

# The Traditional Sheep Penning System: An Exploratory Study on Farmers' Preferences, Farmer-Pastoralist Relationships and Economics of Sheep Penning in Telangana, India

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## Abstract

Penning of livestock especially in the southern Indian peninsula can be traced back to the Neolithic age. The presence of 'Ashmounds' across most parts of the southern Indian peninsula indicates a complex agro-pastoral economy flourishing since the Neolithic era. Contemporary studies on sheep penning in India, however, remain mainly focused on its contribution to soil fertility and relevance to organic farming and economics, but very few studies have focussed on the farmers' preference for sheep penning, farmer-pastoralist relationships and sheep penning economy in the backdrop of a rapidly changing agriculture landscape in the Telangana state of India. Observations of the study indicate that changes in agricultural practices and decrease in commons have led to changes in the sheep flock size, seasonal migration pattern of pastoralists and farmers' preference for sheep penning in the study area. Participant farmers of the study, who practice both penning and application of synthetic fertilizer, reported to have incurred relatively lesser input costs than the farmers who exclusively rely on synthetic fertilizers. Penning was reported to be the second major source of household income for the pastoralists who participated in the study, next to the sale of live animals.

## Keywords

Penning; Sheep; Pastoralism; Deccan Plateau; Telangana; Exploratory study

## 1. Introduction

India has an estimated 535.78 million livestock population (Government of India, 2019). About 80 per cent of which is reared by the rural and pastoralist communities and maintained under extensive livestock management systems (Phand et al., 2021). Penning of livestock is an ancient and the most common practice in the extensive livestock management and pastoralist systems across the world. Penning of livestock especially in the southern Indian peninsula can be traced back to the southern Indian Neolithic age (Korissettar et al., 2001a; Krishna & Morrison,

2009; Murthy & Sontheimer, 1980; Southworth, 2006). The presence of 'Ashmounds' (the remnants of large mounds or heaps of highly-fired cattle dung) across most parts of the southern peninsula indicate existence of a complex agro-pastoral economy flourishing since the Neolithic era (Allchin & Allchin, 1982; Kennedy, 2000; Korisettar et al., 2001b; Morrison, 2007; Murthy & Sontheimer, 1980).

The study by Sekhar (2015) indicates that during the pre-colonial period, despite the availability of permanent village pastures, livestock (cattle and sheep) were regularly driven inside forests for fodder and water, especially during the periods of scarcity. However, dung was never collected from forests, which was the possible reason for improved soil fertility of forests in the region. The pens/corrals were known as *patti* in the regional Tamil language. They were called either as "*maattupatti* (or) *thondupatti*"<sup>1</sup> based on the type of livestock enclosed in the penn/corral. There is also a frequent reference to *patti* in the old Tamil literature (Sekhar, 2015). However, scholars have a divided opinion about the specific relevance of heaping and burning such large piles of dung, as it holds both social and ritual importance (Johansen, 2003; Allchin, 1963) as well as the utilitarian economic value (Paddayya, 1992, 1974).

A few significant geo-ethno-archaeological studies in Africa have shed many interesting insights on the ecological functions of ancient penning sites of pastoralists (Eguez et al., 2017). A study by Marshall et al. (2018) suggests that African grasslands have been enriched, restructured and diversified by the penning and herding activities of the pastoralist communities of Africa. The study by Donihue (2013) on Savannas of Kenya found relatively larger and fast growing trees and higher densities of *Lygodactylus keniensis*, a native gecko species at the edges of glades, suggesting that dung deposits of the ancient penning sites of pastoralists could be the reason behind the presence of large, fast growing trees and higher densities of geckos at the edges of the glades.

Sheep is one of the earliest domesticated animals (Daly et al., 2021; Nomura et al., 2013) and nomadic sheep rearing till today remains one of the dominant ways of rearing. Traditionally, sheep rearing was the primary occupation of a few specific pastoralist communities of the sub-continent (Somvanshi, 2006). The *Dhangars* of Maharashtra, *Kuruma* of Andhra Pradesh and Telangana, *Kuruba* of Karnataka (of the Deccan Plateau region) (Aerukala, 2020; Murthy & Sontheimer, 1980), the *Konar* of Tamil Nadu, the *Bakarwals* of Jammu and Kashmir, the *Gaddis*, *Kanets*, *Kaulis* and *Kinnauras* of Himachal Pradesh, the *Bhotias* of Uttarakhand, the *Raikas* of Gujarat and Rajasthan are particularly associated with sheep and goat rearing in India and are well known for sharing an intricate socio-cultural, religious, spiritual, and economic relationship with them (Koller-Rollefson, 1994; Patil, 2009; Sharma et al., 2003).

Livestock in India produces more than 2600 million tons of dung per year (Kaur et al., 2017). Penning of sheep and other livestock provides a regular supply of dung that is used for manure, fuel and building material (Portillo et al., 2015) and also has cultural and ritualistic significance (Notermans, 2019; Udayavani, 2020; Vedas Resources, 2012). However, contemporary studies on sheep penning in India remain mainly focused on its contribution to soil fertility and relevance to organic farming (Nandhini & Suganthi, 2018; Sriveda & Srihitha, 2020) and economy (Kolay, 2007; Shivkumara & Kiran, 2019); but very few studies have focused on the farmers' preference for sheep penning, farmer-pastoralist relationships and sheep penning economy in the backdrop of the rapidly changing agriculture landscapes in India in general and Telangana in particular.

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<sup>1</sup>. Cattle/buffalo are called *Mattu*, and livestock is called *Thondu*, in Tamil, the regional Language mainly spoken in the Indian state of Tamil Nadu.

The Telangana Socio Economic Outlook report of Government of Telangana (2022) suggests that the overall gross irrigated area in the state has increased by 119% (6.2 million acres in 2014 to 13.6 million acres in 2020), since bifurcation of the state from the former undivided Andhra Pradesh in 2014. The state also moved away from cultivation of the traditional dryland food crops of pulses and millets, and adopted cultivation based on more water intensive paddy (increase by 378%) and synthetic fertilizer intensive commercial crops of cotton (increase by 61%) (Government of Telangana, 2022). Sheep pastoralists do not prefer to graze their flocks among damp and inundated farmlands as sheep have evolved in dry and arid conditions and naturally averse to dampness.

Telangana is now the second largest producer of cotton and paddy in India (Government of Telangana, 2022). It was assumed that the changing agriculture landscapes and shift in crop choices may have some impact on the farmers' preference for sheep penning, farmer-pastoralist relationships and sheep penning economy in Telangana. In this background, an exploratory study was commissioned by Sahjeevan - Center for Pastoralism (Cfp)<sup>2</sup> during 2019-20 to examine farmers' preference for sheep penning, farmer-pastoralist relationships and economics of sheep penning tradition in Telangana state (part of the Deccan plateau region of India).

## 2. Methodology

The study adopted an exploratory study design (Fusch et al., 2017) for scientific inquiry. Adopting the exploratory study design was appropriate for the present study for the following reasons. There were a lot of ambiguity surrounding farmer-pastoralist relationships, negotiations, and economics of sheep penning in Telangana due to lack of similar detailed studies. The objective of the study was to discover new findings and ideas for further research (Kurt et al., 2011). Furthermore, the finances were extremely meagre, and the study coincided with the outbreak of the COVID-19 pandemic in the study area, which greatly limited the sample size and rigour of investigation.

The study area is geographically located in the Telangana state situated in the semi-arid Deccan plateau region of India. It experiences a hot and dry tropical weather. Based on the weather and climatology and soils, the state is broadly divided into three major agro-climatic zones – the Northern Telangana Zone (NTZ), the Central Telangana Zone (CTZ), and the Southern Telangana Zone (STZ) (TSDPS & DES, 2021).

The NTZ comprises of 10 districts, the CTZ comprises of 12 districts and the STZ comprises of 11 districts. Two agro-climatic zones and one district from each agro-climatic zone were selected following the random sampling technique (Bartlett II et al., 2001; Bryman, 2012). Kamareddy district represents the NTZ and Vikarabad district represents the STZ of the state. Both the study districts represent different agro-ecological zones with different precipitation rates, soil and crop profiles and densities of sheep population. It was assumed that such diversity would provide an opportunity to investigate the soil fertility management practices and penning choices of farmers of the study area.

Criterion sampling, a variant of the purposive sampling technique (Cresswell, 2013), was adopted for selection of research participants. Pastoralists involved in mobile sheep pastoralism, and two types of farmers were considered as research participants – farmers who prefer for both penning and synthetic fertilizers and farmers who prefer only synthetic fertilizers for improving soil fertility.

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<sup>2</sup> Sahjeevan is a grassroots organisation based in Bhuj, Gujrat, India. 'Sah' means together and 'Jeevan' is living, implying harmonious-living. The organization envisions a world where pastoral communities will continue their traditional livelihoods living in harmony with nature. The Centre for Pastoralism is an initiative of Sahjeevan, with an objective to promote understanding of Indian pastoralism through action-research and advocacy.

Data was gathered by conducting personal interviews and focus group discussions (FGDs) (Mukherjee, 2003). As a protocol of an exploratory study, it is necessary to learn from the communities themselves. In an exploratory study, data collection is a kind of learning process than collection of evidence for predetermined set of questions. Therefore, a semi-structured questionnaire with predominantly open-ended questions was used for data collection (Fusch et al., 2017). Data was collected through personal interviews and focus group discussions (FGDs) while strictly adhering to the COVID-19 protocols issued by the Government of India during the pandemic. Data was mixed but predominantly qualitative in nature, consisting of anecdotes, personal stories and experiences of farmers and pastoralists.

A two phase data collection strategy was adopted to ensure data saturation (Francis et al., 2010). The two phase sampling strategy comprises of an 'initial analysis sample' and 'stopping criterion' (Francis et al., 2010) to achieve data saturation. The assumption was that data saturation occurs when no new information emerges from the research subjects. As assumed, data related to farmer-pastoralist interpersonal relationships, price negotiations related to penning, farmers' crop choices and soil management practices reached saturation with the initial analysis sample of 24 respondents and further new information hardly emerged thereafter.

Qualitative data collected through interviews and FGDs was transcribed. Transcripts were subjected to inductive coding to initiate the coding process (Leech & Onwuegbuzie, 2007). Codes such as mode of communication between pastoralists and farmers, choice of farms for penning, terms and conditions for penning, and change in interpersonal relationships have emerged naturally from the data itself (Leech & Onwuegbuzie, 2007; Fereday & Muir-Cochrane, 2006). Report was developed by collating the coded information found to be common among the transcripts. Quantitative data related to the size of land, size of sheep flock, fee paid for penning, amount of fertilizer used is analyzed using cross-tabulation for descriptive purposes (Miles et al., 2019).

### 3. Results

#### 3.1. Profiles of the Pastoralists and Farmers of the Study

The sheep pastoralists of the study predominantly belong to the Kuruma community (known also as Dhangar in Maharashtra and Kuruba in Karnataka). The other community found to have been engaged in sheep pastoralism is Yerra Golla (a sub-set of the Golla/Yadava community). Both the communities belong to the other backward caste<sup>3</sup> (OBC) category (Table 1). The average age of the participating pastoralists in the study is 43.5 years. The average duration for which they were involved in pastoralism is 24.5 years. Literacy rate among the pastoralists participated in the study was only 35.7% with 64.3% illiterates. Nuclear family is the common family structure among the study participants with the average family size of 4 persons.

Table 1: Details of the Communities Involved in Sheep Pastoralism

<i>Name of the Pastoralist Community</i>	<i>Community Category</i>	<i>Number of Households (n = 14)</i>	<i>Percentage of Households</i>
Kuruma	OBC	10	71.4
Yerra Golla	OBC	4	28.6

<sup>3</sup> [https://en.wikipedia.org/wiki/Other\\_Backward\\_Class](https://en.wikipedia.org/wiki/Other_Backward_Class)

Participant farmers of the study belong to the small and medium landholder category. The average age of the participant farmers is 43.8 years. The average number of years they are involved in farming is 18.4 years. Participant farmers of the study belong to Kuruma, Telugu Mudiraj Matsya and Yerra Golla communities belonging to the other backward castes (OBC) and Reddy community belongs to the general category (GN) (Table 2).

Table 2: Details of the Communities Involved in Agriculture

<i>Name of the Community</i>	<i>Category of the Community</i>	<i>Number of Households (n = 10)</i>	<i>Percentage of Households</i>
Kuruma	OBC	2	20
Reddy	GN	3	30
Telugu Mudiraj Matsya	OBC	3	30
Yerra Golla	OBC	2	20

Similar to pastoralists, farmers of the study also have nuclear families and the average size of the family is 4 members. Only 40% of the farmers are found to have primary level education with 60% illiterates. The average landholding size (own land) of the studies farmers is 7.4 acres. However, it was found that there is a difference in the average landholding size (own land) of farmers who are practicing both penning and chemical fertilizers and farmers who are using only chemical fertilizers to maintain soil health and enhance productivity.

The average landholding (own land) of the participant farmers who are practicing both penning and chemical fertilizers is 9.3 acres (rainfed 7 acres and irrigated 2.3 acres). The average landholding (own land) of farmers applying only chemical fertilizers is 4.5 acres (rainfed 3.5 acres and 1 acre irrigated). In addition to the own land, farmers relying exclusively on chemical fertilizers were found to lease-in land and the average size of lease-in land is 4.2 acres (rainfed) (Table 3). The crops cultivated by the participant farmers was found to be quite narrow and the major crops reported were paddy, pigeon pea, cotton, sugarcane and peanut.

Table 3: Profiles of the Pastoralists and Farmers of the Study

<i>S.No.</i>	<i>Variables</i>	<i>Pastoralists (n = 14)</i>	<i>Farmers (Penning and Chemical Fertilizers), (n = 6)</i>	<i>Farmers (Only Chemical Fertilizers), (n = 4)</i>
1.	Primary occupation	Sheep pastoralism	Rainfed agriculture	Rainfed agriculture
2.	Average age	43.5	42.6	43
3.	Average years involved	24.5	17.6	19.5
4.	% with primary education	35.7	50	25
5.	Average family size	4	4	4
6.	Average size of own flock (sheep)	139	0	0
7.	Average size of own land holding (in ac)	2.5	9.3	4.5
8.	Average size of lease in land (in ac)	1	0	4.2

Although results of the present study allude to a positive correlation between the small landholding size and exclusive use of chemical fertilizers (Figure 1), but observations of the present study remain inconclusive for two reasons: extremely small dataset and the lack of detailed inquiry in that direction. Further, studies on the

relationship between farm size and the use of chemical fertilizers or adoption of organic agriculture practices also remain inconclusive.

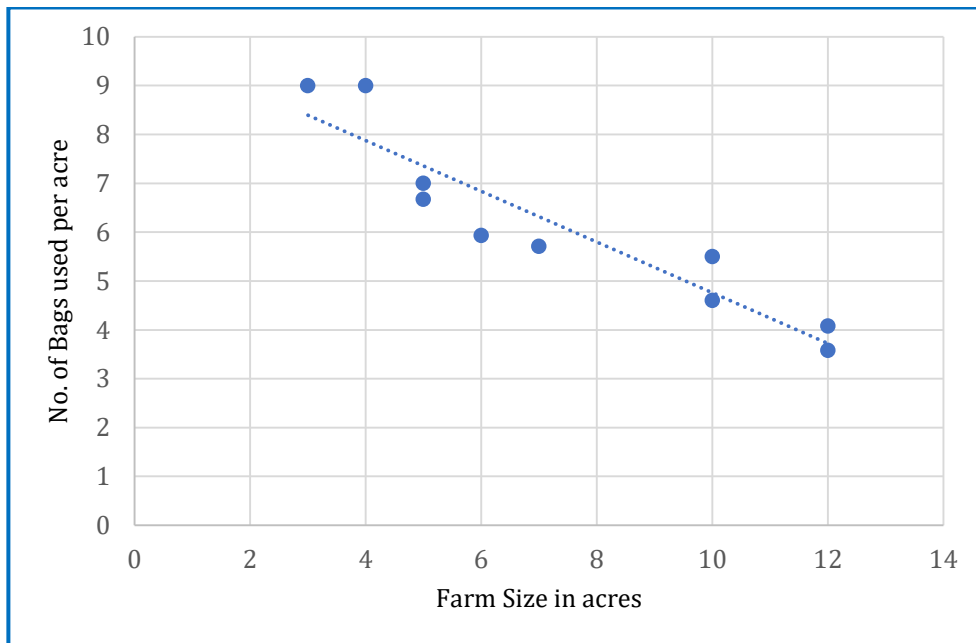


Figure 1: The Correlations Between the Land Size and Number of Synthetic Fertilizer Bags Used Per acre

### 3.2. The Major Livestock Species found in Sheep Pastoralism

The major livestock species maintained by pastoralists under the study is sheep. The average flock size of sheep of the study is 139 animals. The pastoralists also keep a few goats among the sheep and the average number of goats kept in the flock is 8 animals. Pastoralists under the study have reported to leave a few sheep (usually sick/injured) back home and the average number of such sheep is 28. Pastoralists under the study also lease in sheep from neighbours/others of their native villages and the average number of such lease in sheep is 21. The owners of such sheep pay an agreed amount (cash and kind) to pastoralists for taking care of their sheep.

Poultry also forms an important part of the livestock kept by the pastoralists under the study and the average number of chicken maintained by pastoralists is 8 birds. Traditionally, dogs have always been associated with pastoralism and enjoy a very special place in the culture and traditions of the Kuruma community. They are kept for herding and guarding the livestock and also as a regular companion to humans. The average number of dogs kept by pastoralists under the study is 2. In addition, pastoralists were also found to keeping a few other livestock, usually pony/bullock kept as pack animals and the average number of such other livestock is 2.

Earlier (some 25–30 years ago), the average size of the sheep flock was 312 animals (55.4% larger than the present flock size). Traditionally, other livestock of goats, poultry, pack animals and dogs have been a part of sheep pastoralism in the study area. Like today, goats were kept among sheep earlier too and the average number of goats was 42 animals (81% more animals than the present number). Chicken were kept earlier too and the average number of chicken was 13 birds (33% more birds than present). The average number of sheep herding/guardian dogs kept earlier was 2. The average number of other livestock kept for pack animals earlier was 3. Similar to today, sheep were leased in earlier too and the average number of sheep leased in was 40 (46.2% higher than present) and the average number of goats leased in earlier was 14.

### 3.3. Seasonal Migration Patterns and the Penning Season

The inception of seasonal migration in the study area is usually during the month of November–January. However, pastoralists often linger around their native villages till the end of November and leave for seasonal migration during the month of December–January. It was observed that pastoralists of the two study districts prefer different routes of seasonal migration. For instance, pastoralists of Vikarabad district migrate south-west towards Sedam in Karnataka, about 100 km from their native villages. Pastoralists of Kamareddy district tend to migrate north-west towards Nanded in Maharashtra, about 200 km from their native villages.

The penning season in the study area usually commences during the month of December–January and concludes during the month of April–June. The average duration of penning season during the year 2020 was 106.8 days (3.5 months) and the average number of days spent on penning at each farm was 5.2 days.

A sheep flock is referred to as *gumpu* or *manda* in Telugu, the regional language of the study area. It was reported that two to three pastoralists, usually of the same village, come together to form a group, which is called locally as “*Melam*”. A *Melam* consists of both pastoralists and their livestock. They stick together throughout the migration season – they graze, pen, cook and eat together. The few main reasons for pastoralists coming together to form *Melam* are – security during migration, sharing of labour (usually one of them goes out in search of potential farms for grazing and penning), and to increase the size of the flock as farmers in the study area usually prefer to pen a flock having more than 500 sheep. Further, pastoralists (both sheep and cattle) of the study area usually hire one or two labourers for taking care of the livestock (Siripurapu et al., 2020; Siripurapu, 2021).

### 3.4. Hiring of Penning Services in the Study Area

The average number of farmers hiring penning services was observed to have been increasing steadily over the past five years in Telangana study area. For instance, the average number of farmers hiring penning services in the year 2019 was 43.7 (68% increase) compared to 26 number of farmers hired the same in the year 2016 (Figure 2). The year 2020 has shown a 66% dip in the number of farmers hiring penning services in the study area and it can be attributed to the COVID – 19 induced lockdown (Siripurapu, 2021).

Farmers in the study area pay both in cash and kind (food grains) to pastoralists in return for penning at their farms. The average penning fee per night collected from farmers was INR 985.7 (USD 9.55) for an average flock size of 600-800 sheep during the year 2020. On an average, pastoralists in the study area charge INR 1.5–2 per sheep for penning per night. Author’s personal observations of penning economy of cattle pastoralists in four districts of Kamareddy, Nagarkurnool, Nizamabad and Rajanna-sircilla of Telangana also indicate that cattle pastoralists charge between INR 8-10 per animal per night for penning (Siripurapu et al., 2020). It was observed that there has been a steady increase in the average penning fee per night in the study area. For instance, the average fees collected from farmers for penning a flock of the size between 600-800 sheep per night during the year 2016 and 2020 were INR 535.7 (USD 6.51) and INR 985.7 (USD 9.55), respectively (Figure 3). There has been 84% increase in the average penning fee per night from the year 2016 to 2020. As per the response of the participant farmers and pastoralists, one of the major drivers behind the increase in penning fee is the increase in the demand for organic farm inputs and agriculture area and the decrease in number of households rearing livestock (both large and small ruminants). However, further in-depth studies are required to ascertain this.

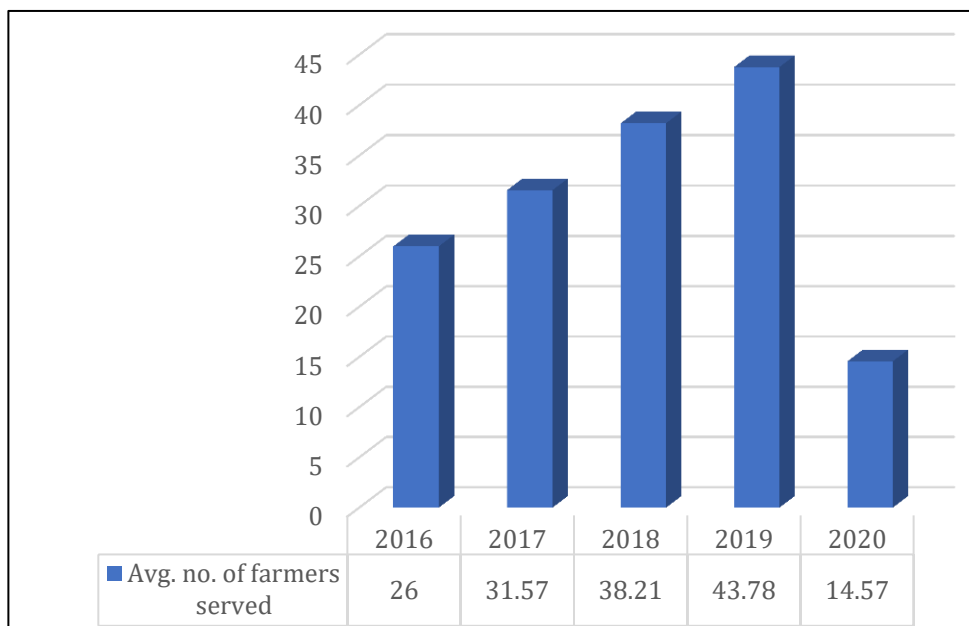


Figure 2: The Average Number of Farmers Hiring Penning Services for the Past Five Years in the Study Area

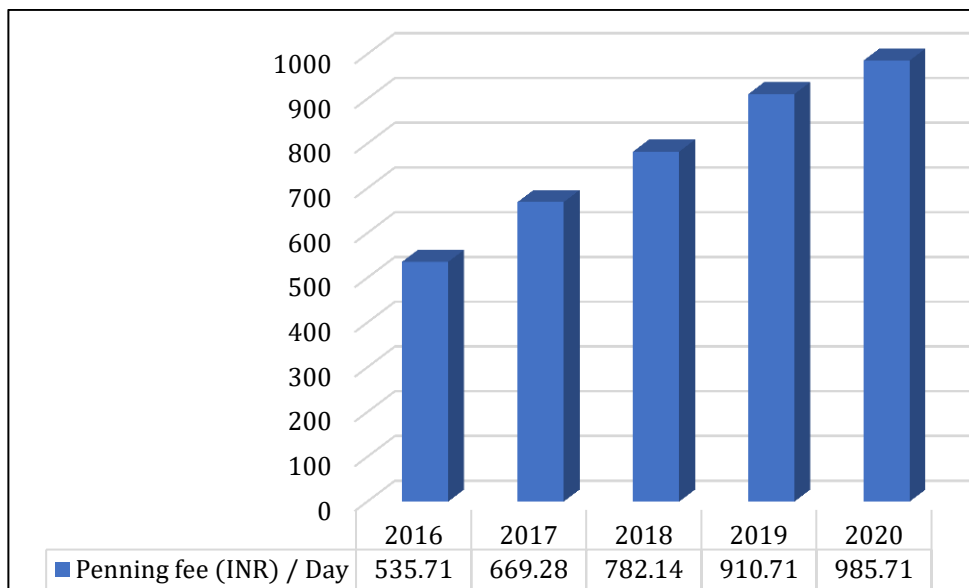


Figure 3: Sheep Penning Fee (INR) /night in the Study Area

Payment in kind (known locally as *Bettam*) by farmers to pastoralists in the study area includes 5-8 kg of food grains (usually rice). Traditionally, food grains were paid in kind to both the pastoralists and their guarding dogs. It was reported that during the period 2016 – 2019 pastoralists were paid mainly 5-6 kg of rice in kind, and only 7% of the respondents have reported to also have received vegetables during 2016 - 2019. However, there is not only an increase in the amount of rice (5-8 kg) but even vegetables (100% HHs) have made their way into *bettam* since the year 2020. It was reported that farmers in the study area have started vegetable cultivation on small-scale on a few decimals of land for domestic consumption, since the advent of borewells at individual farms. Farmers usually share a few vegetables from their gardens with pastoralists as a part of *bettam*. However, it is unclear whether COVID-19 induced lockdown has played any role in the inclusion of vegetables in *bettam* during the year 2020.



### 3.5. Contribution of Penning to the Pastoralist Household Income

Pastoralism is the mainstay of pastoralists of the study area. The household (HH) income of pastoralists is derived from multiple sources that include the sale of livestock, penning, sale of dung, agriculture and others (usually wage labour and occasional sale of small quantities of wool and wool-based products). The mainstay of pastoralist HH income however is the sale of livestock. The average annual pastoralist HH income from the sale of livestock in the year 2020 was INR 199,143 (USD 2,420). It was observed that the average annual HH income from penning in the year 2020 was INR 99,357 (USD 1,207), accounting to the second major source of the pastoralist HH income in the study area (Figure 4).

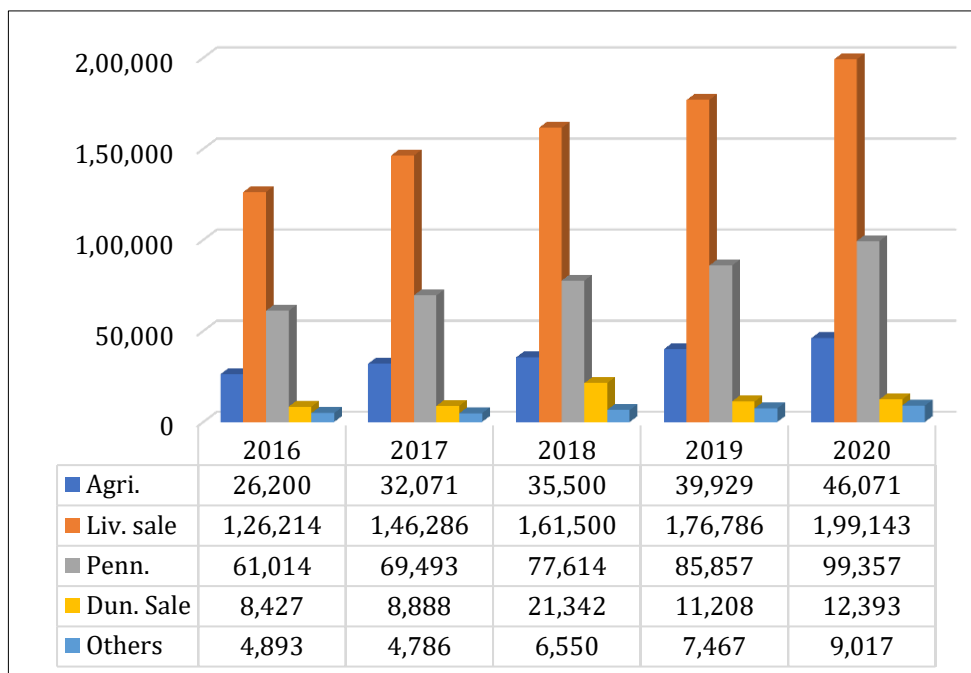


Figure 4: The Different Sources of Annual Pastoralist Household Income in the Study Area

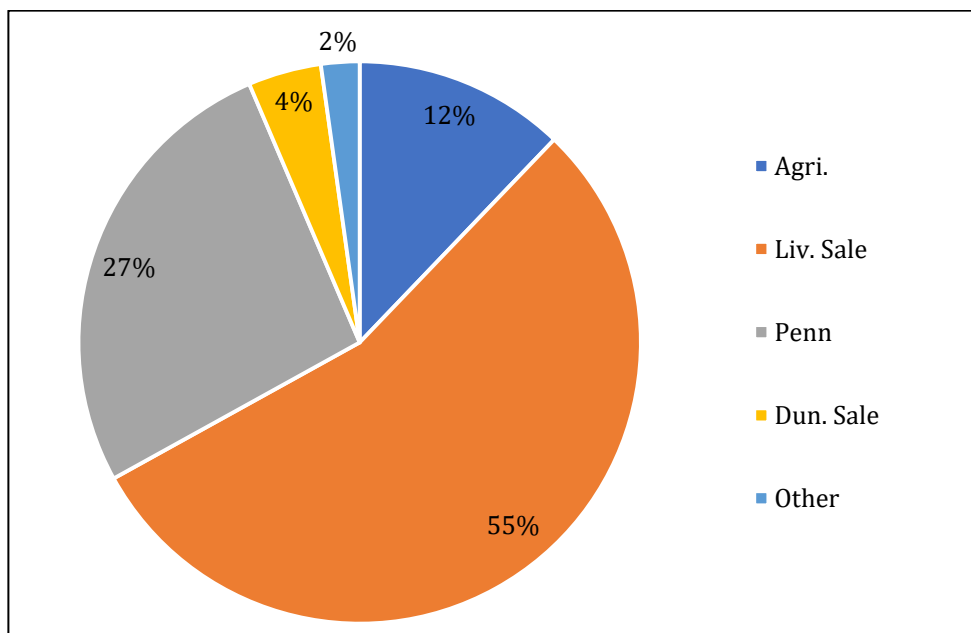


Figure 5: The Share (in %) of Sources of Income of Pastoralist Households in the Study Area (Year 2020)

It was observed that the percentage share of penning, sale of dung and other sources of pastoralist’s annual HH income remains fairly static in the financial year 2016 and 2020. However, a slight (1%) variation was observed in the percentage of share of pastoralist annual HH income from agriculture and livestock. The percentage share of annual HH income from agriculture has increased by 1% and the percentage share of livestock of the HH income has decreased by 1% during the period 2016 – 2020 (Figure 6).

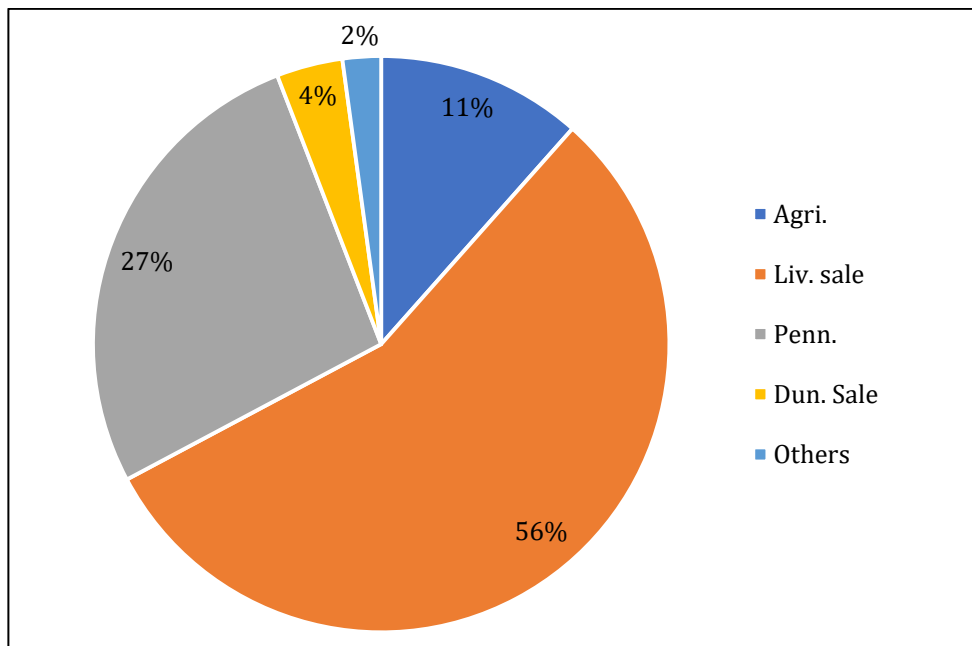


Figure 6: The Share (in %) of Sources of Income of Pastoralist Households in the Study Area (Year 2016)

### 3.6. Investment of Farmers on Penning in the Study Area

On an average, farmers have been practicing in penning for 20 years in the study area. Farmers of the study area have reported that pastoralists charge anywhere between INR 500 (USD 6.08) and INR 1,450 (USD 17.62) for penning for a night. On an average, a farmer pays INR 850 (USD 10.33) for penning for a night. Farmers in the study area usually prefer a flock with more than 500 sheep and an ideal flock should have anywhere between 600 and 800 sheep. The average number of days farmers hire penning services is 5.2 days; however, a few farmers would not mind having the flocks at their farms for a bit longer.

The average investment on penning per acre is INR 2,465 (USD 29.96) in the study area. However, penning is usually practiced in a three year cycle, which means, farmers would invite flocks for penning on the same piece of land only once in three years. Farmers reported that approximately 60% of farmers of the studied villages apply chemical fertilizers as well as practice penning to maintain soil health and enhance yields. It was also reported that approximately 40% of farmers of the studied villages almost exclusively rely on chemical fertilizers for the same. It was found that farmers of Vikarabad district seem to have a strong preference for sheep penning while the farmers of Kamareddy district have shown interest in both penning the cattle and sheep.

### 3.7. The Impact of Penning on the use of Chemical Fertilizers in the Study Area

Observations of the study indicate that the average amount (in INR) spent per acre on chemical fertilizers by farmers practicing penning and applying chemical fertilizers is

relatively lower (47.6%) than the average amount spent by farmers applying only chemical fertilizers (Figure 7). While the average amount spent on chemical fertilizers per acre by farmers practicing penning and applying chemical fertilizers and farmers using only chemical fertilizers in the year 2020 was found to be INR 4,900 (USD 59.55) and INR 7,472 (USD 90.81), respectively. It was however, observed that there is no significant difference in the amount spent on application of pesticides between both the groups. The amount spent per acre on pesticides by farmers practicing penning and applying chemical fertilizers and farmers using only chemical fertilizers in the year 2020 were found to be INR 1,352 (USD 16.43) and INR 1,340 (USD 16.29), respectively. Farmers who practice penning have reported that dung and urine deposited by sheep (or cattle) enriches soil fertility (Immanuel et al., 2010). The fertility of the soil treated with penning usually lasts for three years (or three cropping seasons), because of which the need for application of chemical fertilizers decreases considerably. Farmers in the study area usually treat a piece of land with dung or penning once in three years (or three cropping seasons) to maintain soil fertility.

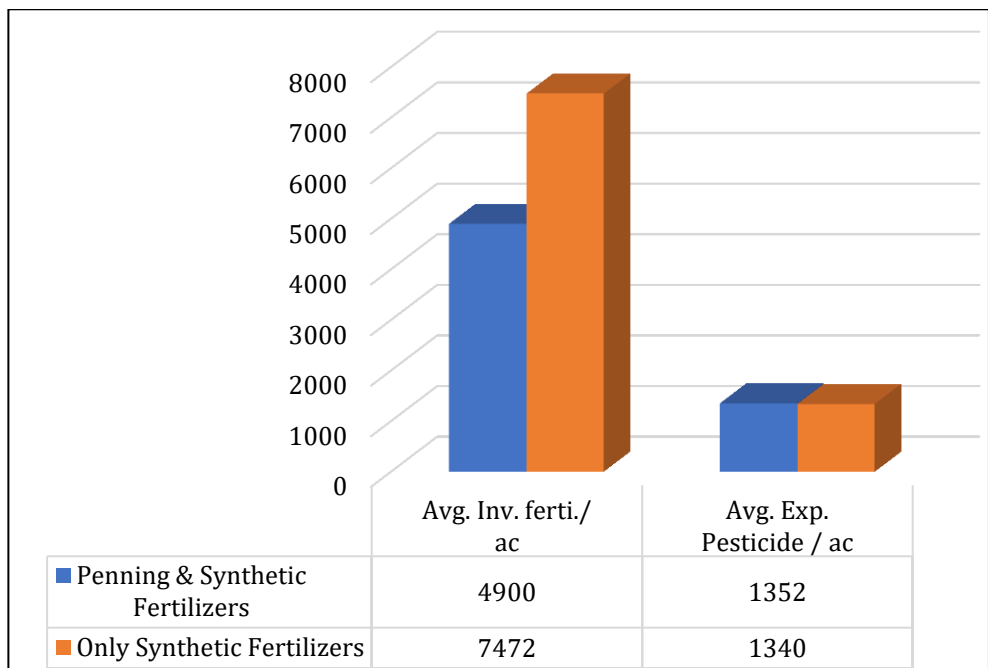


Figure 7: Difference in the Amount Spent (in INR)/per acre on Synthetic Fertilizers and Pesticides by Farmers Practicing Penning and Synthetic Fertilizers and Farmers Applying only Synthetic Fertilizers in the FY 2020

It was evident from observations of the study that both the groups of farmers use chemical fertilizers and pesticides for maintenance of soil health and control pests and diseases. It was however noticed that the average number of bags of urea + DAP (di-ammonium phosphate) used by both the groups vary. Farmers practicing penning and applying chemical fertilizers seem to be applying 60% less number of bags when compared with the farmers using only chemical fertilizers. The average number of bags of chemical fertilizers per acre by farmers practicing penning and applying chemical fertilizers and farmers using only chemical fertilizers in the year 2020 was found to be 5 and 8, respectively (Figure 8).

### 3.8. Communication between Farmers and Pastoralists over Penning

Usually, one of the members of the pastoralist group (*Melam*) or a family member goes out in search of potential farms for grazing and penning. Likewise, farmers also go out in search of pastoralists and invite them to stop by their farmlands for

penning. Farmers and pastoralists keep in touch and communicate with each other over the phone or social networks. It was found that farmers and pastoralists of the study area are acquainted with each other for over 20 years, on an average.

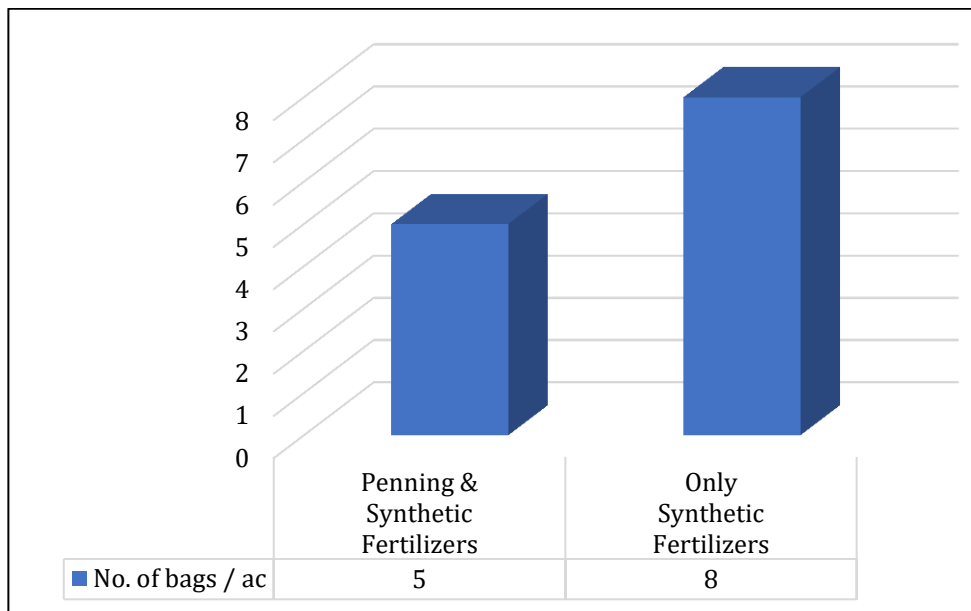


Figure 8: Difference in the No. of Bags (Urea + DAP) used per acre by Farmers Practicing Penning and Synthetic Fertilizers and Farmers Applying only Synthetic Fertilizers

### 3.9. Criteria used by Pastoralists for Choosing a Farm for Penning

It was noticed that pastoralists use an elaborate set of criteria for choosing a potential farm for penning. The criteria used by pastoralists include availability of sufficient fodder and water for their livestock, potential duration of their stay at a farm, existing crops both at the farm chosen for penning and the adjacent farms, character of the farmer and their history of payment for penning, safety of the livestock, presence and convenience of route that they may use for onward journey, safety of the route, and presence of other flocks along the way on the onward journey to avoid any potential competition or conflict among the pastoralists.

### 3.10. Terms and Conditions of Pastoralists to Penn at a Farm

Pastoralists under the study have reported to have a few unwritten terms and conditions for penning at a farm. They would confirm the number of days of stay at a farm and the amount paid by a farmer for penning for a night. They would confirm whether a farmer expects a goat/sheep ram in exchange to allow grazing and staying at a farm. They would also consider the availability of enough fodder and water for the flock. Usually nothing takes place in written form and pastoralists often get into oral agreement with farmers in the presence of a third person (mediator/witness). The oral agreements over penning include payments in cash and kind from farmers and donation of a lamb (goat or sheep) to farmers by the pastoralists.

### 3.11. Terms and Conditions of Farmers to Allow Penning at Their Farms

Farmers in the study area decide the penning fee based on the size of the flock/herd. Farmers usually prefer a flock having about 600 – 800 sheep and do not find a flock with less than 500 sheep desirable for penning. In case of cattle, farmers prefer a herd with 200-400 cattle heads. The average cycle of penning at the farm in the study area is 3 years. In addition, farmers of the study area often lay down a few conditions to allow flocks for grazing and penning at their farms. Pastoralists are asked to prevent

their flocks from going astray and raid crops on their own farm or the neighbouring farms. Pastoralists are asked to take their flocks for drinking water at water bodies of the village without letting out their livestock into farms along the route and prevent any potential crop raiding. Pastoralists are asked to use water from the bore-well and straw heaps at a farm judiciously. Pastoralists are asked not to cut or pollard trees at the farm or neighbouring farms to feed their flocks. Farmers often make it clear that in case of any crop raiding by the flock, either on own farm or neighbouring farms, the compensation will be borne by the pastoralists.

### 3.12. Changes in Interpersonal Relationships and Terms and Conditions over Time

The changes in cropping pattern, increase in area under agriculture, and decrease of commons, among others have brought quite a few changes not only in the livestock population and seasonal migration, but also in the interpersonal relationships between farmers and pastoralists in the study area. It was said that the area under cultivation has increased and livestock has decreased in the study area. This shift has led to farmers actively pursuing pastoralists to pen at their farms in exchange for money.

Unlike earlier, pastoralists are now migrating further away from their native villages and relatively spending very little time at each farm, leading to disruption of long-term relationships that they have enjoyed traditionally. Penning has now become more of a commercial activity than a co-dependent relationship. Earlier, money was not a part of the penning tradition, but now it has turned into a major income generation activity for pastoralists of the study area. Agreements over payment or exchange of livestock are made first before entering a farm for grazing or penning.

Earlier, pastoralists used to give a goat or sheep ram voluntarily as a present on family functions and festivals of landowners but such practices have now become a part of the formal agreements of grazing and penning. Pastoralists have started procuring fodder from market in case of need, a practice which was uncommon earlier.

## 4. Discussion

Factors influencing farmers' fertilizer input behaviour with regards to farmers' own characteristics, land size, land tenure, education, gender, neighbouring effect, resource endowment, cropping structure, among others, have been discussed extensively in the existing literature (Brunelle et al., 2015; Takeshima & Liverpool-Tasie, 2015; Takeshima et al., 2017; Yanggen et al., 1998). Most studies on land size suggest that the intensity of chemical fertilizer application decreases as land size increases without any impact on the yield, as large-scale farms are more likely to substitute advanced farm machinery and agricultural technologies for chemical fertilizer use (Ju et al., 2016). However, Aryal et al. (2021) in the study on the factors affecting farmers' use of organic and inorganic fertilizers across the Indo-Gangetic Plains in India, Nepal, and Bangladesh found that large farm size is positively associated with the amount of application of both urea and DAP in paddy cultivation. The study suggests that wealthier households (HHs) and HHs with more livestock in all study locations, except the Indian state of Haryana, were found to apply more of the same. The same study also found that the likelihood of application of manure has increased with the increase in land size, but the rate of application was inversely related.

Similar to observations of the present study, a study by Rapsomanikis (2015) in Kenya found that small landholding farmers use seeds and chemical fertilizers more intensively than large landholder farmers. Wu et al. (2021a) in the study on farmers of Northern China found that the deviation from optimal use of chemical fertilizers of

small-scale farmers is significantly higher than that of the large-scale farmers. The general notion is that small farmers are usually resource poor, therefore, cannot afford to buy sufficient amount of chemical fertilizers, and also more likely to apply less or an unbalanced use of chemical fertilizers (Singh et al., 2014). However, studies have also found that chemical fertilizer use efficiency is inversely proportional to farm size i.e., the smaller the farm size, the higher the fertilizer use efficiency (Hu et al., 2019).

Wu et al. (2021b) in the study on the impact of land transfer on the intensity of chemical fertilizer application in China found that men farmers with smaller arable land, and long years of farming experience, as well as younger farmers and farmers with higher awareness of low-carbon agriculture or membership in specialized farmer cooperatives tend to apply less amounts of chemical fertilizers (Chen et al., 2011).

Land ownership rights and tenure security also play a major role in farmers' choices and behaviour. The property rights theory suggests that a stable, clear, and long-term land rights will encourage farmers to make responsible investments, such as the application of organic fertilizer that can lead to soil improvement in the long term (Bungau et al., 2021; Liang et al., 2020; Ya-Hui et al., 2019). Conversely, short and unclear tenures and unstable land rights can provoke predatory short-term production behaviour of farmers Wu et al. (2021) submit that farmers may apply more fertilizer on the transferred land, especially when the contract duration and stability are unclear and apply more chemical fertilizer on the transferred land (Otsuka et al., 2001).

Kolay (2007) found that a sheep produces about 0.5 kg of droppings and 1.2 litres of urine every day. The nitrogen, potassium and phosphorus (NPK) content of sheep droppings is N= 0.7%, P=0.51% and K=0.29 % and that of urine is N=1.5%, P=0.05% and K=1.96%. Studies suggest that penning of 100 sheep for 6 nights can fertilize around 2.5 acres of farmland (Nandhini & Suganthi, 2018). Telangana has 17.4 million sheep, providing about 9 million kg of manure and about 21 million litres of urine every day. Farmers of the study area reportedly pay an average INR 1.5 – 2.0 per sheep for penning per night, which could generate a revenue of an estimated INR 26 million (USD 316,843) per day in the state (Nandhini & Suganthi, 2018; Sriveda & Srihita, 2020). The average duration of sheep penning in Telangana state is 107 days and the estimated revenue generated from sheep penning alone could be approximately INR 2.7 billion (USD 327,240) within a span of 3.5 months (107 days). If the revenue generated from the sale of dung of sheep, goat, cattle and buffalo and penning of cattle is calculated, then the figure would be even higher.

Personal observations at Salkapuram village, Kallur Mandal, in Kurnool district of Andhra Pradesh, found that the panchayat (village council) usually auctions the village farmlands and commons for grazing. Pastoralists of the surrounding villages usually participate in a bid to gain access to the village grazing lands. The bidding fee would be anywhere between INR 50,000–100,000 (USD 609-1218) per individual to gain access to grazing at the village.

Nandhini & Suganthi (2018, p.371) hypothetically put forward the “penning theory”, which elucidates that “.....the sheep get their feed from field and field is enriched with nutrients and loads of microorganisms act on them to turn the soil more fertile than before”. It may open new research opportunities to investigate how this hypothetical theory behaves in the different and dynamic socio-cultural, economic, agricultural, land tenure regimes and climate change settings.

## 5. Conclusion

Penning and sale of dung accounts to the second major source of HH income of pastoralists who participated in the study. Results of the study indicate a steady increase in the average HH income of pastoralists from penning during the period 2016 - 2020. However, it is seldom considered as an important livelihood and income generation activity, therefore, remains out of the purview of the Telangana state machinery. Perhaps, the promotion of penning and dung sale should be institutionalized as "*manure economy*" and included as a mandate of both the state agriculture and animal husbandry departments. The Government of India and few Indian states like Chhattisgarh, have already initiated schemes for institutionalization and streamlining of the dung economy.

Godhan Nyay Yojana is the flagship scheme of the Indian state of Chhattisgarh (Pandey et al., 2022). The objective of the scheme is to "facilitate rapid strengthening of the rural economy" by giving "a boost to the dairy business and organic farming" while improving the rural environment. Chhattisgarh is the first state in the country to procure cattle dung and establish a system for procurement in a profit oriented approach. Currently, cattle dung procured under the scheme is used for the production of vermi-compost. GOBARdhan<sup>4</sup>, a centrally sponsored scheme by the Government of India, supports the villages in safely managing the livestock and agriculture waste and converting them into bio-gas and manure through rural enterprises. Similarly, the Ministry of Petroleum and Natural Gas (MoPNG) has already launched the "Sustainable Alternative towards Affordable Transportation" (SATAT)<sup>5</sup>, to boost the renewable energy sector and technologies. The SATAT provides the necessary opportunities for effective management of bio-waste and conversion of the same into economically viable models such as the production of compressed-biogas and manure. The Ministry, under this scheme promotes marketing of bio-compressed natural gas (Bio-CNG) in the country.

With regards to farm input costs, observations of the present study indicate that farmers who are practicing penning tend to incur relatively lower expenses on chemical fertilizers when compared with the farmers who rely exclusively on chemical fertilizers for enhancement of soil fertility and production. However, results of the study assume that land ownership rights and tenure security may also play a major role in farmers' interest in more environmental friendly choices like sheep penning.

Agricultural expansion, disappearance of commons and unavailability of labour were cited as the major constraints of mobile pastoralism. Furthermore, pastoralists of the study indicate that acquiring immovable assets such as agriculture land and a more settled lifestyle is the future. However, more studies are necessary to understand the future of pastoralism in the study area.

Other services of sheep and other livestock include trampling of soils and application of manure directly to farmlands without any transportation and application costs, free services for rejuvenation of commons, pastures, and forests, control of weeds, recycling of nutrients, seed dispersal, among others, in-lieu of grazing throughout the year, are not even accounted. Such dimensions of penning in the context of India need further investigation.

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<sup>4</sup> GOBARdhan: <https://sbm.gov.in/gbdw20/>

<sup>5</sup> SATAT: <https://mopng.gov.in/en/pdc/investible-projects/alternate-fuels/sustainable-alternative-towards-affordable-transportation>

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## Author's Declarations and Essential Ethical Compliances

### *Author's Contributions (in accordance with ICMJE criteria for authorship)*

This article is 100% contributed by the sole author. He conceived and designed the research or analysis, collected the data, contributed to data analysis & interpretation, wrote the article, performed critical revision of the article/paper, edited the article, and supervised and administered the field work.

### *Funding*

No funding was available for the research conducted for and writing of this paper. Therefore, acknowledging any support agency is not applicable in case of this research or the written work. However, informal support of institutional supervisors, colleagues and respondents is duly acknowledged.

### *Research involving human bodies or organs or tissues (Helsinki Declaration)*

The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work. Yet, a Declaration is appended.

### *Research involving animals (ARRIVE Checklist)*

The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind animal. Some contexts of animals are also indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of ARRIVE does not apply in cases of this study or written work. Yet, the ARRIVE checklist is appended.

### *Research on Indigenous Peoples and/or Traditional Knowledge*

The author(s) solemnly declare(s) that this research has not involved Indigenous Peoples as participants or respondents, with the documentation of their Indigenous Knowledge. Some other contexts of Indigenous Peoples or Indigenous Knowledge are indirectly covered through literature review. Therefore, a Self-Declaration in this regard is filed by the researcher and first author to support this study or written work. Ethical Clearance Certificate is also appended.

### *Research involving Plants*

The author(s) solemnly declare(s) that this research has not involved the plants for experiment or field studies. The contexts of plants were only indirectly covered through literature review. Yet, during this research the author(s) obeyed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora.

### *(Optional) Research Involving Local Community Participants (Non-Indigenous)*

The author(s) solemnly declare(s) that this research has involved local community participants or respondents belonging to non-Indigenous peoples. Yet, this study did not involve any child in any form directly or indirectly. The contexts of different humans, people, populations, men/women/children and ethnic people are also indirectly covered through literature review. Therefore, a sample copy of prior informed consent (PIC) of the respondents was taken under this study before the face-to-face interviews and interactions.

*(Optional) PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)*

The author(s) has/have NOT complied with PRISMA standards. It is not relevant in case of this study or written work.

*Competing Interests/Conflict of Interest*

Author(s) has/have no competing financial, professional, or personal interests from other parties or in publishing this manuscript. There is no conflict of interest with the publisher or the editorial team or the reviewers.

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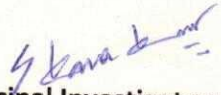
To see original copy of these declarations signed by Corresponding/First Author (on behalf of other co-authors too), please download associated zip folder [Ethical Declarations] from the published Abstract page accessible through and linked with the DOI: <https://doi.org/10.33002/pp0105>

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## ETHICAL CLEARANCE CERTIFICATE ANIMAL RESEARCH DECLARATION FORM

### Declaration by the Principal Investigator

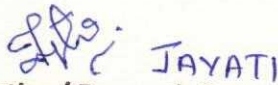
I certify that the study titled: "The Traditional Sheep Penning System: An Exploratory Study on Farmers' Preferences, Farmer-Pastoralist Relationships and Economics of Sheep Penning in Telangana, India", (ref: pp010105), **does not involve** capture, confinement, and use of any animals (either living or dead), collection of their body parts, tissues or genetic material for the purpose of the present study. **No animal** was harmed either physically or subjected to any type of stress in any form for the purpose of the present study. The study fully complies with the legislation and the general principles of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CCSEA), of the Ministry of Fisheries, Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying (DAHD), Government of India, laid down for the Practice, Care and Use of Animals for Scientific Purposes. I hereby declare the same and confirm that all personnel associated with the present study have read this application and have agreed to comply with procedures described and any conditions imposed by the CCSEA.

  
Principal Investigator:

10/4/23  
Date:

### Declaration by Head of the Organization/ Research Committee

I have read this application and am satisfied that the study **does not involve** capture, confinement, and use of any animals (either living or dead), collection of their body parts, tissues or genetic material for the purpose of the present study. **No animal** was harmed either physically or subjected to any type of stress in any form for the purpose of the present study. The study fully complies with the legislation and the general principles of the CCSEA.

  
Head of Organization/ Research Committee:



Date: 10.04.2023

## The ARRIVE Essential 10

These items are the basic minimum to include in a manuscript. Without this information, readers and reviewers cannot assess the reliability of the findings.

Item	Recommendation	Section/line number, or reason for not reporting
<b>Study design</b>	1 For each experiment, provide brief details of study design including: <ol style="list-style-type: none"> <li>The groups being compared, including control groups. If no control group has been used, the rationale should be stated.</li> <li>The experimental unit (e.g. a single animal, litter, or cage of animals).</li> </ol>	
<b>Sample size</b>	2 <ol style="list-style-type: none"> <li>Specify the exact number of experimental units allocated to each group, and the total number in each experiment. Also indicate the total number of animals used.</li> <li>Explain how the sample size was decided. Provide details of any <i>a priori</i> sample size calculation, if done.</li> </ol>	
<b>Inclusion and exclusion criteria</b>	3 <ol style="list-style-type: none"> <li>Describe any criteria used for including and excluding animals (or experimental units) during the experiment, and data points during the analysis. Specify if these criteria were established <i>a priori</i>. If no criteria were set, state this explicitly.</li> <li>For each experimental group, report any animals, experimental units or data points not included in the analysis and explain why. If there were no exclusions, state so.</li> <li>For each analysis, report the exact value of <i>n</i> in each experimental group.</li> </ol>	
<b>Randomisation</b>	4 <ol style="list-style-type: none"> <li>State whether randomisation was used to allocate experimental units to control and treatment groups. If done, provide the method used to generate the randomisation sequence.</li> <li>Describe the strategy used to minimise potential confounders such as the order of treatments and measurements, or animal/cage location. If confounders were not controlled, state this explicitly.</li> </ol>	
<b>Blinding</b>	5 Describe who was aware of the group allocation at the different stages of the experiment (during the allocation, the conduct of the experiment, the outcome assessment, and the data analysis).	
<b>Outcome measures</b>	6 <ol style="list-style-type: none"> <li>Clearly define all outcome measures assessed (e.g. cell death, molecular markers, or behavioural changes).</li> <li>For hypothesis-testing studies, specify the primary outcome measure, i.e. the outcome measure that was used to determine the sample size.</li> </ol>	
<b>Statistical methods</b>	7 <ol style="list-style-type: none"> <li>Provide details of the statistical methods used for each analysis, including software used.</li> <li>Describe any methods used to assess whether the data met the assumptions of the statistical approach, and what was done if the assumptions were not met.</li> </ol>	
<b>Experimental animals</b>	8 <ol style="list-style-type: none"> <li>Provide species-appropriate details of the animals used, including species, strain and substrain, sex, age or developmental stage, and, if relevant, weight.</li> <li>Provide further relevant information on the provenance of animals, health/immune status, genetic modification status, genotype, and any previous procedures.</li> </ol>	
<b>Experimental procedures</b>	9 For each experimental group, including controls, describe the procedures in enough detail to allow others to replicate them, including: <ol style="list-style-type: none"> <li>What was done, how it was done and what was used.</li> <li>When and how often.</li> <li>Where (including detail of any acclimatisation periods).</li> <li>Why (provide rationale for procedures).</li> </ol>	
<b>Results</b>	10 For each experiment conducted, including independent replications, report: <ol style="list-style-type: none"> <li>Summary/descriptive statistics for each experimental group, with a measure of variability where applicable (e.g. mean and SD, or median and range).</li> <li>If applicable, the effect size with a confidence interval.</li> </ol>	




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## ETHICAL CLEARANCE CERTIFICATE

### Research involving Indigenous Peoples and Traditional Knowledge

#### Declaration by the Principal Investigator


I certify that the study titled: "The Traditional Sheep Penning System: An Exploratory Study on Farmers' Preferences, Farmer-Pastoralist Relationships and Economics of Sheep Penning in Telangana, India", (ref: pp010105), **does not involve** collection of data or information on (an) Indigenous land, including reserve, settlement, and land governed under a self-government rule/agreement; the study **does not involve** any of the criteria for participation, including membership in an Indigenous community, group of communities, or organization, including urban Indigenous populations; the study **does not seek** inputs from participants (members of the Indigenous community) regarding a community's cultural heritage, artifacts, traditional knowledge, biocultural or biological resources or unique characteristics/practices; and the study **does not involve** Aboriginal identity or membership in an Indigenous community used or be used as a variable for the purposes of analysis. The present study involves farmers and pastoralists and none of the research participants belong to the Indigenous communities, classified as "the Scheduled Tribes" by the Ministry of Tribal Affairs – The Government of India. I hereby declare the same and confirm that all personnel associated with the present study have read this application and have agreed to comply with procedures described and any conditions imposed by the World Intellectual Property Organization (WIPO), Geneva, with regards to research on Indigenous Peoples and/or Traditional Knowledge.

  
Principal Investigator:

10/4/23  
Date:

#### Declaration by Head of the Organization / Research Committee

I have read this application and am satisfied that the study **does not involve** capturing and collection of data or information of the indigenous community's cultural heritage, artifacts, traditional knowledge, biocultural or biological resources or unique characteristics/practices. The study fully complies with the legislation and the general principles of the World Intellectual Property Organization (WIPO), Geneva.

 JAYATI  
Head of Organization / Research Committee:



Date: 10.04.2023

# SELF-DECLARATION FORM

## Research on Indigenous Peoples and/or Traditional Knowledge

### 1. Conditions of the Research

1.1 Was or will the research (be) conducted on (an) Indigenous land, including reserve, settlement, and land governed under a self-government rule/agreement or?

No

1.2 Did/does any of the criteria for participation include membership in an Indigenous community, group of communities, or organization, including urban Indigenous populations?

No

1.3 Did/does the research seek inputs from participants (members of the Indigenous community) regarding a community's cultural heritage, artifacts, traditional knowledge, biocultural or biological resources or unique characteristics/practices?

No

1.4 Did/will Aboriginal identity or membership in an Indigenous community used or be used as a variable for the purposes of analysis?

No

### 2. Community Engagement

2.1 If you answered "Yes" to questions 1.1, 1.2, 1.3 or 1.4, have you initiated or do you intend to initiate an engagement process with the Indigenous collective, community or communities for this study?

No Applicable

2.2 If you answered "Yes" to question 2.1, describe the process that you have followed or will follow with to community engagement. Include any documentation of consultations (*i.e., formal research agreement, letter of approval, PIC, email communications, etc.*) and the role or position of those consulted, including their names if appropriate:

Not Applicable.

### 3. No Community Consultation or Engagement

If you answered “No” to question 2.1, briefly describe why community engagement will not be sought and how you can conduct a study that respects Aboriginal/ Indigenous communities and participants in the absence of community engagement.

The present study titled: “The Traditional Sheep Penning System: An Exploratory Study on Farmers’ Preferences, Farmer-Pastoralist Relationships and Economics of Sheep Penning in Telangana, India”, involves community participation, however, the research participants of the present study does not belong to any Aboriginal/ Indigenous communities, which were officially classified and identified as the “Scheduled Tribes”, by the Ministry of Tribal Affairs – The Government of India.

---

⇒ Name of Principal Researcher: Kanna Kumar Siripurapu

⇒ Affiliation of Principal Researcher: South Asia Consortium for Interdisciplinary Water Resources Studies, Plot No. 164, Road No. 6, Vayupuri, Sainikpuri, Secunderabad - 500094, Telangana, India.

Signature:



*Declaration: Submitting this note by email to any journal published by The Grassroots Institute is your confirmation that the information declared above is correct and devoid of any manipulation.*

**INFORMATION AND CONSENT FORM FROM RESPONDENTS**  
**(Non-Indigenous or Indigenous Respondents)**

\*This form was translated into local language for the respondents\*

**Title of the Research: The Traditional Sheep Penning System: An Exploratory Study on Farmers' Preferences, Farmer-Pastoralist Relationships and Economics of Sheep Penning in Telangana, India**

Principal Researcher: Kanna Kumar Siripurapu  
South Asia Consortium for Interdisciplinary Water  
Resources Studies, Plot No. 164, Road No. 6, Vayupuri,  
Sainikpuri, Secunderabad - 500094, Telangana, India

Research Supervisor: Sushma Iyengar  
Sahjeevan, Hospital Rd., Jalaram Society, Vijay Nagar, Bhuj  
370001, Gujarat, India

**A) INFORMATION TO PARTICIPANTS**

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**1. Objectives of the research**

The objectives of this study were to to examine famers' preference for sheep penning, farmer-pastoralist relationships and economics of sheep penning tradition in Telangana state

**2. Participation in research**

The researcher will ask you several pertinent questions. This interview will be recorded in written form and should last about 50-60 minutes. The location and timing of the interview will be determined by you, depending on your availability and convenience.

**3. Risks and disadvantages**

There is no particular risk involved in this project. You may, however, refuse to answer any question at any time or even terminate the interview.

**4. Advantages and benefits**

You will receive intangible benefits even if you refuse to answer some questions or decide to terminate the interview. You will also contribute to a better understanding of the causes for pastoralists' livelihood transformation.

**5. Confidentiality**

Personal information you give us will be kept confidential. No information identifying you in any way will be published. In addition, each participant in the research will be assigned a code and only the researcher will know your identity.

**6. Right of withdrawal**

Your participation in this project is entirely voluntary and you can at any time withdraw from the research on simple verbal notice and without having to justify your decision, without consequence to you. If you decide to

opt out of the research, please contact the researcher at the telephone number or email listed below. At your request, all information concerning you can also be destroyed. However, after the outbreak of the publishing process, it is impossible to destroy the analyses and results on the data collected.

## B) CONSENT

---

### Declaration of the participant

- ⇒ I understand that I can take some time to think before agreeing or not to participate in the research.
- ⇒ I can ask the research team questions and ask for satisfactory answers.
- ⇒ I understand that by participating in this research project, I do not relinquish any of my rights, including my right to terminate the interview at any time.
- ⇒ I have read this information and consent form and agree to participate in the research project.
- ⇒ I agree that the interviews be recorded in written form by the researcher: Yes ( ) No ( )

Signature of the participant : \_\_\_\_\_ Date : \_\_\_\_\_

Surname : \_\_\_\_\_ First name : \_\_\_\_\_

### Researcher engagement

I explained to the participant the conditions for participation in the research project. I answered to the best of my knowledge the questions asked and I made sure of the participant's understanding. I, along with the research team, agree to abide by what was agreed to in this information and consent form.

Signature of the researcher :



Date : 15-02-2020

Surname: Siripurapu

First name: Kanna

- ⇒ Should you have any questions regarding this study, or to withdraw from the research, please contact Mr. Kanna Kumar Siripurapu by e-mail [kanna.siripurapu@gmail.com](mailto:kanna.siripurapu@gmail.com)
- ⇒ If you have any concerns about your rights or about the responsibilities of researchers concerning your participation in this project, you can contact the Sahjeevan, Hospital Rd., Jalaram Society, Vijay Nagar, Bhuj - 370001, Gujarat, India by email [sushmasiyengar@gmail.com](mailto:sushmasiyengar@gmail.com)