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Resource utilization pattern with special reference to Fuel and Fodder in village Chak Chua, Jammu, J & K, India

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Abstract

A study of traditional agro-ecosystem conducted to understand status of resources utilization pattern with special reference to fuel and fodder in village Chak Chua, Jammu, J&K. The major fuel types fulfilling the energy demand of local people in study area were wood, kerosene, LPG and dung cake. LPG constituted the major share of consumption which is 7.6x 10^5 kcal/month while dung cake consumption was found least. The common fodder type used were green fodder, top feeds, crop residues and tree leaves. The crop residues consumption was found to be highest i.e., 14.50 kg/day/family while top feed was least consumed i.e., 1.74 kg/day/family. The total fuel consumption in study area was found to be 18.2 x10^5 kcal/month. The study also takes in to account the socio-economic status, bovine population and various environmental problems associated with them.

Keywords: Consumption pattern, socio-economic status, livestock, fuel and fodder.

Introduction

Environment is the basic livelihood and development condition and material foundation for human[1]. Growing population and technological advancement are continuously putting a strain on the environment and on country's natural resources. Overexploitation of the resources like land, water, fuel etc. has resulted in degradation of resources[2]. Sustainable utilization of natural resources is a complex issue that encompasses societal needs, ethical and cultural values, and economic status of communities[3]. Hence, it is utmost important to conserve and promote the natural resources and environment.

Fodder and fuel wood are the two most important livelihood resources for mountainous regions, of the Himalayas[4]. Fodder plays a critical role in the crop, livestock, manure and soil nutrient cycle in traditional farms in the mountains of the Himalaya. Collection of fodder is the first step that turns the wheel of the agricultural economy of the village community[5]. This complex interrelationship between forests, grasslands, livestock and crops in mountain farming systems has contributed to the sustainability of mountain agriculture for generations[6]. Excessive use of firewood as a primary source of energy for domestic purposes is leading to severe deforestation in the Himalayan region[7]. The rural population in India relies heavily on traditional biomasss based fuels such as fuelwood, crop residue, and animal dung for meeting the energy needs efficiencies[8]. As per the results of household consumer expenditure survey conducted by National Sample Survey Organization in the year 2007-8, over 77 percent of household in rural area of country continued to depend on fuelwood, 7 percent use dung cake and only 9 percent use LPG. In urban India, 62 percent of household use LPG as major fuel for cooking and 20 percent use fuelwood. However, disparities in household energy use exist between rural and urban population and also between high and low income group[9].

In Jammu and Kashmir various socio-economic factors affecting fuel consumption. Family size and livestock have negative association with fuelwood consumption whereas land holding, number of trees and annual income have positive association with fuelwood consumption[10]. Jammu and Kashmir have also been facing problems of inadequate fodder to sustain large livestock population. Available natural fodder resources from forest, orchids and pastures on hilly slopes are in excess over fodder requirement, for sustaining the state livestock population, yet the productivity of ruminants in state is below the national average[11]. However, information is still scarce, especially with regard to energy supply in the rural domestic sector of Jammu and Kashmir State, because energy planning prioritizes commercial energy which is consumed in the industrial and agricultural sectors. Fuel and fodder crisis in the state has long been debated as it is seen a widening gap between increasing demand and decreasing supply due to diminishing resources. Thus there is need to devise the way and evolve strategies and solutions to prevent large scale resource depletion which will definitely going to have negative effect on the process aimed at achieving sustainable development. Keeping this in view, present study was conducted with the objectives to study socio-economic status, fuel and fodder consumption pattern, factors affecting its utilization along with various associated environmental problems.

Study area: The study area i.e., village 'Chak Chua' lies in district Jammu of J&K state which is located at 32˚ 36' North latitude and 74˚ 54' East longitude at an altitude of 300m above

mean sea level. The village is 11.7 Km away from the district Jammu. Climate of the study area is humid subtropical and during summer temperature can reach up to 40^0C whilst in July and August, heavy rainfall occurs with monthly extremes of up to 50mm. In September, rainfalls declines, and by October conditions are extremely dry with minimal rainfall and temperatures of around 29^0C. The area is plain and rain fed and depends partially on rainwater for irrigation because most of the water is received from perennial streams. The whole area is irrigated by the perennial streams with the help of canals to the adjoining agricultural fields. The population of the area meets its fodder and fuel wood requirements mainly by lopping and cutting of trees from the agricultural fields and homestead areas. Besides fuel wood, other fuels used include LPG and kerosene.

Material and Methods

For the collection of relevant data, a detailed questionnaire was prepared involving the various aspects such as demographic status of area, types of occupation, land use pattern, details of bovine population, infrastructural facilities and resources endowments. Sources and other details of fuel and fodder collection, utilization, quantity and types of fuel consumed along with other miscellaneous information were also collected. The survey has been conducted in 30 percent of the houses on random basis from centre of the village to the periphery to obtain the real pattern of information. The survey of demographic status of the study area involved the use of adult units i.e., one man =1 adult unit, one women=0.8 adult unit and one child=0.5 adult unit so as to find out the average size of family[12].

For calculating the landholding the units used were, one kanal =1/8 Acre, and one hectare=2.471 Acres. All kinds of livestock in the sample household were converted into cow units using equality coefficients i.e., 1 cow unit for one cow, 1.5 cow units for one buffalo, 0.15 cow unit for one goat/sheep and 1.5 cow unit for one bullock[13]. Units used for quantity of animal droppings were 15 kg/day, 10 kg/day and 02 kg/day for bullock/buffalo/he-buffalo, cow and sheep/goat, respectively[14]. Energy units used for different fuel types were, one kilogram of firewood=4000 k.cal, one kilogram dung cake=2400 k.cal, one kilogram crop residue=3200 k.cal, one kilogram of LPG=10800 k.cal and one liter kerosene=7900 k.cal[15]. Similarly, for collection of the relevant information regarding fuel wood and fodder the season of the year has also been taken in to consideration e.g., during winter fuel wood requirements is more and during rainy/spring season, large quantity of various types of fodder is available for the cattle. The survey has also been conducted in the areas bordering the agricultural land to study the dependency of local population on it.

Results and Discussion

Energy resource is one of the fundamental factors in the functioning of any civilized society needed to improve better life style and socio-economic development of the country[16]. Socio-economic profile of an area is largely determined by energy consumption by people as most highly developed nations have high per capita consumption of energy[16]. Per capita consumption of energy in India is low and most of its population which belongs to rural sector depends upon fuelwood as an energy source[17]. An exploratory study was carried out at household level to find out the annual income, land holdings, cow units per household, dung produced per household, literacy status, infra-structural facilities, state of awareness about various aspects, fuel and fodder consumption pattern with its environmental impacts interrelating socio-economic and demographic factors.

Socio-economic status: Population of the study area was classified into different land holding categories viz. marginal, small, medium and large. The study was conducted in terms of percentage representation of families, their share in total land holding and pattern of land use are represented in table 1. According to observations highest representation of families was from large (60%) followed by small (26.66%) and medium (13.33%). No family falls under the category of marginal land holding. The percentage share in total land holding was found to be highest among large LHC (43.47%), followed by medium LHC (30.43%) and small LHC (26.08%). The families having joint status and large number of members of family were found to be the main reasons behind large LHC having highest representation in total land holding. The share of irrigated land was found to be highest in large LHC (79.33%) and lowest among medium LHC (66.56) and share of un-irrigated land was found to be highest in medium LHC (33.44%) and lowest among large LHC (20.67%). The highest share of irrigated land in large LHC is due to their joint status and availability of large number of family members for carrying out farming practices and even higher economic status for employing agriculture labour while highest share of un-irrigated land was found among medium LHC because of nuclear families status as people were more employed in other professions to sustain living**.** Similar results were obtained by Mathur (2012) while studying resource utilization in village Mandhera of district Samba, Jammu and Kashmir[18].

Livestock population of study area comprised mainly of cow, bullock and buffalo with very few sheeps and goats. Their percentage share in total population and total dung produced in terms of Kg/Family/day was calculated on the basis of data provided by Rao (2000)[14]. The highest percentage share among total bovine population was shown by cow (50.79%) and lowest by sheep and goats (7.93%). Our survey to different households revealed that highest amount of dung was produced by cow and lowest by goat/sheep i.e., 16 kg/day/family and 0.50 kg/day/family, respectively (table 2). The highest amount of dung produced by cow, followed by buffalo was probably due to highest share in bovine population. Total dung produced (kg/day/family) was found to be 36 kg. In a similar study, Kumar (2002) also reported highest amount of dung produced

by cow i.e. 30 kg/day/family in Dandesar Village of district Rajouri[19]. However, Mathur (2012) in village Mandhera of district Samba, reported a comparably very low amount of total dung produced *i.e.,* 10kg/day/family with highest amount of dung produced by bullock due to more quantity of daily dropping (15kg) as compare to cow (10 kg)[18].

Fodder consumption pattern: The common fodder types used in the study area were found to be green fodder, top feed, crop residue and tree leaves. The average quantity of different types of fodder day/family required, percentage of their total requirement, source of collection and average distance covered for collection are given in table 3. The crop residue consumption was found to be highest (14.50 Kg/family/day) followed by green fodder (11.43), tree leaves (2.62) and top feeds (1.75). The highest consumption of Crop residue followed by green fodder was also reported by Mathur (2012) in village Mandhera of district Samba[18]. While studying some environmental issues of Dandesar village of Rajouri district with special reference to resource utilization, Kumar (2002) reported the highest consumption of green fodder followed by crop residue of total fodder requirement[19]. It was estimated that major consumption of crop residue and green fodder varies in different season; crop residue dominated during rainy season because of availability of rain water. While studying diversity, distribution and prioritization of fodder species for conservation in Kullu district, Samant *et al.* (2007) reported that in rainy season, mostly grasses and forbs were used as fodder[20]. In general easy availability and less distance to be covered for collection are the reason which can be mentioned for higher consumption of crop residue and green fodder in the study area. However, studies were found inconsistent with studies conducted by Singh *et al.* (1998) on fodder and fuelwood resources of central Himalaya, who found that more than 60 percent of total consumption of fodder was obtained from forests. The least consumption of top feeds was due to the reason than it had to be purchased from the market and was not freely available. The consumption of tree leaves was season dependent as their most frequent consumption was during summer season due to unavailability of other types of fodder.

Table-1
Landuse pattern in study area among different land holding categories

S.No	Land Holding category (LHC[1])	Representation of families (%)	Share of LHC's in total land holding (%)	Pattern of land holding among LHC's (%)	
				IR[2]	NIR[3]
1	Large	60.00	43.47	79.33	20.67
2	Medium	26.66	30.43	66.56	33.44
3	Small	13.33	26.08	74.61	25.31
4	Marginal	-	-	-	-

Table-2
Details of the bovine population in the study area

S.No.	Animal type	Share of bovine population (%)	Amount of dung produced (kg/day/family)
1	Cow	50.79	16.0
2	Bullock	09.52	4.50
3	Buffalo	31.74	15.0
4	He-Buffalo	00.00	00.0
5	Goat/Sheep	07.93	0.50

Table-3
Fodder consumption pattern in the study area

S. No.	Fodder type	Quantity required (day/family/kg)	% of total requirement	Source of collection	Average distance covered for collection(km)
1	Green fodder	11.43	37.73	Agriculture fields	0.5
2	Top feed	01.74	5.740	Market	1.8
3	Crop residue	14.50	47.87	Agriculture fields	0.5
4	Tree leaves	02.62	08.64	Home stead	-

1 LHC: Land Holding Class, 2 IR: Irrigated, 3 NIR: Non-Irrigated

Fuel consumption patterns: The study of fuel consumption pattern was conducted among different land holding categories (LHCs). The major fuel types consumed in the area were wood, kerosene, liquefied petroleum gas (LPG) and dung cake. The percentage utilization of each fuel type among different LHCs is given in table 4. Fuelwood consumption accounted for the highest percentage consumption in large LHCs (38.09%), followed by medium LHCs (33.33%) and small LHCs (28.57%). The consumption of fuelwood was highest in case of large LHC because of easy availability of fuelwood as they hold more share of land in the community. The consumption of LPG was also highest in case of large LHC (46.05%), followed by small LHC (27.63%) and medium LHC (26.31%). This was probably due to their good economic condition, joint family status and preference for easy use of LPG[18]. The lowest consumption of LPG as energy sources was found in medium LHC was because of availability of fuelwood from nearby fields and small number of members per family[21]. The consumption of kerosene and dung cake as energy source was highest in case of large and medium LHC, respectively while Kerosene oil use was lowest in medium LHC. The use of kerosene and dung cake was highest in large LHC which may be due to more number of bovine population in these families. While kerosene consumption was lowest in medium LHC because of their more dependence on wood and LPG as energy source.

According to table 5, the highest consumption of the fuel in the study area was that of LPG (41.75%), followed by kerosene oil (25.82%), wood (23.07%) and Dung cake (9.34%). The highest percentage consumption of LPG was due to the reason that most of families belonged to high income class which can afford LPG and also its easy availability in the nearby town while the lowest consumption of dung cake can be attributed to use of other energy sources and decreasing number of bovine population in the area[18]. However, present studies was found inconsistent with studies conducted by Singh and Sundriyal in Patharkot Village of Almora district of Uttarakhand, where fuelwood was the only form of energy for cooking due to poor economic condition of people and easy availability of firewood from nearby forest[21]. The total fuel consumption in study area was calculated approximately $18.2x10^5$ kcal/month which is very low as reported ($111.49x10^6$ kcal/month) by Kumar in Dandesar village of Rajouri district of Jammu and Kashmir[18].

The impact of size of farmland on the type of biomass use in the area was also studied (figure 1), which revealed that use of fuelwood, kerosene and LPG was highest in large LHC which comes to be 38.09 percent, 46.8 percent and 46.05 percent, respectively. The consumption of fuelwood by medium LHC was 33.33 percent, followed by small LHC (28.57%). The consumption of kerosene and LPG by small LHC was 34.04 percent and 27.63 percent, respectively followed by medium LHC with fuel consumption of 19.14 percent and 26.31 percent. The consumption of dung was found to be highest in medium LHC (47.05%) followed by small LHC (29.42%) and medium LHC (23.52%). On contrary, Kumar (2002) reported 95.85 percent consumption of wood by marginal LHCs, followed by LPG (29.36%), kerosene (25.03%) and dung cake (1.53 %) by large LHCs, medium LHCs and small LHCs, respectively in Dandesar village of Rajouri district, J&K[19].

The preference pattern for different kinds of fuel as energy source of the people of study area was constructed on the basis of energy ladder given by Smith *et al.* (1983) with increase in income/development level[22]. The observation regarding their preference is given in figure 2. The trend signifies that more preference is given to those fuels as energy resource which can be easy to use and require least effort on the part of people to have access to that fuel and high calorific values per unit of given fuel[18,19]. The study is in consistency with results of Heltberg *et al.* (2000) *i.e.,* the more active the village management and development institutions, the more people appear to switch from forest fuelwood and dung cake to LPG[23].

Environmental problems: About half the world's population relies on biomass i.e. wood, agricultural residues and charcoal as the primary source of domestic energy, burning nearly two billion kg of bio-mass everyday in developing countries[24]. The problem of indoor air pollution was aggravated in study area due to burning of fuelwood and crop residue. Use of inefficient methods of burning like use of traditional *chullahs* and use of fuelwood having low calorific values leading to greater generation of smoke and less heat. Combustion of bio-fuels in poorly vented kitchens using poorly functioning stoves lead to the release of very high concentrations of suspended particulate matter and noxious gases[18,25,26]. People of the study area were found to be more inclined towards use of commercial fertilizers rather than on organic farming. This has lead to decreased productivity of the land over time and even crops grown on such soils. It has been reported that fertilizers and pesticides find their way into the food chain and have implications on human health[27].

Table-4
Fuel consumption pattern in the study area

S.No	Landholding category (LHC)[1]	Wood (Kcal/month)	LPG (Kcal/month)	Kerosene oil (Kcal/month)	Dung cake (Kcal/month)
1	Marginal	-	-	-	-
2	Small	$1.2x10^5$ (28.57)*	$2.1x10^5$ (27.63)*	$1.6x10^5$ (34.04)*	$0.5x10^5$ (29.42)*
3	Medium	$1.4x10^5$ (33.33)*	$2.0x10^5$ (26.31)*	$0.9x10^5$ (19.14)*	$0.8x10^5$ (47.05)*
4	Large	$1.6x10^5$ (38.09)*	$3.5x10^5$ (46.05)*	$2.2x10^5$ (46.80)*	$0.4x10^5$ (23.52)*
	Total	**$4.2x10^5$**	**$7.6x10^5$**	**$4.7x10^5$**	**$1.7x10^5$**

Table-5
Fuel requirement in the study area

S.No.	Type of fuel	Total fuel used (kcal/month)	Percentage (%)
1	LPG	$7.6x10^5$	41.75
2	Kerosene	$4.7x10^5$	25.82
3	Wood	$4.2x10^5$	23.07
4	Dung cake	$1.7x10^5$	09.34
	Total	**$18.2x10^5$**	**100**

[1] Marginal <0.1 hectare, Small 0.1-1 hectare, Medium 1-2 hectare, Large > 2

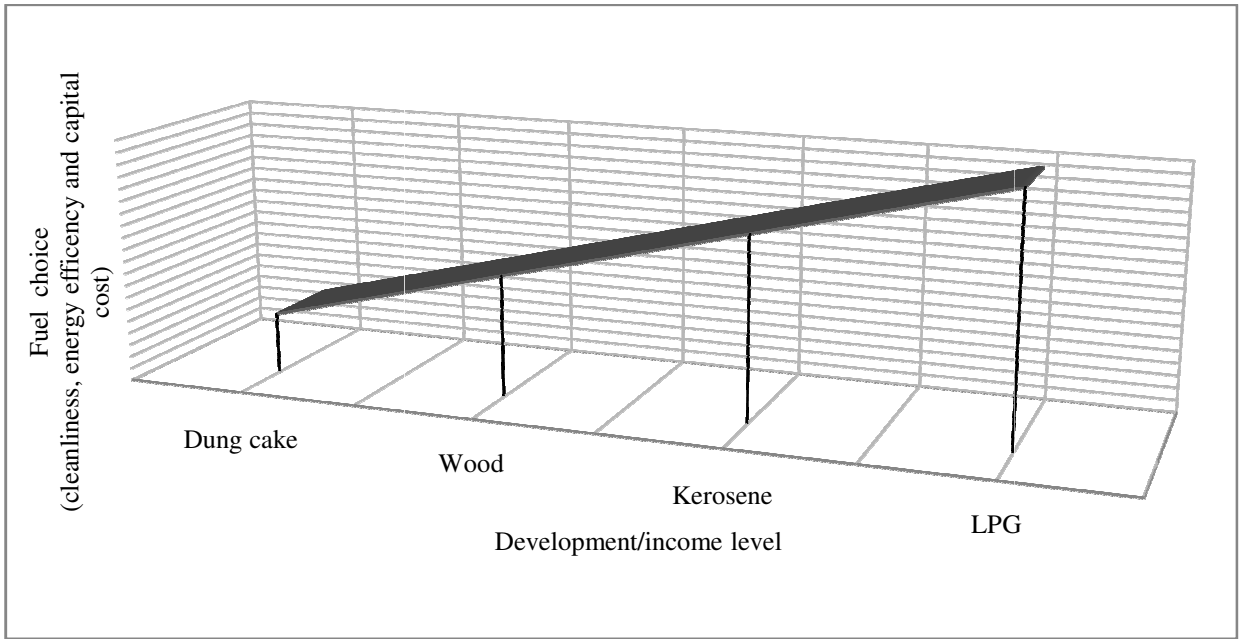

Figure-1
Shift in choice on fuel with increase in income/development level

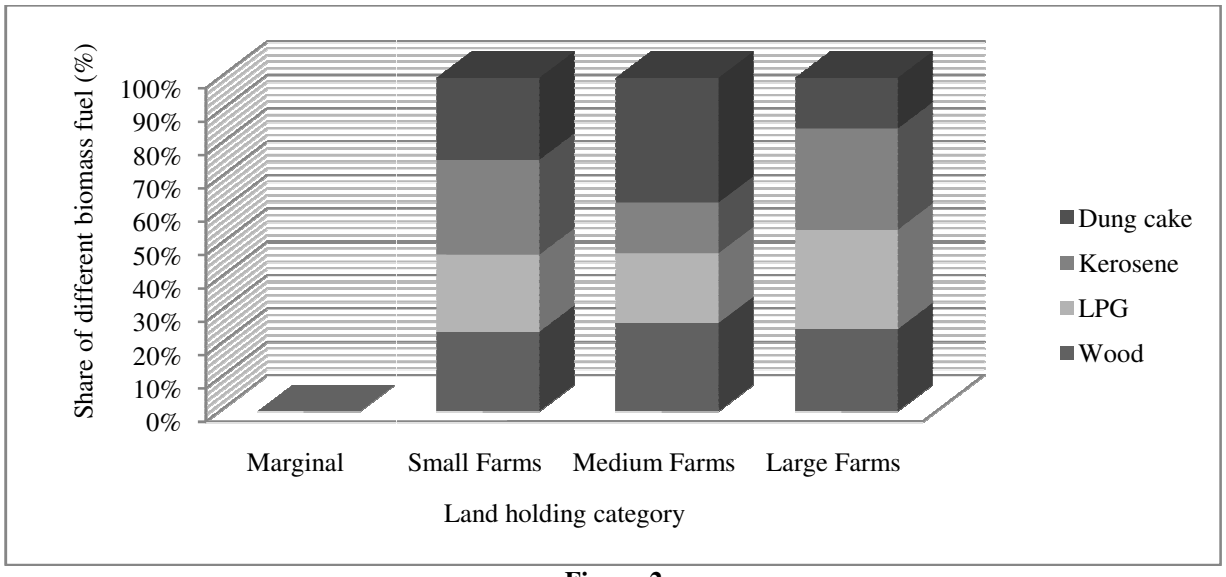

Figure-2
Impact of size of farm land on type of biomass fuel used in study area

Water resources have been contaminated by biological, organic and inorganic pollutants [27]. Water streams which were mostly seasonal in character often suffer water pollution problem as polluted waters from nearby fields enter into these streams. Clean water is not only the basic need of human beings but it also has a great influence on all aspects of human life[28]. Despite the impressive coverage of provision of safe drinking water facilities in the study area, there was considerable gap between infrastructure created and service available at the household level. Drinking water of hand pumps was also used for washing of cloths and other unnecessary uses, this practice often leads to unhygienic condition and depletion of ground water. The condition of most of wells was deteriorated and level of water was also very low and they become non-functional.

Conclusion

People of study area were engaged in agriculture as well as in allied activities but the prime activity of people of area were found to be farming. Infrastructural needs of the area were found well below the desired level. Families belonging to large land holding class was the major consumer of all type of energy resources found in the area while the least consumption of energy resources was found in case of small land holding class. In the study area, LPG and crop residue constituted the major share of fuel consumption and fodder consumption. While the concern regarding the environmental damage was also found low but on positive note, people were found concerned about development works in the area and women education and empowerment was given due importance. Thus, Development of villagers to act in a sustainable manner along with proper education can improve the socioeconomic status of the people and in turn the better awareness about resource utilization.

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