A STUDY ON MIGRATORY ASPECTS OF SHEEP REARING IN ANANTAPUR DISTRICT

By

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CERTIFICATE

T. SREEKANTHA KUMAR, I.D. No: TVM/14-39 *has satisfactorily prosecuted the course of research and that the thesis entitled* **"A STUDY ON MIGRATORY ASPECTS OF SHEEP REARING IN ANANTAPUR DISTRICT"** *submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by him for a degree of any university.*

Date :

Place : Tirupati

Major Advisor

(Dr. D. SURESH BABU)
Senior Scientist & Head,
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CERTIFICATE

This is to certify that the thesis entitled **"A STUDY ON MIGRATORY ASPECTS OF SHEEP REARING IN ANANTAPUR DISTRICT"** submitted *in partial fulfillment of the requirements for the degree of* ***"MASTER OF VETERINARY SCIENCE"*** *of Sri Venkateswara Veterinary University, Tirupati, is a record of the bonafide research work carried out by* **T. SREEKANTHA KUMAR, I.D. No: TVM/14-39** *under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.*

No part of the thesis has been submitted by the student for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of the investigations have been duly acknowledged by the author of the thesis.

(Dr. D. SURESH BABU)
Chairman of the Advisory Committee

Thesis approved by the Student's Advisory Committee

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LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

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(T. Sreekantha Kumar)

DECLARATION

I, **T. SREEKANTHA KUMAR, I.D. No: TVM/14-39** hereby declare that the thesis entitled **"A STUDY ON MIGRATORY ASPECTS OF SHEEP REARING IN ANANTAPUR DISTRICT"** submitted to Sri Venkateswara Veterinary University, Tirupati for the degree of **MASTER OF VETERINARY SCIENCE** is the result of original research work done by me. I also declare that the materials contained in this thesis have not been published earlier in any manner.

Date: **(T. SREEKANTHA KUMAR)**

Place: Tirupati

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The present study entitled "A study on migratory aspects of sheep rearing in Anantapur district" was undertaken to study the socio economic status of the migratory sheep farmers, management practices of sheep rearing, performance of sheep, identification of migratory tracts and patterns and constraints if any. A total of 160 migratory sheep flocks were identified and selected for the study.

Majority (42.5%) of the shepherds in the study area were middle age people with a mean age of 37.48 years and majority of the sheep farmers belonged to backward caste (84.37%) followed by scheduled tribes (9.37%), scheduled caste (4.37%) and others (1.87%). The average size of the family was 4.8 and majority (51.87%) were living as joint families. Regarding education level, majority (56.87%) of the shepherds were literate with 60.44 per cent upto primary school level. With regard to experience in sheep farming, the average was 14.01 years with majority of sheep farmers having 10 to 20 years of sheep farming experience. It was observed that

71.87 per cent of farmers were having sheep rearing as main occupation followed by 28.13 per cent having agriculture related activities as main activity. The mean flock size was 307.85, where majority (93.12%) of farmers had possessed their own sheep.

With regard to management practices it was observed that 100 per cent of the farmers provided lamb enclosures for new born lambs until weaning. It was observed that farmers depend mainly on available grazing resources to rear their sheep flocks. Majority (37.5%) of the farmers utilized all types lands (community land, forests and waste lands) followed by forests + waste lands (35%), waste barren lands (3.75%) and forests (2.5%) for grazing of their sheep. The average grazing time in the study area was found to be 8.5 ± 0.05 hours and the mean grazing distance recorded was 5.14±0.06 km/day. It was observed that all the farmers provided supplementation along with feeding resources available in the grazing area.

The male to female sex ratio was 1:28 and the retention time of ram in the flock was for 5.2 years, with majority (86.25%) of the farmers not practicing rotation of breeding rams and culling of the breeding ewes (77.5%).

It was appreciable that all the sheep farmers practiced deworming and immunization while majority (60%) of the respondents didn't follow the deticking practice.

Majority of the shepherds disposed off manure by way of penning for money against provision for crop stubbles or food provided by the farmers.

The mean birth weight of ram and ewe lambs was 3.04 ± 0.01 kg and 2.84 ± 0.01 kg, respectively. The mean weaning weight of males and females were, 11.88 ± 0.09 kg and 11.75 ± 0.09 kg, respectively. The mean weight at 6 months of age was 16.07 ± 0.2 kg and 15.79 ± 0.11 kg and at 1 year of age it was 28.43 ± 0.25 kg and 23.55 ± 0.25 kg in males and females, respectively.

The age at first mating was 12.24 ± 0.23 and 17.77 ± 0.09 months in females and males, respectively. Age at first lambing of ewes was found to be 17.81 ± 0.10 months. A tupping percentage of 86.9 ± 0.27 and lambing percentage of 81.25 ± 0.16 was observed in the study area. The average lambing interval was 8.03 ± 0.01 months. The mean weaning percentage observed was 87.75 ± 0.26 and the weaning age was 3.4 months.

A total of 14 major migratory tracts (100 km and above) and 12 minor migratory tracts (below 100 km) were identified in the study area. The major migratory tract - I was largest covering 216 km with a duration of 210 days, starting from Chennarayunipalle of Bukkapatnam mandal in Ananthapur district and reaching Ammasandra in Karnataka. The distance travelled by sheep flocks in the identified major tracts ranged from 100 to 202 km with a mean distance of 128.46 ± 8.98 km. The duration (days) of migration in major tracts ranged from 150 to 276 with a mean duration of 193.53 ± 10.0. The minor migratory tract - XII starting from Pamidi and reaching Penakacherla dam of Garladinne mandal was the shortest route covering 18 km with a span of 90 days. The distance travelled by sheep flocks in the identified minor tracts ranged from 18 to 96 km with a mean distance of 69.33 ± 6.89 km. The duration (days) of migration in minor tracts ranged from 90 to 159 with a mean duration of 130.91 ± 7.6.

Drinking water scarcity, shrinkage of grazing lands, resistance from local farmers, fodder scarcity, physical strain associated with migration and attack by predators were the major constraints encountered by the shepherds along the migratory tracts.

LIST OF SYMBOLS AND ABBREVIATIONS

%	Percent
<	Less than
>	Greater than
@	at the rate of
±	Plus or Minus
AP	Andhra Pradesh
BC	Backward caste
Eg	Example
Etc.,	Et cetra
Kg	Kilogram
km	Kilometre
OC	Other caste
SC	Schedule caste
ST	Schedule tribe

CHAPTER – I

INTRODUCTION

Livestock is generally considered as second pillar in the agriculture dominant rural economy of India in which the livestock and agriculture go hand in hand contributing significantly towards rural economy. Down through the centuries, rearing of sheep and goats has remained a primordial occupation for a vast section of the rural population in India. When compared to other livestock enterprise like cows or buffaloes, small ruminants require very little investment and provide more meat and milk per unit weight per year. Rearing of sheep and goat plays an important role in the economy of India for sustainable livelihood of the poor people in rain fed areas by providing a flexible financial reserve during bad crop years. Because of their hardiness and adaptability to dry conditions, a large concentration of sheep is found in the north-western and the southern peninsular regions of the country. Sheep with its multi-facet utility for wool, meat, milk, skins and manure form an important component of rural economy particularly in the arid, semi-arid and mountainous areas of the country and serve as a sole or subsidiary source of income to the livelihood for a large number of small, marginal farmers and landless labourers in India, especially in certain pockets of Andhra Pradesh. It contributes to the farm households not only by acting as a source of livelihood and nutritional security, but also as a moving asset, which can be liquidated at times of crisis within short time. Sheep with its peculiar habit of closer grazing and higher utilization of crude fibre, can reach to the remotest areas and utilize the vegetation on the land which are otherwise uncultivable.

India is a rich repository of sheep germplasm with 44 recognized breeds and a large proportion of non-descript or mixed breeds. According to 19th Quinquennial

livestock census, 2012, India's sheep population is 65.06 million with a share of 7.14 per cent of world population. About 5 million families are estimated to be engaged in various activities related to rearing of sheep and goats and utilizing their products (http:// www.archive.india.gov.in). On an average, 15% of households in rural areas reported ownership of goat/sheep across the country. Around 70 per cent of the sheep and goat in the country are reared by small and marginal farmers and landless labourers. Evidently, the ownership and distribution of small ruminants in the country is more equitable than that of land resources. During last decade, sheep population has shown increasing trend in the southern states especially in drought prone areas. In Andhra Pradesh, rearing of small ruminants and their distribution vary widely in different districts with more concentration of sheep population in some districts like Anantapur, Nellore, Kadapa and Prakasam. Anantapur district takes one of the leading positions with a population of 38.8 lakhs as per 19th Quinquennial livestock census, (2012) against the state's total population of 135.6 lakhs accounting for 28.6 per cent.

Several times, the stocking density of sheep on range lands far exceeds it's carrying capacity. This scenario forces flock owners to migrate with their flocks for sustenance. This migration may be temporary (of short duration to neighboring locations) or permanent where flocks spend most of the time on migration usually for long distances. Migratory sheep and goat rearing is common in economically weaker sections of society. In order to identify the migratory pattern of sheep in Anantapur district the present research work was taken up with the following objectives.

Objectives:

1. To study the socio-economic status of migratory sheep farmers in the study area.
2. To assess the productive and reproductive performance of the migratory sheep flocks.
3. To identify the migratory tracts and study the migratory pattern of sheep flocks in the study area.
4. To identify the constraints perceived by migratory sheep farmers.

CHAPTER – II

REVIEW OF LITERATURE

2.1 SOCIO ECONOMIC STATUS OF SHEEP FARMERS

2.1.1 Age

Rao (2010) in a study on sheep production systems in North Coastal Zone of Andhra Pradesh reported that majority (53.23%) of the shepherds belonged to middle age, followed by 31.15 per cent belonged to old age and 15.62 per cent were of young age.

Rajanna *et al.* (2013) reported that 70.31 per cent of farmers were in middle age followed by 17.53 per cent in old age and 12.15 per cent in young age in a study on flock management practices of sheep farmers in Telangana region of Andhra Pradesh.

Nisha *et al.* (2016) reported that majority (74.3%) of the migratory sheep farmers belonged to age group of 30 to 40 years in Thanjavur district of Tamil Nadu.

2.1.2 Social category

Saravana Kumar (2003) reported that about 2/3^{rds} of the sheep farmers belonged to backward community among migratory sheep farmers followed by other socially backward classes like SC and ST who together accounted for 17.59 per cent.

Rao (2010) reported that majority (75.31%) of shepherds belong to backward community, followed by scheduled castes (8.96%), other castes (8.65%) and scheduled tribes (7.08%).

Rajanna *et al.* (2012a) reported that majority of sheep farmers in the study area were belonging to BC caste (97.80%) followed by ST (1.22%) and SC (0.52%) in a study on sheep farmers in Telangana region of A.P.

2.1.3 Family size and Type

Dhayani *et al.* (2000) studied the socio-economic aspects of migratory livestock management system in Uttaranchal and reported that the Gujjars had large family size of 13 members in a family.

Saravana Kumar (2003) reported an average family size of 10.08 ± 0.60 in migratory sheep farmers of Andhra Pradesh.

Kuldeeep Porwal *et al.* (2006) in a study conducted in Western Rajasthan reported a family size of 6.68, of which 3.06 were males and 3.62 females.

Average house hold size, male: female ratio and literacy rate of Coimbatore sheep flock owners were 4.40, 1:0.87 and 54.34 per cent, respectively as reported by Kandasamy *et al.* (2006).

In a survey conducted among the shepherd communities Kumaravelu (2007) reported that nuclear family type dominated in both North and Southern zones of Tamil Nadu.

Suresh *et al.* (2008) reported that the dominant family settlement was joint family (53%) and the average size of the family was 9.5 members in Tonk district of Rajasthan.

Rao (2010) reported that 78.44 and 21.56 per cent of shepherds were nuclear and joint family type, respectively in North coastal zone of Andhra Pradesh

Rajanna *et al.* (2013) reported an average family size of 5.69 ± 2.12 and further stated that majority (71.53%) of the sheep farmers belonged to medium family size followed by large (21.01%) and small (7.47%).

2.1.4 Literacy level

Kushwaha *et al.* (1999) observed that 20 to 30 per cent of their family members to be literate in a survey on Chokla sheep rearers.

Dhayani *et al.* (2000) reported that sheep farmers of Uttaranchal were 58 per cent literates followed by less educated (30%).

Saravana Kumar (2003) reported an overall literacy rate of 43.91 ± 2.81 in migrating households against 62.71 ± 3.01 in non-migratory households in a survey among shepherds in Nellore sheep of Andhra Pradesh.

Rajapandi (2005) observed the overall literacy of 60.44 per cent among the households maintaining Coimbatore sheep flocks.

Kandasamy *et al.* (2006) reported an average literacy rate of 54.34 per cent among Coimbatore sheep flock owners.

Kuldeeep Porwal *et al.* (2006) reported a literacy rate of 52 and 13 per cent in males and females, respectively in a survey on sheep farming practices in Rajasthan.

Suresh *et al.* (2008) reported 37 per cent literacy rate among shepherds in Tonk district of Rajasthan.

Rao (2010) reported that 63.65% of shepherds in North coastal zone of Andhra Pradesh were illiterates.

Rajanna (2011) reported that majority (74%) of sheep farmers of North coastal zone of Telangana belonged to illiterate category. He further reported a literacy rate of 25.52, 21.35 and 29.17 per cent in Northern Telangana, Central Telangana and Southern Telangana zones, respectively.

Nisha *et al.* (2016) reported that among migratory sheep farmers, 60 per cent were educated upto primary level and 40% up to middle school in Thanjavur district of Tamil Nadu.

2.1.5 Experience

Rao (2010) while analyzing sheep production systems of North coastal zone of Andhra Pradesh found that 47.29 per cent of sheep farmers had 11 to 20 years of sheep farming experience and 36.35 per cent had 20 years of experience, while 16.35 per cent of farmers had 1 to 10 years experience.

Rajanna (2011) reported that the majority of sheep farmers in Telangana got medium level of sheep farming experience with 64.58 per cent followed by low farming experience with 17.92 per cent and high farming experience with 17.50 per cent.

2.1.6 Farmer's dwellings

Kuldeeep Porwal *et al.* (2006) in a survey on sheep farming practices in Western Rajasthan observed that all the sheep farmers owned a house with majority (50.6%) having mud structure and remaining 49.4 per cent having stone/concrete/ brick structure.

Rajanna (2011) reported that in Telangana region of Andhra Pradesh, 80.73 and 19.27 per cent shepherds were having kutcha and pucca houses, respectively.

Nisha *et al.* (2016) reported that the shepherds owned tiled houses, while the labourers owned 20 to 30 sheep in Thanjavur district of Tamil Nadu.

2.1.7 Land holdings

A study conducted in Dharwad district of Karnataka revealed that 67 per cent of the shepherds were small farmers followed by large (21%) and marginal farmers (21%) (Anthra Report, 1995).

Out of 108 migratory and non migratory sheep farmers groups studied, 71.30 and 57.41 per cent were landless agriculture labourers, 12.96 and 12.04 were small sized farmers and 6.48 and 10.21 were medium sized farmers and 9.26 and 20.34 were large sized farmers, respectively (Saravana Kumar, 2003).

Rajapandi (2005) reported an average land holding of 3.92 acres and majority (51.49%) were landless in a study on Coimbatore sheep.

Kandasamy *et al.* (2006) reported that majority (90 per cent) of Coimbatore sheep flock owners were landless and among those who owned land, the average land holding size was 5.29 acres which was mostly dry land in nature.

Kuldeep Porwal *et al.* (2006) in a survey on sheep farmers of Rajasthan reported that majority of shepherds were marginal farmers (88.18%) followed by landless (18.82%). He further reported that average land holding size was 5.70 ha/family of which, 1.90 ha was irrigated, 2.02 ha dry and 1.65 ha waste land.

Suresh *et al.* (2008) studied the management practices of sheep farming in eastern semi-arid region of Rajasthan and reported an average operational land holding size of 0.59, 1.38, 2.81, 6.13, and 16.29 ha for marginal, small, semi-medium, medium and large farmers, respectively with the overall operational land holding size of 5.00 ha.

Rao (2010) reported that 60.10% of shepherds were marginal farmers followed by small farmers (18.43%), landless (16.56%) and large farmers (4.89%) among shepherds in North Coastal zone of A.P.

Rajanna (2011) reported that mean land holding of the shepherds in Telangana region of A.P was 2.47 ± 0.09 acres and majority (45.66%) of the shepherds were

marginal farmers, followed by small farmers (33.16%), landless (14.24%) and large farmers (6.94%).

Nisha *et al.* (2016) reported that all the respondents of migratory sheep rearing did not own any agricultural land in Thanjavur district of Tamil Nadu.

2.1.8 Management Practices

2.1.8.1 Flock size

In a study conducted in Dharward district of Karnataka state, about 33 per cent of shepherds owned a flock size of less than 50, while 64 per cent had between 50-100 sheep and only 2 per cent of the shepherds owned flocks greater than 100 sheep (Anthra Report, 1995).

Kushwaha *et al. (*1999) reported a flock size ranging between 57 to 64 in a survey on Chokla sheep.

Saravana Kumar (2003) reported that the average flock size was 64.38 $\pm$ 2.97 in migratory Nellore sheep flocks against 29.92 $\pm$ 1.38 for non-migratory flocks.

Sushil Kumar *et al.* (2003) while analyzing the data on performance of sheep of South East Rajasthan reported that the flock size ranged from 20 to >130 and farmers having 35 or more animals had their own breeding rams.

Kandasamy *et al.* (2006) reported an average flock size of 503 ± 13 (range 100 to 900) in migratory flocks whereas in stationary flocks it was 60 ± 8 (range 40 to 120) in Coimbatore sheep.

Suresh *et al.* (2008) studied the management practices of sheep farming in Eastern semi-arid region of Rajasthan and reported that the average sheep flock size was 39 in case of land less farmers and successively increased (with minor variations)

to 77 in case of large farmers. He further reported that the sheep flock of 54 comprised of 66 per cent adult animals, 12 per cent hoggets and remaining belonged to young age group of suckling and weaner lambs.

Rao (2010) reported a mean migratory flock size of 297.87±3.91 in North coastal zone of Andhra Pradesh.

Nisha *et al.* (2016) reported that the owners of migratory sheep had a flock size of 600 to 800 sheep, while the labourers had 20 to 30.

Sankhyan *et al* (2016) reported that sheep and goat comprised of 57.4% and 41.9%, respectively along with 3-4 ponies and 2-3 dogs in migratory flocks of Western Himalayan region of India.

2.1.8.2 Systems of rearing

Pattanayak *et al.* (2003) reported that Ganjam sheep were nomadic in habitat.

Sushil Kumar *et al.* (2003) reported that Kheri and Malpura sheep farmers practiced extensive sheep production system.

Dixit *et al.* (2005) reported that Rampur Bushair sheep maintained by Gaddi tribes of Himachal Pradesh were transhumant in nature.

Dinesh Kumar *et al.* (2006) observed that 89 per cent of Muzaffarnagri sheep were non-migratory type in their home tract.

Kandasamy *et al.* (2006) reported that 12.4 and 87.6 per cent of Coimbatore sheep were stationary and migratory type of flocks, respectively.

Suresh *et al.* (2008) reported that 22 per cent sheep farmers migrated in search of green pastures in semi - arid region of Rajasthan.

Rajanna (2011) reported that majority of sheep farmers practiced migratory system (59.03%) followed by stationary system (40.97%) in Telangana region of Andhra Pradesh.

Rao *et al.* (2013) reported that the predominant system of sheep production of North coastal zone of Andhra Pradesh were stationary with migratory system (72.81%), migratory (14.47%) and stationary system alone (12.70%).

2.1.8.3 Penning

Dorji *et al.* (2003) reported sheep were kept in open with make shift enclosures made up of bamboo mats during migration.

Saravana Kumar (2003) reported that part of the income was generated by hiring the sheep flocks to graze in the harvested fields followed by penning the sheep during night time.

Rajapandi (2005) reported that sheep were penned in the open fields from March to September either with open penning without side protection or with nylon net/wooden reaper penning. He further stated that stationary flocks housing type consisted of 80 per cent open type with side protection and 20 per cent half open type sheds which are located near the residence.

Kandasamy *et al.* (2006) reported that no housing was provided for migratory flocks and they were penned in open fields during nights with temporary fences with nylon nets with an area of 20 X 25 metres. In stationary flocks, housing was provided with open type with side protection.

Arora *et al.* (2007) in a survey on Jaisalmari sheep in Jaisalmer, Barmer and Jodhpur districts of Rajasthan observed that lambs were kept under covered area of thatched material for protection.

Suresh *et al.* (2008) analysed the management practices of sheep in eastern semi-arid zone of Rajasthan in Tonk district reported that the lambs were kept in a special enclosure made inside the pens just after the birth.

Devendran *et al.* (2010) reported that housing was not provided for the migratory flocks and they were penned in the open harvested fields during nights with the help of nylon nets. Whereas stationary flocks were housed with the side protection made up of wooden reapers or bamboos.

Rao (2010) reported that 79.39 % of farmers penned sheep without housing followed by closed (14.68%), while 5.93 per cent practiced both the patterns.

Singaravadivelan *et al.* (2015) reported that the mean duration of penning in agricultural lands and coconut grooves was 8.55 ± 0.07 months in a year.

Nisha *et al.* (2016) reported that asbestos roofed housings were provided for housing pregnant sheep and new born lambs with their ewes.

2.1.8.4 Grazing and feeding practices

Grazing is the most important source of fodder for ruminants and they were allowed to graze in forest areas, non-arable land, permanent pasture and grazing areas and land under tree crops and grooves as the common property resources in India (World Bank, 1999).

Saravana Kumar (2003) reported the mean grazing time of 6 hours 39 minutes in Nellore sheep flocks in Prakasam district of Andhra Pradesh.

Sushil Kumar *et al.* (2003) reported that Kheri and Malpura sheep were raised only on grazing for 8-10 hours on natural grass, crop stubble, road side and fallow lands with seasonal tree lopping.

Pattanayak *et al.* (2003) reported that Ganjam sheep of Orissa were maintained on extensive grazing with natural grasses like Dhub (*Cynodon doctylon*), Anjan (*Cenchrus ciliaris*) and stai (*Cynodon plectostachyas*). He further stated that the common shrubs and leaves foraged by sheep in the grazing area were leaves of kantaikoli (*Ziziphus penoplia*), Acacia (*Acacia arbica*), Ber (*Ziziphus mauritiana*), Agathi (*Sesbnia grndiflora*) and Tentuli (*Tamarindus indicus*).

Dixit *et al.* (2005) reported that migratory sheep depend solely on grazing, while non-migratory sheep were supplemented with concentrates (Barley plus wheat) @ 100-200 g/animal/day and tree leaves.

Rajapandi (2005) reported that the grazing duration of Coimbatore sheep was 8 to 12 hours/day with a distance of 5-8 km in migratory flocks and 7-8 hours with distance of 2-6 km in stationary flocks. He further stated that concentrate feeding was not practiced in both the flocks and sources of water were ponds, stagnated water, reservoirs, water channel in cultivable land and wells.

Kandasamy *et al.* (2006) reported that Coimbatore sheep were reared only on grazing upto a distance of 5-8 km for 7 to 8 hours per day and no concentrate supplementation or tree fodder was given to lambs or adults and watering was done two or three times a day depending on the season and availability.

Kuldeep Porwal *et al.* (2006) reported that the farmers on an average employed 6.9, 7.8 and 8 hrs grazing period/day during rainy, winter and summer seasons, respectively and further stated that sheep farmers practiced usage of community rangelands (92.24%), cropped fields after harvesting of standing crop (70.59%) and forest land (97.65%) and other grazing area (4.71%).

Devendran *et al.* (2010) reported that Coimbatore sheep in the field conditions were raised solely on grazing irrespective of the physiological status up to a distance of 5 to 8 km for 7 to 8 hr a day in the harvested fields, barren and uncultivable lands, roadsides and forest areas along with 2 or 3 times watering per day based on the season and availability of sources like canals, ponds or wells.

Rao (2010) observed grazing time (hrs) and grazing distance (km) of 8.48 ± 0.06 and 6.02 ± 0.17, 6.08 ± 0.04 and 3.78 ± 0.03 in summer and in seasons other than summer, respectively in North coastal zone of Andhra Pradesh and the major water source for sheep was tanks / small ponds (57.08%) followed by streams (21.87%), canals (19.89%) and other sources (1.14%).

Rajanna (2011) stated that in Telangana region of Andhra Pradesh, mean grazing time and distance in summer was 7.80 ± 0.04 hours and 6.00 ± 0.04 km whereas mean grazing time and distance other than summer months was 5.29 ± 0.05 hours and 3.76 ± 0.03 km, respectively.

Singaravadivelan *et al.* (2015) reported that the mean grazing time and distance in summer was 10.59 ± 0.05 km and 5.34 ± 0.12 hours and in other seasons it was 9.05 ± 0.08 km and 3.70 ± 0.07 hours, respectively.

2.1.8.5 Breeding management practices

Kushwaha *et al.* (1999) reported two main breeding seasons i.e., January and July in Chokla sheep.

Saravana Kumar (2003) studied the migratory patterns of Nellore sheep and reported an overall mean ram and ewe sex ratio of 1:20 and the lambing frequency of 3 lambs per 2 years in migratory sheep of Andhra Pradesh.

Sushil Kumar *et al.* (2003) reported that breeding rams always remained with the ewes during grazing as well as at home in South East Rajasthan.

Pattanayak *et al.* (2003) observed the main breeding season for Ganjam sheep was the rainy season (July-October) and eighty per cent of lambing took place in winter season (November-February).

Dixit *et al.* (2005) reported that the peak breeding seasons were April to May and October to November in Rampur Bushair sheep.

Rajapandi (2005) reported that rams were allowed with ewes throughout the year and none of the farmers introduced new rams from other flocks resulting in inbreeding.

Kandasamy *et al.* (2006) reported overall mean sex ratio of 1:24 and mean age at first mating in male and female were 12.50 ± 0.10 and 11.10 ± 0.10 months, respectively in Coimbatore sheep.

Kuldeeep Porwal *et al.* (2006) reported that major lambing season was between February- March and minor lambing season was between September-October in Western Rajasthan. He further stated that 90.59 per cent of the respondents harvested three lamb crops in two years, while 9.41 per cent harvested only one crop per year and used the same ram for more than 2-3 years.

Kumaravelu (2007) observed that the main lambing season occurred in the months of October, November and December in Tamil Nadu.

Suresh *et al.* (2008) reported a sex ratio of 1:35 and all the farmers had their own breeding rams which were used for more than 3 years, causing reduced flock performance.

Devendran *et al.* (2010) studied the rearing environment and husbandry practices of Coimbatore sheep in the field and reported that uncontrolled natural mating took place throughout the year as rams and ewes were grazed and penned together.

Rao (2010) reported a mean sex ratio of 1:43.81 in sheep of North coastal zone of Andhra Pradesh.

Rajanna (2011) reported that rams were not rotated for breeding and sheep farmers retained the breeding rams for less than 5 years while 35 per cent farmers used the breeding rams for more than 5 years for breeding purpose.

Sankhyan *et al.* (2016) reported that the common breeding season in case of migratory goats is Summer (March-May), with occasional breeding occurring during Winter (September-October).

2.1.8.6 Weaning

Dixit *et al.* (2005) observed that lambs suckled their mother up to 2 months of age and then sent for grazing along with the mother in Rampur Bushair sheep flocks of Jammu and Kashmir state.

Rajapandi (2005) observed that the lambs of Coimbatore sheep were kept in shed up to 20 days and nourished by suckling. After 20 days, the lambs were sent for grazing along with flock.

Devendran *et al.* (2010) reported that new-born lambs were housed in the lamb hut up to 15 days and were then allowed for grazing along with their dams in Coimbatore sheep of Tamil Nadu.

Singaravadivelan *et al.* (2014a) reported that weaning period (months) for ram and ewe lambs in migratory flocks were 2.94 ± 0.96 and 5.03 ± 0.13 and in non-migratory flocks it were 4.82 ± 0.13 and 6.06 ± 0.17, respectively.

2.1.8.7 Health management practices:

A survey on sheep farmers in Dharward district of Karnataka showed that Rs.11/- to Rs.27/- was spent annually on every sheep for health purpose. About 20 to 30 per cent of this was used for deworming medicines (Rs.3.50 to Rs.9.00 per sheep/annum) and the remaining was spent on treatment (Rs.6/- to Rs.22/- per sheep/annum). Farmers did not spend on vaccination and were dependent exclusively on state animal husbandry department programmes (Anthra Report, 1995).

Shashidhar Nadagouda *et al*. (1998) reported blue tongue in four agro-climatic zones of Karnataka in 116 migratory flocks and showed the overall morbidity and mortality rate of 16.44% and 5.03%, respectively.

Kushwaha *et al.* (1999) observed that deworming was done by the farmers themselves and vaccination was practiced rarely in Chokla sheep in their breeding tract.

Pattanayak *et al.* (2003) reported non adoption of deworming or vaccination for their flocks among Ganjam sheep farmers of Orissa.

Saravana Kumar (2003) reported the incidence of enterotoxaemia, blue tongue, anthrax, foot and mouth disease, foot rot, sheep pox disease and *Peste des Petites Ruminants* in migratory Nellore flocks compared to non-migratory flocks.

Sushil Kumar *et al.* (2003) reported that most of the famers performed prophylaxis health measures against prevalent diseases in their flocks of South East Rajasthan.

Rajapandi (2005) reported 88 per cent of the farmers drenched their flocks for deworming, while vaccination was done by 72.39 per cent farmers and 21.60 per cent farmers practiced spraying/dusting for ectoparasites in Coimbatore sheep.

Kuldeep Porwal *et al.* (2006) in a study on sheep husbandry in Rajasthan observed that sheep farmers spent on an average Rs.1.60, 4.68, 5.20 and 2.14/ sheep/ year for deworming, vaccination, treatment and other health coverage activities, respectively.

Arora *et al.* (2007) reported that vaccination against enterotoxaemia and drenching against endoparasites was commonly practiced by sheep farmers in Jaisalmer, Barmer and Jodhpur districts of Rajasthan.

Suresh *et al.* (2008) reported that Vaccination was done by 94 per cent of the famers for diseases like Enterotoxaemia and Foot and Mouth disease in eastern semi-arid zone of Rajasthan.

Rao (2010) observed that in North coastal zone of Andhra Pradesh, 47.39 per cent practiced deworming at 6 months interval followed by 21.87% at 3 months and 16.97% at 12 months interval, whereas 10.20% of sheep farmers did not deworm the sheep. He further stated that 76.35% of the farmers got their sheep dewormed by veterinarian while 23.64 per cent of them practiced deworming of sheep by themselves.

Devendran *et al.* (2010) observed that Coimbatore sheep were generally vaccinated annually against Anthrax, Enterotoxaemia, PPR and Sheep Pox and were drenched with anthelmintics once in 3 or 4 months to reduce the burden of endo-parasitic infestations.

Rajanna (2011) reported that 46.35, 40.63 and 5.73 per cent of sheep farmers dewormed their flocks once in 3, 4 and 6 months in a year, respectively in Telangana region of Andhra Pradesh.

Rao *et al.* (2013) reported that 87.60% of shepherds have vaccinated their sheep against Enterotoxaemia followed by Foot and Mouth Disease (71.87%), PPR (67.18%), Sheep pox (43.54%) and Anthrax (10.31%), where as 12.70% of farmers have not practiced vaccination.

Nisha *et al.* (2016) reported that the disease control activities like deworming and vaccination (*peste des petits ruminants* and enterotoxemia) were done by migratory sheep farmers themselves.

2.1.8.8 Disposal of Carcass

Kumarvelu (2007) revealed that majority of the farmers in southern and northern zones of Tamil Nadu buried the dead sheep in the event of death due to diseases. Throwing dead carcasses in wells not in use and open area were practiced by 6.88 and 20 per cent farmers in southern and north-eastern zone, respectively.

Rao (2010) reported that 53.22 per cent of sheep farmers sold carcass for meat consumption followed by disposal through burial of carcass (17.39%), burial and throwing (16.97%) and throwing (12.39%) in open areas in North Coastal zone of Andhra Pradesh.

2.2 PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF MIGRATORY SHEEP FLOCKS

The mean weaning weight of migratory Nellore sheep flock was lower (8.17 ± 0.22kg) when compared to non migratory Nellore sheep flock (10.33 ± 0.42kg) as reported by Saravana Kumar (2003).

Kandasamy *et al.* (2006) reported that the average age at first lambing and lambing interval was 16.60 ± 0.10 and 7.70 ± 0.10 months, respectively with a lambing per cent of 82.40 on the basis of ewes available and twinning of 1.10 per cent.

Rao (2010) found that in North Coastal zone of Andhra Pradesh the mean birth weight, weaning weight, weight at 6 months and weight at 1 year of ewe lambs and ram lambs were 2.46 ± 0.05 and 2.84 ± 0.06, 8.96 ± 0.14 and 10.10 ± 0.11, 15.48 ± 0.09 kg and 16.05 ± 0.12, 20.39 ± 0.16 and 26.01 ± 0.30 kg, respectively.

Rao (2010) in a survey on reproductive performance of sheep in migratory and semi migratory production systems of North coastal zone of Andhra Pradesh found the mean age at first mating in ewes and rams as 12.85 and 21.17 months, respectively. The mean age at first lambing and lambing interval were 17.75 and 9.70 months, respectively. The mean lambing percentages were 10.31 (summer), 27.70 (autumn), and 61.97 (winter). The mean sex ratio observed in North coastal zone was 1:43.81.

Singaravadivelan *et al. (2014a)* reported that the months of October, November and December were main lambing seasons and the months of April and May were minor lambing seasons. He further reported that lambing percentage, twinning percentage, livability at birth (per cent), age at first mating (months) in ewes, age at first mating (months) in rams, age at first lambing (months), and weaning percentage in migratory and non migratory flocks was 93.56 and 91.50, 1.87 and 1.52, 98.32 and 98.73, 12.34 and 13.22, 19.64 and 21.44, 18.54 and 19.68 and 85.98 ± 0.48 and 87.15 ± 0.61, respectively.

2.3 MIGRATORY PATTERN

Acharya (1983) indicated that in Rajasthan, 0.5 million sheep were on permanent migration following established migratory routes and are not brought to their homestead at any time of the year. One million sheep migrate to their neighbouring state for 6 to 9 months. Migration begins between October and February and return by May or June or before the onset of monsoon.

Mukundan *et al*. (1987) studied the various features of small ruminant production in four states of south India, viz., Kerala, Karnataka, Tamil Nadu and Andhra Pradesh from 1972 to 1982 and reported that sheep population remained more or less stable and the goat population increased by about 30 per cent, while the traditional system of rearing through migration declined considerably due to shrinkage of grazing lands and practice of more intensive cultivation.

Nagy *et al.* (1991) reported that in Baluchistan region of Pakistan, 30 per cent of sheep and goats were owned by landless nomadic community (Powindas) feeding their livestock on the open range and were continually on the moving using established routes.

Venanzoni *et al.* (1993) reported that the flocks were grazed in the mountains of the Central Alpines in summer and moved across an intricate network of tracts in winter to the lowlands on the Adriatic coast and the plains of Puglia among the migratory flocks in Italy.

A study on sheep husbandry in Dharwad district of Karnataka showed that shepherds with their flocks migrated by January up to a distance of 70 km and the return schedule was dependent on the onset of monsoon (Anthra Report, 1995).

Shinde and Singh (1995) reported that 86 and 67 per cent of sheep were migratory in nature in arid and semi-arid regions with migration of 6 to 9 months and 3 to 4 months, respectively.

Chandramouli *et al.* (1996) observed that the migration was a time tested practice largely followed by sheep and goat farmers who belonged to arid areas and the duration of migration varied from region to region depending on local conditions. They have also found that about 18 per cent of breeders migrated to a distance of 30 to 50 km during April or May months and main reason for such migration was shortage of water and grazing lands in Nellore district.

Kushwaha *et al.* (1999) on Chokla sheep reported that these animals were kept in flocks of about 100 animals mostly under migratory conditions in breeding tracts of Bikaner, Jaipur and Nagaur districts of Rajasthan.

Dhayani *et al.* (2000) studied the migratory livestock management system in Uttaranchal and reported that Gujjars and Bhotiyas were the predominant nomadic pastoral communities in the region who migrated with their livestock from the upper snow bound areas to the lower Shiwaliks during winter and returned to their homeland in summer.

Dorji *et al.* (2003) reported that seasonal migration is an important characteristic of sheep farming in temperate Bhutan to enable better feeding resources and avoid adverse climatic factors.

Pattanayak *et al.* (2003) reported that Ganjam sheep flocks in Orissa migrated after harvesting of Kharif crop (November – December) and returned to the village before onset of rainy season (June-July). He further stated that during migration,

shepherds night shelter their flocks in farmer's field and got some payment either in cash or kind in exchange for sheep manure.

Saravana Kumar (2003) in a benchmark survey on the migratory pattern of Nellore sheep identified a total of eight major and ten minor tracts and the average days of migration in the identified tracts was 91.38 ± 8.04 to cover a distance of 84.03 ± 6.33 km.

Sushil Kumar *et al.* (2003) observed that Malpura and Kheri sheep farmers go on migration with their flocks during the months of April to August in Rajasthan.

Dixit *et al.* (2005) observed Gaddi tribes in Jammu and Kashmir owning Rampur bushair sheep followed fixed annual cycle of migration from the base camp in plains or mid hills to high altitude Alpine pastures during summer months.

Rajapandi, (2005) reported that majority of the flocks (92.50 per cent) of Coimbatore sheep migrated in all directions depending on availability of grazing lands and harvested paddy fields covering approximately 100 to 200 km and several flocks did not return to their village and remained permanently on migration.

Kandasamy *et al*. (2006) reported that the migration routes were not regular and the radial distance to the places of migration varied from 50 to 150 km for 7 months in a year among Coimbatore sheep.

Kuldeep Porwal *et al.* (2006) reported that 68.78 per cent resorted to inter-state migration covering 450 km, while 31.25 per cent opted for short distance migration within the state covering 112 km with an average distance of 6.07 km/day in range lands of Rajasthan state.

Arora *et al.* (2007) observed that most of the animals were migratory covering a distance of about 200 km which returned back after 4 months during rainy season in Jaisalmeri districts of Rajasthan.

Kumaravelu *et al.* (2008) revealed that eleven migratory tracts were present in southern zone of Tamil Nadu and the duration ranged from 91 to 315 days with a mean value of 195.36 ± 23.6 days in southern zone of Tamil Nadu.

Rao (2010) reported that the major reasons for migration were lack of feed resources (92.70%), income from penning (92.39), traditional practice (87.50%), successive droughts (84.37%) and lack of water resources (83.33%) in North Coastal zone of Andhra Pradesh.

Suresh *et al.* (2011) reported that the short term migration of sheep was practiced by 32 per cent farmers in semi-arid region of Rajasthan.

Rajanna *et al.* (2013) reported that twenty migratory routes were identified with mean distance and duration of 112.2 ± 19.5 km and 124.3 ± 10.05 days, respectively in Telangana region of Andhra Pradesh.

Rao *et al.* (2013) reported that the mean duration and distance of migration of flocks were 181.25 ± 0.63 days and 75.87 ± 0.78 km, respectively in the North coastal zone of Andhra Pradesh and the migration mostly started in the mid-December and extended up to mid-July.

Singaravadivelan *et al.* (2014b) identified a total number of 78 migratory tracts comprising 28 major (above 208 km) and 50 minor (below 208km) tracts in the study area. The mean radial distance of migration in major tracts was 317.00 ± 6.21 km and minor tracts were 148.40 ± 6.21 km. Nisha *et al.* (2016) reported that

migration was followed for nine months starting from January to September by the sheep farmers of Thanjavur district in Tamil Nadu.

Sankhyan *et al.* (2016) reported that migration is intense for few months when farmers travel miles of distance by continuously moving throughout the day and resting at night in migratory goat and sheep farming of Western Himalayan region of India.

2.4 CONSTRAINTS

Reduced availability of grazing land, fodder and water, emergence of blue tongue, lack of timely vaccination, ineffective sheep pox vaccines were ranked as major constraints for sheep production in parts of Karnataka State (Anthra Report, 1995).

Saravana Kumar (2003) found that the major constraints perceived by migratory sheep farmers of Nellore sheep are gastrointestinal parasitism as perceived by higher percentage (80.55), followed by non-availability of vaccines (77.77%), diseases onset (75.92%), presence of diseases in villages of migratory path (72.22%), lack of veterinary facilities during migration (70.37%) and problem of caring of lambs (50%).

Dinesh Kumar *et al.* (2006) in a study on Muzzaffrnagri sheep, observed non-availability of adequate grassland, paucity in the availability of pure breeding rams and lack of proper health care (vaccination and deworming) particularly in the flocks of landless and poor sheep breeders were the main constraints in sheep rearing.

Kuldeep Porwal *et al.* (2006) documented the shrinkage in grazing land, restrictive rules and regulations, lack of graded breeding rams, lack of veterinary

coverage and lack of proper market for animal producer were the major problems faced by sheep farmers Western Rajasthan.

Kumaravelu *et al.* (2008) observed that the major problem faced by the sheep farmers en-route migration were objections for camping by local sheep owners, road accidents, theft, threat from wild animals, water scarcity, toll paid to local villagers and restriction to graze in area under forests.

Rajanna *et al.* (2012b) reported that in Telangana region of Andhra Pradesh, the constraints perceived by sheep farmers were disease outbreaks, lack of availability of breeding rams, shrinkage of grazing land, high lamb mortality, exploitation by middlemen, inaccessibility to credit, collapse of wool market, drinking water scarcity, no compensation for deaths, theft and poor veterinary facility in the order from I to XI, respectively.

Rao *et al*. (2013) reported that the major problems during migration included disease outbreaks (85.95%), lack of veterinary facilities (83.81%), lack of shelter (79.08), improper care of lambs (71.63%), problem of predators, abortions due to stress (66.61%), theft (58.73%), carrying of sick animals (50.14%), and restriction of entry of animals in migratory path (42.97%).

Nisha *et al.* (2016) reported that the major problems faced by the migratory sheep farmers of Thanjavur district in Tamil Nadu were labour shortage and water shortage *en route* for watering the sheep.

Sankhyan *et al.* (2016) reported that major constraints were predators, disease and poisoning during migration followed by lack of veterinary and institutional facilities, marketing, accidental death, theft and environmental extremes in migratory goat and sheep farming of Western Himalayan region of India.

CHAPTER – III

MATERIALS AND METHODS

This chapter forms the background for the methodological aspects of the research work with regard to sampling procedure for selection of district, sample respondents, data collection and statistical tools and techniques employed for the analysis of data.

The details of the study are presented under the following sub heads:

3.1 Description of the study area

3.2 Methodology used in the study

3.3 Preparation of interview schedule and data collection

3.4 Identification of migratory tracts

3.5 Maps

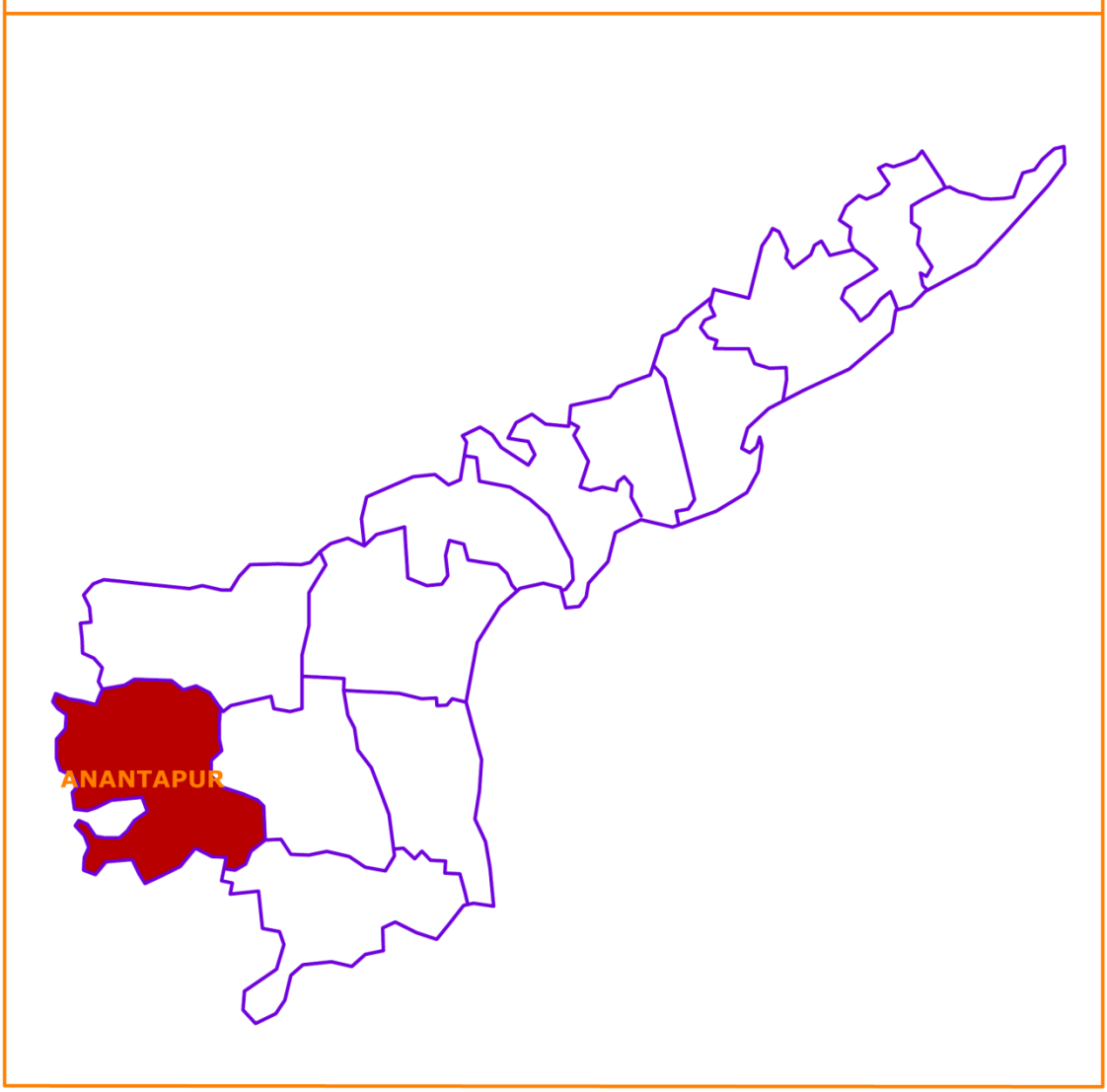
3.6 Statistical analysis

3.1 DESCRIPTION OF THE STUDY AREA

3.1.1 Location of the study area

A study was undertaken to identify the migratory tracts and migratory pattern of sheep in Anantapur district of Rayalaseema region of Andhra Pradesh. The present research was purposively conducted in Anantapur district as it is the leading district with sheep population where majority of the shepherds follow migratory system of rearing. The location of the study area is given in Map 1.

MAP 1: ANDHRA PRADESH STATE



3.1.2 Geographical profile of Anantapur District

This district is located at 14.68 °N 77.6 °E. It is the largest district of Andhra Pradesh spanning an area of 19,130 square kilometers and is bounded on the north by Kurnool district, on the east by Y.S.R district, on the southeast by Chittoor district and on the southwest and west by Karnataka state. Anantapur has a semi-arid climate and receives an average annual rainfall of 381 mm. Sheep and goat reared under extensive grazing system is one of

the major livelihood sources for the small, marginal and landless farmers.

Table - 1. Livestock holding particulars of Anantapur district

S.No	Livestock	Male	Female	Total
1	Non descriptive cattle	2,11,890	2,43,605	4,55,495
2	Crossbred cattle	13,363	1,48,401	1,61,764
3	Buffaloes	36,493	3,34,626	3,71,119
4	Goat			7,85,185
5	Sheep			38,79,843
6	Poultry			
	i. Layers			2,00,003
	ii. Broilers			2,19,850
	iii. Desi			11,17,057

Source : (Animal Husbandary Department, Anantapur district, 19th Quinquennial Livestock census)

3.2 METHODOLOGY USED IN THE STUDY

3.2.1 Sample design

The design of the study included random selection of migratory sheep farmers of Anantapur district.

3.2.2 Selection of respondents

A total of 160 respondents were randomly selected in consultation with Animal Husbandry Department personnel and by personal visits.

3.3 PREPARATION OF INTERVIEW SCHEDULE AND DATA COLLECTION

A pilot study was conducted to elicit the information regarding migratory flocks and their tracts by consulting shepherds and Animal Husbandry department personnel in Anantapur district. Based on the preliminary study, the present research was planned and the data was collected from the respondents using a pretested and well structured interview schedule (Appendix A). The data pertaining to the socio economic profile of the shepherds, management practices, productive and reproductive performance of sheep flocks (Appendix A) identification of migratory tracts and migratory pattern (Appendix B), were recorded.

Secondary data regarding demographic features and livestock particulars were obtained from the records maintained by the Animal Husbandry Department.

3.3.1 Socio-economic status of sheep farmers

3.3.1.1 Age

The chronological age at the time of enquiry was taken as a measure and classified into three categories as young, middle and old according to Lavanya (2016).

Category	Young	Middle	Old
Age	Upto 35 years	Between 36 to 45 years	Above 45 years

3.3.1.2 Education

The actual level of education of the respondents was taken as the literacy level. The respondents were categorized into literate and illiterate on the basis of their ability to read and write.

3.3.1.3 Social Category

The caste of an individual is conceptualized as the one which is ascribed by birth. Caste reported by respondent was taken into account, based on social status.

3.3.1.4 Land size

On the basis of the total land holdings, the respondents were classified as follows.

Type of farmers	**Land Holding size**
Large farmers	Above 5 acres
Small farmers	2.6 to 5 acres
Marginal farmers	0.1 to 2.5 acres
Landless farmers	0 acres

3.3.1.5 Sheep farming experience

It refers to the number of years of farmer's experience in sheep rearing activities. The respondents were grouped into three categories.

Low experience	0-10 years
Medium experience	10-20 years
High experience	Above 20 years

3.3.2 Flock Size

The flock size was determined taking into account the number of heads of sheep which included rams, ewes, and lambs possessed by the flock owners and the average flock size per household were calculated.

3.3.3 Management practices during migration

Management practices during migration, productive and reproductive performance of migratory sheep, reasons and problems of migration were studied

from the respondents by face-to-face interview and personal observation by the researcher.

3.3.3.1 Feeding pattern of migratory sheep flock

The data pertaining to grazing resources, duration of grazing and water sources were collected from the shepherds by interviewing them and through personal observation.

3.3.3.2 Health Management practices

The information on various prophylactic health measures viz., deworming, vaccination and deticking were recorded and the data pertaining to the treatment of sick animals was obtained using the pretested interview schedule.

3.3.3.3 Penning

The respondents were interviewed to record the penning practices followed during migration.

3.3.3.4 Productive performance

Body weights for various age groups were taken with the help of spring balance at farmer's flocks. This was performed in the morning before the animals were let out for grazing. The birth weight of lambs, weaning weight, 6 months body weights and adult weights for both males and females were recorded.

3.3.3.5 Reproductive Performance

Reproductive performance of rams and ewes was recorded by observation and interview of the shepherds. The information on age at first mating for males and females, age at first lambing, lambing interval and weaning period were collected to

the nearest month. Tupping and lambing percentage was calculated based on the ewes available in the flock.

3.3.3.6 Constraints during migration

The various reasons for migration were recorded through informal discussion with the farmers as well as field personnel of Animal Husbandry Department. Constraints faced by migratory shepherds were investigated as per the interview schedule and were ranked in descending order.

3.4 IDENTIFICATION OF MIGRATORY TRACTS

The migratory tracts were identified based on the results of the enquiry from the shepherds, Animal Husbandry department personnel, direct survey and field visits. The places covered during migration and their distances were obtained from the revenue maps.

3.5 MAPS

The mapping of the migratory tracts was done by using the district map. The map of Andhra Pradesh state and the areas of study were shown in map 1 and map 2. The migratory tracts were shown in different colours along with the indication of important places in each tract as shown in Maps 3 - 8.

3.6 STATISTICAL ANALYSIS

The data collected were analyzed by conventional tabular analysis in the form of mean, standard error and percentages using the methods suggested by Snedecor and Cochran (1994).

MAP 2 : ANANTAPUR DISTRICT

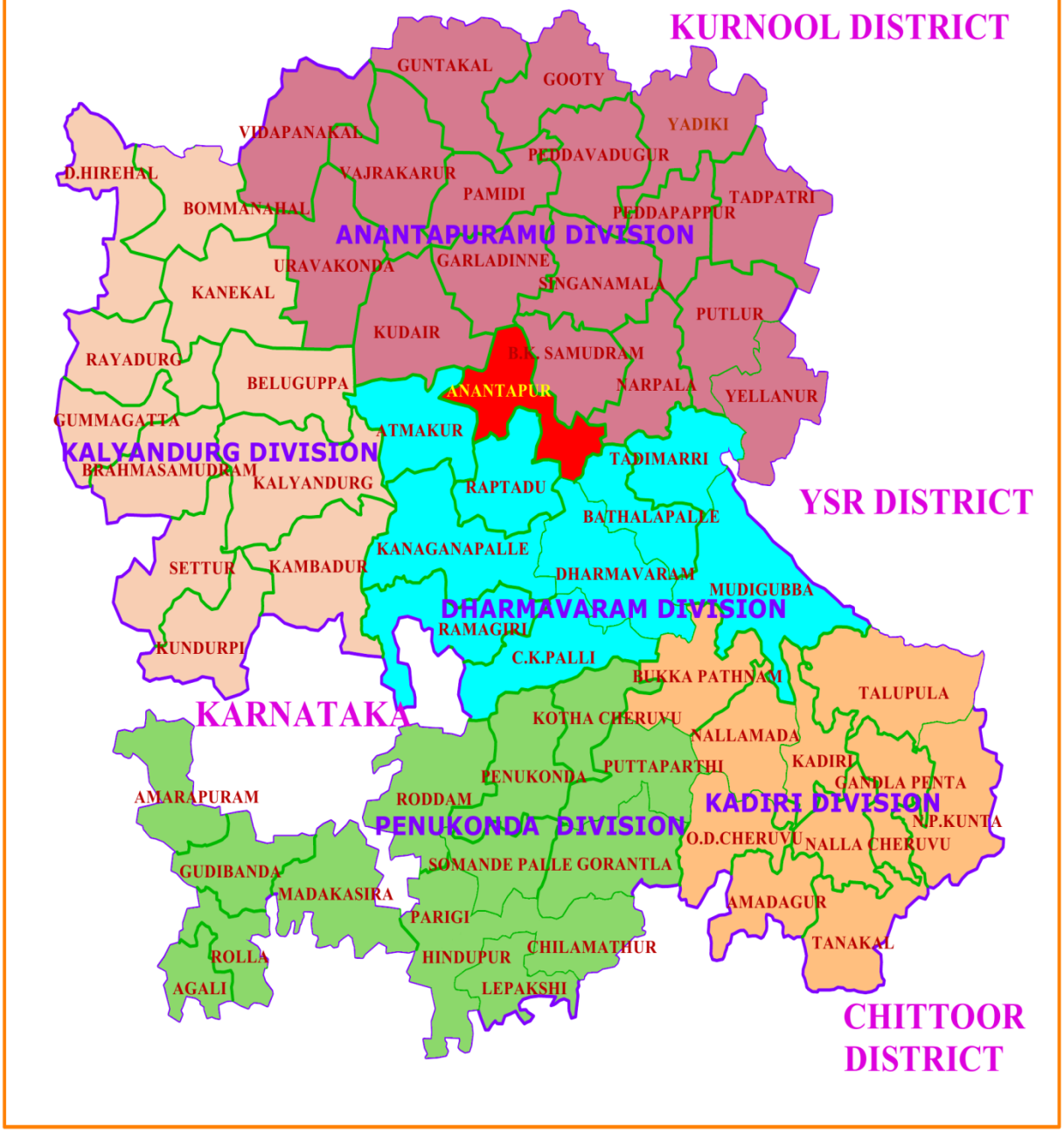


Fig.1 : Sheep flock in a migrant village of Dibburivandlapalli of Karnataka

Fig.2 : Researcher with grazing migratory sheep at N.S. Gate of Karnataka

Fig.3 : Lamb enclosures during migration

Fig.4 : Drinking water resource while in migration at Chintakunta of Kurnool district

Fig.5 : Practice of penning in migration at Kothapalli of Somandepalli mandal

CHAPTER – IV

RESULTS

In this chapter, an attempt is made to examine the results based on empirical data of the present study. The data collected during the investigation were tabulated, analyzed, interpreted and presented under the following heads.

4.1 Socio-economic status of migratory sheep farmers

4.2 Productive and Reproductive performance of the migratory sheep flocks

4.3 Identification of migratory tracts and assessing the migratory pattern of sheep flocks

4.4 Constraints perceived by the sheep farmers

4.1 SOCIO-ECONOMIC STATUS OF MIGRATORY SHEEP FARMERS

4.1.1 Age

It was observed that 42.5 per cent of the farmers were of middle age, 40 per cent of them were of young age and only 17.5 per cent of the farmers belonged to old age group. Out of 160 sheep farmers in the study area, mean age of farmers was found to be 37.48 years as shown in Table 2.

Table 2. Distribution of farmers according to age

S. No.	Age group (Years)	Percentage (%)
1	Young age (<35 years)	40
2	Middle age (36 to 45 years)	42.5
3	Old age (> 45 years)	17.5

Mean Age: 37.48 ± 0.80 years N=160

4.1.2 Social category

The study revealed that majority of the sheep farmers (84.38%) belonged to backward caste, followed by scheduled tribes (9.38%), scheduled caste (4.37%) and open category (1.87%) as shown in Table 3.

Table 3. Distribution of farmers based on social category

S.No.	Particulars	Percentage (%)
1	OC	1.87
2	BC	84.38
3	SC	4.37
4	ST	9.38

N=160

4.1.3 Family size and type

It was observed that mean family size was 4.8 members. With regard to family type, 51.87 per cent of the farmers were living as joint families and 48.13 per cent of the farmers confined to nuclear type of families.

Table 4. Distribution of farmers based on family type and size

S.No.	Family size	Percentage (%)
1	Joint family	51.87
2	Nuclear family	48.13

Mean family size: 4.8 ± 0.11 N=160

4.1.4 Gender of sheep farmers

In the entire study area only 2.5 per cent of females were involved in sheep rearing and the remaining 97.5 per cent of farmers were males.

Table 5. Gender of sheep farmers

S.No.	Gender	Percentage (%)
1	Male	97.5
2	Female	2.5

N=160

4.1.5 Education

It was observed from Table 6 that majority (56.87%) of the shepherds were literates. Among literates, primary school educators (60.44%) were more than secondary (32.97%), Intermediate (5.5%) and graduates (1.09%). About 43.13 per cent of farmers were found to be illiterates in the study area.

Table 6. Distribution of farmers based on education

S.No.	Literacy	Percentage (%)
1	Literates	56.87
	a . Primary school	60.44
	b . Secondary school	32.97
	c . Intermediate	5.5
	d . Graduation	1.09
2	Illiterates	43.13

(N=160)

4.1.6 Experience

From Table 7 it was observed that majority (48.1%) of the farmers had medium experience in sheep rearing followed by low experience (37.5%) and high experience (14.4). with the mean sheep rearing experience of 14.01 years.

Table 7. Distribution of farmers based on experience in sheep rearing

S.No.	Experience (Years)	Percentage (%)
1	Low (0-10)	37.5
2	Medium (10-20)	48.1
3	High (Above 20)	14.4

Mean experience: 14.01 ± 0.60 (N=160)

4.1.7 House type

From Table 8 it was found that 100 per cent of the farmers possessed pucca houses as their dwellings.

Table 8. Distribution of farmers based on house type

S.No.	House type	Percentage (%)
1	Pucca	100.0
2	Kutcha	0

(N=160)

4.1.8 Distribution of farmers based on land holding category and occupation

Table 9 shows that 38.12 and 31.25 per cent of the farmers were agricultural labourers and large farmers, respectively followed by 25 per cent were small farmers and lastly 5.62 per cent were small and marginal farmers in the study area. It was also observed from Table 9 that 71.87 per cent of the farmers were having sheep rearing as

their main occupation while 28.13 per cent had agriculture related activities as their main occupation.

Table 9. Distribution of farmers based on category and occupation

S.No.	Particulars	Percentage (%)
Land holding category		
1	Agricultural labourers (Landless)	38.13
2	Marginal farmers (0-2.5 acres)	5.62
3	Small farmers (2.5-5.0 acres)	25.00
4	Large farmers (above 5 acres)	31.25
Occupation		
1	Sheep rearing	71.87
2	Agriculture	28.13

(N=160)

4.1.9 Flock size and composition

The composition of flock and average flock size was presented in the Table 10. The average flock size in the study area was 307.85 heads. Among the flock, 7.0, 181.66, 25.98, 41.98 and 51.21 heads were breeding rams, ewes, male hoggets, male lambs and female lambs, respectively.

Table 10. Flock composition particulars of migratory sheep farmers

S.No.	Particulars	Number
1	Mean flock size	307.85
Flock composition		
2	Breeding Rams	7.0

3	Ewes	181.66
4	Male hoggets	25.98
5	Male lambs	41.98
6	Female lambs	51.21

4.1.10 Ownership status

Distribution of sheep farmers according to ownership status was presented in Table 11. Majority (93.12%) of farmers possessed their own sheep units while 6.87 per cent farmers reared sheep on rental basis (paliki).

Table 11. Distribution of farmers based on ownership status

S. No.	Ownership of flocks	Percentage (%)
1	Own	93.13
2	Hired (Paliki)	6.87

(N=160)

4.1.11 Penning and lamb enclosure

It was observed from Table 12 that all the farmers in the study area penned their sheep during night times to provide night shelter and get reasonable amounts as penning charges in exchange for manuring the farmer's fields. Further it was observed that 100 per cent of the farmers provided lamb enclosures for new born lambs until weaning.

Table 12. Distribution of farmers based on provision of penning and lamb enclosure

S.No.	Particulars	Percentage (%)
1	Penning	100

2	Lamb enclosure	100

(N=160)

4.1.12 Labour involvement in sheep rearing

The extent of labour involvement in sheep rearing is presented in Table 13. Majority of sheep farmers (76.87%) involved themselves in sheep rearing whereas 10 per cent of the farmers hired the services of labour for sheep rearing and 13.13 per cent shepherds who are owners reared the sheep along with hired labour in the study area.

Table 13. Distribution of labour employment in sheep rearing

S.No.	Particulars	Percentage (%)
1	Self	76.87
2	Hired	10
3	Both	13.13

(N=160)

4.1.13 Grazing and feeding practices

Grazing and feeding practices followed in the study area was presented in Table 14. It was observed that farmers depend mainly on available grazing resources to rear their sheep flocks. Overall majority (37.5%) of the farmers utilized all types lands (community land, forests and waste lands) followed by forests + waste lands (35%), waste barren lands (3.75%) and forests alone (2.5%) for grazing of their sheep. The average grazing time in the study area was found to be 8.5 ± 0.05 hours and the mean grazing distance recorded was 5.14 ± 0.06 km per day.

Table 14. Grazing and feeding practices

S.No.	Type of grazing resources	Percentage (%)
Grazing lands		
1	Forests	2.5
2	Waste lands	3.75
3	Community lands +Forests	3.75
4	Community lands + Waste lands	17.5
5	Forests + Waste lands	35.0
6	All resources	37.5
7	Total	100
Grazing management		
1	Grazing time (hours)	8.5 ± 0.05
2	Grazing distance (km)	5.14±0.06

(N=160)

4.1.14 Breeding practices followed by sheep farmers

The distribution of sheep farmers according to breeding management practices adopted by shepherds were presented in Table 15.

4.1.15 Sex ratio

The average sex ratio maintained by the sheep farmers was 1:28 i.e. one breeding ram was maintained to breed 28 females.

4.1.16 Retention of breeding rams in flock

The mean retention time of breeding rams in flock was observed to be 5.2 years. It was observed that majority (86.25%) of the farmers didn't practice rotation

of breeding rams, whereas only 13.75 per cent of the farmers followed rotation of breeding rams.

4.1.17 Culling of breeding ewes

The findings pertaining to culling pattern of breeding ewes showed that 22.5 per cent of the farmers culled their sheep, whereas majority (77.5%) of the farmers didn't practice culling.

4.1.18 Lambing frequency

The observations on lambing frequency showed that majority (58.13%) of sheep farmers harvested one lamb crop in a year followed by 25 per cent harvested three lamb crops in two years whereas 16.87 per cent of shepherds obtained two lamb crops in 18 months.

4.1.19 Weaning

All the farmers in the study area practiced weaning. The average weaning age was observed to be 3.4 months.

Table 15. Breeding management practices

S.No.	Practice	Percentage
1	**Rotation of breeding rams**	
	Yes	13.75
	No	86.25
	Sex ratio	1:28
	Retention age of rams (Years)	5.2
2	**Culling**	
	a. Yes	22.5

	b. No	77.5

Contd…

3	**Lambing frequency**	
	a. Once in a year	58.13
	b. Twice a 18 months	16.87
	c. Thrice in 2 years	25
	Weaning	
	a. Practice of weaning	100
	b. Weaning age (Months)	3.4

(N=160)

4.1.20 Health care mangement practices

Deworming and Deticking

Deworming and deticking practices followed by the sheep farmers were presented in Table 16. It was observed that all the farmers followed deworming of their flocks, but the frequency of deworming varied from farmer to farmer. On an average deworming was done 4.26 times in a year.

Majority (45%) of the sheep farmers got their flocks dewormed by self medication and advice of veterinarian, followed by 26.87 per cent of flocks dewormed by advice of veterinarian and veterinary drug stockists, 17.5 per cent of flocks dewormed together by advice of veterinarian, stockists and farmers themselves. While 10.63 per cent of them got dewormed their flocks by advice of veterinarian.

The management practice of spraying to protect the sheep from external parasites was followed by 40 per cent of shepherds while majority (60%) of the respondents didn't follow the deticking practice.

Table 16. Practice of deworming and deticking

S.No.	Particulars	Percentage (%)
1	Deworming	100
2	Frequency of deworming/year	4.26 times
Advice of deworming agent		
	Vet	10.63
	Self+vet	45.00
	Vet+Stockist	26.87
	Self+Vet+Stockist	17.50

(N=160)

4.1.21 Vaccination and treatment of sick animals

The vaccination practices and treatment of sick animals carried out in the study area was presented in Table 17.

All the farmers in the study area adopted the practice of immunization in their flocks to protect their sheep from infectious diseases. Majority (68.13%) of the sheep farmers got their flocks vaccinated by qualified veterinarian and paraveterinary staff. However a sizable proportion (31.87%) of shepherds vaccinated their flocks by themselves by procuring the vaccines from the stockists of veterinary drugs.

Migratory farmers of the study area followed vaccination programme as a preventive measures against diseases like Enterotoxaemia (94.37%) followed by Haemorrhagic Septicemia (92.5%), Blue Tongue (22.5%) *Peste-des-petites ruminants* (87.5%), sheep pox (85.63%) and others (6.87%). The treatment of sick animals was carried out by shepherds themselves and also on the advice of veterinarian and at times stockist.

From the results (Table 17) it could be observed that on an average there was 42.55 per cent morbidity and 15.6 per cent mortality due to various infectious and systemic diseases.

Table 17. Practice of Immunization

S.No.	Particulars	Percentage (%)
1	**Vaccination agent**	
	Self	31.87
	Vet	68.13
2	**Vaccination against particular diseases**	
	PPR	100
	ET	94.37
	HS	92.5
	BT	22.5
	Sheep Pox	85.63
	Others	6.87
3	Morbidity	42.5
4	Mortality	15.6

(N=160)

4.1.22 Carcass disposal pattern

Carcass disposal pattern in the study area was presented in Table 18. It can be observed that throwing of carcass into open fields was practiced by 53.7 per cent of farmers. About 23.75 per cent of farmers practiced burial and the remaining 22.5 per cent of farmers used for human consumption.

Table 18. Carcass disposal pattern

S.No.	Carcass disposal	Percentage (%)
1	Thrown in open fields	53.75
2	Burial	23.75
3	Consumption	22.50

(N=160)

4.1.23 Manure disposal pattern

It was observed that all the farmers disposed the manure either by sale or by penning in farmers fields. Majority of the shepherds disposed manure by way of penning for money against provision of either food or crop stubbles by the farmer.

Table. 19 Utilization / pattern of manure disposal

S.No.	Manure disposal	Percentage
a	Sale by penning for money	30.62
b	In lieu of stubbles by penning	22.5
c	Penning for food	19.38
d	In lieu of stubbles + food	23.12
e	Penning for money + food	4.38

(N=160)

4.2 PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF THE MIGRATORY SHEEP FLOCKS

4.2.1 Productive performance of migratory sheep flocks

The Productive performance of the migratory sheep flocks in the study area were presented in Table 20. The mean birth weight of ram lambs and ewe lambs was 3.04 ± 0.01 kg and 2.84 ± 0.01 kg, respectively. The mean weaning weight of males and females were 11.88 ± 0.09 kg and 11.75 ± 0.09 kg, respectively. The mean

weights at 6 months of age were 16.07 ± 0.2 kg and 15.79 ± 0.11 kg in males and females, respectively. The body weights at 1 year of age were 28.43 ± 0.25 kg and 23.55 ± 0.25 kg in males and females, respectively.

Table 20. Productive performance of migratory sheep flocks

S.No.	Age group	Mean ± S.E of Body weights	
		Male	Female
1	Birth weight (kg)	3.04 ± 0.01	2.84 ± 0.01
2	Weaning weight (kg)	11.88 ± 0.09	11.75 ± 0.09
3	6 months weight (kg)	16.07 ± 0.2	15.79 ± 0.11
4	1 year weight (kg)	28.43 ± 0.25	23.55 ± 0.25

4.2.2 Reproductive performance of migratory sheep flocks

The reproductive performance of the migratory sheep flocks were presented in the Table 21. Age of the ewes and rams at first mating was 12.24 ± 0.23 months and 17.77 ± 0.09 months, respectively. Age at first lambing of ewes was found to be 17.81 ± 0.10 months. A tupping percentage of 86.9 ± 0.27 and lambing percentage of 81.25 ± 0.16 were observed in the study area. The average lambing interval was 8.03 ± 0.01 months. The mean weaning percentage observed was 87.75 ± 0.26.

Table 21. Reproductive performance of sheep flocks

S.No.	Parameters	Months
1	Age of ewes at first mating	12.24 ± 0.23
2	Age of rams at first mating	17.77 ± 0.09
3	Age of ewes at 1st lambing	17.81 ± 0.10
4	Tupping%	86.9 ± 0.27
5	Lambing%	81.25 ± 0.16

6	Lambing interval	8.03 ± 0.01
7	Weaning%	87.75

4.3 IDENTIFICATION OF MIGRATORY TRACTS AND PATTERNS IN ANANTAPUR DISTRICT

The migratory tracts were classified as (i) major migratory tracts (100 km and above) and (ii) minor migratory tracts (below 100 km) and a total number of fourteen major and twelve minor migratory tracts of sheep were identified in Anantapur district and were numbered serially based on the distance covered.

4.3.1 Major migratory tracts of sheep flocks in Anantapur District

The distance travelled in major migratory tract-I was 216 km which started from Chennarayunipalle of Bukkapatnam mandal and passed through Puttaparthi, Guvvalagutta palle, Pedaballi,Gorantla, Kothapalli, Peddaguddampalle, Lepakshi and entered Karnataka, proceeded through Bagepalle, Dibburivandlapalle and reached Ammasandra. The duration of migration of the tract-I was 210 days (Fig.6).

The major migratory tract II started from B.K.Samudram which passed through Brahmanapalli, Jallipalli, Peddamusturu, Uravakonda and Vidapanakal of Anantapur District and Chellagurki and Moka of adjacent Bellary District of Karnataka to finally reach Holagundi of Kurnool District covering a distance of 202 km. The duration of migration of the tract II was 276 days (Fig. 7).

In migratory tract III, the sheep flocks started from Gondireddypalli of Raptadu mandal and travelled 186 km covering nine places and passed through Sanapa, Kudairu, Uravakonda, Palthuru to reach Sankarabanda of Bellary District. The flocks spent 90 days and then passed through PABR dam, Muttala, Maddelacheruvu, Ralla Anantapuram and Kambadur of Anantapur district to reach

NS gate of Karnataka. The total distance covered in this tract was 186 km and the total duration of migration was 216 days (Fig. 8).

Fig.6 : Flow Chart of Major Migratory Tract- I in Anantapur District

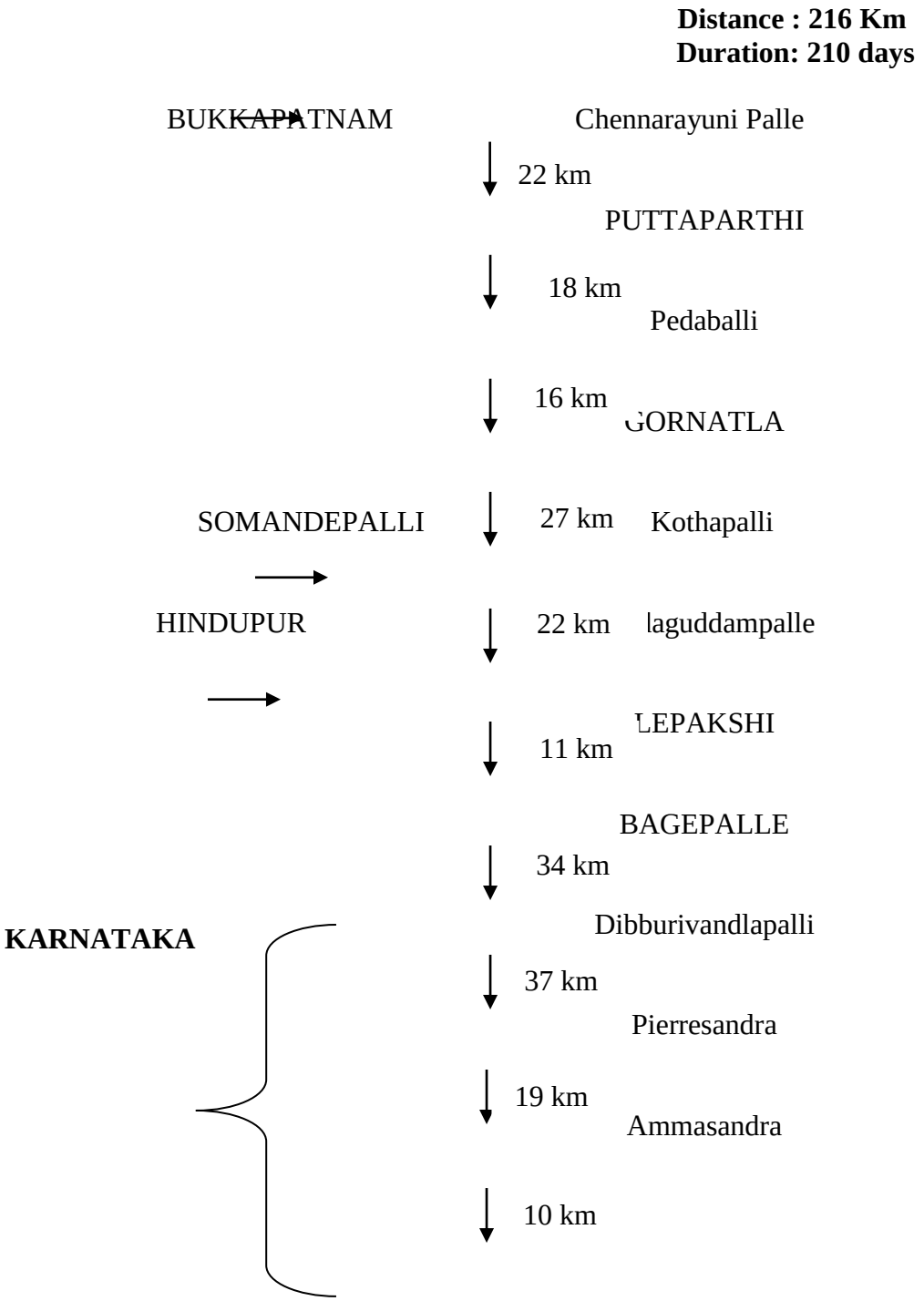


Fig.7 : Flow Chart of Major Migratory Tract- II in Anantapur District

Distance : 202Km

Duration: 276 days

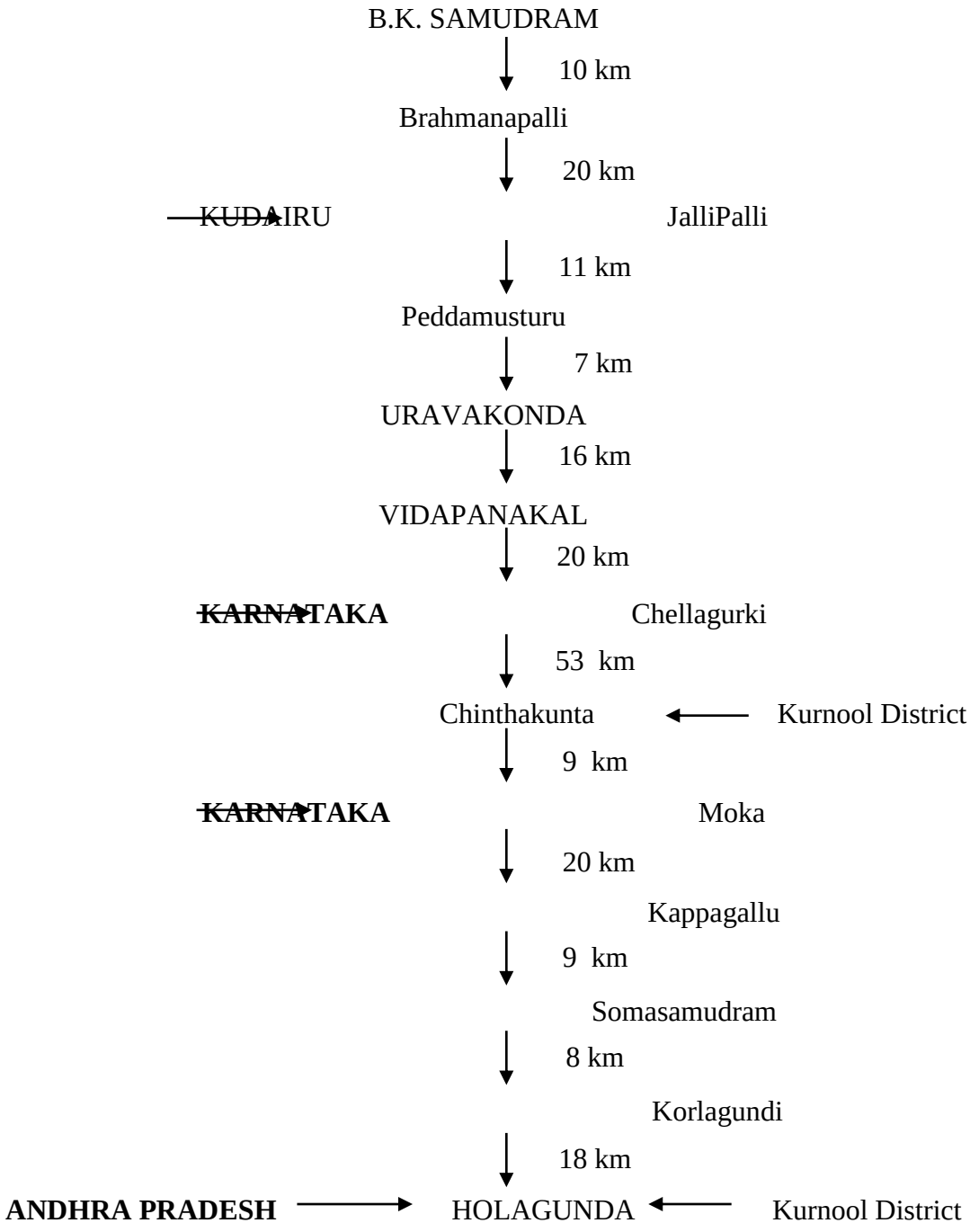
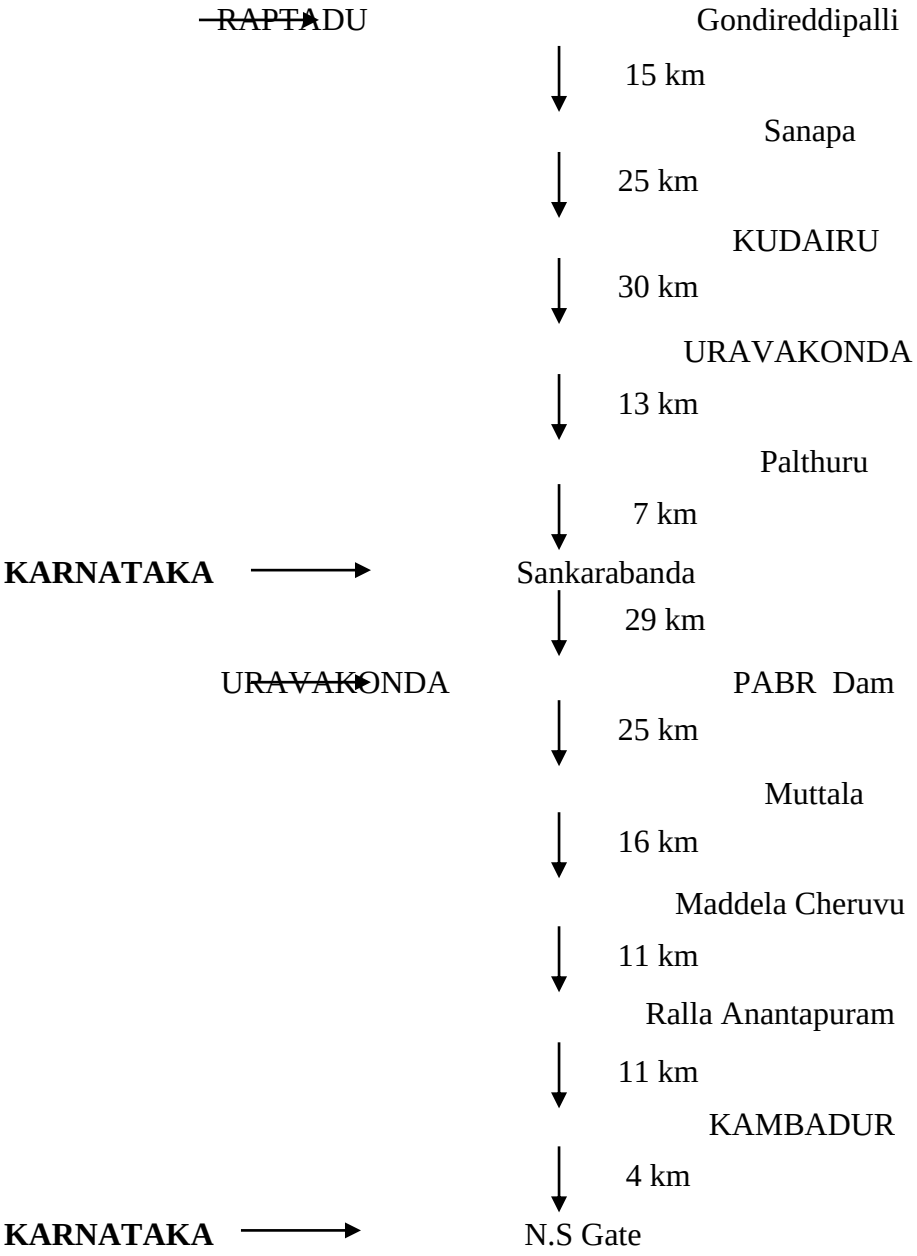


Fig.8 : Flow Chart of Major Migratory Tract- III in Anantapur District

Distance : 186 Km

Duration: 216 days



The sheep flocks in tract IV travelled a distance of 143 km strating from Bhoginepalle of Raptadu mandal to reach Bellary after passing through Thogarakunta, Nuthimadugu, Palavayi, Hulikal, N.Gundla palle including mandal headquarters of Kanaganapalle, Kaylayandurg, Kanekal, Bommanahal. The duration of migration was 208 days (Fig. 9).

The tract V was considered a major tract as the sheep flocks travelled a distance of 134 km. The sheep flocks have commenced their migratory phase from Konapuram of Kanagana palle and reached Parigi of Anantapur District after travelling through Karnataka. The places covered during migration were Nasanakota, Perur, Pavagada, and Roddam. The duration of this tract was 202 days (Fig. 10).

The major migratory tract VI started from Ellakuntla of Kanaganapalle mandal and reached Gajrampalli of Pamidi mandal of Anantapur District after passing through six places including Mandal headquarters of Kudairu, Uravakonda, and Guntakal. The duration of migration of sheep flocks was 200 days covering a distance of 132 km (Fig. 11).

The major migratory tract VII started from Settur, passed through Mulakaledu of Settur Mandal and entered Karnataka state and travelled through Parasuramapura and Challakere to reach Davanagere. The distance covered was 125 km and the duration of migration was 186 days (Fig. 12).

The major migratory tract VIII started from Kanaganapalle and reached Midigesi of Karnataka after crossing places like Konapuram, Nasanakota, Perur, Atchampalle, Pavagada and Madakasira. The distance travelled was 117 km and the duration was 180 days (Fig. 13).

Fig.9 : Flow Chart of Major Migratory Tract- IV in Anantapur District

Distance : 143 Km

Duration: 208 days

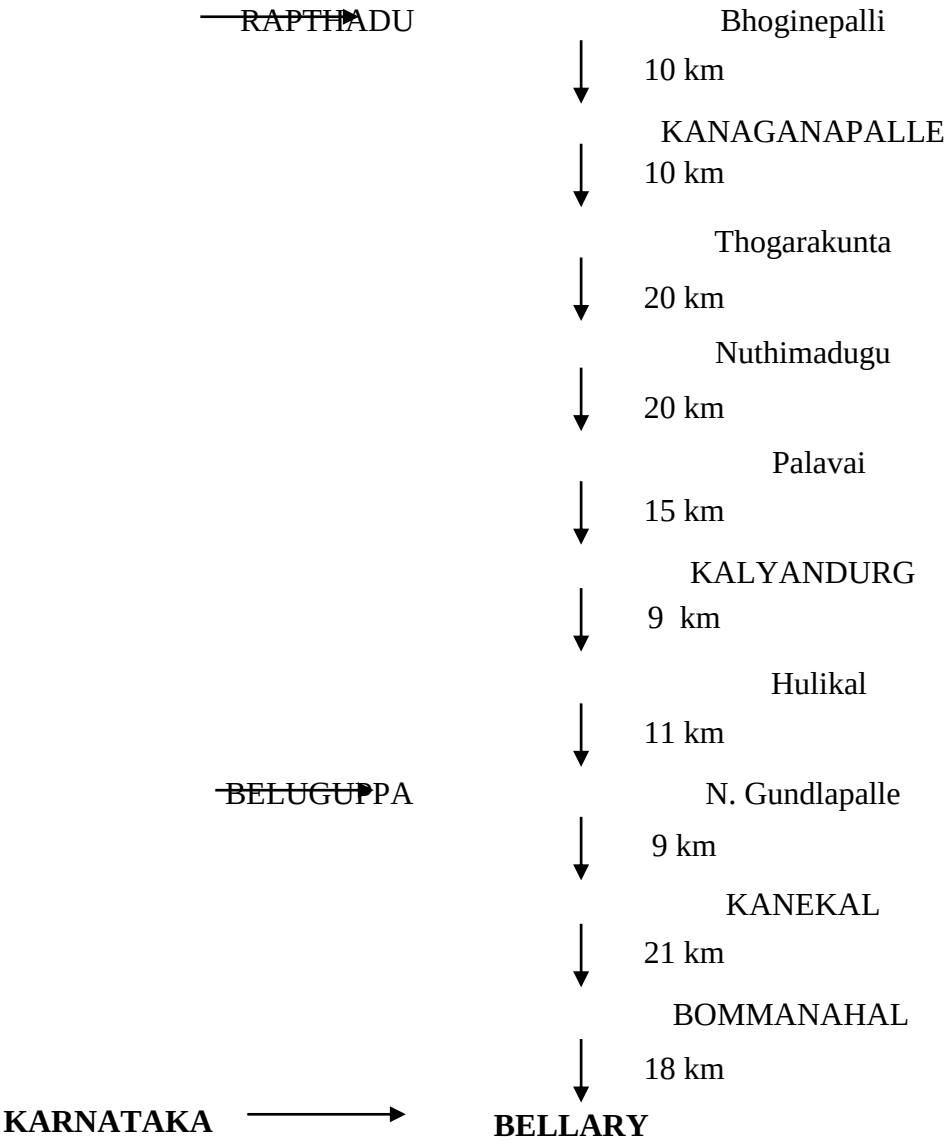


Fig.10 : Flow Chart of Major Migratory Tract- V in Anantapur District

Distance : 134 Km

Duration: 202 days

Fig.11 : Flow Chart of Major Migratory Tract- VI in Anantapur District

Distance : 132 Km

Duration: 200 days

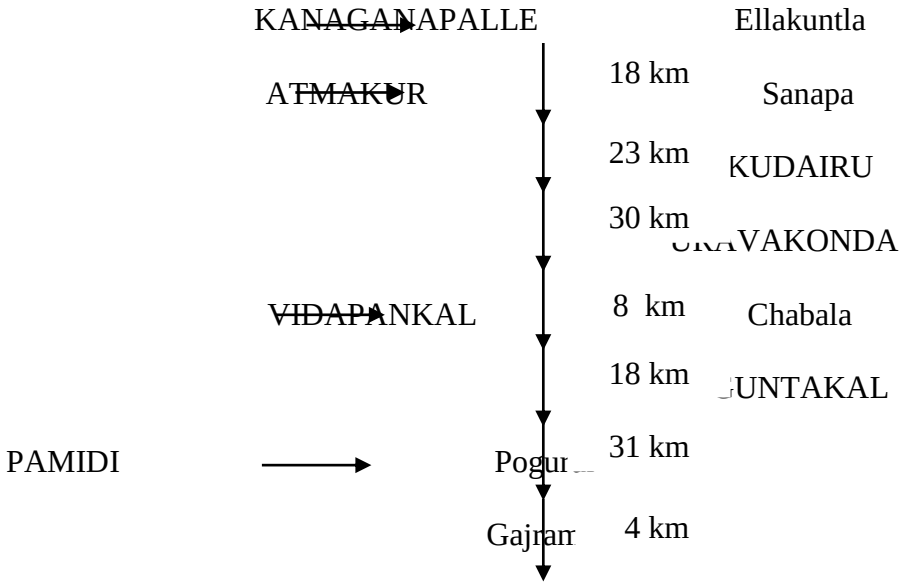


Fig.12 : Flow Chart of Major Migratory Tract- VII in Anantapur District

Distance : 125 Km

Duration: 186 days

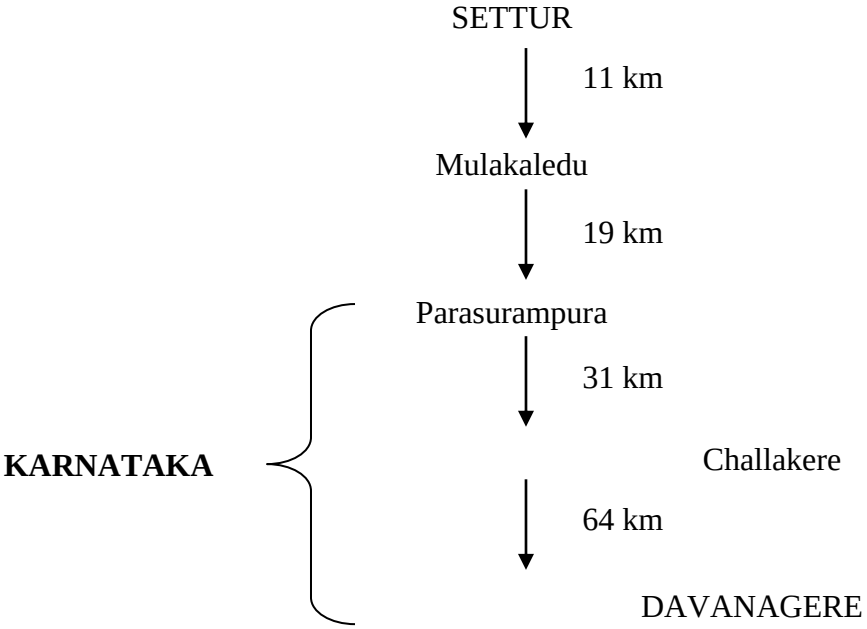
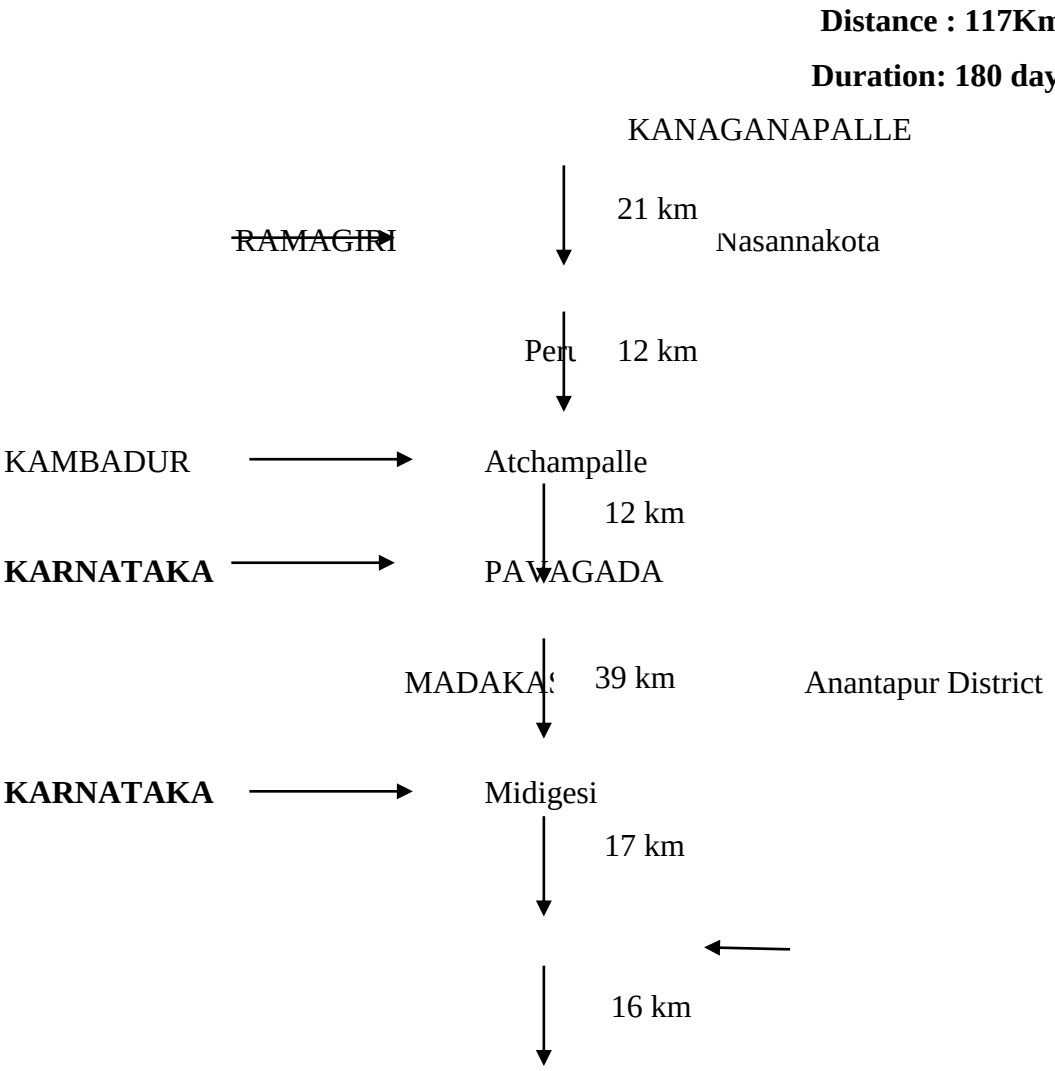


Fig.13 : Flow Chart of Major Migratory Tract- VIII in Anantapur District



The major migratory tract IX got originated from Sangala of Bathalapalle mandal and reached Bagepalle via Kanumukkala, Kodapaganipalle, Kappalabanda, Pedaballe and Gorantla. The distance covered was 116 km and the duration of migration was 176 days (Fig. 14).

The major migratory tract X originated from Kanaganapalle to reach Kanekal having passed through six places like Narsampalle, Nuthimadugu, Kalyandurg, Hulikallu and Gundlapalle cross. The distance travelled was 111 km and the duration was 170 days (Fig. 15).

Sheep flocks from B.K.Samudram passed through Singanamala, Garladinne, Penakacherla dam, Uravakonda, Godekal and entered Bellary District of Karnataka and reached Halaharvi of Kurnool District forming tract number XI covering a distance of 103 km. The duration of migration was 156 days (Fig. 16).

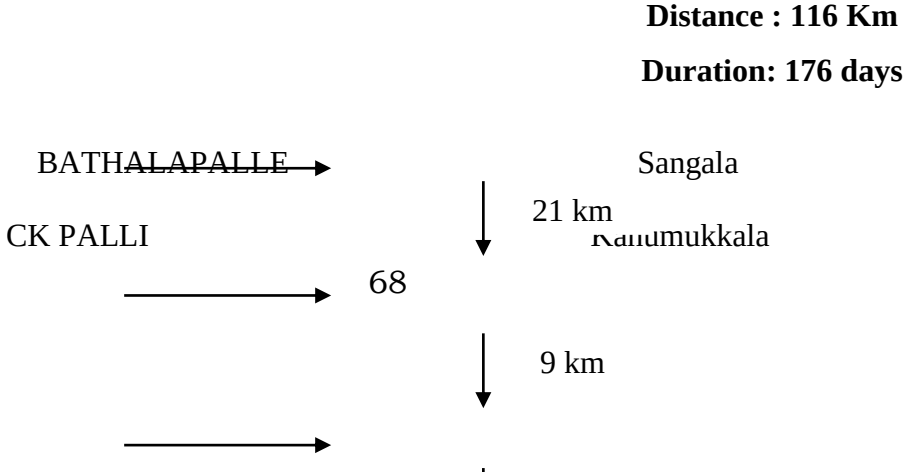
The major migratory tract XII started from Sangala of Bathalapalle mandal and travelled through Mudigubba, Kadiri, Gandlapenta and N.P.Kunta mandals of Anantapur district to reach Galiveedu of Y.S.R district. The distance travelled was 101 km and duration of migration was 150 days. (Fig. 17).

The sheep flocks of Kambadur mandal started from Erramallepalle and travelled to Bellary of Karnataka after passing through Golla, Beluguppa, Malyam, D.Honnura of Anantapur district and Rupanagudi of Bellary district. This route was designated as major migratory tract XIII which covered a distance of 100 km and the duration of migration was 156 days. (Fig. 18).

The major migratory tract XIV started from B.K.Samudram passed through Kudairu, Beluguppa, Kanekal, Bommanahal mandals of Anantapur district to reach Sankarabanda and then to Bellary. The distance travelled was 100 km but the duration

of migration was 240 days (Fig. 19). The migratory tracts I, III and XIII of sheep flocks of Anantapur district were shown in map 3 with different contrast colours. The migratory tracts of II and XIV were diagrammatically depicted in map 4. The migratory tracts IV, V, IX, XI and XII were depicted in map 5, while map 6 indicated migratory tracts of VI, VII, VIII and X.

Fig.14 : Flow Chart of Major Migratory Tract- IX in Anantapur District



KOTHACHERUVU	Kodapaganipalle
PUTTAPARTHI	Kappalabanda
	Pedaballe
	GORANTLA
	Gangampalli
KARNATAKA	BAGEPALLE

Fig.15 : Flow Chart of Major Migratory Tract- X in Anantapur District

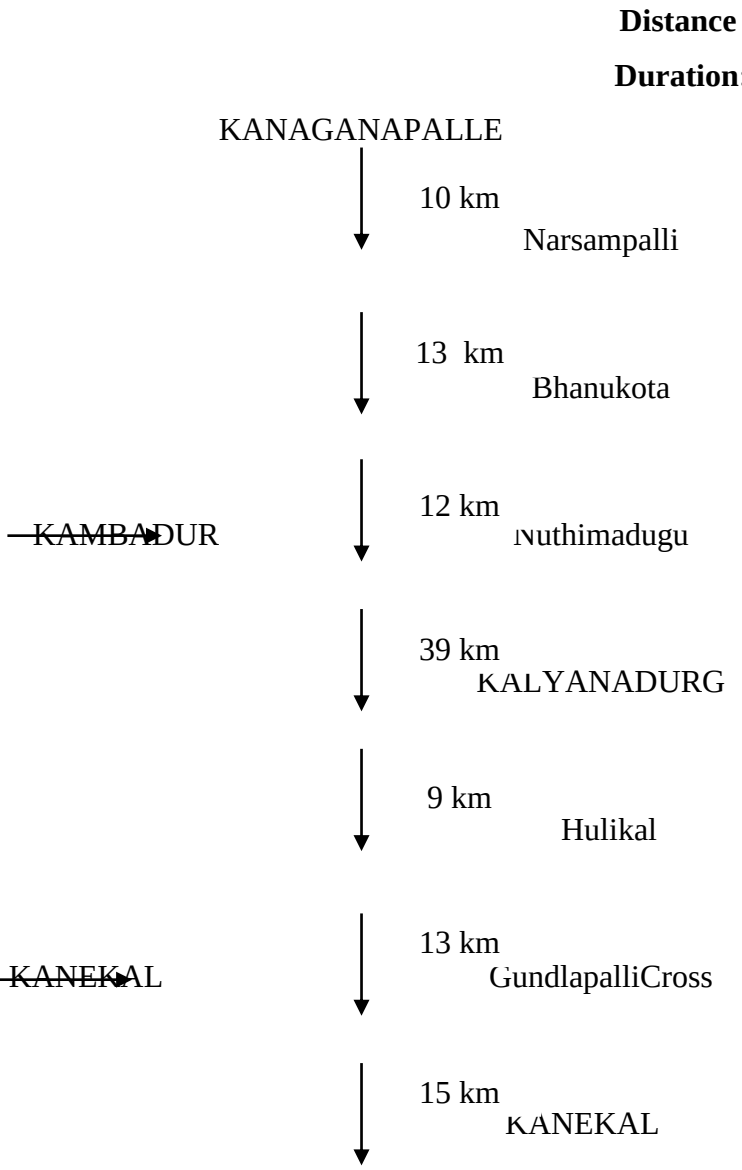


Fig.16 : Flow Chart of Major Migratory Tract- XI in Anantapur District

Distance : 103 Km

Duration: 156 days

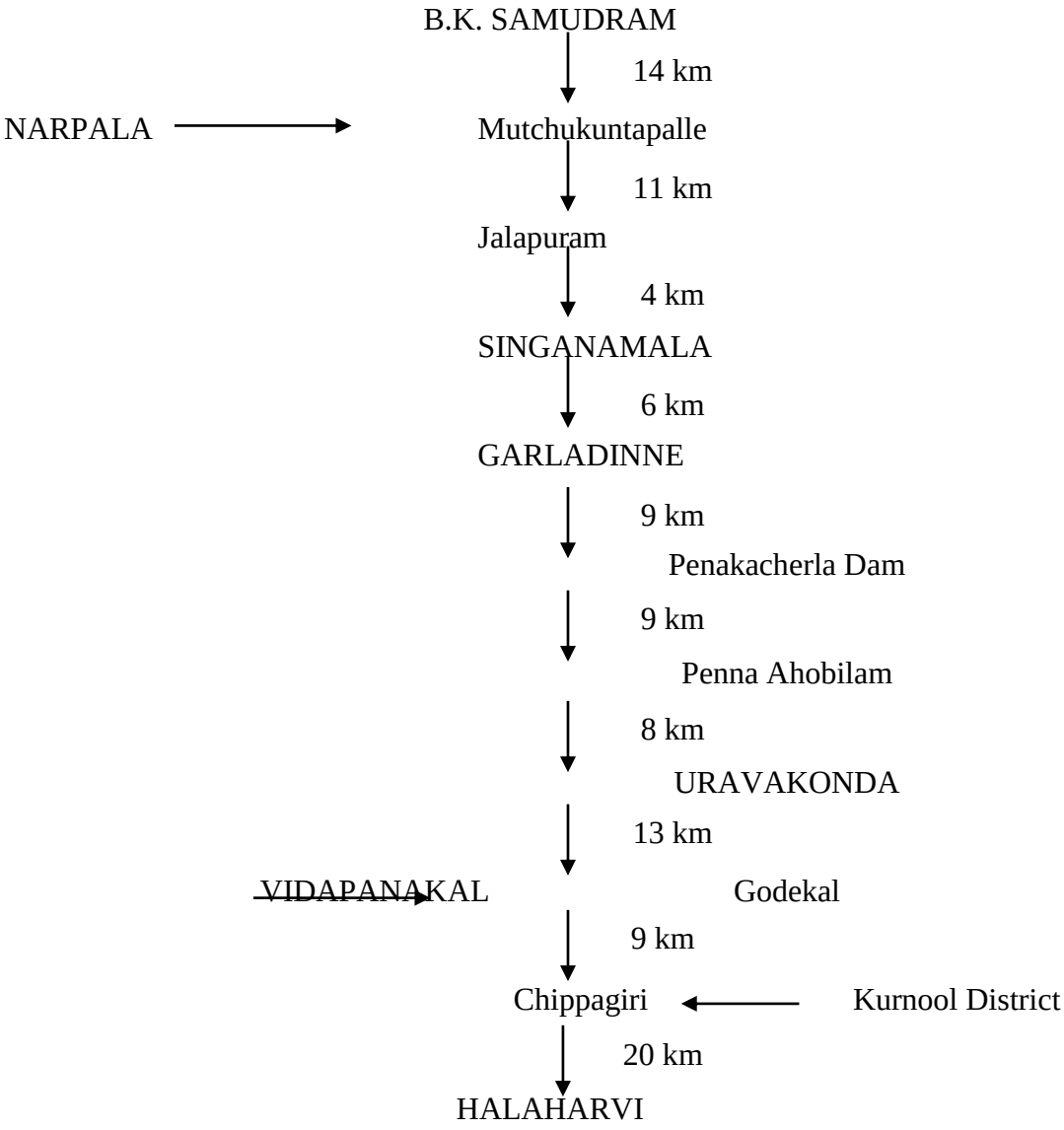


Fig.17 : Flow Chart of Major Migratory Tract- XII in Anantapur District

Distance : 101 Km

Duration: 150 days

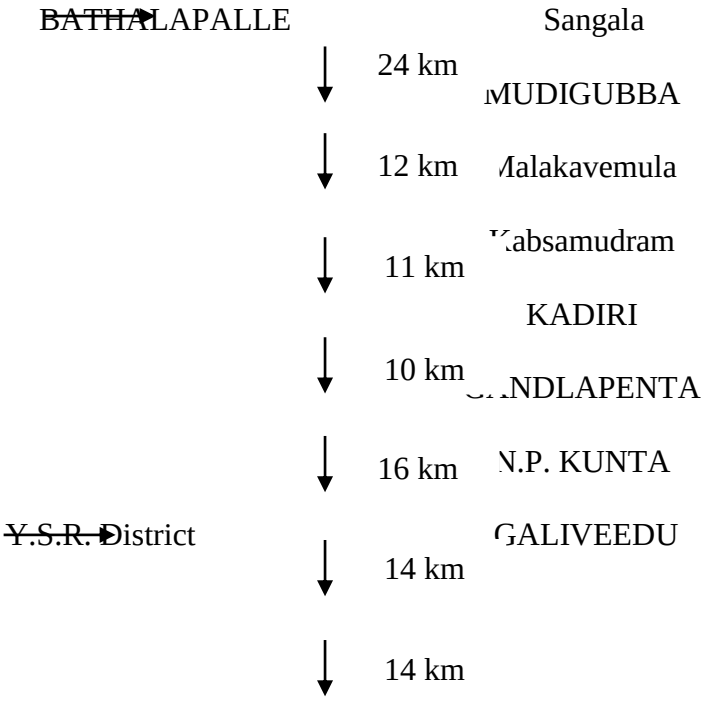


Fig.18 : Flow Chart of Major Migratory Tract- XIII in Anantapur District

Distance : 100 Km

Duration: 156 days

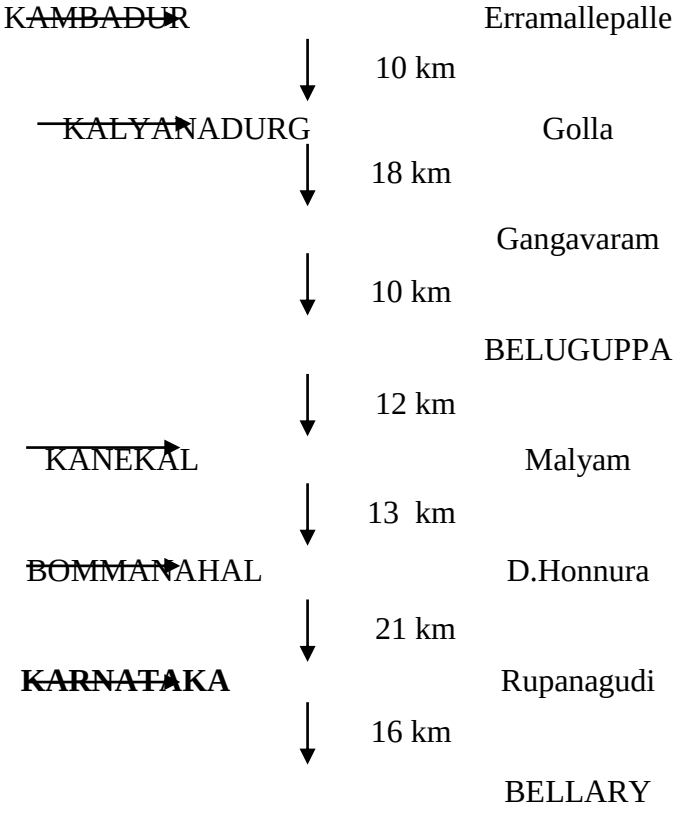
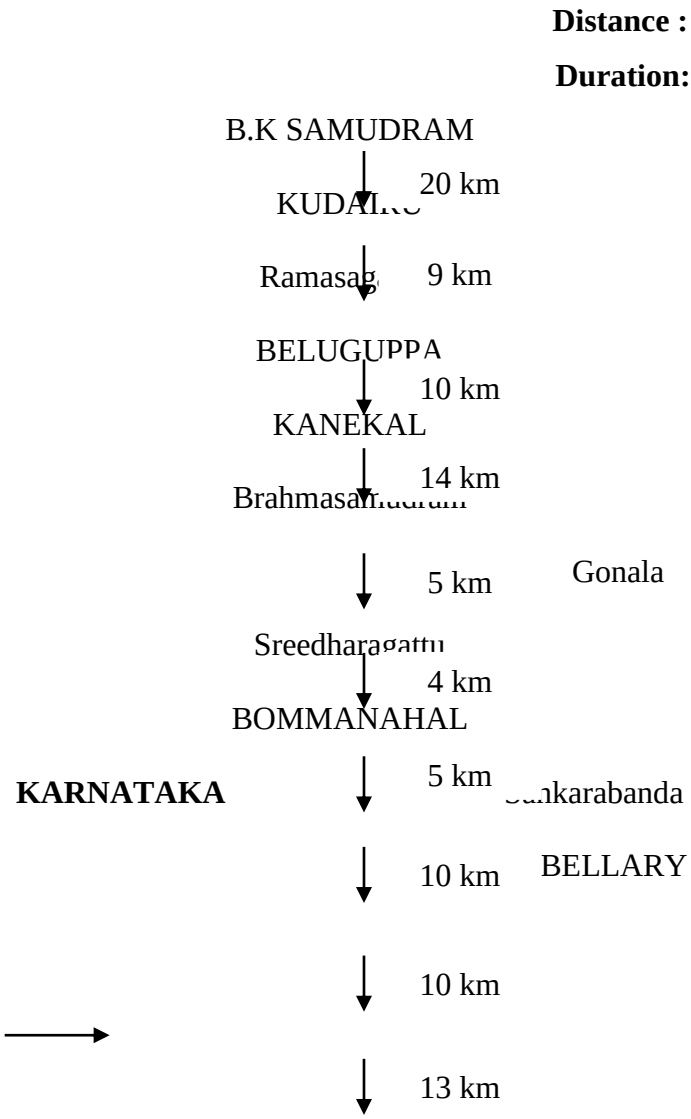
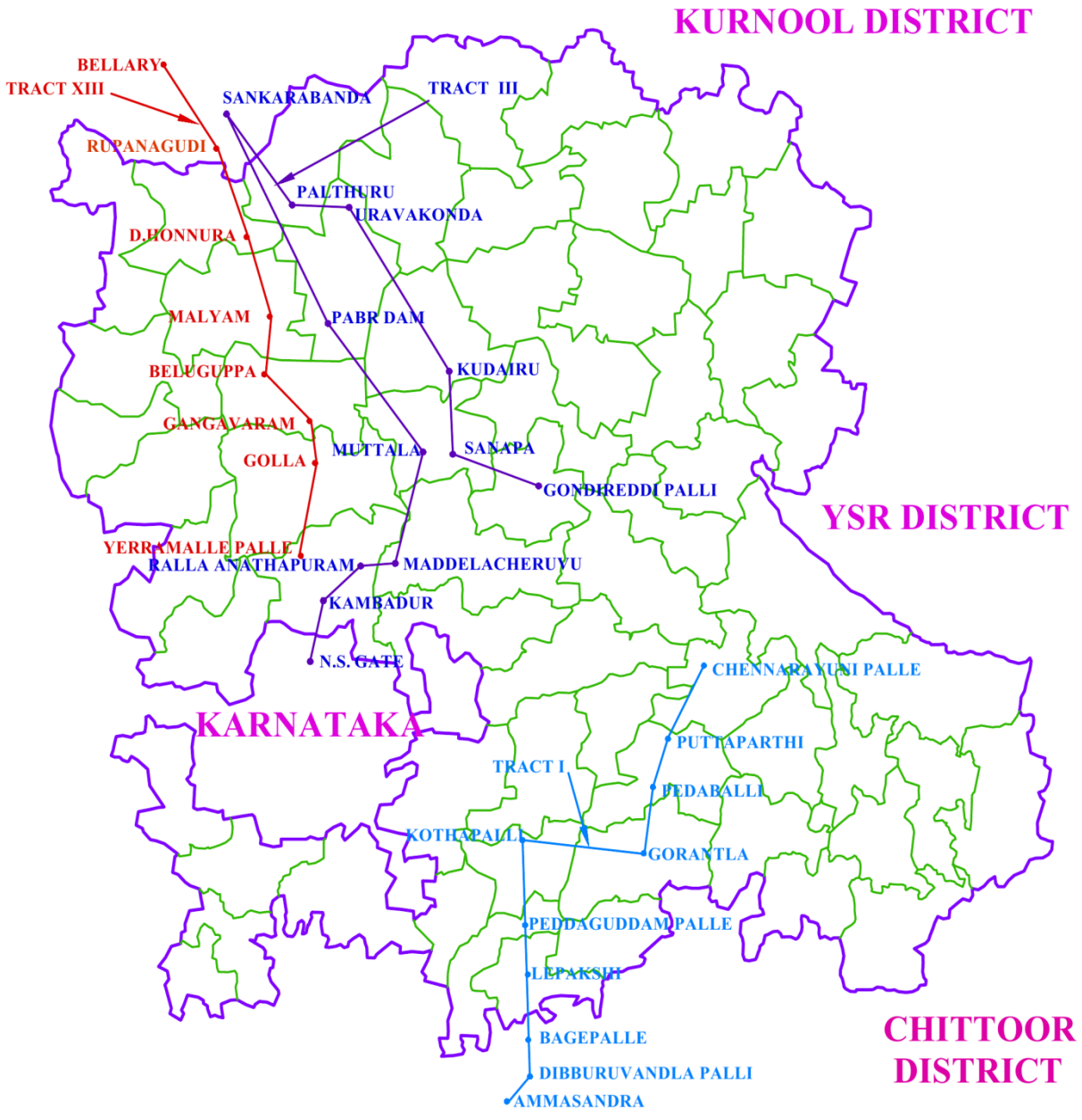


Fig.19 : Flow Chart of Major Migratory Tract- XIV in Anantapur District



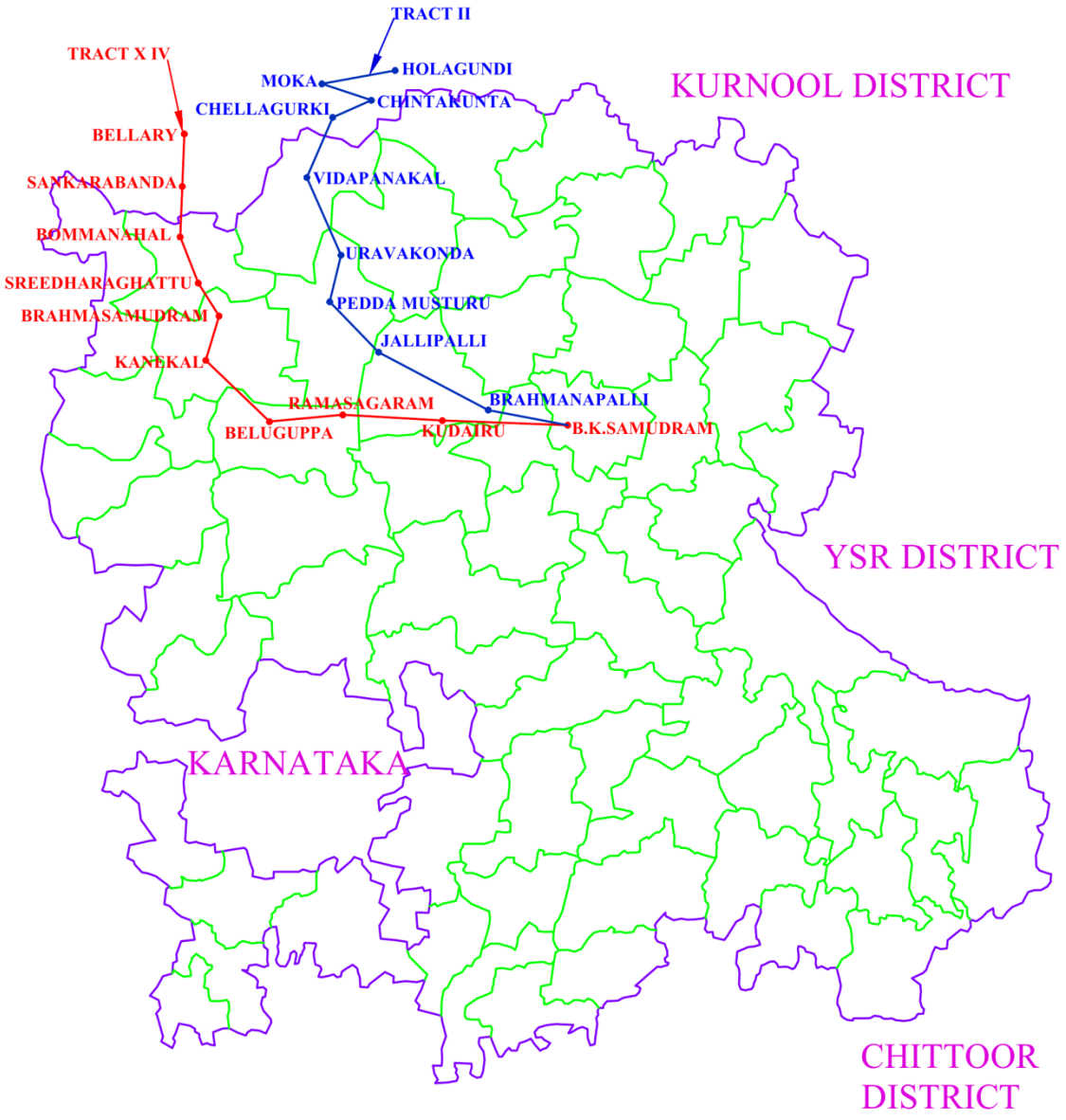
MAP 3 : MAJOR MIGRATORY TRACTS

TRACT I :: DISTANCE 216 Km FROM CHENNARAYUNI PALLE TO AMMASANDRA
TRACT III:: DISTANCE 186 Km FROM GONDIREDDI PALLI TO N.S.GATE
TRACT XIII :: DISTANCE 100 Km FROM YERRAMALLE PALLE TO BELLARY



MAP 4 : MAJOR MIGRATORY TRACTS

TRACT II :: DISTANCE 202 Km FROM B.K.SAMUDRUM TO HOLAGUNDI
TRACT XIV :: DISTANCE 100 Km FROM B.K.SAMUDRUM TO BELLARY



MAP 5 : MAJOR MIGRATORY TRACTS

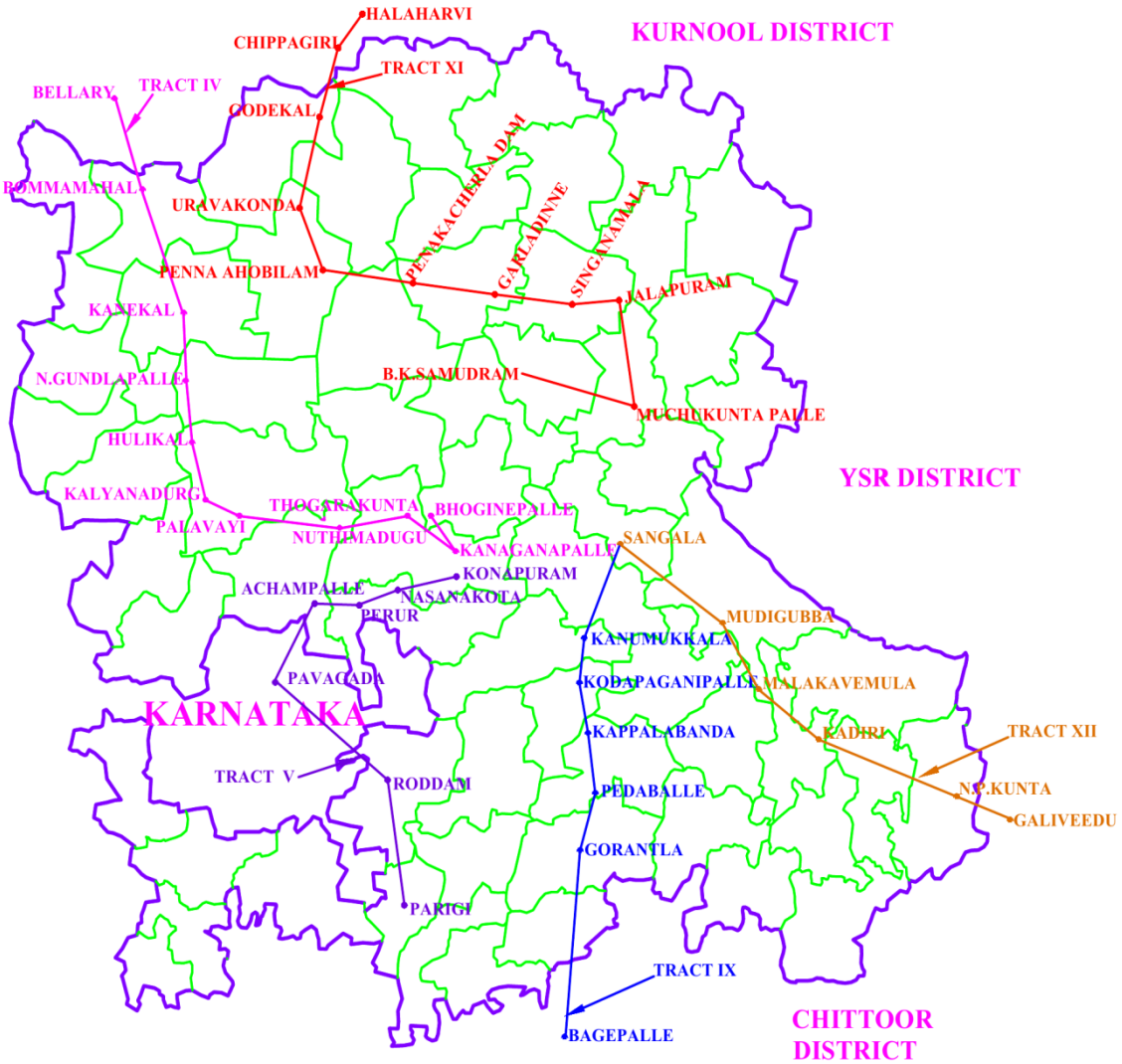
TRACT IV :: DISTANCE 143 Km FROM BOGINEPALLE TO BELLARY

TRACT V :: DISTANCE 134 Km FROM KONAPURAM TO PARIGI

TRACT IX :: DISTANCE 116 Km FROM SANGALA TO BAGEPALLE

TRACT XI :: DISTANCE 103 Km FROM B.K.SAMUDRAM TO HALAHARVI

TRACT XII :: DISTANCE 101 Km FROM SANGALA TO GALIVEEDU



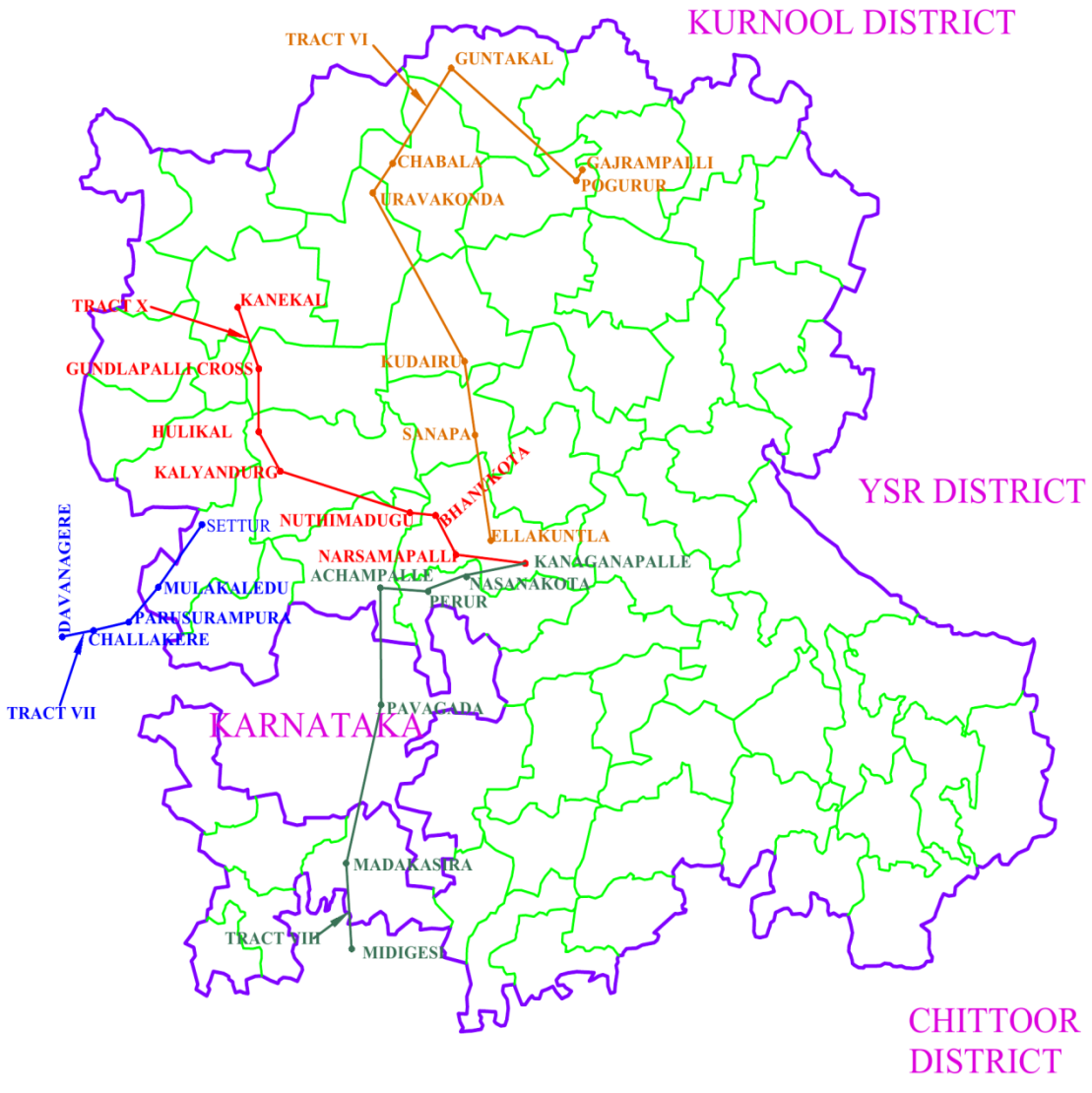
MAP 6 : MAJOR MIGRATORY TRACTS

TRACT VI :: DISTANCE 132 Km FROM ELLAKUNTLA TO GAJRAMPALLI

TRACT VII :: DISTANCE 125 Km FROM SETTUR TO DAVANAGERE

TRACT VIII :: DISTANCE 117 Km FROM KANAGANAPALLI TO MIDIGESI

TRACT X :: DISTANCE 111 Km FROM KANAGANAPALLI TO KANEKAL



4.3.2 Minor migratory tracts of sheep flocks in Anantapur district

A total number of twelve minor migratory tracts were identified in Anantapur district. Minor migratory tract-I started from Raptadu mandal and reached Pavagada of Karnataka after passing through Kanaganapalle and Ramagiri mandals covering a distance of 96 km and the duration of migration was 159 days (Fig. 20).

The distance travelled in minor migratory tract II was 93 km where the sheep flocks started from Vadrahonnuru of Rayadurg mandal and passed through Beluguppa, Malyam, Uravakonda, Vidapanakal and reached Thonganakallu after Bellary in Karnataka. The distance travelled was 93 km and the duration of this tract was 150 days (Fig. 21).

The minor migratory tract III got originated from Mudigubba and passed through mandal headquarters of Kadiri, Nallacheruvu, Tanakallu of Anantapur district and entered into Chittoor district after crossing Kokkanti cross to reach Burakayalakota via Molakalacheruvu covering a distance of 90 km and spent 150 days on migration (Fig. 22).

In minor migratory tract IV, the sheep flock started from Vadrahonnuru of Rayadurg mandal and passed through Kanekal cross, Uddehal, Bommanahal and reached Bellary in Karnataka after travelling a distance of 83 km. The duration of migration was 145 days (Fig. 23).

In migrataory tract V, the sheep flocks of Mudigubba mandal have started from A. B. Palii Thanda crossed Mudigubba, Yerripalli of Anatapur district and entered into Y.S.R. district and reached Yellampalli of Pendlimarri mandal after crossing mandals of Pulivendula and Vempalli. The distance of this tract was 77 km and duration of migration was145 days (Fig. 24).

Fig.20 : Flow Chart of Minor Migratory Tract-I in Anantapur District

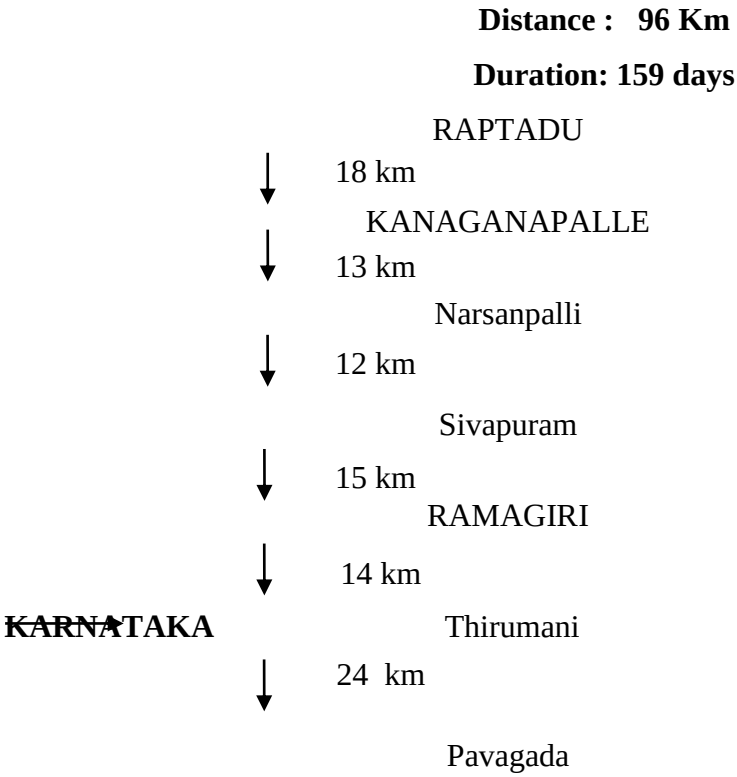
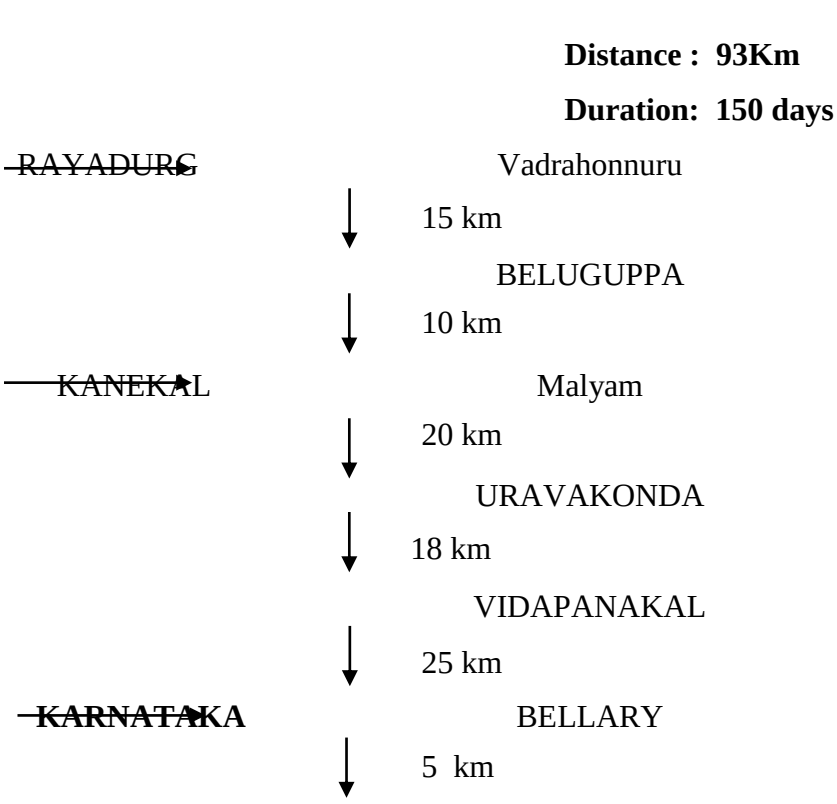


Fig.21 : Flow Chart of Minor Migratory Tract-II in Anantapur District



Thonganakallu

Fig.22 : Flow Chart of Minor Migratory Tract-III in Anantapur District

Distance : 90 Km

Duration: 150 days

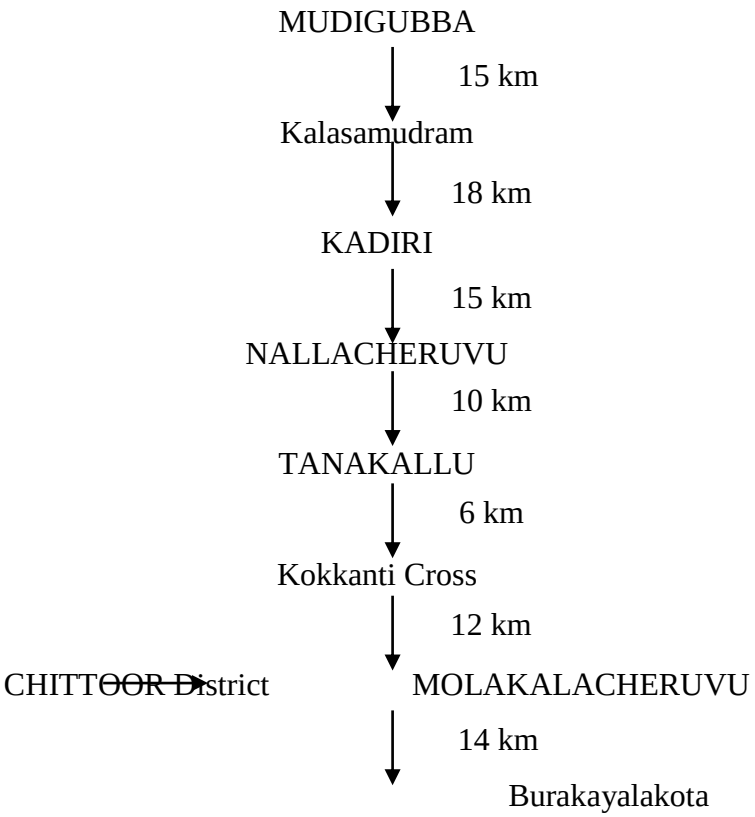


Fig.23 : Flow Chart of Minor Migratory Tract- IV in Anantapur District

Distance : 83 Km

Duration: 145 days

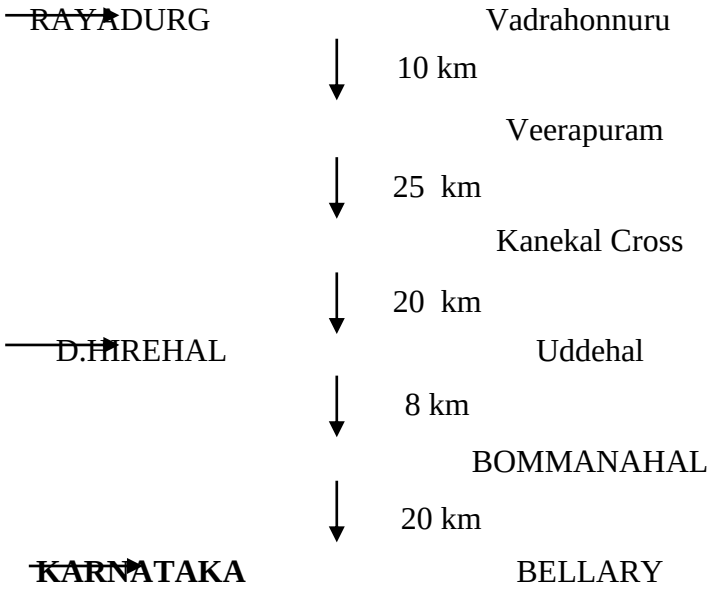
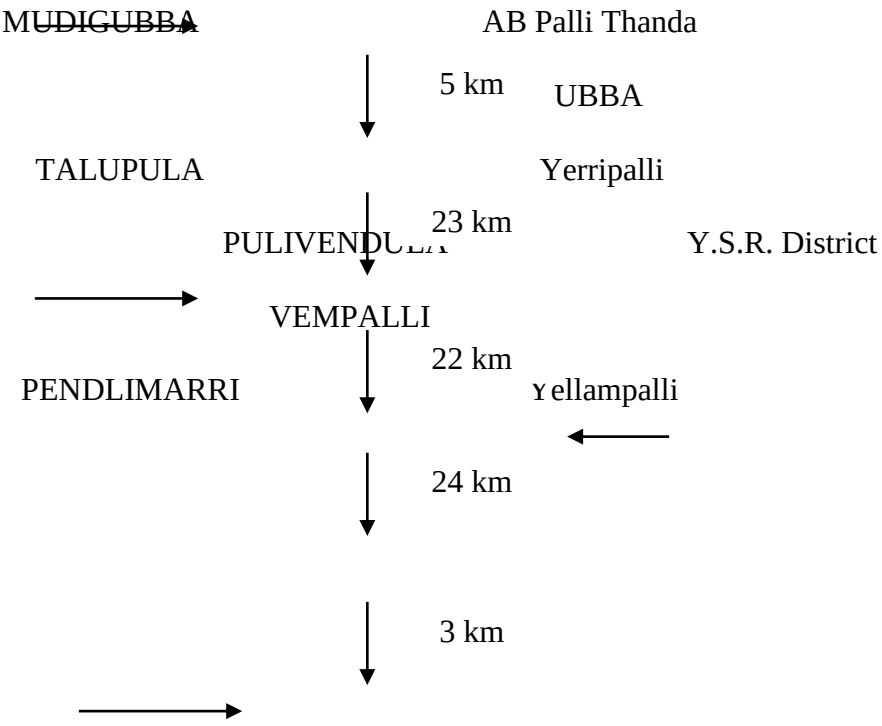


Fig.24 : Flow Chart of Minor Migratory Tract- V in Anantapur District

Distance : 77 Km

Duration: 145 days



In minor migratory tract VI, the sheep flocks started from Rayadurg and reached Adigili of Karanataka via Somalapurm, Hosaguddam, Obulapuram of Anantapur district and Rupanagudi of Bellary district of Karnataka. The distance and duration in this tract was 75 km and 140 days respectively (Fig. 25).

The tract VII originated from Vemuletipalle of Kothacheruvu mandal, passed through Puttaparthi, Bonthalapalle, Gorantla and entered into Karnataka. In Karnataka, after spending 45 days at Gadi dam area, the flocks moved to Chikballapur via Paragodu. The total distance covered was 74 km with duration of 142 days (Fig. 26).

In minor migratory tract VIII, the migration of sheep flocks stared from Konapuam of Kanaganapalle mandal and reached Pamidi after passing through Varimadugu, Gundlaparthi, Kakkalapalle, Garladinne. The distance in this tract was 71 km with a duration of 120 days (Fig. 27).

In minor migratory tract IX, the migration of sheep flocks stared from Kothacheruvu passed through Puttaparthi, Bonthalapalle, Gunthapalle, Chilamathuru and entered Bagepalle of Karnataka to reach Chikballapur. The duration of this tract was 150 days and distance was 63 km (Fig. 28).

The distance travelled by sheep flocks in minor migratory tract X was 62 km which proceeded from A.B.palli thanda of Mudigubba mandal and reached Kondakamarla of O.D. Cheruvu mandal via Mudigubba, Malakavemula, Nallamada. The duration of the tract was 90 days (Fig. 29).

The distance travelled by sheep flocks in minor migratory tract XI was 30 km which started from Gondireddipalli of Raptadu mandal and passed through

Siddaramapuram to Narpala. The duration of migration of the tract XI was 90 days (Fig. 30).

Fig.25 : Flow Chart of Minor Migratory Tract- VI in Anantapur District

Distance : 75 Km

Duration : 140 days

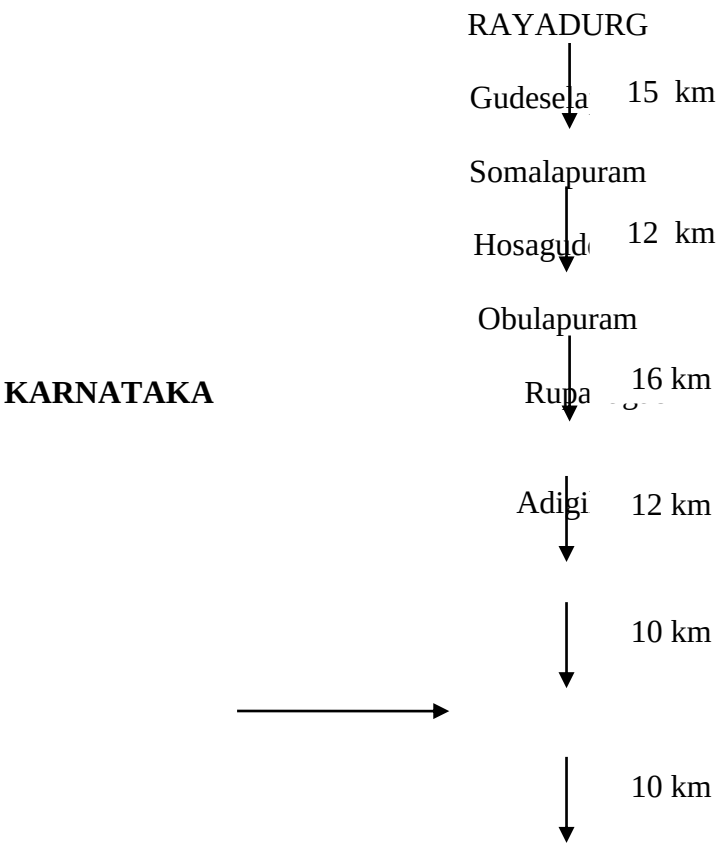


Fig.26 : Flow Chart of Minor Migratory Tract- VII in Anantapur District

Distance :74 Km

Duration: 142 days

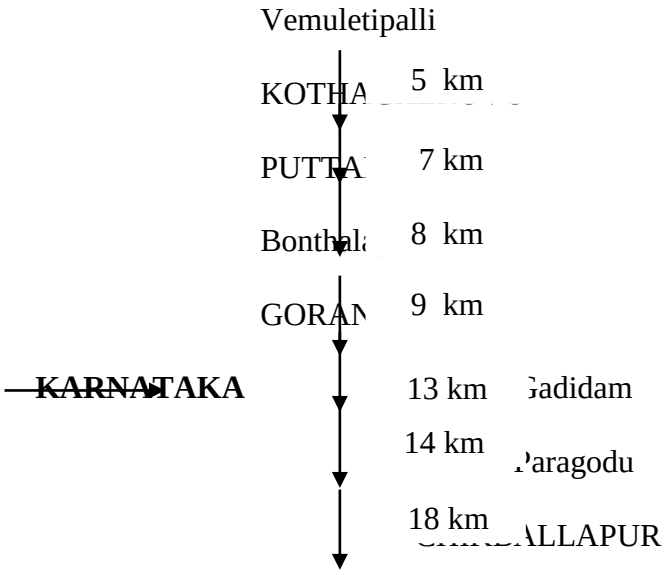


Fig.27 : Flow Chart of Minor Migratory Tract- VIII in Anantapur District

Distance : 71 Km

Duration: 120 days

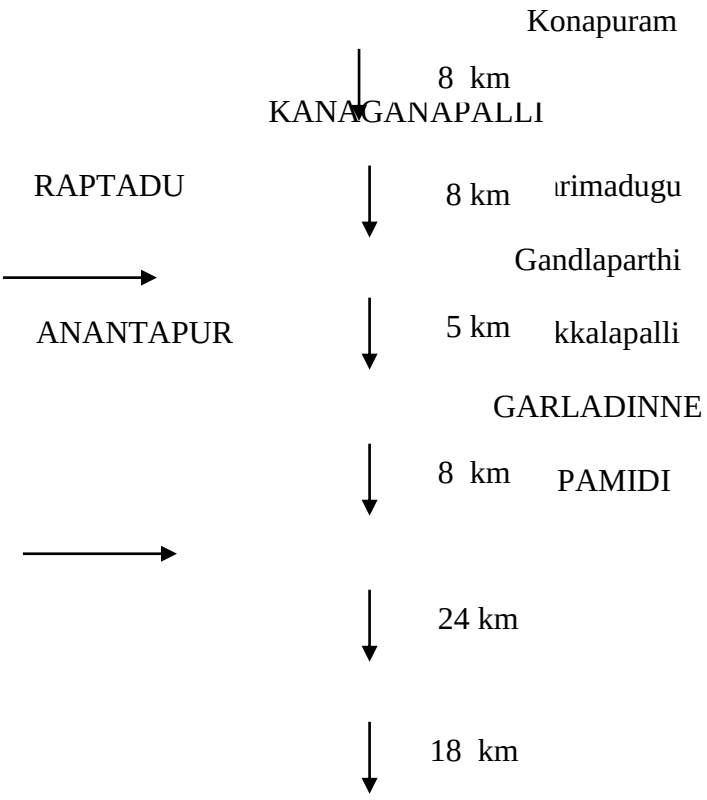


Fig.28 : Flow Chart of Minor Migratory Tract- IX in Anantapur District

Distance : 63 Km

Duration: 150 days

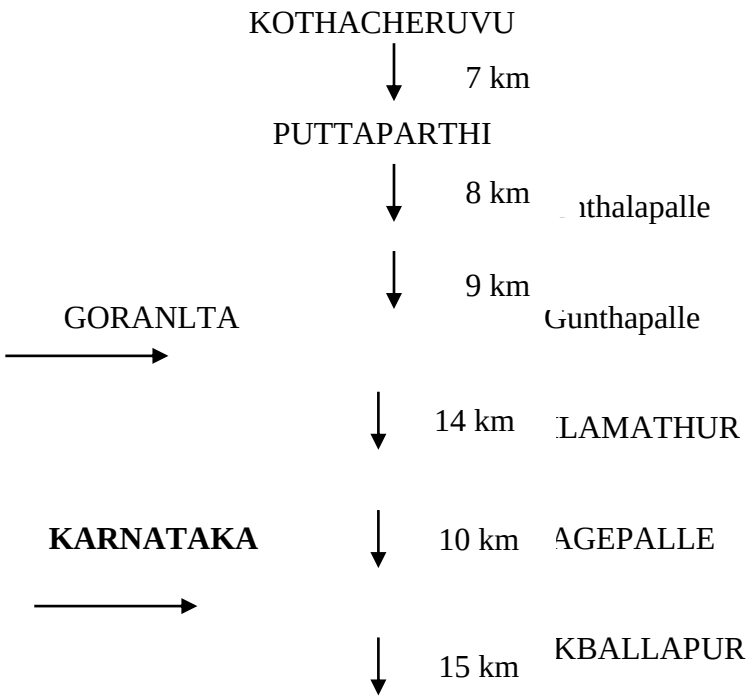


Fig.29 : Flow Chart of Minor Migratory Tract- X in Anantapur District

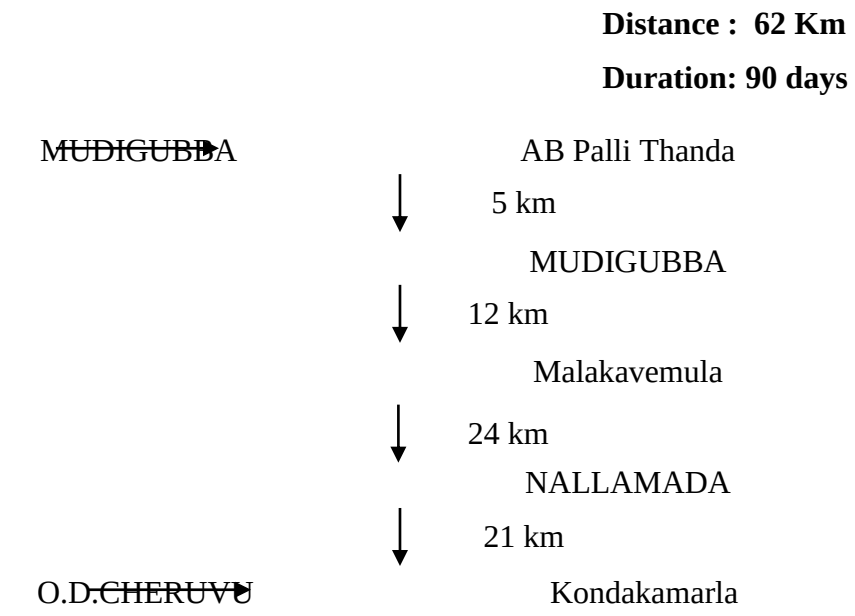
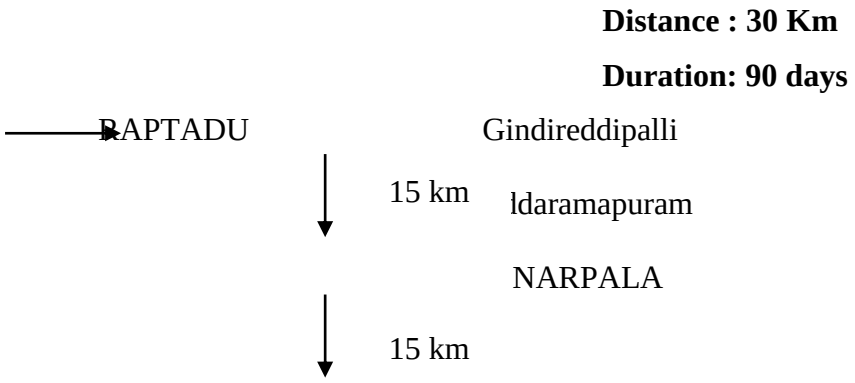


Fig.30 : Flow Chart of Minor Migratory Tract- XI in Anantapur District

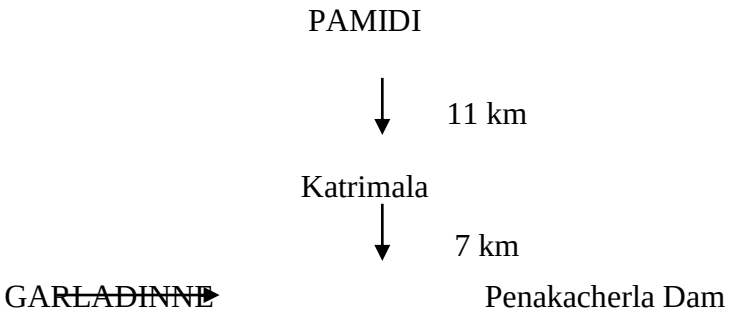


The XII minor migratory tract got started from Pamidi and reached Penakacherla dam of Garladinne mandal. Though the distance covered was 18 km, the duration of migration was 90 days (Fig. 31).

Fig.31 : Flow Chart of Minor Migratory Tract- XII in Anantapur District

Distance : 18 Km

Duration: 90 days



MAP 7 : MINOR MIGRATORY TRACTS

TRACT I :: DISTANCE 96 Km FROM RAPTADU TO PAVAGADA

TRACT II :: DISTANCE 93 Km FROM VADRAHONNUR TO THONGANAKALLU

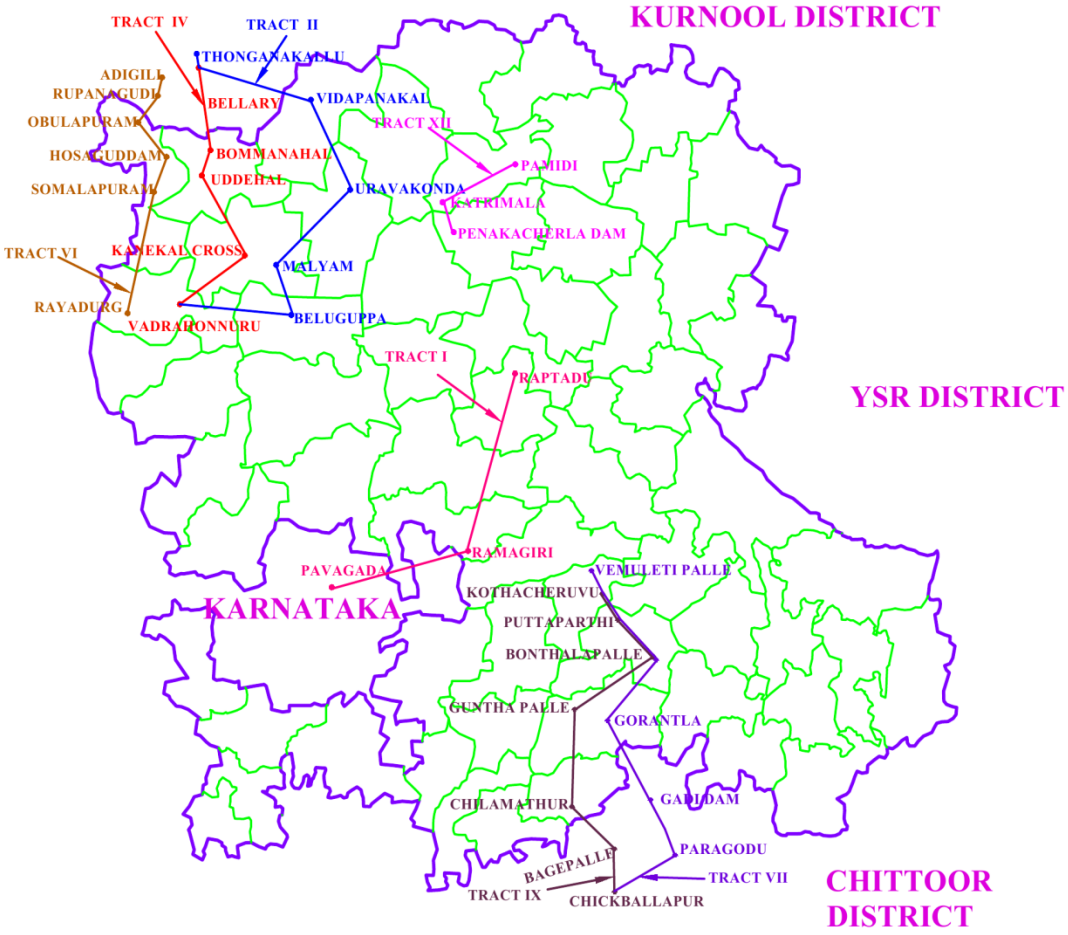
TRACT IV :: DISTANCE 83Km FROM RAYADURG TO BELLARY

TRACT VI :: DISTANCE 75 Km FROM RAYADURG TO ADIGILI

TRACT VII :: DISTANCE 74 Km FROM VEMULETI PALLI TO CHIKBALLAPUR

TRACT IX :: DISTANCE 63 Km FROM KOTHACHERUVU TO CHIKBALLAPUR

TRACT XII :: DISTANCE 18 Km FROM PAMIDI TO PENAKACHERLADAM



MAP 8 : MINOR MIGRATORY TRACTS

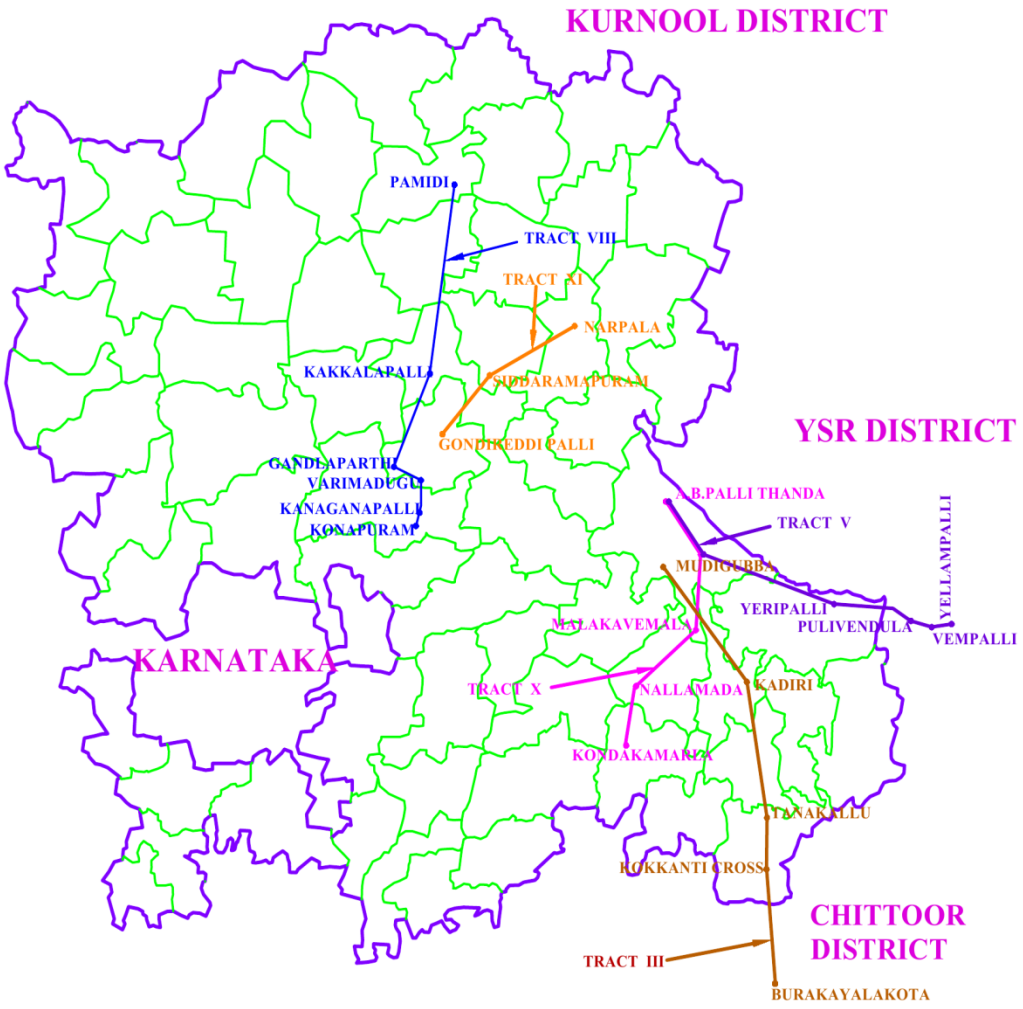
TRACT III :: DISTANCE 90 Km FROM MUDIGUBBA TO BURAKAYALAKOTA

TRACT V :: DISTANCE 77 Km FROM A.B.PALLI THANDA TO YELLAMPALLI

TRACT VIII :: DISTANCE 71 Km FROM KONAPURAM TO PAMIDI

TRACT X :: DISTANCE 62 Km FROM A.B.PALLI THANDA TO KONDAKAMARLA

TRACT XI :: DISTANCE 30 Km FROM GONDIREDDI PALLI TO NARPALA



4.3.3 Migratory Patterns

The climate in the migratory study area is tropical with temperature ranging from 18ºC to 44ºC. The soils in the district comprise of 76 per cent red soils with gravel and 24 per cent black soils. There are numerous isolated peaks and rocky clusters which are devoid of any vegetation at certain places.

The migration in the region usually starts from the mid December and continues up to mid July, while the flocks return to their native places after the onset of monsoons.

Enroute migration, the sheep flocks graze on the current fallow lands and other fallows constituting 15 per cent of geographical area, along with forest cover (11.11%) and the uncultivable lands constituting 12.08 per cent in the district.

The major crops that are grown in the migratory region are groundnut, red gram, bengal gram, sun flower, cotton, maize etc. The flocks utilize the crop stubbles of red gram, cotton, tomato, watermelon, chillies along with leaves of mulberry, beet root and onions.

It was observed that the shepherds made prior agreement for purchase of crop stubbles and crop residues with the farmers of enroute villages. In some areas, it was also noticed that Acacia pods were fed to flocks which were purchased through public auction organized by local panchayats. A great demand for penning along with the availability of the harvested fields during the course of migration in the region forced the shepherds to take up the sheep rearing.

4.3.3.1 Distance, duration of major migratory tracts

The distance travelled by sheep flocks in the identified major tracts ranged from 100 to 216 km with a mean distance of 128.46 ± 8.98 km. The duration (days) of migration in major tracts ranged from 150 to 276 with a mean duration of 193.53 ± 10.0.

Table 22. Distance, duration of major migratory tracts

S.No.	Tract No.	Distance (Km)	Duration (Days)
1	I	216	210
2	II	202	276
3	III	186	216
4	IV	143	208
5	V	134	202
6	VI	132	200
7	VII	125	186
8	VIII	117	180
9	IX	116	176
10	X	111	170
11	XI	103	156
12	XII	101	150
13	XIII	100	156
14	XIV	100	240
Mean ± S.E		128.46 ± 8.98	193.53 ± 10.0

4.3.3.2 Distance, duration of minor migratory tracts

The distance travelled by sheep flocks in the identified minor tracts ranged from 18 to 96 km with a mean distance of 69.33 ± 6.89 km. The duration (days) of migration in minor tracts ranged from 90 to 159 with a mean duration of 130.91 ± 7.6.

Table 23. Distance, duration of minor migratory tracts

S.No.	Tract No.	km	Days
1	I	96	159
2	II	93	150
3	III	90	150
4	IV	83	145
5	V	77	145
6	VI	75	140
7	VII	74	142
8	VIII	71	120
9	IX	63	150
10	X	62	90
11	XI	30	90
12	XII	18	90
Mean ± S.E		69.33 ± 6.89	130.91 ± 7.6

4.4 CONSTRAINT ANALYSIS OF MIGRATORY SHEEP FARMERS

The constraints perceived by the migratory flock owners were presented in the Table 24. Out of 10 constraints identified, drinking water scarcity (95%) was ranked as the first constraint, followed by shrinkage of grazing lands (91.87%). The third constraint faced by migration sheep flock owners was resistance from local farmers (85.62%) apart from fodder scarcity (81.87%) which was of considerable magnitude ranked fourth in the order. The other constraints faced were physical strain associated with migration (70%) in the 5^{th}, followed by attack by predators (65%) ranked 6^{th} in the order. The other constraints which were of lesser magnitude in the descending order were disease attack (VII rank), inaccessibility to credit (VIII rank), lack of veterinary aid (IX) and theft (X rank) with percentages of 60, 57.5, 34.7 and 28 per cent, respectively.

Table 24 Constraint analysis perceived by migratory sheep farmers

S.No	Constraints	Frequency (160)	Percentage	Rank
1	Resistance from local farmers	137	85.62	III
2	Shrinkage of grazing lands	147	91.87	II
3	Drinking water scarcity	152	95	I
4	Theft	45	28	X
5	Lack of veterinary aid	55	34.7	IX
6	Fodder scarcity	131	81.87	IV
7	Attack by predators	104	65	VI
8	In accessibility to credit	92	57.5	VIII
9	Physical strain associated with migration	112	70	V
10	Disease attacks	96	60	VII

CHAPTER – V

DISCUSSION

Sheep farming is one of the major occupations practiced in the Anantapur District of Andhra Pradesh undertaken by various categories of farmers including the landless agricultural labourers on a large scale.

The migratory system of sheep rearing is viewed as a method of adoptive mechanism evolved over the years to provide alternate feed source arising due to erratic and uneven distribution of rainfall in the region. Suresh *et al*. (2011) stated that migration was a way of life evolved over the years due to interaction of various forces emanating from social and economic reasons. The availability of grazing resource and the demand for penning in the post harvested fields determined the migratory tracts of sheep.

5.1 SOCIO-ECONOMIC STATUS OF SHEEP FARMERS

The mean age of the farmers involved in sheep farming comprised of 37.48 years with majority of farmers belonging to middle age (42.5%) followed by young age (40%) and old age (17.5%). This is in agreement with findings of Rao (2010) and Rajanna *et al.* (2012a) of Andhra Pradesh and Nisha *et al.* (2016) of Thanjavur district of Tamil Nadu who reported that majority of migratory sheep farmers belonged to age group of 30 to 40 years. Majority of the sheep farmers belonged to backward caste (84.38%) followed by scheduled tribes (9.38%), scheduled caste (4.37%) and others (1.87%). These findings are in agreement with Rao (2010) and Saravana Kumar (2003) who reported that 2/3rd of the sheep farmers belonged to backward caste among migratory sheep farmers.

The average size of the family was 4.8 with 51.87 per cent of farmers living as joint families and 48.13 per cent as nuclear type of families. This is in agreement with findings of Suresh *et al.* (2008) and Rajanna (2011) stating that majority of the sheep farmers were joint family belonged to medium family size. Moreover sheep farming is highly labour intensive and joint families are often supportive of their migratory system of management with 97.5 per cent of them males and only 2.5 per cent females involved in sheep rearing. Regarding education level, majority (56.87%) of the shepherds were literate with 60.44 per cent upto primary school level which is in agreement with findings of Dhayani *et al.* (2000), Rajapandi (2005) and Nisha *et al.* (2016) who reported that 60 per cent were educated up to primary level among migratory sheep farmers. With regard to experience in sheep farming, the average was 14.01 years with majority of sheep farmers having 10 to 20 years of farming experience, coinciding with observation of Rao (2010) and Rajanna (2011) in Andhra Pradesh.

It was observed that 71.87 per cent of farmers practiced sheep rearing as main occupation followed by 28.13 per cent having agriculture related activities as main activity. It was observed that majority (38.13%) sheep rearing activities was undertaken by landless agricultural labourers, followed by large farmers (31.25%) and small farmers (25%) which is in agreement with findings of Rajapandi (2005) who reported that majority were landless in a study on Coimbatore sheep. Kandaswamy *et al.* (2006) also reported that majority (90%) of Coimbatore sheep flock owners were landless. The total size of sheep holding was 307.85 where majority (93.12%) of farmers had possessed their own sheep units while 6.87 per cent of sheep farmers maintained the sheep on rental basis (paliki). These findings are similar to flock size reported by Rao (2010) among migratory flock of North coastal zone of Andhra

Pradesh. The flock size in the present study is lower than livestock holding size reported by Kandaswamy *et al.* (2006) and Nisha *et al.* (2016).

All the farmers penned their sheep during night time with specific lamb enclosures for the new borns till weaning. These findings are in agreement with Kandaswamy *et al.* (2006), Arora *et al.* (2007) and Devendran *et al.* (2010).

Majority of sheep farmers involved themselves as sole labourers in rearing of their sheep, where as 10 per cent of the farmers hired the services of others and 13.13 per cent of the respondents were owners who rear their sheep along with hired labour. It was observed that majority of the sheep farmers (37.5%) depend on all types of lands like community lands, forests, wastelands etc for feeding of their flocks. The average grazing time (hours) was found to be 8.5 ± 0.05 hours and the mean grazing distance recorded was 5.14 ± 0.06 kilometers. These findings are in agreement with Devendran *et al*. (2010), Rao (2010), Rajanna (2011) and Sushil Kumar (2003) who reported that sheep grazed on natural grasses, crop stubbles, residues, forest areas and uncultivable lands depending upon the availability of the resources and the seasons.

With regard to management practices during breeding, it was observed that male to female sex ratio was 1:28 and the retention time of ram in the flock was for 5.2 years. But majority (86.25%) of the farmers did not practice rotation of breeding rams and only 13.75% followed a good practice of rotation of breeding rams. These findings are in agreement with Kandaswamy *et al.* (2006) who reported the sex ratio of 1:24 and Rajanna (2011) who reported that farmers used the breeding rams for more than 5 years for breeding purpose.

It was observed that majority (58.12%) of sheep farmers harvested one lamb crop per year followed by three lamb crops in two years (2.5%) and 16.87 per cent of

shepherds obtained two lamb crops in 18 months. These observations are in agreement with the findings of Saravana Kumar (2003) who reported three lambs per two years in migratory sheep of Andhra Pradesh. The average weaning age of 3.4 months in the present study is a little higher than the observations of Singaravadivelan *et al.* (2014) who reported 2.94 ± 0.96 and 5.03 ± 0.13 months in ram lambs and ewe lambs in migratory flocks. It was observed that majority of farmers (77.5%) did not practice culling of the breeding ewes and only 22.5 per cent followed the good practice of culling breedable ewes after certain period.

It was appreciable that all the sheep farmers practiced deworming 4.26 times in a year for a better health care of their flocks. It was also observed that majority of the shepherds (45%) dewormed their flocks without taking the advice from veterinarians on the type of deworming agent and only 10.62 per cent of sheep farmers used the deworming agents suggested by veterinarian. These observations are coinciding with reports of Kushwaha *et al.* (1999), Rajapandi (2005) and Nisha *et al*. (2016) who reported that deworming was done by migratory sheep farmers themselves.

It was observed that all the farmers in the study area adopted the practice of immunisation of their flocks to protect the sheep against infectious diseases (Enterotoxaemia, Haemorrhagic Septicemia, *peste des petits ruminants*, Sheep Pox and Blue Tongue) but majority of sheep farmers (39.75%) got their flocks vaccinated by themselves and on advice of stockman, followed by advice of veterinarian (36.87%). This is similar to the observation of Nisha *et al*. (2016) who observed that vaccinations were done by migratory sheep farmers themselves. It was further observed that the mortality was only 15.6 per cent as all the sheep farmers practiced immunisation programme against the major infectious diseases as shown in Table 17.

It was observed that majority (53.75%) of farmers practiced throwing of carcass in open fields followed by 23.75 per cent of farmers practicing burial method. A sizable number of farmers (22.50%) consumed the meat of dead carcass especially when the death was due to non-infectious diseases like bloat, accidents etc (Table 18). It was observed that all the farmers disposed the manure directly by sale for money or indirectly by penning in farmers fields. Majority of shepherds disposed manure by way of penning for money or against the provision of either food or in lieu of crop stubbles by farmers (Table 19).

5.2 PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF MIGRATORY SHEEP FLOCKS

It was observed that mean body weights at birth, weaning, 6 months and one year of age were higher in the present study than the earlier reports by Saravana Kumar (2003) and Rao (2010). It might be due to supplementary feeding of post harvested crop and vegetable residues (Red gram, Bengal gram, Cotton, Tomato, Chillies, Beetroot, Beans etc.) by all the shepherds in addition to normal grazing during migration.

With regard to the reproduction performance of migratory flocks, it was observed that the age of ewes at first mating, age of rams at first mating, tupping and lambing percentages, age of ewes at first lambing, lambing interval and weaning percentage in the present study are almost similar to the findings of Singaravadivelan *et al.* (2014) and Rao (2010). However a lower age at first lambing and lambing interval was also reported by Kandaswamy *et al*. (2006) in Coimbatore sheep.

5.3 IDENTIFICATION OF MIGRATORY TRACTS AND PATTERNS

The study was conducted to identify and document existing migratory sheep production systems in order to explore the opportunities for development of sustainable sheep production and utilisation of available resources efficiently. Keeping the above main objective, a survey was conducted in Anantapur district to identify the migratory tracts. It was observed that large numbers of shepherds were practicing migration as a traditional occupation in the district. The places and distance covered during migration were obtained from sheep farmers along with information from revenue maps. A total of 14 major and 12 minor migratory tracts were identified in the district with the help of Animal husbandry department personnel, enquiry from shepherds and by direct survey.

The major migratory tract - I started from Chennarayunipalle of Bukkapatnam mandal passed through mandals of Puttaparthi, Gorantla, Somandepalli, Hindupur and Lepakshi to reach Ammasandra in Karnataka after crossing Bagepalle. The total distance travelled was 216 km and the duration of migration lasted for 210 days. The flocks were fed with Acacia purchased from village panchayat in Kothapalle of Somandepalli mandal. After reaching Dibburivandlapalli the flocks were fed with leaves of onion crop after harvesting of onions on nominal cost basis.

In major migratory tract II, the sheep flocks started from B.K.Samudram passed through Kudairu, Uravakonda, and Vidapanakal to enter into Karnataka and reached Holagundi of Kurnool district after crossing Chellagurki, Moka of Karnataka. The sheep flocks were fed with stubbles of chillies in Karnataka and failure crops of maize in Chintakunta of Kurnool district. The distance and duration of migration were 202 km and 276 days.

The major migratory tract III the sheep flocks started from Gondireddipalli of Raptadu mandal and reached Sankarabanda of Karnataka after crossing mandal headquarters of Kudairu and Uravakonda. After a stay for 120 days the flocks retreated back through PABR dam, Muttala and Kambadur to N.S Gate of Karnataka. The total distance of migration was 186 Km in a span of 216 days.

The major tract V was started from Konapuram of Kanaganapalle mandal and concluded at Parigi after covering a distance of 134 Km and duration of migration was 202 days. In this tract the flocks were fed on harvested chilly fields in exchange for night penning in farmers fields.

The distance travelled in tract VI was 132 Km where sheep flocks started from Ellakuntla of Kanaganapalle mandal passed through mandal headquarters of Kudairu, Uravakonda and Guntakal to reach Pamidi mandal where sufficient grazing resources were available in the form of post harvested cotton fields. The duration of migration of this tract was 200 days.

In tract VII the sheep flocks started their migratory phase from Settur and Parasurampura of Karnataka to reach Davanagere. The distance and duration of migration were 125 Km and 186 days.

The sheep flocks in tract VIII were fed with stubbles of red gram after harvesting the crop in Pavagada and Madakasira areas.

In tract IX the sheep flocks from Sangala of Battalapalli mandal in two different directions, one towards Bagepalli of Karnataka another towards Galiveedu of YSR district farming IX and XII major migratory tracts, respectively.

The distance in minor migratory tract-I was 96 Km which started from Raptadu and reached Pavagada after crossing Kanaganapalli and Ramagiri mandals of

Anantapur district. In this tract the flocks were grazed in post harvested fields of tomato and chillies. The duration of migration was 159 days.

The minor migratory tracts of II, IV and VI were started in Rayadurg mandal and reached Bellary district of Karnataka where the grazing resources were harvested paddy, cotton and chilly fields.

The minor migratory tracts of III, V and X were started from Mudigubba mandal and reached Burrakayalakota of Chittoor, Yellampalli of YSR and Kondakamarla of Anantapur districts respectively.

The minor tracts VII and IX were originated from Kothacheruvu mandal and reached Chikballapur in Karnataka state. In tract VII the sheep flocks spent 30 days at Gadi dam before moving to Chikballapur and were fed on harvested fields of vegetable crops like Beetroot and Beans.

In tract VIII the sheep flocks moved from Kanaganapalli to Pamidi via Garladinne where the grazing resources are harvested cotton fields. In this tract the shepherds were provided with food by local farmers for night folding of sheep in their fields.

In minor migratory tract XI the sheep flocks after moving from Raptadu, grazed in harvested chilly fields in Narpala mandal.

The minor migratory tract XII which started from Pamidi to Penakacherla dam, covering a mere distance of 18 km spent a prolonged 90 days on migration. Since the area was under dam irrigation with rich grazing resources.

The study with regard to migratory patterns adopted by the shepherds of Ananthapur district revealed that the number of days on migration was found to be 193.53 ± 10.0 while the distance covered was 128.46 ± 8.98 km in the case of major

migratory routes. Likewise in the case of minor migratory routes the recorded duration and distance were 130.91 ± 7.6 days and 69.33 ± 6.89 km, respectively. Singaravadivelan *et al.* (2014) reported relatively higher migratory distance of 317 ± 6.21 km in the case of major migratory tracts and 148.4 ± 6.21 km in the case of minor migratory tracts. Similar studies carried out by Ananda Rao (2010) in North coastal zone of Andhra Pradesh, Saravana Kumar (2003) in Nellore district of Andhra Pradesh and Rajanna (2011) in Telangana region reported similar results with regard to distance and duration covered by the sheep farmers on migration.

5.4 CONSTRAINT ANALYSIS OF MIGRATORY SHEEP FARMERS

As per the Table 24, it was found that constraints perceived by sheep farmers were ranked in the order of drinking water scarcity, shrinkage of grazing land, resistance from local farmers during migration, fodder scarcity, physical strain associated with migration, attack by predators, diseases, inaccessibility to credit, lack of veterinary aid and theft from I to X respectively. The present findings were in agreement with Anthra Report (1995), Sarvana Kumar (2003), Rajanna (2011), Nisha *et al.* (2016) and Sankhyan *et al.* (2016). Lack of drinking water for sheep en route during migration was perceived as major constraint in the study area. This problem can be tackled by providing water points at certain areas. The water to such points can be supplied through the tanker by nearby panchayat or self help groups or sheep cooperatives or water societies etc. Non availability or shrinkage of the grazing lands or common property resources over a period of time due to overgrazing and conversion of lands for buildings to weaker sections and development of special economic zone are indirectly affecting the feeding resource of small ruminants. Efforts are needed by concerned village panchayat / social institutions and legal authorities to make laws to prevent their conversion from grazing lands to other

purposes**.** Reseeding of the grazing lands can be taken up by Government agencies like District Water Management Agency (DWMA), for propagation and improvement of existing lands. Development of community grazing lands needs to be taken up along the roadsides, railway tracks for reducing fodder scarcity. Supplementation with mineral blocks during migration can be taken up along with prophylactic measures like deworming or deticking to prevent weight loss /growth rate. Total mixed ration blocks can be provided en route during identified migratory tracts by sheep cooperative societies.

Inadequate knowledge on identification of sheep diseases by farmers can be enriched by organisation of animal health camps and extension programmes. Mass media programmes on importance of vaccination, prevention of diseases has to be taken along with vaccination campaign and supply of medicines to sheep farmers to mitigate the constraint.

Poor accessibility to veterinary services during the migratory tracts can be rejuvenated by mobile veterinary clinics during that specific period of migration. Inaccessibility to credit facility to increase the shepherd flock size can be improved by strengthening the sheep cooperatives.

CHAPTER – VI

SUMMARY

Sheep and goats are the most important ruminant species of economic value to the small and marginal farmers and landless labourers in our country. Among the livestock farming, sheep rearing is considered as the most traditional occupation carried out by the resource poor farmers but with change of time due to more commercialization the demand has increased for sheep by-products. As a consequence, sheep farming in India has developed into a full fledged and viable enterprise.

The two conventional grazing systems prevalent in the country are migratory and semi-migratory in nature. Several times, the stocking density on range lands far exceeds its carrying capacity. This scenario forces flock owners to migrate with their flocks for sustenance. This migration may be temporary (of short duration to neighboring locations) or permanent where flocks spend most of the time on migration usually for long distances. In order to identify the migratory pattern of sheep in Anantapur district the present research work was taken up.

The main objectives of the study were recording the socio-economic status of shepherds, to assess the productive and reproductive performance of sheep flocks, identification of migratory tracts and pattern and to identify constraints if any of the migratory shepherds.

Socio economic status of sheep farmers revealed that the the mean age of the farmers involved in sheep farming comprised of 37.48 years with majority of farmers belonging to middle age (42.5%) followed by young age (40%) and old age (17.5%). It was observed from social category that majority of the sheep farmers belonged to

backward caste (84.38%) followed by scheduled tribes (9.38%), scheduled caste (4.37%) and others (1.87%). It was observed that mean family size of the sample farmers was 4.8 members. With regard to family type, 51.87 per cent of the farmers were living as joint families and 48.13 per cent of the farmers confined to nuclear type of families. With regard to education, 56.87 and 43.13 per cent were literates and illiterates, respectively. Mean experience in sheep rearing was found to be 14.01 years.

On observation of land holding, 38.13 and 31.25 per cent of the farmers were agricultural labourers and large farmers, respectively followed by 25 per cent small farmers and 5.62 per cent marginal farmers in the study area. It was also observed that 71.87 per cent of the farmers were having sheep rearing as their main occupation while 28.13 per cent have agriculture related activities as their main occupation.

The average flock size in the study area was 307.85. Among the flock, 7.0, 181.66, 25.98, 41.98 and 51.21 heads were breeding rams, ewes, male hoggets, male lambs and female lambs, respectively.

With regard to grazing lands overall majority (37.5%) of the farmers utilized all types lands (community land, forests and waste lands) followed by forests + waste lands (35%), community lands + waste lands (17.5%), community lands + forest lands (3.75%), waste barren lands (3.75%) and forests (2.5%) for grazing of their sheep. The average grazing time in the study area was found to be 8.5 ± 0.05 hours and the mean grazing distance recorded was 5.14±0.06 km per day.

With regard to breeding management practices, it was observed that the average sex ratio maintained by the sheep farmers was 1:28. The mean retention time of breeding rams in flock was observed to be 5.2 years. It was observed that majority

(86.25%) of the farmers didn't practice rotation of breeding rams while only 13.75 per cent of the farmers followed rotation of breeding rams.

The observations on lambing frequency showed that majority (58.13%) of sheep farmers harvested one lamb crop in a year followed by 25 per cent harvested three lamb crops in two years whereas 16.87 per cent of shepherds obtained two lamb crops in 18 months. The average weaning age was observed to be 3.4 months. All the farmers in the study area practiced deworming and vaccination.

It was observed that all the farmers disposed the manure directly by sale for money or indirectly by penning in farmers fields. Majority of shepherds disposed manure by way of penning for money or against the provision of either food or in exchange for crop stubbles of the harvested fields.

It was observed that majority (53.75%) of farmers practiced throwing of carcass in open fields followed by 23.75 per cent of farmers practicing burial method while 22.50% consumed the meat of dead carcasses.

Productive performance of sheep flocks revealed that the mean birth weight of ram lambs and ewe lambs was 3.04 ± 0.01 kg and 2.84 ± 0.01 kg, respectively. The mean weaning weight of males and females were, 11.88 ± 0.09 kg and 11.75 ± 0.09 kg. The mean weights at 6 months of age were 16.07 ± 0.2 kg and 15.79 ± 0.11 kg in males and females, respectively. With regard to reproductive performance it was observed that age of the ewes and rams at first mating was 12.24 ± 0.23 months and 17.77 ± 0.09 months, respectively. Age at first lambing of ewes was found to be 17.81 ± 0.10 months. A tupping percentage of 86.9 ± 0.27 and lambing percentage of 81.25 ± 0.16 were observed in the study area. The average lambing interval was 8.03 ± 0.01 months. The mean weaning percentage observed was 87.75 ± 0.26.

The reasons for migration of sheep flocks in Anantapur district as perceived by sheep farmers were lack of feeding and water resources, age old traditional practice of migration, reasonable income from penning and availability of good quality crop byproducts from harvested fields during the course of migratory region. The migratory system of sheep rearing is viewed as a method of adoptive mechanism evolved over the years to provide alternate feed source arising due to erratic and uneven distribution of rainfall in the region. Migration is a way of life evolved over the years due to interaction of various forces emanating from social and economic reasons. The availability of grazing resource and the demand for penning along with post harvested fields in the season determined the migratory tracts of sheep. A total of 14 major and 12 minor migratory tracts were identified in the Anantapur district.

The distance travelled by sheep flocks in the identified major tracts ranged from 100 to 202 km with a mean distance of 128.46 ± 8.98 km. The duration (days) of migration in major tracts ranged from 150 to 276 with a mean duration of 193.53 ± 10.0. The mean distance and duration of major migratory tracts were 128.46 km and 193.53 days, respectively.

The distance travelled by sheep flocks in the identified minor tracts ranged from 18 to 96 km with a mean distance of 69.33 ± 6.89 km. The duration (days) of migration in minor tracts ranged from 90 to 159 with a mean duration of 130.91 ± 7.6.

Among major migratory tracts Tract-I starting from Chennarayunipalle to Ammasandra was the longest migratory tract covering a distance of 216 km while Tract XIV which started from B.K.Samudram to Bellary was shortest migratory tract covering a distance of 100 km.

Among minor migratory tracts Tract-I starting from Raptadu to Pavagada was the longest migratory tract covering a distance of 96 km while Tract XII which started

from Pamidi to Penakacherla dam was the shortest migratory tract covering a distance of 18 km.

Constraints perceived by sheep farmers were identified and ranked in the order of drinking water scarcity, shrinkage of grazing land, resistance from local farmers during migration, fodder scarcity, physical strain associated with migration, attack by predators, diseases, inaccessibility to credit, lack of veterinary aid and theft from I to X respectively.

The following conclusions and recommendations may be drawn from the study

Efforts are needed by concerned village panchayat / social institutions and legal authorities to make laws to prevent their conversion from grazing lands to other purposes**.** Re seeding of the grazing lands can be taken up by Government agencies like District Water Management Agency (DWMA), for propagation and improvement of existing lands. Development of community grazing lands needs to be taken up along the roadsides, railway tracks for reducing fodder scarcity. Supplementation with mineral blocks during migration can be taken up along with prophylactic measures like deworming or deticking to prevent weight loss /growth rate. Total mixed ration blocks can be provided en route during identified migratory tracts by sheep cooperative societies.

Inadequate knowledge on identification of sheep diseases and management practices like rotation of breeding rams, culling of unproductive animals by farmers can be enriched by organisation of animal health camps and extension programmes. Mass media programmes on importance of vaccination, prevention of diseases has to be taken along with vaccination campaign and supply of medicines to sheep farmers to mitigate the constraint.

Steps may be taken by the department of Animal Husbandry, Govt. of Andhra Pradesh to render the services of mobile veterinary clinics in the identified tracts during migratory seasons.

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APPENDIX A

SOCIO ECONOMIC STATUS OF MIGRATORY SHEEP FARMERS

Interview schedule

1. **Socio-economic status:**

Name of the member: Category: OC/BC/SC/ST
Age: Education:
Village: Mandal:
Family size (No.): Family type: Joint/Nuclear
Experience in sheep rearing (Years): House Type: Pucca / Kutcha

Flock size:

Particulars	No. of animals	Age
Breeding Rams		
Marketable Rams		
Ewes		
Male lambs <6M		
Female lambs <6M		

Main occupation: Sheep rearing/ Agriculture

2. **Systems of Rearing:**

i. Systems of sheep production: 1. Stationary 2. Migratory 3. Both
ii. Systems of sheep rearing: 1. Extensive 2. Semi-intensive
iii. Ownership status: 1. Own 2. Rental (Paliki)

3. **Housing Management Practices: (During Migration)**

i. Type of housing: a. penning
ii. Provision of lamb enclosure: Yes / No
iii. Farmers involvement in rearing of sheep: a.self b.hired c. both

4. Grazing and feeding practices: (During Migration)

S.No	Time (hr)	Distance (km)

i. Grazing lands (source) a. Community land b. Forests c. Waste lands

ii. Supplementary feeding: Kandi/ Onion/ Dosakaya/ Jaali/ Concentrates(Kg) Tree leaf feeding (Kg), Others

5. Breeding Practices: (During Migration)

i. Male:Female ratio:

ii. Age up to which the rams are retained for breeding:

iii. Preference of keeping rams: Throughout year / Breeding season only

iv. System of breeding: Controlled / Flock mating / A.I

v. Heat detection followed: Yes / No

vi. Change of breeding rams: Yes / No

vii. Practice of culling: Yes / No

viii. Breeding Seasons: Summer / Rainy / Winter

ix. Rotation of breeding ram practiced: Yes / No

x. If yes how often breeding ram is rotated:

xi. Frequency of lambing in a year Once / twice

xii. Practice of weaning: Yes / No

xiii. Age of weaning (months):

6. Health care practices: (During Migration)

i. Practices of deworming: Yes / No

ii. Frequency of deworming in a year:

iii. De-worming conducted by: Self / Vet / Stockist / Others

iv. Treatment of sick animals: Self / Vet / Stockist / Others

v. Practices of deticking: Yes / No

vi. Method of deticking: a. Spraying b. Dipping c. Dusting

vii. Practices of immunization: Yes / No

viii. Vaccination conducted by: Self / Vet / Stockist / Others

ix. Name of the diseases (Vaccine administration)

x. Diseases encountered:

xi. Morbidity %: x. Mortality %:

xii. Distress sale:

xiii. Disposal of dead animals: Thrown in open fields/ Buried/ Burnt/ used for consumption

7. Manure details: (During Migration)

i. Disposal of manure: a. Sale b. in lieu of harvested crop fields

ii. Penning in fields: Yes/ No If Yes No. of days / year:

iii. Remuneration for penning: Yes/ No, Price/day (Rs.):

8. Productive Performance (During Migration)

i. Body weight of animals (Kg)

	Birth	**Weaning**	**6 Months**	**1 year**	**At Disposal**
Male					
Female					

9. Reproductive Performance: (During Migration)

Age of ewes at first mating:	Lambing %:
Age of rams at first mating:	Lambing interval:
Tupping %: (No. of ewes crossed by rams in the flock)	Age at weaning:
Age at first lambing:	Weaning %:

10. Constraints

S.No.	**particulars**	**Ranks**
1	**Constraints**	
	Resistance from local farmers Disease attacks Shrinkage of grazing lands High lamb mortality Drinking water scarcity	

	Fodder scarcity Lack of veterinary aid Theft predators	

APPENDIX B

To be collected flock wise

Name of the farmer: **No. of Sheep:** **Route**

1. Starting place
2. ↓ (Distance)
3. Next point (Duration of stay)
4. ↓ (Distance)
5. Next point (Duration of stay)
6. ↓ (Distance)

End point of migration (Duration of stay)