7 Wells and well-being in South India¹

Gender dimensions of groundwater dependence

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Introduction

In 2010, nearly 27 million hectares of land in India were groundwater irrigated compared to 21 million hectares irrigated by surface-water sources (Mukherji et al. 2013). Groundwater usage is growing at an unprecedented rate; it is estimated that one in every four rural households owns at least one groundwater irrigation structure (Shah 2013).

Groundwater development has been credited with increasing farm incomes and well-being by increasing productivity (Roy and Shah 2002; Sekhri 2014). On the other hand, it has also resulted in chronic resource depletion in terms of both quality and quantity (Gleeson et al. 2010). Groundwater irrigation is currently at an impasse. It has cemented its vital position in the drought-proofing of agriculture. However, the exploitation of the resource for irrigation has resulted in critical groundwater levels, particularly in already water-stressed regions (Kumar and Singh 2008; Livingston 2009). The number of irrigation blocks in India reporting overexploited groundwater levels grew at an alarming rate of 5.5 per cent per year between 2002 and 2007 (Gandhi and Namboodiri 2009). Increased well proliferation has led to aquifer contamination and salinization, alongside increased pumping costs. The problem is particularly severe in arid and semi-arid regions, where communities depend on groundwater for both domestic and agricultural purposes (Taylor 2013).

Water scarcity is expected to grow in the future, exacerbated by changes in precipitation patterns and increase in temperatures (Shah 2013). A study by Geethalakshmi et al. (2011) on the impacts of climate change on the Cauvery basin in Tamil Nadu, using regional climate models, showed an increasing trend in maximum and minimum temperatures, and a decrease in the number of rainy days. These climatic changes will have an impact

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on the hydrological cycles in the region and lead to more run-off and less recharge, affecting the groundwater tables. There has also been an increase in the frequency of droughts in the state. Tamil Nadu declared droughts both in 2016 and 2017 (Promod 2017). This has driven farmers to increase their dependency on groundwater to secure their crops. Climate changes act as a force multiplier, increasing the criticality of the resource while simultaneously threatening it (Shah 2013).

The emergence and spread of an intensive groundwater-based irrigation regime has had important socio-economic consequences for rural households (Roy and Shah 2002; Shankar et al. 2011). Curiously, given the centrality of groundwater to the contemporary agricultural economy, few studies have focused on the socio-economic impacts, particularly gendered intra-household impacts of groundwater usage and dependence (Mukherji and Shah 2005). In fact, a recent review of the literature on water and gender in India (Kulkarni 2016) focused entirely on surface water and the gendered and social facets of its management. In our research, we attempt to fill this gap by focusing on the relationship between, and the micro-politics of, gender and the multiple uses and users of groundwater, in both agriculture and the domestic sphere. Specifically, we focus on the everyday experiences of men and women to understand the gendered segmentation of agricultural labour and its relationship to the control of assets, including water.

Context and methodology

With only 3 per cent of the national water resources, Tamil Nadu is one of the most water-vulnerable states in India (Janakarajan 1999). Around 15 per cent of the land area of Tamil Nadu is in the semi-arid zone, with less than 700 mm annual rainfall (Walker 2012). This explains why 56.8 per cent of the net sown area in Tamil Nadu was irrigated in 2009–10 (DES 2011).

Dependence on surface water (tanks and canals) for irrigation has been replaced by extensive groundwater use in the state (Kajisa et al. 2007); the area irrigated by groundwater has doubled since 1950 (Janakarajan and Moench 2006). Fifty-five per cent of the irrigated land is under groundwater in Tamil Nadu (DES 2011). Since 1991–92, state government subsidies to promote irrigation – particularly free electricity for pumpsets and loans for deepening existing wells and constructing new ones – have reoriented the role of wells from a source of supplemental irrigation to a key productive asset (Kannan 2013).

Lack of appropriate and properly enforced state regulation promotes fierce competition among farmers to extract groundwater to cultivate water-intensive cash crops (Phansalkar and Kher 2006). From 2002 to 2012, the groundwater declined by 1.4m annually on average, indicating that groundwater usage was nearly 8 per cent more than the annual

recharge rate (Chinnasamy and Agoramoorthy 2015). Richer farmers can drill deeper, giving them an advantage over small and marginal farmers, who are burdened with 73 per cent of the non-functioning wells (Kulkarni et al. 2015). Furthermore, extensive ground and surface-water pollution by textile and paper mills has seriously affected the the availability and quality of drinking water, with adverse consequences for human health and well-being (Puthiyasekar et al. 2010; Saravanakumar and Kumar 2011).

This chapter is based on 25 in-depth interviews with 20 women and five men and a 200-household survey containing gender-disaggregated sections on livelihoods, time use and asset ownership, conducted in 2016 in two villages in the Coimbatore district of Tamil Nadu (Figure 7.1). Coimbatore, a drought-prone semi-arid district, was known for the cultivation of dryland crops over large areas using tank irrigation in the 1950s, but since then, along with the production of cotton and rice, the region has developed into a major textile hub (Kosalram 1973). Between 2003 and 2014, the cultivated area in Coimbatore declined, largely attributable to the scarcity of both water and labour (Selvaraj and Ramasamy 2006; Prabu and Ahmad Dar 2018a).

For the household survey, we selected households that stated agriculture as their primary livelihood strategy and owned agricultural land. Stratified proportional sampling based on landholding size (small: 0–2 acres;

Figure 7.1 Location of Coimbatore district in India.

Data source: Global Administrative Areas (2012). GADM database of Global Administrative Areas, version 2.0. [online] URL: www.gadm.org. Map prepared by author.

medium: 3–6 acres; large: 7 acres and above) and caste, to ensure weighted representation, was used. Two panchayat¹ villages, Marudur (50 per cent small, 43 per cent medium, 7 per cent large) and Chinnakallipatti (47 per cent small, 45 per cent medium, 8 per cent large), were selected for the surveys (see Table 7.1). Although the surveys were primarily conducted with the head of the household, gender-specific questions were addressed to other members of the household. Only 8 per cent of the primary respondents were women, reflecting the lack of female-headed farming households in the region.

Twenty-five households were selected for in-depth interviews based on landholding size to understand the intra-household dynamics of groundwater usage among different economic classes of farming households. While the surveys provided information on the broader dimensions of livelihoods, in-depth interviews were used to understand groundwater usage, dependency and intra-household relations. Additionally, two focus group discussions (FGDs) with men only and two FGDs with women only were conducted in Chinakallipetti and Marudur respectively. Each FGD had 7–14 participants, though the caste composition was mixed. A majority of participants belonged to the Other Backward Castes (OBC). The names of interviewees have been changed to protect identities.

Chinnakallipatti and Marudur are small agricultural villages in Coimbatore district, having settlements of about 1,000 households. The majority of landowners are VellalaGounders, Mudaliars, VokkaligaGounders and VettaiyarGounders, all OBCs. These villages also have a small population of largely landless Pallars, who belong to the Scheduled Castes (SCs),² and Kurumbas, who are a Scheduled Tribe (ST), with small and medium landholdings. After the land distribution of the 1970s, the OBC castes established their hegemony in the region; they are the main landholding castes and occupy the majority of seats in the gram panchayat.¹

Over the last decade, there has been a shift to intensified cash crop cultivation, aided by the groundwater revolution, mechanization and the introduction of hybrid seed varieties. Eighty-four per cent of farmers reported using groundwater for irrigation in the survey; of these 74 per cent reported at least one borewell failure in the last decade. While buffering against climate risks, such water-intensive cultivation has simultaneously increased the vulnerability of both the resource and the communities dependent on it. Secondary sources of livelihood involve livestock, small ruminants and agricultural labour (Coimbatore District Statistical Handbook 2012–2013, 2013–2014). As the region is close to the textile and manufacturing centres in Coimbatore and Tiruppur, many young people from the village migrate daily or seasonally for work. Several factories specifically employ young unmarried women (Heyer 2016) and pay them a lump sum for their dowry after three years' service in addition to their monthly wage (Rao 2014). Although the controversial Sumangali scheme is beyond the scope of this

Table 7.1 Land and well ownership among households, sampled by caste

<i>Caste</i>	<i>Subcaste</i>	<i>Sample size</i>	<i>Average land holding size (acres)</i>	<i>Percentage with irrigation</i>	<i>Number of borewells (average)</i>	<i>Percentage with outstanding debts</i>	<i>Percentage that practice seasonal migration</i>
OBC	VokkaligarGounder	48	5.2	90.8	3.2	70.8	70.8
OBC	Mudaliar	22	5.7	92	3.8	72.7	68.2
OBC	Chettiyar	10	6.3	97	4	60.0	60.0
OBC	VellaraGounder	45	3.6	89	4.2	84.4	80.0
SC	Pallar	37	2.4	84	2.8	89.2	81.1
ST	Kurumba	38	2.2	72	1.5	92.1	71.1
Total sample		200					

Source: Primary survey data collected in 2016.

chapter, the rise in dowries can be linked to the need for capital to dig additional and deeper borewells to sustain commercial agriculture.

Women play an essential role in the agrarian system here. However, the labour participation and responsibilities of women in the field and at home depend on the caste of the household. Rao (2014) and Heyer (2016) show that *Dalit* women are withdrawing from paid employment and moving to unpaid household work, often on farms, at least temporarily when their children are young, while OBC women are pursuing higher education, and at the same time contributing to household agriculture. Women also contribute to household nutrition by maintaining sustenance crops such as millet, vegetables and fodder either through intercropping or in domestic gardens. Despite women's role and contribution to farming, they remain subordinate to their male kin with respect to agricultural decision making.

Our household survey indicated that men, particularly from OBC groups (97.8 per cent), are the primary decision makers with respect to cash crops, including crop choices, irrigation inputs and markets. While still high, male control over decision making was relatively lower in SC households (94.2 per cent) and lowest in ST households (90 per cent). Men also carried out most technology-related and, indeed, more remunerative tasks. In the next sections, we briefly set out the changes in cropping patterns as a result of changing climate, policy signals and people's aspirations, and discuss the implications for livelihood choices. We particularly focus on the intersections of gender, caste and class which mediate access to and control over assets (land, livestock and money) and how this shapes intra-household cooperation and conflicts, considering also the special case of female-headed households. In the concluding section, we explore what the growing dependence on groundwater means for gendered well-being in general, and for specific caste and class groups.

Cropping patterns and divisions of labour

Tamil Nadu gets two monsoons, unlike many other parts of the country. The north-east monsoon, which arrives in early November, is the primary monsoon in the region and marks the peak *aadi* cultivation season. The south-west monsoon, which extends from the end of May to August, is comparatively weaker and marks the *avani* cropping season. A 2014 study found a significant shift in monsoonal patterns, with a weakening north-east monsoon and a strengthening south-west monsoon (Krishnaswamy et al. 2015). In our survey, 98 per cent of the respondents felt that total annual rainfall has decreased from 2005 onwards, and 84 per cent reported that rainfall variability had increased over this period. Irregular precipitation, along with increasing instances of drought (Kabirdoss 2017), has prompted farmers to adapt by shifting from supplemental to complete groundwater irrigation. A functional borewell hedges the household's fortunes against the capricious nature of monsoons and provides a reliable source of water.

Figure 7.2 Plantation area of dryland crops (coarse millets and grains) in Coimbatore District, 1997–2015.

Data source: Directorate of Economics and Statistics (DES), (1997–2015) Government of India.

The expansion of groundwater irrigation has, in turn, led to a dramatic shift in cropping systems and crop management practices. It has facilitated the shift from rain-fed food and fodder crops (sorghum, pearl millet, foxtail millet and finger millet), to high-value but high-risk perennial cash crops like banana, turmeric, jasmine, tobacco and, recently, curry leaf (Figure 7.2). There was a decrease of 71 per cent in the cultivated area of rain-fed food and fodder crops in the district between 2000 and 2013 (DES 2000, 2013). Rain-fed millets are hardy and resistant to long dry spells, do not require expensive agricultural inputs and provide nutritional security to households. However, the market for these crops is limited and returns are low.

Around 72 per cent of respondents reported that they grow only perennial cash crops in 50 per cent of the cropped area. This shift has increased the risks associated with farming. Cash crops are input intensive and require considerable financial outlays. Almost 78 per cent of total respondents reported significant losses from agriculture in the last five years, mainly due to drought and water scarcity. This was fairly consistent across caste groups – OBC 74.6 per cent, ST 76.2 per cent, SC 79 per cent – although the losses were significantly larger for SC and ST farmers (74 and 73 per cent of investments on average) than for OBC farmers (61 per cent). Being largely small and marginal landholders, the SC and ST farmers depend on loans for inputs. Sources of loans include banks (24 per cent), moneylenders (36 per cent), and relatives (40 per cent), with interest rates of 4–7 per cent, 20–40 per cent and 10–30 per cent, respectively. The implications of this are discussed later in the chapter.

The shift in cropping patterns entails gendered costs and risks. Cash crops are water and labour intensive. Crops such as curry leaf and jasmine require regular pruning and weeding, and are harvested by hand. Labour requirements have tripled since the introduction of cash crops (FGDs). With an increase in off-farm employment opportunities (primarily for men) and work schemes including the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA),³ primarily used by women, the study area has witnessed a severe labour deficit for farming activities. To offset this deficit, women have taken on additional tasks in agriculture. This is particularly relevant for poorer farmers who cannot afford to pay the higher wages resulting from a tight labour market. Continuous engagement in physically strenuous work has, however, taken its toll on women's health. Women reported suffering from chronic back pain during the FGDs.

Rengalakshmi (41), a VokkaligaGounder from Chinnakallipatti village, whose household owns 6 acres of land, complained about her increasing work burden:

It is so difficult to get labour to work on our farms, especially during the harvest season. When they do come, they demand too much money for us to pay ... I have started working more on the farm now. I do not have a choice. My husband goes for construction work in the neighbouring town, and if I do not do agricultural work the crops will die.

Well-off farmers with larger landholdings use technologies such as drip irrigation to reduce labour requirements; but medium and small farmers depend on women in the household for their additional on-farm labour requirements. Women across castes play an active role in irrigation activities in the region. Around 47 per cent of total women in our study reported that they handled the majority of irrigation activities on the farm. For households with medium-sized holdings, mainly OBCs, 82 per cent of women reported that the average time available for household activities has reduced from eight hours to six hours per day over the last ten years. While borewells have ensured the availability of household water, reducing domestic drudgery for women, the time saved is often reallocated to unpaid farm work.

Manual methods such as flood irrigation cause increasing evaporation, and consequently a demand for more water and more labour. Alongside the increase in the on-farm unpaid labour of women, studies have also shown a positive impact on gender wage differentials (Narayanamoorthy and Deshpande 2003): with an increase in demand for labour, women have been able to negotiate higher daily wages for their agricultural work. This has been particularly significant for ST and SC women with marginal and small landholdings, 75 per cent of whom reported engaging in agricultural labour outside their farm. Lakshmi (35), a Kurumba female agricultural labourer from Marudur, explained:

Even 5 years ago, we were paid much less than men. Women would get about Rs. 100 per day for work on the field while men would get nearly Rs. 200. Now, since there is so much work on the fields and so few people, we can demand more wages ... Men get Rs. 350 and women get Rs. 300 for one day's work.

Around 78 per cent of respondents reported that they no longer grow any food crops. The declining production of nutritious millets and vegetables at farm level has led to increasing reliance on markets and the Public Distribution System (PDS).⁴ The PDS in Tamil Nadu is among the most efficient in the country, with close to universal coverage and a relatively effective delivery system (Anuradha 2018). The security that the PDS provides is one of the reasons that households can make the shift away from food crops. However, the PDS has further entrenched the dietary shift away from millets and coarse cereals to low-nutrition polished white rice as the most consumed cereal crop.

Reflecting on the dietary changes in her household over the 10 years (2006–16), Revathy (53), a VellalaGounder from Marudur village with a 4-acre farm, said:

Our profits from agriculture have increased, but now we do not grow *ragi* (finger millets) or *jowar* (sorghum). The rice we eat does not give us the energy to work in the fields all day. Earlier we used to eat *ragimudde* (ragi ball) and not have any health problems; now almost everyone in the village has diabetes and other problems ... I ask my husband to buy *ragi* when he goes to the market, but he says it is expensive. Moreover, it takes a lot of time to prepare and my children prefer rice.

Revathy indicated that the reduction in cultivation of coarse cereals on the farm has reduced her autonomy in making choices on household nutrition. Nutritional choices are now based on market prices and availability.

Gendered assets

The bargaining power and agency of men and women in the household are shaped by their control over material assets and perceived (economic) contributions to the household (Sen 1990; Kelkar and Jha 2016). Access to and control over assets, however, are not necessarily determined by legal ownership, but are shaped by larger socio-cultural contexts and prevalent notions of legitimacy (Rao 2017). In Tamil Nadu, state-led gender discourses reflected in state-sponsored welfare schemes targeting women have strongly influenced notions of gendered asset control and ownership. We discuss here the impacts of borewells on two highly gendered assets: gold and livestock.

Gold

The total cost of digging a borewell in Tamil Nadu averages between Rs. 100,000 and Rs. 150,000, a substantial amount in a region where the average monthly income of families is around Rs. 5,000–10,000.⁵ Around 62 per cent of the farmers reported having sold household assets to finance well boring; of them, 72 per cent had medium and small landholdings and 68 per cent belonged to ST. Kurumba households, which generally have lower incomes, are forced to sell household assets for large investments including in borewells.

Around 85 per cent of all households said that gold was the primary asset to be pawned or sold. Gold ornaments are a strongly gendered asset in the region (Swaminathan et al. 2012), traditionally given as dowry, a gift to a daughter on marriage. While dowry has been used to control and exploit women, women in this region (western Tamil Nadu) have control over their gold ornaments. Gold has social legitimacy as a woman's asset. As well as a source of security that can be pawned in emergencies, it enhances her bargaining power within the household.

Jaya (48), a Pallar woman whose household owns 4 acres of land in Marudur village, points to her wedding photo and describes the dowry she brought:

My parents gave 50 *pauns*⁶ of gold for my wedding. It was not demanded by my in-laws, but my parents chose to present it to me. I have kept it safely for the last twenty years, but over time I have had to pawn most of it. Two years ago (2014), to dig a new borewell, my husband pawned nearly all of it. I was very upset; I wanted my daughter to have it for her wedding ... Now I have only this *thali* (wedding pendant).

Jaya resented her husband pawning her gold, hinting that she was made to part with it forcibly. She comforts herself, however, with the reflection that this is a common occurrence in the village. With borewells increasingly seen as essential for a secure livelihood, women's gold is now being used to finance this investment. Jaya still worries about gold for her daughter's marriage and has started a small chit fund (a rotating savings system which yields a lump sum payment) from her agricultural labour earnings to buy gold.

Livestock

Livestock rearing is an important source of supplemental income for agricultural households, and provides nutritional security. The survey indicates that livestock rearing can provide as much as Rs. 3,000 per month, a buffer against crop failure and periods of declining agricultural productivity. Livestock ownership is strongly gendered owing to cultural norms and various government subsidies to promote the dairy industry. The ruling political

party, All India Anna Dravida Munnetra Kazhagam (AIADMK), launched a scheme for the free distribution of milch cows and goats/sheep to poor women in 2011. At the time of the survey in 2016–17, about 36,000 milch cows had been distributed in the district under this scheme (GoTN, n.d.). Around 84 per cent of women across all castes in the survey reported that up to 60 per cent of their time each day is devoted to livestock-rearing activities, with women over 50 spending significantly more (up to 80 per cent of their time). Unable to undertake rigorous farm activities, they contribute to the household by looking after livestock. It is more or less a female domain.

Findings from our survey and FGDs reflect insights from studies on gender and livestock in India which highlight the role of livestock and small ruminants in the managerial and economic autonomy of women (Upadhyay 2005). Women handle the processing of milk into ghee, butter and other dairy products, and maintain personal savings through the sale of these products. The prevalence of women's milk cooperatives in the region supports and reinforces the importance of livestock as a source of women's income, to be spent on their personal or children's needs. Mariamma (62) is a VellaraGounder woman who has lived with her brother's family since her husband died when she was 20. She said: "I received a cow as part of a government scheme in 2008. I take complete care of the cow including taking it to graze and milking it. In this way I can contribute to the family." The area still has some common pasture land in the surrounding forested areas. Meanwhile the larger incomes from crop sales are spent on consolidating agricultural investments, seen as the responsibility of men as 'providers' (Garikipati 2009).

Rearing livestock is a water-intensive activity, as dairy cows consume up to 171 litres of water per day (Schlink et al. 2010). With lakes and ponds in the region shrinking, most of the water for livestock is provisioned from borewells. During periods of water scarcity, there is fierce competition within the household over limited water resources. Men prioritize water for maintenance of cash crops, while women prioritize the maintenance of cattle. Women reported that at times of extreme scarcity, such as in 2013 when the north-east monsoon failed, they were unable to maintain their cattle and had to resort to distress sales. This was higher among SC women (82 per cent) who could not afford to buy water, unlike OBC women who could buy water from neighbours' wells. ST women resorted to using water sources in forested areas, and although this further impinged on their productive time, they managed to maintain their livestock.

Despite the importance of livestock for women's livelihoods, men view livestock as a disposable asset. This was highlighted in our survey, with 82 per cent of male household heads reporting that cattle are sold in case of financial stress. Further, the area devoted to fodder crop production reduced by 66.87 per cent between 2000 and 2013 (DES, GOI). The reduced fodder production has increased the price of fodder and reduced cattle ownership in the region. This has also resulted in a decline of household dairy usage, with possible implications for household nutrition.

Borewells and indebtedness

There are about 250 drilling units in Coimbatore alone that charge around Rs. 200 per metre for drilling (in 2016). A traditional water diviner determines the exact location for the well. Farmers prefer to use water diviners, as they are cheaper and more easily available than hydrogeological experts. In 2012 the state government introduced the Tamil Nadu Minor Irrigation Scheme to provide expertise, machinery and funds for drilling wells.⁷ However, lack of awareness, and an excessively bureaucratic and inefficient delivery system led many farmers to hire private contractors to drill borewells, obtaining the required funds through informal loans from money-lenders or by selling assets.

The costs associated with informal borrowing in the region range from 10 to 40 per cent (key informant interview). Tamil Nadu has some of the highest levels of household indebtedness in India at 82.5 per cent, compared to the national average of 52 per cent (NSSO 2013). Farm debt driven by social and economic aspirations is leading to pauperization, marginalization and growing arrogance on the part of the local elite (Guérin et al. 2011). Although the digging of borewells is not the sole reason for the high level of indebtedness in the region, it is strongly associated with reckless borrowing practices (Taylor 2013). In our study, 60–70 per cent of OBC farmers and close to 90 per cent of Pallar and Kurumba farmers reported having unpaid debts at the time of the interview in 2016 (see Table 7.1).

The hydrogeological characteristics of the region and the exploitation of groundwater have resulted in a high borewell failure rate. A study by Palanisamy et al. (2008) reported that farmers had a success rate of only 30 per cent in borewell drilling in Coimbatore district. A failed borewell can lead to financial ruin. Farmers often take loans in the hope that a bumper crop provisioned by irrigation will allow them to pay off debts. Depleting groundwater tables can drive farmers to bore up to three times in the same place to ensure a functioning well, often accruing substantial debts in the process. Around 67 per cent of the households in our study reported failed borewells as the primary cause of agricultural debt. The amount of debt varied significantly across castes, with SCs reporting a 24 per cent higher average amount of debt than OBC castes.

Rajeshwaree (42), a Pallar woman whose household owns 2.5 acres of land in Chinnakallipati village, described the indebtedness of her family due to multiple failed borewells on her farm: “I was not even aware of the cost of drilling the borewell, or the loan taken; we simply continue to pay monthly to the debt collector, hoping that one day we can clear our debts.”

Rajeshwaree’s household has accumulated debts amounting to almost Rs. 3.5 lakh with the local moneylender over the past 10 years. The annual income of the household from agriculture is Rs. 74,000. Unable to repay the full amount, they have resorted to taking smaller loans from multiple sources to clear the initial debt. Rajeshwaree’s 17-year-old daughter had to discontinue her college studies and take up a job in a textile factory in

Tiruppur to help pay off some of the debt. Rajeshwaree currently works as a cleaner in the local panchayat office in addition to her domestic and farm duties. She also invests whatever small savings she manages to gather in the village-level self-help group and chit funds.

Indebtedness in the region has forced men and women to diversify their livelihood portfolios (Djurfeldt et al. 2008). 81.1 per cent of farmers belonging to the Pallar (SC) and 71.1 per cent belonging to the Kurumba (ST) communities practice seasonal migration. Around 74 per cent of the male farmers reported clearing farm debts as the main reason for seasonal migration. Indebtedness is disproportionately higher among small farmers belonging to SC (89.2 per cent) and ST (92.1 per cent) groups (Table 7.1), reinforcing the fact that coping strategies are shaped by class and caste positions. Seventy-two per cent of women above the age of 30 in our survey reported engaging in jobs outside the farm and the home, with 31 per cent engaging only in MGNREGA work, 40 per cent working as agricultural labourers and 29 per cent engaging in both. While SC (68.4 per cent) and ST (71 per cent) women engage in both MGNREGA and agricultural labour, women from OBC groups prefer not to work as agricultural labourers (24 per cent). Given the restrictions on their mobility due to domestic chores, and the limited options that married women have for earning additional incomes (Rao 2014), MGNREGA provides a valuable source of income for women during the summer months, compared to other physically demanding and poorly paid jobs available locally (Carswell and De Neve 2014).

Household cooperation, conflict and decision making

While women in rural South India are seen to have more autonomy and agency than their North Indian counterparts (Dyson and Moore 1983), they appear to have limited agency over water production (Zwarteveen 1997). Men maintain control over groundwater resources, from the decision to drill wells to well maintenance and water allocation. The drilling of boreholes is carried out by private male contractors who prefer to deal with the men of the household, perpetuating a masculine culture around borewells. As Zwartveen (2008) notes, colonial and neocolonial relations of technology and gender have informed these 'traditional' (irrigators) and 'globalized' (engineers and mechanics) masculinities. This is despite the fact that women share the burden of work involved in irrigation, require water for livestock and household maintenance, and more importantly, often contribute to the cost of the borewells from their gold and other savings. Their exclusion here is justified by the social construction of the well as a male asset similar to other productive assets such as machinery or land across rural communities in India (Rao 2006; Deere et al. 2013).

Selvi (53) is a Vokkaliga Gounder woman whose household has 9 acres land in Chinnakallipatti. With eight failed borewells, she discussed the decision to invest in well boring:

The first well was dug about twenty years ago, before that we depended only on the rain. My husband wanted to start growing different types of crops, so he suggested that we dig the well ... Initially, I was not convinced; it is a lot of money, and I was not sure if we would get water. But he convinced me and dug the well. After two years the water in the first borewell decreased. We had also bought more land for agriculture and needed water to irrigate the crops; he decided to dig another well ... My husband did not consult me on this ...

This bore failed, and I asked my husband to stop digging. He did not listen to me ... If we had not spent so much money on the wells we could have invested in something else, maybe a petty *kadai* (small shop). Now we already have invested too much of our money in it, it is too late to do anything else.

Figure 7.3 shows how groundwater depth in Coimbatore district has fallen since 1999, with a dramatic dip in 2005. Selvi's narrative highlights the change in her attitude towards investing in borewells as the groundwater levels declined, and her resentment of her husband's decision to take higher risks by boring for more wells is palpable. Many women in the area expressed similar feelings, mentioning their limited agency in influencing decisions on the digging of borewells. Women, especially those in households with smaller landholdings, preferred to invest in small businesses or in assets such as gold and livestock; they regarded the digging of borewells as a precarious gamble that could result in financial ruin.

Borewells are useful to both men and women. However, as symbols of a productive farm and a successful (male) farmer, they are socially constructed as 'male' assets. During our interviews, borewell ownership was often used

Figure 7.3 Average pre-monsoon (May) and post-monsoon (July) groundwater levels in Coimbatore District, 1997–2015.

Data source: Average annual groundwater levels in Coimbatore district (1997–2015) from Tamil Nadu Water Supply And Drainage Board (TWAD) data.

as a qualifier of success, even replacing land as a source of prestige and status within the community. Paramasivam (44), a VokkaligaGounderfarmer in Bhavani, had borrowed money from the village moneylender to dig a borewell four months previously, despite having one working borewell to irrigate his 3-acre field. When asked why he wanted to dig another well despite being aware of the risks, he pointed to his brother's adjacent field, stating "My brother has no worries, he has two working borewells and is doing very well in his farming and in his life". Competition in relation to well boring stemming from the associated feeling of success is shaping the behaviour of farmers in the region, often leading to indebtedness. Farmers like Paramasivam resort to borrowing from moneylenders due to the inflexibility of formal financial institutions over providing second loans where crop loans remain outstanding.

The construction of the borewell as associated with male identity can be unpacked using Sandra Harding's seminal text on how gendered social life is produced via symbolism (Harding 1986; Zwarteveen 2008). The hegemonic construction of irrigation, particularly borewell irrigation, can be attributed to the androcentric trappings of cash cropping, a co-production of irrigated systems in the region (Connell and Messerschmidt 2005). The very term 'cash crop', alluding to a crop grown only for sale, relegates it to an 'enterprise' that, under traditional cultural and societal norms, falls into the purview of men. In this case, as in similar cases elsewhere in Asia and in Africa, men control the growing and sales of cash crops such as banana, tobacco and curry leaf, while women retain control of the less remunerative fodder and food crops, even though they also contribute labour for cash crops (Rajamma 1993; Doss 2002). While women do not necessarily lack the knowledge or skills to engage with well boring, they have been systematically discouraged by both state institutions and the community from entering these 'technical', male-dominated spaces (Satyavathi et al. 2010).

Murugan, Selvi's husband, explained why he decided to bore multiple wells despite repeated well failures:

I initially got the idea to dig a borewell after our *ooruthalevar* (village headman) dug his borewell. This was twenty years ago. It functioned well and allowed me to plant all the crops that I wanted. It provided enough water for the cattle and the house. But water in the well started decreasing in the past ten years. This is because everyone around has started to dig many wells. I had to ensure that I had enough water. So, I dug two more wells. These failed, so I took a loan and dug another one. Over the last eight years I have dug nearly five wells.... Of course, I have to keep digging to ensure that I have a functioning well. How else will I irrigate my crops? I cannot go back to rain-fed farming. All the farmers in the village have wells. If I have a good well I can make my farming very successful ... I cannot consult my wife regarding these decisions. She does not understand farming.

The borewells in Murugan and Selvi's farm have been financed through a combination of personal savings, bank loans and, more recently, loans from relatives and moneylenders. The household has sold assets to repay these loans, but they still have outstanding debts amounting to about Rs. 7 lakhs to pay off. Murugan hoped that he would at least be able to repay the moneylender after his next banana harvest.

The proliferation of borewells has had important implications for intra-household gender relations. Economic success and financial provisioning are an important conjugal expectation from men in patriarchal rural societies, who in turn expect their wives to meticulously perform familial and mothering roles (Rao 2012). Women may suggest alternative investment strategies, but once the borewell option is pursued, they have no choice but to also contribute to the repayment of loans. Men frequently resort to drinking to cope with a sense of hopelessness as a result of failed borewells and mounting debt burdens, sometimes even leading to violence. This link, however, requires further exploration (Rao 2015).

While tensions are rising due to failed borewells, new forms of cooperation are also visible. Although the primary impact of wells has been in the sphere of livelihoods, wells have also allowed easier access to water for domestic activities. Reproductive roles remain women's primary responsibility, and the direct burden of water provisioning falls on them. Yet, in the FGDs, women did indicate that when borewells failed, men increasingly contributed both cash and labour to the provisioning of domestic water for their households.

Savitree (32), a Vokkaliga Gounder woman from Marudur, with 4 acres of land in the household, discusses this shared responsibility:

During the dry years, when there is less water in the borewell, my husband goes to the stand pipe [government-provided water tap in the village square] to collect water. I used to do it, but he has a bike, and it is easier for him to do it especially later in the day when it is not very safe for women to go out ... At times of scarcity, we have to buy water from tankers for household needs like cooking and washing. My husband knows that I need water to cook for the family, so he will ensure we get water from the tanker even though it is expensive.

This is an interesting reversal of the gendered binary of domestic water as the domain of women, while its livelihood use becomes the domain of men (Van Koppen 2007; Zwartveen and Ahmed 2012). Savitree and her husband Gopal both agree that it is no longer the responsibility only of women to collect water; if there is no water in the house, all of them will suffer. However, she does admit that during the summer months, when there is no work on the fields and her husband goes to the town for construction work, she has to collect the water herself.

Female-headed households

Feminist scholars have postulated that the atomization of water ownership through borewells allows women to circumvent historical inequalities in access to water by invalidating the necessity to participate in male-dominated patriarchal water user groups (Meinzen-Dick and Zwarteveen 1998; Ilahi and Grimard 2000). However, rights to water are tenuous and mediated through other constraining factors such as technology, knowledge and infrastructure (Boelens and Zwarteveen 2005; Ahlers and Zwarteveen 2009). This comes to prominence in the boring and maintenance process, when women have to depend on external support systems to operationalize their access to groundwater. Furthermore, groundwater access has never been fully equitable and is often determined by hydrogeological features of the land and shaped by patterns of marginalization propagated through, for instance, inheritance of less productive land (such as land located on hard rock aquifers).

There are a limited number of households in this region headed by widowed, divorced or unmarried women. The 2005 amendments to the Hindu Succession Act of 1956 established a gender-equal basis for inheritance of land and resources (Kelkar and Jha 2016). However, women continue to face a host of barriers and taboos that make their cultivation less productive than that of men (Agarwal 1994). Female-headed households usually have to diversify their livelihood activities and they prefer to undertake more 'gender-accepted' livelihoods such as animal husbandry and mill work.

Recounting her experience, Nagamma (48, VellalaGounder), a widow from Chinnakallipatti village who owns 5 acres of land, said:

There was only one well on the 10 acres of land that my father owned. When it was time to divide the land, I had no say or choice on which land I received. I received an equal portion of land because it is the law, but my land does not have any water source. I have to buy water from my brother to irrigate the land but he usually does not have water to spare. I cannot dig a well as I do not have the money and I will not be able to do it by myself. I will require support from my brother, and I do not wish to be indebted to him. I have decided to sell the land as it has become unprofitable.

Namma cultivates only half of her land with finger millet and foxtail millet and has kept the rest fallow. She has limited access to water even for supplemental irrigation and usually suffers crop losses in dry years, particularly of finger millet, an important source of nutrition for the family, but which does not fare well in water-stressed conditions. The unprofitability of the land has made her decide to sell it. Nagamma has two daughters and is the sole earner for her family since her husband died 10 years ago. She works as an agricultural labourer and performs odd jobs (cleaning the local school) around the village to provide for her family as she cannot move

out of the village for work. She says that she can save the money she gets from the sale of the land for her daughters' weddings. Nagamma is in a particularly vulnerable position, as she has no sons to help consolidate her social agency. She is vulnerable to land grabbing, mainly for real estate and house construction, from the local land mafia, and depends on her brother's family to provide security for her and her family.

Groundwater and gendered well-being

The development of groundwater in the region has been credited with increased farm profits, reduction of rural poverty and equitable access to water. Having access to a fully functioning borewell ensures uninterrupted water supply, allowing farmers to grow crops of their choice, increasing both productivity and incomes. Our research suggests that the availability of groundwater has had positive and negative implications for gendered well-being, varying across class and caste. Groundwater has allowed for the spread of intensive cash crop-based agrarian systems, augmenting livelihoods across social groups, and increasing gender wage parity for agricultural labourers, especially SC and ST women (see Table 7.2). It has also provided water for domestic usage, reducing women's domestic work burdens. Some fluidity can be observed in gender roles concerning water, with men taking increasing responsibility for domestic water provisioning and women spending more time in irrigation activities. However, with groundwater now reframed as a symbol of wealth and prosperity and not just a

Table 7.2 Intra-household strategies for coping with water shortages in order of preference

	OBC	SC	ST
Male	Selling livestock	Selling Livestock	Agricultural labor
	Deepening existing wells	Agricultural labor	Selling Livestock
	Buying water from tankers and neighbours		Collection of forest produce
	Temporary migration		
Female	Buying water from neighbours	Collecting water from public sources	Sourcing water for cattle from forested areas
	Selling livestock	Selling livestock	Agricultural labor
	Collecting water from public sources	Agricultural labor	Collection of forest produce

Note: The strategies are not mutually exclusive and vary within caste by age and social determinants such as marriage.

Source: Primary data from surveys, FGDs and interviews conducted in 2016.

productive asset, it has emerged as an embodiment of economic aspirations and successful masculinity.

Since 2011 this enhanced sense of well-being has begun to show signs of waning, with a decrease in the quality and quantity of groundwater. Farming households have indicated that household well-being, which in many ways is inextricably linked with groundwater, both in the domestic and the livelihood sphere, is seriously threatened by depletion of the resource in the region. Farmers in Chinnakallipatti reported that 20 years ago, groundwater was available at less than 200 feet. But now, they must dig to a minimum of 800 feet to access water. The depth of boring has increased, as has the number of failed borewells.

Failing borewells are severely affecting agricultural productivity and livelihoods, ensnaring communities in cycles of debt. Indebtedness has resulted in increased work burdens for both men and women. While men have wider options for more remunerative work owing to their mobility, women often have to shoulder additional burdens of paid and unpaid farm work.

Women invest more time in collecting water from other sources, such as public standpipes. In particularly dry months when water is bought from tankers, this expensive resource has to be strictly rationed. Also, with a focus primarily on cash crop cultivation, women's nutritional choices have been compromised.

Jayamala (62), a VellalaGounderwoman from Marudur village whose family has been farming in the region for the last three generations, talked about the present state of groundwater in the region:

Twenty years ago, we used to only grow millets and sometimes vegetables. It was enough for the household. After we got access to a borewell, we have started growing jasmine, this gives us more money, but we have to buy our vegetables and grains from the ration shop or the village market ... The last five years we got less and less water from the wells. This year is the worst [2016]. Our crop has failed. We have no money to buy food, and there is no food in our fields.

Peer pressure and changing notions of masculinity, along with aspirations for more profitable farming and higher incomes to finance children's education and status-enhancing consumption, have led to competitive borewell digging. This has had implications for the financial security of the household, often giving rise to marital conflict. In this context, women have a tenuous hold on their assets, vital to their social standing, household agency and economic autonomy. In the absence of other risk-management strategies, women's assets are the first to be pawned or sold.

Despite the precarious state of groundwater in Tamil Nadu, there is no sign of the regulation of groundwater usage. A Groundwater Regulation Bill, which included provision for the setting up of the Tamil Nadu Groundwater Authority, was passed in 2003, but repealed in 2013. In 2015, efforts to regulate groundwater use were renewed and the Tamil Nadu Panchayats

(Regulation of Sinking of Wells and Safety Measures) Rules was passed. This made it mandatory for borewell operators to obtain permission from local panchayats before deepening and renovating borewells. However, enforcement of these rules is limited, and unregulated borewell digging and groundwater over-exploitation continues unabated in the region (Palanisami et al. 2008; Moench et al. 2012). Communal water sources, such as traditional tanks and farm ponds, have been neglected, leaving farmers with a lack of viable alternative water sources.

Although our entry point is groundwater, our analysis has allowed us to explore the complexities of decision making at the household level, where men and women hold gendered interests in resource management through their distinctive roles, responsibilities and livelihood stakes. These vary with class and caste positions, with women in smallholder households, mainly SC and ST, often bearing the brunt of growing indebtedness, higher work burdens and less nutritious food. Groundwater is ‘multi-use’ water, yet its primary purpose is seen as servicing livelihoods. This has allowed patriarchal norms and practices from the male-dominated agrarian space to be carried forward into decision making around the use of water. The experiences of women-headed households emphasizes the key gendered relational aspects of groundwater usage. Women continue to require the support of male family members to operationalize their access to groundwater, perpetuating the disadvantage they face in resource access, use and control in the agrarian sphere.

There is an urgent need to properly enforce regulation, not only to deal with the rapid depletion of groundwater due to variable monsoons and other developmental factors, but also to ensure that farming communities are not caught in a vicious cycle of indebtedness. This has particularly negative effects on women’s status and well-being, as apart from intensifying labour burdens, indebtedness also contribute to a loss of women’s assets, especially gold and livestock. Assetlessness, in turn, can enhance vulnerabilities to livelihood shocks, but equally to domestic violence. In rural communities, land and water are key livelihood assets, and their sustainable use becomes central to other forms of sustainability – livelihood security and social and gender equity. One needs to be mindful, then, that in dealing with water stress and drought, one does not intensify inequities of gender, class and caste.

Notes

- 1 Body of local self-government at the village level.
- 2 Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Castes (OBC). SCs largely cover communities have been historically disadvantaged and marginalized and are often associated with the socially degrading occupations. STs are characterized by geographical and social and economic isolation, and low economic status. OBC is a collective term used by the Government of India to classify castes which are educationally and socially disadvantaged. Source: Department of Social Justice and Empowerment, Government of India.

- 3 The MGNREGA is an Indian social security measure that guarantees 100 days of work per household per year.
- 4 Public Distribution System (PDS) is a scheme in India that facilitates the supply of essential food grains and commodities at a subsidized rate through a network of fair trade shops on a recurring basis. Source: Department of Food and Public Distribution
- 5 According to the National Sample Survey's 70th report, 'Situational Analysis of Agricultural Households 2012–13', the average income for farm households in Tamil Nadu is Rs. 7,000.
- 6 Paun is a unit of measurement of gold. It is equal to 8 grams, and valued at approximately Rs. 27,500 (July 2019).
- 7 http://www.tn.gov.in/scheme/data_view/19481 accessed on 7 July 2019.

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