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Mitigation strategies against adverse effects of climate change on animal husbandry practices by Maldhari community of Kutch district in Gujarat

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Abstract

Maldharis reside in a few small villages along Gujarat's borders. Maldharis are forced to raise small ruminants like sheep, goats, and camels due to a lack of available water and green grass for both human and animal consumption. There are no grazing lands available. Private dairies have taken advantage of herdsmen as a result of the nearby village milk cooperative's rejection of goat and sheep milk. Maldharis are unable to sell their goods for a good price. Poor man's milk is the name given to goat milk. Maldharis prefer pastoralism as a source of income due to a lack of resources for skill development and training and the absence of higher education facilities in the villages. Government authorities are reluctant to give funds to Maldharis on a long-term basis because of this seasonal migration. This paper and documentation aims at the conservation of indigenous livestock breeds and traditional knowledge of the rarest and dwindling pastoralist ethnic community of Gujarat – Maldhari with the support from Maldhari Rural Action Group.

Keywords: Maldhari, Pastoralism, Climate change, Sustainable livelihood, Kutch, Gujarat

Introduction

The pastoral communities in Gujarat are popularly known as “Maldharis”. “*Mal*” means animals and “*Dhari*” means the owner of the animals. Maldharis is a generic name for over a dozen communities in Gujarat whose main occupation is animal rearing and who depends on common property resources. The main Maldhari communities found in Gujarat are Rabaris, Bharwads, Charan, Aahir, and Sandhi Muslim Maldhari (Jats, Fakirani, Matva, etc.). Gujarat has a population of around 50.50 million. More than 10% of the population belongs to the Maldhari community. The Maldharis are spread in all parts of Gujarat but in Saurashtra, Kutch, and North Gujarat the population of Maldharis is much higher. In Saurashtra and Kutch, Maldharis form a healthy 20% of the population. In north Gujarat, it is around 15-20%, while in other areas there is hardly any Maldhari population. Thus the heavy concentration of the Maldhari communities is in Saurashtra and Kutch regions because of the widespread grasslands in the Panchal, Gir, Bardo, Alech, Gardo, Vagad, Vadhiyar, and Banni areas. The major pastoral communities of Kutch are Rabari and Bharwad. In agricultural India, several pockets of pastoralists survive. In the dry western regions, the pastoralists have been important ecologically, economically, and culturally. Some are long-distance nomads, traveling thousands of kilometers. Migrating with flocks of a hundred animals or more, several families together, they stay out of villages. During the dry season, they graze their animals on the stubble of the barren fields: in summer they retire to semi-desert areas. Maldharis, living on the city outskirts, survive in selling milk, clarified butter (ghee), and dung cakes besides penning their flocks in fields for manure, feeding their animals from grazing on unoccupied land as well as fodder bought in the market.

Indigenous livestock breeds and animal agriculture

Maldharis are landless pastoralist farmers in Gujarat who depend on the raising of seasonal animals. They are typically thought of as the Gujarati dairymen who previously provided the kingdoms with milk and cheese.

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The selling of pure ghee, milk, wool, animals, and handicrafts are their main sources of revenue. The Banni buffalo, Kankrej and Gir cattle, Patanwadi and Duma/Marwari sheep, Kutchi goat, Tari camel, Sindhi horse, Haleri donkey, and Kharai swimming and Kutchi camels, which are specially adapted to the dry ecosystem of Gujarat, have coevolved with the Maldhari way of life. The local Banni buffalo breed registration process was carried out through the Maldharis themselves in 2010 with National Bureau of Animal Genetic Resources, Karnal. With time, Maldharis have developed their own Indigenous Traditional Knowledge (ITK) to achieve economic stability without affecting the sustainability of the pastoralists. Many times Maldhari tribe treats their animals using traditional medicine. While there are veterinary hospitals outside, they consider it expensive. Therefore they rely on their traditional forms of medicine for their animals. So it is important to conserve the biological diversity of both of their livestock breeds and associated traditional knowledge by documentation.

Climate change and Maldharis

Northwest India is home to a nomadic community of cattle, camel, and shepherds known as the Rabari or Desai. The Vagadias from eastern Kutch (Rapar block) and the Dhebarias from the Anjar tehsil in Kutch are the two different kinds of Rabaris found in Gujarat. As a result of rising average surface temperatures and sea levels, climate change is becoming a severe hazard to the entire world community. This poses a major threat to both the local livestock breeds and the living community. Therefore, it is imperative to strengthen policies related to such cattle, their welfare, and the environment (Mohapatra *et al.*, 2022) [9]. Rabari community is nomadic. They are found settled on the outskirts of cities and towns in semi-nomadic lifestyles. Their migration depends on the period of the seasonal rains. The Rabari population is estimated to be about 2,700,000. They earn a living by selling sheep and goats for milk and meat, and dung for fertilizer, and wool. "Dang" is a group of five to fifteen families who migrate with their livestock in search of green fodder and water. They travel from autumn through the following spring, during the dry months between the Southwest monsoons.

Research gap and objectives

As per the estimation of milk, egg, and wool production in Kutch for the year 2019-20, Kutch district ranks nine in the state by producing 604.86 thousand tonnes of milk. Kutch ranks 24th in egg production in Gujarat. Kutch leads in wool production in the state by producing 743.74 kg of wool. The meat price (up until March 2020) of chevon and mutton is Rs 350 per kg. The mitigation strategies for small ruminants to cope with drastic climate change during seasonal migration with respect to dairying as a livelihood for Maldharis in Kutch

have not been explored fully. The sheep population is 17.87 lakh in Gujarat as per the 20th livestock census. Small/marginal farmers and landless labourers raise more than 70% of sheep and goats. Gujarat's efforts to promote its sheep and wool industry need to be significantly improved because the state's sheep population, which makes up around 8.47% of all livestock, has enormous room for growth. The Maldharis are forced to care for their animals with native herbs without veterinary assistance due to their seasonal movement. This traditional and confident form of medicine has no prior documentation.

Table 1: Livestock population census 2019 of Kutch

Detail	Figure
Cattle	575000
Buffaloes	466000
Sheep	611000
Goat	439000
Total Livestock (Cattle, Buffalo, Sheep, Goat & Pig)	2091065
Total geographical area of Kutch	45652 Sq. Km.
Density of livestock in Kutch	46 per Sq. Km

The objectives are as follows

1. To analyze the source and destination of seasonal migration of Maldhari in Gujarat.
2. To document and conserve the traditional animal husbandry practices for Maldhari livestock breeds.
3. To study the impact of climate change on Maldhari livestock breeds for sustainability during seasonal migration.
4. To study the utilization of milk and milk products from livestock among the Maldharis.
5. To create a training programme for the Maldharis that will improve skill growth and income through smart dairy practises.

Research Methodology

The largest district in India is Kutch in the state of Gujarat sharing the international border with Pakistan. The entire district is divided into ten blocks. The Rabari and Bharwad tribes of the Maldhari community inhabit Rapar and Anjar blocks in Kutch.

The primary survey was conducted in the Anjar and Rapar blocks of the Kutch district in Gujarat between September and November 2022. Information from a total of 207 households was gathered for analysis. The blocks were selected on the basis of the seasonal migration routes of Maldharis. Based on the survey of 207 households from 7 villages of Anjar and 15 villages of Rapar, Focus Group Discussion, the In-depth interview, and Participatory Rural Appraisal, this study uncovers different livelihood challenges faced by the Maldhari households in Kutch.



Fig 1: Tehsil map of Kutch

Table 2: Socio-economic profile of Maldharis in sample blocks of Kutch

Block	Number of villages covered	Name of the villages	Number of respondent households
Anjar	7	Tapar, Ratnal, Ajar, Khokhra, Modsar, Jaru, Mindiyala	96
Rapar	15	Balasar, Bela, Besarar, Vrajwani, Dhabda, Kuda, Nagalpur, Mauvana, Sai, Umaiya, Suvai, Rav Moti, Jesda, Deshalpar, Kanmer, Jatavada	109
Total	22		207

The methodologies are as follows

1. Analysis of primary data through a survey questionnaire in Anjar and Rapar talukas in Kutch
2. Collection of secondary data through a survey questionnaire.
3. Documentation from interactions, focus discussion groups, field visits, and experiences of Maldhari livestock owners spread across Rapar, Anjar, Bhachau, Bhuj, and Nakhatrana tehsils of the Kutch district.

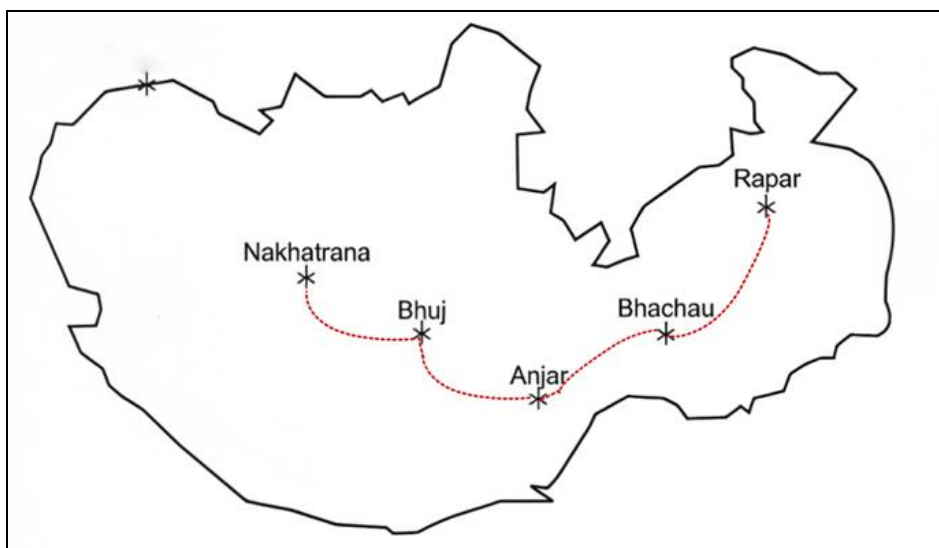


Fig 2: Routes of field visits in Kutch by the researcher team

Findings and discussion

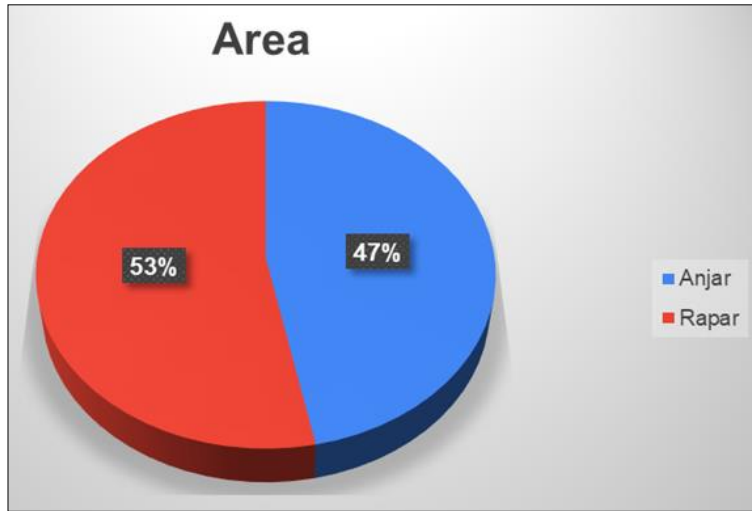


Fig 3: Two blocks in the Kutch district - Anjar and Rapar covered for study and data collection.

47% of the survey information was gathered from the Anjar block while 53% of the survey information was gathered from the Rapar block in the Kutch district of Gujarat.

The literacy of the respondents in the villages was major at the primary level with 24% into the higher secondary level of education.

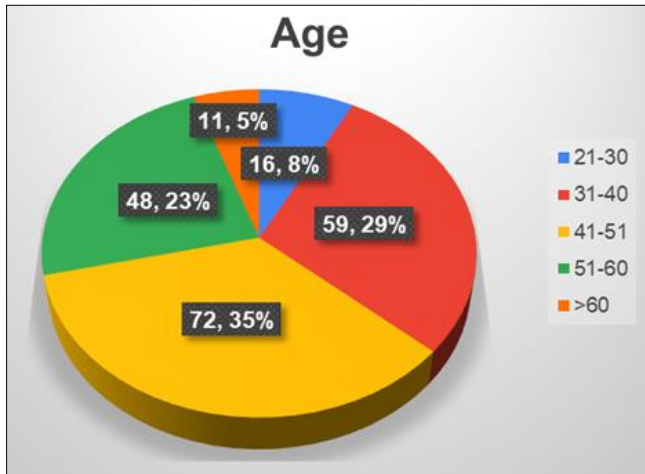


Fig 4: Age of the respondent Maldharis in Anjar and Rapar blocks in Kutch district

The majority of the respondents in the villages were in the age group of 41-51 years.

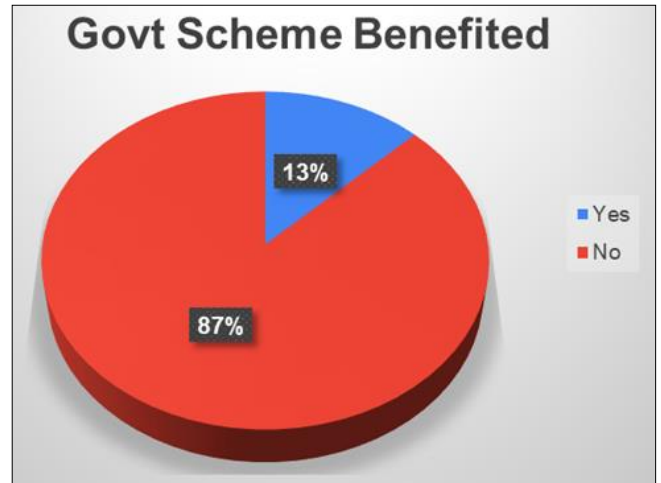


Fig 6: The government scheme benefited by the respondent Maldharis in Anjar and Rapar blocks in Kutch district

87% of the respondent Maldharis in Anjar and Rapar blocks in Kutch district have not benefited from the government schemes.

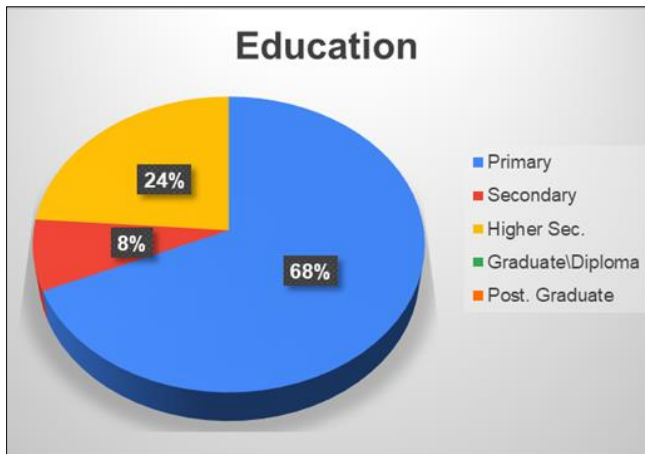


Fig 5: Literacy level of the respondent Maldharis in Anjar and Rapar blocks in Kutch district

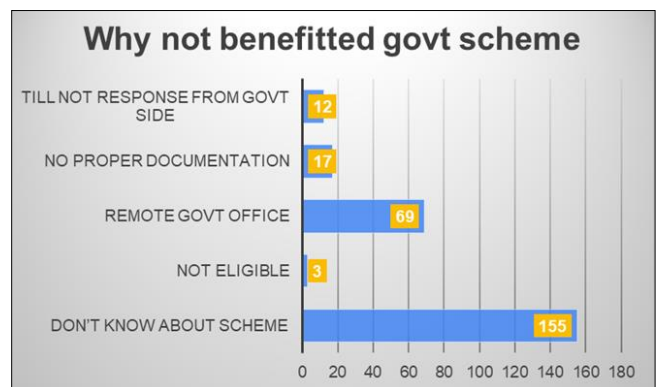


Fig 7: Reasons stated by the respondent Maldharis for not being able to benefit from the government schemes in Anjar and Rapar blocks in Kutch district

Majority of the respondent Maldharis were not aware of the scheme, while the remote location of the government office, lack of proper documentation, apathy from government sides,

and ineligibility were cited by the other respondent Maldharis from the sample blocks.

Objective 1: To analyze the source and destination of the seasonal migration of Maldhari in Gujarat

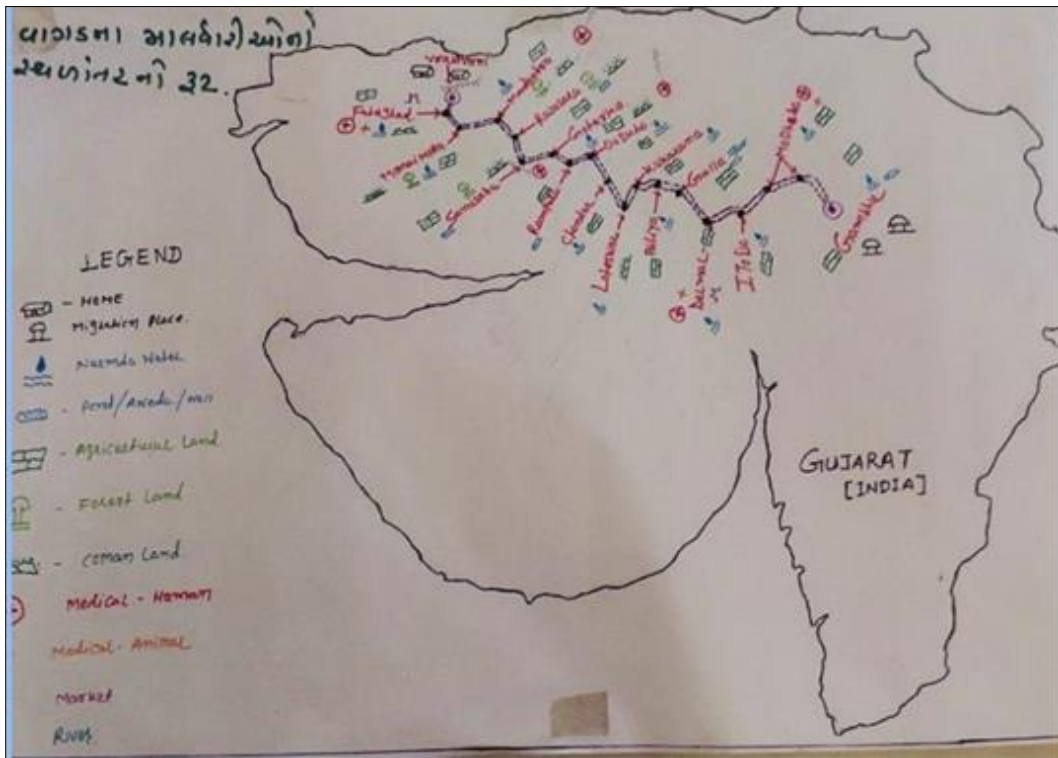


Fig 8: Route of migration of Maldharis in Kutch

Dhabda - Vrajvani-Vauva-Santhalpur-Sidhada-Manpura-Varahi- Nani Pipdi-Radhanpur-Sinad-Dharavadi-Kamalpura-Banas Nadi-Kakhal-Sariyad-Patan-Kansa-Aghar-Sankhari-Islampur-Ranuj-Manund-Lanva-Panchot-Mehsana-Nandasan-Kalol-Gandhinagar-Magodi post office-Lunawada-Vadodara-Pavagadh Hills-Kheda-Godhra-Chhota Udepur-Redhana-Bhamiya-Surya-Bambhoj-Waghodia-Vaghbod

Objective 2: To document and conserve the traditional animal husbandry practices for Maldhari livestock breeds.

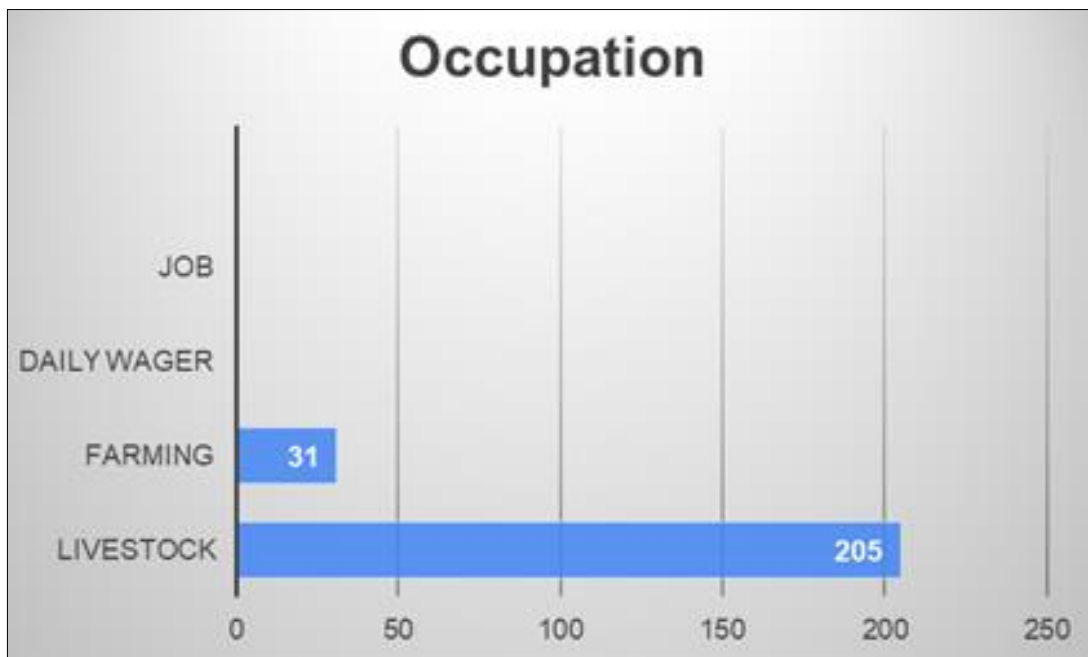


Fig 9: Occupation of the respondent Maldharis in Anjar and Rapar blocks in Kutch district

With most of the respondents with primary education level, the majority of the respondents are into livestock rearing

followed by farming in Anjar and Rapar blocks in Kutch district.

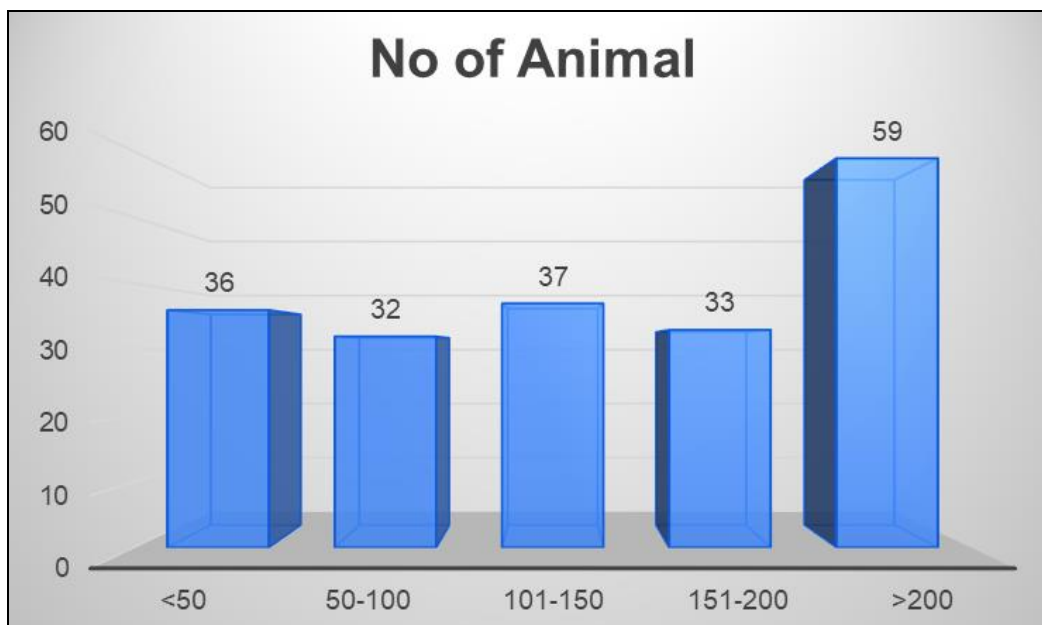


Fig 10: Number of animals owned by the respondent Maldharis in Anjar and Rapar blocks in Kutch district.

Majority of the respondent Maldharis own more than 200 animals in Anjar and Rapar blocks in Kutch district.

Table 3: Livestock breeds in Kutch district

Livestock species	Breeds
Cattle	Kankrej, Gir
Buffalo	Jafarabadi, Banni buffaloes
Sheep	Patanwadi, Dummas, Marwari
Goat	Kachchi goat
Camel	Kutchi (feeds on mainland grazing) Kharai (feeds on mangroves)
Horse	Kutchhi-Sindhi horse
Donkey	Halari

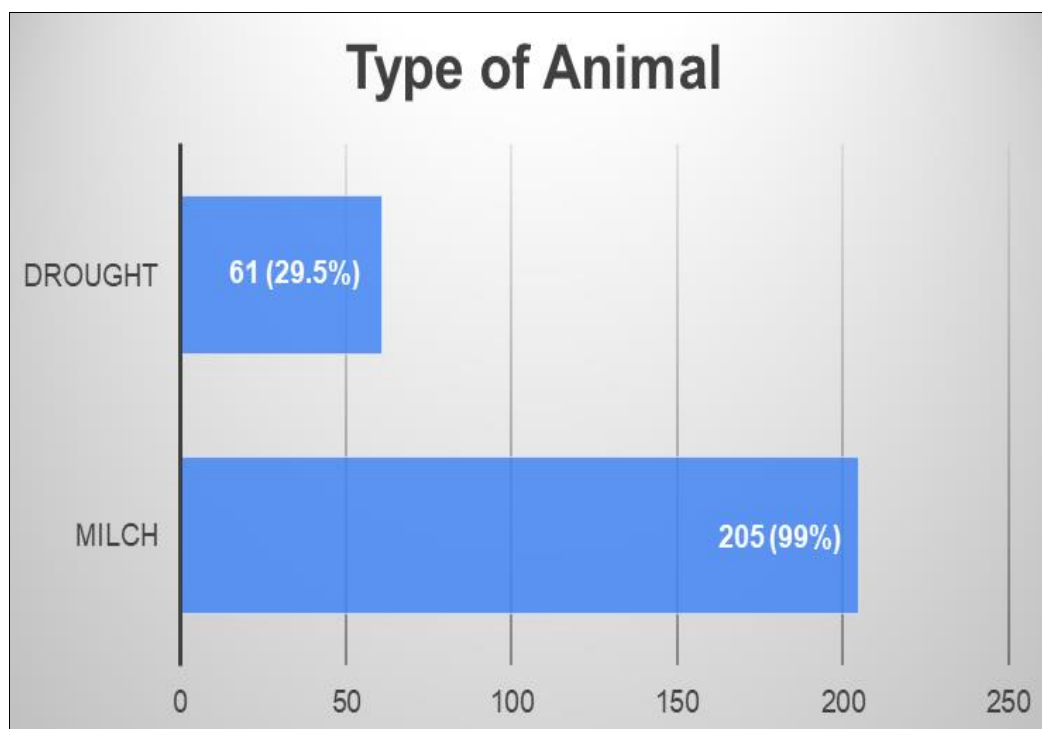


Fig 11: Types of animals owned by the respondent Maldharis

Most of the respondent Maldharis had milch animals in the Anjar and Rapar blocks in the Kutch district.

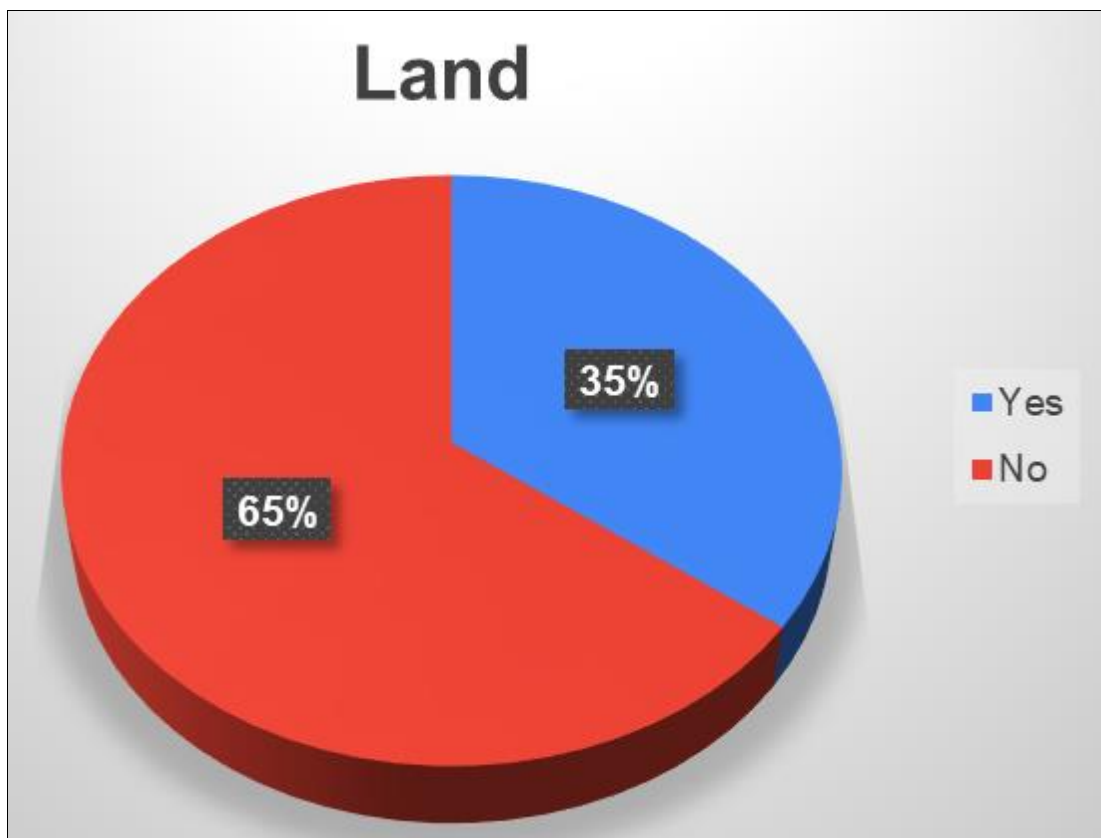


Fig 12: Land owned by the respondent Maldharis in Anjar and Rapar blocks in Kutch district

Out of 31 respondent Maldharis who are into farming, only 35% of the respondent Maldharis owned the land in the Anjar and Rapar blocks in the Kutch district.

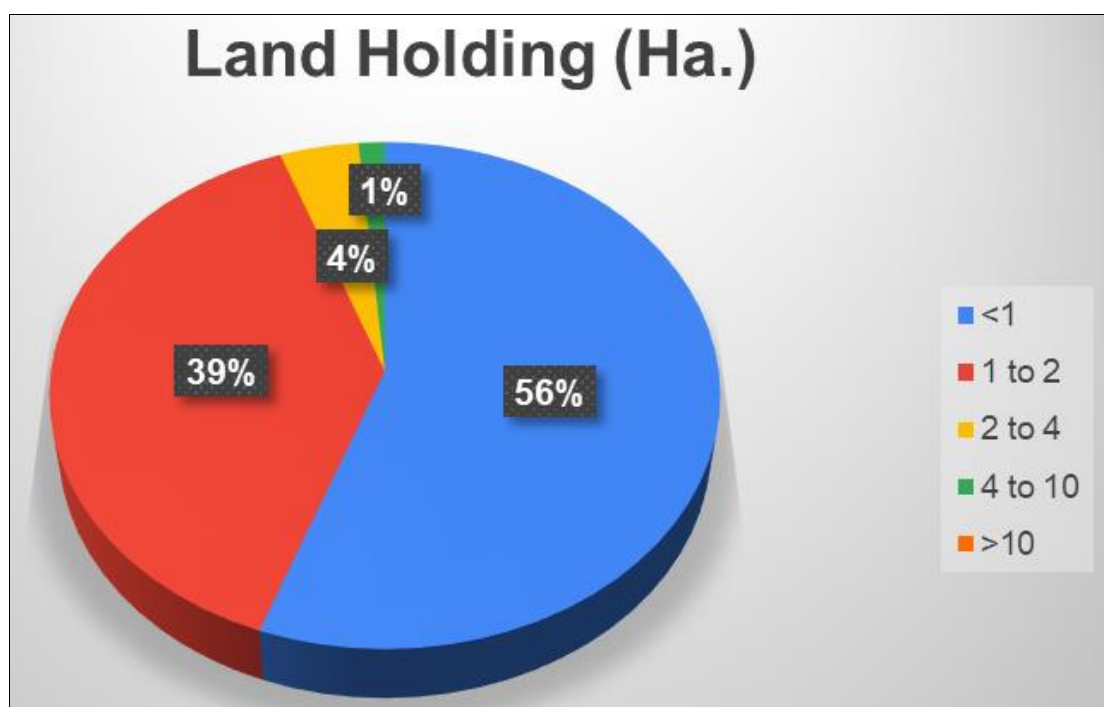


Fig 13: The land holding of the respondent Maldharis in sample villages in Anjar and Rapar blocks in Kutch district

56% of the respondent Maldharis own less than one hectare of land while 39% own more than 10 hectares of the land in Anjar and Rapar blocks in Kutch district.

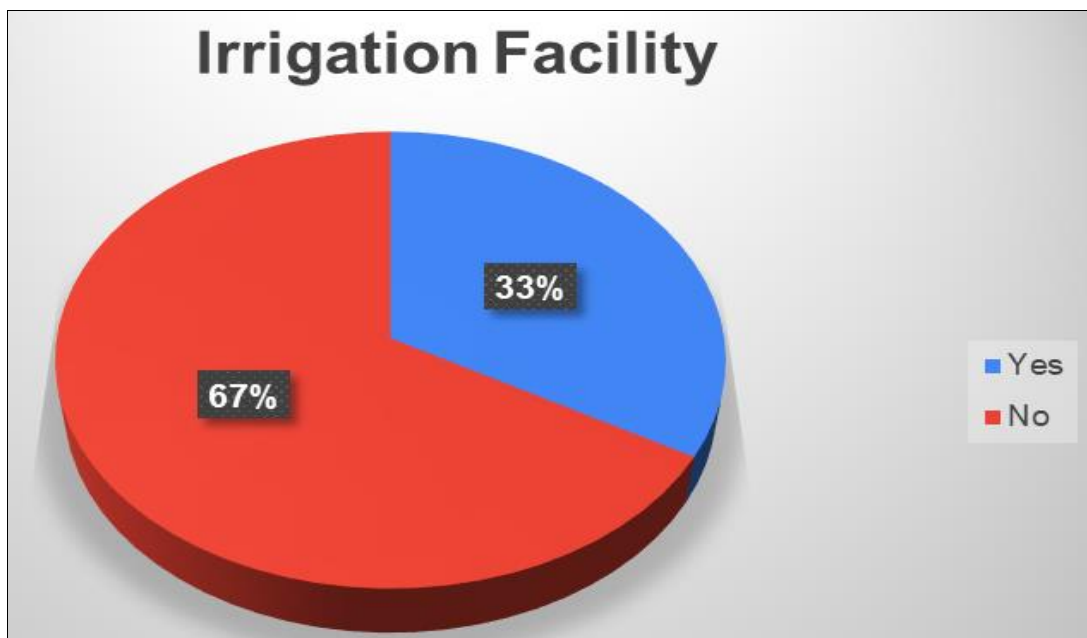


Fig 14: Irrigation facility for the respondent Maldharis in Anjar and Rapar blocks in Kutch district

67% of the respondent Maldharis had irrigation facilities in Anjar and Rapar blocks in Kutch district.

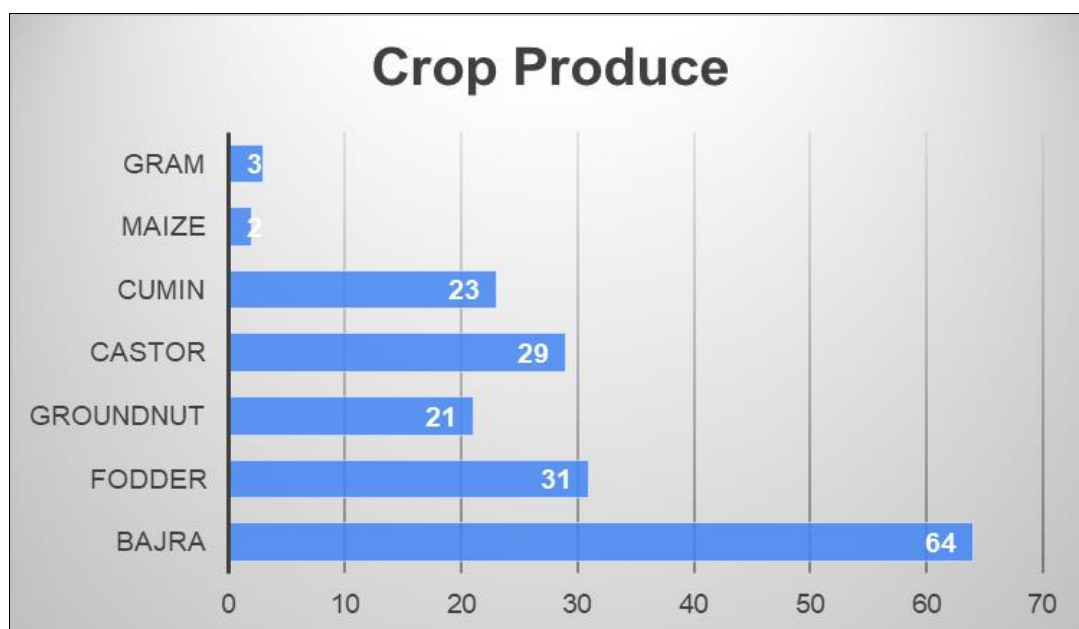


Fig 15: Crops grown by the respondent Maldharis in Anjar and Rapar blocks in Kutch

The major crops produced by the respondent Maldharis of the sample villages in Anjar and Rapar blocks in Kutch district were Bajra, castor, groundnut, fodder (green/dry), cumin, gram, and maize.

Focus group discussions and in-depth interviews were

conducted in the villages of Rapar (Vagad area), Anjar, Nakhatrana, Bhuj and Bhachau blocks of Kutch to understand the various aspects of climate change, animal husbandry practices, fodder, and grazing land management in Kutch.

Table 4: Govt. Veterinary Institutions in Kutch (2019-20)

Govt. Veterinary Institutions	Number
Polyclinic	1
High-tech Veterinary Polyclinic	0
Veterinary Dispensary / Block Veterinary Dispensary	32
First Aid Veterinary Centre	29
Mobile Veterinary Dispensary	6
Rural Primary Veterinary Health Care Centres	11
Mobile Veterinary Dispensary (Per 10 Village)	23
RP Centres	7
Intensive Cattle Development Programme Centres	50
Intensive Poultry Development Project -DPEC	4
Total Veterinary Institutions	91

Total Livestock Units Per Livestock Census 2019 (Cattle, Buffalo, Sheep, Goat, Pigs)	1146167
Total Livestock Units Per Veterinary Institutions	12595
ADIO	1
Staffs in Panchayats for Animal Husbandry and Dairy Development (2019-20)	148
Collection of milk by	<ul style="list-style-type: none"> ▪ Sarhad Dairy ▪ Maahi Milk Producers Company ▪ Aadvik Foods

Traditional animal husbandry practices by Maldharis in the Vagad area for their livestock

1. Maldharis select a male sheep that is tall, has a long tail, and is healthy. To avoid inbreeding, a livestock owner exchanges the male sheep with other Maldharis every three years. A male is kept for at least 5 years and then replaced.
2. Maldharis make the livestock drink mustard oil in winter and castor oil in summer to keep them healthy.
3. Maldharis use various herbs for different treatments in livestock such as Aghedo, Gokharu, Bahukooli, Haatodi, Hangvekh, Kaanti, Galo, Parbatraay, Kunvarkood, Mamejo, Mindhi naval, Truhada, Kothimbu, and Vikaro.
4. Parbatraay, Akda, and Chas are put in a pot and pressed into the udder for 7 days. 100ml of the mixture is fed to the sheep which improves strength, acts as a dewormer, protects against diseases, and improves appetite.
5. Sheep are sheared three times a year so that the sheep become stronger, do not show disease, the thorns do not get filled and the sheep do not get moths in the wool.

Breeding and selection of animals in the Vagad area

The good rams are kept and the poor quality rams are culled. A good offspring is one whose appearance, weight, milk, and disease resistance are seen by taking care of their parents. The goat is selected by looking at the height, weight, and appearance of his body. 1 or 2 males are kept in one group of small ruminants. Males are swapped from one group to another. Earlier Labi, Kabri, Bhuri Tipti Laba, and Zeti were kept, but now due to climate change, Marwari sheep are kept more in Vagad. The Marwari sheep are highly prized for their robustness, good gait, and good weather protection. Long-eared sheep and goats have prickles in their ears and blood also oozes. So as a remedy now, short-eared sheep are preferred over cattle. Maldharis plan for less wind in summer and vacate during monsoon and winter. After weaning, the sheep are milked and then taken to the barn. A lamb lactates

for 4 to 5 months. During migration, young sheep and goats are carried with those who cannot walk on camels. Dalda ghee and Parbatraay are drunk for males. Parbatraay is fed to one-year-old sheep for protection against seasonality. Animals sit where the big tree canopy is big in summer. During the monsoons, large trees are preferred in which the cattle are not damaged by rain and are protected. When there is thunder, one prefers to stand in one place. A thorn fence is built so that there is no danger of theft of animals and the animal stays in one place. At present, plastic nylon net is used to make the fence, which the Maldhari women prepare in half an hour. Carts for the baby animals are placed on legs or spans, sometimes with large bamboo trunks, under which small babies are kept. Maldhari carries four baby animals on his shoulders and sometimes also on camels. After the weaning, Maldharis wait for the navel cord which falls after some hours and if it doesn't fall, then traditional medicine is used.

Animal mortality during migration

Animal mortality occurs due to weather and others during migration. Animals are electrocuted while grazing under power lines. Animals also die due to lightning in rain. They also die due to diseases like dizziness. There are also deaths due to vehicular accidents on the roads. If the animal is brought from another area to the wild area, it dies even if the environment is suitable.

Climate change

Three decades ago drought caused huge losses due to a lack of water and fodder management which resulted in a high death rate. The extent of drought in the middle ages was the same. Currently, the problem has become more severe due to increasing drought, the bore water has also gone deep. Some areas have been getting water due to canals for the past 10 years.

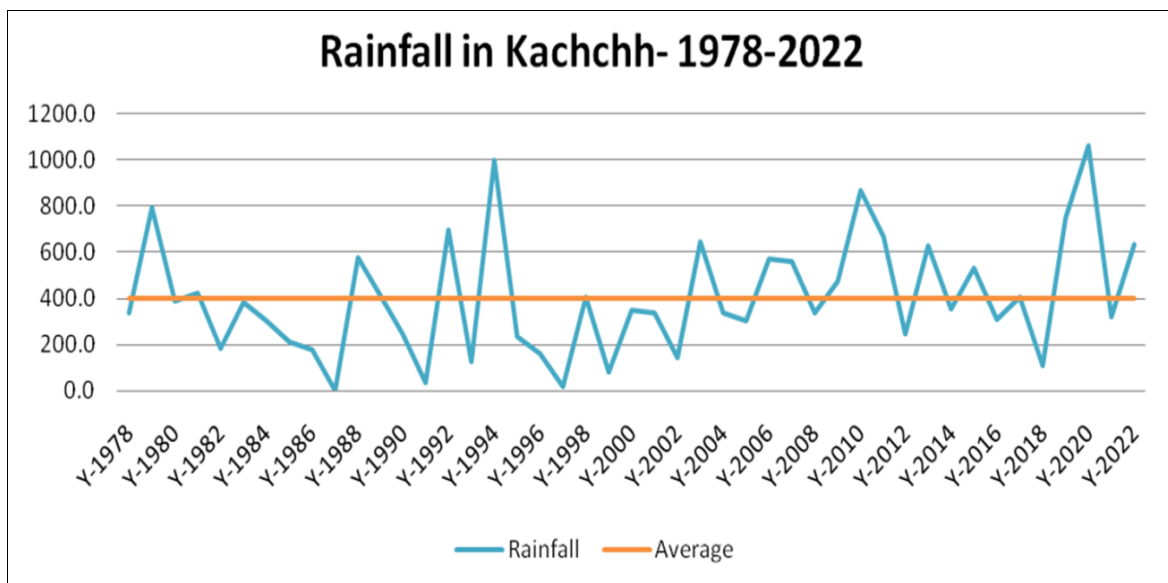


Fig 16: Rainfall in Kutch district from 1978 to 2022

In the year 2015, heavy rains in the Vagad area led to flood-like conditions, causing huge losses. The roads were washed away, the lake burst, and the soil was eroded on a large scale. And in the water, the little goods, the sheep, the goats, were drowned; the grass and the plants on the banks of the river were uprooted and drowned in the water. Diseases in animal husbandry increased due to excess water. Small grasses and small vegetation were washed away by the flood causing grazing problems. Where more animals have died, other animals do not graze in irregular rain. Due to the lack of sufficient water and fodder due to incessant rains, there is more migration among Maldharis. Due to irregular rains, one has to move from one village to another village because if there is not enough grass in that village or in the village, one has to make a long migration. Maldharis are fully dependent on cultivable land and if there is no rain there is no cultivation in the field. Due to shifting to different villages and not getting a proper market for milk, the price of milk is low. Increasing migration increases residential and livestock theft.

Prediction for climate change

Drought can be predicted from the atmosphere wind and clouds. If the wind is cold, it will not rain. If there are clouds in the morning and stars appear in the evening, there will be no rain. How the rain will fall can be known from the time of Holi. Thunderstorms from the eastern corner ensure rain. If the cloud falls, it will be known from the rain, whether it will rain again or not. From the moon of *Chaitra Poonam*, it is known how the year will go. If the moon is clear, then the year is good and if the moon is cloudy or cloudy, then the year is bad. If the sparrow is in the dust, the rain is near. The clay turns red if it rains. If ants change their rates, it will rain. And if the above does not happen, understand there will be drought. According to the place where the red-wattled lapwing (*titodi*) lays its eggs, the rain can be known. If the cart is parked at night and moves towards Gujarat in the morning, it is drought and if it moves towards Kutch, it is a good year. If the animal drinks more water, the year will be good and if it drinks less, the year will be known. Rain is good if lilies speak more. If Loki talks too much about Diwali, the year will be tough from the tree. If banana tree has more leaves and flowers, the year will be tough. If the chikoo ripens more, the year is good. If there is more bore in Indian Jujube (*Bordi*), the year is good. The year is good if there are more neem seeds. Vagad experiences drought every three years and permanent drought in summer due to which we have to migrate. In Vagad, floods occur only occasionally, which means they are negligible, but due to the breakdown of roads during migration, cattle have to face more difficulties, and if large cattle are tied together, they also die in floods. When a cyclone occurs in the environment, it causes a lot of damage to people and crops. When the temperature rises, the death of animals also increases, while due to heavy rains, the number of animals and epidemics also increases and different diseases are seen.

Grass varieties used for livestock

Animal feed and fodder

Cattle feed of Vagad area

Cows and buffaloes - Gumdi, Jowar Maize, Govantri, Bokno, Suchel, Khad, Kapsoya, Sorghum

Sheep, goats

Sheep – Govantri, Jejvo, Dundi, Kego, Limdo, Lap, Paidiya, Sangra.

Goat – Paidiya, sangra, salt jaru, piludi, govantri, talakhti bordi, neem, Govantri, Castor leaves, Neem leaves, Nettle leaves, Board, glue, Gangeti, Sweet, acacia, Jahavi, slush, alfalfa, scrap, Spider leaves, Guar leaves, Dhuwana Pilu+Paan, Fang Velli, Mawuli, Rowdy, Acacia leaves, Rapadi, Zildo.

Cow-buffalo

Alfalfa, sorghum, Rohdi, Dhusu, pretend, Talakato, lap.

Camel

Sweet acacia, Phag, Vaccario, Neem, Gord, hives (hives), Gangeti.

Grass growing in the wild area

Sabo lap, Dharmol Bhildo, Jijwo Bhopario, Thago dhrokla.

Vegetation in Vagad

Sweet acacia scratch, Eucalyptus, Abo lemonade, Kharek, glue, Gergeti

The varieties of grass used for livestock by Maldharis are Dabhado (a harsh rhizomatous perennial grass), Ghokad, Gho, Lamp, Dhraman grass (*Cenchrus setigerus*), Jinjavo/Marvel grass, Khevai (*Sporobolus fertilis*), Rohadi, Sambo, Dudheli, Bahukooli, Kanjaro, Lambadi, Sangetaro, Javari, Kanti, Bharadiyo, Guntila (kutara), Aghado, Hatodo, Bhorigani, Bordi, Vaansi, Zibado, Kuri, Chakbaalu, Naasariyo, Bokano, Kangipar, Bhegido, Mankhani, Dilo, Kodyu, Theglo, Aankh futdi, Andhi fuli, Kanzo, Kharsan, Bhimbhado, Parbatray, Gokharu, Taandaliyo, Mamejo, Veka.

Ethno-veterinary practices by Rabari Maldharis for ailments in livestock

1. **Thakelo:** This condition in sheep is treated by the traditional veterinary knowledge from the ancestors. The locally sourced 'Parbatray' herb is soaked in buttermilk for two days. Then the herb is buried under the heap of organic waste. After two days it is filtered and given to the diseased sheep to drink. Maldharis believe this is the best treatment for Thakelo in sheep.
2. **Foot sepsis:** Septic in the foot is a major livestock issue during monsoons. To heal the feet with septic, salt is rubbed on the animal's feet and the feet are wrapped with cloth or covered with socks.
3. **Fracture:** If the bone of the leg of the livestock breaks, two parallel wooden blocks around the broken feet are put and it is tied up by wrapping a cloth around it. Then stitches are put along with the skin to make the leg steady. Thus the fractured leg is healed. When the leg of the animal is fractured, a small wooden stick is tied to the side of the leg and the fixture is fixed.
4. **Measles:** Skin from the anal part is taken of the sheep infected with measles. The skin is cut into pieces and heated in oil with neem leaves. After cooling down those pieces, they are planted on the neck of each infected sheep by putting a small cut. This process helps in getting rid of measles in sheep.

Objective 3: To study the impact of climate change on Maldhari livestock breeds for sustainability during seasonal migration

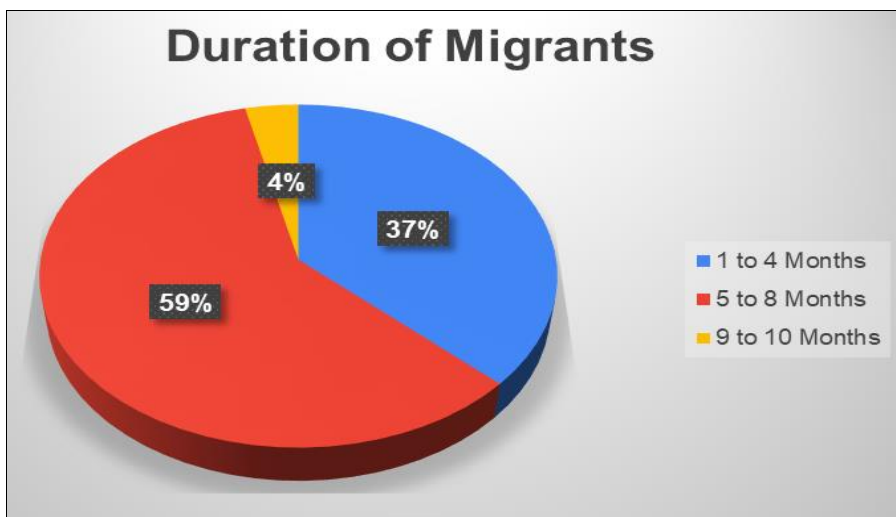


Fig 17: Duration of migration (in months) of respondent Maldharis in Anjar and Rapar blocks

59% of the respondent Maldharis migrate for 5 to 8 months in a year.

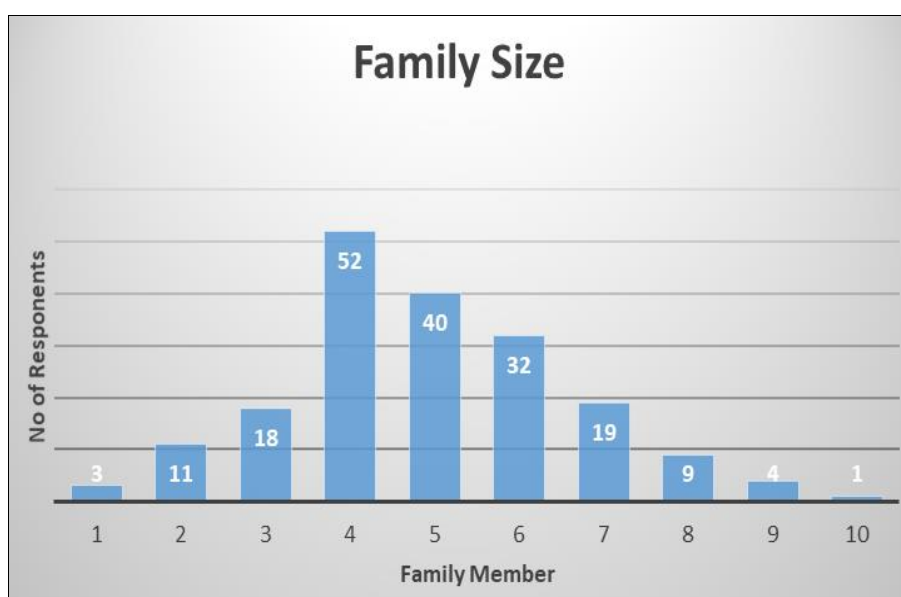


Fig 18: The family size of the respondent Maldharis in Anjar and Rapar blocks

52 families have 4 family members, and 40 families have 5 family members. It was estimated that the average size of a Maldhari family comprises around 5-6 people.

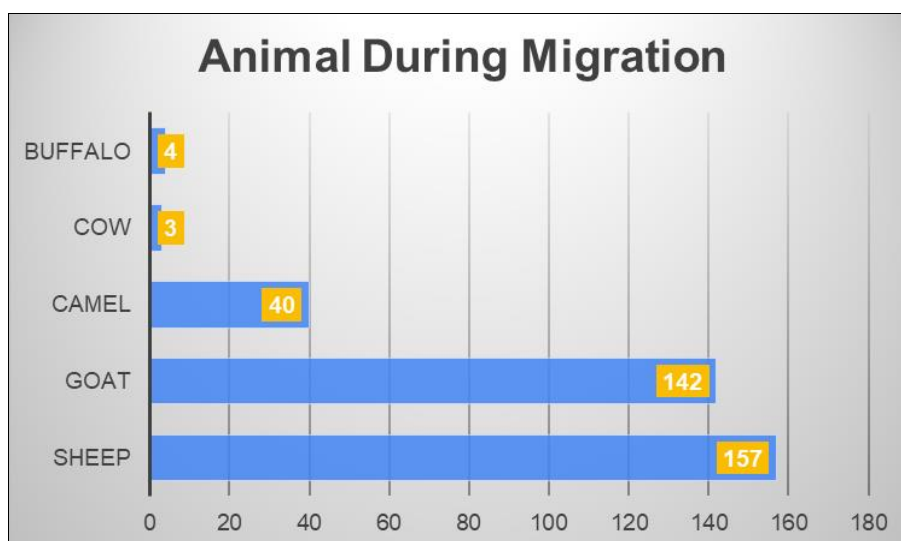


Fig 19: Type of livestock accompanied by respondent Maldharis during migration in Anjar and Rapar blocks.

The respondent Maldharis migrate with sheep in large numbers along with goats. Maldharis bring camels during migration which carry their luggage. They specialize in small

ruminants or bovines, in both cases keeping a few camels for transporting their tents and other luggage.

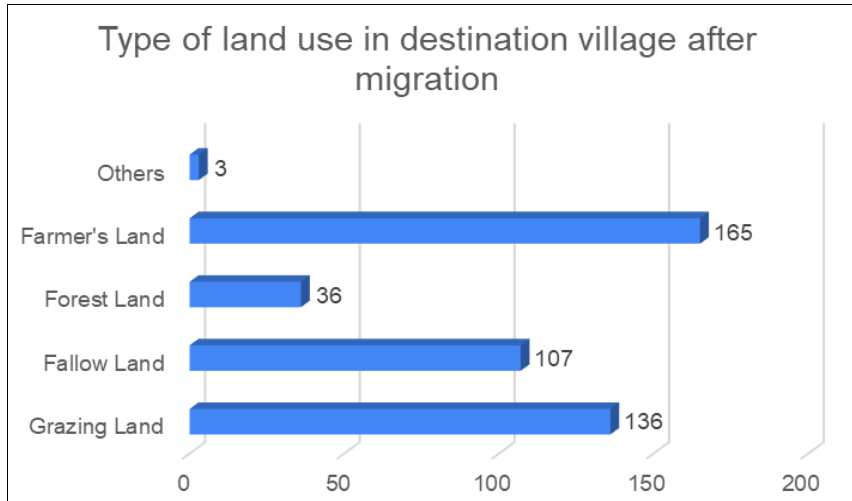


Fig 20: Type of land use in destination villages after migration

Majority of the respondent Maldharis use farmer's land migration. followed by grazing land in destination village after

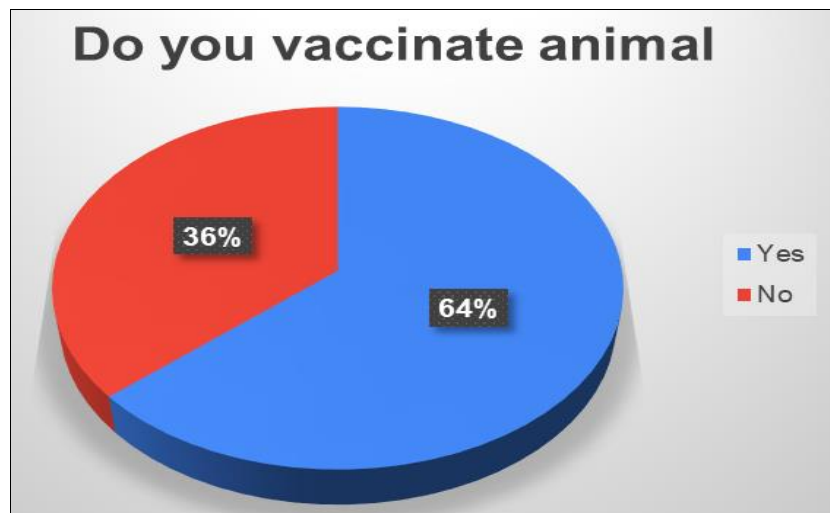


Fig 21: Vaccination of livestock by the respondent Maldharis

64% of the respondent Maldharis vaccinate their animals.

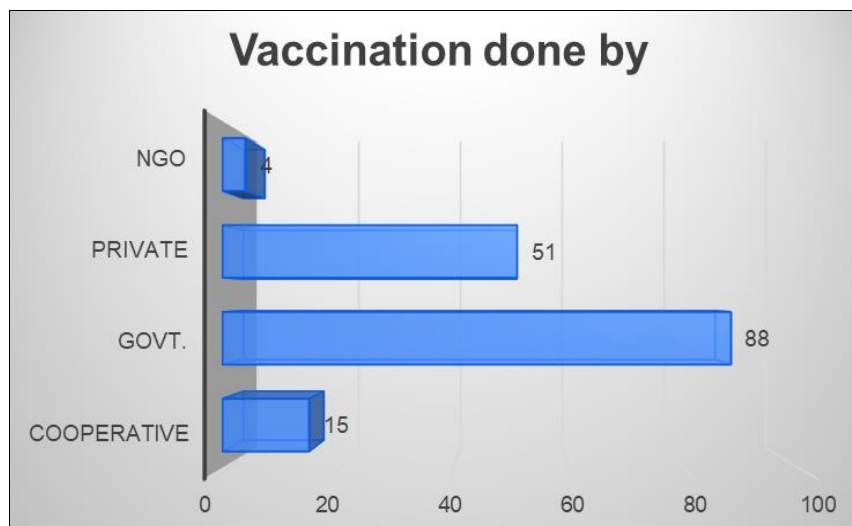


Fig 22: Source of vaccination of the livestock of the respondent Maldharis in Anjar and Rapar blocks

The majority of animal vaccination is done by the state government. Vaccination camps by Sarhad dairy are done.

Objective 4: To study the utilization of milk and milk products from livestock among the Maldharis

Procurement of milk by organizations

Sarhad Dairy at Kutch was visited as part of the study of the dairy processing sector. Sarhad dairy has two camel cooperative societies with four milk collection centres at Nakhatrana, Anjar, Rapar, and Bhachau. As per the Kutch

district Livestock Census (2019), a total of 9042 camels are spread over 92 villages in Kutch district.

The societies are Kachchh Unt Uchherak Maldhari Sangathan (KUUMS) and Shri Madhya Kutch Unt Uchherak Sahakari Mandali Limited, Nakhatrana, Lakhpat-Abdasa. Maahi Milk Producer Company procures cow and buffalo milk in Kutch district. Aadvik Foods procure raw camel and goat milk in Kutch and sell pasteurized or flavoured camel milk and different products across India.

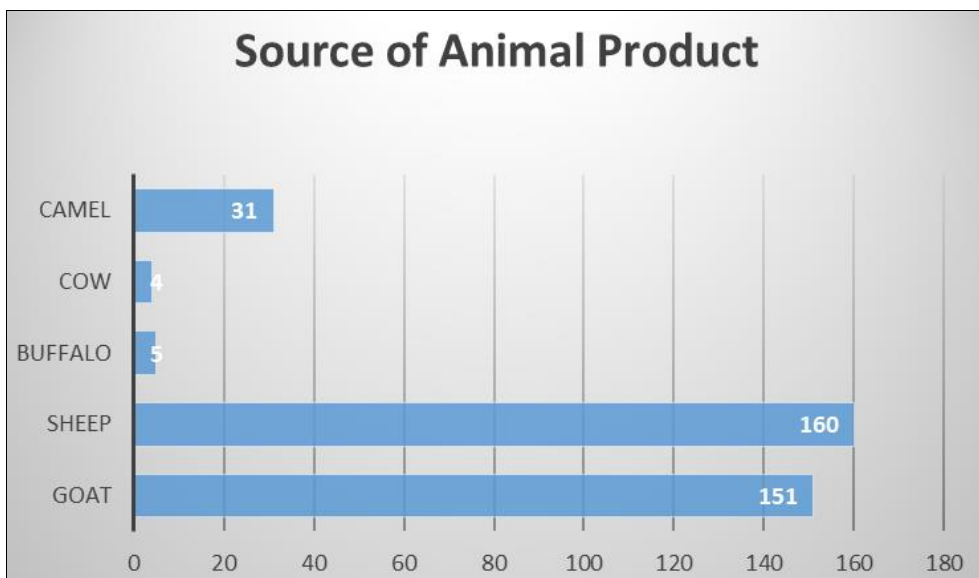


Fig 23: Source of animal products of the livestock of the respondent Maldharis in Anjar and Rapar blocks

Since the large number of livestock comprises of sheep, goat and camel, the maximum source of animal products are from sheep, goat and camel milk in Kutch. Additionally, studies have shown that the best cheese is made when sheep milk is blended with cow milk to some extent. Given that India is a significant exporter of dairy items, examining the potential of milk from such small ruminants to create lassi, shrikhand, yogurt, mawa, milk powder, and desserts is critical in Indian markets as well as establish a profitable value chain.

Objective 5: To create a training programmer for the Maldharis that will improve skill growth and income through smart dairy practises

Women are the backbone of the Maldhari community. They are extremely important in maintaining and disseminating indigenous traditional and ancestor knowledge. VKCoE's exposure to Maldhari women has inspired them to pursue sustainable livelihood options. One of them is Laxmi Rabari Handicrafts from Anjar block. On September 23, 2022, VKCoE organized the 'Rural Haat by Maldharis' in partnership with Maldhari Mahila Sangathan (Pastoral Women Alliance) and MARAG at IRMA. Women pastoralists from the remote border villages of Gujarat's Kutch and Patan districts displayed their extremely stunning embroidery and handicrafts. A workshop on climate change and sustainable livelihood was organized by VKCoE for Maldhari pastoralists on 24 February 2023. Thus the Maldhari women in Rabari communities are not only achieving leadership in community roles, but also protecting Kutch's decreasing biodiversity.

Mitigation strategies against climate change in Kutch

1. Rearing of Kharai camels

A case study on the kharai camels and Amul Dairy were done. The availability of a milk marketplace has increased the number of camels in Sanosara, Jangi, and many other villages in Kutch. Youth have left professions in other industries to work in the traditional business of camel herding. Camel milk and chocolate provide a lifeline to herders of the remarkable but endangered Kharai camel, which can swim in the ocean and eat saltwater plants.

2. Agroforestry for camel grazing

Kharai camels in the Kutch area are the only livestock species that are solely dependent on natural vegetation and not cattle feed or concentrate. Pasture and silvi-pastoral areas need to be created for grazing of camels. Fodder crops like Guar and Moth and fodder trees such as neem, Khejri, Israeli babool, Babool, Jhar beri, Ardu, Jaal, Seasum and Ker can be planted as in the farm areas in Rajasthan.

3. Commercialization of camel milk

Camel milk contains less fat and total solids than cattle and buffalo milk, but more total salts, free calcium, protective proteins, vitamin C, and micro minerals including iron, copper, and zinc. In humans, camel milk skin cream offers relaxing, calming, and radiant properties. Kulfi, flavored milk, lassi, paneer, cheese, mawa, gulab jamun, barfi, camel milk powder, tea, and coffee can all be made with camel milk. In pursuit of changing the camel into a milk animal and in light

of the therapeutic features of camel milk for human health, different organizations have made ongoing attempts to popularise camel milk. At the National Research Centre on Camels in Bikaner, value-added camel milk products such as sapota-flavoured camel milk, camel milk cheddar cheese, camel milk nuggets, fruit flavoured whey drink, sugar-free camel lassi, camel milk paneer, camel milk kheer, camel milk chocolate, camel milk gulab jamun, camel milk barfi, camel milk peda, camel milk sandesh, spray dried camel milk powder, lyophilized skim milk powder and camel milk skin cream.

4. Revival of Gusheel

Gujarat Sheep and Wool Development Corporation Limited (GUSHEEL) encompass all the activities relating to sheep and wool development in Gujarat. It must aim to improve the economic status of Maldhari shepherds through its revival of GUSHEEL in the bordering villages of Kutch.

Conclusion and policy implications

Due to the lack of higher education facilities in the villages, Maldharis in Kutch choose pastoralism due to a lack of resources for skill development and training. The declining population of camels in Kutch is a great concern. Also many young pastorals have left this traditional livelihood and started working in industries, as taxi drivers and daily-wage labour and salt panning workers. But, since, the milk economy has begun through mainstreaming the milk collection through government and private dairies in Kutch, many young pastorals are now starting again keeping some animals and coming back to their traditional livelihood. Maldhari women are widely under-represented in the national map. Though India's expanding livestock business deserves praise, we must also consider inclusivity.

The recommendations from the study are as follows

1. Training programmes for Maldharis at ICAR research institutes such as NRC (Bikaner), CIRG (Mathura) and CSWRI (Avikanagar).
2. Need to form producer companies for goat and sheep milk with aid from Nabard.
3. Fodder cultivation programmers through smart dairying.
4. Sustainable market linkage in the far flung border villages in Kutch.
5. Popularization and brand marketing of milk of small ruminants and camels and the value added products and protection by IPR.
6. Making use of camel dung as organic fertilizer.
7. Restoration of Maldhari artwork, handicraft and textiles by Maldhari women.
8. Sale of sheep wool and goat hair/fur through revival of Gusheel.
9. Initiatives for change in policies conducive to the livelihood of Maldharis.
10. Conservation of soil/water/fodder resources.
11. Need to evolve high-yielding and drought-resistant crop/fodder varieties.
12. Proper breeding policy for small ruminants with respect to Kutch.

13. Evolving and implementation of adaptive measures for climate change.
14. Price policy for animal products made by Maldharis.
15. Extension of climate resilient technologies in Kutch.
16. Academicians and scholars need to acknowledge and recognize Maldharis for their traditional knowledge and protect by IPR.

References

1. A report on the workshop on "Climate change and ensuring the sustainable livelihood of Maldharis through dairying' organized in IRMA on 23 September, 2022. <https://www.irma.ac.in/centres-of-excellence-units/verghese-kurien-centre-of-excellence-vkcoe/news/1096>
2. Bio-Cultural Community Protocol of the Pastoralist Community of Vagad (Kutch). MARAG.
3. JB Prajapati and Smruti Smita Mohapatra. मालधारी समुदाय की आजीविका बचाना जलवायुसमेत कई संकटोंका समाधान. Rural Dialouge. Rural Voice; c2023. <https://www.ruralvoice.in/rural-dialogue/pastoralism-a-clarion-call-to-save-the-maldhari-livelihood.html>
4. JB Prajapati and Smruti Smita Mohapatra. Pastoralism: A clarion call to save the Maldhari livelihood. Rural Connect. Rural Voice; c2023.
5. <https://eng.ruralvoice.in/rural-connect/pastoralism-a-clarion-call-to-save-the-maldhari-livelihood.html>
6. Smruti Smita Mohapatra, Joydip Mukherjee, Mukesh Kumar Bharti, Manish Kumar and Thulasiraman Parkunan. Effect of global climate change on livestock production and mitigation strategies to decelerate climate change: A Review. International Journal of Current Microbiology and Applied Sciences. 2022;11(1):34-45. DOI: <https://doi.org/10.20546/ijemas.2022.1101.006>
7. Smruti Smita Mohapatra, Cynthia de Xavier Carvalho. Nalsarvar: The Lake of opportunity for Maldhari pastoralists. Field Journal. Village Square India; c2023. <https://www.villagesquare.in/gujarat-lake-nalsarvar-sustains-the-maldhari-pastoralists/>
8. 20th Livestock census, DAHD, India. <https://www.villagesquare.in/amul-works-to-protect-the-endangered-kharai-camel/>
9. Mohapatra SS, Momin IA, Prajapati JB, Patel D. Mitigation strategies against detrimental effects of climate change on animal health of Maldharis in Kutch, 3rd Annual Convention of Veterinary Internal and Preventive Medicine Society and National Symposium on Pragmatic Approaches for Animal Health and Welfare in Present Perspective of Climate Change; c2022 Oct 7-8. p. 294.
10. Prajapati JB. Let us be inclusive of Maldhari communities as dairy farmers. VKCoE column, Indian Dairyman, October 2022 edition. p. 55.
11. Smruti Smita Mohapatra, Cynthia de Xavier Carvalho. *Prosopis* species: A potential animal forage for livestock of Maldhari tribe in Nalsarvar. International Conference on Contemporary Multidisciplinary issues in Applied Sciences, Humanities, Agriculture, Animal Health & Production (ASHAA-2022), BHU; c2022 Nov 15.

12. Smruti Smita Mohapatra, Cynthia Carvalho. *Prosopis* spp: A potential dewormer for livestock of Maldharis in Nalsarovar. 31st National congress of veterinary parasitology and national symposium on “Green Management of Animal Parasites to Enhance Livestock Production, Livelihood and One Health. OUAT, Bhubaneswar; c2022 Dec 6-8.
13. Smruti Smita Mohapatra, Inayathaidar Abidali Momin, Jashbhai Prajapati. Climate-based migration for a sustainable livelihood by Maldharis of Kutch. 2nd Annual International Conference on Internal Migrants in the Cities: Entangled lives. IIMAD and IIT, Hyderabad; c 2022 Dec.
14. Smruti Smita Mohapatra, Inayathaidar Abidali Momin, Jashbhai Prajapati, Darshan Patel. Ethnoveterinary practices: A case study on Traditional Healthy Remedy amongst pastoralists in Kutch. 49th Dairy Industry Conference, Gandhinagar Souvenir. March 2023;214:16-18.