 1989. AHREP *headrace gravity irrigation scheme feasibility report*. Kathmandu, Nepal: United Mission to Nepal.
- Chambers, R.; N.C. Saxena; and T. Shah. 1989. *To the hands of the poor: Water and trees*. London, UK: Intermediate Technology Publications. Xii: 273p.
- IWMI (International Water Management Institute). 1999. Nepal Management Transfer: A review of Irrigation Service Fees in Nepal. June 1999. Kathmandu. Colombo, Sri Lanka: IWMI.
- Jazairy, I.; M. Alamgir; and T. Panuccio.. 1992. *The state of world rural poverty: An inquiry into its causes and consequences*. London: Intermediate Technology Publications.
- Martinez, Nelson. 1998. Peasants, Andean Irrigation and Equity: The experience in Chingazo-Pungales, Ecuador. In *Searching for equity. Conceptions of justice and equity in peasant irrigation*, eds. R Boelens and G. Davila. Assen, The Netherlands: Van Gorcum.
- NSAE (Nepal Society of Agricultural Engineers). 1997. *Impact Evaluation Study of Andhi Khola Irrigation System*. Kathmandu, Nepal: United Mission to Nepal.
- PATA (Project Integrated Agricultural Development). 1996. *Participatory irrigation scheme development process guide book*. PATA publication 108. Islamic Republic of Pakistan Government of North Western Frontier Province, Department of Planning and Development; Ministry of Foreign Affairs, Directorate-General for International Cooperation, The Netherlands; IWACO The Netherlands and DHVConsultants, The Netherlands. Saidu Sharif: PATA.
- Poppe, J. 1983. *Andhi Khola project, socioeconomic survey*. Kathmandu, Nepal: United Mission to Nepal.
- Sarin, M. 1996. *Joint forest management: The Haryana experience*. Environment and Development Series. Ahmedabad: Centre for Environment Education, Nehru Foundation for Development, Thaltej Takra.
- Thiessen, E. 1983. AHREP *headrace irrigation preliminary report*. Kathmandu, Nepal: United Mission to Nepal.
- UMN (United Mission to Nepal). 1997. *Project completion report, Andhi Khola irrigation project*. Syangja, Nepal: UMN.
- van Koppen, B.; and S. Mahmud. 1996. *Women and water-pumps: the impact of participation in irrigation groups on women's status*. London: Intermediate Technology Publications.
- Westborg, J. 1989. AHREP Irrigation Scheme Andhi Khola development project. Project Proposal, Nepal.

Postal Address

P O Box 2075
Colombo
Sri Lanka

Location

127, Sunil Mawatha
Pelawatta
Battaramulla
Sri Lanka

Telephone

94-1-787404, 784080

Fax

94-1-786854

E-mail

iwmi@cgiar.org

Website

www.iwmi.org