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Land degradation and migration in a dry land region in India: extent, nature and determinants

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ABSTRACT. Migration literature has considered environmental constraints as one of the prime movers of populations, especially from dry regions, where water rather than land is the primary limiting factor. This study examines the impact of degradation of private as well as common pool land resources on migration decisions, based on primary data from over one thousand households in three dry land districts in Gujarat. The study finds that economic assets and natural capital have differential impacts on short-term and long-term migration decisions. Thus, any employment creation in rural dry land regions is likely to help the poorest. Further degradation of common-pool land resources influences short-term but not long-term migration. Therefore, better management of common-pool resources would strengthen the livelihood base of traditional herder communities and limit migration among middle-income households. Overall, in dry areas such as Gujarat, access to irrigation, rather than land ownership *per se*, is likely to deter migration.

1. Introduction

Environmental constraints have long been seen as one of the prime movers of populations. In many parts of the world, populations have had to move to new areas after sedentary agriculture exhausted natural soil fertility in the former location. Increasing demographic pressure in the recent decades has only expedited this process. In dry regions, where water rather than land is the primary limiting factor, population growth has resulted in overuse of water and land and, in turn, eventual out-migration (Bilsborrow, 1992).

Existing migration theories treat environmental-stress-induced migration as a distress phenomenon influenced by 'push' factors. Such migration can in turn lead to sub-optimal land use and further degradation of land owing mainly to shortage of labour of able bodied persons of the households (Scherr and Yadav, 1998). Similarly, additional income earned from out-migration could expedite the degradation process by inducing private investment in water extraction; in absence of the additional income, investment in ground water extraction may remain limited. Environmental factors, in general, form part of the set of structural factors that motivate households to make a variety of decisions, including migration. There is, however, little understanding on the interface between development and migration in general and resource degradation and migration in particular.

The recent discourse on migration poses a counterview asserting that efforts for rural development do not reduce migration; at best it may only change the pattern of migration. It has been argued that migration, especially circular migration, is often seen as a means to augment additional income rather than being a survival mechanism for the poor (Ghatak, *et al*., 1996; Munshi and Rosenweig, 2005; Farrington, *et al*., 2006; Kundu and Srangi, 2007). There are, however, certain inadequacies in the existing body of literature as noted by a number of scholars (Stark and Levhari, 1982; MacDowell and Haan, 1997; Hann, 1999; Haan and Rogaly, 2002; Srivatsava and Bhattacharya, 2002).[1] Households in developing economies have multiple reasons for migration. It could be a combination of distress and precautionary migration. Standing (1985) refers to migration as a 'safety-valve mechanism' that may help prevent a further decline in livelihood status. Similarly, the Indian National Commission on Rural Labour distinguishes between survival- and subsistence-driven migration (NCRL, 1991). The complexities in analysing migration have led to refinements in the dichotomous perspective on 'push' and 'pull' factors shaping out-migration, which often is not a one-time movement (Mandel, 1990). This calls for a dynamic context to understand migration decisions.

There are a few studies that have carefully examined the *impact* of degradation of water and land on migration. A recent study by Chopra and Gulati (2001) shows that land degradation has a significant positive impact on out-migration. They find moreover that better management of common property land resources through creation of property rights has a negative impact on out-migration. The study, however, is based on secondary data for regions in India and captures migration indirectly though higher sex (female/male) ratio.

An important feature of the migration literature in India is lack of generalizability (Haan and Dubey, 2006), thus calling for more location specific research based on primary investigation. Environmental aspect is yet another critical gap in the literature. The present study aims at bridging this gap. Drawing upon the existing literature – theoretical as well as empirical – the study seeks to examine migration decisions in the light of the socio–economic, environmental and cultural context existing at the place of origin. The analysis incorporates impact of degradation of private land, as well as common pool resources (CPRs), on migration decisions. There are two important propositions underlying the empirical investigation: First migration is not a once-and-for-all decision, and these decisions could be influenced by a combination of distress as well as income-augmenting motives. And second, apart from actual income gains, the decisions are shaped by what people perceive as desirable from the vantage point of households' socio–economic–cultural attributes.

[1] These inadequacies stem from the fact that (i) most theoretical constructs, at least initially, emerged from the experiences of the early industrializing countries with well-developed labour markets, and (ii) official data in most developing economies are ill-equipped to capture the complex realities within which migration takes place and is sustained – realities which may also lead to changes of course or direction from time to time.

The study is located in three dry land districts in Gujarat, India, and is based on primary data collected from over one thousand households. Gujarat is a particularly interesting region because it is characterized by adverse agro-climatic conditions with degraded land and water resources, yet having a dynamic and diversified economy.

2. Migration from dry land regions: a review of evidence and issues

Migration literature in India, barring a few studies, has paid little attention to the conditions prevailing in the place of origin[2] (Banerjee, 1986; Appleyard, 1988; Yadava and Yadava, 1998). Similarly, the studies, based on official statistics on in-migration, have focused on the place of destination. This often leaves out short duration, seasonal or circulating, migration, which may have special significance in the context of livelihood among both poor as well as 'not-so-poor'. This is particularly true for the dry land areas where drought-induced migration is fairly common and has a long history. The recent spur of interest in the question of 'staying put' reinstates the importance of socio–cultural–historical factors. At the same time, it highlights unequal opportunities, especially among the poor, to seek migration as a livelihood option. This section discusses some of these aspects in the context of the study region.

2.1 Distress versus development induced migration

Until the late 1980s, households with medium- to large-sized land holdings, with some investment in irrigation, did not have to move out of dry land regions for subsistence purposes (NIRD, 2000).[3] Migration for such relatively wealthy households growing high-valued commercial crops like oil seeds, spices, horticulture was mainly for better prospects rather than a distress move. Similarly, areas with moderately good soil and ground water table could also escape distress migration.

While this may hold true for many who migrate from rural areas, the larger reality is that of selectivity bias in terms of who can manage to migrate and what kind of opportunities they find (Cashin and Sahay, 1996; Yadava and Yadava, 1998).[4] There is evidence from the rural areas that the landless or the very poor and socially marginalized communities have the least chance of migration (Connell *et al.*, 1976; Lipton, 1980; Oberai *et al.*, 1989).

There is often an element of distress even among those who apparently migrate for income enhancement (Sah and Shah, 2005). When households find very bleak chances of actually realizing the expected benefits from

[2] It is noted that there are only two studies in the case of Punjab, which has a long tradition of out-migration (MacDowell and Haan, 1997).

[3] A typical weather cycle of five years, with two drought years, one average year, and two good rainfall years, was sufficient to economically sustain a land holding of about five hectares.

[4] Distress migration is generally under-represented in the studies that use official statistics, and often captures economic status after the migrant has shifted almost permanently to the place of destination without reference to the initial conditions prevailing at the time of migration (Kundu and Sarangi, 2007).

migration, it leads to a perception of 'distress' among both those who actually migrate and those who consider migration as inevitable in future.[5]

2.2 Risk aversions and precautionary migration

A dominant tradition in migration studies analyses employment decisions and migration through the risk-aversion expected-income-maximization model. In this model, a migrant household compares the risk associated with life-long income in agriculture vis-à-vis urban jobs (Stark and Levhari, 1982). With declining quality and quantity of land and water resources, households face a situation of increasing risk in terms of the future flow of income from agriculture.

In India, there is ample evidence of long-term migration of people from drought-prone regions of Gujarat, Maharashtra, Rajasthan, *etc*., to other parts, including hilly areas in the north. Historically, dry land regions in India have been more prone to out-migration (Visaria and Kothari, 1984; NIRD, 2000; Shah, 2002a; Deshingkar and Start, 2003; Sah and Shah, 2005). Weather-induced uncertainty and a low level of land productivity appear to be largely responsible for this pattern. Of late, rapid depletion in land and water resources appears to have only aggravated the situation. The three consecutive droughts in the mid 1980s seem to have changed the above pattern, which resulted in migration, even among the landed. The migration decision for these households arose mainly out of a precautionary motive, i.e. households chose to migrate because of uncertainty about future prospects. The aim was to maintain at least the pre-migration level in the face of the risks associated with uncertain rainfall (as indicated by Standing, 1985). Precautionary migration as a conceptual category is thus different from development induced (accumulative) migration on the one hand, and also from that which is essential for survival (or coping with subsistence living). In reality these categories may overlap, and as a result, the distinction among them may get blurred.

2.3 Land degradation, labour markets and circulatory migration

In dry areas of India and elsewhere, difficulties in establishing property rights over groundwater result in farm households pumping out ground water at a rate faster than that of their neighbours (Shah, 2002b). Shifting to certain high risk and more remunerative crops forms an important strategy, though it is driven primarily by a short-term perspective. Another strategy is to keep the land idle or to lease it out. Such risk-averse strategies may have significant environmental implications and may have a direct impact on labour markets and migration (Bilsborrow, 1992; Leighton, 1999). Firstly, it may lead to increased migration, mainly of a circular type, resulting in a

[5] Being able to get a semi-skilled job with a future prospect of moving up the ladder and/or starting a business of one's own, with a decent place to live along with the family, and maintain social expenses/status back home is something that a migrant from a 'better off' household may expect. Compared to this, the expectation of a landless poor household may be to find employment opportunities that are regular and predictable in nature. Falling short of these expectations may lead to perception of 'distress' in the local setting of dry land region in Gujarat.

rise in wage rates during periods during the peak season. Secondly, it may pull labour from regions with a higher level of degradation and from among the poorer communities such as tribals who have a lower reservation price. Overall, it may aggravate the problem of sub-optimal use of land – both in the place of origin as well as destination.

Although there is no firm estimate, official documents suggest that there are about 30 million workers engaged in circular/seasonal migration. According to the recent document of the XIth Five Year Plan, short-term or circular migrants are the most vulnerable and exploited among the informal workers, who need special attention under the new policies. The analysis of motives as well as impact of migration thus may remain lopsided if it overlooks the phenomenon of circular migration, which constitutes a formidable proportion of the total migrants in the country (Breman, 1996; MacDowell and Haan, 1997).[6]

2.4 Socio-cultural context

A number of socio–cultural factors such as age, sex, marital status, location and access to information impinge upon migration decisions (Taylor, 1969). A number of studies observe that migration decisions are often influenced by what the households and their kin think of the potential migrants' place of relocation and the labour market (Haan and Rogaly, 2002), suggesting thereby that the social world of the migrant's place of origin influences and in turn is influenced by migration. Social networking, based on castes and family relationships, creates strong pillars of support for out-migrants from relatively less developed regions. Access to institutional credit is cited as an effective mechanism for reducing the dependence on social networking. In reality, this may have only limited impact in a scenario where the dependence is not merely for seeking financial help, but also involves support in terms of information, strategic contacts, and social identity which play a significant role in getting the right kind of work, given the imperfect labour markets within developing economies.

The study region is endowed with good 'social networking', which may help overcome some of the risks and costs of migration. But, this can work only up to a point, beyond which overcrowding occurs. At this juncture, a process of return migration and plowing back of savings into the rural economy may start.[7] What is also important is to recognize that migrants tend to seek social acceptability or respectability in the place of

[6] In fact, the recent estimates suggest a decline in what is called short duration (less than 10 years) migration in the country. These estimates surely overlook those who migrate for a few months over a couple of time periods in a year.

[7] In numerous villages in Saurashtra, migrants have begun investing in small-scale diamond units, irrigation facilities, and water-harvesting structures. It is observed that 'sons of the soil' from dry land regions, settled in the wetter parts of the state and/or abroad, are remitting part of their accumulated earnings to finance water-harvesting structures. This confirms the tradition of 'charity or philanthropy' widely prevalent in this part of the country. For details, see Iyengar (2000). Engelshoven (2002) paints a vivid picture of how social networking in Surat, a heartland of the diamond industry and a panacea for migrants from the

migration. Ensuring social acceptability is particularly important among those in the middle and upper strata of households who adopt a strategy of 'precautionary' and/or 'development induced' migration (Engelshoven, 2002). This, however, does not apply to the social outcasts, who do not have any social networking or marketable labour. They face the worst situation in the place to which they migrate. According to Dasgupta (1993: 255–256), unable to find even seasonal work, some of these migrants become beggars in the streets of cities; in the market sense these migrants become 'non-people'.

2.5 Remittances and on-farm investment

Besides helping with consumption over the seasons and years, remittances from migrants also enhance on-farm investment, though much of the remittances may be used to pay off debts (Oberai and Singh, 1980). This phenomenon has been observed in the case of dry land regions in India (Walker and Ryan, 1990; Shah, 2002a). A substantial part of ground water irrigation seems to be financed through such migration, directly or indirectly, via servicing the debt incurred for such investments. The evidence on impact of remittances on agriculture, however, is mixed. Those from the relatively better economic strata are likely to invest in agriculture as compared to those with chronic indebtedness. An important feature of the region is return migration of at least some of those who made a better fortune as workers in the diamond industry; these workers set up a small household unit for diamond cutting/polishing back in their villages.

Given this backdrop, we move to the next section, depicting the extent and nature of migration in the study region.

3. The study region and migration

The study is based mainly on primary data collected from six villages in three districts of Saurashtra, a dry land region in Gujarat. Almost half of the 25 districts in the state are designated, fully or partly, as drought or desert prone (Government of India, 1994). Normally, every third year is a drought or semi-drought year in parts of the state. The districts are Surendranagar, Amreli and Jamnagar which represent some of the most drought-prone regions in the state, characterized by low level of rainfall (<500 mm per year) and a high proportion of wasteland relative to total geographical area (GIDE, 2002). In each district, two *talukas* (sub-districts) were selected, representing relatively high and low levels of land degradation. The selection was based on both the extent and the severity of degradation in terms of soil nutrients, as well as depth and salinity influencing productivity in agriculture. Severity was captured mainly through qualitative information obtained from informed persons at the *taluka* as well as the village level. Subsequently, one village representing each *taluka* was selected to carry out primary surveys. The village selection was based on multiple criteria: soil type, extent of irrigation, village size, distance from a large urban or industrial centre and presence of reasonably

dry land in Gujarat, has eventually created a major impact on the socio–economic fabric at the point of origin.

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successful watershed programmes. Broadly, the six sample villages can be grouped into three categories of land degradation: moderate, high and very high.

Collection of primary data was undertaken in two stages. The first stage involved a complete listing of the 1,227 households with a total population of 6,631 that inhabited the study villages. A household survey was undertaken to obtain information about important variables such as land size and extent of degraded land; labour force and occupational diversification; migration during different years and duration; distance, type of work, remuneration; other assets; types of crop grown and income and on-farm investment and direct benefits from watershed programmes. Data were also collected about households from which occupants had migrated, partially or completely.

3.1 Land degradation, irrigation and incidence of migration

There are no systematic time-series data measuring land degradation and changes over time in the study villages. Nevertheless, discussions with informed farmers in the villages as well as soil scientists in the region suggest increased land degradation in the recent past, especially over the past two decades. The survey villages represent different types of land degradation: coastal salinity in Jamnagar district, aridity in Surendranagar district and shallow soil in Amreli district.

Table 1 shows that land degradation on *private* land is a serious problem in the region. Between 9% and 43% of the land or a total of almost 2,000 acres of privately owned land belonging to nearly 60% of the landed households was reported as degraded. On average, 26% of the total private land owned in our study area can be considered degraded.[8]

Twenty-three per cent of cropped area in the study region is irrigated. Thirty-eight per cent of landed households irrigated at least part of their land. Irrigation is a major mediating factor that counters the effect of private land degradation. This notion emerged clearly during our discussion with the village community, that is, irrigated private land is not perceived as degraded even if the land is saline or eroded. While the estimates of degradation of private land in table 1 do not take into consideration its irrigation status, these kinds of perceptions highlight the critical importance of irrigation as a countervailing factor to land degradation.

Village pastures and other common property land resources (CPLRs) are important assets, particularly for the landless. We find that on average 32% of CPLRs are degraded. As table 1 shows, CPLR degradation varies from 12% to 64% among the study villages. Our data suggests that CPLR degradation is far higher than private land degradation. We identify as degraded CPLRs those lands that were previously used as a source of fodder but are currently not in use due to overdepletion. Village-level degradation

[8] It may be noted that the impact of degradation of private land is mediated by the extent of irrigation and also quality (suitability) of water for irrigation. In fact, soil salinity *per se*, may not be a negative feature for influencing crop productivity, owing to leaching of the dissolvable soils below the root zones under certain soil conditions (Sengupta, 2002).

Table 1. *Degradation of private lands in sample villages*

		Private land					*Village commons Degraded CPLRs (%)**
Degradation	*Village*	*Land with salinity (acres)*	*Other wasteland (acres)*	*Total degraded land (acres)*	*Degraded land (% of total land)*	*Gross irrigated to gross cropped areas*	
Moderate	Dudhai	163	390	554	26.3	31.7	18.1
	Dudhia	17	103	120	8.9	40.6	12.3
High	Veraval	84	167	251	20.5	20.7	27.7
	Vaghania	23	88	111	19.2	2.9	39.3
Very high	Susiya	130	337	467	43.5	7.4	64.4
	Liliya	50	77	127	26.1	2.3	47.2
	All villages	566	1359	1925	26.1	23.1	32.3

*Based on village level information about common property land resources, including pastures. If CPLRs have ceased to be used as important sources of fodder or fuel because of the declining quality, such land has been considered as degraded. The percentages refer to degraded area to total CPLRs.

is estimated by calculating the proportion of degraded land in the village to total CPLRs in the village.

3.2 Land and livestock

Table 2 shows that a significant 34% of households in the study villages are landless. The percent of landless households is somewhat low in the moderately degraded villages relative to the medium and high degradation villages. Among those with land, the average land holding is 8.4 acres.

Approximately, 40% of landed households have access to irrigation. Sixty-seven per cent of landed households grow high valued commercial crops like cotton, groundnut, and spices. The type of crop choice can partly be explained by how important livestock is to agricultural households. Traditional herder communities tend to choose crops such as bajri, which has a high fodder value. Approximately 65% of all households own livestock. However, the extent of livestock ownership is found to be higher among the landed; the majority (57%) of the landless have no livestock as compared to 23% among landed households. The landless own one unit of livestock (in terms of adult cattle units (ACUs); 5 sheep/goats = 1 ACU.). Compared to this, the landed with no or limited irrigation own two ACUs (10 sheep/goats) of livestock and the richer landed on average own 3 ACUs (15 sheep/goats).

3.3 Incidence of migration

Table 3 presents the incidence of migration in the study villages. Nearly 28% of all households reported migration of at least one person from the household. This includes both short-term (i.e. seasonal or circulatory migration during the reference/previous drought year) as well as long-term (i.e. in the last 10–12 years but retaining a part of the household's economic base as well as decision making).[9] While there are no readily available estimates of household level out-migration for Gujarat state,[10] evidence from microlevel studies in dry land regions suggests a somewhat similar proportion of households reporting at least one person going out for economic reasons (Deshingkar and Start, 2003). Migration appears to be higher in the medium and highly degraded villages relative to villages with moderate land degradation. Our data suggests that both long-term and short-term migration is prevalent nearly to the same degree in the surveyed households.

3.4 Migration among landless and landed

In order to assess whether the rich and poor had different patterns of migration, we studied migration among the landed and landless (see table 4). Approximately 23% of the landless and 30% of the landed

[9] This percentage does not include those who commute daily to work outside the village. Also, this leaves out those who did not migrate during the reference years or those who migrated out during the 10 years but came back.

[10] The official statistics in India enumerate in-migration; estimate of out-migration is to be derived by ascertaining the places of origin (countries/states/districts) of the in-migrants.

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Table 2. *Asset base among sample households (hhs)*

Degradation	*Villages*	*Per cent of landless (hhs)*	*Avg land-holding size (acres)*	*Per cent of area irrigated*	*Per cent of hhs covered with irrigation**	*Per cent of hhs without livestock*	*Per cent of landed hhs growing commercial crops*
Moderate	Dudhai	17.1	9.1	31.7	46.2	25.4	34.5
	Dudhiya	22.6	7.6	40.6	46.3	17.7	100.0
High	Veraval	36.2	11.8	20.7	42.3	49.7	82.7
	Vaghaniya	42.1	8.8	2.9	5.7	51.8	87.9
Very high	Sushiya	44.2	6.2	7.4	15.5	34.5	55.5
	Liliya	55.2	8.1	2.3	14.1	53.0	83.3
	All	34.0	8.4	23.1	38.3	35.0	67.2

*For those with land.

Table 3. *Incidence of migration among households in the study villages (no of households)*

		Type of migration			
Degradation	*Villages*	*During reference year*	*Long duration**	*All migrants*	*Per cent of all hhs*
Moderate	Dudhai	28	19	47	16.8
	Dudhia	11	23	34	15.0
High	Veraval	15	43	58	35.6
	Vaghania	16	21	37	32.4
Very high	Susiya	107	15	122	39.4
	Liliya	16	27	43	32.1
	All	193	148	341	27.8
		[56.5]	[43.5]	[100]	

*Includes 6 hhs which also have other member/s who have migrated during the reference year. Refers to the households having at least one member (son or brother) who migrated during the past 10–15 years but continues to remain part of the household as they share both income as well as expenditure with the family. The information was obtained by asking how many years it has been since the person migrated.

households count a migrant among their household. Among landed households, the proportion of migrants is slightly higher in the case of those with more than 10% irrigation (32.9%) as compared to those with no or less than 10% irrigation (29.7%). However, our data shows that the rich and poor participate in different forms of migration. While nearly 58% of all households with migration undertake short-term migration,[11] the proportion among the landless is 17.3% as compared to only 1.3% among the category of asset-rich. Conversely, 31.6% among the category of asset-rich (the landed with more than 10% irrigation) of households reported long-term migration with at least one household member living outside the village for a long period of time during the last 10 years.[12] These members visit their families especially during festivals and other social functions, and also have some kind of arrangements for sharing income from and expenditure on different activities.[13] The proportion of long-term migration

[11] This includes six households reporting both short-term as well as long-term migration (see table 3).

[12] Short duration migration generally culminates in settlement in the place of destination. The chances of this happening are higher among the landed as compared to the landless households.

[13] Apart from the migrants from households in the study villages, a large number of households were reported to have shifted out of the village on a permanent basis. We collected the information from village leaders about such households. Some 196 households (approximately 15% of the total number of households) were reported to have shifted out with no one staying back in the village. Most

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Table 4. *Distance and duration of migration*

Indicators of migration migrant households/ workers (%)	*Household categories*				
	Landless	*Landed with up to 10% irri.*	*Landed with >10% irri.*	*All*	*Significantly different pairs*
Households with short-term migration (as % of all households)	17.3	16.3	1.3	15.7 (0.002)	All pairs
Households with long-term migration (as % to all households)	6.2	13.4	31.6	12.1 (0.00)	All pairs
Households with short- and long-term migration	23.5	*29.7*	*32.9*	27.8 (0.046)	*Except 29.7% and 32.9%*
Average time (months) spent per short-term migrant worker **(ANOVA)**	5.54	6.06	4.0	5.86 (0.006)	All pairs
Migration outside the district (all migrants)	88.0	*80.0*	*76.0*	82.0 (0.004)	*Except 80% and 76%*
Migration to industrial centres	*62.2*	*57.8*	75.8	60.0 (0.048)	*Except 62.2% and 57.8%*

Note: Figures in parentheses indicate values of Pearson Chi-square. Refers to migrant workers within the households. It is possible that if there is more than one migrant worker in a household, they may have different destinations. The result indicates a significant association between the indicators of migration and the categories of land holding size. We also tried to test for the difference in the proportion of households/workers along these categories (with Bonfferoni's adjustment). The results were found to be significant in most of the cases.

Table 5. *Educational attainment and migration*

Level of education among persons older than 13 years	*Per cent of all households*	*Per cent of households with short-term migration*
Illiterate	54.2	61.8
Up to 7 class	29.6	22.7
8 – 12 class	14.7	14.3
>12 class	1.4	.0.01
All	100.0	100.0
	(4603)*	(391)*

*Number of persons older than 13 years.

is 6.2% in the case of landless households, which increases to 13.4% among the middle-category and touches a high of 32.9% for the top category.

The average duration of short-term migration (during the reference year) was about 6 months. This ranges from 6 months in the case of middle-range households, 5.5 months among the landless and 4 months among the landed with better irrigation facilities. When it comes to migrant destinations, a large proportion of migrants (82% in fact) go out of the district. However, if we consider long-distance migration to industrially developed cities such as Surat, Mumbai, Ahmedabad and Rajkot, the proportion is about 60%. Significantly differing pairs of proportions after Bonferroni adjustment are also shown in table 4.

3.5 Education and occupation among migrants

Educational attainment could be an important feature associated with migration. We examined level of education among those who engaged in migration. It is observed that whereas 54% of the population above 13 years was illiterate, the proportion among households with short-term migrants was about 62% (see table 5). The pattern across landed and landless households confirms the generally observed scenario of positive association between ownership of land and literacy. It is observed that whereas 25% of the landless households do not have even a single literate person, the proportion among the landed is 13% of all the households in the study villages.

Table 6 presents information on the main occupation of migrant workers. It is observed that while 42% of the households are engaged in activities related to agriculture and livestock at the destination point, the rest find opportunities in the non-farm sector, in areas such as industry, trade, and service. More than one-fourth of the migrant workers are found to be engaged in industry, especially, diamond cutting and polishing, which has more or less played the function of a coping mechanism in the wake of frequent droughts that plague the region. It may be noted that migration to Surat to work in the diamond industry has a genesis in by far the most severe consecutive droughts in the region, and is still

of these households owned land, which was at times kept fallow and eventually sold.

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Table 6. *Occupations among migrant workers*

Main occupation in place of migration	*Household categories*			
	Landless	*Landed with up to 10% irri.*	*Landed with >10% irri.*	*All*
Agricultural labour	26.2	23.2	-	23.0
Livestock	27.3	16.8	3.4	19.4
Other labour	13.9	10.1	6.9	11.1
Business/own account enterprise	16.0	12.9	20.7	14.3
Industry	11.8	31.3	55.2	26.4
Salaried job	4.8	5.7	13.8	5.8
All	100	100	100	100

Table 6a. *Distribution of per-capita landholding by dummies of asset*

Per-capita landholding class	*ASSETRICH (land with > 10% of net sown area with irrigation)*	*ASSETMED (land with 0%–10% of net sown area with irrigation)*
Up to 5 acres	339 (46.2%)	6 (7.9%)
More than 5 acres	395 (53.8%)	70 (92.1%)
All	734 (100%)	76 (100%)

being viewed as an important coping mechanism under the situation of frequent droughts (Basant *et al.*, 1998). Another 14% have started their own businesses/own account enterprises. Only about 6% have found salaried jobs. The proportion of households engaged in these non-farm activities, however, is significantly higher among the landed households with better irrigation facility. A similar pattern is observed in the case of business and service.[14] Of course, those engaged in the diamond industry also constitute a fairly differentiated lot, as noted earlier. This highlights the differential paths taken by migrants from the landed and landless households when it comes to occupation.

4. Determinants of migration

4.1 The model

In the dry land regions of Gujarat, migration decisions are part of the labour allocation decisions made by households to maintain a certain consumption

[14] A study by Engelshoven (2002) observed that the migrants in Surat were increasingly getting stratified, consisting of a large group of working class, more or less floating diamond cutters and polishers at the bottom, a growing middle class with white collar jobs as merchants and a few very wealthy owners of diamond enterprises. It may, however, be noted that in the initial stage of entry into the industry, say 15–20 years back, most of the migrants were in the category of 'floating' working class population.

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basket and to improve their living standards. In general, our review of the literature and understanding of ground reality suggest that six major sets of factors influence out-migration from rural households. These are: asset base, status of farm economy, degradation of land, human capital, social networking, and various pull factors.[15] The impact of these variables may, however, vary across the types of out-migration, i.e. long-term and distress short-term migration.[16] The impact of each of these variables will also depend on other socio–economic factors such as nature of education, presence of specific caste groups and indebtedness.

We postulate that rural households maximize their long-term income by adopting a diversified portfolio of production and labour allocation decisions, which includes migration. The decision to migrate is depicted in equation (1) as

$$Mi = f(LSi, Di, WLi, IRi, LFi, ALFi, CUi, Si, AD1i, AD2i), \qquad (1)$$

where *Mi* refers to migration status in household *i*. We estimate equation (1) by using binomial logistic regression with 'no migration' as the reference category. Moreover, we also estimated equation (1) using a multinomial logistic regression model with households having 'no migration' (MIGRAT = 0) as the reference category and those with long-term migrants (MIGRAT = 1) and short-term migrants (MIGRAT = 2) representing the two categories of migration among the households. The coefficients of multinomial logit estimate marginal effect of an independent (explanatory) variable on the probability of the two categories of migration, i.e. long-term migration and short-term migration, in relation to the reference category (i.e. 'no migration'). Long-term migration refers to those households with at least one person migrating out for work for more than a year during the past 10 years. Short-term migration is defined as a household with at least one person migrating outside the village for work during the reference year.[17] The variables that are hypothesized to influence migration are presented in table 7. All the explanatory variables are household-level variables except for *Dj*, which refers to degradation of village common lands in village *j*.

We hypothesize that ownership of livestock could induce migration, particularly short-term; it is less likely to induce long-term migration. Degradation of land both under private (WLAND) as well as public ownership (DEGTOT) is expected to induce migration because of the perceived non-sustainability in the short run. On the other hand, irrigation

[15] Natural capital is subsumed under asset base and land degradation.

[16] By and large, short-term and long-term migration may reflect distress and precautionary or income enhancing motives. The two types of migration are more or less exclusive, with only six households having both types of migration. These have been treated as part of the subset of long-term migration as noted in table 3.

[17] We estimated the same equations assuming that the household made its migration decision based on a choice set that contained three simultaneous options: short-term migration, long-term migration or no migration. The two categories are by and large mutually exclusive with an overlap of only six households (see table 3).

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Table 7. *Dependent and independent variables in estimating migration and its determinants*

Code	*Variables*	*Description*	*Direction of marginal effects*		
		Dependent variables			
01	MIGRAT(MIi)	Households with out-migration coded as **0** No migration **1** Long-term migration **2** Short-term migration			
		Independent variables	*All migration*[1]	*Long-term*[2]	*Short-term*[2]
LSi	LSTOCK	Ownership of adult cattle units (ACU), treating 5 sheep/goats = 1 ACU. (No.)	**(+)**	**(−)**	**(+)**
Di	DEGTOT	Degraded land (degraded pastures and other uncultivable land) as proportion to total CPLRs of the village (%)	**(+)**	(−)NS	**(+)**
WLi	WLAND	Percentage of degraded to total private land (%)	(−) NS	(−) NS	(+) NS
IRi	IRRI15	Percentage of irrigated (0 = 1; <20% = 2; 20–40 = 3; >40 = 4)	**(−)**	**(−)**	**(−)**
LFI	LFM	Male labour force (No.)	(+)	**(−)**	**(+)**
ALFi	AGMAIN	Proportion of main workers in agriculture and animal husbandry (excluding migrating member) (%)	**(−)**	**(−)**	(−) NS
Cui CASTE	UPCASTE-CUi	Upper caste dummy (Brahmin, Bania, Darbar, Patel = 1; else 0)	**(+)**	**(+)**	(+)NS
CASTE	MIDCASTE- CMi	Middle level caste dummy (Koli, Rabari, and Miscellaneous [like Goldsmith, Blacksmith, Prajapati, Carpenter, Pujari, *etc.*] castes = 1; else = 0)	(+)NS	**(+)**	(0)NS
Si	EDU	Highest level of education attained by members of the household (No. of years)	**(−)**NS	(+)NS	(−)NS
AD1i	ASSETPOOR	Land dummy (Landless = 1; else 0)	**(−)**	**(−)**	(+)NS
AD2i	ASSETRICH	Landed dummy (land with > 10% of net sown area with irrigation = 1; else 0).	**(+)**	**(+)**	(−)NS

1 = Based on Binary Logistic Regression with no migration as reference category.
2 = Based on Multinomial Logistic Regression with no migration as reference category.
NS = Not significant statistically.

(IRRI15), which improves land quality, is likely to decrease the probability of migration.

A large male labour force (LFM) may also induce migration owing to the more likelihood of surplus labour that could be dispensed, at least in the short run, without losing income from the households' economic activities in the village. The greater the proportion of workers in agriculture and animal husbandry (AGMAIN), the more the household is invested in rural activities and hence less likely to migrate.

Human capital and social networking/links are represented by education and caste. Educated and higher caste households are expected to engage in long-term migration because of their superior skills and access to new opportunities.

To estimate the impact of wealth on migration we created two dummy variables, ASSETPOOR and ASSETRICH, which are compared with their reference variable ASSETMED. ASSETPOOR are those who do not have land, while ASSETRICH are those who possess land with more than 10% of the net cultivated land receiving irrigation. The rest are considered as ASSETMED, consisting of those who possess land with no or less than 10% irrigation. Combining irrigation with land is particularly relevant in light of the fact that land *per se* matters little in terms of income or livelihood security in a region where frequent droughts have become the norm in the past two decades. Incidentally, more than 92% of the ASSETRICH possess per-capita land of more than 5 acres, as compared to 58% in the case of ASSETMED (see table 6a). It is imperative that ASSETRICH are not only better in terms of level of irrigation but also richer in terms of per capita land holding compared to ASSETMED. Here water or irrigation is the primary constraining factor. For wealthier households with irrigated land, migration to superior jobs or precautionary migration is an attractive option. We also hypothesize that the landless are less likely to migrate, particularly long term, relative to the landed with no or poor access to irrigation. Frequent droughts and low demand for farm labour are likely to motivate their migration.

Table 8 presents summary statistics on the variables. It is observed that some important variables such as area of degraded land, ownership of livestock, and educational attainment vary significantly across households. Similarly, the number of the male labour force per household also varies substantially between zero and three. The proportion of main workers in agriculture also has a significant variation with a mean of 67% and a standard deviation of 39.4.

4.2 Main results

Table 9 presents results of the binomial and multinomial logit analysis, predicting incidence of migration among households in the study villages. The predictive power and the two models have been found to be statistically significant at the 5% level. Additionally, we have also checked for multi co-linearity using the variance inflation factor (VIF). The results are presented in table 10.

Table 8. *Summary statistics for the dependent and independent variables*

Variables	*N*	*Minimum*	*Maximum*	*Mean*	*S.D.*
MIGRAT (Dummy)	1227	0.00	2:00	1.60	0..69
LSTOCK (ACU No.)	1227	0.00	40.00	1.76	3.43
DEGTOT (%.)	1227	1.0	5.0	3.09	1.4
WLAND (%.)	1227	0.00	100	17.11	28.40
IRRI 15	1227	1.00	4.00	1.65	1.15
LFM (No.)	1227	0.00	3.00	1.52	0.73
AGMAIN (%.)	1227	0.00	100.00	66.94	39.84
UPCASTE (Dummy)*	271	0.00	1.00	0.22	0.41
MIDCASTE (Dummy)*	558	0.00	1.00	0.45	0.49
EDU (Years)	1227	0.00	17.00	5.82	4.13
ASSETPOOR (Dummy) *	417	0.00	1.00	0.34	0.47
ASSETRICH (Dummy)*	76	0.00	1.00	0.06	0.24

*N represents values corresponding to code 1 of Dummy variables.

4.2.1 Incidence of migration

Binary logistic regression results reveal that eight out of eleven independent variables are statistically significant. Ownership of livestock (LSTOCK), village level degradation of land (DEGTOT), higher social status (UPPERCASTE), and relatively better economic status (ASSETRICH) positively influence the migration behaviour. As expected, irrigation (IRRI15), proportion of main workers engaged in agriculture (AGMAIN) and landlessness (ASSETPOOR) reduce the odds of migration. Moreover, number of males in labour force (LFM) also reduces the probability of migration. The variable, however, may exert differential impact on short- and long-term migration as observed subsequently. It may be noted that among the households with more than one male member in the labour force, almost 60% belonged to medium asset category (land with less than 10% irrigation). These households may not have the need or the compulsion to seek work outside the village. *Prima facie*, these results tend to indicate a mixed picture where ownership of livestock and larger proportion of irrigated area increase the likelihood of migration, whereas being landless reduces the likelihood of migration; access to irrigation *per se*, reduces migration. Similarly, larger size male labour force reduces chances of migration. How far does the pattern vary across two types of migration that appear to be mutually exclusive across the households?

4.2.2 Long-term migration

The pattern of long-term migration presents interesting results with eight out of the 11 explanatory variables having significant effects. As expected, ownership of livestock (LSTOCK) and irrigation (IRRI15) have significant negative effects on the probability of long-term migration in the household. Similarly, proportion of main workers (AGMAIN) engaged in agriculture also has negative effect on long-term migration. Together this may suggest that a relatively stronger base in the primary sector activities such as

Table 9. *Results of binary and multinomial logistic regressions*

	Binary logistic regression with no migration as reference category			*Multinomial logistic regression with no migration as reference category*					
	Migration			*Long term*			*Short term*		
	Sig.	*Log odds*	*Odds*	*Sig.*	*Log odds*	*Odds*	*Sig.*	*Log odds*	*Odds*
Intercept	0.023	−0.809	0.445	.144	.927		.000	−3.273	
LSTOCK	0.001	0.073	1.075	.023	−.185	831	.000	.103	1.109
WLAND	0.673	−0.001	0.998	.196	−.006	.994	.503	.002	1.002
DEGTOT	0.000	0.243	1.275	.551	−.055	.946	.000	.467	1.595
MIDCASTE	0.252	0.217	1.242	.002	1.109	3.033	.998	.000	1.000
UPCASTE	0.000	0.742	2.099	.000	2.038	7.675	.968	.012	1.012
LFM	0.033	−0.228	0.796	.000	−1.812	.163	.000	.554	1.740
IRRI15	0.000	−0.409	0.664	.002	−.373	.689	.000	−.485	.616
AGMAIN	0.015	−0.226	0.798	.009	−.367	.693	.442	−.094	.910
HEDU	0.192	−0.024	0.976	.632	.013	1.013	.348	−.023	.977
ASSTPOOR	0.000	−0.718	0.488	.000	−1.729	.177	.220	−.299	.742
ASSTRICH	0.003	0.972	2.642	.000	1.935	6.924	.143	−1.540	.214
Significance of the overall model	Sig. 0.000 (Chi-Square 115.13, df = 11)			Sig = 0.000 (Chi-Square = 429.64, df = 22)					
Nagerkerke's R^2	0.15			0.374					

Table 10. *Co-linearity statistics for independent variables*

	Co-linearity statistics	
Explanatory variables	*Tolerance*	*VIF*
LSTOCK	0.788	1.270
WLAND	0.707	1.414
DEGTOT	0.660	1.516
MIDCASTE	0.516	1.937
UPCASTE	0.575	1.738
LFM	0.845	1.183
IRRI15	0.607	1.647
AGMAIN1	0.808	1.238
HEDU	0.772	1.296
ASSTPOOR	0.524	1.907
ASSTRICH	0.782	1.279

Note: In order to rule out multi co-linearity among the independent variables, a multiple linear regression was estimated. The above results suggest that for all the variables VIF remains below 2.5 and tolerance > 0.4. This suggests that there is no reason to suspect multi-co-linearity.

agriculture and livestock may hold back the workforce to support the household economy within the village. This is probably what is reflected by the fact that number of male workers in the households also has a negative effect on long-term migration.

On the other hand, the results indicate negative effect of ASSETPOOR (landless) on long-term migration. This, however, may not necessarily imply that the very poor households do not aspire to long-term migration. Rather, a more realistic depiction of the situation is that the landless are unable to obtain such opportunities given their weak financial base on the one hand and social networking on the other. Interestingly, among those with land and irrigation, the relatively better households (i.e. the ASSETRICH) have higher probability of long-term migration compared to the households in the middle category (ASSETMED, i.e. those with land but no or limited irrigation) and also the landless (ASSETPOOR). The households from higher strata of castes (HIGHCASTE and MIDCASTE) are found to have positive effects on long-term migration as compared to the category of socially marginal communities.

Overall, the results tend to suggest that those at the bottom level of land ownership (i.e. landless) can not afford to opt for long-term migration as compared to those who own land especially with more than 10% irrigated area. Social networks or contacts do seem to matter positively. Strangely, level of land degradation or education did not show significant effect on long-term migration with relation to 'no migration'. The scenario is somewhat different for short-term migration, at least in the case of village level land degradation.

4.2.3 Short-term migration

The results for short-term migration are somewhat less complex. First of all, only four out of the 11 explanatory variables show significant effects on short-term migration, which is quite different from the results discussed above. As expected, extent of irrigation (IRRI15) seems to be holding back households from opting for short-term migration, which often involves 'inferior' type of labour work as compared to working on one's own field. Conversely, those having more livestock (LSTOCK) tend to go out for short-term migration; a part of this could be moving along with the livestock and/or in search of fodder, especially during the summer season. Larger number of male members in labour force seems to facilitate such short-term migration as also suggested by positive and significant effect of LFM.

It is important to note that village level degradation of land (DEGTOT) does influence short-term migration as noted earlier. What is somewhat surprising is that landlessness (ASSETPOOR) does not exert significant influence in determining short-term migration *per se*. This observation is at variance from what we observed earlier where landless worked as an impediment to long-term migration. Similarly, the variables pertaining to better social status (MIDCASTE and HIGHCASTE) do not suggest significant effect on short-term migration, unlike in the case of long-term migration.

The above findings thus suggest a divergent scenario across the two categories of migration, depicted by three major differences. First, whereas land ownership and castes matter for long-term migration, they do not appear to be important for influencing short-term migration. Second, degradation of land does not effect long-term migration but does influence village level short-term migration. And, third, size of male labour force and livestock have opposite effects on long- and short-term migration. It is found that only the extent of irrigation (IRRI15) has similar ('-') effect on both types of migration in relation to 'no migration'.

While the above findings are more or less consistent with the hypothesized relationships, the following observations deserve special attention:

a) Demographic factors, such as the size of the male labour force, exert a positive impact on short-term migration but a negative impact on long-term migration. The greater the proportion of workers engaged in agriculture in the household, the less likely it is that the household has a migrant member.
b) Degradation of land, especially private land, does not influence out-migration. CPLRs, which are primarily used for livestock activity, influence short-term migration. Thus, migration of short duration appears to be an important labour allocation strategy, especially for herder communities.
c) Large landholding coupled with relatively higher level of irrigation is an important factor influencing long-duration migration. Landed households with poor or no irrigation are less likely to migrate for long term, whereas the chances further drop in the case of landless households.

d) Irrigation has an unequivocal impact on migration. Whether it is short-term or long-term migration, access to irrigation has a significant negative influence on migration. This may imply that these households treat irrigation as a substitute for quality of land.
e) Social networking is another important factor influencing migration, particularly of long term. Households belonging to a higher and middle caste status have a higher probability of long-term migration as compared to those belonging to the lower caste status. This, once again, confirms the commonly observed phenomenon of chain migration, confined mainly to the enterprising peasant community (called the *patels*), in some of the rapidly industrializing urban centres such as Surat, Jamnagar and Rajkot within the state of Gujarat.

5. Conclusions

This analysis provides some interesting insights into the nexus between land degradation, migration and economic assets in a dry land region in India where frequent droughts create acute water scarcity. The analysis is placed within a framework where decisions of migration/staying-put are taken in a socio–culturally contextualized households setting; where push and pull factors are seen as operating simultaneously.

The analysis suggested the need for promoting productivity of land and water resources in a sustainable manner so as to enable sustenance of livelihood, especially among landed households. Improvement of CPLRs may help enhance livestock base among the landless, which in turn may work as an important avenue for diversification of the sources of income in the drought prone region. But improvement in the status of land and water alone may not be sufficient. This may still necessitate effective implementation of employment guarantee schemes in the vicinity where workers could commute rather than resort to circular migration of the distress type. The policy approach, therefore, should work simultaneously on issues such as resource regeneration, employment creation and also reduction of the distress element in migration decisions.

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