Livestock are of vital significance in the rural agrarian system in all parts of the country. Structurally, livestock are considered as an importantly of Indian agriculture, but productionally, the most neglected field of agricultural economy. Though India is very rich in livestock wealth in the world but very poor in production economy. The reasons for such a state of affair are not far to seek but many which can be ascribed as sociological, religious, demographic, economic, political and technological etc. Basically the Indian agriculture policy from the beginning of Five Year Plans onwards is predominantly foodgrain oriented. The traditional outlook, economic backwardness, very poor level of agro-technification and small scale nature of farming have prompted the Indian farmer by and large to make use of livestock as drought force rather than dairy or meat stock. Especially, cattle are the best companions to the Indian farmer in the agriculture field by day, and live beside his house, or even under his roof, at night (Jasbir Singh, 1974). Andhra
Pradesh is not an exception to this fact, where majority of the peasant community never thought of without draught animals in their farm operations.

The agricultural scene has been changing radically especially with the expansion of dairy and livestock farming during the present century (Chisholm, 1971). The crop production has reached its optimum levels in some of the agricultural pockets in the State. The next alternative for further development of agriculture has to go for diversification of agricultural economy which immediately calls for dairying and livestock development. In dry areas, where the income from crop husbandry is uncertain and inadequate, the development of animal husbandry as an alternative agricultural enterprise claims an unrivalled place in affording a fillip to the rural agrarian economy. "Mixed farming is more valuable in an agrarian economy and it makes farmer more progressive in his out look on agriculture" (Jasbir Singh, 1974, p.264). Thus, the livestock development has become decisive element in the spread and strengthening of the regional agriculture into dynamic and developed. Now, the urgent call for diversification of agricultural economy and the advantage of mixed farming speak volumes on the significance of livestock within agrarian system.

Livestock in Agricultural Regionalisation

Whittlessey's system (1936) was one of the first to emphasize the relative importance of livestock in overall
agricultural production for regionalisation of agriculture. As a result, he identified four major classes of agricultural regions in terms of livestock production and its importance. Helburn (1957) has also argued that the relative importance of livestock products is a criterion of great significance, because so many other properties agricultural systems co-vary with it. Coppock (1964) has stated that "crops and livestock do not occur in isolation on farms, they compete with and complement each other and form parts of farming systems." To examine the integrative crop and livestock complexes, Coppock delineated 'Agricultural Enterprise Combination Regions in England and Wales' with the help of 'man-days required for each crop and class of livestock' conversion factor. To integrate crop and livestock combinations, Weaver and his associates (1956) have suggested to use farm income i.e. the monetary-value of the different crops and livestock.

In the recent studies on agricultural typology, animal husbandry is usually included among the major criteria selected. Here typologies aimed specifically at animal husbandry, either alone or in conjunction with other branches of agriculture. It is indeed, most types of agriculture recognised are in fact specific combinations of crops and livestock.

In the present study, in absence of adequate statistics related to either gross returns obtained or labour requirements of each class of livestock, it is difficult to integrate crop and livestock combinations as essential parts of farming systems.
However, an attempt is made here to examine the areal differences in different kinds of livestock and their associations in terms of the numbers of livestock. Such a study helps to regionalise the areas of specialisation or diversification in the distribution of different kinds of farm animals and thus finally assists in the development of livestock based economic activities.

Objectives of the Study

The main objectives of the present study are (i) to examine the areal differences in distribution of various categories of livestock, and (ii) to identify livestock association regions on the basis of Doi's method.

Livestock Units

In the case of animal husbandry, it is impossible to find accurate comparisons in the distribution of different categories of livestock with their absolute numbers. Because of the different categories of livestock, namely, bovines, ovines, equine strains etc., differ greatly in their requirements of land, labour and capital, and the income which the farmer may derive from them. In order to obtain any comparison, the various species must be reduced to some more or less common denominator. (Talman, 1979, p.156), "Some system of equating the different categories is a pre-requisite to any comprehensive analysis" (Gillmore, 1970, p.587). Equalisation of different categories of livestock involves many inherent difficulties, not least of which is the inadequacy
Table 9.1: I.C.A.R. Conversion Scale of Absolute Number of Livestock into Livestock Units.

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Age groups (in years)</th>
<th>Livestock Head</th>
<th>Livestock Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow</td>
<td>Over 3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>She-buffaloes</td>
<td>Over 3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bullocks and Bulls</td>
<td>Over 3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>He-buffaloes</td>
<td>Over 3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Horses, Ponies and Mules</td>
<td>Over 3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Camels</td>
<td>Over 4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Young Stock of Cattle, buffaloes, horses, ponies and mules</td>
<td>Over 1-3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Young Stock of Cattle, buffaloes, horses, ponies and mules</td>
<td>Under 1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Young stock of camels</td>
<td>Under 4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sheep and goats</td>
<td>Over 1</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Sheep and goats</td>
<td>Upto 1</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Donkeys</td>
<td>--</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Pigs</td>
<td>--</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Poultry</td>
<td>--</td>
<td>100</td>
<td>1</td>
</tr>
</tbody>
</table>
of adequate livestock data on gross production returns and labour required for their maintenance. No simple technique can eliminate all problems but the most satisfactory methods to be those based on feed requirements. The immediate concept which is available, on the basis of which the numbers of different animal species may be related one with another on the basis of fodder consumption and compared with other branches of livestock production is called as the livestock unit or animal feed unit. In deed, this is commonly and most satisfactorily used concept of achieving comparability between the various branches of livestock production in regional studies (Weaver, 1956, p.238); Coppock, 1964, p.67-68; Gillmor, 1970, p.587-588, Jasbir Singh, 1974, p.267; Talman, 1979, p.156).

**Methodology Adopted**

For the analysis of areal differences in the distribution of various categories of livestock and highlighting the regional interests and importance, the animal feed unit developed by Indian Council of Agricultural Research, 1971 is adopted as criterion for the conversion of absolute numbers into homogeneous livestock units. The concentration of each kind of animal is calculated to the total livestock units of the component areal unit and mapped at mandal level for the year 1987 livestock census. Since the proportion of grazing land especially meant for livestock is scanty, the overall density of livestock is
calculated to 100 hectares of arable land. The livestock association regions are delineated with the help of Doi's method.

**Taxonomy of Livestock and Spatial Distribution**

The rearing of livestock in the State consists of bovine population like cattle and buffaloes, ovine population like sheep and goats and other livestock including pigs, horses, donkeys, ponies etc., inclusive of poultry also. In an agricultural economy like the one in Andhra Pradesh, the upkeep of livestock including the associated crops is most important because of the necessity of drought and milch stock.

The spatial distribution of livestock units is related to many factors such as the suitability of physical environment, availability of fodder, and pasture land, nature of agricultural economy, type of farming, size of land holding, type of cropping pattern, purchasing power of the people and standard of living, nutritional aspects of people, density of population, transport and marketing facilities, attitude of the farmer, Government policies etc.

**Distributional Pattern of Cattle Units**

Cattle includes both cows and bullocks. Cattle are overwhelmingly the most important livestock accounting for 54.2 percent of the total livestock units in the State. They are the leading livestock in many parts of the State because of their importance lies
in two important aspects namely, (i) bullock is the main source of motive power in agricultural operations, and (ii) cows which provide milk is the main source of animal protein. Most of the cattle in the State are indigenous and are nondescript. They are small in size and of low productivity both in terms of milk production as well as energy force.

Distinct regional pattern in the distribution of cattle units is noticed in the State. The highest proportion of cattle units in the total livestock of a component areal unit is found in Rajavommagi mandal (96.71%) of East Godavari district while the lowest in Sangam mandal (4.3%) of Nellore district. High (60-80%) and very high (>80%) proportions of cattle units in the total livestock population found in 462 mandals which account for 41.8 per cent of the total mandals of the State. Very high proportion of cattle units distributed in the agency areas of East Godavari, Visakhapatnam, Warangal and Karimnagar districts. Here cattle are the main source of energy in the traditional agricultural operations of tribal communities. High proportion of cattle units distributed heavily in southern and western parts of Rayalaseema, most of Telangana and a small portion in the north Coastal plain. The high concentration of cattle population in the plateau region is due to (i) low rainfall and dry climatic conditions are suitable for cattle population rather than buffaloes, (ii) they can withstand to drought occurrences, (iii) bullocks are the chief source of animal power in agriculture and they regarded as the consummation
of regional agriculture and (iv) cattle are the chief source of milk production due to unfavourable climatic conditions to buffaloes.

Moderate (40-60%) proportion of cattle units is found in 325 mandals which account for 29.4 per cent of the total mandals of the State. These mandals are distributed in eastern part of Rayalaseema, north Coastal plain and some portions of central Telangana. Where the climatic conditions are moderate and stall feeding facilities are available, both cattle and buffaloes share the equal importance. In these areas, cattle pre-dominantly meant for agricultural operations and buffaloes for milk production.

Low (20-40%) and very low (< 20%) concentrations of cattle units are found in 318 mandals (28.8 per cent of the total mandals of the State), of them, 249 mandals are located in the Coastal plain, 45 mandals in Rayalaseema and 24 mandals in Telangana. The high degree of mechanisation of agriculture, scarcity of grazing lands and high rainfall conditions are responsible for low proportion of cattle population in the Coastal plains. In these areas buffalo is the most competitive and climatically the most suited breed for milk production rather than cow.

From the above analysis it is found that varied physical conditions and regional agricultural pattern have vividly brought out a clear distinction in the distribution of cattle population in the State. In agriculturally developed areas of
Coastal plains, the importance of cattle as a draught force is little insignificant whereas in the agriculturally backward areas of interior parts of the State cattle are the sustainable breeds both for work and milk.

**Distributional Pattern of Buffaloes**

Buffaloes constitute the second most important category of livestock production in Andhra Pradesh accounting for 33.4 per cent of the total livestock units of the State. Buffalo are reared both for agricultural work and for milk production. However, buffalo as a milk breed is more prevalent and pronounced rather than as a draught animal. The milk yielding capacity of indigenous buffalo breed is significantly higher than the indigenous milch cow, and hence, buffaloes play dominant role in dairy farming in the State. Buffaloes sustain very well under stall feeding facilities better than the cattle and also thrive well on all kinds of coarse roughages and thus need not require extensive grazing lands. Buffaloes thrive well in the humid and sub-humid climatic conditions and in the areas where water conditions are congenial.

When compared with the distribution of cattle, the regional pattern is practically reversed in the case of buffalo rearing. The highest proportion of buffalo units is found in Karamchedu mandal (89.1%) of Prakasam district while the lowest in Nimmanapalli mandal (4%) of Chittoor district. High (60.1-80%) and very high (>80%) proportions of buffalo units are noticed
in 154 mandals, (13.9% of the total mandals of the State) out of the, 147 mandals are situated in the Coastal plain, 4 mandals in Rayalaseema and 3 mandals in Telangana. It has shown their akiness to the Coastal plains due to favourable humid climatic conditions and plenty of water facilities. In view of paucity of specified grazing fields and absence of forest cover which can also be used for rearing of animals, buffaloes rearing at the mostly based on stall feeding consists of both green and dry fodder and other rich protein feed. The stable irrigated farming, availability of fodder round the year, high density of population and agricultural prosperity, large number of urban settlements, high purchasing power of the people, high standard of living and well communication network etc., are the other favourable socio-economic conditions for overwhelming dominance of buffalo population in the Coastal plain. Moderate (40.1-60%) proportion of buffalo units is found in 220 mandals (19.9% of the total mandals of the State), out of them, 141 mandals are located in the Coastal plain, 51 mandals in Rayalaseema and 28 mandals in Telangana. These mandals are mostly distributed in Visakhapatnam, West Godavari, East Godavari, Krishna, Nellore and Guntur districts of the Coastal plain, Kurnool and Cuddapah districts of Rayalaseema.

Low (20-40%) and very low (< 20%) proportions of buffalo units are found in 730 mandals which account for 66 percent of the total mandals of the State. Out of these mandals, 416 mandals are situated in Telangana, 178 mandals in Rayalaseema
and 136 mandals in the Coastal plain. The environmental conditions of plateau region are more restrictive for the growth of buffalo population. The arid and semi-arid climatic conditions, scanty water facilities, non-availability of fodder round the year for stall feeding are not favourable for high densities of buffalo production in many parts of Telangana and Rayalaseema. In these two regions where cattle population are more prevalent, the buffalo population is low or very low.

The above study has revealed that the regional pattern of buffalo rearing is conditioned by both environmental conditions as well as the agronomic and production. Leaving aside the environment, in general, the concentration of buffalo population is very close to canal irrigated areas and prosperous agricultural zones.

**Distributional Pattern of Drought Force Units**

Draught force consists animals which are used in the agricultural operations such as ploughing, harrowing, threshing, harvesting, lifting water, and transporting the agricultural produce etc. It is mainly confined to bullocks and he-buffaloes. However, bullocks are the predominant drought force units because the he buffalo has not proved as useful working animal as the bullock. Drought force is the essential ubiquitous animal power in all parts of the State to carry out agricultural operations on account of the traditional small-scale subsistence and unmechanised nature of farming and poor socio-economic conditions of farming community.
As per the 1987 census, on an average, the drought force accounted for 35.5 per cent of the total livestock units in the State. Spatially it varies from a maximum of 75.5 per cent in Attili mandal (West Godavari district) to a minimum of 1.0 per cent in Secunderabad mandal (Hyderabad district). The regional importance and areal differences in the density of draught force is linked with the nature of the soil, intensity of irrigation, cropping pattern and the level of mechanisation. High (>60%) proportion of draught force to the total livestock production is found in 31 mandals mostly distributed in the agency areas of north Coastal plain. In the forest belt of agency areas draught force is the chief source of energy for tribal agriculture. Moderately high proportion (40-60%) of draught force is noticed in 426 mandals which account for 38.6 per cent of the total mandals of the State. Out of them, 259 mandals are situated in Telangana, 85 in Coastal plain, and 82 mandals in Rayalaseema. Many parts of Telangana, Western portion of Rayalaseema and upland and forest areas of north Coastal plain found with moderately high concentration of draught force. Most of these areas are known for rainfed agriculture. The poor socio-economic conditions of the farmers, extensive rainfed farming, limited pressure on agricultural operations due to cultivation of rainfed crops confining to one season are not favourable and encouraging conditions to go for mechanisation, and hence, most of the peasants try to maintain a pair of bullocks to carry out their agricultural work at low cost.
Moderately low (20-40%) proportion of draught force is found in 501 mandals which account for 45.4 per cent of the total mandals of the State. Out of them, 200 mandals are located in the Coastal plain, 160 in Telangana and 141 in Rayalaseema. Low (<20%) proportion of draught force is found in 146 mandals, out of them, 117 are situated in the Coastal plain, 20 mandals in Telangana and 9 mandals in Rayalaseema. The high level of modernisation of agriculture in the central Coastal plain has reduced the use of animal power and replaced by mechanical power to carry out the agricultural operations at the faster rate throughout the year.

From the above study it is observed that wherever the agriculture is stable, dynamic and progressive there the modernisation of agriculture has reduced the importance of draught force as chief source of energy in agricultural development. On the other hand, where the rainfed agriculture is more prevalent agriculture is precarious and the presence of dominant cattle population and poor socio-economic conditions, motivated to continue the draught force in agricultural operations. Many farmers of the small size land holdings are necessity to look at animal power and they unable to afford mechanical power for agriculture. As long as this is continued, draught force essentially plays a significant role in agricultural development of the State.
Distributional Pattern of Milch Stock Units

The milch stock in the State is chiefly confined to cows and she-buffaloes. Numerically, the she-buffalo is the most important milch breed when compared with a milch cow as it accounts for about 65 per cent of the total milch stock in the State. It indicates that cattle is mainly meant for workforce whereas buffaloes for milch stock. The importance of she-buffalo and a bull-calf can be judged from local adage, when fortune favours farm family, the she-buffalo drops a heifer and the cow a bull-calf besides, the housewife takes a greater care of the she-buffalo as the producer of milk and fat which are her daily requirements; a cow is looked after well by the cultivator mainly because he is the mother of bullock (Jasbir Singh, 1974, p.272).

In 1987, the total milch stock units accounted for 26.2 per cent of the total livestock units in the State. The highest proportion of milch stock to the total livestock is registered in Rayavaram mandal (65.4%) of East Godavari district while the lowest in M-Putti mandal (2.6%) of Srikakulam district. High (30-40%) and very high (> 40%) proportions of milch stock are found in 296 mandals which account for 26.8 per cent of the total mandals of the State. Out of them, 228 mandals are located in the Coastal plain, 43 mandals in Telangana and 25 mandals in Rayalaseema. It indicates that the Coastal plain, especially the 4 deltaic districts are very significant for milk breeding animals rather than draught force or other livestock. Apart from the
ANDHRA PRADESH

MILCH STOCK UNITS
(COWS AND BUFFALOES)-1987

LEGEND
(as percentage to total livestock)

- < 10
- 10 - 20
- 20 - 30
- 30 - 40
- > 40

FIG. 9.4
favourable physical and agro-geographical conditions, the high
density of population, rural and urban settlements and high
standard of living of these deltaic districts favoured for the
development of milch breeds. Here, buffalo is the important milk
breed.

Moderate concentration (20-30%) of milch stock is
found in 403 mandals which account for 36.5 per cent of the total
mandals of the State. Out of them, 165 mandals are situated in
Telangana, 110 mandals in Rayalaseema and 108 mandals in the
Coastal plain.

Low (10-20%) very low (< 10%) proportions of milch
stock are found in 405 mandals, out of them, 219 mandals are
located in Telangana, 98 mandals in Rayalaseema, and 88 mandals
in Coastal plain. The districts important for low concentration
of milk stock are Srikakulam, Visakhapatnam, Kurnool, Chittoor,
Anantapur, Mahabubnagar, Nalgonda, Nizamabad, Adilabad,
Karimnagar, Khammam and Warangal. It is significant to state that
in the harsh climatic conditions as well as in the agency areas,
where fodder facilities for stall feeding are scarce those areas
are found with low density of milch stock.

From the above analysis it is inferred that
she-buffalo is the most milk yielding animal in the State. Its
pre-eminence in the Coastal plains is unquestionable in milk
production. The Coastal plains are identified as the pre-dominant
areas of milk breeding animals because of favourable physical,
agro-geographical and socio-economic conditions. In the recent years the small-scale household confined dairing has to be excogitated as a subsidiary occupation to alleviate the tribulations of the small and marginal farmers in the State.

Distributional Pattern of Sheep Units

Sheep are more suited to arid and semi-arid climatic conditions and poor grassland vegetation system. Sheep do not withstand heavy rain. They are least affected by fodder famines and seem to have made sturdy progress in the years of distress. Sheep are generally reared by small and marginal farmers who belong to the weaker sections of community in the State. Sheep contribute a farmer's income, food and enrich the soil. Obviously, they are called as "poor man's wealth". The sheep commonly found in the State are non-descript and indigenous and consists of both mutton and wool types.

In 1987, the proportions of sheep units in the total livestock of the State accounted for 5.6 per cent. Spatially, the proportion of sheep units varies from a maximum of 74.4 per cent in Sangam mandal (Nellore districts) to a nil proportion in a number of mandals. High (10-15%) and very high (>15%) proportions of sheep units are found in 142 mandals, out of them, 72 mandals are located in Rayalaseema, 41 Telangana and 29 mandals in the Coastal plain. The important locations of high proportions of sheep units are found in Western Rayalaseema, and southern Telangana and upland areas of south Coastal plain. The
districts important for these concentrations are Anantapur, Chittoor, Cuddapah, Mahabubnagar and Nellore. The semi-arid climatic conditions of these areas and extensive fallow lands and rough pasture lands provide favourable conditions for flourishing of sheep rearing.

Moderate proportion (5-10%) of sheep units is found in 323 mandals, out of them, 149 mandals are located in Telangana, 87 mandals in Rayalaseema and 87 mandals in Coastal plain. The southern and central Telangana, south Coastal plains and the extreme north Coastal plain and Rayalaseema are found with moderate proportions of sheep.

Low (< 5%) proportion of sheep units is found in 608 mandals which account for 55 per cent of the total mandals of the State. Out of them, 294 mandals are situated in the Coastal plain, 254 in Telangana and 60 mandals in Rayalaseema.

The study has revealed that the sheep rearing is opulent in the rain-shadow region of Rayalaseema and southern Telangana and some portions of south Coastal plains. Extensive fallow cover, rough wastelands and dry meadows are the other favourable aspects besides the dry climate for sustainable sheep production. The real problem which is seriously menacing the prosperity of sheep rearing is disease-prone. Sheep population are greatly susceptible to diseases as a result heavy mortality rate may be recorded. Sheep rearing is a fortune of diseases. If this problem is overcome and good breeding facilities are
provided, certainly sheep rearing will be a prosperous agricultural activity of weaker sections in the drought prone areas of Rayalaseema and Telangana.

Distributional Pattern of Goat Units

Goats are allied to sheep, but are much harder and more active. In arid and semi-arid areas, goat breeding is more lucrative than the other breeds on account of the low cost of maintenance and their sturdy nature. They can easily thrive under stall fed conditions, and it is foe of afforestation. Goat is largely fed on the reckless chopping of trees. Goats are mainly raised by the weaker sections of society in the State and it is said that "Goat is the poor man's cow".

In 1987, the goat units accounted for 3.7 per cent of the total livestock units in the State. The highest percentage of goat units is found in Gorantla (17.5%) mandal of Anantapur district, while in a number of mandals goat rearing is completely absent. High (10-15%) and very high (>15%) proportions of goat units are found in 45 mandals, out of them 22 mandals are located in Rayalaseema, 14 mandals in Coastal plain and 9 mandals in Telangana. The districts important for high concentration of goat units are Anantapur, Prakasam, Kurnool, Medak, Chittoor and Nellore. The rearing of goats mostly occupies in the areas adjoining to hills, forests and scrub jungles. The dry climatic conditions of Rayalaseema are congenial for the development of goat rearing.
Moderate (5-10%) proportion of goat units is found in 263 mandals, out of them, 150 are located in Rayalaseema mandals in the coastal plain and 27 mandals in Telangana. The moderate concentration of goat population is more prevalent in areas all along the Eastern Ghats. Low (< 5%) proportion of goat units is found in 765 mandals which account for 69.3 per cent of the total mandals of the State.

It is significant to state that goat rearing is completely restricted to the forest areas because of their habits of nibbing of plants which causes great damage to areas under afforestation. Otherwise, goat population can flourish very well in southern part of the State especially in Eastern Ghat section due to extensive grazing lands in the forest areas. If their feeding, breeding and management are all well planned, goat population will certainly become the source of livelihood to the poorer sections of the community in the State.

Distribution of Other Livestock Units

Apart from bovine and ovine population, poultry is the next important category of livestock accounted for 2.3 per cent of the total livestock in the State. In recent years, poultry farming has been received marked attention and it is being developed on industry basis in the close vicinities of urban settlements. The highest proportion of poultry units are found in Ranga Reddy district (11.3%) followed by Hyderabad (6.6%),
Krishna (5.5%), West Godavari (4.0%), Chittoor (3.3%), Nellore (2.7%), East Godavari (2.6%) and Visakhapatnam (2.4%) districts.

The next important category of livestock is pig rearing which is by tradition a subsidiary occupation of depressed classes who are socially backward and economically poor. The quality of the breed is very poor. The pig units are accounted for 0.6 per cent of the total livestock production of the State. The highest population of pig units is found in Adilabad (4.7%) and Hyderabad (2.9%). The north Coastal districts are also significant for high proportions of pig units.

Density of Total Livestock Units

The density of total livestock units is calculated on the basis of arable land but not on grazing land, because the land specifically used for grazing is very meager. Since the dry fodder consisting of the residual material and by-product of most of the non-leguminous and leguminous crops, it is the main source of livestock feed through-out the year, and hence the arable land is heavily supporting the distribution of livestock.

The pressure of total livestock units is calculated per 100 hectares of arable land. As per 1987 census, the average density of livestock units was 160 units per 100 hectares of arable land in the State. Spatially, the density varies from a maximum of 2177 livestock units in R.C. Puram mandal of Medak district to a minimum of 13 livestock units per 100 hectares of arable land.
in Golkonda mandal of Hyderabad district. High (251-300%) and very high (> 300) concentrations of livestock units per 100 hectares of arable land are found in 275 mandals (24.9% of the total mandals of the State), out of them, 138 mandals of are located in Telangana, 96 mandals in Coastal plain, and 41 mandals in Rayalaseema. They are distributed in the South Coastal plain, upland areas of north Coastal plain, agency areas of northern part of the State and northern Telangana. The districts important for higher densities of livestock are Karimnagar, Warangal, Nizamabad, Visakhapatnam, West Godavari, Nellore, Cuddapah, Chittoor, Ranga Reddy, Nalgonda and Adilabad.

The limited availability of arable land in Nellore, Chittoor and Cuddapah districts of southern part of the State and the agency area of the northern part of the State is one of the reasons for high concentrations of livestock. On the whole, these areas are significantly potential areas for the sustainance of large number of livestock units because of high carrying capacity of arable land.

Moderate (201-250) concentrations of livestock units are noticed in 179 mandals, out of them, 74 mandals are located in the Coastal plain, 73 mandals in Telangana and 32 mandals in Rayalaseema. These mandals are also located in the peripheral areas of high concentration. Low (151-200) and very low (< 150) concentrations of livestock units per 100 hectares of arable land are found in 650 mandals which account for 58.9 per cent of the
total mandals of the State. Out of them, 254 mandals are situated in the Coastal plain, 236 mandals in Telangana and 160 mandals in Rayalaseema. The major portion of these low densities are such as western Rayalaseem, southern, western and a small fringe in the extreme northern tip of Telangana and the central Coastal plain. The reasons for such low densities of livestock units are quite contrasting from one region to other region. In central Coastal plain, the extensive arable lands, limited use of animal power for agriculture and non-suitability of climatic conditions favour ovines and heavy reliance on milch buffalo prove to probable reasons for low concentrations of livestock units, whereas in the interior parts of the plateau region, the extensive arable lands that are suffering from low productivity, seasonal cropping, scarcity of fodder especially for bovines and non-suitability of climate for buffaloes may be the probable reason for low densities of livestock.

Livestock Association Regions

Although there are spectacular regional variations in the concentration of individual categories of livestock, few areas specialise in one category of livestock to the insignificance of all others. "An examination purely of the numbers of animals kept within small areal units for each area still leaves open the question of the manner in which a given branch of animal husbandry may be associated with other branches in the framework of the individual farm." (Talman, 1979, p.162). In subsistence and
semi-subsistence agricultural economics, in general, farmers extend patronage to several categories of livestock rather than a single one. Thus, it is obvious that the complete concentration on a single class of livestock is uncommon as in the case of crops. Hence, livestock are raised in associations for various enterprisings. So to impress upon the significance of livestock categories on livestock associations or combinations need to be elicited. In the present study, livestock association regions are identified on the basis of Doi's crop combination method. For the purpose of analysis there were eight classes of livestock namely draught force, milch stock, other bovines, sheep, goat, pig, poultry and other livestock are considered for the combinations. Here, the total bovines are classified into draught force (both cattle and buffaloes), milch stock (both cattle and buffaloes) and other which are not used for any purpose. This classification is made with an intention to differentiate the areas of dependency on the major livestock category of bovines.

There are five major livestock association regions identified in the State with various sub-combinations, on the basis of rank differences of the categories of livestock.

Mono-livestock Association

Mono-livestock association is found in 11 mandals distributed in Visakhapatnam, West Godavari, Prakasam, Nellore and Khammam districts. Two categories of livestock namely, draught force and sheep emerged as mono-livestock
classes. Draught force as a mono-livestock is found in 10 mandals located in the agency area where cattle is the main work force for tribal agriculture. The tribals rear cattle mainly meant for agricultural work. Sheep as a mono-livestock is found in Sangam mandal of Nellore district.

Two-livestock Association

In terms of spatial spread, the livestock association with two classes of animals is the second most important one, distributed in 176 mandals. Out of them, 118 mandals are situated in the Coastal plain, 42 mandals in Telangana and 16 mandals in Rayalaseema. A significant concentration of two-livestock association is noticed in the central and north-Coastal plains, northern and north-eastern parts of Telangana and eastern portion of Rayalaseema. There are 7 different sub-livestock associations identified on the basis of rank differences in the two-livestock association region. Among them, draught force as the main category of livestock formed two different sets of association distributed in 90 mandals. Among the associations draught force and other bovines are the most significant noticed in 71 mandals distributed intensively in Srikakulam, Vijayanagaram, Cuddapah, and in the agency areas of Khammam, West Godavari and East Godavari districts. Draught force and milch stock combination is found in 19 mandals in Warangal, West Godavari, Khammam and Ranga Reddy districts.
Milch stock as the first ranking category formed two sets of associations distributed in 57 mandals. Milch stock and other bovines association is the most significant one and found in 50 mandals of heavily concentrated in Guntur, Krishna, East Godavari and West Godavari districts. In these deltaic areas, the importance is given to the buffalo for milk and next only to the other animals. Milch stock and draught force association is found in 7 mandals distributed in East Godavari, West Godavari and Prakasam districts.

Other bovines as the first ranking category of animal formed two sets of association in 28 mandals. Out of which, other bovines and draught force is an important association found in 23 mandals distributed in the forest areas of Adilabad and Srikakulam district. Other bovines and milch stock association is found in Prakasam district.

Three-Livestock Association

In terms of area, three livestock association region is the largest one with 853 mandals (77.3% of the total mandals of the State). Out of them, 399 mandals are situated in Telangana, 273 mandals in the Coastal plain and 181 mandals in Rayalaseema. There are 5 types of animals formed 28 different sub-livestock associations on the basis of rank difference in the proportion of animal categories.
Draught force surpassed as the major type in forming three different sets of livestock associations in 498 mandals. The leading three-livestock association is draught force-other bovines-milch stock found in 308 mandals distributed in Karimnagar, Khammam, Warangal, Nalgonda, Mahabubnagar, Chittoor, Anantapur and Kurnool districts. In indicates that this combination is more prevalent in the plateau region. Draught force-milch stock-other bovines is the second most common three-livestock association found in 180 mandals distributed in Visakhapatnam, Guntur, Kurnool, Cuddapah, Chittoor, Medak, Mahabubnagar, Nalgonda and Karimnagar districts. In these areas more or less equal importance is given to draught force and milch stock.

Milch stock as the first ranking category of livestock formed 5 different sets of associations found in 167 mandals. Milch stock-other bovines-draught force is the most common combination found in 114 mandals distributed in East Godavari, West Godavari, Krishna, Guntur, Prakasam, Nellore and Chittoor districts. It reveals that milch stock is the most dominant animal category rearing in the Coastal districts. Milch stock-draught force-other bovines is another association of animals found in 48 mandals distributed in East Godavari, Nellore, Guntur and Chittoor district.

Other bovines as the first ranking category of livestock formed 5 different sets of associations in 141 mandals. Other bovines-draught force-milch stock is the most prevalent
association noticed in 90 mandals centered mainly in Adilabad, Nizamabad, Nalgonda, Khammam and Kurnool districts. Here, cattle are the leading livestock especially in north Telangana. The next most frequent association is other bovines with milch stock and draught force found in 56 mandals centered mainly Prakasam, Nizamabad, Kurnool and Nellore districts. Draught force with milch stock and sheep found in Mahabubnagar and Kurnool districts. Poultry with draught force and other bovine combination found in two mandals located in Ranga Reddy and Krishna districts.

Four-Livestock Association Region

This region embraces 62 mandals, out of them, 33 are located in Rayalaseema, 23 in Coastal Andhra and two mandals in Telangana. In Krishna and Guntur districts milch stock as the primary livestock formed combination with the association of draught force, other bovines, poultry and goat. The significant four-livestock association is milch stock with other bovines, poultry and draught force found in Krishna district.

Draught force as the primary livestock unit formed combinations with the association of different animal like goat, sheep, milch stock, and other bovines, most frequent in Rayalaseema districts. The high concentration of four-livestock combination is found in Anantapur, Cuddapah and Chittoor districts.

Draught force as the first ranking animal formed a combination in association with other bovines, milch stock and
sheep found in 11 mandals distributed in Anantapur, Cuddapah and Nellore districts. Draught force-milch stock - other bovines-sheep is another important four-livestock association found in Rayalaseema and south Coastal plain.

**Five-livestock Combination Region**

This combination is insignificant and found in two mandals located in Anantapur and Chittoor districts. Draught force-milch stock other bovines - sheep and goat have participated in five-live stock association.

From the above analysis it is found that where the cattle population is dominant in Telangana and Rayalaseema, the main category of livestock may either draught force or other bovines, and next only the milch stock. So in the buffalo dominated areas of the central Coastal plain, milch stock is the primary category followed by other bovines or draught force. On the whole, draught force, milch stock and other bovines are important classes of livestock participated in forming the livestock associations. The diversified livestock associations are frequent in Rayalaseema and south Coastal Andhra where the physical, agro-geographic and socio-economic conditions are conducive for the growth of heterogeneous livestock types. Sheep and goat are included in the livestock association only in Rayalaseema and south Coastal plain. Although poultry is there in all areas of the State, they are not sufficient important livestock combination except in few cases in Krishna and Ranga Reddy districts.
Distinct Regional differences are to be found between the different types of livestock in the State. It has revealed that the State has propitious environment for a plenitude of livestock resources especially cattle, buffaloes, sheep, goat and poultry. The livestock combinations showed that mixed livestock farming is common and no one category of animal is ever sufficiently dominant to exclude all other types to form any one type. The mixed character is more clearly revealed by the livestock associations. However, the draught and milch stock types of livestock are most distinctive aspects of livestock associations in many parts of the State.

The factors of agricultural production might be employed more as gainfully with greater diversification, as more factors are realising. Since crop-husbandry is unstable, unprotective and unproductive in most of the rain-shadow areas of the State, animal husbandry has to be excogitated as an alternative possible primary occupation to improve the economy of these agriculturally backward areas. An agricultural planning aiming at greater diversification of agriculture will certainly offset some of the risks involved in specialisation and mono-culture farming. At the same time it reflects the new tradition of small-scale marketing agriculture, gainful employment to the farm people and sustainable agricultural development of the region. The diversification of agriculture leading to the development of mixed farming must be brought to lessen the environmental and
socio-economic problems and to make maximum use of available bio-diversity for sustainable regional agricultural development in the State. Here the concepts of Green Revolution and White Revolution are to be placed more or less on equal plane and both the twins must be made to travel together to achieve the noble destination of the rural economic uplift and balanced regional agricultural development in the State. Any official agricultural policy of the State or Centre may be designed to encourage such a trend of agricultural diversification.