

Social Equity Impacts of Increased Water for Irrigation

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Introduction

It is a commonly held belief that the benefits of irrigation are not limited to farming households, and that irrigation systems can make a significant contribution to reducing rural poverty in a region by creating employment and improving livelihoods (Chambers 1988). Economists often argue that irrigation's benefits will impact rural development gradually, where at first, income inequality may increase, but eventually an improvement is seen as the benefits trickle down and as economic multipliers gain momentum (Kuznet 1955 cited in Bhattarai et al. 2002). This paper unpacks some of the assumptions of the impacts of irrigation by taking a closer look at the beneficiaries of large irrigation investments. The basic premise of this research is that the population within command areas is not homogenous. By differentiating the population on the basis of landholding and social strata, a wide variety of outcomes can be observed. These irrigation-related impacts are often shaped by existing inequities within populations in terms of access to information, capital, land and the existing social stratification. This study looks at the Polavaram Project of Andhra Pradesh and studies it in comparison with the Nagarjunasagar Project (NSP) for an insight into the different factors that shape long-term poverty and the equity impacts of irrigation on command areas.

Methodology

As the Polavaram Project is still at a very early stage, two villages under the Nagarjunasagar command were chosen based on their similarities in hydro-geology and socioeconomic features with the proposed Polavaram command, to study irrigation outcomes (see Table 1 for socioeconomic profile of the villages). Given that more than 40 years have passed since the construction of the Nagarjunasagar Dam, its command offered a good opportunity to study the long-term (crystallized) impacts of irrigation on poverty and on altering social and economic situations. In total, 160 households were surveyed for the study, 40 from each village. An initial exploration revealed the land ownership status in the villages, and based on that, the sample was divided into four groups: 1) the landless; 2) those owning 0-3 acres; 3) those owning 3-10; and 4) those owning above 10 acres.

Table 1. Socioeconomic photo of the study villages.

	Nagarjuna Sagar Command		Proposed Polavaram Command	
Village name	Kondrepole	Velatoor	Chinnadoddigallu	Yernagudem
District	Nalgonda	Krishna	Vishakhapatnam	West Godavari
Mandal	Dameracharela	G.Konduru	Nakkapalle	Devarapalle
Population	6,000	5,800	7,000	7,837
Caste Distribution (%)				
Scheduled cast (SC)	24	35	10	21
Scheduled tribes (ST)	9	6	0	0
Backward class (BC) /Other	55	38	34	28
Backward class (OBC)				
General	12	21	47	51
Dominant caste	Reddis 150	Kapus 150	Kapus 600	Kamma 100
Land Distribution (%)				
Landless HHs	30	24	21	21
Upto 3 acres	42	19	39	44
3-10 acres	26	33	12	21
Over 10 acres	11	28	18	12
Average landholding	4	7	6	9
Source of Livelihood (%)				
% sample with farming as main occupation	56	38	49	67
% sample with farm wage labor as main occupation	29	44	39	31
Other water-dependent livelihoods	Livestock rearing	Livestock rearing	Livestock rearing	Livestock rearing
Migration	~ 20 % (seasonal, labor work, prevalent among SCs, BCs/OBCs only)	8	Very high - 41 % (seasonal, for agrl. or non-farm wage labor, prevalent among landless, young men)	2%
Paddy over (rough estimates)	2,207 acres-double crop	930 single crop	900 – single crop	2,500 – double crop
Cash crops (rough estimates)	-	2,780 mango	1,000 cashew	2,700– tobacco, sugarcane 1,000 palm oil 1,000
Land value	1/2-1 lakh	9-20 lakhs	5-16 lakhs	10 lakhs
Main mode for irrigation	Surface water (Head end village)	Surface water canal- fed tanks (Tail end village)	Largely tank irrigation or rain-fed farming	Groundwater
Groundwater level	Varies between 100- indeterminate as the canal flows	300 ft	250 ft. but only 1 inch pipe	300 ft.
Drinking water availability	Domestic water supply-piped/ hand pumps	Common water source	Common water source-severe water scarcity during peak summer months	Common water source

Study methods included in-depth village case studies, questionnaire surveys, and interviews with key informants, and focused on open ended discussions with different socioeconomic groups as well. The survey methods were used to generate a socioeconomic 'photo' of the villages, understand the water-livelihood linkages, and test certain popular hypotheses on inter-sectoral, inter-class and inter-caste equity issues. In addition, detailed case studies were used to capture the three main trends that were observed in the preliminary field visits: 1) the change in social geography of the command with increased land transactions and movements into (and out of) the region; 2) the long-term impacts of irrigation on livelihoods; and c) the gender disaggregated benefits of irrigation. Qualitative discussions also covered the issues of irrigation management and access to irrigation water, inclusion/transparency of water management, crop productivity, livelihood security and diversity and perceived outcomes in terms of the nature of transformations as a result of irrigation. During the course of the study, continuous revisions were made to the tools and methods used, for example, initial plans to survey women farmers had to be changed as it became known that instances of women managing farms were rare. Over time, and with continued interactions with the community, thinking on the subject evolved—forcing adjustments to the approach.

Polavaram - Proposed Benefits and Concerns Expressed

The Polavaram Project is one of the eight projects that the current government of Andhra Pradesh plans to finish within its 5-year tenure, on an express basis. It has already launched a mega program named 'Jalayagnam', which plans to bring an additional 73 lakhs of acres of land under irrigation within a span of 5 years. However, the plans for Polavaram have been there for a long time, and the project derives its *raison d'être* from several angles; only one of them stems from the reemphasis on agriculture and the need to provide cheap irrigation to boost the growth rate of agriculture. The project plans to irrigate 2.91 lakhs of hectares of land (1.29 along the right canal and 1.62 on the left). Apart from that, it proposes to stabilise existing *ayacuts*, supply water to the city of Vishakapatnam and for industry purposes, divert 80 TMC of water to the Krishna River basin, generate 720 MW of power and create navigable canals from Polavaram to Vishakapatnam (through a system of locks).

Interestingly, the project comes at a time when groundwater irrigation has become the norm in several parts of the state, faith in surface irrigation (canal and tank) is diminishing, and efforts at reviving them through more and more participatory irrigation management (PIM) reforms do not seem to be yielding the desired results. Reddy (2003) notes that huge expenditures incurred in irrigation development are not translating effectively into the area irrigated. On the other hand, in the absence of effective groundwater regulation, the dropping groundwater levels are also posing a serious threat to the future of irrigation in the state and these massive investments on irrigation infrastructure are reportedly also intended to reverse the groundwater drawdown and stabilise the irrigation scenario.

The biggest opposition comes to the project from the resettlement and rehabilitation (R&R) lobby. Currently, more than 276 villages are expected to be submerged under the project, mostly from the Andhra Pradesh region and few from Orissa and Madhya Pradesh.

There is considerable civil society mobilisation against the dam; many have started to name it the second ‘Narmada’. In Box 1, we mention all the concerns that are being raised against the project.

Box 1. Popular Oppositions to Polavaram

- The Rs. 9,000-crore project displaces 1.45 lakhs of people in AP, Chhattisgarh and Orissa and submerges several archaeological sites.
- The project seeks to irrigate the coastal districts of Visakhapatnam, Krishna, East and West Godavari and quench the thirst of Vizag city. The opponents advocate that the urban areas would be the biggest gainers and the dam is meant to boost industrialisation at the expense of agriculture and the livelihoods of several tribal communities.
- It also raises regional conflicts – main opposition is coming from Telangana (which has always felt left out), which questions the priority of irrigation investments in the state.
- Allegedly, villages that needed water desperately are left out, and areas which had good groundwater potential are included.

(Source: Newspaper articles and field visits 2006-2007)

At the village level, there is angst against the loss of land to canal construction. There has been considerable land loss due to canal construction, and the rates of compensation that the government is offering are well below the prevailing market rates. Though there was an increase in the rates offered after Polavaram was declared open, it was not much above the registration rates. The Polavaram left canal currently runs parallel to the one coming from Tadipudi Lift Irrigation Project and in some parts the two canals are as close as 400 m to each other. This doubles the area of displacement, estimated at 6,600 acres in total, as well as doubles the amount of resources required for the construction. If one takes into account canal displacement for both the left and right main canals of Polavaram, the land lost amounts to 6,523 acres¹ (Samata Report 2006). This loss of land to canal construction hits the small-scale and marginal farmers much harder as they lose their sole means of livelihood; the large-scale farmers, who are also adversely affected, are able to absorb the shock.

Testing Popular Hypotheses on Irrigation-Equity Links

Equity is an increasingly important concern for irrigation impact studies but has not been addressed sufficiently – “whether the benefits of irrigation have accrued to wider sections of society have not yet been answered adequately” (Bhattarai et al. 2002). Scholars such as Sampath (1990 cited by Bhattarai et al. 2002) find that surface-flow irrigation has produced greater inequality in the distribution of benefits across farms than lift irrigation, and more so

in areas with skewed landholding.¹ These inequities jeopardize the poverty alleviation impacts of irrigation, and many authors believe that in order to maximize the benefits of irrigation development, it is important to have the right institutional environment and a ‘pro-poor’ focus while designing such large-scale interventions (ibid).

In this study we solely focus on those aspects of irrigation, which have a bearing on equity. Starting with the physical aspects, we first explore how the head and tail divide manifests itself, and how the inequities get sharper as a result of inefficiency in canal management, plus the iniquitous ownership of plots in terms of their location. Further, we go on to study the impact of canal irrigation on crop diversification. Finally, we study the irrigation-employment link to ascertain what irrigation brings to the resource-poor i.e., the landless and the marginal farmers, whose only tangible benefits from irrigation are increased labor opportunities. While the discussion is largely on findings from the NSP villages, Kondrepol and Velatoor, we also use data from Yernagudem and Chinnadoddigallu at certain places to add interesting dimensions to the discussion, such as the effects of different sources of irrigation –groundwater vs. canal vs. rain-fed tanks.

The Head-tail Divide

The discussion on the equity dimensions of irrigation projects is closely related to the unequal distribution of water across different reaches of canals. The head-end farmers and farmers in the middle reaches usurp a large share of the water through illegal lifting and diversions, leaving little or sometimes no water at all for the tail-end farmers. This is one of the major factors contributing to income inequality in irrigated agriculture and unfortunately, it continues to be one of the unresolved issues in water distribution policies in irrigation commands. The problem is particularly severe in large-scale irrigation commands with large numbers of smallholding farmers, which are found in the developing countries (Bhattarai et al. 2002). A study shows that within the different reaches of the Rohera irrigation command in India, and the Khadir irrigation command in Pakistan, the tail-end farmers received, on average, only about 20 % of the water that the head-end farmers of the respective irrigation commands received for winter wheat in 2000-01 (cited by Bhattarai et al. 2002). As a result of this, often there is a significant difference in the income levels of farmers in the different reaches of a canal. Chambers (1988) found that the income of head-reach farmers was more than six times higher than that of tail-reach farmers in a minor. Our investigation in the Nagarjunasagar command lends more evidence to such problems, and also brings other interesting dimensions to the unequal distribution of benefits like the impact of the politics involved in the location of plots.

¹ Due to highly skewed land distribution, large farms can obtain disproportionately large shares of incremental benefits from irrigation development—both in relative as well as in absolute terms. For example, small farms in India constitute about 46% of the total rural households, but they only get access to 15% of the total irrigable land and 14% of the total canal-irrigated area. However, larger farms (more than 4 ha), representing the top 12.5% of the households, get about 40% of the total canal-irrigated area and 38% of the total irrigated land (Sampath 1990; cited by Bhattarai, 2002). of the households, get about 40% of the total canal-irrigated area and 38% of the total irrigated land (Sampath 1990; cited by Bhattarai, 2002).

Unauthorized Water Withdrawal in Upper Reaches

The surveys in Kondrepole revealed that there was great dissatisfaction among the tail-end farmers with the distribution of water. The village received water from Vazirabad major, a major head with an original design of 410 cusec. The pressure on the major head however, had continuously increased with the rise in unauthorised water lifting and water diversions in the head and middle reaches. In view of the rising demand, the design was later increased to 513.97 cusec, but the problems of water distribution in the tail reaches continued. Now the requirement is proposed to be at 600 cusec and there is a significant push and pull operating between the different stakeholders. Reportedly, the tail-enders have appointed an unofficial water users association (WUA) to go to the major head and lift the sluice to ensure their share of water.

There is considerable angst against the authorities who have been quite lax on checking such diversions, especially since most of these diversions are, interestingly, justified by irrigation officials on humanitarian grounds. For example, apart from the unauthorized water lifting, majority of them created unauthorized *ayacut* in its upper reaches. This was estimated to be around 10,000 acres. During initial planning, several plots of land were not estimated to be in the *ayacut* because of elevation, rocks, etc. Over the years however, the farmers have labored to lower elevation, literally remove rocks and flatten hilly parts, and prepare the ground for irrigation. As a result, irrigation officials felt that the farmer's right to receive his due share of water for irrigation was a natural right. Along with these types of unauthorized *ayacuts*, lands under tanks were also irrigated under the NSP, again unofficially. We were told that when the NSP fills the tanks for drinking water and cattle, farmers under the tank-*ayacut* use the water for irrigation. No survey has been done to check such encroachments. On the contrary, the revenue authorities collect as water cess from these unauthorized *ayacutdars*.

Irrigation department officials, on the other hand, complain of unbridled democracy among farmers, and also the short staffing pattern (there has not been any recruitment in the staff since the last three decades). One official said, "Two decades ago, it was unheard of that an unauthorized drawing of water would go unchecked. Motors were seized, crops were allowed to dry up, and farmers were penalized." Today, the department is unwilling even to go on field inspections if they anticipate trouble. "We take detours, if we see tail-enders," they say.

The water users associations (WUAs) set up a decade ago, have yet to yield any results. There are 12 TC (territorial constituency) members to one WUA covering 4,000 acres. Farmers term the WUAs as non-starters. They say that the situation was better when there was no WUA, because the Irrigation Dept. officials were somewhat more accountable and would come for inspection, sort out problems etc. But, now officials insist that the WUA should handle issues of farmers with regards to conflicts in water distribution. During an interview, one person made a remark on the functioning of the WUAs as thus: "The WUA is also corrupt; it is active only when there is some money; after that, it is silent. In fact, the WUA is only active to ensure that their (own) areas do not have a tail end."

Location of Plots – Who is in the Head and Who is in the Tail?

In a study on the poverty dimensions of Irrigation Management Transfer in certain villages in Andhra Pradesh, Koppen et al. (2002) found that in the canal commands the small farmers invariably had their plots at the tail-end of the canal. Drawing from the literature available, we started with the hypotheses that the influential and better off farming households manage to have their plots in the upper reaches, while the lower castes and small-scale farmers get the more water deprived locations in the tail-end. Our analysis supports this argument to an extent. In our questionnaire we had asked people about the location of their plots with respect to the nearest distributary/ canal irrigation source. In Kondrepol, we found that most of the smallholders were concentrated in the tail-end, while in the upper reaches, the large-holders dominated (Table 2).

Table 2. Location of plots for different land classes in Kondrepol.

Kondrepol	Head	Middle	Tail
Average landholding	7	6	5
Smallholders	17	28	56
Medium-holders	15	31	54
Large-holders	73	18	9

Source: Analysis based on Primary survey 2006-07

In Velatoor too, we found a similar bias where the majority of the large-holders were concentrated in the head reach while the smallholders were pushed to the tail-end.

Table 3. Location of plots for different land classes in Velatoor.

Velatoor	Head reach	Middle	Tail end
Average landholding	7.91	5.58	5.58
Smallholders (till 3 acres) ²	19	19	62
Medium-holders (3-10 acres)	44	8	48
Large-holders (above 10 acres)	50	30	20

Source: Analysis based on Primary survey 2006-07

² In the sample we found several Madigas and Malas having plots in the head reaches, contrary to our hypothesis. Further investigation revealed that these plots were too close to the head reach and that they faced frequent waterlogging. Thus, for the purpose of our analysis we have removed those plots from the sample.

Similarly, in terms of social groups, the tail region was again dominated by the BC/OBCs/SCs (Table 3). In Kondrepol, the Gollas and Chakalis were concentrated in the tail reach while the head reach was dominated by the high caste or the general category population i.e., the Reddys and the Chowdarys. In Velatoor, the Kapus were concentrated in the tail reach along with the Gollas, while the Reddys had their plots in the upper reaches (Table 4). Interestingly, the data stands in contradiction to our hypothesis – the Madigas and Malas, belonging to the SC community had land in the upper reaches, especially in the case of the Velatoor village. Upon an in-depth investigation of this situation we found that most of these plots were too close to the head reach of the canals and, as such, often experienced problems of waterlogging.

Table 4. Location of plots for different castes in the Sagar command.

	Kondrepol				Velatoor			
Acharyulu					1 plot		middle	
Chakalis	2 plots			All tail	4 plots			All tail
Chowdary	4 plots		3 middle	1 tail				
Gollas	4 plots			All tail	13 plots	2 head	1 middle	10 tail
Goud	2 plots		middle		2 plots		1 middle	1 tail
Goundla					1 plot	head		
Kapus					9 plots	2 head		7 tail
Lambadi	4 plots	1 head	2 middle	1 tail				
Madigas	7 plots	3 head	4 middle		7 plots	head		
Mala	2 plots		1 middle	1 tail	10 plots	7 head	2 middle	1 tail
Marati					1 plot			tail
Mudi Raju	3 plots		1 middle	2 tail				
Potter	2 plots			2 tail				
Reddy	9 plots	5 heads	4 middle	1 tail	3 plots	head		
Uppara					3 plots	head	middle	tail
Vaddera	2 plots			2 tail				
Velama					2 plots	head		
Vishwa Brahmin					1 plot			tail

Source: Primary survey 2006-07

In the absence of regulatory support either from the irrigation authorities or the WUAs, the tail-enders have found their own mechanisms to ensure water availability. During interviews we found out that in Kondrepol they have organized themselves into an unofficial and illegal association, which employs two people at Rs. 3,000 a month to: a) check for obstructions all along the distributary, b) raise the sluices of the major, if and when necessary.. There have also been several direct protests by the tail-end farmers against the authorities; last year the Lambadas (an upwardly mobile community –for more on their transition see Paper 6) reportedly shaved their heads and sat in protest in front of the Nalgonda District Collectorate.

Box 2. The Arbitrariness of Irrigation Infrastructure

The conception and design of the distributaries, majors and minors themselves are riddled with controversies. Velatoor, one of the study villages, presents the case of arbitrariness of projects because of changes dictated by political compulsions.

According to the villagers, one of the local politicians in Velatoor having 300 acres wet land under tank irrigation has been able to get the route of the canal changed to suit his irrigation needs. The villagers say that with the earlier alignment, the canal would have passed south of the village, necessitating an uncertain lift to irrigate lands under the tank. However, the plan has now been changed and the canal would be passing through the north of the village, assuring water to the tank.

The other conflict is related to the Jakkampudi major, which despite being the last major in the tail end that passes through Velatoor does not get the 150 cusec it requires, because the canal is silted and water does not flow. Besides, upstream farmers from Vissanapeta, Gollapudi, etc, use water for paddy crop, not for the intended irrigated dry crops (crops which require only occasional wetting unlike intensive irrigation crop like paddy). Hence, the quantum of water coming down is much less. Velatoor villagers feel that this situation is entirely political, as the congressmen who own land in the upper reaches are politically powerful, and they influence the officials not to act to remedy this problem. Velavaleru, a village close to Velatoor, at a distance of 4 km, is the village of the local MLA. While Velatoor is known to be a village of laborers (as it is inhabited largely by Kapus and other laboring castes), Velavaleru is known to be a farmers' village, as Kammas are the dominant caste there; villagers loyal to the MLA also admit that the MLA got their village tank filled this year exercising influence. Farmers of Velatoor, largely Kapus, feel they do not have enough strength to stop these political influences, while Kammas in the upstream can easily influence changes in the canals and distributaries, major and minor.

Irrigation and Crop Diversification

One of the main impacts of irrigation is the increase in cropping intensity and crop diversification. In practice, it has been observed that high-valued and water-intensive crops, like sugarcane, are grown at the head-ends of the canal, and generate a higher yield and net return per hectare compared to other cereals (Bhattarai et al. 2002). This further aggravates income inequality across the different reaches of a canal system. In this section we explore whether there are conspicuous differences in the cropping pattern being followed across different farmer groups based on their landholding, caste, irrigation source and position in the canal system. Two villages-Velatoor and Yernagudem in the Polavaram command, which were surveyed for this study, clearly bring out the importance of the irrigation source in crop diversification. Both in Velatoor and Kondrepol, villagers confirmed that before the canal was commissioned they used to grow crops such as red gram, maize, *sajjar*, *jowar* and black grams, which are all rain-fed crops. With the commencement of canal irrigation however, there was a mass shift to paddy cultivation. Unfortunately, paddy cultivation has now become the norm in the region and in the entire Sagar command there is hardly any or little crop diversification to be seen.

Table 5. Cropping intensity and crop diversity across sample villages.

	Kondrepol	Velatoor	Chinnadoddigallu	Yernagudem
Area under single cropping	97	41	84	62
Paddy	100	70	54	24
Maize	-	30		
Cashew			38	
Sugarcane (Kharif)				26
Tobacco				46
Others (Grams,Sapota,Sarugudu,Tomato)			18	
Area under Annual Crops	-	59	16	23
Mango ³	-	69	100	
Sugarcane	-	31		
Oil farms (Palm,Sesamum)				36
Coconuts				64
Area under Double Cropping	3			15
Kharif Paddy				50
Rabi Paddy				50

Source: Analysis based on primary survey, 2006-07, all figures are percentages

As Table 5 shows, the canal irrigated village of Kondrepol is the one with least amount of crop diversification. According to all the interviewed farmers the entire area is under paddy cultivation, and almost all of them (97 %) take a single crop a year, that too in the kharif season only. Canal irrigation seems to have become a demoting factor to diversification. Farmers in the region complain that there is nothing else they can grow except paddy as there is too much water. Further, as water is supplied at a low price it may be possible that there is little incentive for farmers to optimize its usage and grow high-value crops.

In the tail-end village of Velatoor, the respondents used tubewell irrigation to grow sugarcane. They also had a large area devoted to plantation crops such as mango, which are very much dependent on rainwater. The paddy grown in the area is irrigated through tanks, which are filled using canal water/rains. In Chinnadoddigallu, which is largely tank irrigated (tanks are filled using rainwater), a large share of the cultivated area was again, single cropped. Although only a very small share of the land was under mango (a dry crop) cultivation, crops were reasonably diversified - farmers in the region grew cashew (38 % of the single cropped area), sapota, red and black grams, tomato, sarugudu etc. Among the four sample villages, the most dynamic farming system was that of Yernagudem— a groundwater irrigated village. The respondents had 62 % of their cultivated land under single cropping, 23 % under annual crops and 15 % of the land was double cropped. Within the single cropped area, high-value crops

³ In our sample, more than 40 % of the land cultivated was under mango cultivation, which does not require frequent irrigation and is termed as a dry crop.

such as tobacco (which occupied 46 % of the area) and sugarcane were more common. Only 24 % of the single cropped area was under paddy. Half of the paddy area was double cropped, thus increasing the net area under paddy cultivation.

In the Sagar command i.e. Kondrepol and Velatoor there was no significant difference in the cropping pattern across land classes or castes. Only in Velatoor, we found that there was a significant dependence of the SCs on mango farms. Many BC/OBC families also grew mangoes, but the instance of high caste farmers growing mangoes was rare. It was in the groundwater irrigated Yernagudem that we found some biases regarding the type of crops grown across different land classes. Tobacco, especially, was grown by the high caste and primarily by farmers having large landholdings - the average size of a landholding of a farmer growing tobacco was 15.4 acres. Sugarcane was grown by farmers of all castes and the average landholding of farmers growing sugarcane was 8 acres.

Irrigation and Employment Generation

From the equity perspective, knowing how much benefit the landless and the resource-poor are able to garner from such mammoth public investment, becomes extremely important. Increased rural employment as a result of higher cropping intensity, cultivation of labor-intensive crops plus opportunities for non-farm employment is the way that irrigation benefits reach the poor. However, it has often been found that such investments benefit the land-rich or 'landed' classes largely and the benefits to the resource-poor are not at all commensurate. In our study area, we found that while the 'landed' class was able to tap the opportunity and diversify to more remunerative livelihoods, in the absence of an effective wage regulation such benefits have remained largely elusive to the poor, and as a result the poor have failed to move out of the poverty trap (more on this in Paper 6). In this section we discuss our findings on the labor opportunities available to the landless and marginal farmers in the four villages —Velatoor (Sagar command⁴), Chinnadoddigallu (proposed Polavaram command and largely rain-fed/tank irrigated) and Yernagudem (groundwater irrigated).

In the Sagar command, the qualitative investigations revealed that initially when the canal water came in, there was a huge influx of labor from outside the region. Reportedly, out of the 300 landless households in Kondrepol, approximately 100 households are migrants from other places. This is one of the main reasons why the wage rates in the canal irrigated areas have remained suppressed. In Table 6 we see that the total number of labor days available for a landless or marginal farmer household in the tail-end village of Velatoor (using canal fed tanks) is 95 days for men and 96 days for women - there is a negligible instance of non-farm work. In the groundwater irrigated village of Yernagudem, we find that the number of work days on the farm is marginally higher than Velatoor for men and women both. However, if we include non-farm work available to laborers in Yernagudem, the divide becomes much sharper- laborers in Yernagudem have 37 more days of labor available to them. In Chinnadoddigallu, we found that since there was little wage labor opportunity available at home, a large number of laborers migrated to adjoining areas to work on sugarcane farms.

⁴ We have excluded data from Kondrepol because of its poor quality.

Table 6. Total number of work days available (average).

	Canal-fed tanks irrigated Velatoor		Groundwater irrigated Yernagudem	
	Men	Women	Men	Women
Kharif Paddy	65	86	45	46
Rabi Paddy			43	56
Mango	36	33		
Sugarcane			88	100
				(Single respondent)
Farm work total	95	96	109	103
Non-farm work	60		83	
				(Single respondent)
Average (farm and non-farm)	97	96	134	103

Source: Analysis based on Primary survey 2006-07

Table 7 gives the wage rates for men and women across three villages. The wage rates received by women are invariably lower than those of men. The difference is most pronounced in the case of Yernagudem. In the canal irrigated villages, while employment is more or less guaranteed, and often assured to mitigate labor migration, wage labor rates have not increased although landed received improved returns from irrigation. During a discussion, laborers in Kondrepole remarked, “All the money from the irrigation in Kondrepole goes out of Kondrepole – nothing stays here – especially as paddy prices fall steadily.” In the mostly well irrigated Kondrepole, wage labor is the lowest compared to other villages. A constant, although inadequate (lower than the national wage rate), income allows the landless poor to escape starvation and migration, but is certainly not a path out of poverty. Hanging the poorest by this kind of slender thread also encourages a stream of detrimental social impacts such as primarily alcoholism, and alcohol-induced impacts among men.

Table 7. Average wages paid to men and women laborers.

	Peak Wages		Wages Non-peak	
	Men	Women	Men	Women
Yernagudem	103	45	87	41
Chinnadoddigallu	70	0	62	39
Velatoor	75	36	63	37

Source: Primary survey 2006-07

Social Geography and Changing Livelihoods

A detailed look at the two villages of Kondrepol and Velatoor reveals how different communities in the villages have experienced significant changes in their material conditions, which can be attributed to the introduction of irrigation and its associated changes. This paper describes the movement of people into, out of, and around the villages of Kondrepol and Velatoor, and takes a social geographic perspective to examine how the NSP canal has affected different communities.

It has been observed that since the commencement of operations of the NSP and the flow of water through its canals, the social geography of the region had altered significantly. Changes in the location of different castes/communities in the area were driven by the route of the irrigation canal and the benefits it brought. Closely related to the examination of altering social geography in the villages is the changing and diversifying livelihoods that have taken place over the course of the years since the canal was built and its subsequent consequences. Communities have found that the canal has improved their opportunities to shift to different livelihoods, or add on more types of work to improve their security.

The Kondrepol village belongs to the Damaracharla Mandal, and is located in the Nalgonda District. It lies on the state highway from Hyderabad to Guntur. Fifty kilometers downstream of the Sagar Dam, at Vemanapalli, the highway itself crosses the Nagarasagar Canal. About 6 km upstream of Vemanapalli lies the Vazirabad major⁵, which supplies water to Kondrepol that lies about 20.5 km from the major head as the canal water flows. Of the total 4,900 acres of land in the village, 2,207 acres are in the Nagarjunasagar Project's *ayacut* (area served by the dam) and 600 acres are forest lands, while the rest are mostly dry lands owned and distributed by the government. The dominant communities in the village are Madigas and Malas, both SC, Lambadas, (a nomadic tribe that has settled in the village), and Gouds (toddy tappers). There is also a large proportion of Gollas (Yadavas). Other castes include Kammari (blacksmiths), Kummaries (potters), and Chakali (washermen). Prior to the state delivery of irrigation water from the Nagarjunasagar, only a limited number of farmers had access to irrigation. Irrigation water was obtained from the tank in the village and through manual pumping of groundwater wells by using oxen. While paddy was grown in these areas, the predominant crops grown in the dry land were maize, *jowar*, castor and pulses. After nearly four decades of canal irrigation villagers have witnessed a major transition in their material condition.

Velatoor lies 1.5 km from the Jakkampudi major of the NSP left canal. The canal itself ends about 10 kms from Velatoor. Velatoor also lies about 10 km from the Polavaram Canal. Though the Krishna District is generally thought to be controlled by the Kammas (one of the most powerful and influential castes in Andhra Pradesh and leaders in agriculture), the Kapus, who are close rivals of the Kammas, account for about 150 households in Velatoor. While not having the same amount of land or extensive businesses as the Kammas, they have been an upwardly mobile and influential farming community (they both own land and also work as laborers). SCs, while being the majority caste in the village own approximately 550 households, 300 of which are Madigas

⁵ All majors are named after tail-end villages. Vazirabad is the erstwhile taluqa village on the banks of the Krishna River.

and 250 Malas. Gollas or Yadavas account for 60 households and a small number of Reddis account for 10 households. Other communities are Goudas, Vaddera, Yanadi (ST), Kammaris, Vaisyas and others (in small numbers) belonging to artisan castes who now work as agricultural laborers. Of the 700 households in the village, there are about 250 landless households, while the rest own varied amounts of land - about 20 households own over 10 acres of land, but the majority (around 500 households) own between 3 and 10 acres.

Social Geography

Taking a closer look at the villages shows that certain communities with wide networks have been able to secure land with better access to the canal water, and have maximised the benefits of irrigation to work towards changing their livelihoods during the course of one or two generations. On the other hand, certain communities have slowly moved out or fallen into hardship as a result of losing their small land parcels to more enterprising and influential farmers. These movements and changes over time, since the introduction of irrigation, reveal how irrigation shapes the social geography of an area, giving important clues as to how existing inequities can benefit or be detrimental to communities positioned differently.

The Landed Move Out

The Lambadas of the Kondrepole village present an interesting example of how a community was able to capitalise on the benefits of irrigation. The case is of particular interest as it illustrates how the presence of a support system, network and protective legislation have collectively played a role in this community's ability to reap the benefits of irrigation and eventually move out.

While many of the Lambadas are migrants from elsewhere, the original Lambada inhabitants had land. The first Lambada educated engineer in Andhra Pradesh (AP) is from this village: his father owned 15 acres of land, all of which started to receive irrigation in 1969, the year the boy passed his engineering exam. In the wake of the precedent set by the boy's success in eventually obtaining a secure government job with various forms of support from the village, an example was set and other Lambada boys and girls have followed suit with similar aspirations.

One of the most important factors is the granting of ST status for Lambadas in 1977 in Andhra Pradesh (no other state in South India has given ST status to Lambadas and this may have contributed to their large population in the state). This has translated into the Lambadas cornering most of the reservations in education and employment for STs. The authentic tribes (forest tribes such as the Chenchus, Gonds, Koyas, Kondareddis, etc.) do not possess the networks in the towns and major villages that the Lambadas have, since they are largely confined to agency areas, whereas the Lambadas live out in the plains. While ST students do not pay tuition fees and almost always get scholarships, it is also true that the scholarships are not generous to cover all living expenses—books, travel costs, medical expenses, etc.—and are never given on time. The success of the Lambadas could not have been replicated in un-irrigated areas, in that the irrigation of Lambada lands has helped the next generation to sustain their education and other expenses. Farmers with assured irrigation are able to put aside cash to provide for their children's schooling and college. Farmer Nenavath Chandru, for instance, is able to send Rs. 5,000 to his son in Delhi, who has completed his B. Tech and is preparing for his Civil Services exam, notwithstanding the fact that funding his education is a heavy financial drain on the family.

The Lambadas today boasts of 150-200 government employees, of which 100 are teachers, 20 engineers, 5 in the police service, 1 in the IAS, 1 in the Air Force, and one a revenue divisional officer. Of these employees, 20 are women. Four members of the community have migrated to the USA.

Networks and Political Capital

At the other end of the spectrum are the ‘Coastal Kamma Farmers’ who came virtually as marginal farmers, selling their less than one acre parcels in coastal Andhra, but with a specific knowledge of project locations. Today, they are among have the largest landholdings or are ‘the big-landed’ farmers of Kondrepol.

Box 3. The Kamma Community’s Political Capital

Simhadri Subba Rao’s father had half an acre of land in small village in Vishakapatnam mandal and was rated a marginal farmer. He sold his land 45 years ago, came to a village on the Mehboobnagar-Karnataka border under the Rajolibanda Project and purchased 5 acres of land. Subba Rao and his two elder sisters were born there. As there were poor roads and other facilities in that village and, the fact, that Subba Rao’s father was not overly happy with the quality of the land, he came away with his family and bought 10 acres of land in the mandal neighbouring Damaraherla, where NSP waters were also going to be available. This was about 40 years ago. When asked about how Kamma families had managed to purchase land all over the state well in advance of projects, and before local people were aware themselves, he replied that the Kamma network working with politicians and bureaucrats had helped them to obtain such information.

Losing Land to the Canal

Kondrepole is a village with a large SC population. The SCs are the poorest people in the village, and since the introduction of irrigation there has been a variation among this group in terms of movement with their circumstances being largely dependent on land ownership. The Madiga community of the village were given as *inam*,⁶ lands in return for *vetti* or unpaid work for the state. Interviewed respondents recalled times when Madiga elders would have to walk to Wadpalli everyday (14 km one way) to report to the Tahsildar (person responsible for revenue collection) there. On the Tahsildar’s order they would be sent to different villages (where there were not sufficient SCs to do *vetti*) to perform duties such as collecting information reports from the government’s agents and carrying instructions from the authorities in Wadpalli to the village officials. This work was done without any food or payment from anyone. Parangi Kanakaiah, an 80-year old man, recalls how often the Madigas did not have time to even earn

⁶ Inam lands are lands given for work from the state.

their daily bread – they were always flying from one village to another on government work. When they could not feed their families, particularly if their wives/other earning members fell ill, they had to sell land to avoid prolonged starvation.

SCs lost land when the canal was being dug and immediately after water flowed into the canals (after a period of about 5 years since canal construction). The village itself has no records, and information gathered from the interviewed respondents show that the perception is that SCs have been forced to sell much of their land. Respondents clearly narrated that there was a Reddy farmer who had 40 acres under the tank, and the canal was dug for his benefit. Consequent to this, it was only the poor people who lost their land, and who however did not ask for compensation due to fear of reprisals. Respondents in Kondrepole reported that soon after canal waters started flowing, there was an influx of landless laborers in the region. As a result of this increase in labor supply, wages remained low, and irrigation did not improve their financial situation either. About 20-25 years ago, the Madigas too, lost considerable and valuable lands to the canal under the village tank, and they too were not given any compensation.

In Velatoor, at the tail-end of the Sagar canal, once again it was the poor who lost lands to the canal. Out of the 12 households who lost land and have not received compensation, 5-6 are SCs. Lands were also acquired for the canal in such a way that it rendered other lands uncultivable. For example, Manda Yesuda's 2 acres of land were cut into two uncultivable halves because of the canal, and in spite of losing an entire ½ acre to the canal under an acquisition that took place 7-8 years ago, he has yet to receive compensation. With his land spilt into two fields, he finds that cultivation costs are doubled—neither a tractor nor laborers can cross over the two pieces of land.

Changing and Diversifying Livelihoods

Qualitative research on the communities in the study villages explored the question of how different communities fared after the coming in of irrigation and how well they have been able to make use of the economic opportunities presented to them. In the villages of Kondrepol and Velatoor, significant time has passed since the introduction of irrigation and it has served as a trigger of sorts for different communities to diversify and/or shift over to more or prosperous livelihoods depending on their situations. The examples of altering social geography come from Kondrepol and they also depict some of the circumstances under which people change their livelihoods. This section presents examples largely from Velatoor on some of the obstacles that communities face when they attempt to change their livelihoods.

It is interesting to note that when different groups were asked to rank the following assets in order of importance—land, water, finance, markets and physical ability to farm, different groups ranked them differently. Large-scale farmers ranked water and finance in the top two categories, medium farmers responded in the same way, while the small-scale farmers rated land, and then water. The landless put land in the top spot, and then said that capital was the next most important asset: *“The landed have several diversified activities—they trade in mangoes, they take the contracts for fish tanks, they take contracts for repairs to tanks and canals, they take a cut from all developmental activities in the village etc. We have nothing except our limbs. Only the landed get loans but we cannot because the banks ask for collateral as security,”* said landless farmer, Velatoor.

In cases where there are other options for livelihood diversification, other constraints appear to operate: “*We are living here for generations but not allowed to fish. Outsiders are given the lease to fish in the village tank, because they are from the Mudiraj community⁷. This is injustice. We do not have any society of our own. Some villages do not function like this. They allow local inhabitants also to take the lease [for fishing rights],*” said Parangi Robert, a Madiga from Kondrepol.

Such responses indicate that caste-based policies that attempt to protect some communities work to the disadvantage of others, especially in cases where there are limited opportunities.

Over the years, small farmers, predominantly among the Gollas and Kapus, have managed to move out of poverty. They have been able to retain their landholdings, and many have been able to educate their children to higher education and professional courses. The Gollas of Kondrepol continue with their sheep rearing, employ grazing hands from their own community as well as from other communities, and have built good houses. The Gollas who were interviewed narrated how they heard about the canal- they had first heard rumours of the canal construction, but were sceptical about it and the opportunities it promised. Some among them started to believe the rumours and promised benefits once a certain amount of construction had been completed, but others were not sure if the water flowing through the canals would be sufficient for irrigation. It was only after the first successful crop that they finally believed that they could be benefited.

Table 8. Who takes decisions related to farm and household matters? (As answered by male respondents).

	Men alone	Both	Remarks
Farm Decisions			
Decision on input purchase	✓		Women participation in these matters was seen only in the case of one woman farmer respondent
Decision on cropping pattern	✓		
Decision on irrigation management	✓		
Decision on sale of produce	✓		
Household decisions			
Decisions on education of children	60	40	The proposed Polavaram villages showed higher female participation vis-à-vis the Sagar command villages. Thus women’s involvement seemed to be influenced more by other factors such as education and their social group
Decisions on marriage of children	35	65	

⁷ Government allows lease of village tanks only to people of the Mudiraj community, a traditional fishing caste.

Gender

Women's participation in decision-making on farm issues was zero. One of the reasons for this could be that these questions were answered by men respondents only.⁸ Table 8 presents the results of responses from them. We get to see a certain amount of participation from women in household matters, especially in the case of children's marriage and education. What we found was that female participation was low in the Nagarjunasagar command villages namely, Kondrepol and Velatoor. On the contrary, Yernagudem had more women's participation. This could be attributed to the higher education levels in the village plus a larger proportion of the high-caste population.

Work Participation. In the proposed Polavaram command, close to 30 % of women in the age group of 13 and above, were found to be working on the farms as agricultural laborers. In this group, three women from the Chetty Balaji group introduced themselves as farmers. Twelve percent of the women were found to be pursuing their studies while the majority (50 %) were housewives.

Compared to the proposed Polavaram command, a higher percentage of women were engaged in work outside their houses in the Sagar command. Thirty-five percent of women were engaged as agricultural laborers. Ten percent of women in the age group 13 and above were pursuing their studies. A number of them were engaged in non-farm activities, working in the capacity of shop-keepers, washerwomen, craftswomen, teachers, and aanganwadi workers for example. Less than 30 % of women were housewives.

Savings and Loans. In the proposed Polavaram command, 30 % people said they saved money. Almost all of them saved in self help groups (SHG), few had accounts in banks. When we asked about loans, 86 % of the respondents said that they had taken loans, and half of these loans were for agriculture. The rest were consumptive loans for marriage, house expenditure etc. Sources for the loans were generally mixed – cooperative banks, the Andhra bank and local money lenders in different combinations. On the question of who decided to take the loan- the answer was commonly 'both' i.e., both men and women. The median amount of loan was 40,000 Indian rupees (INR).

In the Sagar command, 36 % of the respondents said that they saved money and that was with the SHGs. Eighty-eight percent of the people said that they had taken loans. Forty percent of these were for agricultural purposes and the rest for a host of other reasons such as health, marriage and general household expenses. The median amount of loan was INR 35,000.

⁸ The questionnaire was originally intended to have been administered to both men and women members of the household but (because of lack of understanding on the part of the investigators) the question was addressed to men only.

Table 9. Time-use by men and women in the Nagarjunasagar command.

	Kondrepol		Velatoor		Sagar Command	
	Men	Women	Men	Women	Men	Women
Agricultural Work	6.83	7.08	6.68	7.44	6.74	7.23
Livestock	1.9	1.27	4.83	3	3.45	2.33
			(five samples)			
Domestic		3.51		4.01		3.66
Non-farm	5.88	3.43	7.7	4.8	6.73	4.0
			(four samples)			

Source: Authors' estimates based on survey

Table 10. Time-use by men and women in the Polavaram command.

	Chinnadoddigallu		Yernagudem		Proposed Polavaram	
	Men	Women	Men	Women	Men	Women
Agricultural Work	5.60	5.27	6.25	5.72	5.9	5.5
Livestock	2.06	2.05			2.06	2.05
Domestic	2.15	5.56	2.30	4.76	2.25	5.16
Non-farm	4.9		4.2		4.55	

Source: Authors' estimates based on survey

The time-use statistics provide interesting insights (Tables 9 and 10). We can see that in the Sagar command the average number of hours spent by men and women on agricultural work is higher than the Polavaram command. Further, the number of work hours of women on the farms is higher than that of men. In the proposed Polavaram villages however, the number of work hours on the farm is much less in comparison, and women's work hours are slightly lesser than those of men. In the Polavaram proposed command, women's time is spent more on household chores.

Concluding Remarks

The ownership of land remains one of the most critical pre-requisites to derive benefits from improved irrigation. Additionally, land size is also important in maximizing the impacts of improved production. This study reveals how richer, more powerful farming communities have been observed to move into new irrigation areas, buying out small pockets of scattered lands belonging to the poor. For these communities who are connected to influential networks, irrigation plans and designs are known in advance, leading to a significant amount of land trading and consolidation even before the water flows through the canals. For marginal landholders, on the other hand, the benefits from irrigation may help to cope with poverty, but does not necessarily provide an escape. In times of stress there is little option for these households but to sell their small parcels of productive land. In addition, canal construction

usurps a significant amount of land from the cultivated commands. The inequity of a marginal farmer losing all or most of his land to the canal, and receiving poor or no compensation is incomparable to a large farmer losing a small piece of land. Yet, this very evident inequity is often given little thought in irrigation planning and design. Surface irrigation schemes, as commonly implemented, can suffer from several limitations that result from not taking into account these realities.

Another important issue that emerges is the lack of ‘conscious design’ in planning that attempts to target irrigation to the poorest geographical clusters. It is claimed that contour alone determines the path of irrigation canals – thereby self-selecting and excluding villages along their flows. However, analyses show this is not overtly true. Several discussions and studies of the irrigation maps of Andhra Pradesh show that at the macro level, irrigation plans have followed conscious political designs, and at micro levels, canal pathways are defined by elite interests and needs. This paper illustrates this point by showing the distribution of farmers along the canal and presents findings, which reveal that the majority of head-end farmers in irrigated villages are large-holding farmers belonging to dominant caste groups and have large amounts of land.

The impact on changing livelihoods is also revelatory. While certain enterprising and resourceful communities have been able to tap the economic opportunity thrown open to them by irrigation, the status of the landless and the SC communities has changed very little. An analysis of wage employment and wage labor in the 40-year old NSP system in Kondrepole shows that while employment is more or less assured to mitigate labor migration, wage rates have not increased – even though ‘landed’ farmers have secured improved interests from irrigation. A constant, although inadequate, income (lower than the national wage rate) allows the landless poor to escape starvation and migration, but does not offer a path out of poverty. Hanging the poorest by this slender thread also encourages a stream of detrimental social impacts – primarily alcoholism, and alcohol-induced impacts among men. Finally, irrigation interventions have made only a little dent on the unequal gender relationships. Four decades of reliable irrigation in Kondrepole have not brought change to women’s access to and control over key primary assets – with little impact on their personal lives and decision-making.

While the largely sociological approach to the question in this study helps us characterize the post-irrigation scenario and the inequities therein, we, as the authors of this paper, believe that appreciating the fact that the impact of irrigation is not the same across different groups of people is the first step to formulating effective policies, which act as enablers to help communities avail the benefits of irrigation.

“The policy goal, in the case of an irrigation command, is to reduce this income inequality to a level accepted by society through appropriate institutional and policy changes in the irrigation system operation, and through improved maintenance and overall management of irrigation systems. This would help the poor and marginal sections of society to gain from the benefits of the windfall (irrigation infrastructure) provided by government.”

- (Bhattarai et al. 2002).

Bhattarai et al. (2002) in their analysis on irrigation impacts on income inequality and poverty alleviation emphasize that the benefits coming from the introduction of new irrigation water could be multiplied by recognizing these inequities and making up for them by having the right institutional environment and a 'pro-poor' focus in policies. In order to engineer such policies, knowing who benefits, who loses and the processes by which this occurs, is the first step.

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