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Occupational structure and determinants of household income of pastoralists in *Banni* grasslands of Gujarat

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ABSTRACT

Migratory pastoralism is the traditional occupation of pastoralists (*Maldharis*) for more than 500 years and agriculture is not practised in entire *Banni* grasslands. The present study was conducted in *Banni* grasslands between 2014 and 2017 covering 280 households from 12 villages to investigate the livelihood and income dynamics. *Banni* buffalo based pastoralism and *Prosopis juliflora* based charcoal production were the primary occupations for 70 and 20% households respectively. Charcoal production was the predominant secondary occupation for 60% households. Sheep and goat rearing, handicrafts production, services and trade were the primary occupations for 2–3% households each. At least three livelihood options contributed to annual income of households. Contribution of primary occupation to annual income ranged from 38 to 93% whereas secondary occupation(s) contributed 0.3 to 42%. The analysis revealed that families owning >40 buffaloes were the richest group with net annual income of ₹ 12,07,429, followed by the households owning 21–40 animals with an average income of ₹ 6,94,008 and those engaged in trade with net income of ₹ 6,68,254. Households engaged in charcoal production and services earned net annual income of ₹ 65,059/ and ₹ 66,288/ respectively and were the poorest groups as majority of them did not own buffaloes and cattle. Those engaged in service sector were either in unorganized sector or were unskilled and semi-skilled labourers. Factors such as ownership of livestock (*Banni* buffalo and Kankrej cattle) and herd size; market access to milk collection centre and its distance from the village; and income from sale of milk and milk products, livestock (buffalo, cattle and camel), charcoal, embroidery, tourism and trade contributed significantly to the net annual income of households. Income earned from labour and sale of minor forest produce (honey and gum) were low and nonsignificant. Scientific management of rapidly expanding *P. juliflora* is crucial for conservation of *Banni* ecology and improving livelihoods. Establishment of milk collection centres in interior villages would contribute significantly in increasing incomes (upto ₹ 35,920/buffalo/lactation) of pastoralists.

Key words: *Banni* grassland, Gujarat, Income, Livelihood, *Maldharis*, Pastoralist

Banni grassland in Bhuj taluka in Kachchh district of Gujarat in India is spread in about 2600 sq km area and is the largest natural tropical semi-arid grassland in Indian subcontinent (*Banni* 2018, RAMBLE 2018). *Banni* region is a vast salt affected plain and experiences arid climate. It receives an average annual rainfall of 317 mm through southwest monsoon spread between June to September. Recurrent droughts (to the extent of 3 years drought out of every five year cycle) are a common phenomenon in *Banni* and Kachchh region.

Banni area comprises 48 hamlets/villages organized into 19 Panchayats with a population of approximately 21,338 people in 2011–12 (Directorate of Animal Husbandry 2016).

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The nomadic pastoralist communities are generally known as *Maldharis*, comprising of 22 ethnic communities.

Maldharis are landless and dependent on *gauchars* (village commons) for their livestock rearing. *Banni/Kundi* buffaloes, Kankrej cattle, *Pathanwadi* and *Duma/Marwari* sheep, *Kachchhi* goat, *Kachchhi* and *Tari* camel and *Sindhi* horse are the domesticated animals. Livestock rearing is the traditional occupation and was the predominant source of income for pastoralists. However, significant changes have occurred in *Banni* after independence such as declaration of *Banni* as Protected Forest, lack of community grazing rights of *Maldharis* over *Banni*, invasiveness of *P. juliflora*, shift in livestock composition (from cattle to buffalo), improved road connectivity and gradual establishment of organized dairy industry (Table 1). These changes have affected the livelihood structure and income of pastoralists in a significant way. Questions such as What are the predominant sources of livelihood for pastoralists in *Banni* grasslands at present?; What is the nature and extent of integration of different livelihoods for income

security?; What factors affect the income of households in *Banni*?; What are the options to enhance the incomes of pastoralists in *Banni*? are important to be addressed in the present context wherein the focus of the present government has shifted from increase in productivity to doubling/ enhancing farmers' income (Chand Ramesh 2017). The specific objectives of this research were to delineate the occupational structure of pastoralists in *Banni* grasslands, estimate the annual income of pastoralist households in *Banni* grasslands; and identify the factors contributing to annual income of households in *Banni* grasslands.

MATERIALS AND METHODS

Research design: An *ex-post facto* and survey research design were adopted for the study.

Locale of the study, sample and sampling procedure: Banni grasslands located in Bhuj taluka in Kachchh district of Gujarat was purposively selected. There are 48 villages in *Banni* area. Twelve villages were selected for the study using stratified sampling technique to represent different parts of *Banni*. A sample of 280 households from these 12 villages was randomly selected for the study. Focussed group discussions were held with key pastoralists in each village and other stakeholders such as representatives of *Banni* region (*Banni* Breeders Association), researchers and NGOs (Gujarat Institute of Desert Ecology (GUIDE), SAHJEEVAN, Research And Monitoring in the *Banni* Landscape (RAMBLE), Ashoka Trust for Research in Ecology and the Environment (ATREE)) working on *Banni* grasslands to validate the primary data collected from pastoralists.

Table 1. Demographic and livestock population in study villages in *Banni* area (2012)

Village	Number of households	Human population	Livestock population			
			Buffaloes	Cattle	Goat	Sheep
Dhordo	80	500	850	30	40	50
Hodko	304	1909	2828	834	85	219
Patgar	50	450	200	15	20	90
Uddo	25	200	300	25	0	0
Varli	25	260	20	0	60	0
Sadai	178	1052	1252	1273	140	152
Burkhal	60	600	500	10	10	90
Mehar Aliwand	25	180	350	30	20	0
Madhav-nagar	56	260	0	0	6	0
Udai	154	806	3615	25	210	64
Sargu Nava	62	349	933	444	114	109
Bhiran-diyara	592	2917	8040	3442	1469	747
Total	1611	9483	18888	6128	2174	1521
Composition in study villages (%)			65.79	21.34	7.57	5.30
Composition in entire *Banni* (48 villages) (%)		71.58	15.61	6.94	5.88	

Data pertaining to Hodko, Sadai, Udai, Sargu Nava and Bhirandiyara panchayats collected from Directorate of Animal Husbandry. Data pertaining to other villages were collected by the researchers from respective panchayats during data collection in 2016.

Data collection tools and analysis: A structured interview schedule was developed specifically for the study. The primary data were collected by personally interviewing 280 households between July 2014 and June 2017. Annual incomes were calculated for the agricultural year 2016–17 based on the prices prevailing in *Banni* grasslands in April 2017. The respondent households were classified into various categories based on the combination of primary and secondary occupations contributing to family annual income. Multiple regression analysis was employed to find out the factors (18 independent variables) significantly contributing for net annual income (dependent variable) of households.

RESULTS AND DISCUSSION

The human and livestock population in study villages in *Banni* grasslands is provided in Table 1. Buffaloes constituted 66% of livestock whereas cattle contributed 23%. Sheep and goat together constituted 13% livestock.

Livelihood opportunities at village level: The livelihood options in *Banni* grasslands at village level are presented in Table 2. Rearing of *Banni* buffaloes was the primary occupation for majority of the pastoralists in ten villages and *Prosopis juliflora* based charcoal production was the primary occupation in two villages. Charcoal production was the predominant secondary occupation in 10 villages. Other secondary occupations were goat and sheep rearing, production and sale of handicrafts (embroidery, leather work and wood work), non-agriculture labour work such as Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) and tourism.

Occupational structure of pastoralist households: The households were grouped into various categories based on the combination of different primary and secondary occupations contributing to annual family income (Table 3).

At least three livelihood options contributed to the annual income of households in *Banni* region. Banni buffalo rearing was the primary occupation for approximately 70% households, whereas sheep and goat rearing accounted for only 3% households. Buffalo rearing included domestication of buffaloes for production and sale of milk and milk products; and sale of milch buffaloes. Breeding of pure *Banni* buffaloes was a highly skilled enterprise and generally families who owned large buffalo herd were involved in it. Pastoralists shared that pure *Banni* breed buffalo cost anywhere between ₹ 40,000/ to ₹ 1,50,000/ animal depending on its parentage, age, milk productivity and other characteristics. Pastoralists owning large buffalo herd sold few milch buffaloes every year. Pastoralists owning few buffaloes sold buffaloes whenever they needed cash money for meeting expenses for social ceremonies

Table 2. Source of livelihood opportunities in *Banni* grasslands at village level (N=280)

Village	Primary occupation	Secondary occupation 1	Secondary occupation 2
Dhordo	Buffalo rearing	Handicrafts (Embroidery)/Tourism	Services, Charcoal production
Hodko	Buffalo rearing	Leather work/Embroidery	Tourism/Charcoal production
Patgar	Buffalo rearing	Charcoal production/Services	Handicrafts (Embroidery)/Tourism
Uddo	Buffalo rearing	Handicrafts (Embroidery)	Charcoal production/Labour
Varli	Charcoal production	Labour work	Goat rearing
Sadai	Buffalo rearing	Charcoal production	Labour (migration/agriculture)
Burkhal	Buffalo rearing	Charcoal production	Sheep and goat rearing
Mehar Aliwand	Buffalo rearing	Charcoal production	Sheep and goat rearing
Madhavnagar	Charcoal production	Labour work	Honey/gum collection
Udai	Buffalo rearing	Charcoal production	Sheep and goat rearing
Sargu Nava	Buffalo rearing	Charcoal production	Sheep and goat rearing
Bhirandiyara	Buffalo rearing	Charcoal production	Sheep and goat rearing

Table 3. Occupational structure of pastoralist households in *Banni* grassland (N=280)

Category	Primary occupation	Secondary occupation 1	Secondary occupation 2	Number of households	% Households
I	Buffalo rearing				
IA	> 40 animals	Charcoal production	Tourism/Embroidery	8	2.9
IB	21–40 animals	Charcoal production	Embroidery/Tourism	20	7.1
IC	11–20 animals	Charcoal production	Embroidery/Leather work	56	20.0
ID	6–10 animals	Charcoal production	Embroidery/Leather work	70	25.0
IE	< 6 animals	Charcoal production	Embroidery/Leather work	42	15.0
II	Charcoal production	Labour work (including migration)	Goat rearing/embroidery	56	20.0
III	Sheep and goat rearing	Charcoal production	Labour work (including migration)	8	2.9
IV	Handicrafts (leather work)	Charcoal production	Embroidery	8	2.9
V	Services	Charcoal production	Embroidery	6	2.1
VI	Other (trade, etc.)	Labour work	Charcoal production	6	2.1
Total				280	100

such as marriage, construction of new house and emergencies. There was decline in number of animals owned by each household over generations. Households (60%) owned less than 20 buffaloes and 40% households owned less than 10 buffaloes. Few households in each village owned 2 to 3 cows. The number of households who exclusively owned cows in large numbers was rare (< 2%). Pastoralists shared that number of Kankrej cows in each household was higher than *Banni* buffaloes till 1960's. Since then, there was a gradual shift towards buffalo based pastoralism.

Prosopis juliflora based charcoal production was the primary occupation for 20% households. Generally, these households were poor and did not own any buffaloes or cows. Few of these households owned one or two buffaloes only to meet domestic requirements of milk and milk products. Charcoal production was secondary occupation for 80% households during drought/low rainfall years and off (non-rainy) season. Embroidery work is a traditional occupation in all households of *Banni* region and women in each family spent 3 to 4 h a day in this activity. However, it was an economic activity only in certain villages such as Dhordo, Hodko, Patgar and Uddo. These villages are well connected by road to Bhuj city and some NGOs are working in these villages that supply raw materials and collect finished products at pre-agreed prices. Village Jura had 25 families which were completely involved in production and sale of copper bells. Other occupations in *Banni* region included services and tourism. A marine chemicals manufacturing company, Agrocell, was established in salt desert adjacent to *Banni* region in 1994 and approximately 250 persons from nearby villages in *Banni* region have been employed. Gujarat government organizes Rann Utsav from November to March every year in white desert since 2006. Consequently, villages adjacent to this desert have been benefitted by the tourism. Certain pastoralists have established resorts/villas for tourists and many others have found employment in tourism related activities during these months (Manjunatha 2015).

Household annual income: Family income of 280 households was calculated for the agricultural year 2016–17. Actual prices prevailing in *Banni* area during April 2017 were used for calculating costs and returns. The net annual income for different categories of pastoralists is provided in Table 4.

The economically richest group in *Banni* included

Table 4. Net annual income (₹) for different categories of pastoralists in *Banni* grassland

Category	Primary Occupation	Mean	Standard Deviation	Standard Error	Range	Minimum	Maximum
I	Buffalo rearing						
IA	> 40 animals	1,207,429	584,026	100,114	170,5100	229,500	1934,600
IB	21–40 animals	694,008	213,197	27,072	739,400	344,400	1083,800
IC	11–20 animals	375,127	86,090	13,608	251,840	207,040	458,880
ID	6–10 animals	245,809	5,792	1,665	11,090	239,760	250,850
IE	<6 animals	123,005	25,616	7,364	49,050	100,710	149,760
II	Charcoal production	65,059	24,089	2,710	93,900	26,600	120,500
III	Sheep and goat rearing	109,275	17,722	5,861	42,000	90,000	132,000
IV	Handicrafts (leather)	215,282	40,463	11,632	77,480	173,020	250,500
V	Services	66,288	13,463	3,870	25,780	54,570	80,350
VI	Other (trade, etc.)	668,254	338,259	79,590	751,610	354,750	1106,360
	Total	433,118	446,757		1908,000	26,600	1934,600

Table 5. Factors contributing for net annual income of households in *Banni* grasslands

Independent variable	Coefficients	Standard Error	t value	P value
Number of working adults in the family	49.317	153.803	0.321[#]	0.745
Number of buffaloes owned	1,627.789	496.531	3.278**	0.002
Number of cattle owned	198.666	65.674	3.025**	0.003
Number of sheep and goat owned	138.205	90.329	1.530[#]	0.125
Number of camels owned	800.239	1,452.352	0.551[NS]	0.576
Number of enterprises	170.823	520.975	0.328[#]	0.739
Distance from milk collection centre	1.020	0.018	55.724**	0.000
Income from sale of milk and milk products	0.946	0.021	46.048**	0.000
Income from sale of livestock (buffaloes, cattle, bullocks and camels)	0.829	0.055	15.076**	0.000
Income from sale of sheep, goat and their products	1.005	0.094	10.665**	0.000
Income from sale of charcoal	0.998	0.030	32.795**	0.000
Income from labour work	1.185	0.764	1.551[#]	0.120
Income from embroidery	1.064	0.224	4.755**	0.000
Income from leather work	0.962	0.038	25.306**	0.000
Income from sale of honey and gum	0.209	3.288	0.064[#]	0.948
Income from services	1.354	0.090	15.005**	0.000
Income from tourism	1.002	0.014	73.484**	0.000
Income from trade	–1.016	0.015	–66.416**	0.000
Constant	–2,792.484			

**Significant at 1% probability under both multiple and simple linear regression analysis; [#]Non-significant under multiple linear regression analysis but significant at 1% probability under simple linear regression analysis; [NS]Non-significant under both multiple and simple linear regression analysis.

households owning >40 buffaloes. Some of these households were also the largest beneficiaries of the tourism industry promoted by Gujarat government. The net incomes decreased with decrease in number of buffaloes owned. The economically poorest group in *Banni* grasslands consisted of families whose primary occupation was charcoal production. Majority of these families did not own any livestock at all. Some of the households in this category owned sheep and goat but the share of net income earned from charcoal production was much higher (ranged from 54 to 90%) than the net income generated from sheep and goat rearing (ranged from 10 to 46%). Some families in this category also owned buffaloes but again the share of net income generated from charcoal production was much higher than buffalo rearing (ranged from 15 to 39%). The net income of families whose primary occupation was sheep and goat rearing was equivalent to those families who owned less than six buffaloes. The net income of families engaged in service sector was low because most of them were employed in unorganized sector (drivers) or were unskilled and semi-skilled labourers in factories. The net income of families dependent on handicrafts (mainly leather work) was comparable to net incomes earned by families owning 6 to 10 buffaloes. The net income of households belonging to VI category (mostly tourism and trade) was higher and equivalent to households owning more than 21–40 buffaloes.

The families owning less than six buffaloes were dependent on charcoal production for supplementary income (ranged from 17 to 27%). However, the share of charcoal sale in annual income varied depending on the amount of rainfall received. In normal rainfall years, income

from buffaloes was higher because of availability of grass for longer period in the grasslands for free grazing, lower costs and higher milk production. In case of moderate drought years, the availability of grasses in grasslands is for short duration and farmers have to purchase grasses and concentrates to feed animals. While, the number of people and the duration engaged in charcoal production increased during drought years. During severe drought years, these families sent their buffaloes for migration on contract basis with the families who owned large herds and go out of *Banni* for migration. In these years, family members of these categories become completely dependent on charcoal production as primary occupation whereas labour and MNREGA contribute supplementary incomes.

Factors contributing for annual income: Factors contributing to net annual income were found out using multiple regression analysis (Table 5.) Ownership of buffaloes and cattle and their herd size significantly contributed to annual income of pastoralists. Households (70%) in *Banni* owned buffaloes and each milch animal (irrespective of herd size) contribute significantly to annual income. However, ownership of sheep and goat and camel did not contribute significantly to annual income. The number of households who owned sheep and goat was very low and the herd size was also very low in majority of these families. The number of pastoralists who owned camels was very low (<1%) although the average herd size was very high (93). Number of enterprises did not contribute significantly because all families had at least 2–3 sources of income and the variation in number of enterprises contributing to annual income between households was found to be low. Presence of milk collection centre (MCC) in the village meant that milk was sold at fair and remunerative prices (₹ 35–40/litre) based on the fat content. The absence of MCC in the village forced farmers to transport milk to nearest MCC leading to extra costs or sell their milk to traders/middlemen at very low prices (₹18–20/litre). The distance between village and place of MCC was indirectly correlated with milk prices realized by farmers. Hence, presence of MCC contributed significantly to the annual incomes of pastoralists.

The annual income of pastoralists was contributed by combination of several enterprises. Hence, the significance of contribution of each enterprise to net income was tested. Incomes generated from buffalo rearing, sale of livestock (buffalo, cattle and camel), goat and sheep rearing, charcoal production, embroidery, leather work, services, tourism and trade contributed significantly to net annual incomes. Incomes generated by labour work and sale of minor forest produce (gum and honey) were low and insignificant. The ANOVA indicated that 18 independent variables selected for regression analysis fit very well and explained 99% of the variation in net incomes of pastoralist households.

Simple linear regression analysis was employed to find out the contribution of each independent variable to the dependent variable (net annual income). All 17 independent variables (except number of camels owned by the family) were statistically significant at 1% probability.

Further analysis found that presence of MCC in the village alone contributed up to ₹ 35,920/buffalo/lactation to the net income. However, the presence of MCC was dependent on pucca road connectivity to the village. Hence facilitating establishment of MCCs in interior villages by connecting them with pucca roads would lead to realization of fair and equitable prices for milk and milk products.

The goal set by the Indian Government to double farmers' income by 2022–23 is central to promote farmers' welfare, reduce agrarian distress and bring parity between income of farmers and those working in non-agricultural professions (Ramesh Chand 2017). All the State Governments have been requested to prepare strategy for doubling the income of the farmers (MoA 2017) and the report is likely to be released this year (MoA 2018). The Government is realigning its interventions to move from a production-centric to a farmer income-centric approach (MoA 2018).

Scientific management of rapidly expanding *P. juliflora* is crucial for conservation of *Banni* ecology and livelihood sustainability. Several studies have established that *P. juliflora* can be successfully exploited for production of animal feed, fuel and energy (Tewari *et al.* 2011, HDRA 2002). It is recommended based on the study that market access to milk collection centers, scientific management of *P. juliflora* and recognition of community rights of *Maldharis* over *Banni* grasslands are the important issues to be addressed to enhance pastoralists' income. *Banni* grassland has unique ecosystem with rich agro-biodiversity (distinct breeds of all domesticated livestock species), traditional knowledge systems, culture and landscape contributing to food and livelihood security of the pastoralists. *Banni* grassland deserves to be designated as Globally Important Agricultural Heritage System by the FAO of the United Nations.

Decline in demand of Kankrej bullocks for draught purpose, higher milk productivity of *Banni* buffaloes and policy interventions (establishment of dairy units, road and drinking water connectivity) towards establishing organized dairy industry have contributed to rise of buffalo based pastoralism as the primary source of livelihood in *Banni* grasslands. Migratory pastoralism is being gradually replaced by semi-migratory and sedentary pastoralism. *P. juliflora* has spread from 315 km^2 in 1960's to 1500 km^2 in 2010 in *Banni*. Exploitation of *P. juliflora* for charcoal production was an adaptation strategy to mitigate the impact of droughts. It was the predominant secondary occupation for poor *Maldharis* who did not own buffaloes and cattle. However, charcoal production was not sustainable from socio-cultural (shift from centuries' old traditional occupation), economic (lower incomes compared to pastoralism) and ecological (invading grasslands, reduction in biodiversity, causing pollution) perspective. Hence, scientific management of *P. juliflora* is crucial for conservation of ecology and improving livelihoods. *Banni* grassland was declared as Protected Forest in 1955.

Maldharis do not have either individual/private land rights or legally sanctioned community grazing rights over *Banni*. It is recommended based on the study that recognition of *Maldharis*' community grazing rights over *Banni* grasslands, establishment of milk collection centers in interior villages and scientific management of *P. juliflora* are the important issues to be addressed that would contribute significantly to livelihood and income security of *Maldharis*. *Banni* grassland with unique ecosystem, rich agro-biodiversity, traditional knowledge systems, culture and landscape contributing to food and livelihood security of the pastoralists deserves to be designated as Globally Important Agricultural Heritage System by the FAO of the United Nations.

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