SPATIAL PATTERN AND DYNAMICS OF LANDUSE AND ARABLE LANDUSE EFFICIENCY

The serious concern which has itself forced more insistently on world attention in the recent times, is the question of the ecological management and utilisation of land resources. "The days of large-scale exploration in the old sense are over: the area of the land surface available for occupation and use by man can be measured with an accuracy that becomes greater year by year .... the fact remains that the land surface is finite" (Stamp, 1958, p.1). Although land is a basic natural resource and one of the main components of natural ecosystem; but its utilisation pattern is one of the most complex expressions of human activity performed within Man-environment constraints.

It is obvious that land resource plays a significant role in determining the degree of man's economic, social and cultural
prosperity. Its significance is further enhanced in the areas where the kind and degree of landuse is the crux of the economy of the inhabitants. In the regions where agriculture is paramount important, land resource use is central to all discussions of land problems and policies (Barlowe, 1954, p. 99).

The Concept of Landuse:

The transformation of land cover for various purposes, namely, agriculture, pasture, forest, settlement, industry, communication and etc., which are desired to fulfil man's and ecological accomplishments is called landuse. The degree of transformation of a land cover into landuse is the result of scarcity of land and the competition that exists among human settlements to satisfy as many as possible of the needs and necessities. The concept of landuse is a functionable one and it is dynamic as well as highly spatially variable. "The form and function of landuse is a human enterprise, while the development of landscape is the continuous efforts of man for his needs and sustenance under every possible combinations of climatic, vegetative and soil conditions" (Ramanalaih, 1984, p. 42-43). Stamp (1948, p. 74-77) has classified the needs of man into six major categories, viz., the need of work, home, food transportation, communication, defence and recreation.

The concept of landuse has also been defined by many geographers. Vink (1975, p. 1-2) stated that "the concept of landuse is often considered a relatively stable subject, related mainly to the use to which the land in a certain region at a certain time is put."
Landuse is any kind of permanent or cyclic human intervention to satisfy human needs, either material or spiritual or both, from the complex of natural and artificial resources which together are called 'land'. In this sense, landuse is the result of a continuous field of tension created between available resources and human needs and acted upon by human efforts." Stamp (1962, p. 426) explained that 'the land as a whole must be so used as to satisfy as many as possible of the needs and legitimate desires of the people, the nation as a whole.' According to Vanzetti (1970, p. 282-283)" land utilisation is concerned with the type of use which man carries out over a certain area at a certain time or nonutilisation of an area on account of its particular nature or the presence of unfavourable environmental conditions .... Land utilisation is a fundamental element for the knowledge of a region; it supplies its main features and gives a synoptic view of the technical and economic aspects." In a common parlance, landuse is related conversion of land from one major use to another general use and the use of land changes according to the changing need of man. Landuse is always strongly linked with the man-environment interaction.

The pattern of the present landuse is the result of different causes, many of which are directly related to the nature and quantity of land resources, others of which have their genesis in socio-economic, cultural and organisational conditions of the past and their developments. "Present landuse is only rare in accordance with the interplay of today's resources and human society" (Vink, 1975, p. 15). The pattern of landuse is complex. The complex
land use pattern in an area manifests the outcome of trial and errors of many thousand years of settlement." The present pattern of land use in India is the result of long continued operation of the whole range of environmental factors, basically physical but modified by socio-economic and historical elements related to the sequence of human occupancy." (Shafi, 1966, p. 16). The need of the hour is a careful evaluation of land resources for the future which must consider the present and past patterns of land use. The terms both 'land use' and 'land utilisation' are generally used synonymously although there is some fine difference according to Burley (1961, p. 18).

**Importance of Land use Studies:**

A study of land use of any region provides a good amount of information on different types of land use, the rate and kind of change in the use of land resources, land capability, land use efficiency particularly agricultural land, man-land ratio and ecology. Such information is essential to the planning and management of the use of land resources in general and agricultural land in particular. Land use study forms the "spearhead of the advance of geography into the applied sciences as maps of land use became recognised as essential tools of regional planning and development" (Symons, 1978, p. 224). The rational use, conservation and management of land resource play a crucial role in developing the agricultural economy of any region.

From the stand point of natural ecosystems, land use study is of paramount importance for maintaining the ecological
equilibrium. It is very clear from the idea of Simmons (1966) that land use is a process of modification of ecosystem and land use ecology might form a central theme in biogeography. It suggested that any scientific and rational land use planning should see that the ecological balance was not disturbed and that proper equilibrium between the environment and the socio-economic needs of the region may be maintained. Anderson and et al., (1971) also stated that "land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels." It is significant to state the ecosystem concept provides the necessary modern scientific framework to the study of land use at various levels.

The ever-increasing pressure of population, and decreasing man-land ratio on one hand and the main problems of land use include under-utilisation, over-utilisation and mis-utilisation on the other hand are posing challenging problems to the planners and academicians. To circumvent some of these problems an in-depth study of land use patterns, changes, land use efficiency, and land use problems is essential for scientific land use planning. The land use planning is in essence "the determination of the optimum use of every acre of the country" (Stampt, 1962, p. 246). In the successful interpretation of land use patterns, and problems in relation to man and concerns to land use mapping, geographers role is paramount importance. "The geographer by applying his technique of survey, mapping, analysis and interpretation would provide the correct base to evolve a 'rational scheme of land use planning (Shafi, 1967 p. 476). The planning of land use especially agricultural land use is
essential for the rational and optimum use of land resource of the region. A study of arable land use reveals how terrain, soil and climate influence land utilisation in a region.

Objective of the Present Study:

In the present study an attempt is made to examine the spatial as well as temporal changes and trends in the landuse of Cuddapah district. An endeavour is made to develop a typology of landuse based on mapping and quantitative techniques.

To put it in a nutshell the main objectives of the present study are:

(i) to classify and analyse the spatial patterns of various landuse types,

(ii) to perceive the dynamics and trends of landuse categories in the possible interactions of physico socio-economic environments,

(iii) to develop the typology of landuse based on landuse orientation method of Kostrowicki, and

(iv) to measure the agricultural landuse efficiency with the help of simple coefficient method.

Methodology of the Study:

In the present study, 'mandal' is taken as the unit for the analysis of spatial patterns of landuse, landuse orientation and arable landuse efficiency for the triennium 1986-90. Since there was
no 'mandal' administrative unit earlier to 1985; the changing patterns of landuse, and arable landuse efficiency were examined between three points of time namely, 1962-65, 1972-75 and 1982-85. In order to correct the distortions, a three year average is taken for the purpose of analysis. Computer analysis is made to find out the trends of change in different types of landuse with the help of linear regression equation, \( Y = a + bx \), where \( Y \) is the index number of the element and \( X \) is the time. The goodness of fit of a trend line is measured to know how well the regression line fits the data and the extent to which the regression accounts for the variation in the observed values of the dependent variable. This is quantified by calculating the ratio between regression variance \((SY^2)\) and observed variance \((SY^2)\) and this ratio is known as co-efficient of determination \((r^2)\).

Here, Kostrowicki's method of landuse orientation has been employed to discern the spatial and temporal distributions of major landuse types and the development of landuse typology. An attempt is also made to measure the agricultural landuse efficiency by employing modified standard co-efficient method and analysing its spatio-temporal variations in the district.

**Landuse Classification in Cuddapah District:**

In the elementary form of landuse typology one can distinguish different landuse types on the basis of general purpose namely, agricultural, non-agricultural and ecological. However, this general distinction between landuse types is not sufficient to
comparable account of land resource potentials. Thus, for the characterisation of landuse, a systematic classification of landuse is essential in the process of land evolution. Standard definitions of landuse types are essential pre-requisites for improving their reliability and comparability from year to year and place to place (Jasbir Singh, 1974, p. 104).

"At present, there is no standard landuse classification system in India" (Gautam and Narayan, 1982, p. 2). But there are different organisations like National Atlas and Thematic Mapping Organisation, All India Soil and Landuse Survey, Directorate of Economics and Statistics, Department of Agriculture, Remote Sensing Techniques etc., have developed their own classification schemes for landuse mapping. But a need has been identified by the Government of India for a uniform landuse classification system to be adopted by all the states and Union Territories of India with an objective of comparative account of country's land resource. In this endeavour, the T.C.C.A.S. (Technical Committee on Coordination of Agricultural Statistics) in 1950 recommended standard landuse classification and uniform definitions of the same to be adopted by the States all over India. The definitions and explanations have been further revised by the committee on improvement of Agricultural Statistics for the sake of clarity and workability. Based on uniform landuse classification, the total land area geographically accessible for major uses is classified into nine types, namely,

(i) **Forest** cover any land classified or administered as a forest under legal enactment.
(ii) **Area under non-agricultural use** covers all land occupied by settlements, roads and railways, beds of streams, ponds and canals.

(iii) **Barren Lands** which are bare rocky out-crops of hills, plateaus, mountains, deserts etc. This land can under no conceivable circumstances be brought under cultivation but at a very high cost a very little proportion may be classified as unculturable.

(iv) **Permanent Pastures and other grazing lands** embrace all grazing lands which may be permanent meadows and village common pastures.

(v) **Area under miscellaneous tree crops etc.** covers all cultivable land which is not included in the net area sown, but is put to some agricultural use other than seasonal cropping.

(vi) **Culturable Wasteland** denotes land considered by present judgements as cultivable but actually not cultivated during the current year and last five years or more in succession. It is left untilled on account of physical and socio-economic limitations.

(vii) **Current fallows** means the lands left unsown during the current agricultural year only to regain fertility and also that which remained uncropped in the short term for want of moisture and economic reasons.

(viii) **Other fallow lands**: comprise all lands which were taken up for cultivation but are temporarily unsown for a period of not less than one year and not more than five years and

(ix) **Net area sown** represents the extent of the cultivated area actually sown during the agricultural year. It may be referred to as net cropped area.
The above landuse classification and definitions have been accepted by all the States leading to comparability in landuse returns (Jasbir Singh, 1974, p. 105). In the present study, these nine types of landuse are grouped into five major landuse categories for the purpose of examining the spatiotemporal variations in agricultural, non-agricultural and ecological environment in the district. These five major landuse types are:

(1) **Forest cover**

(ii) **Non-cultivable land** includes and used for non-agricultural purposes and land not suitable for agricultural activities.

(iii) **Other uncultivated land** includes pastures, land under miscellaneous tree crops and culturable wasteland.

(iv) **Follow land** includes both current and other fallows.

(v) **Net area sown**

The distributional patterns of these five major landuse types in Cuddapah district are examined in spatio-temporal levels.

**Forest Land:**

The term 'forest' is defined as "a community of trees and associated organisms covering a considerable area, utilising air, water and minerals to attain maturity and to reproduce itself; and capable of furnishing mankind with indispensable products and services" (Allen and Sharp, 1980 p, 68). But in India, it is...
defined as any land classified or administered as a forest under any legal enactment. In simple meaning, forests are close formation of diversified variety of trees growing together at one place and giving a distinguished picturesque. Forest land is generally incompatible with other landuse types. Forests from distinct ecosystems and the character and type of vegetation in a forest is the product of climatic, edaphic and topographical conditions as well as human interference. Cuddapah is one of the important districts in the State in respect of forest resources. It is clear from the fact that the forest land accounted for 32.3 per cent (1986-89) of the total geographical area of the district. This proportion of land under forest has accomplished the requirement for balancing the ecosystem of the region. Cuddapah district consisted dense growth of tree population with a large and important plant species. In the district, vast stretches of forest cover are noticed on the hill ranges like the Veligonda, Seshachalam, Palakonda, Nallamalai and Lankamalai of Badvel, Sidhout, Rajampet, Cuddapah and Proddatur taluks. Isolated patches of forest cover are found in Pulivendula and Jammalamadugu taluks.

The forests of the district can be classified into (i) dry deciduous type, and (ii) tropical thorny forests. The nature of the forests, density and floristic distribution considerably varying in relation to altitude, slope, soil and rainfall conditions. For example, the forests of southern portion of the district are categorised into three types based on elevation namely, (i) terai or fuel forest upto an elevation of 275 mts. (ii) hill or Red sander forest laying between 275 mts. and 675 mts. and (iii) Sharea-enginia of above
675 mts. elevation. The thorny scrub jungles are found all along the outer edges of the forests, all over the lower plains with their poor and stunted growth. In some areas the lower belts of the hill forests are occupied by the forests of Hardwickia type which occurs in large numbers.

The chief distinction of the forests of Cuddapah district lies in the fact that there is an utmost important species is Pterocarpus Santalinus or Red sanders. In India, this species occurs only in this district and its bordering areas. In view of its high commercial value and seldom grown in the country, the district's forest organisation has designed the forest policy to concentrate on conservation, extension and proper utilisation of Red sanders. This species is largely noticed in the hill forests of an elevation of more than 275 mts., the cooler sides of the hill slopes with good drainage conditions. Red sander species is commonly associated with Anogeissus Chloroxylon, Hardwickia, Terminalia Coriacea, and Terminalia Chebula. Hardwickia binata and Anogeissus latifolia are found in the areas where quartzite rock occurs and quartzose ferruginous sandy loam exists. Bamboo species also occurs in dense distribution confining to stream banks, moist localities and plateau portions of Velikonda, Nallamalai and Lankamalai hill ranges.

Spatial Pattern of Forest Landuse:

The distribution of forest cover in the district is most uneven. For example, Narasapuram mandal accounts for 54.2 per cent of its area under forest, while 5 mandals namely, Rajampet, Nandalur,
CUDDAPAH DISTRICT
Forest Land—1986-89

INDEX
(as percentage of geographical area)
Nil 201-30
H 301-40
101-20
H >40

FIG G 1

INDEX
(as percentage of geographical area)
Nil 201-30
≤10 301-40
101-20 >40

0 30 Km

FIG G 1
Penagalur, Chapadu and Rajupalem located in the valleys do not have even semblance of forest cover. In 1986-89, very high (above 40%) and high (30.1 - 40%) concentrations of forest cover are found in 11 mandals distributed in the central and north-eastern parts which are adjoining areas of the hill ranges. The rainfall is moderate to high in these hilly bounded areas for the dense growth of tree population. Moderate proportion of forest land is noticed in 7 mandals which also come under the coverage of famous hill ranges like Lankamalai, Velikonda and Palakonda in the eastern part of the district.

Low (10.1-20%) and very low (<10%) concentrations of forest cover are found in 27 mandals which accounts 54 per cent of the total mandals of the district. These mandals are distributed in western plains of the district. Barring all along the Seshachalam and Palakonda ranges, the entire western, south-western and north-western parts of the district are endowed with very thin cover of vegetation comprising mostly discontinuous thorny thickets and scrub jungles. Forest growth in these areas is stunted due to poor isohyetal conditions. Absence of prominent hill ranges and presence of plain topographical conditions with very low rainfall conditions and rocky exposure of soils in the western plains are not conducive for the growth of dense forest cover.

Changing Pattern of Forest Landuse:

The increase in the percentage of forest land in the district between the period 1962-65 and 1982-85 was 2 per cent. In
terms of hectarage, the forest land increased from 480 thousands in 1962-65 to 517 thousands in 1982-85 showing a net increase of 37 thousand hectares. This significant increase has been achieved due to the efforts of district's forest organisation which launched several schemes of afforestation, conservation and plantation of economically useful plants like Red sanders, bamboos eucalyptus, neem, tamarind, dirisinam, gulmohar and etc., in the fertile valleys, open scrub lands, old forest areas and culturable wasteland. There has been a gradual increase of the forest land in the district i.e. from 27.5 per cent in 1962-65 to 29.1 per cent in 1972-75 and 29.5 per cent in 1982-85 and further it increased to 32.3 per cent in 1986-89.

Spatially, increase in the concentration of forest land between 1962-65 and 1982-85 was registered in 7 taluks in different proportions. The highest increase of 8 per cent was noticed in Cuddapah taluk followed by Rayachoty (5.9%), Badvel (4.6%), Pulivendula (3.6%) and in the remaining taluks, the increase is small. In the areas of undulating topography of southern plateau and in the adjoining parts of Cuddapah urban centre, large scale social forestry and afforestation programmes are implemented. As a result, a significant proportion of land under culturable waste and fallows have been brought under tree plantation.

A decrease in the proportion of forest land is noticed in only two taluks namely, Sidhout (4.9%) and Kamalapuram (1.3%).
<table>
<thead>
<tr>
<th>Taluk</th>
<th>Percentage of forest land to total geographical area</th>
<th>Percentage variation between 1962-65 1972-75 1982-85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddapah</td>
<td>34.6 42.4 42.6</td>
<td>7.8 0.2 8.0</td>
</tr>
<tr>
<td>Rayachoty</td>
<td>30.0 30.8 35.9</td>
<td>0.8 5.1 5.9</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>3.1 1.8 1.8</td>
<td>-1.3 -- -1.3</td>
</tr>
<tr>
<td>Rajampet</td>
<td>45.2 46.3 46.3</td>
<td>1.1 -- 1.1</td>
</tr>
<tr>
<td>Sidhout</td>
<td>56.7 51.6 51.8</td>
<td>-5.1 0.2 -4.9</td>
</tr>
<tr>
<td>Badvel</td>
<td>39.0 44.5 43.6</td>
<td>5.5 0.9 4.6</td>
</tr>
<tr>
<td>Jammalamadugu</td>
<td>9.7 11.4 10.6</td>
<td>1.7 -0.8 0.9</td>
</tr>
<tr>
<td>Proddatur</td>
<td>23.4 13.2 23.6</td>
<td>-0.2 0.4 0.2</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>5.9 9.6 9.5</td>
<td>3.7 0.1 3.6</td>
</tr>
<tr>
<td>District</td>
<td>27.5 29.1 29.5</td>
<td>1.6 0.4 2.0</td>
</tr>
</tbody>
</table>
CUDDAPAH DISTRICT
Trend Of Forest Land

Scale
Y 1 Cm  50,000
X 1 Cm  2 Years

area in Hectares (1000)

Year
1962  74  '84

Fig: 6.1a
Trend of Forest Landuse (1962-84):

The regression trend analysis has also shown that there has been a marginal increase in the area under forest. The trend line is positive and accounted by 18 per cent co-efficient of determination. The growth rate is marginal and accounted for 0.01 per cent increase per annum for the whole district.

Out of nine taluks in the district, six taluks namely, Cuddapah, Rayachoty, Badvel, Jammalamadugu, Proddatur and Pulivendula have shown the positive trend in the area under forests. The trend lines of Cuddapah, Sidhout, Kamalapuram and Rayachoty are accounted by high $r^2$ values of 72 per cent, 70 per cent, 67 per cent and 58 per cent respectively. Cuddapah taluk has registered a high growth rate of 1.2 per cent per annum followed by Rayachoty with 0.06 per cent per annum. The lowest positive growth rate is recorded in Proddatur taluk with 0.001 per cent per annum.

There are three taluks namely, Kamalapuram, Rajampet and Sidhout exhibited the negative trend of forest land. A high negative growth rate is found in Kamalapuram taluk with -0.3 per cent per annum followed by Sidhout (0.03%) and Rajampet (0.01%).

Problems of Forest Landuse:

Earlier, in the 17th and 18th centuries, the forests of Cuddapah district were dense as well as rich engaged to sustain even wild animals. Gradually due to degradation of man and ravages of environment relating to fire, ruthless cutting of trees for different purposes, robbing of valuable plant materials and uncontrolled
Plate 6.1a The dry deciduous forest type of Velikonda hill ranges in the eastern part of the district.

Plate 6.1b A view of the burned forest in the dense forest zone of Velikonda ranges which is a usual practice here for the purpose of char-coal production.
grazing of livestock, and changes in the rainfall, occurrence of
droughts and increase of soil erosion have combinedly brought out a
poor look both in the appearance and quality of forest cover in the
district. In effect, the forest cover has been losing its significance
in terms of regional ecosystems and economy. Because of large scale
exploitation of economically valuable plants like red sanders, bamboos
and house construction wood materials and firing of vast stretches
a forest cover for charcoal and uncontrolled grazing of livestock have
degenerated the dense forest cover into scrub jungles, thorny bush
lands, dry meadows and in extreme condition barren sterile grounds
have been formed. Soil erosion has become a serious menace in the
slopy areas of forest degeneration and which has aggravated the
situation of the water storing points by siltation and degradation of
land cover in general.

Development of Forest Cover:

Several measures have been taken by the district's
forest organisation to improve the quality of forests and also to
enhance the area under forests through crash programmes like
afforestation, social forestry, agro-forestry and other rural
development programmes. Some attempts are made to introduce exotic
species like Persian Gulf Dates in the Balapalle area, Peri Yavaram
Palmyra Plantations in Rajampet area during 19th century but they
proved a failure due to unfavourable soil conditions. Similarly,
efforts made to introduce Mahogany plantations in Balapalle area-
Cassia siamea and Samanea saman in Kodur area; Dalbergia
sissoo in all over the district, Anacardium occidentale (cashew).
Plate 6.2a People of the poorer strata and landless labourers depending on forest products for their livelihood. They cut the trees ruthlessly for firewood and rob the economically valuable plants for other commercial purposes.

Plate 6.2b A view of the forest nursery located near Badvel. Under afforestation programme it supplies different plant species at free of cost to the farmers for the development of social forestry, agro-forestry etc.
Plate 6.3a A view of the extension stretch of barren land with large heaps of mining waste near Yerraguntla Cement Factory.

Plate 6.3b An extensive stretch of wasteland due to large scale mining of barytes at Mangampet in the eastern valley region.
Broussonetia Papyrifera in Badvel area; Prosopis juliflora in all along the banks of Pennar and Papaghni rivers and much more plantations of Red sanders in Kodur and Rajampet areas of the district. Some of these plantations in the old forest areas were successful. Several plants like eucalyptus, cashew, gulmahar, neem, tamarind, subabul and others are introduced in the areas of social forestry and agro-forestry programmes.

The actual problem of degeneration of forest cover in the district lies with the poor socio-economic conditions of people. Large section of small and marginal farmers as well as landless labourers are heavily depending on forest for their livelihood on account of lack of agricultural employment and frequent failure of cropping systems in the region. Unless the orientation and economy of the poor people is changed from forest-base to agricultural and non-agricultural-bases (secondary and tertiary economics) the development or improvement of forest cover may not be significantly brought out and become a continuing problem to both environment (ecosystem) and economy of the region. To solve this, concerted efforts should be taken to divert the economy of poor people who depend on forest for their livelihood to agriculture and industry by generating employment through rural development or reconstruction programmes. It is necessary to strengthen the crash programme like social forestry, agroforestry, pasture development etc., by involving all poor people and generating employment opportunities by providing land, capital in the form of subsidies, seedlings, technical help and work experience. The awareness of the problems and prospects of
forestry among rural people must also be brought through Adult Education, Audio-visual Education and other Extension Programmes. There is a great scope still to bring former richness of forest cover in the district.

**Spatial Distribution of Non-cultivable Land:**

The land agriculturally unproductive and land under non-agricultural uses may be termed as 'non-cultivable' land. It includes two types of land use namely, (i) barren and unculturable land, and (ii) the area under non-agricultural uses. Barren and unculturable lands are such lands practically useless or unproductive and unfit for cultivation. These lands are bare rocky out crops of hills, plateaus, deserts, stone quarries, badlands, sandy wastos and alkaline tracts which can not be brought under cultivation except at a high cost. The area under non-agricultural uses include the land under settlements, roads, railways, embankments, water bodies, industrial establishments, grave yards, recreation grounds, mining etc. The above two types are rendered sterile from the point of agriculture.

In 1986-89, the non-cultivable land accounted for 29.6 per cent of the total geographical area of the district. Within the district there is a significant spatial variation in the distribution of this category of land use. It is clear from the fact that the highest concentration of non-cultivable land is recorded in Chitvel mandal with 70 per cent while the lowest proportion in Peddamudiam mandal with 3.7 per cent.
CUDDAPAH DISTRICT
NON-CULTIVABLE LAND 1986-89

INDEX
(as percentage of total geographical area)

- ≤ 10
- 10.1 - 20
- 20.1 - 30
- 30.1 - 40
- > 40

0 30
Km

FIG 6.2
High (30.1 - 40%) and very high (>40%) concentrations of non-cultivable land are observed in 27 mandals accounted for 54 per cent of the total mandals of the district. These mandals are situated in eastern, south-eastern and southern parts of the district. The presence of hilly topography and bare rocky exposures and large amount of area under mining activities of barytes and asbestos minerals in southeastern part, undulating topography with eroded and degraded lands, rocky outcrops as well as mining in southern plateau region are the causes for high proportion of land under non-agricultural uses. High concentration of this category of landuse is also found in Mylavaram, Jammalamadugu mandals in north-western part of the district and three more mandals in Pulivendula basin. The construction of medium irrigation project at Mylavaram and the extensive mining activity in Jammalamadugu area are responsible for high proportion of this category of landuse.

Moderate concentration of 20.1 to 30 per cent non-cultivable land is found in 13 mandals. These mandals are distributed in Pulivendula basin and central part of the district. The development of industries, transport network, water bodies, urban centres and tertiary structures are attributed to significant proportion of land under non-cultivable landuse type in the central part of the district.

Low (10.1 - 20%) and very low (<10%) concentrations of non-cultivable land are noticed in 10 mandals distributed in all over the western plains of the district.
Plate 6.4a The terrain near Rajampet with innumerable rocky exposures. This type of land is sterile from the point of agriculture.

Plate 6.4b A view of the degraded land surface due to man's interference by digging the earth material for non-agricultural purposes like roadlaging, brick industry etc.
Changing Pattern of Non-cultivable Landuse:

Theoretically, this type of landuse might be shown as an increase in the area due to increasing demand for land under settlements, industries, mining, transport network, construction, irrigation projects and canal systems.

A comparison of the non-cultivable land between 1962-65 and 1982-85 showed that the proportion of this landuse type has increased by 11.4 per cent. This is a significant increase indeed. In 1963-64, this category accounted for 13.4 per cent to the total geographical area of the district. It is increased to 23.9 per cent in 1973-74 and further increased to 24.8 per cent in 1982-85. In terms of actual area, the non-cultivable land has increased from 193 thousand hectares in 1962-65 to 408 thousand hectares in 1982-85, indicating more than a two-fold increase of 215 thousand hectares.

An increase in the proportion of non-cultivable land is noticed in 7 taluks, while there is decrease in two taluks. The outstanding increase of 27 per cent is registered in Sidhout taluk followed by Rajampet (23.2%), Badvel (22.5%), Rayachoty (17 %) and Kamalapuram (11.3%). These outstanding increase in the proportion of non-cultivable land in general are due to extensive mining activities for large scale exploitation of minerals like barytes, asbestos, limestone, clays and building materials in all over the district in general and specific to Rajampet, Badvel, Sidhout and Rayachoty taluks. In the eastern valley region of Badvel, Sidhout and Rajampet taluks, the severe soil erosion, siltation and land degradation have aggrandized the barren and unculturable land.
### Table 6.2

**Changing Distribution of Non-Cultivable Land in Cuddapah District**

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Percentage of noncultivable land to total geographical area</th>
<th>Percentage variation between</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddapah</td>
<td>11.4</td>
<td>17.4</td>
</tr>
<tr>
<td>Rayachoty</td>
<td>10.8</td>
<td>31.3</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>13.2</td>
<td>20.2</td>
</tr>
<tr>
<td>Rajampet</td>
<td>8.4</td>
<td>32.4</td>
</tr>
<tr>
<td>Sidhout</td>
<td>6.9</td>
<td>23.7</td>
</tr>
<tr>
<td>Badvel</td>
<td>7.2</td>
<td>31.1</td>
</tr>
<tr>
<td>Jammalamadugu</td>
<td>25.1</td>
<td>22.3</td>
</tr>
<tr>
<td>Proddatur</td>
<td>17.9</td>
<td>12.5</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>19.8</td>
<td>23.9</td>
</tr>
<tr>
<td><strong>District</strong></td>
<td><strong>13.4</strong></td>
<td><strong>23.9</strong></td>
</tr>
</tbody>
</table>

(See Table 6.2 for the detailed distribution of non-cultivable land in Cuddapah District, including percentage variations between different years.)
CUDDAPAH DISTRICT
Trend Of Non-Cultivable Land

Scale
Y 1 Cm = 50 000 he
X 1 Cm = 2 Years

Area In Hectares (1000)

Years

1962  '74  '84

Fig : 6-2 a
The decrease in the proportion of non-cultivable land occurred in Froddatur taluk (5.1%) and Jammalamadugu taluk (3.2%). In these two taluks, due to the development of canal irrigation and costly reclamation measures, a significant amount of land has been brought under plough.

**Trend of Non-cultivable Land (1962-84):**

The linear regression analysis too has revealed the trend of increase of non-cultivable land in the district during 1963-85 period. This positive trend was accounted by 43 per cent of coefficient of determination. On an average, the land under non-agricultural use was increased by 0.1 per cent per annum in the district.

The trend of increase of the non-cultivable land is found in seven taluks namely, Cuddapah, Kamalapuram, Rayachoty, Rajampet, Sidhout, Badvel and Pulivendula. The positive trend lines of non-cultivable land in Sidhout, Kamalapuram, and Badvel were accounted for by more than 50 per cent of coefficient of determination. The rate of increase in the area under non-agricultural use is high in Cuddapah taluk with 2.1 per cent per annum followed by Rayachoty (0.7%), Sidhout (0.4%), Rajampet (0.4%), Badvel (0.3%), Kamalapuram (0.2%) and Pulivendula (0.01%).

The negative trend of non-cultivable land is found in Proddatur and Jammalamadugu taluks. In these two taluks, the negative trend lines are accounted by 50 per cent and 45 per cent of coefficient of determination respectively. A high negative growth
rate of 0.07 per cent per annum is found in Proddatur and 0.05 per cent in Jammalamadugu taluks.

From the above analysis it is conspicuous that the non-cultivable land encompassed a larger area in the district and also there has been a perpetual increase in its proportion. Both constructive and destructive aspects are connected with the spatial spread of this land use type in the district. From the point of constructive use, the land for mining is one. But what is observed that there has not been a systematic way of mining activities for the exploitation of various minerals. It is due to the involvement of many private people in operating the mining activities. These private people do the mining as they like and sometimes mis-utilise the other lands and thus ultimately leads to heavy degradation of land cover and turn into badlands. On the other side the deforestation, soil erosion, siltation and faulty methods of cultivation, land and water management in the steep slope areas of hilly ranges have also been converting the cultivable and other lands into barren lands. In view of high population pressure, decreasing man-land ratio and shortage of agricultural land, it is necessary to have a control over the extension of non-cultivable land in the district through various measures like rational and systematic utilisation of land, scientific mining, large involvement of public sector in mining, soil and water management practices and other scientific reclamation measures and agricultural exploitation.
Spatial Distribution of Other Uncultivated Land:

Other uncultivated land (excluding fallow land) includes (i) permanent pastures and other grazing lands, (ii) miscellaneous tree crops and groves not included in the net area sown, and (iii) culturable wasteland. The land for horizontal expansion i.e. areal extension of agriculture may possible with the colonisation of other uncultivated land. Expansion of arable land through reclamation of other uncultivated wasteland is important for developing the regional agricultural although modernisation and intensification of agriculture are of paramount importance. This category of landuse was mainly meant for livestock grazing in the earlier times. But due to increase of population pressure on arable land, the land under pastures, miscellaneous tree crops and culturable waste has been bringing under cropping with little reclamation measures. "The utilisation of cultivable and uncultivated lands is one of the protective, and profitable measures of meeting the national food requirements" (Jasbir Singh, 1974, p. 115). In general the other uncultivated land can also be called as cultivable waste (Spate, 1967, p. 227) which has potential status to raise the crops with in the scope of economic considerations.

In 1986-89, the proportion of the other uncultivated land accounted for 8.1 per cent to the total geographical area of the district. But there has been a significant spatial variation in this category of landuse ranges from a maximum of 23 per cent in Kondapuram mandal to minimum of 0.7 per cent in Cuddapah mandal. High (10.1-15%) and very high (> 15%) concentrations of other
CUDDAPAH DISTRICT
Other Uncultivated Land 1986-89

INDEX
(as percentage of total geographical area)

- $\leq 5$
- $5.1 - 10$
- $10.1 - 15$
- $> 15$

FIG 0.3
uncultivated land are found in 12 mandals distributed in western plains and south-eastern valley. In Rajampet, Nandalur and Penagalur mandals of south-eastern valley consisted high proportion of pasture lands in the adjoining parts of hill ranges. The proportion of culturable waste is significant in the western plains. In these areas there is a scope for agricultural colonisation and to increase the area under cropping.

Moderate proportion (5.1-10%) of other uncultivated land is found in 14 mandals in Pulivendula basin, southern plateau, south-eastern valley, and central part of the district. Low concentration (<5%) of other uncultivated land is found in 24 mandals distributed in all over the district.

Changing Pattern of Other Uncultivated Land:

"The magnitude of decrease in cultivable wasteland is an ideal index for reckoning the extent of agricultural colonisation" (Jasbir Singh, 1974, p. 118). Between 1962-65 and 1982-85 the percentage of other uncultivated land has decreased by 9.2 per cent which was a significant decrease indeed in the district. There has been a gradual decrease in the percentage of uncultivated land from 16.2 per cent in 1962-65 to 7.8 per cent in 1972-75 and further a small decrease to 7.0 per cent in 1982-85. In terms of hectarage, the area under other uncultivated land has decreased from 270 thousand hectares in 1962-65 to 104 thousand hectares in 1982-85 showing a net decrease of 165 thousand hectares in the 20 year period.
Table 6.3

Changing Distribution of Other Uncultivated Land in Cuddapah District

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Percentage of other uncultivated land to total geographical area</th>
<th>Percentage variation between</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddapah</td>
<td>14.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Rayachoty</td>
<td>8.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>13.5</td>
<td>3.3</td>
</tr>
<tr>
<td>Rajampet</td>
<td>28.1</td>
<td>6.3</td>
</tr>
<tr>
<td>Sidhout</td>
<td>16.3</td>
<td>9.4</td>
</tr>
<tr>
<td>Badvel</td>
<td>35.4</td>
<td>5.1</td>
</tr>
<tr>
<td>Jammalamadugu</td>
<td>12.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Proddatur</td>
<td>3.1</td>
<td>9.2</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>15.2</td>
<td>13.6</td>
</tr>
<tr>
<td>District</td>
<td>16.2</td>
<td>7.8</td>
</tr>
</tbody>
</table>
CUDDAPAH DISTRICT

Trend Of Other Uncultivated Land

Scale
Y 1 cm 25,000
X 1 cm 2 years

Area In Hectares (000)

1962

1974

1984

Years

Fig: 63a
The decrease in the percentage of other uncultivated land is found in 7 taluks. The highest decrease is found in Badvel taluk (31.5%) followed by Rajampet (21.6%), Sidhout (12.5%) and Cuddapah (10.4%).

The increase in the proportion of other uncultivated land is noticed in two taluks namely, Proddatur (4.4%) and Jammalamadugu (0.7%).

**Trend of Other Uncultivated Land (1962-84):**

A negative trend in the area under other uncultivated land is found in the district. This trend of decrease is accounted for 55 per cent of coefficient of determination. On an average, the compound growth rate is -0.1 per cent per annum for the district as a whole.

The trend of decrease of other uncultivated land is registered in all taluks except Proddatur. The negative trend line of Cuddapah taluk is accounted by 76 per cent coefficient of determination followed by Badvel by 60 per cent, Rajampet by 56 per cent and Kamalapuram by 50 per cent $r^2$ values.

The high negative growth rate is recorded in Cuddapah with 7.5 per cent per annum and 0.5 per cent growth rate in Badvel, Rajampet, Rayachoty and Kamalapuram taluks.

The negative trend is not so conspicuous but it is almost marginal in Jammalamadugu and Pulivendula taluks. This marginal negative trend is accounted by 0.06 per cent and 1 per cent $r^2$ values.
in Jammalamadugu and Pulivendula taluks respectively. In these two taluks the negative growth rate is almost marginal accounted for 0.01 per cent and 0.006 per cent per annum respectively. It suggests that there are significant fluctuations in the temporal distribution of other uncultivated land. The positive trend is found in Proddatur and the trend line is accounted for 17.8 per cent of coefficient of determination. The growth rate is 0.2 per cent per annum.

It is interesting to mention that the general assumption about the other uncultivated land is the decrease in other uncultivated land is an ideal index of reckoning the extent of agricultural colonisation. But it is rather puzzling and perplexing in the dynamics of landuse of Cuddapah district. Not surprisingly, a decrease in the other uncultivated land has not been found any increase in the arable land in Cuddapah district. In fact, the arable land itself is decreasing. From this it is inferred that there is not any sign of expansion of arable land with the reduction of culturable wastelands. Much of this category of land may either be brought under mining or forestry and other non-agricultural uses.

Spatial Distributional Pattern of Fallow Land:

Fallow land includes both current fallow land and other fallow land which are actually arable. But due to inclement climatic, edaphic, hydrologic and socio-economic conditions, the arable land cannot be brought under plough perpetually. Sometimes for the improvement of natural fertility and for the better conservation of soil, the rotation of cropping and fallowing to be practiced. Thus,
such lands become temporarily out of cultivation for a period from one year to five years.

In 1986-89, the proportion of fallow land accounted for 9.9 per cent to the total geographical area of the district. The intra-regional variations in the magnitude of physico-socio-economic conditions, individually or collectively lead to the spatial differences in the distribution of fallow land ranging between a maximum of 28.7 per cent in Kondapuram mandal and to a minimum of 0.3 per cent in Lakkireddy palli mandal in the district.

High (15.1-20%) and very high (> 20%) proportions of fallow land are found in 13 mandals distributed in central, north-western and north-eastern parts of the district. The low development of irrigation and low amount of rainfall in the central and north-western parts of the district have a bearing effect to the high extent of arable land under fallows.

Moderate concentration (10.1 - 15%) of fallow land is noticed in 11 mandals situated numerically more in the Kunderu and Pennar valley areas of northern part of Cuddapah district.

Low (5.1 - 10%) and very low (< 5%) proportions of fallow land are found in 26 mandals distributed prominently in southern, south-western and south-eastern parts of the district. The conjunctive utilisation of both surface and sub-surface water and moderate to good isohyetal conditions in the southern and south-eastern parts of the district have left a little proportion of land under
fallow. Obviously, the horizontal expansion of agriculture in the low concentration areas appears to be rather limited.

The study has indicated that there is an ample scope for horizontal expansion of agriculture in the western plains of the district where the amount of rainfall is less. With the advanced techniques of dry farming, the extension of cropland can be possible in the rain-shadow tracts of the district.

Changing Pattern of Fallow Land:

In the 20 year period i.e. between 1962-65 and 1982-85, the concentration of fallow land has decreased by 0.6 per cent which is amounting to 32 thousand hectares. In 1962-65, the proportion of fallow land accounted for 11.2 per cent and it was decreased to 7.5 per cent. In between 1972-75 and 1982-85, the proportion of fallow land has increased from 7.5 per cent to 10.6 per cent.

The decrease in the concentration of fallow land is noticed in three taluks namely, Rayachoty (20.4%), Pulivendula (8.2%) and Sidhout (8%).

Increase in the proportion of fallow land is found in 6 taluks. The highest increase is recorded in Jammalamadugu taluk (9.3%) followed by Badvel (6.9%) Kamalapuram (5.7%) and Cuddapah taluk (5%). The high increase in the proportion of fallow land are more conspicuous in the rain-shadow areas of western taluks where crop farming is largely rainfed.
Table 6.4

Changing Distribution of Fallow Land in Cuddapah District

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Percentage of fallow land to total geographical areas</th>
<th>Percentage variation between</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddapah</td>
<td>8.7</td>
<td>8.0</td>
</tr>
<tr>
<td>Rayachoty</td>
<td>26.3</td>
<td>4.7</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>16.0</td>
<td>12.1</td>
</tr>
<tr>
<td>Rajampet</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Sidhout</td>
<td>11.0</td>
<td>6.7</td>
</tr>
<tr>
<td>Badvel</td>
<td>3.6</td>
<td>5.4</td>
</tr>
<tr>
<td>Jammalamadugu</td>
<td>6.7</td>
<td>15.4</td>
</tr>
<tr>
<td>Proddatur</td>
<td>7.6</td>
<td>7.6</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>18.3</td>
<td>4.2</td>
</tr>
<tr>
<td>District</td>
<td>11.2</td>
<td>7.5</td>
</tr>
</tbody>
</table>
CUDDAPAH DISTRICT
Trend Of Fallow Land

Scale
Y- 1 cm = 20,000 he
X- 1 cm = 2 Years

area in Hectares (100)

1962 1974 1984
Years

Fig: 64a
Trend of Fallow Land (1962-84):

An increasing trend in the area under fallows is noticed in Cuddapah district. This positive trend is accounted for 2 per cent of coefficient of determination. It indicates that this increase is not found constant through time. From the fig. 6.4a it is observed that there are marked fluctuations in the actual area under fallow compared to trend values. Because of striking variations in the temporal distribution of fallow land, the growth rate is marginal and accounted for 0.03 per cent per annum in the district.

A trend of increase in the area under fallows is found in 7 taluks namely, Cuddapah, Kamalapuram, Rajampet, Sidhout, Badvel, Jammalamadugu and Proddatur. The positive trend of fallow land of Jammalamadugu is accounted by the highest value of 50 per cent of coefficient of determination. The rate of increase of the area under fallow is recorded in Cuddapah taluk with 3.9 per cent per annum followed by Kamalapuram (0.4%), Badvel (0.2%) and Rajampet (0.2%).

A trend of decrease is recorded in Rayachoty and Pulivendula taluks. The slope of the negative trend line is steep in the case of Rayachoty taluk and it is accounted by 18 per cent coefficient of determination and the rate of decrease is 0.3 per cent per annum.

An examination of the spatio-temporal distribution of fallow land in Cuddapah district has revealed that there has been much fluctuations in the spatial spread of fallow land especially in
the rain-shadow areas of the district. Significant spatial spread of fallow lands found in the western plains could not utilise them continuously for cropping due to low rainfall, scanty irrigation, poor red-black soils, undulating terrain and poor socio-economic conditions. It is worth while to mention that the actual land under plough is limited in the district. With the increase of population pressure on agricultural land, the spatial expansion of the area under cropping is a must. Significant spatial expansion of the area under cropping is possible in the western plains, Pulivendula basin and all other river valleys with the help of dry farming technology. Since the district has large number of livestock population, the cultivation of fodder crops for the development of grass and pasture in the fallow lands particularly situated in the valleys is another alternative measure for effective utilisation of fallow lands. It also helps to check the soil erosion in the valleys and develop plant nutrients in the soil organic matters. In such a way the spatial spread of fallow lands can be controlled and the potentiality and productivity of fallow lands can be improved.

Spatial Distribution Pattern of Net Area Sown:

Net area sown denotes the area actually cultivated or sown land once during a particular year. Obviously, the spatial distributional patterns of net area sown is profoundly influenced by physical factors like topography, soil and climatic conditions. However, the socio-economic conditions too exert considerable influence on its proportion to the total geographical area.
CUDDAPAH DISTRICT
Net Area Sown—1986-89

INDEX
( as percentage of total geographical area )

\[
\begin{array}{|c|c|}
\hline
\text{Symbol} & \text{Percentage} \\
\hline
\leq 10 & \text{ Light grey } \\
10.1-20 & \text{ Grey } \\
20.1-30 & \text{ Dark grey } \\
30.1-40 & \text{ Medium grey } \\
> 40 & \text{ Dark grey with black squares } \\
\hline
\end{array}
\]

FIG: 6.5
Plate 6.5a An extensive portion of wasteland with stunted growth of acacia plants in the Western plain region.

Plate 6.5b A large size of ploughed agricultural field before sowing the rainfed crops in the black soil zone of Western plains.
In 1986-89, the proportion of net area sown accounted for 32.1 per cent to the total geographical area of the district. Indeed it is a low amount of land under cropping when compared with the State's average proportion of about 43 per cent. It is due to unfavourable physiographical conditions prevailing in the district. The spatial variations in the extent of the net area sown are conspicuous in the district linking chiefly with the differences in physical conditions like terrain, slope, climate, soil and water. It is clear from the fact that the maximum proportion of 70.6 per cent net area sown is found in Simhadriapuram mandal while the minimum of 6.6 per cent in B. Mattam mandal.

High (30.1-40%) and very high (> 40%) concentrations of net area sown are found in 25 mandals which accounted for 50 per cent of the total mandals in the district. These mandals are situated in southern plateau portion, Pulivendula basin, Kunderu river valley and in all over western plains of the district. It appears that plain topographical conditions and fertile black soils in the western plains; low undulating grounds, presence of red sandy soils and the development of conjunctive utilisation of surface and sub-surface water resources for agriculture in southern plateau and central parts of the district are favourable conditions for high concentration of net area sown.

Moderate (20.1 - 30%) concentration of net area sown is found in 7 mandals distributed in the western plains.
Low (10.1 - 20%) and very low ( < 10%) proportions of net area sown are noticed in 18 mandals and consisted 36 per cent of the total mandals in the district. These mandals are located in all along the eastern valley region where the prominent hill ranges, steep valleys and dense forest cover are found and combinedly restricted the area under plough. The development of agriculture in the entire eastern valley is hopeful only through the intensification of crop farming but not through extensive agriculture.

Changing Pattern of Net Area Sown:

Between 1962-65 and 1982-85 there has been a variation in the concentration of net area sown indicating a decrease of 3.6 per cent. It terms of actual area, net area sown has decreased from 430 thousand hectares in 1962-65 to 383 thousand hectares in 1982-85 showing a net decrease of 47 thousand hectares. In 1962-65, the net area sown accounted for 31.7 per cent and it increased to 31.8 per cent in 1972-75 but in 1982-85 it decreased to 28.1 per cent. Since the farming on large scale is rainfed and the development of irrigation is low, the frequent changes in the area under cropping are not uncommon in the drought prone area of Cuddapah district.

The decrease in net area sown is also found in all taluks of the district except Pulivendula and Rayachoty in the last 20 year period. The highest decrease is registered in Kamalapuram taluk (9.7%) followed by Cuddapah (8.6%) and Jammalamadugu (7.7%). Since the period 1982-85 was more prone to drought than the other study periods, the changes in the net area sown have shown negative in almost in all taluks. Consequently, high decreases are found in
Table 6.5
Changing Distribution of Net Area Sown in Cuddapah District

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Percentage of net area sown to total geographical area</th>
<th>Percentage variation between</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddapah</td>
<td>31.3</td>
<td>26.2</td>
</tr>
<tr>
<td>Rayachotth</td>
<td>24.9</td>
<td>28.4</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>54.2</td>
<td>62.6</td>
</tr>
<tr>
<td>Rajampet</td>
<td>15.8</td>
<td>11.9</td>
</tr>
<tr>
<td>Sidhout</td>
<td>9.1</td>
<td>8.6</td>
</tr>
<tr>
<td>Badvel</td>
<td>14.8</td>
<td>13.9</td>
</tr>
<tr>
<td>Jammalamadugu</td>
<td>46.5</td>
<td>38.4</td>
</tr>
<tr>
<td>Proddatur</td>
<td>48.0</td>
<td>47.5</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>40.8</td>
<td>48.7</td>
</tr>
<tr>
<td>District</td>
<td>31.7</td>
<td>31.8</td>
</tr>
</tbody>
</table>
CUDDAPAH DISTRICT
Trend Of Net Area Sown

Scale
Y 1 cm  50 000 hectares
X 1 cm  2 Years

Area In Hectares (1000)

Years

Fig: 65a
the rain-shadow areas of western taluks while small decreases in eastern valley areas and no substantial change in the plateau region.

Trend of Net Area Sown (1962-84):

During 1962-84 the trend of net area sown in the district as a whole has been negative. The goodness of the fit of the regression trend i.e. coefficient of determination states that the present trend of decrease is to the tune of 28.5 per cent only. It suggests that the 'time' factor was accounted for only 28.5 per cent for this trend of decrease and the other factors were held more responsible for the temporal variations in net area sown in the district. On an average the net sown area has decreased at the rate of -0.08 per cent per annum. The regression analysis has also revealed that all the taluks in the district have shown the decreasing trend in the net sown area. The trend of considerable decrease is noticed in Cuddapah taluk with a high negative growth rate of 3.4 per cent per annum followed by Kamalapuram, Rajampet, Sidhout and Jammalamadugu taluks. This conspicuous constant decrease in the area under plough may be due to identification of mineral reserves in the arable lands and the extension of mining activities for more exploitation of minerals like asbestos and barytes.

From the above analysis it is inferred that the district has limited agricultural land in the eastern valley region and extensive arable land in western plains and southern plateau regions. On the whole, the land suitable for agriculture in the district is not extensive due to the dominance of forest cover and non-agricultural
land. Normally, "more than 40 per cent of area under plough has been considered as the basic requirement" (Singh, 1975, p. 358). The net area sown in the district accounts for 32.1 per cent in 1986-89 indicates the shortage of land under plough to fulfil that condition. With the development of irrigation, soil conservation, dry farming technology and land and water management, there is every possibility to achieve the minimum requirement of land under plough. If all the fallow lands and wastelands are effectively utilised with the help of scientific reclamation measures, the net area sown will be enhanced and ultimately contributed to the development of regional agriculture.

Spatial Pattern of Land Sown More Than Once:

Land sown more than once really means the intensity cropping. It refers to the practice of more number of cropping cycles on a field i.e. double cropping or triple cropping systems in the same field and in the same agricultural year. The percentage of gross area sown (total cropped area) to net area sown gives a measure of index to the intensity of cropping. In general, the degree of intensity of cropping and its spatiotemporal variations are related to the intensity of irrigation, rainfall distribution and soil fertility.

In Cuddapah district, as it expected, the intensity of cropping is low accounts for 105 per cent in 1986-89. Spatially, the intensity of cropping varies from a minimum value of 100.5 per cent in Galiveedu mandal to a maximum of 152.9 per cent in Chitvel Mandal exhibited marked disparity depending upon the degree of spatial variability in determinants influenced in the district.
CUDDAPAH DISTRICT

Intensity of cropping 1986–89

INDEX

(Gross sown area as percentage of net area sown)

Nil

≤ 110

110.1 – 120

120.1 – 130

> 130

0 30 Km

FIG: 6.6
Areas of high (120.1 - 130%) and very high (> 130%) intensity of cropping accounted to 11 mandals located conspicuously in the south-eastern valley of the district. In this valley region, since the net area sown is limited and the well irrigation is well developed, the cultivators have to opt for intensification of agriculture for the development of their agricultural economy. Moderate (110.1 - 120%) intensity of cropping is found in 4 mandals, out of which, three mandals located in the central part of eastern valley region.

Areas of low (< 110%) intensity of cropping comprise 29 mandals i.e. 58 per cent of the total mandals of the district shows the low degree of agricultural landuse efficiency. Barring Eastern valley region, the entire district comprises western plains and southern plateau has characterised with low intensity of cropping. It is due to an account of significant proportion of agricultural land, low and uncertain rainfall conditions, deficit soil moisture, scanty irrigation facilities, low level of conjunctive use of water resources and poor socio-economic conditions of the farmers. It has indicated that the pattern of intensity cropping in Cuddapah district is depending more on the interaction of both physical and socio-economic conditions.

Changing Pattern of Intensity of Cropping:

The extent of double cropped area in the drought prone areas may be fluctuating due to high variability and uncertainty in the amount and distribution of rainfall and irrigation discharges. It is quite obvious in the case of drought-prone Cuddapah district which
### Table 6.6

**Changing Distribution of Intensity of Cropping in Cuddapah District**

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Percentage area to net sown area</th>
<th>Percentage variation between</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddapah</td>
<td>107.8</td>
<td>102.3</td>
</tr>
<tr>
<td>Rayachoty</td>
<td>108.6</td>
<td>101.6</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>120.7</td>
<td>101.4</td>
</tr>
<tr>
<td>Rajampet</td>
<td>103.9</td>
<td>108.6</td>
</tr>
<tr>
<td>Sidhout</td>
<td>123.8</td>
<td>125.4</td>
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<td>Badvel</td>
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</tr>
<tr>
<td>Jammalamadugu</td>
<td>101.2</td>
<td>100.6</td>
</tr>
<tr>
<td>Proddatur</td>
<td>101.9</td>
<td>104.9</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>101.9</td>
<td>100.9</td>
</tr>
<tr>
<td><strong>District</strong></td>
<td>104.8</td>
<td>106.0</td>
</tr>
</tbody>
</table>
accounted 104.8 per cent intensity of cropping in 1962-65 has increased to 106 per cent in 1972-75 and later it decreased to 103.9 per cent. It shows a variation of 0.9 per cent decrease occurred in the past 20 year period. In terms of actual area, the double cropped area has decreased from 21 thousand hectares in 1962-65 to 15 thousand hectares in 1982-85 showing a net decrease of 6 thousand hectares.

It is noticed that the increase in the intensity of cropping is found in Rajampet taluk only, while the decrease is found in 7 taluks. The highest decrease is recorded in Kamalapuram taluk with 18.2 per cent followed by Sidhout (10.2%) and Badvel (7.1%). The decrease in intensity of cropping in many taluks is attributed to decrease in irrigation intensity. It is confirmed that the increase/decrease in intensity of cropping is subjected to similar change in the intensity of irrigation and the correlation coefficient between these two variables is 0.9

Trend of Land Sown More Than Once (1962-84):

A decreasing trend is noticed in the area sown more than once in the district. The rate of decrease was 0.1 per cent per annum. This negative trend is registered in 7 taluks namely, Cuddapah, Rayachoty, Kamalapuram, Badvel, Jammalamadugu, Proddatur and Pulivendula. The rate of decrease was high in Cuddapah taluk with 4.9 per cent, and very low rate was 0.06 per cent in Proddatur taluk.

The trend of increase in area sown more than once is found in Rajampet and Sidhout taluks.
Degree of Dynamism in Landuse (1962-65 to 1982-85):

To measure the overall volume of change in landuse during the period 1962-65 -- 1982-85, the simple method developed by Jasbir Singh (1974) is employed. The index for determining the degree of dynamism or 'total volume of change' in landuse is obtained by the ratio A/B, where A' is the difference of percentages of landuse categories of increase, and B' is the difference of percentages of landuse categories of decrease. The summation of the numerator and the denominator respectively for different regions must be same.

The total volume of change in landuse refers to the percentage of landuse category which is actually involved in the transfer of area from one category of landuse to the other. It provides a comparative view of the areas where landuse patterns have been relatively dynamic in the changing physico-socio-economic conditions. Higher the index value more dynamics is the landuse. Similarly, lower the index value more the stable is the landuse.

The total volume of change in the landuse pattern of Cuddapah district is about 13.4 per cent between the period 1962-65 and 1982-85 which is significant transfer of land from one category to another category of landuse. Very high degree of dynamism in the landuse pattern is found in Badvel with 34 per cent followed by Sidhout (27%), Rajampet (26.5%), and Rayachoty (22.9%) taluks. In all these eastern and south-eastern taluks, the high degree of dynamism in the landuse pattern is due to continuous mining activities for large scale exploitation of minerals.
### Table 6.7
Degree of Dynamism in the Landuse Pattern of Cuddapah District

<table>
<thead>
<tr>
<th>Period</th>
<th>Forest (F)</th>
<th>Non-cultivable land (B')</th>
<th>Other cultivated land (C)</th>
<th>Fallow land (D)</th>
<th>Net Area sown (A)</th>
<th>Total per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962-65</td>
<td>27.5</td>
<td>13.4</td>
<td>16.2</td>
<td>11.2</td>
<td>31.7</td>
<td>100.0</td>
</tr>
<tr>
<td>1982-85</td>
<td>29.5</td>
<td>24.8</td>
<td>7.0</td>
<td>10.6</td>
<td>28.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Difference</td>
<td>2.0</td>
<td>11.4</td>
<td>-9.2</td>
<td>-0.6</td>
<td>-3.6</td>
<td>+13.4</td>
</tr>
</tbody>
</table>

The index of total volume of change $\frac{F_{2.0} + B_{11.4}}{C_{9.2} + D_{0.6} + A_{3.6}} = \frac{+13.4}{-13.4}$
Table 6.8
Degree of Dynamism in Landuse in Cuddapah District (1962-65 to 1982-85)

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Increase/decrease in different categories of Landuse</th>
<th>Total landuse change in per cent between 1962-65 and 1982-85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddapah</td>
<td>F 8.0+B 6+ D 5.0</td>
<td>19.0</td>
</tr>
<tr>
<td></td>
<td>A 8.6+ C 10.4</td>
<td>19.0</td>
</tr>
<tr>
<td>Rayachoty</td>
<td>F 5.9+B 17.0</td>
<td>22.9</td>
</tr>
<tr>
<td></td>
<td>D 20.4+C 2.5</td>
<td>22.9</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>B 11.3+D 5.7</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>F 1.3+A 9.7+C 6.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Rajampet</td>
<td>F 1.1+B 23.2+D 2.2</td>
<td>26.5</td>
</tr>
<tr>
<td></td>
<td>A 4.9+C 21.6</td>
<td>26.5</td>
</tr>
<tr>
<td>Sidhout</td>
<td>B 27.0</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td>F 4.9+D 8.0+A 1.6+C 12.5</td>
<td>27.0</td>
</tr>
<tr>
<td>Badvel</td>
<td>F 4.6+B 22.5+D 6.9</td>
<td>34.0</td>
</tr>
<tr>
<td></td>
<td>A 2.5+C 31.5</td>
<td>34.0</td>
</tr>
<tr>
<td>Jammalamadugu</td>
<td>F 0.9+D 9.3+C 0.7</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>B 3.2+ A 7.7</td>
<td>10.9</td>
</tr>
<tr>
<td>Proddatur</td>
<td>F 0.2+D 2.5+C 4.4</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>B 5.1+ C 2.0</td>
<td>7.1</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>F 3.6+B 4.0+A 4.0</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>D 8.2+ C 3.4</td>
<td>11.6</td>
</tr>
<tr>
<td>District</td>
<td>F 2.0+B 11.4</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>D 0.6+A 3.7+C 9.2</td>
<td>13.5</td>
</tr>
</tbody>
</table>

F - Forest; B - Non-cultivable land; D - Fallow land; A - Net area sown; C - Other uncultivated land.
Moderate change in the landuse pattern is noticed in Cuddapah (19%) and Kamalapuram (17%) taluks. In Cuddapah, land under forest and in Kamalapuram, land under non-cultivable purpose are gained.

The total landuse change has been quite low i.e. below the district's average value is found in Proddatur (7.1%), Jammalamadugu (10.9%) and Pullivendula (11.6%) taluks situated in the rainshadow belt of western plains in the district. It shows that these areas have shown considerable amount of stability in their landuse pattern. Any significant change which is amounted in these areas is only due to the change occurs in the area under fallows because of large scale rainfed farming.

**Landuse Orientation:**

Landuse orientation was taken into consideration the essential factors such as mechanism, distributive system and consciousness of relative direction in landuse pattern. Landuse orientation in an area is the result of the interaction of physico-socio-economic, cultural and technological environments that exists there. Hence, a study of landuse orientation helps to understand the geographical character of an area. The spatial patterns of landuse orientation in Cuddapah district is examined by the method of Kostrowicki (1960, p. 169; 1965, p. 453) who classified landuse orientation into four types (Table 6.9). As per this method, the significant orientation of landuse and the possible landuse combinations of each component areal unit will be emerged and also represented
spatially. In the present analysis, the area contributing less than 20 per cent in any landuse type is left out.

Table 6.9

Kostrowicki's Method of Landuse Orientation

<table>
<thead>
<tr>
<th>Area in Per cent</th>
<th>Role</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 80</td>
<td>Dominant</td>
<td>4</td>
</tr>
<tr>
<td>60 - 80</td>
<td>Predominant</td>
<td>3</td>
</tr>
<tr>
<td>40 - 60</td>
<td>Semi-dominant</td>
<td>2</td>
</tr>
<tr>
<td>20 - 40</td>
<td>Accompanying</td>
<td>1</td>
</tr>
</tbody>
</table>

In the method, symbolic nomenclature is given to each landuse type eg., A = Net sown area, F = Forest, C = Other uncultivated land, B = Non-cultivable land, and D = Fallow land. They have been grouped in a combination formula, where letters represent the landuse type and figures show their rank. In general the landuse orientation of the district is accompanying agriculture with non-cultivable landuse and forest cover ($A_1 + B_1 + F_1$). The spatial pattern of landuse orientation in the district ranging from a predominant agriculture (A3), forest cover (F3) and non-cultivable (B3) to a mixed base of different types of landuse ($D_1 + C_1 + A_1 + B_1$). On the whole as per the Kostrowicki's method of landuse orientation there were
about 27 different landuse combinations identified in the district during 1986-89.

Agricultural Land : The Cropping Base (1986-89):

Agricultural land (net sown area) form the first ranking category of landuse orientation but its spatial spread is not that significant. It is evident from the fact that the agricultural landuse type as first ranking, second ranking and third ranking landuse category is distributed in 32 mandals out of 50 mandals in the district. It reveals that in 18 mandals this category of landuse is left out from the landuse orientation combinations since it occupies less than 20 per cent. As a first ranking category of landuse combinations, agricultural land is found in 20 mandals accounting 40 per cent of the total mandals in the district.

Agricultural land as a first ranking category of landuse has formed 8 different landuse combinations. These 8 landuse combinations put together accounted for 25 per cent of the total geographical area of the district.

Predominant agricultural landuse ($A_3$) is noticed in two mandals namely, Rajupalem and Simhadripuram which together accounted for 2.9 per cent of the total geographical area of the district. Predominant agricultural landuse with accompanying fallow land ($A_3 + D_1$) found in Peddamudiam and Chapadu mandals. The high proportion of agricultural landuse in all these mandals is due to favourable topographical conditions particularly gentle slope with 0-1°, presence of river valleys, and fertile black soils as well as the development of canal irrigation.
Table 6.10

Landuse Orientation in Cuddapah District (1986-89)

<table>
<thead>
<tr>
<th>Dominancy class</th>
<th>Name of the Mandal</th>
<th>Total area of the mandals under the class (in hectares)</th>
<th>Percentage in relation to total geographical area of the district</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Agricultural Base

A3 + C1          Rajupalem Simhadripuram 38504 2.9
A3 + D1          Peddamudium 22858 1.8
A3 + B1          Chapadu 10383 0.8
A2 + B1          Kamalapuram L.R. Palli Ramapuram Chinnamanandem T. Sundupalli Veerapunayunipalli Pulivendula Vemula Vempalli Lingala Thondur 167566 12.9
A2 + F1          Duvvur 14257
A2 + C1          Proddatur 19621 1.5
A2 + D1 + B1     Vallur Yerraguntla 35111 2.7
A + D1 + C1 + B1 Kondapuram 30586 2.4
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
</table>

Non-Cultivable Land Base

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>Rajampet</td>
<td>45654</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>Chitvel Atloor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3 + D1</td>
<td>Nandalur</td>
<td>12287</td>
<td>0.9</td>
</tr>
<tr>
<td>B3 + C1</td>
<td>Penagalur</td>
<td>19363</td>
<td>1.5</td>
</tr>
<tr>
<td>B3 + F1</td>
<td>Sidhout</td>
<td>16006</td>
<td>1.2</td>
</tr>
<tr>
<td>B2 + A2</td>
<td>Galiveedu</td>
<td>22977</td>
<td>1.8</td>
</tr>
<tr>
<td>B2 + A1</td>
<td>Chakrapet</td>
<td>81275</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>Rayachoty Kodur</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jammalamadugu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2 + F1</td>
<td>Obulavarpalli</td>
<td>89469</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>Pullampet</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vontimitta</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Badvel Gopavaram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2 + A1 + F1</td>
<td>Veeraballi</td>
<td>18154</td>
<td>1.3</td>
</tr>
<tr>
<td>B1 + A1</td>
<td>Mylavaram</td>
<td>20989</td>
<td>1.6</td>
</tr>
<tr>
<td>B1 + F1 + D1</td>
<td>B. Kodur</td>
<td>36824</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Forest Base

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3</td>
<td>C.K. Dinnae</td>
<td>22506</td>
<td>1.7</td>
</tr>
<tr>
<td>F3 + A1</td>
<td>Mydukur</td>
<td>27538</td>
<td>2.1</td>
</tr>
<tr>
<td>F2 + B1</td>
<td>B. Mattam Narasapuram</td>
<td>61690</td>
<td>4.8</td>
</tr>
<tr>
<td>F2 + A1</td>
<td>Chennur</td>
<td>8011</td>
<td>0.6</td>
</tr>
<tr>
<td>F2 + A1 + B1</td>
<td>Sambepalli</td>
<td>33642</td>
<td>2.6</td>
</tr>
</tbody>
</table>
(Table 6.10 contd.)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2 + D1 + B1</td>
<td>Porumamilla</td>
<td>35004</td>
<td>2.7</td>
</tr>
<tr>
<td>F1 + D1</td>
<td>Pendlimarri</td>
<td>91953</td>
<td>7.1</td>
</tr>
<tr>
<td>F1 + B1 + A1</td>
<td>Cuddapah</td>
<td>27671</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Fallow Land

| D1+C1+A1+B1 | Muddanur | 38286 | 3.0 |
Semi-dominant agricultural landuse with accompanying non-cultivable landuse \((A_2+B_1)\) is found in as many as 11 mandals. The total area under this combination is recorded maximum in all the possible agricultural base combinations which put together accounted for 12.9 per cent of the total geographical area of the district. These mandals are largely distributed in western plains and southern plateau region where gentle slope and undulating terrain conditions favourable for significant spatial spread of agricultural landuse orientation. Semi-dominant agricultural landuse with accompanying forest cover \((A_2+F_1)\) in Duvvur mandal; semi-dominant agricultural landuse with accompanying other uncultivated land \((A_2+C_1)\) in Proddatur mandal; and semi-dominant agricultural landuse with accompanying fallow land and non-cultivable landuse \((A_2+D_1+B_1)\) in Vallur and Yerraguntla mandals are the other important landuse combinations with agriculture as the base to form combination types. All these agriculture based landuse combinations are found in the western plains of the district. In Kondapuram mandal the landuse combination is diversified and consists of \(A_1+D_1+C_1+B_1\).

Non-Cultivable Land Base:

In terms of spatial spread and number of areal units, the orientation of non-cultivable landuse type is significant in Cuddapah district. Though it is next to agricultural landuse type in the landuse combinations of the district but it is the rich second landuse type found in as many as 39 mandals with different ranking positions. Non-cultivable landuse type is left out from landuse
combinations in 11 mandals only in contrast to 18 mandals in the case of agricultural landuse type. As a first ranking landuse category non-cultivable landuse type is noticed in 19 mandals and formed 10 different landuse combinations. Under this non-cultivable land base the total area of all the possible landuse combinations accounted for 27.8 per cent to the total geographical area of the district. All the above facts have revealed the importance of non-cultivable landuse in the general landuse orientation of the district. This much of significance to this landuse category is due to vigorous mining and quarrying activities as well as the presence of rocky out crops in all over the district.

The predominant non-cultivable landuse type \((B_3)\) is found in 3 mandals namely, Rajampet, Chitvel and Atloor. Predominant non-cultivable landuse with accompanying fallow land \((B_3+D_1)\) in Nandalur; with other uncultivated land \((B_3+C_1)\) in Ponagalur; and with forest cover \((B_3+F_1)\) in Sidhout are together accounted for 7.1 per cent of the total area of the district distributed largely in the eastern valley region. In southern part of the eastern valley region, the land under mining especially the extraction of baryte mineral in large quantities is spectacular. Land under quarrying is also another significant use in these areas. Semi-dominant non-cultivable land with semi-dominant agricultural landuse \((B_2\cdot A_2)\) is noticed in Galiveedu mandal. But semi-dominant non-cultivable landuse with accompanying agricultural landuse \((B_2\cdot A_1)\) in four mandals and semi-dominant non-cultivable landuse with accompanying forest cover in five mandals are the significant landuse combinations widely distributed in southern and south-eastern parts of the district. In southern plateau region the undulating topography
with rocky exposers and less fertile red soils in combination have rendered some lands into unproductive and barren.

Forest Landuse Base:

The ecosystem of the region can also be comprehended through landuse ecology which is apparent from the spatial distribution of forest cover with other categories of landuse. Next to agricultural and non-cultivable landuse types, the forest land cover occupied equally a significant place in the landuse orientation of the district. Forest cover either as first ranking, second ranking or third ranking category of landuse in the landuse combinations found in 19 mandals. In the remaining 31 mandals, forest landuse is left out from the combinations since it accounts for less than 20 per cent. As a first ranking category of landuse, forest cover has formed 8 different landuse combinations found in 10 mandals and accounting an area of 23.7 per cent to the total geographical area of the district.

Predominant forest cover ($F_3$) is found in C.K. Dinne mandal and the predominant forest cover with accompanying agriculture ($F_3 + A_1$) in Mydukur mandal. Semi-dominant forest cover with accompanying non-cultivable landuse ($F_2 + B_1$) is noticed in B. Mattam and Narasapuram mandals. Semi-dominant forest cover with accompanying agricultural landuse ($F_2 + A_1$) is found in Chennur mandal. Semi-dominant forest cover with accompanying agricultural landuse and non-cultivable landuse ($F_2 + A_1 + B_1$) in Sambepalli mandal and semi-dominant forest cover with accompanying fallow land and non-cultivable landuse ($F_2 + D_1 + B_1$) in Porumamilla mandal are the other important landuse combinations. The areas with predominant and semi-
Dominant orientation of forest cover are found in the zones of principal hill ranges of Velikondas, Seshachalam, Palakonda, Nallamalai, Lankamalai of central, eastern, north-eastern and south-eastern parts of the district. In view of natural consequence, in all the areas of extensive forest cover, the utilisation of land for agriculture purpose is considerably reduced.

**Intermixed Landuse Orientation:**

Mixed landuse orientation shows the heterogeneous physico-socio-economic conditions of the region. Landuse combination with different categories of landuse more or less with equal proportion of area shows the diversified pattern of landuse without any significance of particular landuse type. Landuse combinations with multi-landuse types like $A_1 + D_1 + C_1 + B_1$ and / or $D_1 + C_1 + A_1 + B_1$ are insignificant in their spatial spread. Such landuse combinations are found in 6 mandals namely, Kondapuram, Muddanur, Cuddapah, Khajipet, Mylavaram and B. Kodur. In all these mandals diversified economic activities like agriculture, mining, industry, urban settlement, irrigation projects, communication net work on one hand and the considerable extent of fallow and wastelands due to low rainfall and scanty irrigation on the other hand had produced a diversified orientation of landuse in the district.

From the analysis of landuse orientation and landuse combinations, it is observed that the pattern of landuse largely confined to three major categories of landuse namely, agricultural, non-cultivable and forest. The interaction of physical and
socio-economic environments have a profound bearing on the emergence of the present landuse orientation in the district without giving any significant importance on one landuse type over the others. In terms of agricultural landuse development, the transformation of other landuse types into agricultural landuse is limited since the other major landuse types like forest from ecological sense and non-cultivable land from secondary and tertiary economic activities point are too important.

**Agricultural Landuse Efficiency: An Explanation:**

The measurement of agricultural landuse efficiency and a critical examination of its spatial and dynamic patterns is of paramount importance to design systematic and scientific agricultural landuse planning. The land resources available in an area for diverse landuses depend upon various factors. The interaction of physical, socio-economic and technological factors determines to a large extent the effective utilisation of arable landuse. Here, agricultural landuse efficiency is concerned with the effect of the integrated system involving the impact of socio-economic, and technological factors on physiography and on natural quality of the land. It represents the degree of optimal use and performance of cultivated as well as cultivable land (Reddy and Ramaiah, 1985). A critical study of agricultural landuse efficiency provides a conceptual framework to understand how the arable land is effectively being used for rational use and optimal returns.

Barlow (1954, p. 106) defined landuse efficiency in terms of the effectiveness with which the particular land unit produces in
response to the successive units of capital investment and labour inputs that are combined with them in the production process. It indicates the geonomic status of the landuse under agriculture.

Jasbir Singh (1972, p. 316) explained landuse efficiency as "the extent to which the net area sown has been cropped or resown." Here, the gross sown area is expressed as a percentage of the net sown area and it indicates the intensity of cropping, in turn, shows the efficiency and effective utilisation of agricultural land.

In essence, the study of agricultural landuse efficiency broadly involves the grouping and averaging the related positive effect variables namely, (i) the percentage of net sown area, (ii) net sown area as percentage of the total land available for cultivation (arable land), (iii) intensity of cropping, (iv) percentage of irrigated area to the cultivated area, (v) intensity of irrigation (vi) the percentage of area under HYV, and (vii) the percentage of area under commercial and intensive cropping system. The term 'efficiency' is used here to denote the overall performance of agricultural land as manifested by the above mentioned variables besides the management of land at an optimum productive level by bringing harmony among the physical, socio-economic and technological factors.

Agricultural landuse efficiency is a complex and dynamic concept. Any change in socio-economic and technological input applications may bring corresponding change on the effective utilisation of the natural quality of arable land. At the outset, it seeks to
evolve an effective agricultural system. It provides a systematic device to divide a region into hierarchical agricultural landuse efficient segments. Such a hierarchical division of agricultural landuse efficiency is of significant importance in regional agricultural landuse planning.

**The Methodology Employed:**

In the present study, simple 'mean per cent coefficient' method which is a modified version of 'standard coefficient' method of Reddy and Ramanaiah (1985) is employed to evaluate the agricultural landuse efficiency of Cuddapah district. Earlier Kendall (1939) developed a measure to determine agricultural efficiency based on per hectare yield levels of various crops in an areal unit and devised a system of 'ranking coefficients.'

Singh (1970, p. 97) applied Kendall's 'Ranking Coefficient' method to measure the landuse efficiency of Baraut Block in Meerut district of Uttar Pradesh. In his study, instead of per hectare crop yield levels be took five related variables of landuse namely, (i) net sown area (ii) cropped land more than once, (iii) irrigated land, (iv) non-cultivable land, and (v) cultivable wasteland for measuring the ranking coefficients. Here, the first three variables are positive and last two are negative to indicate the effective use of land resources for agricultural development. To resolve the assigning of ranks to the positive and negative variables, the first rank is given to the highest percentage in the case of positive variables while in the case of negative variables, the first rank is
given to the lowest percentage of variable. Finally, the given ranks of both positive and negative variables of a component areal unit are added and averaged to obtain the ranking coefficient. The degree of landuse efficiency of a component areal unit is determined on the basis of the ranking coefficients thus obtained. The obtained ranking coefficients are inversely related to the degree of landuse efficiency.

According to Reddy and Ramanaiah (1985), the Kendall's ranking coefficient method suffers from certain disadvantages. In order to eliminate or minimise some of the shortcomings of the 'Ranking Coefficient' method, they have completely modified this method. This modified method has been designated as the 'Standard Coefficient' method. Here, instead of assigning ranks, the actual percentages of the variables of a particular areal unit are added and averaged. The problem of positive and negative variables has been resolved by converting the percentage of each variable into a standard value. Hence, the mean standard coefficient is directly proportional to the degree of landuse efficiency. This 'standard coefficient' method has brought certain improvements over the 'ranking coefficient' method for measuring the agricultural landuse efficiency both in spatio-temporal levels of study.

Jasbir Singh (1972) employed 'intensity of cropping' procedure for calculating the landuse efficiency of Haryana. This measure is very simple in which the percentage of the gross sown area to the net sown area gives a measure of index to the degree of landuse efficiency. In this method the minimum index value will be 100 and it go on further increase, and the index values are
directly proportional to the degree of landuse efficiency.

In the present study, the modified version of 'Standard Coefficient' method of Reddy and Ramanaiah is employed to measure the degree of agricultural landuse efficiency. In the 'Standard Coefficient' method, the percentages of positive and negative variables have been standardised to resolve the diversified effect of positive and negative variables. Such a problem does not arise in the present procedure since all the variables taken in the present study are positive variables. Hence, computation of standard values is not necessary. Instead of assigning ranks or computation of standard values, the actual percentage values of all the variables of each component areal unit are added and averaged. The mean percent coefficient value of the variables of a component areal unit thus obtained is directly proportional to the degree of agricultural landuse efficiency in which 100 per cent is the highest efficiency value.

Spatial Pattern of Agricultural Landuse Efficiency:

An endeavour is made here to accomplish the task of measuring the agricultural landuse efficiency in Cuddapah district by employing 'Simple Coefficient', method (modified standard coefficient' method). In the analysis eight positive variables namely, (i) arable land, (ii) net sown area, (iii) area sown more than once (iv) net sown area as percentage of total arable land, (v) irrigated area, (vi) area irrigated more than once, (vii) area under HYVs, and (viii) area under commercial and intensive cropping system are choosen as the parameters since they are considered as the essential determinants or indicators of agricultural landuse efficiency.
The agricultural landuse efficiency of Cuddapah district, as could be expected is low to moderate. But there is much spatial variation in the degree of agricultural landuse efficiency in the district ranging between a maximum of 51.9 per cent in Pullampet mandal to a minimum of 19.2 per cent in Narasapuram mandal during 1986-89. High agricultural landuse efficiency of more than 50 per cent is found in six mandals namely, Pullampet, Sidhout, Chennur, Cuddapah, Chinnamandem and Rayachoty distributed in southern region of the district. K.C. Canal irrigation system and intensive cultivation of paddy and other commercial crops in Cuddapah and Chennur mandals; development of well and tank irrigation, significant area under double cropping and commercial cropping particularly groundnut and furit farming in the remaining mandals have contributed more for high degree of agricultural landuse efficiency.

Moderate agricultural landuse efficiency of 40.1 - 50 per cent is registered in as many as 25 mandals accounted for 50 per cent of the total mandals in the district. They are distributed over the south-eastern valley region, southern plateau region and some portions of western plains. In the south-eastern valley region, the moderate landuse efficiency is due to intensive cultivation of crops under well and tank irrigation systems, considerable extent of double cropped area, practice of HYV technology and high amount of rainfall. In the southern plateau region, the moderate agricultural landuse efficiency is due to extensive cultivation of groundnut as a commercial crop, development of well, tank and other minor irrigation projects like Pincha etc., in southern and central portions of western plains, the
high agricultural landuse efficiency is because of extensive area suitable for cultivation and also under cropping and presence of river valleys like Pennar and Papagni.

Low and very low (30.1 - 40% and < 30%) levels of agricultural landuse efficiency noticed in 12 and 7 mandals respectively. These together accounted for 38 per cent of the total number of mandals in the district. These mandals are distributed in the north-eastern and central hilly tracts and the very low rainfall area of western plains. In all these mandals, the very low proportion of arable land due to hilly terrain, very low development of irrigation, low rainfall conditions, predominant millet farming and low intensity cropping individually or cumulatively rendered for the low degree of agricultural landuse efficiency.

Changing Pattern of Agricultural Landuse Efficiency:

The degree of agricultural landuse efficiency in Cuddapah district has not been registered any impressive progress in the last 20-year period. However, marginal improvement in agricultural landuse efficiency is recorded in the district as a whole as well as at the highest level of efficiency. On an average, the degree of agricultural landuse efficiency has been increased from 34.4 per cent in 1962-65 to 39.8 per cent in 1982-85 showing a net increase of 5.4 per cent in the last 20-year period. The highest level of agricultural landuse efficiency in 1962-65 was 42.8 per cent (Kamalapuram taluk) and it increased to 44.7 per cent (Rajampet taluk) in 1982-85 showing a net increase of 1.9 per cent. It is worthwhile to state that after so much
Table 6.11

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Mean per cent Co-efficient values of agricultural land use efficiency</th>
<th>Variation between</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Mean per cent Co-efficient values of agricultural land use efficiency</td>
<td>Variation between</td>
</tr>
<tr>
<td>District's average</td>
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<td>37.5</td>
</tr>
<tr>
<td>Highest Value in the District</td>
<td>42.8</td>
<td>43.0</td>
</tr>
<tr>
<td>(Kamalapuram)</td>
<td>(Proddatur)</td>
<td>(Rayachoty)</td>
</tr>
<tr>
<td>Lowest value in the district</td>
<td>28.7</td>
<td>29.3</td>
</tr>
<tr>
<td>(Badvel)</td>
<td>(Jammalakmadugu)</td>
<td></td>
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</table>
### Table 6.12

**Changing Distribution of Agricultural Landuse Efficiency in Cuddapah District**

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<tbody>
<tr>
<td>Cuddapah</td>
<td>38.8</td>
<td>42.0</td>
<td>43.8</td>
<td>3.2</td>
<td>1.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Rayachoty</td>
<td>32.5</td>
<td>36.7</td>
<td>36.7</td>
<td>6.2</td>
<td>-2.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Kamalapuram</td>
<td>42.8</td>
<td>36.9</td>
<td>41.4</td>
<td>-5.9</td>
<td>4.5</td>
<td>-1.4</td>
</tr>
<tr>
<td>Rajampet</td>
<td>36.2</td>
<td>39.0</td>
<td>44.7</td>
<td>2.8</td>
<td>5.7</td>
<td>8.5</td>
</tr>
<tr>
<td>Sidhout</td>
<td>40.9</td>
<td>38.2</td>
<td>42.2</td>
<td>-2.7</td>
<td>4.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Badvel</td>
<td>28.7</td>
<td>31.5</td>
<td>21.8</td>
<td>2.8</td>
<td>-4.7</td>
<td>-1.9</td>
</tr>
<tr>
<td>Jammalamadugu</td>
<td>35.5</td>
<td>29.3</td>
<td>33.7</td>
<td>-5.8</td>
<td>-4.4</td>
<td>-1.8</td>
</tr>
<tr>
<td>Proddatur</td>
<td>39.8</td>
<td>43.0</td>
<td>41.5</td>
<td>4.2</td>
<td>-1.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Pulivendula</td>
<td>32.2</td>
<td>38.3</td>
<td>37.9</td>
<td>6.1</td>
<td>0.4</td>
<td>5.7</td>
</tr>
<tr>
<td><strong>District</strong></td>
<td><strong>34.4</strong></td>
<td><strong>37.5</strong></td>
<td><strong>39.8</strong></td>
<td><strong>3.1</strong></td>
<td><strong>2.3</strong></td>
<td><strong>5.4</strong></td>
</tr>
</tbody>
</table>
of agro-technology has been diffused in the last two decades, this much of increase is a marginal improvement indeed. But at the lowest level of agricultural landuse efficiency, there has been a decrease in the coefficient value i.e. from 28.7 per cent (Badvel taluk) in 1962-65 to 21.8 per cent (Badvel (taluk) in 1982-85, indicating a net decrease of 6.9 per cent. This shows that the development of agricultural landuse is not progressive in all areas of the district. Still in certain parts of the district, the vagaries of monsoon and frequency of drought occurrence and prolonged dry spells and uncertain supply of assured water have a debilitating effect on agricultural landuse development.

The improvement in the level of agricultural landuse efficiency during the first decade i.e. from 1962-65 to 1972-75 was found in 6 taluks with the highest increase of 6.2 per cent in Pulivendula taluk. The development of well irrigation in Rayachoty and canal irrigation in Pulivendula and the use of arable land from millet farming to commercial oil seed farming are the reasons for significant improvement of agricultural landuse in those taluks. The decrease in the level of agricultural landuse efficiency was recorded in 3 taluks namely, Kamalapuram, Jammalamadugu and Sidhout. These taluks were witnessed to large scale of rainfed farming and marginal agricultural character. In the second decade i.e. from 1972-75 to 1982-85, the values of agricultural landuse efficiency have revealed that there has been a decrease in five taluks and increase in 4 taluks. During this period, the decrease is found in the taluks where rainfed farming is high and irrigation by canals and wells considerably less.
Because of severe drought conditions in 1982-85 there has been a significant shrinkage in the area under net cropping, tank irrigation and double cropped area.

In the last 20-year period i.e. from 1962-65 to 1982-85 the level of agricultural landuse efficiency has been increased in six taluks while the decrease in 3 taluks. A maximum increase of 8.5 per cent is noticed in Rajampet followed by Pulivendula (5.7 per cent), Cuddapah (5.0 per cent) and Rayachoty (4.2 per cent). The conjunctive utilisation of both surface and sub-surface water resources and increase of intensive cropping and commercial farming have contributed more towards the development of agricultural land for better crop production. The decrease in the level of efficiency noticed in Kamalapuram, Badvel and Jammalamadugu taluks is marginal. However, these taluks are frequently prone to droughtness and also the development of irrigation and intensive cropping system are also insignificant.

From the above analysis, it is inferred that the achievements made in hybridisation, irrigation, better cropping systems and intensive utilisation of arable land through Green Revolution and other associated agricultural development programmes have not brought about any radical changes in the levels of agricultural landuse efficiency. All these agro-technological measures could not overcome the severity of drought impact on agriculture in many pockets of the district. Much could be done to improve the utilisation agricultural land at optimum level. The conjunctive utilisation of surface and sub-surface water resources, supply of assured water through the
development of canal irrigation, extensive diffusion of dry farming technology and improvement the socio-economic conditions of the farming community will certainly ameliorate the performance of agriculture through optimum use of agricultural land.