

Drought management and livelihood adaptations

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Abstract

Drought is a regular feature of Jaisalmer district. Diversification of livelihoods forms the basis of surviving strategies during droughts which supplement the major income derived from Agriculture and forms an integral part of the peoples' lifestyle. Migration as a strategy to combat drought makes an essential component of the above. Role of traditional knowledge for drought adaptation secures the paramount position which has helped communities to survive long periods of droughts since olden times. It is because of practicing these traditional techniques of water harvesting that has ensured regular fodder supply for animals and food security for the people of the region.

Keywords: climate sensitivity, vulnerability, adaptability, resilience, traditional knowledge, livelihood diversification

Introduction

Jaisalmer falls within the areas of greatest climate sensitivity. In the era of climate change, the district is likely to suffer further water shortage due to overall reduction in rainfall. In addition, the district has the highest vulnerability and lowest adaptability. Jaisalmer has the highest probability of occurrence of drought in India. Conditions may deteriorate in terms of severity of drought in Jaisalmer. Appropriate policy responses can strengthen adaptation and help build the resilience of communities towards drought.

Objectives

- To inspect the role of Livelihoods in coping with Droughts in the study area
- To comprehend the role of Traditional Technologies to manage Droughts

Methodology

Structured questionnaires were used for data gathering. Every person was asked the same set of questions. The type of responses was than measured according to the same set of criteria. All the possible responses were covered and presented in uniform manner. Bar graphs are used to draw comparisons by the data obtained from the field area. Line graphs are drawn to analyze spatial and temporal trends in rainfall. Pie charts are pinched to display various information. Transects are drained for the graphical presentation of historical facts in study space.

Study Area

Jaisalmer is located in the Thar Desert and receives scanty rainfall. The district has experienced frequent and severe spells of drought than any other region in India. Learning from adaptations employed by village communities of areas like, Jaisalmer can provide insights to design useful policies and public actions. The Household survey was performed in two villages namely Kanod and Ghuria. Kanod is inhabited mostly by Hindu population, located in Canal-irrigated zone where caste system is very predominant. On the other hand, Ghuria is Muslim population dominated located in Sam and consists of single banbarra caste belonging people.

Livelihoods and coping with droughts

A Livelihood comprises capabilities, assets and activities required for means of living. A livelihood is sustainable if it is able to cope up with and from stress and shock, maintain and enhance its capabilities and assets, while not depleting its natural resource base. Situated on an important trade route, the walled city of Jaisalmer amidst the Thar Desert of Rajasthan has been a flourishing commercial center since medieval period. Understanding the livelihoods of people in Jaisalmer is important to comprehend their strategies of surviving with drought.

Livelihood diversification

The importance of alternate livelihood diversification is accentuated due to increasing pressure on land and water resources and the increasingly unfavorable gains from agriculture leading to poverty. As such, people are attempting to diversify out of the farming to more lucrative activities to reduce the risk of failing agrarian livelihoods in case if drought. This may involve specialization in secure, full time occupations or even into part-time casualised activities with low gains/profit and low security to escape the nexus of poverty. The latter, while essential to ensure meeting of ends are also associated with increasing poverty and vulnerability.

Table 1: Livelihoods

Livelihood	Total number of people engaged
Farming	48%
Wage Labourer	30%
Animal Husbandry	8%
Tourism	4%
Mining	2%
Others (Barber, teacher, tailor, shopkeeper, policeman)	8%

Source: Household Survey in Jaisalmer

Agriculture-

Agriculture continues to be the major form of employment in Jaisalmer. It is the single most important source of household income. In fact, half of the household income is from

agriculture, emphasizing the importance of farming in the region. However, Agriculture is not steady in Jaisalmer. There has been a rapid decline in population engaged in agriculture. Most of the people grow crops only if there is good monsoon year. Agricultural production is mainly by Kharif crops like Guar, Bajra, Moth, Til and Moong.

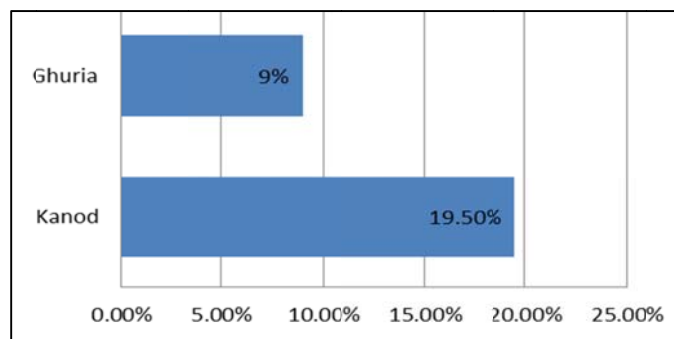
Table 2: Household Survey Villages from two Agro-Climatic zones of Jaisalmer

Tehsil: Mohangarh Village: Kanod	Canal Irrigated east
	<ul style="list-style-type: none"> Farming system with incidence of irrigation
Tehsil: Sam Village: Ghuria	Desert west
	<ul style="list-style-type: none"> representing arid desert conditions extensive farming with high incidence of livestock

Source: Prepared by researcher

Irrigation

Irrigation makes it possible to double the productivity of land by taking a second crop and has an important role to play in times of monsoon failure. Irrigation is practiced in Kanod village which is canal irrigated, but in Ghuria village, located in desert west irrigation is still very limited. Average size of irrigated landholdings also vary considerably across the two villages, being higher in canal irrigated Kanod.



Source: Household Survey in Jaisalmer

Fig 1: Practice of Irrigation

Indira Gandhi Canal provides water for irrigation to the nearby fields of the Kanod village. Thus wheat is also grown by the farmers in this village. But many of the villages in Jaisalmer still have no access to water of Indira Gandhi Canal for irrigation. Crops are mainly rain fed and are grown with help of family labour. Agriculture also involves the growing of cash crops. In particular, a high incidence of cash cropping is seen in desert by growing guar, which grows well even with less rainfall. This commercial cropping is possible in desert if, the conditions are favourable.

Table 3: Total Areas under Different Crops

Crops	Jowar	Bajra	Guar	Others (Moong, Til, Wheat and Moth)
Total area under crops	7.9%	34.6%	40.3%	16.8%

Source: Household survey in Jaisalmer

Animal husbandry

Animal husbandry is a major economic activity of the rural people in Jaisalmer. Due to animal husbandry, unemployment and poverty has reduced to a great extent in rural areas. The importance of animal husbandry can be implicit from the organization of large number of cattle fairs in this region. Animal husbandry is of special significance as rural livelihood strategy because it can play a crucial drought proofing function in context of agro-climatic conditions in the district.

While crop output is severely affected during monsoon failure, and is a regular phenomenon, milk production does not decline by the same proportion which allows people to meet their domestic need for milk or sale for supplementing household income. In terms of livestock reared, there are two main types of practices-

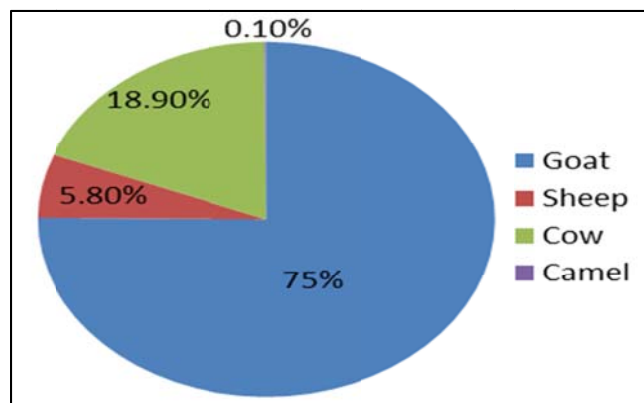
1. Milk animal based economy where the animal reared is cow.
2. It is the small, sheep and goat based economy.

Goats

In Kanod and Ghuria, goats were the most popular choice for animal husbandry. This is because goats can feed on different kinds of vegetation and drink less water. Also goats act as an economic asset as they can be exchanged for money during difficult times.

Sheep

A number of sheep herders were seen grazing there sheep in Jaisalmer. Sheep are mainly reared for their wool.



Source: Household survey in Jaisalmer

Fig 2: Livestock under Animal

Camel

“ship of the desert”- Camels are domesticated for transport. They can carry heavy loads and can also sustain long periods of time without food and water. Very less families surveyed in villages owned camels. However Camel Safari was very popular as tourist attraction.

Cows-

It is reared for milk. Milk cooperative dairies report an increase in milk procurement with the onset of drought, which happens because farmers tend to maximize their attention on this source of livelihood as additional household income.

Wage labourers

The singular feature common to Jaisalmer is the shift towards labour as the main occupation. Most of cultivator households are also engaged in manufacturing activities as their secondary occupation. The pattern also reflects a shift towards casual wage labourer. In Kanod and Ghuria many people were engaged in secondary activities other than agriculture. During the drought period the state provides employment through drought relief works. Most of the people were employed under the government schemes like-

- MNREGA
- NREGA
- Desert Development Program
- Drought Prone Area Development Program

The rate of unemployment is high during drought years. Though some work is available, the wage received by the casual labourer is far below the minimum wages and the total earning from wage labour does not exceed Rs 10, 000 per annum. Gender based differences in wages were recorded. Female labourers are paid Rs 30-40/day whereas male labourers are paid Rs70-80/day.

Mining-

Jaisalmer is rich in minerals and has vast mineral deposits. Mining of gypsum in western Rajasthan constitutes 90% of country's production. Granite industry is also developing very fast in Jaisalmer. High quality limestone is mined in Jaisalmer by Rajasthan State Mines and Mineral Deposits Limited (RSMML) and Rajasthan State Mineral Development Corporation for steel industry. RSMML factories and mines were seen in Sanu, 6 km before Ramgarh. Many people work in these mines for livelihood.

Table 4: Available Minerals and Employed People (2010-2011)

Major Minerals	Employment
Dolomite, Gypsum, Limestone, Rock Phosphate, Siliceous Earth, Ball Clay, Ochre	13,149
Brick earth, Granite, Bajra-Kankar, Masonry stone, Marble	19,400

Source: Aajeevika Livelihoods, Rajasthan

Water suppliers

In Kanod and Ghuria villages, Water supplying is a lucrative business. People belonging to high castes (Rajput, Brahmins) owned water tanks. Every water tank has caste written on it. Hence different suppliers catered to different castes.

Tourism

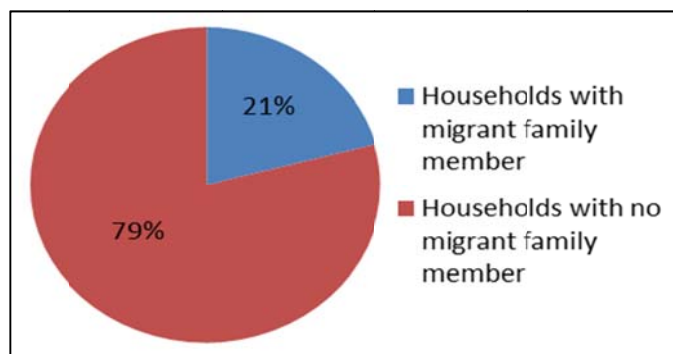
Tourism industry of Jaisalmer is one of the thriving sectors of the economy. Tourism in Jaisalmer has emerged over the past 20 years. It can be said that Tourism Industry in Jaisalmer has emerged as the job generator, both service oriented and product oriented. The increased income by job generation helps to raise living standard of the people. Jaisalmer is a popular tourist destination for both foreign and domestic tourists. Tourism in Jaisalmer despite of some downfalls manages to grow till date. There is constant increase in domestic arrival, and despite of 2009 downfall, foreign tourist once again started to visit Jaisalmer.

Tourism sector employs a large proportion of people, educated and uneducated, skilled and unskilled. They are employed in

travel agencies, hotels, airline services, handicraft manufacture, cultural activities and other tourism related works. It creates maximum job opportunities for artisans in the recreation and souvenir-shopping category. Recreation facilities like theatres, cultural dance, folk music and complexes offer job opportunities to the local artisans.

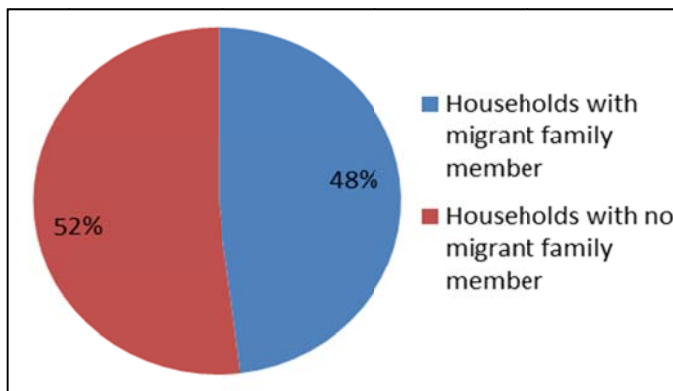
Migration

Jaisalmer has a tradition of migration, during the years of drought, for as crops dry up and fail, everyone is forced to search for some work. As communication networks improve, even the remote villages are now having accessibility to road and transportation, migration is becoming regular feature of the rural economy of the state. Families with small land holdings opt for this opportunity- driven migration in search of better income.



Source: Household survey in Ghuria village

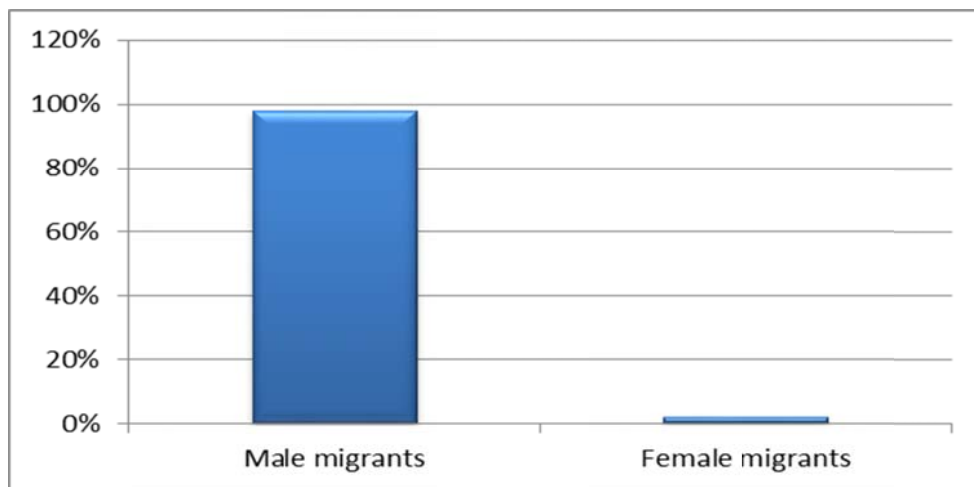
Fig 3: Migration across Households in Ghuria



Source: Household survey in Kanod village

Fig 4: Migration across Households in Kanod Village

Analysis of household survey shows that there remains a very poor section which is not able to migrate, as migration requires a certain level of human and financial capital. Also households should be in a position to spare labour from household chores. Therefore, migration is an option beyond the reach of poorest classes in rural areas. Migration is dominantly a male phenomenon, with the household survey results showing negligible number of female migrants out of the total number of migrants. Also the overwhelming majority of migrants are in the age group of twenty to forty years as the migrant labour is expected to perform some hardest physical jobs. Thus only young and tough are absorbed to migrate.



Source: Household survey in Jaisalmer

Fig 5: Migration across Kanod and Ghuria

Livelihood strategy and caste linkage

The caste-wise pattern of livelihood indicates the different livelihoods followed by different caste groups in the survey areas. Overall it is found that land based livelihoods like agriculture and animal husbandry are the most important for upper caste communities. Diversification into non-farm activities and migration are comparatively more important for poor strata of the scheduled caste and scheduled tribe.

The position of intermediate castes lies in between these two options and varies across regions depending on the socio-economic conditions. In Ghuria village, Animal Husbandry and Wage labour are most important, which derive a significant amount of income from non-farm activities. The livelihood strategies adopted by various castes and communities can be approximated in the table below-

Table 5: Livelihood strategies-Caste Linkage

Caste	Livelihood strategy
Upper caste	<ul style="list-style-type: none"> Intensification of agriculture Diversification into agro-bussiness <ul style="list-style-type: none"> Government jobs
Intermediate caste Artisan castes	<ul style="list-style-type: none"> Migration Diversification
Poor castes	<ul style="list-style-type: none"> Wage labour Migration Diversification

Role of traditional technologies to manage droughts

Traditional systems are specific response to ecology and values in which they are evolved and satisfied certain local needs in environmental friendly manner. They played an important role in saving human and livestock population from climatic disasters like droughts. It is the variability of rainfall over time and space which forced human beings to innovate techniques to deal with adverse conditions and make available fresh water round the year in desired quantity and quality. The crisis is not due to lack of fresh water as such, but availability of adequate amount of freshwater at the right place and time to meet basic needs.

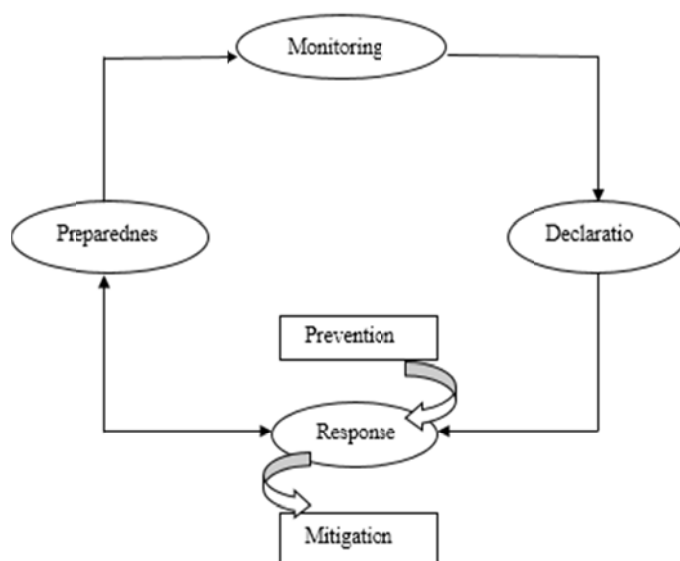


Fig 6: Elements of Drought Management system

Over centuries, people in Jaisalmer use their land-water - vegetation resources in a clever and sustainable manner. Due to seasonal nature of rains, people had developed several water harvesting and diverting systems to meet their needs round the year. They collect the huge amount of water that fell in their villages, before it vanished in the sands. Therefore, water needs for domestic and agriculture in different regions need to be efficient systems of water supply, distribution and management.

Traditional drought management strategies

Water management

Water is life and its realization takes place only when one comes across water scarcity as prevailed in Jaisalmer. Surface and sub-surface water harnessing structures were evolved to satisfy the thirst. Even in adverse conditions people and livestock could survive with the traditional rain water harvesting technologies. The system not only supported the scattered settlement of rural population but also a city of Jaisalmer. Traditional technologies which save water and energy and is being practiced in various survey areas are as follows-

Table 6: Traditional technologies used in Jaisalmer to manage droughts

Traditional Technology	How is it used
Talab	Talab are water reservoirs. They can be both natural and manmade. They are used to collect and store rain water.
Saza Kuva	An open well with multiple owners. It is the most important source of irrigation. The soil dug out to make the well pit is used to make an elevated platform, sloping away from the well. The construction of saza kuva is undertaken by a group of farmers with adjacent land holding. Saza Kuva was found both in Kanod and Ghuria.
Tank	Tanks are smaller, underground smaller water storage structures which were found in every surveyed household. It generally stores water from the ponds, wells and private tankers. Tanks are being used in households of Kanod and Ghuria to store water. In Ghuria these are called Takas.
Kuis	They are 10-1 2m deep pits to collect seepage. Kuis are also used to harvest water in meager rainfall. The mouth of the pit is made narrow. This prevents the collected and stored water from evaporating. The pit gets increasingly wider underground and the structure is covered with wooden planks on the top.
Pag Baoris	They are community wells with steps built on series of level mainly used for drinking. Most of them are very old, built by the Banjaras. They can hold water for longer time due to negligible evaporation. They were found at Amar Sagar Lake.

Source: Indigenous Knowledge for disaster risk reduction in South Asia

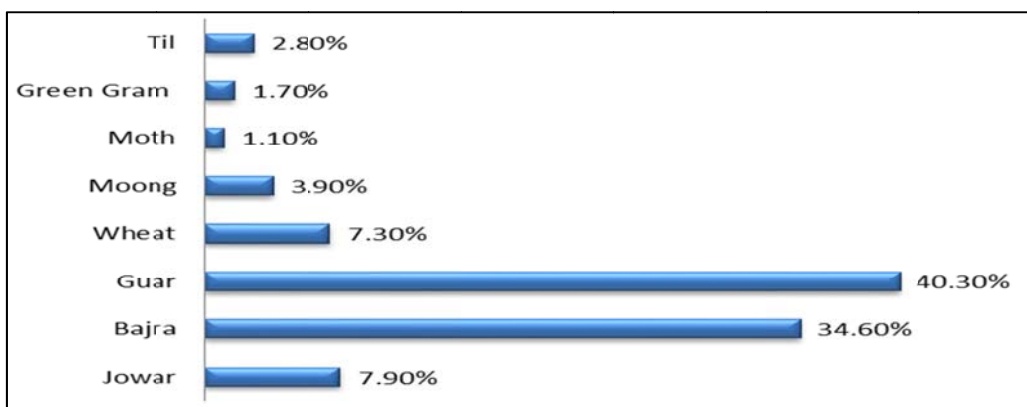
The society evolved cultural beliefs that ensured judicious use of scarce water resource and over the centuries enabled it to keep challenging pressures on its natural resource base with manageable limits, permitting survival in the desert terrain. Gadisar Lake is the living example of how with very meagre rainfall, a lake in middle of sand dunes can sustain life.

Food security

Besides drinking water security, food security use to be the second major issue for the people of Jaisalmer. Society used to develop ways to produce enough food for their survival, except in severe drought years and consecutive drought years. Multiple strategies were developed to meet the food

requirements by organizing efficient combination of land-water-vegetation- livestock.

People have developed time-tested mix farming system to minimize climatic risks. Mix farming involves the distribution of production risk. The crop combination to be taken up in a year is based on the timing of occurrence of rain, and prediction of rainfall in a year based on traditional knowledge. The chief Kharif crops are Bajra, Maize, Jowar, Guar, Green gram, Groundnut etc. If there is timely rain and rainfall forecast is normal, then farmer will grow Bajra as the only crop in the larger part of the holding and rest of the crops in smaller holdings.

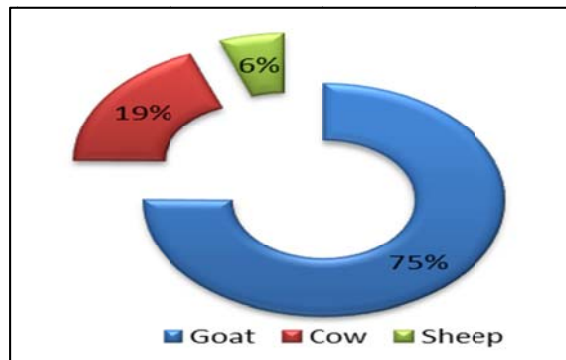


Source: Household survey in Jaisalmer

Fig 7: Crops grown in Surveyed areas

Fodder supply

People keep animals on the basis of fodder supply, grazing land and water. Animals are part of adaptation techniques to mitigate and reduce the impact of climatic variability. They provide food, nutrition and income to the households in all the conditions. There are communities specializing in rearing of goats, camels, sheep and cows. Animals are productive and more resistant to climatic variability. Animals are good source of supplementary income, food and mobile asset. The combination of small and large animals is to meet short term cash requirement and also to establish credibility in the market of the household and moneylender.



Source: Household survey Jaisalmer

Fig 8: Animal Husbandry

Goats are least affected by droughts and can be raised at zero household cost; therefore all income category households keep goats. It is for this reason the number of small animals is increasing as compared to the large animals. One of the mitigation strategies of the people is to migrate with their herds of animals during the adverse conditions to different areas based on fodder availability.

Weakness of traditional knowledge

In severe drought and consecutive drought years, ranging from two to five, traditional system could not provide water, food and fodder security. The significant limitation of traditional technologies is that it used to be in oral form, transferred from

one generation to the next, confined to few people. Hence, further development in technique could not take place to cope up with various changes. The political instability took away the gains of traditional knowledge to cope up with drought. It experienced a further jolt after independence. Western science became the base for development policies and the traditional system, even the culture was looked down. There was further neglect of traditional knowledge in all walks of life. The following table presents a historical transect highlighting the changes that took place in Jaisalmer over a period of time.

Historic Transect

Table 7: To get a picture of changes in Jaisalmer over time

1950-1960	<ul style="list-style-type: none"> • The source of water was Gadisar Lake • Water accessibility was less • Population Density was low • Transportation system was not much developed
1960-1970	<ul style="list-style-type: none"> • People used to fetch water from distance • Indira Gandhi Canal was built in 1965 • Tube wells were constructed
1970-1980	<ul style="list-style-type: none"> • Railways were introduced for the first time • Population Density increased • Military security service increased
1980-1990	<ul style="list-style-type: none"> • Same environment as the period of 1970-1980
1990-2000	<ul style="list-style-type: none"> • Vegetation started to decline • Wheat was introduced along with Bajra and Guar due to irrigation facilities
2000 onwards	<ul style="list-style-type: none"> • There is tap water supply in every household of Jaisalmer city • Well-developed water supply systems • Water supplied by municipality • No dearth of water in city of Jaisalmer

Conclusion

Jaisalmer is an arid region so agriculture is not much dependable livelihood. It was observed that people in rural areas are engaged in multiple activities to sustain their living. Like practicing agriculture during monsoon and working as guides during other months. Also most of the people are engaged in Animal Husbandry to cope up with water scarcity and droughts. In the ultimate analysis these measures benefit relatively more large farmers and those with large access to land. Non-farm activities as livelihoods have tremendous potential to cope up with drought and leading to sustainable employment creation within rural economy.

People evolved and innovated water harvesting technologies suited to different agro-climatic regions. Kings, business communities, religious priests tried to provide financial, spiritual and other inputs to help the construction of water harvesting structures to provide drinking water to meet basic needs. Traditional technologies have the strength to cope up with drought. The need is to identify these strengths and weaknesses and build upon to evolve new strategies which are people and user friendly.

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