The changing land-use in the Rural-Urban Fringe of Dharwad: an observation of the agricultural land-uses

Bas van der Wal
Supervisor: dr. P.C.J. Druijven
Faculty of Spatial Sciences
University of Groningen
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Preface

This thesis is the completion of my master's degree in study Human Geography at the Faculty of Spatial Sciences, University of Groningen, the Netherlands. It is the result of five months of fieldwork from October 2003 to February 2004 in Dharwad, Karnataka, India. The subject of this thesis is chosen on the basis of personal interest in the developing world and the interesting processes happening due to the strong urbanisation in these countries. Due to a collaboration of the University of Groningen and the Karnataka University in Dharwad (KUD), I was able to go to the country of India to experience the Indian society and learn the process of fieldwork in all aspects. Performing fieldwork in a developing country is the final part of the specialisation 'Geography of Developing Countries'. This 'Indian period' has been interesting, intensive, special and joyful for me. The zone around the twin-city of Hubli-Dharwad is further described by fellow students in a large collection of theses that all explore different aspects of the rural-urban fringe of Hubli-Dharwad.

Doing fieldwork and writing a thesis without any help is impossible. Therefore I would like to give thanks to the following people.
First of all I would like to thank my supervisor in the Netherlands Dr. P.C.J. Druijven. He made it possible for me to do fieldwork in India, arranged the contacts in India and was there to give comments in the different phases of the research.
In India I owe gratitude to Prof. Dr. S.R. Nidagundi of the Geography Department at the Karnataka University Dharwad. He arranged the stay, introduced us to key-informants, supervised the fieldwork and was there when there were any questions. Apart from that he introduced me to the Indian culture and together with his wife and children gave me a good time with delicious meals and good conversations. During the interviews in the field I was accompanied by Mr. Nagesh Duganavar, who I like to thank for his sharp and thoroughly translations and discussions and also Mr. Basarajav Talawar, who accompanied me on some occasions in the field and knew how to communicate with the farmers very well. Besides the people above, I like to thank the Tahasildar of Dharwad Taluka for granting me permission to interview the village-accountants and also the village-accountants themselves, farmers and other informants talked with during the research for their hospitality and participation.
Furthermore I like to thank my family and friends for their support, help and interest shown during the research.

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B.M.C. van der Wal

Summary

This research observes and analyses the different agricultural cropping patterns in the rural-urban fringe of Dharwad, India. The idea for this research topic came out of the rapid growth of urban centres which is taken place in developing countries like India. The urban growth is accommodated in the so-called rural-urban fringe, where land pressure is high and agricultural land-use has to compete with urban land-uses for space. The outcome of the battle of urban and rural land-use in the research area is summarised by the different observed cropping patterns for the 26 selected villages in the three transects of the research area.

The concept of the rural-urban fringe can be characterised as the transitional zone between the city and the rural hinterland. The rural-urban fringe is the arena where many changes regarding demography, economy and ecology are occurring and linkages between urban and rural actors are intensified. These linkages can be characterised as flows of people, goods, capital, information, waste, etc. Through these dynamics, the rural-urban fringe is shifting from mostly agricultural land-use to more non-agricultural land-use.

The moment rural land-use is observed near the city, the rural-urban fringe starts. In the city of Dharwad the rural-urban fringe starts within the administrative borders of the Hubli-Dharwad Municipal Corporation, as the city already incorporated villages near the city for further urban developments and to avoid illegal land-use transformations. The process of urbanisation in India is described by Ramachandran (1989) in his stages-model. In his ‘stages of urbanisation’ he describes the rural-urban fringe as an area where different land-use forms and economic activities move from rural to urban in different stages.

In the first stage of urbanisation no influence of the city whatsoever is experienced by the village. The second stage of urbanisation is the influence of the agricultural markets in the city on the cropping patterns of the villages. A change from subsistence cropping to more urban demanded commercial cropping pattern of vegetables, fruits and flowers differentiate villages from each other. Important determinants for the agricultural land-use patterns available are the different soil types in the research area, the possibilities for irrigation and the distance and road infrastructure to the city. The last stage of urbanisation by Ramachandran is the change from agricultural land-use to urban land-use. The villages its cultivable areas are decreasing in favour of build-up land with residential, industrial, commercial or institutional land-use. During the transition through different stages of urbanisation the different rural and urban land uses and activities can be found next to each other in the rural-urban fringe zone.

The research area, a 16-km circle around the city of Dharwad with the 26 selected villages, is divided in three transects on the base of their location and soil types. The heterogeneity in soil type, rainfall and infrastructure developments in the rural-urban fringe of Dharwad leads to differences in land use developments and interaction with the city for the different selected villages in the research area. The northern part of the research area is dominated by agricultural land use with large cultivable areas, determined by the fertile black soils and the lack of infrastructure developments. Although part of the cropping patterns in this transect are influenced by urban demand like vegetables, potato and onion (with a distance decay), no other urban influences could yet be observed. The 10 selected villages are therefore located in between the first and second stage of urbanisation. It must be mentioned that the urban planning institutions made regulations to prevent build-up developments on the black-soils as these are fertile lands for agriculture. On the black-soils it is possible for the farmer to cultivate crops without irrigation in the 'mungary' and 'hingary' season, whereas on red soils only the 'mungary' season can be used for cultivation without irrigation.

The transect to the west of the build-up area of the city of Dharwad has large areas of red soils with some black soils in between. The cultivable areas are smaller, due to the hilly landscape with forests. Cropping patterns in this area are the most traditional of the three transects, with only large plots of commercial, urban demanded cropping patterns, mostly fruit-orchards, next to the national highway-4. The field crop rice is the main cropping pattern for this area, with only a small share for the commercial cropping patterns of cotton, maize and potato. The highway attracts also urban land-uses. In the 1970's a large industrial area is established by the urban planning institutions in Belur village area, which is already expanded in the village area of Mummigatti. About 40% of their agricultural land is transformed in to build-up area. Another large area next to the highway, but closer to the city is used by the Agricultural University, who acquired the land from the village areas of Yattinguda and Narendra. Smaller plots next to the highway are often owned by businessmen from the city who see it as a good investment (there is no tax on agricultural land). More away from the highway, the selected villages like Devageri and Chikkamalligwad have no urban land uses at all.

The transect South, located in between the cities of Hubli and Dharwad is the area under most change from urban influences. The urban institutions planned a new township in the corridor, next to the national highway, which is in development. Residential, industrial, institutional and commercial land use is replacing agricultural land-use, especially close to the highway. This new township 'Navanagar' was planned to connect the two urban cores of Hubli and Dharwad with each other. The village areas of Lakmanhalli, Navalur and Rayapur therefore experience large conversions of agricultural land into urban

land use. Village areas not connected with the main road infrastructure have no urban land uses. Only The village area of Jogellapur, incorporated in the administrative borders of the city, had some urban land use development in the form of the new by-pass road and some parts of the village area are mentioned in future HDUDA-plans for residential developments. The red soil areas do have some rural-urban land uses like brick kilns, poultry farms and diaries. Especially the exploitation of agricultural land for brick kilns causes changes to the land as it loses it fertile top soil and viable cultivation of crops is no longer possible for some years. Most common cropping patterns in this transect are rice on red and groundnut on black soils. Commercial crops have a relative high share here with the mango-orchards dominating, especially close to the city.

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Chapter 1: Introduction

1.1 Background

Up to today India remains in economic terms a largely agricultural country with more than 70 percent of the population workforce engaged as agricultural worker (Census data 1991). The demographic data shows an increasing urbanisation rate from 20,2% in 1971 to 27,8% in 2001 (Census data 2001). This is a moderate growth of urbanisation in comparison to other developing countries. Transforming it in absolute numbers there is an increase of 109 million people in 1971 to 288 million people living in urban areas in 2001 (Census data 2001). Especially the large metropolitan cities and some 1-lakh cities (population > 100.000) have high population growth rates and expand beyond their borders into the rural surroundings in an uncontrolled manner to accommodate the growth of the population and their activities.

Looking at the urban population growth, there are three components. At first there is the in-migration of people from outside, whom lack opportunities in the economically underdeveloped places they left. This has often the biggest share. The second component is the natural increase of the urban population itself. The third component is the population of villages of settlements that are integrated into the urban areas (Gugler 1996). Especially the last group of rural people becoming part of the urban population is often overlooked in urbanisation studies, as Brookfield et al. (1991) conclude that: “literature on land and population issues in urban fringe areas is remarkable lean”. But the expansion of the city strongly influences the bordering villages in terms of land-use and population, both physically and in an socio-economic sense (in Bentinck 2000).

In the literature, the area that borders the (administrative) city has many names, but in this thesis it is referred to as rural-urban fringe (see Bentinck, 2000). The rural-urban fringe is a transitional zone where many changes regarding demography, economy and ecology are occurring and linkages between urban and rural actors are intensified. In this arena the linkages can be characterised as flows of people, goods, capital, information, waste, etc. Through these dynamics, the rural-urban fringe is shifting from mostly agricultural land-use to more non-agricultural land-use. Other effects can be seen in a change of the (agricultural) land-use patterns and economic activities that become more focussed on the demand of the city. As a result, the income generating activities of the people who live in this area are diversifying. The traditional farmer’s occupation is therefore under pressure from higher paid city jobs. In this sense the division made by the Indian Census between rural and urban population is hard to keep up.

The growth of industry, commerce, administration, and institutions of learning, arts and health generate jobs for the rural population. Jobs, even of an unskilled nature with low salaries, are invariably welcomed by the rural communities, who in the past have had to depend on an uncertain and precarious living by farming. For agriculture the rapidly growing city also provides opportunities with expanding markets for vegetables, milk, and so on. The traditional cropping patterns are replaced by more commercial cropping patterns with perishable crops, cultivated primary for the urban market. These changes in cropping patterns are variable in space and distance. Furthermore it is a consequence of the dynamics and intensified linkages with the city. The agricultural cropping patterns in the rural-urban fringe of Dharwad are examined in this research.

1.2 Research Goals and Questions

"The objective of this research is to describe the impact of urbanisation on agricultural land-use patterns (and economic activities) in the rural-urban fringe of Dharwad.

From this research goal the following main questions are identified and further divided into sub-questions:

1.What encompasses the concept of the rural-urban fringe in literature and how can it be applied as spatial context for the dynamics in agricultural land-use patterns?

-What are the concepts of rural-urban fringe in the literature?

-What are the main aspects of Ramachandran his model of 'the stages of urbanisation' for villages in the rural urban fringe?

2.Which important characteristics of the rural-urban fringe of Dharwad can be identified in relation to the (agricultural) land-uses?

- The natural 'determinants' for agricultural land-use in the research area
- Introduction of the non-agricultural land-use in the research area
- Identification of land-use planning institutions

-Demographic Characteristics

-Infrastructure

3. What are the dynamics in location of agricultural cropping patterns in the rural-urban fringe of Dharwad?

-What kind of agricultural cropping patterns are observed and analysed in the rural-urban fringe of Dharwad?

-Identification of commercial crops cultivated for the urban market

-Spatial analysis of the specific cropping patterns for the three transects

-Identification of two specific commercial cropping patterns with high urban demands.

1.3 Research Methodology

The research can be divided in three phases with corresponding methodology. The first phase is the preparation in Groningen, the Netherlands. The second phase consists of the actual research in Hubli-Dharwad, India and the last phase is the analysing of the data and the writing of the research report.

Phase 1:

The preparation for the research started in Groningen, the Netherlands by means of a literature study to get more insight on the concepts of rural-urban fringe, urbanisation and rural development theories. Also secondary data about India was obtained by conversations with fellow students and their research papers.

Phase 2:

This stage corresponds with the duration of the actual research in the research area of Hubli-Dharwad. Stage 2 can be further divided into three parts, which represents the three activities of information gathering. Starting with the observation of the research area followed by the collecting of the primary data and finishing with secondary and tertiary data sources.

First after arrival and settling in the research area we made exploratory field trips by bus and two-wheeler with professor Dr. S.R. Nidagundi and students of the Department of Geography, Karnataka University, Dharwad. These observations were extremely useful to get a good impression of the surroundings of Hubli-Dharwad and to get background information of the research area by our supervisor Dr. Nidagundi. On the base of these observations decisions were made for the implementation of the research. The corridor between the two cities, which was intended to be the research area, was substituted for a circular shape research area with Dharwad as centre to get an overview of the developments and changes in all directions. A 16km radius from the city centre of Dharwad demarcates the research area, whereas to the south-east of Dharwad -in the corridor between Hubli and Dharwad- the border of Dharwad Taluka is taken to demarcate the research area. This Taluka border is located at about 10km from Dharwad centre.

For the collections of primary data about the cropping patterns and general developments in land-use of the villages in the research area a questionnaire (see appendix 1) was made for the key-informants. These are the village-accountants of each village. The selection of villages was made by the observations in the field and by distance and direction to Dharwad. In total 26 villages were selected (see figure 1.1), this is about 25% of the total amount of villages in the research area. The location of the villages can be seen in figure 3.4.

Figure 1.1: Number of interviews held for this research

	Number of interviews	**number of villages**
Number of village-accountants interviewed	26	26
Number of farmers interviewed	69	8

The collected data have been used to get a clear picture of the cropping patterns on farmland, the presence of industry, housing and infrastructure, the service level of the village and the morphology of the village area.

From the outcome of the 26 interviews and key-informants information a selection of villages was made in which 69 farmers/landowners were interviewed. The choice of villages is also based on highlighting certain land-uses around Dharwad. Furthermore some farmers at locations next to important main roads were also interviewed. A second questionnaire was made for the farmers/landowners (see appendix 2) to collect more information about the process of land-use change on farmer's level and to get insight in the economic activities of different types of landowners. Farmer's were chosen in the selected villages on their land size and if possible on the presence of irrigated land. The form of the questionnaire was twofold, if possible standardised question forms were opted for quantitative data and open questions were used to collect more qualitative data. Apart from interviewing the village accountants and the farmers, some interviews were held with industrialists in the field. This was done to get a better insight in the working and actors of the land use process.

The sources for secondary data on the research area were difficult to find and to approach. Letters of introduction from the Karnataka University, Dharwad were necessary to get access to the authorities. The 'Census of India' data were collected from the District Statistical Office, while information about the urban and industrial development came from the Hubli Dharwad Urban Development Authority

(HDUDA), Karnataka Industrial Area Development Board (KIADB) and Hubli Dharwad Municipality Corporation (HDMC). Secondary data on agriculture trends on Taluka level were obtained from the Department of Horticulture of the HDMC. At the end of the research it was discovered that the Agricultural University of Dharwad in co-operation with the Universities of Wales, Birmingham and Greenwich in England carried out a Peri-Urban Interface project on Hubli-Dharwad. A book of their report was obtained and provided a valuable tertiary data source.

Phase 3:

The last stage was accomplished in Groningen, the Netherlands. It consisted of categorising the collected data by using SPSS and Excel and analysing it, before finishing the writing of the thesis. The presentation of the data is done through cross tables and is outlined in the text. Further insight in the methods of analysing the data is given in Chapter 4.

1.4 Problems and Limitations during Fieldwork

Uncertainties and doubts about the right choices and decisions you have to make in the field always surround the first time doing fieldwork in a strange country. A translator, who made it possible to communicate, was necessary for the interviews. Despite all efforts some information went lost due to the extra medium between respondent and researcher. Furthermore the validity of the received information can sometimes be questioned, because of the poor memory of the respondents and the bureaucratic administrative system not working so well. The collection of secondary data collected for this research gave some problems, as records of cropping patterns were only stored for 5 years.

The content of the other chapters will be given in the following paragraph.

1.5 Structure of the Text

This thesis is structured by the research questions given in paragraph 1.2. Chapter 2 starts with an exploration of the different facets of the concept of rural-urban fringe, used by professionals in the developing science. Next the working definition of the rural-urban fringe for this thesis is given, with the typology of the ‘stages of urbanisation’ for villages by Ramachandran.

In chapter 3 the setting in which the research has taken place will be discussed. The chapter starts with an introduction of the location and the administrative, institutional classification of the research area. In the next paragraphs important determinants for commercial development of agriculture land-use like physical landscape, soil types, climate, rainfall, irrigation and infrastructure in the research area are discussed. This is followed by urban developments in land-use and infrastructure. Next the rural and urban administrative

institutions responsible for the land-use planning and implementation are discussed. In paragraph 3.7 the demographic characteristics of the research area are displayed. The chapter ends with an introduction of the villages selected for the research. The research area has been divided in three parts, discussed separately in terms of demographic characteristics, non-agricultural land use, total cultivable area and net area sown.

In chapter 4 the main research questions of this thesis will be answered. After the classification of the different crops observed in the field with a division into subsistence and commercial crops, the marketing flows of the different commodities are discussed. Next a short introduction of trends in cropping patterns in the past for the larger regions of North-Karnataka and Dharwad District are displayed, to be able to compare the general trends of these regions with those of the rural-urban fringe of Dharwad. After this the collected data of cropping patterns, classified in the different crop-groups is analysed. Next the main subsistence crops for each transect of the research area is displayed, followed by the main rainfed commercial crops. The main irrigated commercial crops are given in paragraph 4.4.4, together with a table concerning the development of number of bore wells for irrigation in each transect. After this the villages selected for research are displayed with the total cropped area for commercial and subsistence crops, together with the four main crops cultivated. The rest of this chapter is filled with two case studies. As mango and flowers are important commercial crops, two villages were selected with large shares of total cultivable areas under these crops. Jogellapur is selected for its large share of mango-orchards and Kurabagatti for its flower cultivation. Besides the cultivation aspects the focus is on the different marketing routes for these crops.
Chapter 5 presents the conclusion of this research.

Chapter 2: Theoretical Framework

2.1 Introduction

The dynamics in agricultural land-use in the areas located on the outskirts of the city is the topic of this research. The first concern in this chapter is to refine the concepts relating to the rural-urban fringe to come to a proper definition of the area where this research takes place. Secondly the theoretical framework of this research will be explained.

2.2 The Rural Urban Fringe: some explorations

The occurrence of the rural-urban fringe is a rather recent phenomenon around Indian cities, claims Ramachandran (1991). Before 1950, the rural-urban fringe was non-existent even around the largest metropolitan cities in India. Only after the British period, when a flow of new migrants came into the city, the cities could no longer absorb the population growth and started to grow over the boundaries of the existing cities. With a population increase of 40-50% per decade many large cities (>100.000 inhabitants) grew in a haphazard, uncontrolled way (Ramachandran 1991) into their rural hinterlands. The urban functions sprawl on the edges of the cities where they compete with agricultural functions for space.

The social scientist Wehrwein (in Bentinck 2000) was the first to use the term rural urban fringe in 1942 applying to demographic changes in the fringe areas of the cities in the United States, due to the early industrialisation in the Western World and the sub-urban residential developments. It was seen as an area where suburban growth happened and where urban and rural uses of land were mixed, forming together a transitional zone between city and countryside (Johnson in Adell, 1999). This process occurs at the borders of large cities in developing countries, as well as in the western world. There are many other names for this zone, with different manifestations in the literature in terms of the way it is conceptualised and delimited. Examples of this diversity of terminology are *rurban fringe* (Schenk 1997), *rural hinterland of the city* (Kundu 1991), *peri-urban fringe* (Swindell 1988), *peri-urban areas* (McGee 1991), *desakota regions* (McGee 1991), *metropolitan fringe* (Browder et al. 1995), etc. All these terms have different limitations and scope, supporting different development perspectives. The concept of the rural-urban fringe is used in various contexts, from demographic research to development theories trying to bring ‘urban’ and ‘rural’ together. The transitional landscapes they support can have sectoral dimensions, such as economic activities, demographic features or cultural and physical dimensions. What they have in common is the reference to an area that can neither be called ‘urban’ or ‘rural’.

Before we start with defining the comprehensive concept of rural-urban fringe for this research, let's first examine the two separate concepts of 'rural' and of 'urban'. So for a moment we take a rural-urban dichotomy for granted, encompassing both spatial and sectoral dimensions to try to give more clarity. Unfortunately there is no single clear definition of urban or rural, numerous definitions are circulating and used in research, government policy and statistical surveys. Every nation constructs his own definition of 'urban' and 'rural' areas. The criteria used for defining an urban settlement involves the adoptation of one or more of the following criteria (Champion and Hugo 2004):

-A population threshold
-Population density
-Contiguity of build-up area
-Political status
-Proportion of the labour force engaged in non-agricultural work
-Presence of particular services or activities

The criteria of the proportion of the labour force engaged in non-agricultural work already refer to the division in rural and urban economic activities. The rural area is seen as agrarian based, whereas industry and services can be found in the urban area. The definition used in the India Census for an urban area builds on the same criteria as mentioned above. Only the last criterion is kept out of the definition. Following the Census of India (2001) an urban settlement is based on the following definition:

1. *All places declared by the state government under a statute as a municipality, corporation, cantonment board or notified town area committee, etc.*
2. *All other places which simultaneously satisfy or are expected to satisfy the following criteria:*
    - A minimum population of 5.000 inhabitants;
    - At least 75% of the male working population engaged in non-agricultural economic pursuits; and
    - A density of population of at least 400 per square kilometre.

This definition of an urban area stays questionable. Areas who have not all the above mentioned characteristics can also fall under the urban definition on the basis of their distinct urban characteristics, spatial importance and contribution to the urban economy of the region in the future (Government of India, 2003). Implicitly, these are fringe areas incorporated in the administrative urban areas on the basis of future urban developments.

On the other side is the rural area, defined by the India Census (2001) as:

> *"Any area, which is not covered by the definition of urban".*

The Indian definition of a rural area looks straightforward. If it can not be included in the definition of an urban area, than it is a rural area. Both definitions suggest a clear-cut distinction between urban and rural areas, and hence deny the existence of an area with both rural and urban characteristics. This dichotomy of rural and urban can be useful in comparing international statistical population data or as stated in Adell et al. (1999): "In physical terms the distinction between rural and urban landscapes can still be relevant. Nevertheless in functional terms, the increasing and sustained integration is recognised" (Potter and Unwin 1995). Consequences of the Indian Census definitions for rural villages already placed in the urban area are there. As they are no longer defined as rural area the farmers can't participate in rural development projects for farmers. Ramachandran (1991) claims that many Indian cities have deliberately defined their limits beyond the urban build-up area to include some agricultural land. This is also the case for the Hubli-Dharwad Municipal Corporation, with only 55% of the HDMC-territory is in use as build-up land (HDUDA 2003).

Although the administrative and physical borders are still seen by policy makers as clear-cut lines, in reality the urban functions sprawl beyond these borders. This makes the definition of an urban centre boundary difficult. Jones and Visaria state (1997): "It is increasingly accepted that in many regions of the developing world the boundaries between urban and rural are getting blurred". Tacoli (1998) gives a good example about the population movements. Commuting and temporary and seasonal migration is common in India, but is not reflected in census figures making enumeration of rural and urban population unreliable. As Hugo (1992, in Bentinck 2000) puts forward in the case of populations, the blurring of the distinction between urban and rural populations resulting from mobility of people, goods, services, capital and ideas raises issues about the utility of simple urban/rural dichotomous classifications. So there is a need to come to a third category, which is the intermediate between rural and urban.

But how can the rural-urban fringe than be best characterised? Following a report of the Municipal Development Program (MDP, 2001b) cited by Van Veenhuizen (2002) there are different methods of defining the peri-urban areas. MDP identifies four main classes based on:

- Physical criteria including street patterns and housing density.
- Functional criteria encompassing communication systems, employment levels and transportation networks

- Social and socio-psychological criteria involving the determination of the urban life quality and the general social life of the people.
- Administrative criteria covering the local authority boundaries.

These criteria can be used together or mixed in order to describe the dynamics in the rural-urban fringe. A recent definition, which uses all criteria mentioned above for describing the rural-urban fringe is the functional descriptive definition used by the Peri-urban Research Project Team of the Development Planning Unit, University College London (Adell et al 1999):

The peri-urban interface is where urban and rural activities meet. The peri-urban areas are a mosaic of rural (mainly agricultural) and urban ecosystems, affected by material and energy flows demanded by urban and rural areas. They are socially and economically heterogeneous and subject to rapid change. Small farmers, informal settlers, industrial entrepreneurs and urban middle class commuters may all coexist in the same territory but with different and often competing interests, practices and perceptions. Few institutions can address both urban and rural activities. Local government agencies have either an urban or rural focus. Few metropolitan governments include rural jurisdictions. District and regional governments fail to bridge urban and rural concerns.

The descriptive definition above displays the rural urban fringe as a meeting place for rural, urban and institutional actors with all different, individual and often competing interests. The outcome of these interactions or the strength of the actors determines the landscape on the frontiers of the city. While the most beneficial use of land varies from place to place and from user to user, depending on its location-specific context, in the rural-urban fringe many land-uses are more beneficial to the owner than the traditional agricultural ones. Examples of rural-urban fringe land-uses are brick kilns, poultry farms, milk dairies, fruit orchards, land under speculation, farmhouses and so on, up to urban build-up land (Bentinck 2000). Therefore traditionally dominant agricultural activities are under increasing pressure, although new chances are emerging for market oriented agriculture (Bentinck 2000). For non-agricultural occupations, the villagers' options are enhanced by their proximity to the expanding city. But there are great differences in access to resources and opportunities among villagers and also the willingness to leave the historical and traditional occupations and cropping patterns in favour of new urban-oriented ones.

Van Veenhuizen (2002) points to the superiority and inevitability of the urban processes and the unruly way institutions and regulations are organised. Or as Omutu (1985) observes "rural urban fringes in developing countries are often characterised by faulty and ad-hoc government planning and interventions, leading to an institutional desert" (in Bentinck 2000). It must be mentioned that the urban institutions are

far more powerful in implementing new projects than the rural institutions, although they are not always able to cope with the speed and the scale of changes, especially in the large Metropolitan Cities. Problems in the peri-urban areas are most often characterised by a lack of urban facilities, such as the lack of adequate infrastructure, services and regulations or the vanishing of rural values, the high prices for the land, loss of fertile soil and social cohesion, etc" (Van Veenhuizen 2002). In the rural urban fringe of the twin-city Hubli-Dharwad, defined by the Indian Urban Census as a 100.000+ City, the scale and speed of the developments are of a lesser magnitude. In Hubli-Dharwad, with a population of 700.000 inhabitants, the urban institutions are an important actor in land-use changes and due to smaller scale and lower speed of the urban processes compared to Metropolitan cities the problems here are of a substantial smaller magnitude.

Researchers of the Peri-Urban Research Project Team, which is a part of the Planning Development Unit (Brook et al 2003) conducting research in the greater region of Hubli-Dharwad, have defined the peri-urban interface as a territory created by urban development.

"Urban activities grow and spread on the outskirts of the city, having an impact on the land-use patterns and economic activities in these frontiers of the city. These developments cause changes to existing rural production systems and create new ones that can affect the population in both urban and rural areas".

This definition emphasises on the impact on land-use patterns in the frontier areas of the city. The changes in land-use originate from urban activities and flows expanding the build-up area of the city. This is also the scope of this thesis. But the definition lacks a proper limitation of the concept and can therefore not be applied in this research as working definition for the rural-urban fringe.

The limitation in space of the rural-urban fringe is difficult to give. In the words of Lang (1986, in Champion and Hugo 2004), rural and urban denote opposite ends of the conceptual continuum with real people and communities falling somewhere between the two hypothetical extremes. The urban influences of the city on their hinterland reach to different distances. The area of reach for example urban investments is smaller than for urban occupations.

Ramachandran (1991) his descriptive definition of the rural-urban fringe does provide a limitation of the concept. He defined the concept of rural-urban fringe as follows:
"The rural-urban fringe is an area of mixed rural and urban populations and land-uses, which begins at the point where agricultural land uses appear near the city and extends up to the point where villages

have distinct urban land uses or where some persons, at least, from the village community commute to the city daily for work or other purposes".

This definition is chosen as working definition for this research because it emphasises on land-use changes and also limits the concept in space. Furthermore the definition by Ramachandran originates from the Indian situation and is therefore best applied to this thesis. In the next paragraph the concept will be further explored.

2.3. Theoretical Orientation

To analyse the effects of the urbanisation on the agricultural land-use of villages in the rural-urban fringe of Dharwad, in this thesis the concept of rural-urban fringe defined by Ramachandran (1991) is used. This paragraph starts with his model of the rural-urban fringe, which is build upon the notion of different stages of urbanisation, or so to say of differences in the amount of urban influence on the villages located near the city. Next the theoretical concepts relating to agriculture in the transitional zone are reviewed. At last the definitions used in this research will be explained.

Ramachandran expounds his definition of the rural-urban fringe in a 'fringe' village at the rural end of the spectrum, which has a distinctly rural land use, while the population already starts urbanising. The first transformation of the rural local situation occurs by a change in land-use towards market-oriented agriculture. After that the villagers start commuting and adopting an urban livelihood. This occurs before urban land use starts to dominate the local landscape. Finally, the village is incorporated into the urban area (Bentinck 2000). So in total there are five stages in the model of Ramachandran, displayed in Table 2.1.

Table 2.1. Stages of urbanisation by Ramachandran (1991)

Stage 1:	*Rural* (no influence of the city, either on the population or the land)
Stage 2:	*Agriculture land-use change* (showing influence of the agricultural markets in the city on the agriculture land-use change)
Stage 3:	*Occupational change* (where the majority of the population is no longer working in agriculture)
Stage 4:	*Urban land-use growth* (where urban land-use types start dominating the area around the village settlement)
Stage 5:	*Urban* (where urban land-use types have taken up all rural land).

This typology refers to development in course of time, but it would be valid for development in space as well. Villages in ‘stage one’ are traditional rural villages with no influences from the city on their occupation structure, cropping patterns and land-use. So these rural villages represent the outer boundaries of the rural-urban fringe. On the other side agricultural land-use is also used to define the inner boundaries of the rural-urban fringe. If agricultural land-use occurs within the municipal boundaries, the rural-urban fringe begins inside the city limits. This is the case for Dharwad

The second stage, that of the agricultural land-use change is important to identify. The agricultural cropping-patterns will alter to more market oriented production, like perishable goods such as vegetables, flowers and fruits. Important determinants for these changes are the transport facilities, the growing urban demand and the contacts with the city. Especially the contacts with the city help to identify the new possibilities for urban market agriculture.

In the third stage the village population responds to the employment opportunities in the city. This starts often with low-paid jobs in the informal and formal construction work, where earnings are still higher than as an agricultural labourer. A consequent problem for the rural landowner is the loss of agricultural labourers to the city, which has to be countered with higher wages and labourers from more distant rural places. In this stage the village population has increasing contacts with the city and spatial mobility increases significantly (Ramachandran 1991).

The stage of the “urban land-use growth” often starts with real estate agents from the city buying up some land to develop a residential layout or industrial site. In most cases city people or immigrants come to live there. Usually land near the main road connecting the village with the city is first developed for industrial or residential purpose. If the government or city development authorities take the land the transition in land-use can be rather abrupt. In this way the land is urbanised, but inhabitants of the village can continue their rural activities.

After reviewing the different stages above, it must be mentioned that: ”a stages-model should be interpreted carefully, as stages might overlap both in space and time, and some villages might be in one stage permanently while others go through all stages” (Druijven 1996). The diversity of the villages limits the usefulness of the stages of urbanisation. Within each stage there are profound differences in the course of development of land-use and population, which warrant further in-depth research. The model of Ramachandran used here is not like a ladder villages have to climb step by step to become urban, but more as different changes (in cropping patterns, occupation and land-use) that indicate an increase in

urban influence on the village. It is evident that changes in cropping patterns and occupations can be reversed, whereas this is more difficult with the urban land-uses.

For this research agricultural data about cropping patterns are gathered, together with data about the conversion of land into build-up land and the various non-agricultural land-uses present in the selected villages. No primary or secondary data could be obtained about occupation of the inhabitants of the selected villages were obtained. Therefore, the third stage of urbanisation identified by Ramachandran, the occupational change is not analysed in this research. Indications of occupational shifts towards urban jobs were there, as a number of farmers complained about the lack of agricultural labourers and the increase in wages they had to pay. But the specific situation in the selected villages could not be given.

The weight of the urban influence on villages in the rural-urban fringe is not equal in all directions. The economist J.H. Von Thunen displayed the different agricultural land-uses at various distances from the city in his 'Von Thunen Model'. Assuming an isolated state, no infrastructure and consistent soil quality, rings could be drawn at different distances around the city where different agricultural activities were produced. The crops cultivated on a location depended on the distance to the city, which determined the transportation costs. The city of Dharwad is not isolated in a homogeneous surrounding. Different soil types and road infrastructure are main aspects for differences in agricultural land-use between villages, together with the distance of the village to the city. Infrastructure connections decrease the relative distance to the city. It is therefore assumed that urban influences are largest in the vicinity of good infrastructure layouts to connect them with the urban areas.

Chapter 3: Setting

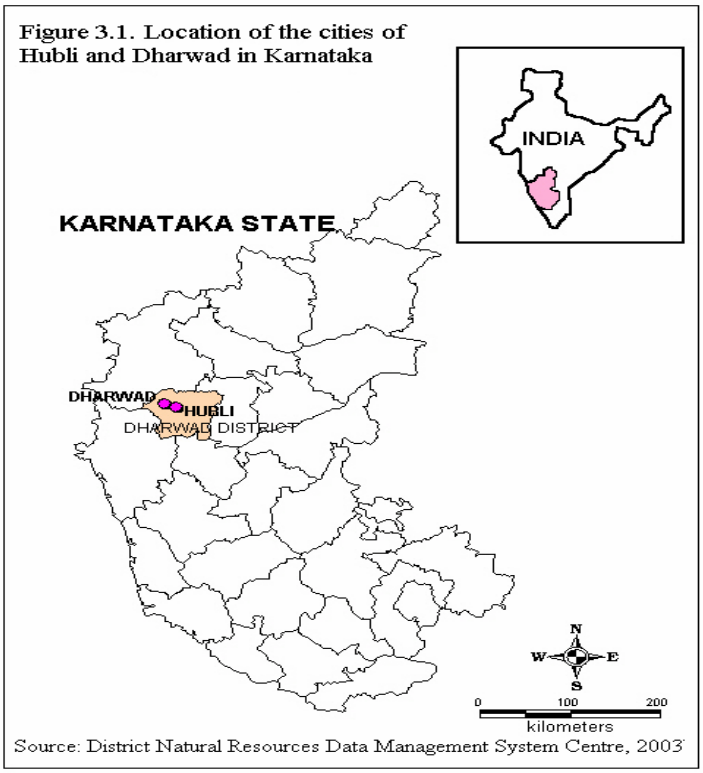
3.1. Introduction

In this chapter the setting in which the research was performed will be discussed. The research area is the rural-urban fringe of Dharwad. The chapter starts with an introduction of the location and physical landscape of the research area. Furthermore the natural determinants for agricultural activities, like soil type, climate, rainfall and availability of irrigation in the rural-urban fringe of Dharwad are discussed. Next, the focus is on rural-urban aspects, with infrastructure developments like the roads, railway and electricity discussed. After this the scope is on the urban part, introducing the urban agglomeration of Dharwad with developments in land-use. This is followed by the different urban and rural institutions responsible for land-use planning in the research area. The demographic characteristics of the city and the hinterland are next. The chapter will end with an introduction and description of the villages selected for this study. The description will be according to the land-use aspects introduced by Ramachandran in the previous chapter.

3.2. Location and Physical Landscape

The research area of this thesis is located in south-west India, in the northern part of the state Karnataka (see figure 3.1). The urban part of the research area is a conurbation comprised of the urban areas of Hubli and Dharwad, which are connected by a 20km corridor. This twin-city of Hubli-Dharwad is located 425km north-west of Bangelore and 600km south-east of Mumbai. Karnataka State was administratively re-divided in 1997 from 20 into 27 Districts, one of them being Dharwad District, with Hubli-Dharwad as centre of administration (Birmingham et al 1998). The Districts are further divided into smaller administrative units, the Talukas. Dharwad District is divided into 5 Talukas: Dharwad, Hubli,

Figure 3.1. Location of the cities of Hubli and Dharwad in Karnataka



Source: District Natural Resources Data Management System Centre, 2003

Kalghatgi, Kundgol and Navalgund (see figure 3.2). The city of Hubli-Dharwad is located in the Talukas of Dharwad and Hubli. The research area of this thesis covers the rural-urban fringe of the city of Dharwad[1] and consists of Dharwad Taluka only. The two areas meet each other in the corridor between the two cities at 10km distance from the city-centres.

Figure 3.2. The Talukas of Dharwad District

Source: District Natural Resources Data Management System Centre, 2003

The physical landscape of Karnataka changes eastward from the Arabian Sea coast with sand beaches to the forest-covered jagged Western Ghats (Singh 1995). Further to the east the landscape slopes into the flat and dry Karnataka Deccan Plateau. In general it is said for the North Karnataka Plateau that except for the steep hill slopes, the land is intensively cropped land with the net sown area occupying almost 75% of the total geographical area. The yields however, are scanty and undependable rainfall and poor irrigation development, which lead to frequent crop failure and large-scale diversion to fallow land (Sharma, 1999).

Dharwad District is located on the western edge of the Deccan Plateau on a height of 800 meters above sea level. Due to this location on the edge of the plateau, the rural-urban fringe of Hubli-Dharwad lies in a transitional zone with different physiology and soil types" (Sharma 1999). To the north and east of Dharwad the land is plain and level with fertile black soils (locally known as black 'cotton' soils). The land is intensively cultivated with a net area sown of more than 75% of the total surface. The area to the north of the city of Dharwad is characterised by medium (23-90cm deep) black soils, while in the east the black soils are more than 90cm deep. These soils with a high clay content have poor drainage conditions, but their water retention is high. This makes it possible to cultivate in the second season of the year on the residual soils moisture (Birmingham et al 1998). In the next paragraph the climatic situation of the area will be discussed. Examples of crops cultivated in these areas are cotton, groundnut, onion and potato.

[1] Vrieze (2005) is describing the other part of the twin-city, the rural-urban fringe of the city of Hubli in Hubli Taluka.

To the south and especially to the west of the city of Dharwad there is more relief in the landscape with some hillocks. In these semi-hill areas the percentage of land available for cultivation is lower than on the plains, as most hills (owned by the government) are covered with forests and cultivation is not possible (own data). These parts are more dominated by red soils. The National highway 4 in the corridor can be seen as a border between red soils to the west and black soils to the east (see figure 3.3). The red soils vary in their sand and clay content with a low to moderate cation exchange capacity, so drainage conditions are better than in the black soils, but the soil will retain less water. Therefore the agricultural land cannot be used for a second season in one year without some irrigation facility (Birmingham et al 1998). The good drainage capacity and the higher groundwater table than the black soils, make the digging of bore wells more viable on these red soils (De Boer, 2005). On these soils rice, maize and green gram is cultivated and there are mango-orchards. It must be mentioned that the diversity of crops that can be cultivated on the red-soils is limited, as compared to the black-soils.

3.3. Climate, Rainfall and Irrigation

The climate in Karnataka State is tropical and hot with the monsoon winds providing the rainfall. The seasons are based on the onset and withdrawal of the south-western monsoons, which are strong winds changing direction with the seasons. The year is divided in three seasons of which two are used for agricultural produce. First there is the '*mungary*' season, from June to September. It is the main raining season. With about 80% of the rainfall in a year received from the south-western monsoon winds, farmers depend largely on these rains to irrigate their land. Arable farming is therefore for a very large part synchronised with the onset and withdrawal of these winds (Sharma 1999). As a result of the climatic conditions the crops that are cultivated in the '*mungary*' season are provided with more moisture and sun. Examples are paddy, maize, groundnut and green gram. The second season is the '*hingary*' season. This season can be considered as the winter and lasts from October to January. In this period little rain comes from the north-east monsoon. In this season the farmers chose crops that need less humidity and less sun (days are shorter), such as bengal gram, wheat and sorghum. The third season is the '*summer*' season that lasts from February to May. Most of the farmers are using this period to clean the land and prepare it for the new monsoon to come. No production without irrigation is possible in this period due to high temperatures and no rainfall.

The amount of rain produced by the monsoon depends on the location and is most of the times not evenly distributed over the region. Due to the physical differences in landscape the rainfall in Dharwad Taluka declines from west to east from 1000 to 650mm a year, whereas from north to south the differences are minor with 700 to 800mm rainfall in a year (Brook et al 2003). Agriculture in Dharwad Taluka has to

cope with a lack of rainfall and high temperatures. The high variability of the rainfall causes problems, as agricultural activities cannot rely on the weather. It is insecure when specific crops have to be planted or harvested. Farmers in the research area wait for the first rain before cultivating the land. Some farmers choose for mixed cropping (two or more crops sown mixed on one plot of land) to secure at least one crop. Another problem is the flooding of the land by heavy rains, resulting in erosion and low quality of the soil. Together with the poor development in water retention there are frequent crop failures and large-scale diversion to fallow land (Sharma 1999).

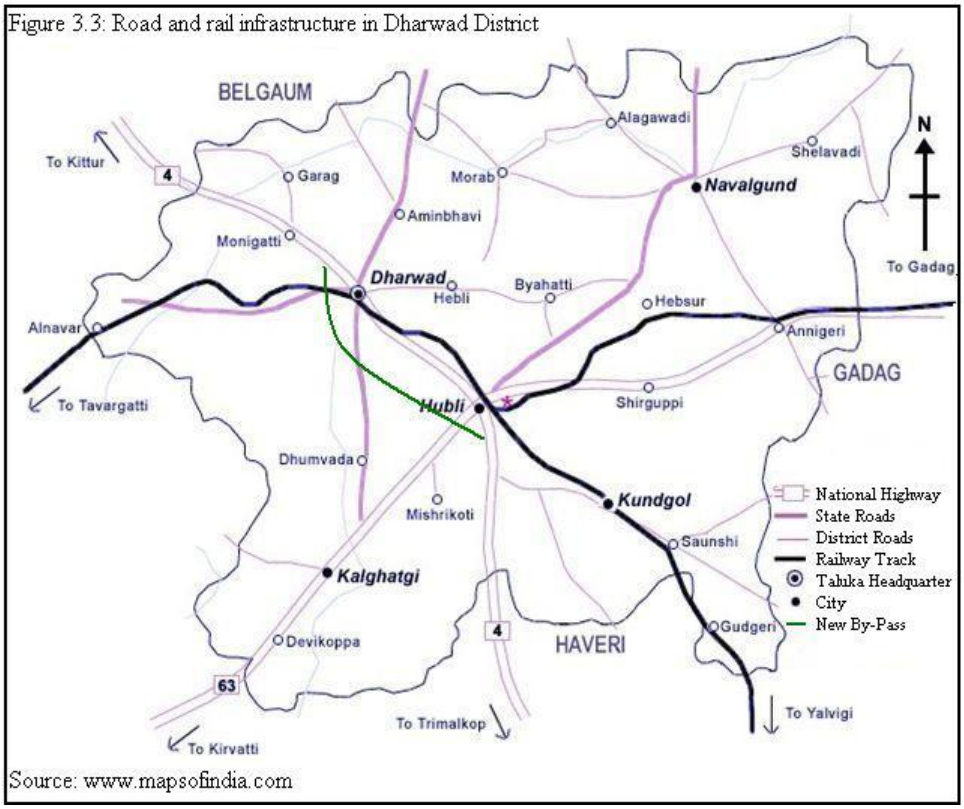
Irrigation is since long used in India to cultivate crops in dry periods or to cultivate crops like paddy, which need extra moisture. The proportion of cropped land irrigated in Dharwad District is only 9%, compared to 18% for Karnataka State and 31% for India as a whole (Census Data 1991). Irrigation techniques vary from the traditional way of capturing the monsoon rains in ponds or tanks and then diverse it to irrigate farming land close to it, to the modern way of sinking a bore well and use electricity to pomp water up and onto the cultivated land. Research done by Sharma (1999) gives a detailed picture about developments in irrigation in Dharwad District. The net area irrigated by bore wells came up from 389ha in 1980 to 20442ha in 1990, while tank irrigation decreased sharply, accounting for 74% of all irrigation areas in 1980 to only 16% in 1990. Due to less rainfall and bad maintenance, more and more tanks fall dry and can't be used for irrigating the land anymore (Sharma 1999).

Dharwad Taluka has 2600 ha under irrigation, accounting for 3% of the total area sown (Census data 1991). This is meagre in comparison to Dharwad District and Karnataka State and can be accounted by the physical location on the Deccan Plateau and therefore the absence of a river or canal passing by the area. The Peri-Urban Interface Production System Research (1998) concluded that relative few villages in Dharwad Taluka where without any irrigated areas but the majority of villages had less than 5% of the village area under irrigation. Brook et al (2003) recorded no villages in Dharwad Taluka with more than 25% of their total area under irrigation. Only 4 of the 112 villages had an irrigated area between 10 to 25% of the total area. However, comparing the total irrigated area in Dharwad Taluka with the situation in 1981 (1540 ha), there was a large increase of 64% over ten years Census data 1991). Today, irrigation is mostly done by bore well in this area, and the irrigated plots are often located near the larger roads, where the electricity is available. The infrastructure of the research area will be discussed in the next paragraph.

3.4. Infrastructure

The National Highway-4 is the backbone of the twin-city, going trough both city centres and connecting the two cities through a 20km corridor. This busy 2-lane highway is the main connection between Mumbay and Bangelore and opened in 1996. Other state and district roads in Dharwad are the Goa Road, Saundatti Road, Gadag Road and Haliyal Road (see figure 3.3), connecting the city with other cities and towns in the region. At present the part of the NH-4, to the north west of the city is being upgraded to a 4-lane highway. Another project which upgrades the road infrastructure in the rural urban fringe of Dharwad is the in 2000 opened by-pass at the western side of Dharwad to halt the increased traffic congestion in the corridor and in the two city centres (HDUDA, 2001). Despite these developments in road networks, there are still villages entirely isolated from public roads. Dharwad Taluka lacks a proper road network to connect more isolated villages with the city (Singh 1995). The conditions of the roads in Dharwad are bad, especially the intra-urban road network due to bad or insufficient maintenance of the local rural and urban authorities. This prevents an efficient marketing of the agricultural yields.

Figure 3.3: Road and rail infrastructure in Dharwad District



Source: www.mapsofindia.com

The railway station at the south-west outskirts of Dharwad on the Bangalore-Pune Broad gauge Railway line gives Dharwad a fast connection with Bangelore and Mumbay. In the corridor, near Navalur and near Amargol new stations are planned, to promote (industrial) developments in the new township of Navanagar. But these are not yet functioning properly (HDUDA, 2001).

Dams in the rivers “Krishna” and “Tungabhadra” in the north of Karnataka state generate most electricity used in Dharwad district. Because of the lack of rain and bad management and bad connections there are frequent power failures in the area (Birmingham et al 1998). The urban area covered by the Hubli-Dharwad Municipality Corporation (HDMC) has a 24-hours 3-phase connection. Outside the borders of

the HDMC the villages receive only 6 to 8 hours of 3-phase current a day on variable moments and therefore farmers also have to work at night when necessary. This causes problems with their security and results in less productivity (own data).

The development of the road network to open and connect the rural areas, together with a constant current supply will be necessary for the economic development of Hubli-Dharwad and the rest of the region. The agricultural land-use can than be developed into more commercial cropping-patterns with more possibilities due to better marketing routes and irrigation possibilities.

3.5. Urban Agglomeration of Hubli-Dharwad

Dharwad and Hubli are two separate cities, administratively merged in 1962 after a reorganisation of the municipal boundaries, forming the Hubli-Dharwad Municipal Corporation (HDMC). The developments of both cities are completely different but rather complimentary. Where Hubli has a long tradition of commerce and trade, Dharwad has been an administrative centre since the British Administration started it and an higher education centre for the north of Karnataka since the Agricultural University and the Karnataka University were established in 1946 and 1947 (Brook et al, 2003). The population of the city is a reflection from this with Hubli having more the traders and entrepreneurs, while the population of Dharwad consist of more students, teachers, officials and elderly. Industry tends to be agriculturally related, such as milk and fruit processing, although manufacturing is increasing in importance.

Table 3.1 gives an overview of the developments and distribution of the land-uses in the twin-city of Hubli-Dharwad. The area covered by the city is almost doubled, with large increases in the land utilised for residential use and public and semi-public use. Since 1962 the city of Dharwad has annexed village areas to meet the demand in urban land-use. The share of industrial land-use grows equal the overall growth of the city, whereas the share of commercial land-use shows a decrease in growth. In between the two cities next to the NH-4 the new settlement of Navanagar was planned by the Hubli-Dharwad Urban Development Authority (HDUDA) in the 1970's to direct the trend of development of Hubli and Dharwad towards each other. The developing process started in the 1980s by locating a number of institutional offices, industries and plan large residential layouts. The inclusion of this new settlement of Navanagar in the corridor between Hubli and Dharwad is the main reason for the increase in built-up area. In figure 3.4 the location of the settlement of Navanagar is displayed.

Table 3.1. Comparative analyses of land-uses in the built-up areas of the twin-city

Existing Land Use	1986 Survey		2000 Survey	
	Area in hectares	Percentage	Area in hectares	Percentage
Residential	1356	25	3196	31
Commercial	194	4	336	3
Industrial	296	5	528	5
Public and Semi public	719	13	1750	17
Parks and Open spaces	409	6	663	6
Transportation	1531	28	2269	22
Water sheet and vacant	935	19	1632	16
Total	**5440**	**100**	**10374**	**100**

Source: HDUDA Overview, 2003.

It must be said that of the total area of 190,94 square km of the HDMC (Birmingham et al 1998), 103,74 square km is developed for urban land-uses accounting for 55% of the area. So agricultural land-uses and rural-urban land-uses such as brick kilns, poultry farms and diaries can be observed outside, as well as inside the HDMC-borders.

3.6. Urban and Rural Administrative Institutions

The two urban cores and most peri-urban areas close around and between the two cities come under the municipal administration of the Hubli-Dharwad Municipal Corporation (HDMC). The HDMC covers an area of 190,94 square km, with several village areas incorporated into the HDMC since 1962 (Birmingham et al 1998). In Figure 3.4 the borders of the HDMC are displayed, together with the 26 research villages. Nine of these villages are located within the HDMC-area. Outside the administrative urban area the land is governed by the Panchayat Raj (council) system, divided into three sub-divisions, Zilla (district), Taluka (sub-district) and Gram (two or three villages) Panchayat. Although none of these rural institutions is concerned with land use planning and natural resources management, they are responsible for the allocation of resources and the implementation of programs and schemes defined by the Central and State government (Budds and Allen, 1999). On Gram Panchayat level, the village accountant is one of the employees of the village panchayat, appointed to record all (changes in) land-uses of the village area. The data about the cropping patterns of the selected village areas in the next chapter are collected by interviews with the village accountants of the selected villages.

The Hubli-Dharwad Urban Development Authority (HDUDA) is charged with developing the Comprehensive Development Plan for the twin-city, regulating urban development activities and providing new residential layouts and is therefore an important actor in the transformation of agricultural

land to build-up land. The HDUDA is the dominant institution on urban physical planning in the rural-urban fringe of Dharwad. The planning boundaries of HDUDA exceed the HDMC-border by about 10 km, to include villages[2] that may be destined to become part of the urban area (Budds and Allen, 1999). The policy of the HDUDA is to conserve as much fertile black soil for agriculture purpose. The planning of urban expansions is therefore focused on the red-soil areas (HDUDA, 2001).

3.7. Demographic Characteristics

From the 52,7 million people living in Karnataka State, 1,6 million live in Dharwad District. The urban agglomeration of Hubli-Dharwad is a medium-sized city with 786.018 inhabitants in 2001, which makes it the third largest urban agglomeration in Karnataka after Bangelore and Mysore. In total 49% of the population of Dharwad District lives in the twin-city of Hubli-Dharwad (Census data 2001). The population growth of Dharwad and the HDMC together with the urban growth rates of Karnataka State is given in Table 3.2. From the start of the HDMC in 1961, Dharwad has always been the smaller city occupied by about 30% of the total population of HDMC. In the period 1961-1971 Dharwad experienced a high population increase of 58,5%, due to the location of a number of regional offices of State Government covering the north Karnataka region after reorganisation (HDUDA 2003).

Table 3.2. Decadal Population Growth Rates for Dharwad City, the Hubli-Dharwad Municipal Corporation (HDMC) and the urban growth rate of Karnataka State.

Years	**Population Dharwad**	**Decadal growth (%)**	**Population HDMC**	**Decadal growth (%)**	**Urban growth rate Karnataka (%)**
1961	77235	16,0	248.489	_____	_____
1971	122495	58,5	379.166	52.6	_____
1981	174101	42,2	527.108	39.0	50,7
1991	Not available	_____	648.298	23,0	29,6
2001	236333	26,3	786.018	21,2	28,9

Source: Budds and Allen 1999, Census of India 2001, HDUDA 2003.

From 1981 onwards the rates of increase dropped, mostly because of a lack of new economic activities and the development of other district centres for trade and commerce in the region (HDUDA 2003). The urban growth rates for Karnataka State in the later periods exceed those of Dharwad.

[2] The village areas of Belur, Mummigatti, Hiremalligwad, Jogellapur, Narendra and Salakinkoppa in Dharwad Taluka, which are selected for this research are covered by the 1988 Comprehensive Development Plan of the HDUDA (Birmingham et al, 1998).

As a result of the distribution mentioned above about half of the population of Dharwad District is living in rural and semi-rural areas around the city. Regarding the village size and the distribution of the villages, the red soil areas to the west and south of Dharwad are occupied by a large number of predominantly small size villages, whereas in the north and east there are less but larger villages. This division can be explained by the highly dependability on the nature of the soil and drinking water facilities (Singh 1995). Water is the utmost important asset of an Indian village. From the black-soils it is difficult to obtain potable water and perennial streams are scarce. Hence there is a tendency to form large clusters around certain points with availability of water. For the red soil areas to the west and south of Dharwad, groundwater is easier to obtain which has resulted in a more scattered pattern of smaller settlements (Singh 1995). Dharwad Taluka, with large areas covered by red soil has the largest number of villages (112) of the District, with an average village size of 1651 persons compared to the black soil areas of Hubli (58) with an average size of 2115 persons (Birmingham et al, 1998).

Research done by the University of Birmingham (1998) on the changing characteristics of villages in the rural-urban fringe of Dharwad concluded: “Dharwad Taluka stands out as having a large concentration of villages that have grown more than the natural rate of increase of 24% through attracting in-migrants. Of the total 112 villages, 79 villages (70,5%) fall in this category. These data account for the period 1981-1991. The villages with growth rates above the natural rate of increase are generally located to the west of the city in the wetter red soil zone”, close to Dharwad. So the population increase is boosted by the influx of people coming to the city for non-agricultural employment opportunities. The reason behind the in-migration is mainly to work in the city, where higher wages are paid for construction or industrial labourers, or work as agricultural land labourer where there is shortage. In there own villages agriculture is not viable anymore, so they move to the city. The largest share of non-agricultural workers is nowadays occupied as construction workers (Brook et al 2003). For villages along major roadsides an increase in opportunities for non-agricultural employment can be experienced, like jobs in hotels, restaurants and transport commodity shops along the roads. With other income sources being in reach, village people do not have to rely completely on agricultural income anymore.

3.8. Introduction and classification of the villages selected for this research

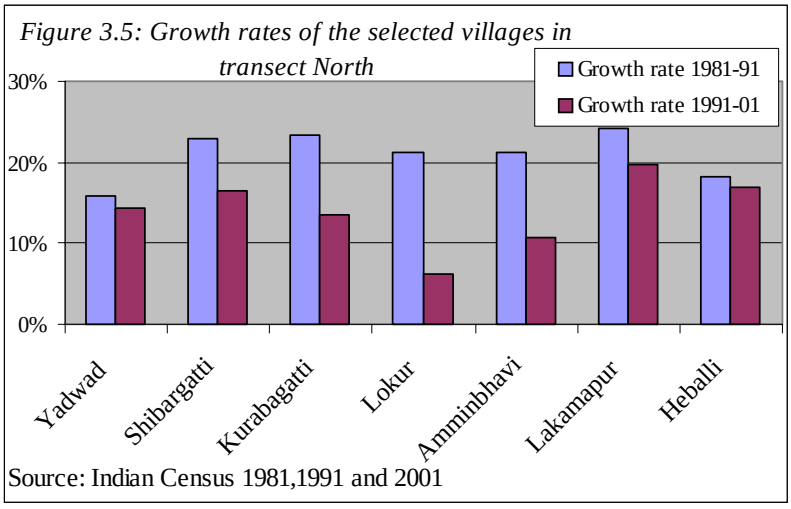
The criteria used to select the villages for the research are the absolute and relative location of the villages to main roads and soil characteristics. In total 26 villages are selected for this research, inside a 16km radius from Dharwad Centre. Only to the south of the city of Dharwad the radius is shortened to 10 km, to keep within the administrative area of Dharwad Taluka. This limitation of the research area was practically necessary, because of the time frame for this research and the logical decrease in urban

influence with distance. Of the total 112 villages in Dharwad Taluka (Indian Census 1991) 23% was selected, all inside the 16km radius to analyse the cropping patterns of these villages for the period 1998-2003. The initial intention was to compare the collected data with data of an earlier period, but no comparing data could be obtained on the same village level. Therefore the collected data are compared with those of Dharwad Taluka, Dharwad District and North Maidan Region (northern part of Karnataka). The location of all selected villages is displayed in figure 3.4 (next page), together with the administrative borders of the HDMC. Seven of the selected villages are already incorporated inside HDMC, which has consequences for the availability of data. For these villages who have become a 'ward' of the city, no individual records were available by the Census of India. Another six villages are under control of the HDUDA, but not yet incorporated in the HDMC, so data is available for these villages. The research area is further divided in three transects to group village-areas by location, soil type and infrastructure. The demarcation of the three transects is also shown in figure 3.4. Below each transect is discussed by their physical, soil, climate, infrastructure and demographic characteristics. Together with a schematic display of the features of the selected villages this thesis will come to an initial classification of the villages by Ramachandran (1991) his working definition.

3.8.1. Transect North

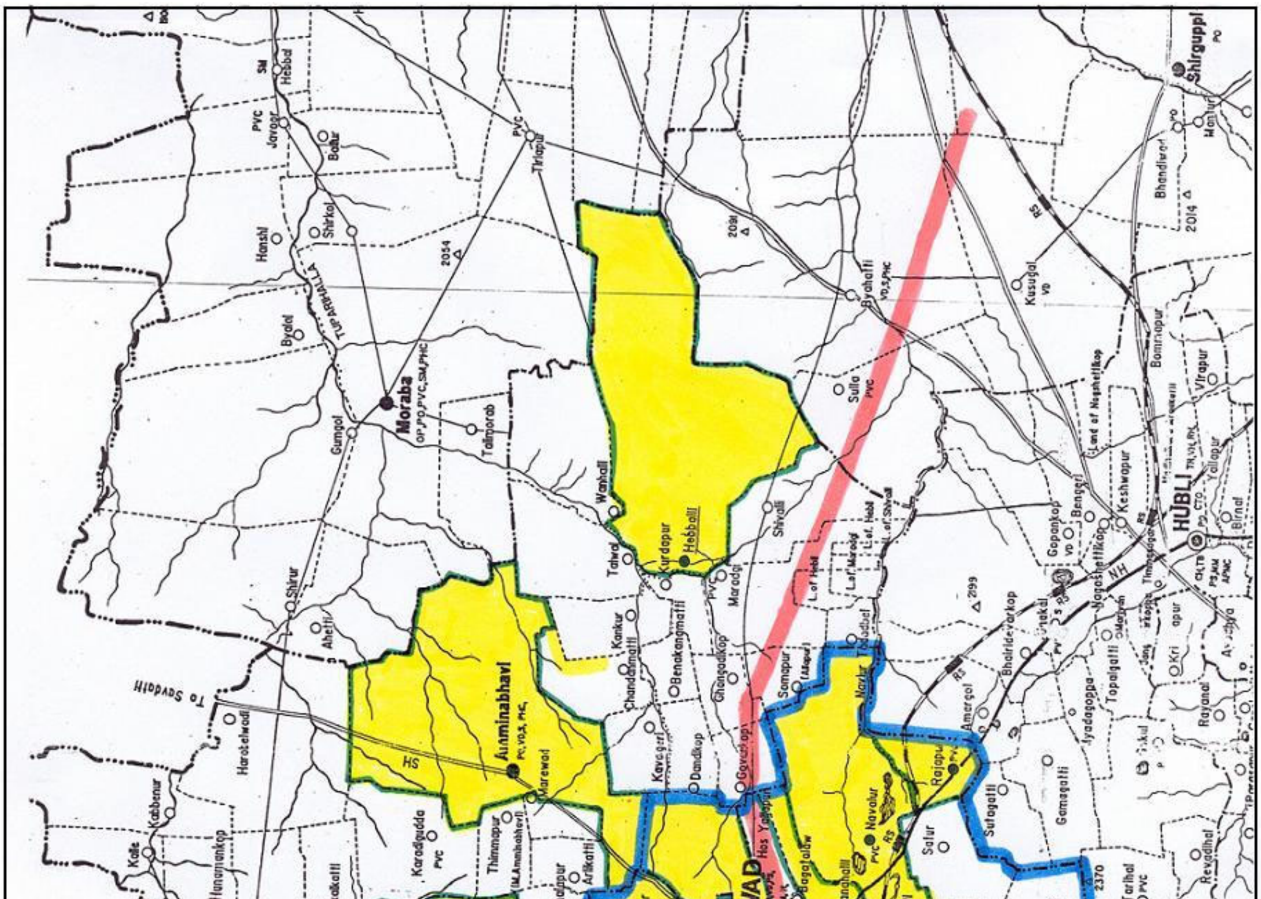
The first transect discussed here is transect North. This transect is located in a predominant black soil area to the north of Dharwad. In this area ten village areas were selected for research on developments in cropping patterns and all had more than half of their area covered with black soils. The demographic growth for the selected villages is given in figure 3.5. For Dharwad Rural, Malapur and Kamalapur no data is present, as they are incorporated into the HDMC. The figure displays the decrease in demographic growth with large decreases for almost all villages. All villages fall below the National Growth Rate of India of 21,3% (Census India 2001). Research done by the University of Birmingham (1998) state that the influx of migrants occurs mainly in the red-soil areas to the west of Dharwad. The economic developments of Dharwad are stagnating and therefore fewer migrants can come to the city for work.

Figure 3.5: Growth rates of the selected villages in transect North



Source: Indian Census 1981,1991 and 2001

Figure 3.4: Map of the Research area with the selected villages, The HDMC-borders of the city of Dharwad and the division-line of the three transects



Selected villages:

Institutional borders of the HDMC area in Dharwad Taluka

Borders of the three transects

Table 3.3 the land-use data for the individual villages are given. Due to their location on the black plain soils with no hills and forests the villages have large cultivable areas up to 98,6% of the total geographical area. Agricultural land-use dominates this terrain and more than one yields in a year are possible on these grounds. The 'net area sown' gives the share of cultivable land actually sown in *mungary* 2003. This number varies between 80% to 100%, so a high share of the cultivable land is actually in use. The large villages of Amminbhavi and Hebbali have the lowest share, 80 and 85%, which can be accounted for by the large absolute number of small-farmers, who are unable to make a living out of agriculture. For the agricultural labourer and also for small farmers, job opportunities in the city with a higher wage are preferred over an uncertain agricultural income. So agricultural land becomes fallow land. The diversification of economic activities inside the villages is hardly there.

Table 3.3. Distance, population and land-use characteristics of the selected villages in transect North of the research area

Village (distance)*	Population	TGA**	TCA***	Net Area Sown****	Residential Land-use	Industrial Land-use
Dharwad Rural (1km)	In HDMC	2951	96,6%	98%	0,3%	0,0%
Malapur (2km)	In HDMC	765	98,6%	100%	0,4%	0,0%
Kamalapur (5km)	In HDMC	1691	98,0%	98%	0,3%	0,0%
Yadwad (11km)	3095	3086	96,1%	97%	0,7%	0,0%
Shibargatti (13 km)	1676	768	96,2%	97%	1,4%	0,0%
Kurabagatti (15km)	2131	1483	97,2%	89%	0,8%	0,0%
Lokur (16km)	3102	2504	96,2%	96%	1,2%	0,0%
Amminbhavi (15km)	10889	11499	96,5%	85%	0,9%	0,0%
Lakamapur (10km)	1780	1297	95,0%	96%	0,2%	0,2%
Heballi (14km)	11506	13518	93,1%	80%	1,0%	0,0%

*Distance: Distance to Dharwad City Centre in a direct line.
**TGA: Total Geographical Area in acres
***TCA: Total Cultivable Area as percentage of TGA.
****Net Sown Area: Percentage of TCA actually sown in *mungary* season 2003
Source: India Census 2001, Interviews with village-accountants 2004.

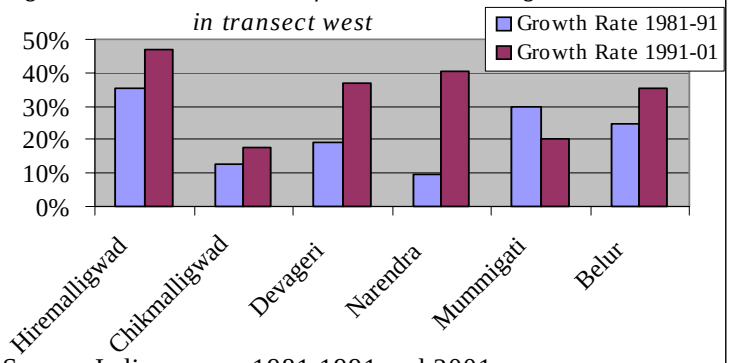
Three village-areas are incorporated in the urban administration of the HDMC, with the villages itself connected to the build-up area of the city. But land-use transformations into non-agricultural land-use are more accidental than common in transect North. The low share of residential and industrial land-use confirms this claim. In the village area of Dharwad Rural, inside the HDMC-borders, three and a half acres of agricultural land was developed for apartment buildings, while in the village area of Amminbhavi a research and development company for cottonseeds is located (own data 2004). No other developments can be accorded from the village-accountant records. In the last 20 years no development in road

infrastructure was achieved in the selected villages, there is no national highway crossing the territory and non-agricultural land-use developments cannot be observed next to the roads in transect North.

3.8.2. Transect West

The area to the west of Dharwad is located in a predominantly red soil, with plots of black soil in the village areas of Yattinguda and Narendra in the north-west. The NH-4 runs through the area and through parts of the village areas of Mummigatti, Belur and Yattinguda. Furthermore the new by-pass runs through the village area of Hiremalligwad and therefore the village area is recently incorporated in the HDMC. This is done in order to prevent any unwanted and illegal land-use conversions and land speculation. Figure 3.6 displays the demographic growth in the selected villages. The tendency of an increase in population, exceeding the national growth rate is visible in almost all villages. The high growth rates can be subscribed to the large industrial area in this transect, located between Belur and Mummigatti, attracting in-migrants and also new residential developments that come up on Hiremalligwad territory next to the turn-off for the by-pass.

Figure 3.6: Growth rates of the selected villages in transect west



Source: Indian census 1981,1991 and 2001

From Table 3.4 (next page) the land-use in the village areas is characterised. The share of cultivable land is varies considerably due to the hilly landscape and the urban developments in this area. Combining the shares of cultivable land with the net area sown, an indication of the intensity of the agricultural activities can be given. In the isolated village area of Devageri, located 16km west of Dharwad with bad road connections, only 28,8% of the land is cultivable due to a large forest area, which is also the reason for the low share of Chikmalligwad. But here farmers have also used parts of the forest area for cultivation. The net area sown as percentage of the TCA gives the share of the cultivable land actually sown in mungary 2003. In Belur this is 70% of the TCA, indicating that 30% of the cultivable land is fallow land. The village areas of Yattinguda, Narendra, Mummigatti and Belur all experienced a transformation of agricultural

Table 3.4. Distance, population and land-use characteristics of the selected villages in transect West of the research area.

Village (distance)*	Population	TGA**	TCA***	Net Area Sown as % of TCA	Residential Land-use	Industrial Land-use
Hiremalligwad (6km)	850	826	90,9%	92%	2,2%	0,6%
Chikmalligwad (7km)	2024	1502	54,4%	130%	2,1%	0,0%
Devageri (16km)	614	1880	28,8%	99%	0,1%	0,0%
Yattinguda (4km)	in HDMC	1163	43,6%	99%	0,4%	0,0%
Narendra (8km)	5930	2965	89,8%	91%	3,9%	0,0%
Mummigatti (10km)	3859	3790	46,9%	104%	1,1%	19,5%
Belur (14km)	2280	2216	38,5%	76%	1,1%	42,0%

*Distance: Distance to Dharwad City Centre in a straight line.
**TGA: Total Geographical Area in acres
***TCA: Total Cultivable Area as percentage of TGA.
Source: India Census 2001, Interviews with village-accountants 2004)

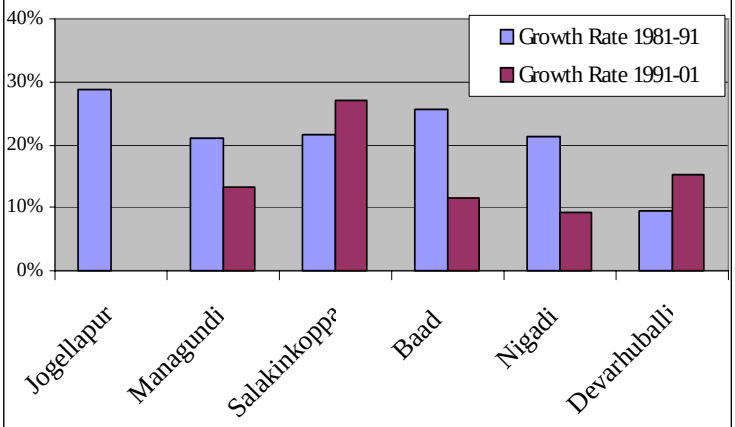
land taken by the HDUDA for urban purposes. Yattinguda and Narendra together lost 1100 acres of agricultural land due to the Agricultural University, who wanted this location due to the specific soil conditions. Belur and Mummigatti have a huge industrial area of more than 1400 acres on their territory. Large parts of these village areas are taken by the HDUDA from the 1970s up to today for development of an industrial area for chemical, textile and general engineering industries (Karnataka Industrial Areas Development Board, 1999). For the future the KIADB already acquired 267 acres from Mummigatti village and is proposing a further 500 acres. With these developments the cultivable areas have declined, although some industrial plots are not yet developed and still in use by farmers for cultivation of staple crops. In this transect specific rural-urban land-uses like brick kilns (only possible on red soils), poultry farm and diaries can also be observed. The land-use next to the NH-4 (being developed in a 4-lane highway) is a mix of fruit-orchards, residential layouts in development and a large area of the agricultural university. At more distant from Dharwad, the industrial areas of Belur and Mummigatti are located next to the NH-4, together with an agricultural land-use of more field crops and few fruit-orchards.

3.8.3. Transect South

In this area largely in between the cities of Hubli and Dharwad 9 villages are selected. Lakmanhalli, Navalur, Rayapur and Jogellapur are located inside the HDMC boundaries (so no demographic data can be presented). The NH-4, the infrastructure lifeline between Hubli and Dharwad in the corridor, crosses the areas of Lakmanhalli, Navalur and Rayapur whereas the other villages, located more to the south and south-west of Dharwad have only secondary road connections to the centre of Dharwad. The national highway also marks the composition of the soil types, with black soils to the north-eastern side in Navalur

and Rayapur, while to the south-west of the NH-4 red soils is dominant. The demographic growth in this area is displayed in figure 3.7. The village of Jogellapur is only recently incorporated in the urban area due to the by-pass crossing the village area and therefore no data for the last decade was available. The village of Salakinkoppa, 8km from Dharwad centre stands out with a high growth rate exceeding the national growth rate. In this village the residential area increased to house in-migrants, who are responsible for the extra growth. The other villages fall below the national figure.

Figure 3.7: Growth rates of the selected villages in transect South



Source: Indian Census 1981,1991 and 2001

In Table 3.5 on the next page the land-uses are displayed, with the villages already incorporated having more non-agricultural land-uses. The urban development force is strongest in between the two cities and next to the NH-4. The HDUDA has planned a new township between these two cities and implementation is under way, transforming mainly red-soil agricultural areas in to build-up residential or commercial areas. Village areas like Navalur, Rayapur and Lakmanhalli are in the middle of a planned conversion of their agricultural lands, which can be seen in the share of industrial and residential land-use. The village of Lakmanhalli is completely incorporated into the build-up area of the city. The actual area sown is divers, with Lakmanhalli using all available agricultural land still available, while in Navalur the cultivable land is under more speculation, so net area sown is lower.

The transect stands out with relative low shares of TCA actually sown, which indicates relative high shares of fallow land for the villages at the end of the research area and non-agricultural land-use developments close to the city. In the villages Rayapur and Lakmanhalli industrial areas were developed in the 1970s (KIADB, 1999). Today Lakmanhalli industrial area is full, whereas in Rayapur a further 287 acres is acquired by the KIADB near the railway to expand the industrial areas in the corridor between the two cities. In the red-soil village areas numerous brick kilns were observed during our stay. In general it can be said that next to the NH-4 in the corridor hardly any agricultural land-use can be seen. Further away from the highway, agricultural land-use is still dominant. Examples of non-agricultural land-use next to the highway are petrol stations, showrooms, canteens, offices, colleges and schools, industry, warehouses and residential developments.

Table 3.5. Distance, population and land-use characteristics of the selected villages in transect South of the research area

Village (distance)*	Population	TGA**	TCA***	Net Area Sown as % of TCA	Residential Land-use	Industrial Land-use
Navalur (8km)	in HDMC	5622	91,4%	55%	1,3%	0,0%
Rayapur (10km)	in HDMC	1200	45,9%	98%	1,3%	29,2%
Lakmanhalli (2km)	in HDMC	2432	35,0%	100%	57,6%	3,0%
Jogellapur (7km)	in HDMC	382	92,4%	63%	3,1%	0,0%
Manigundi (12km)	4243	5049	77,9%	76%	1,1%	0,0%
Salakinkoppa (8km)	1174	1441	68,5%	75%	1,5%	0,0%
Baad (12km)	1698	1197	93,1%	51%	1,5%	0,0%
Nigadi (13km)	1919	1440	74,3%	77%	1,9%	0,0%
Devarhuballi (14km)	1954	1363	91,9%	80%	0,3%	0,0%

*Distance: Distance to Dharwad City Centre in a straight line.
**TGA: Total Geographical Area in acres
***TCA: Total Cultivable Area as percentage of TGA.
Source: India Census 2001, Interviews with village-accountants 2004

3.9 Conclusion

The three transects are divers in their available soil types, which create different cropping-patterns for them. The shares of agricultural land-use from the total geographical area also fluctuates from 90-100% in transect North to 39-92% in transect South and 35-91% in transect West. The industrial land-use for the different transects is opposite proportional with the agricultural land-use. Most industrial developments have taken place on initiative of the government, which have guidelines to conserve the fertile black soil areas for agriculture. As a consequence the urban influence in transect North are low, which can also be seen by the lack of good infrastructure facilities. Most urban developments take place in the corridor in transect South and next to the NH-4 in transect West.

Chapter 4: Analysis of the impact of urbanisation on Agricultural Cropping Patterns around Dharwad

4.1. Introduction

In this chapter the main question of the research: 'what is the impact of urbanisation on the observed and analysed agricultural land use patterns in the rural-urban fringe of Dharwad?' will be answered. The chapter focuses on the different agricultural land-uses in the rural-urban fringe of Dharwad and tries to identify typical rural-urban fringe agricultural land-use for this area. The agricultural land-use is reflected in the different cropping patterns covering the research area, from rainfed to irrigated cropping patterns. In the literature concerning agricultural developments in developing countries a distinction is made between agriculture in more isolated areas and agriculture close to the cities. As Ramachandran (1999) mentioned the cropping patterns near cities are different, more diverse and in line with the demand of the city, whereas in isolated areas the cropping patterns will be more traditional and subsistence based. A similar trend is supposed for the agricultural cropping patterns in the rural-urban fringe villages of Dharwad, selected for the research. The agricultural land-use of the 26 research villages in the rural-urban fringe will be analysed by looking at the existing cropping patterns in the period 1999-2003. This is done on the basis of the data collected during fieldwork research and interviews with village accountants compared with secondary data sources of North Karnataka, Dharwad District and Dharwad Taluka. By comparing the general trends of North Karnataka and Dharwad district, this thesis tries to describe a trend in specialisation of cropping patterns more oriented on city demand.

The first paragraph will introduce the crop classification used in this thesis. All the crops came across during research are classified in five groups, with a first division between commercial and subsistence crops. An introduction of the marketing strategies and possibilities in the research area is next. In order to assess the effects of the twin-city on the changes in cropping patterns around the city, first the historical cropping patterns in the North-Karnataka region and Dharwad District are discussed to display the general trends in the region. Next the general cropping trends in Dharwad District, Dharwad Taluka and the research area are compared with general trends in agriculture in North-Karnataka. After this comparison the specific cropping patterns of the three transects are discussed. First the subsistence cropping patterns in the three transects are discussed, followed by the rainfed commercial cropping patterns. The irrigated commercial cropping patterns are next. After this an overview of each transect is given for more insight in specific patterns in each transect. This is given transect-wise. The chapter ends with the characteristics of two crops typical for the rural-urban fringe, the floriculture and the fruit-

orchards. The first is labour- and capital-intensive, but highly profitable on the urban markets and the second does not acquire many labourers, but is a long-term profitable cropping pattern, which also protects the land from acquisition by the government. Two case studies are given of villages with high shares of these crops together with insights of the possibilities and constraints for the individual farmer to start this kind of cultivation.

4.2. Classification of the different cropping patterns

Before the analysis of the different cropping patterns encountered during research, the diverse cropping patterns have to be grouped in order to make comparison possible. The main distinction in cropping patterns is between the traditional, subsistence crops and the commercial crops. This is one the basis of input and seed costs and labour requirements. The classification of cropping patterns used by Sharma in "Technological change in Indian Agriculture" (1999) is also used here to distinguish the different cropping patterns, as it is in line with the situation in the Indian agricultural markets. In Table 4.1 the classification of the observed cropping patterns is displayed.

The subsistence crops are first of all cultivated for home consumption and have generally low marketable surpluses. They can be stored rather easily (1-6 months) and are sold as bulk goods with little margin for profit. Furthermore the subsistence crops are all rainfed, so no irrigation is used for the cultivation. For some crops the purpose for cultivating is twofold. Home consumption plus the extra of fodder for the livestock. An example of this is sorghum. The seeds for cultivating these subsistence crops are relative cheap compared to the commercial crops. The subsistence crops are classified in three groups, based on their biological origin into '*cereals and millets*', '*pulses*' and '*oilseeds*'. This is in line with the classification used by Sharma[3] (1999) and is used here because it is a classification based on the Indian agricultural situation.

The commercial crops consist of two groups: the '*rainfed commercial crops*' and the '*irrigated commercial crops*'. Cultivation of these crops is mainly for the urban market with marketable surpluses exceeding the 75%. Due to the perishable character, storage is difficult and cultivation is more risky, since larger investments are necessary for cultivation. However, the margin for profit is exceeding that of the subsistence crops by far. The commercial crops can be cultivated with irrigation, but some do not need irrigation.

[3] A small difference between Sharma's classification in "Technological change in Indian Agriculture" (1999) and the classification used here is the crop maize, which is classified in this thesis as '*irrigated commercial crop'*, because in most observations in the field the crop was cultivated with irrigation in the 'mungary' and the ' hingary' season. In Sharma's research maize was classified as '*cereals and millets*'.

Another division in the crops can be made between the field-crops on one side and the vegetables, flowers and permanent crops like fruit trees on the other side. The field crops are characterised by their traditional cycles of sowing and harvesting it, with the harvest being sold in large quantities. The other crops are more labour-intensive (in the case of vegetables and flowers), need investments such as irrigation facilities and are more profitable.

Table 4.1: Classification of the crops observed in the rural-urban fringe of Dharwad.

	The crop groups	**The different crops:**
Subsistence crops	*Cereals and millets*	Rice, Sorghum, Wheat, Save, Fodder, Ragi, Navane, Haveri.
	Pulses	Green gram, Tur, Bengal gram, Horse gram, Black gram, Cow gram, Red gram, Agasi.
	Oilseeds	Groundnut, Safflower, Sunflower, Sojabean, Sesamum (Ellu and Gurellu).
Commercial crops	*Rainfed commercial crops*	Chillies, Onion, Potato, Cotton, Tabacco.
	Irrigated commercial crops	Maize, Sugarcane, Vegetables*, Hippunerali, Mulberry, Floriculture, Fruit-Orchards**

*Varieties like Aubergine, Peas, Beans, Tomato, Cucumber, Cauliflower, Carrot, Beetroot, Ladyfinger and Garlic.
**Varieties like Mango, Sapotha, Guava, Coconut, Banana, Papaya, Lemon, Citafel, Curry leaf and Tamarind.
Source: Sharma (1999)

The marketable surplus for the main subsistence and commercial crops cultivated in the research villages is given in Table 4.2. This marketable surplus indicates the share of agricultural production for the urban market and indicates the level of interaction with the city. Due to the perishable character of *vegetables* and *flowers* the cultivating farmers frequently have to visit the market to sell their produce.

Table 4.2. Marketable surplus of main crops cultivated in the research area.

	Marketable surplus (%)	
Sorghum	S	10 - 25%
Green Gram, Bengal Gram	S	10 – 75%
Paddy, Wheat, Maize	S/C	40 - 80%
Groundnut	C/S	60 - 90%
Potato, Onion, Chillies	C	75 - 98%
Vegetables	C	75 - 98%
Fruit orchards	C	90 - 98%
Flowers	C	98 - 100%
Cotton, Sugarcane	C	98 - 100 %

*S= subsistence marketable surplus, C= commercial marketable surplus.

Source: Birmingham et al. (2001) and data from interviews with the village accountants

4.3. Marketing

The availability of reliable marketing routes for agricultural products has a significant influence on farm households' cropping decisions. A distinction must be made between the local markets and the regional markets. In the local market the buying and selling activities are confined among the buyers and sellers drawn from the same or nearby villages. The market exists mostly for perishable commodities (like horticulture crops and milk) in small lots. The large villages of Heballi, Amminbhavi and Narendra have their own small vegetable markets once or twice a week.

The regional market draws buyers and sellers from a larger area. These markets exist for food grains and other bulk crops. In the research area there are several agricultural produce markets, mostly located within the urban boundary of Dharwad. They appear severely fragmented and with insufficient linkage to state, national or international markets (Birmingham et al. 1998). This results in sporadic price collapse and price signal distortions. The lack of good storage facilities, information and infrastructure to bring the produce where demand is high contributes to this. Due to this the farmers can be hesitant in their cropping decisions for producing certain high value products and return to cultivation of traditional stable crops to avoid price and post-harvest, storage risk. This was also mentioned in interviews on household level with farmers. So, besides the influence of distance-decay on cropping patterns, the lack of clear and good functioning agricultural produce markets decline the opportunities for more commercial agricultural crops.

Box 4.1: Marketing Systems in the research area of the rural-urban fringe of Dharwad

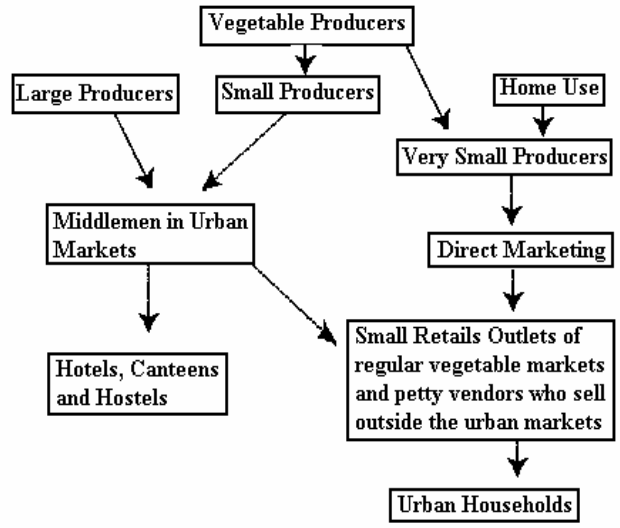
The *Agricultural Produce Marketing Committee*, better known as *APMC* is a government body erected in 1947 to support the agricultural market by offering price support, providing storage and marketing facilities. This government body is divided in the *APMC* and the Taluka Agricultural Produce Marketing Committee (TAPMC). The TAPMC caters to the rural populations, while the *APMC* caters to the peri-urban and rural populations. There are two locations of the *APMC* markets on this moment, in the city centre market of Dharwad and in the Corridor between Hubli and Dharwad at Amargol. This last one has been recently constructed. These markets are regulated markets, monitored by the government where licensed agents, farmers and traders from across the State meet. The agents are provided space for pooling and displaying the commodities within the *APMC* premises, while farmers can approach them to agree in facilitate sale through auctioning or tendering systems. The *APMC* deals in bulk sales bases on tenders submitted by large buyers. Only non-perishable commodities will be traded here. A problem mentioned by farmers is the payment of the produce, due to delays in payment between agents and APMC and so between APMC and the farmers (Source: Interviews with two APMC-agents, 2004).

For some horticulture products the Dharwad markets are passed in favour of more distant markets. From data of the UAS Dharwad Study (Brook et al. 2003) and own interviews with farmers in Narendra and Amminbhavi the marketing flows of large quantities of horticulture products, especially potato and

onions went as far as Belgaum or Mumbay if they could receive a higher price. In general the cereals, pulses and oilseeds are traded in the APMC, a regulated market in Dharwad (see box 4.1).

Horticulture commodities have multiple marketing routes, from the pre-harvest merchant to wholesale contractors, retailers or the self-selling of small quantities on the vegetables market. The APMC is not trading in perishable commodities. These perishable commercial crops have their own marketing chains. In figure 4.1 the marketing chain for vegetables are given. The small and medium farmers tend to concentrate on their own agricultural activities, as generally they cannot afford to spend their own labour towards full-time marketing. They will bring it to the urban market and sell to the middlemen (Brook et al. 2003). Only very small farmers do direct marketing as their quantities are to small for the middlemen. Further in this chapter the marketing strategies for the high value crops mango and flowers will be discussed.

Figure 4.1: Marketing chains of vegetable producers



Source: Brook et al. (2003)

4.4. Development of Cropping Patterns in the Region

This paragraph gives an introduction of the common cropping patterns in the region. They are used as a standard to compare with the cropping patterns of Dharwad Taluka and the research area around Dharwad. Table 4.3 (next page) shows the trends of the main cropping-groups of the North Maidan (Northern part of Karnataka) and Dharwad District for the periods 1966/69 and 1987/90 and the largest crops. The data are derived from the book "Technological change in Indian Agriculture" by T.C. Sharma (1999). The search for data on a smaller level (Taluka, Transect or Village level) for comparison with the collected data unfortunately gave no results.

The most important trends in cropping patterns derived from Table 4.3 are the dominating position of the cereals and millets in the North Maidan and Dharwad District, although there share decreased in the 20-year research period. *Sorghum* is the main staple crop for the whole region in both periods. The cereal-crops *sorghum*, *wheat* and *rice* all decreased in Dharwad District over the period, but the percentage of total cropped area for *wheat* and *rice* is higher in Dharwad District than the North Maidan. The decrease in *rice*-cultivation in Dharwad District in contrast with the increase in the North Maidan can be explained by the lack of sufficient rains, while *rice* needs a lot of moisture in contrast with *sorghum*. Oilseeds have

experienced the greatest increase in share at both spatial levels, mainly because of the introduction and fast rise of *sunflower* cultivation in the North Maidan and to a lesser extend in Dharwad District. The *groundnut* had a small decrease, but is still one of the main crops grown at both spatial levels. Pulses also increased slightly in both regions, whereas in the North Maidan *tur* increased its share and in Dharwad District *bengal gram* was the rising crop. *Cotton* is the main commercial rainfed crop for the North Maidan and Dharwad District, but the share decreased considerably. Dharwad district has in both periods the highest share of all districts in the State. The share of *chillies* increased little in the North Maidan, whereas in Dharwad District it rose sharply. In 1990 no other District had a higher share of *chillies* than Dharwad District (Sharma, 1999).

Table 4.3 Trends of the TCA of the dominant crop groups with the main crops in the North Maidan and Dharwad District for the periods 1966-69 to 1987-90.

	North Maidan 1966-69	**North Maidan 1987-90**	**Dharwad District 1966-69**	**Dharwad District 1987-90**
Cereals/Millets:	**55 %**	**47,2 %**	**46,7 %**	**38,8 %**
Sorghum	34,4 %	28,4 %	23,6 %	21,1 %
Wheat	5,4 %	3,4 %	9,5 %	6,5 %
Rice	3,8 %	4,1 %	8,8 %	6,1 %
Pulses:	**12,1 %**	**15,3 %**	**10,5 %**	**12,5 %**
Bengal gram	2,1 %	2,8 %	1,2 %	3,6 %
Tur	3,4 %	5,7 %	1,9 %	1,6 %
Oilseeds:	**14,9 %**	**23,8 %**	**15,4 %**	**20,7 %**
Groundnut	11,3 %	9,6 %	13,5 %	11,9 %
Sunflower*	1,5 %	8 %	0,5 %	4,5 %
Safflower**	0,6 %	1,7 %	0,2 %	0,9 %
Commercial crops:	**14,1 %**	**8,4 %**	**23,2 %**	**23,2 %**
Cotton	13,2 %	6,9 %	20,6 %	16,5 %
Chillies	0,9 %	1,5 %	2,6 %	6,7 %
Total %	**96,1%**	**94,7%**	**95,8%**	**95,2%**

* The research period for Sunflower is 1980-1990, because it was introduced in 1973.
**The research period for Safflower is 1974-1990, because it was introduced in 1974.
Source: Sharma (1999)

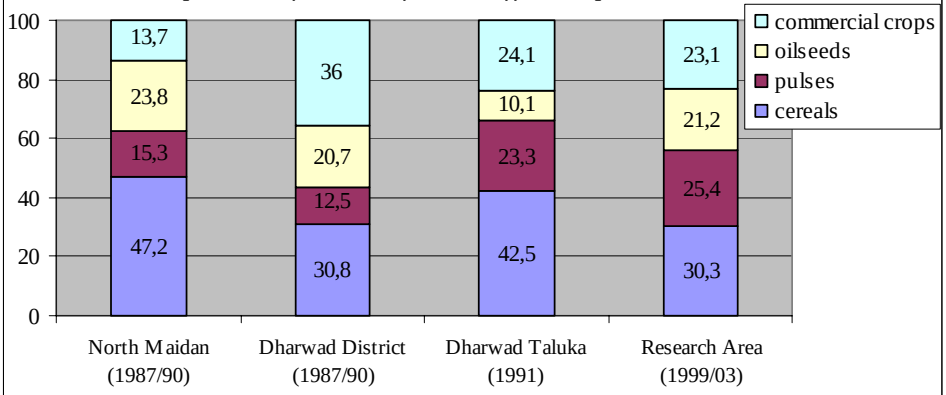
The trends of an increase in pulses and oilseeds together with a decrease in cereals and millets is similar in the two areas, although the shares of total cropped area are smaller for Dharwad District than the North Maidan. This is compensated by the high share of rainfed commercial crops in Dharwad District, compared to the North Maidan. So there is an indication of a higher share of TCA for commercial crops in Dharwad District.

4.4.1. Distribution of all Crop-groups in the Research Area

Below (see Figure 4.2) the distribution of the three rainfed subsistence crop-groups and the commercial crops in the rural-urban fringe will be compared with the cropping patterns in Dharwad Taluka and the wider regions of Dharwad District and the North Maidan to examine the differences.

Starting with the commercial crop group, consisting of irrigated and rainfed commercial crops, there is a large increase in Dharwad district and the smaller regions close to the city, compared to the North Maidan[4]. The main commercial crops in the research area are *onion*, *potato* and *cotton*.

Figure 4.2: Distribution of the subsistence crop-groups and the commercial crops as % of the TCA for the different spatial levels.



Source: Sharma (1999) and own research

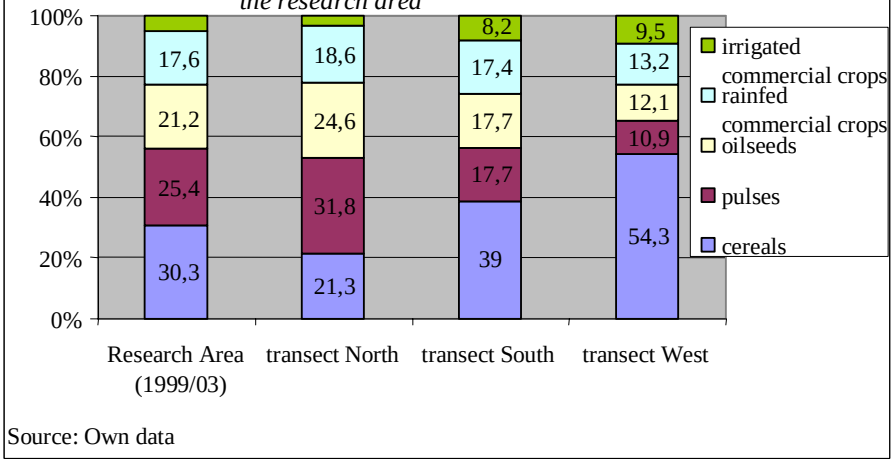
The share of TCA for oilseeds in the research area is far higher than in Dharwad Taluka and has more resemblance with the areas of North Maidan and Dharwad district. The oilseed-group in the research area consists mainly of *groundnut*, which has the highest share of the individual crops in the research area. The pulses have the largest share of TCA in the research area, with Dharwad Taluka having a similar share. *Green gram* is the main crop here. For the cereal-group the research area has the lowest share, which is in line with Dharwad District, but has still the largest area of TCA in the research area. The crops *sorghum* and *rice* are the most important cereals.

In the research area the three transects give a clear picture of their shares of different crop-groups in their cropping patterns for the years 1999-2003. This is displayed in figure 4.3 (next page).

Transect West has more than half of the TCA covered with cereals and millets. As a result the pulses and oilseeds have a meagre share. The share of TCA for the irrigated commercial crops is the highest in the research area, while rainfed commercial crops have the lowest share of TCA from all the transects.

[4] Sharma (1999) discusses only the main crops (more than 1% of TCA) cultivated in Karnataka. No irrigated crop is therefore included in his book.

Figure 4.3: Distribution of the crop-groups as % of TCA in the research area



Source: Own data

Transect South in the corridor also has a high share of cereals and millets, above the average of the research area. The pulses and oilseeds are evenly distributed and the share of commercial crops is high with 25,6% of TCA. Because of the mixed soils in the transects West and South, the comparison with larger spatial levels is less convincing due to their large areas of black soils.

Transect North has by far the largest TCA and is therefore dominant for the average in the research area. As this is the area with almost solely black soils, the comparison with the other spatial levels is more relevant. The drop in share of cereals and millets is huge in comparison with the other areas and the large share of pulses cannot be found in any other area. It seems that all other groups are gaining share from the low percentage cereals. The share of the third group of oilseeds also stands out, with the largest share off all areas.

An interesting point is the share of commercial crops for the different transects. Despite the differences in soil type the share of commercial crops is in all transects between the 22 and 26 % of TCA. Transect North has the highest share of rainfed commercial crops, while transect West has the highest share of irrigated commercial crops. All areas around the city of Dharwad seem to have a rather equal share for commercial crops. In paragraph 4.4.4 en 4.4.5 these crop-groups will be discussed further.

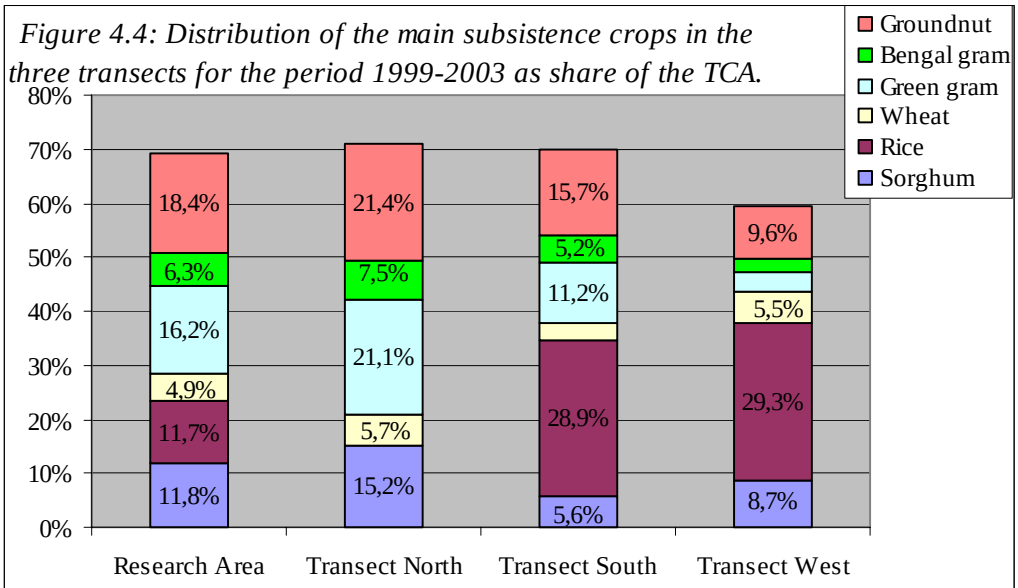
4.4.2. Cropping Patterns of the main Subsistence Crops in the three Transects of the Research Area

Closing in on the city, the trends in the main rainfed cropping patterns of the rural urban fringe research area of Dharwad, together with a division into the three transects are shown in Figure 4.4 (see next page). The main crops of the first three rainfed crops groups, the cereals and millets, the pulses and the oilseeds are discussed here. In total these crops cover about 60 to 70% of TCA in each transect.

Transect North is a dominant black soil area. It has a large proportion of *sorghum*, of which half is cultivated in ‘hingary’ season. Compared to the other transects, the northern area benefits the most from

the second season with a large area cultivated in the 'hingary' season. The share of the 'hingary' crops *wheat* and *bengal gram* is therefore highest in the northern transect. Major crops in this transect are *green gram* and *groundnut* with both more than 20 percent of the area covered. Close to the city *groundnut* dominates, while village areas more on the edge of the research area cultivate more *green gram*.

Figure 4.4: Distribution of the main subsistence crops in the three transects for the period 1999-2003 as share of the TCA.



Source: Own data

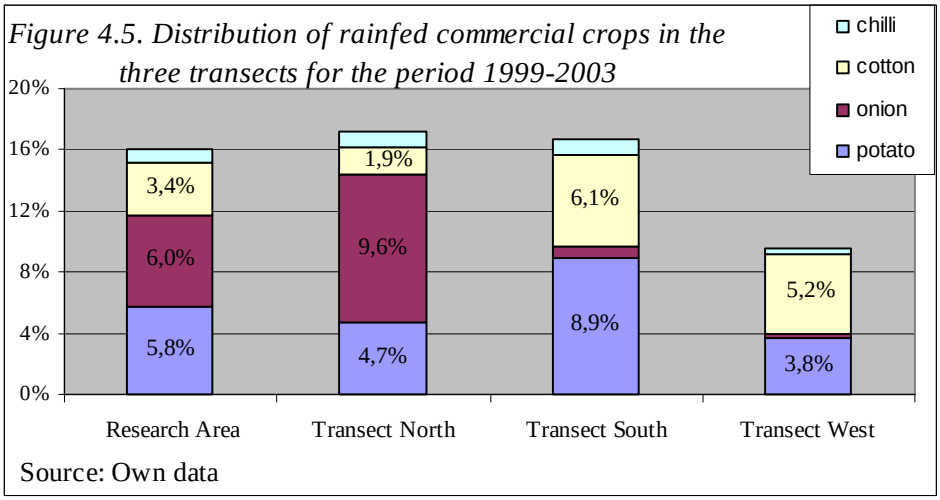
Transect South, located in the corridor between the two cities, has mixed soil types with a larger share of red soils. *Rice* is the main crop, cultivated solely on the red soils. In the red soil village areas the share of rice varies from 29,1% up to 83,8% of the TCA of the village area. *Groundnut* is the second main crop cultivated mainly on the more black soils in the village areas next to the NH-4, with *green gram* as second crop.

Transect West has *rice* as dominant crop on the red soils. *Sorghum* can be seen as a substitute crop for *rice*, when rainfall is less, but the transition to *sorghum* is not yet started on a large scale (the same trend is there in transect South). *Groundnut* is the second largest crop, cultivated on the black soils in the area. *Fodder* for animals, not mentioned in Table 4.3 because this is mostly a by-product of cereals, but in transect West it is cultivated on 5,4% of the total cultivated area, mainly on dried-up *rice*-fields.

4.4.3. Cropping Patterns of the Rainfed Commercial Crops in the three Transects of the Research Area

In this paragraph the commercial crop-group is further divided in the rainfed commercial crops and the irrigated commercial crops. Below the main rainfed cultivated commercial crops are displayed for the three transects of the rural-urban fringe research area (see figure 4.5).

Figure 4.5. Distribution of rainfed commercial crops in the three transects for the period 1999-2003



Source: Own data

Transect North has with 18,6% the largest share of all transects under rainfed commercial crops. The variation in share between the village areas is from 12,0% to 31,2%. The village areas with a low share of rainfed commercial crops have a relative high share of irrigated commercial crops. *Onion* is the number one commercial rainfed crop, cultivated almost exclusively in the northern and eastern part of the transect with the large village areas of Amminbhavi and Hebbali (about 15 km from Dharwad) as main producers. *Potato* is an important crop in the village areas more close to the city, but had a decreasing trend in area cultivated in the research period. Both crops can only be cultivated on black-soils. *Cotton* (1,9%) only has a meagre share when comparing it with data on District (16,5%) and Taluka (14,7%) level. It appears that *onion* and *potato* are more preferred in this area, instead of *cotton.*

In Transect South, the cash crops *potato* and *cotton* dominate the corridor zone. This transect can be separated in two parts. The first with the village areas located on the western side of the transect on red soils, with rainfed commercial crops having shares between 3,7% and 6,1%. The second with the village areas more to the south with shares between 13,2% and 23,0%. The *potato* is cultivated only in the village areas of Lakmanhalli, Navalur and Rayapur next to the NH-4 on the black soils. *Cotton* is the main cash crop for the rest of the villages in the more red soil areas, with Manigundi standing out with 19,1% of TCA under *cotton*.

Transect West has similar soil-type characteristics as transect South. The cultivation of rainfed commercial crops is highest in the village areas next to the NH-4, between the 13,2% and 16,8%, compared to a share between 5,8% and 8,2% for the village areas further away from the highway. The

village areas of Yattinguda and Narendra are main *potato* producers, whereas *cotton* is cultivated in almost all villages.

4.4.4. Cropping patterns of the Irrigated Commercial Crops in the three Transects of the Research Area

The availability of irrigated land is a great opportunity for farmers to develop their cropping pattern and increase their income out of the agricultural produce. As already mentioned in the paragraph 3.3, irrigation in the research area around Dharwad irrigation is mostly done by bore wells, tanks or wastewater. The amount and availability of irrigation water is divers in the research area. From interviews held with the village-accountants data of the amount of bore wells for each village in 1998 and 2003 and the irrigated area were gathered. In Table 4.4 the number of bore wells per transect are given (see appendix 3 for village-wise data on the number of bore wells and irrigated area).

Table 4.4. Total number of bore wells in the research villages for each transect in 1998 and 2003.

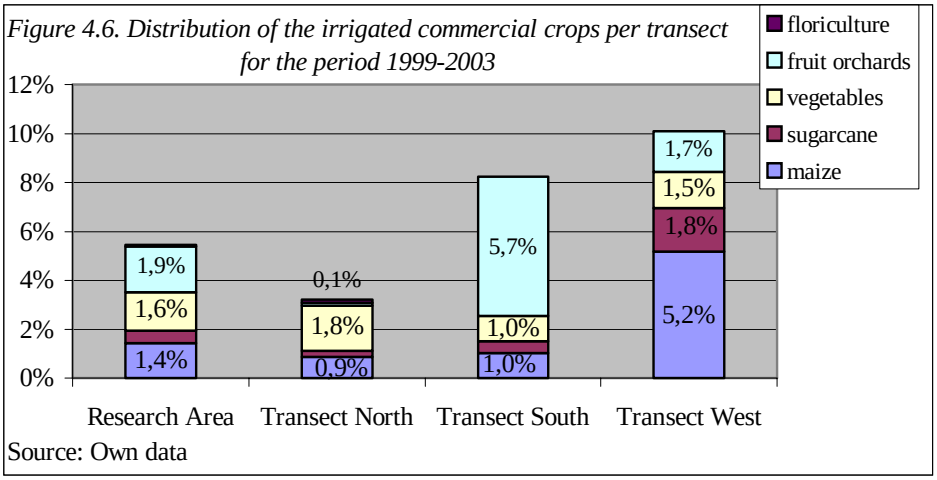
Transect	**Cultivable area**	**1998**	**2003**	**% increase**
North	37.638 acre	135	252	86,7%
South	15.250 acre	149	353	136,9%
West	7.909 acre	34	99	191,2%

Source: Adapted from the questionnaires of the village-accountants (2004)

In Figure 4.6 (next page) the distribution of the irrigated commercial crops per transects are displayed. A large difference in irrigated area is noticed. The villages in transect North have only 3,1% of their area irrigated, compared to 8,2% in the south and 10,1% in the west. The different soil characteristics of the red and black soils are great determinants in the areas under irrigation.

In transect North irrigation is mainly used for *vegetables*. Close to the city *vegetables* like aubergine, cucumber, cauliflower, peas and leafy vegetables are cultivated on the irrigated plots for the urban market. Irrigation here is also possible through wastewater from Dharwad. Further away from the city the field crop *maize* starts to replace the *vegetables* and the *vegetable*-cultivation becomes dominated by the peas. Also a small share (0.1 %) is used for *floriculture*. This flower cultivation is labour and capital intensive and has strong linkages to the city. This will be further discussed in the paragraphs 4.6.4, 4.6.5 and 4.6.6.

Figure 4.6. Distribution of the irrigated commercial crops per transect for the period 1999-2003



Source: Own data

The southern transect located in the corridor zone between the two cities has a dominating share of *fruit-orchards* on the irrigated land. This dominates especially the red-soil areas on the western side of the transect. The *fruit-orchards* are often located close to the roads, because the heavy produce must be transported by tractor or truck to the market, the factory or to warehouses. In the paragraph about the *fruit-orchards* more characteristics of this rural-urban phenomena are discussed. Furthermore *vegetable*-cultivation is concentrated close to the city and *sugarcane* and *maize* is produced more distant from Dharwad.

Transect West has the largest area under irrigation with the field crop *maize* having the lion's share. *Fruit-orchards* are mainly encountered next to the roads throughout the area, with a sharp increase near the NH-4 and the by-pass. *Vegetable*-cultivation in this area is distributed more evenly with almost every village having a small share. *Sugarcane*, with the second highest share is the most traditional of the irrigated crops. Its share is decreasing, and, looking at the shares of the other transects it gives an indication of the more commercial priorities of the farmers in the Northern and Southern research areas.

4.5.1. Commercial vs. Subsistence Cropping in transect North

To display the differences in cropping patterns between the villages in transect North the total percentage for the subsistence and commercial crops for each village is displayed in Table 4.5, together with the dominant crops for the village. Near the city, in the three village-areas of Dharwad Rural, Malapur and Kamalapur *potato* and *vegetables* are the main commercial crops. Along the wastewater stream in Dharwad Rural *vegetables* are cultivated, whereas in all other places the bore well must be used for irrigation. These three villages are incorporated inside HDMC. Due to the small number of bore wells and the soil characteristics (see 3.2) commercial crops are mainly rainfed in this transect. *Cotton* is the traditional crop for the black 'cotton' soils, whereas *potato* used to be cultivated more to the south. The produce of *onion* has come up due to good market prices (Nidagundi, 2003), but is only confined to the large village areas of Amminbhavi and Heballi. The villages near Dharwad have almost half of their cultivated land sown with the subsistence crop *groundnut*. Of all subsistence crops it has the highest share

for the urban market (see table 4.2). Besides *groundnut*, *green gram* is a major crop cultivated more in the distant villages.

Table 4.5. Percentage of commercial and subsistence agricultural land-use with the main crops for the research villages in transect North.

Village area	Distance/ Location	Share of TCA		Share of TCA	
		Commercial	Crops:	Subsistence	Crops:
Dharwad Rural	0,5 km / North	*20,1%*	Potato (6,7%) Vegetables (5,3%)	*79,3%*	Groundnut (41,1%) Green gram (10,5%)
Malapur	1,5km / North	*35,7%*	Potato (28,4%) Vegetables (2,7%)	*64,3%*	Groundnut (49,0%) Wheat (4,4%)
Kamalapur	5 km / North	*32,4%*	Potato (28,8%) Vegetables (1,3%)	*67,1%*	Groundnut (49,8%) Green gram (4,1%)
Yadwad	11 km / North	*16,0%*	Cotton (7,0%) Potato (3,3%)	*84,0%*	Green gram (53,4%) Groundnut (12,9%)
Kurabagatti	13 km / North	*37,0%*	Potato (9,7%) Cotton (9,7%)	*63,5%*	Groundnut (19,7%) Green gram (16,1%)
Shibargatti	15 km / North	*26,2%*	Cotton (7,8%) Potato (7,4%)	*73,8%*	Green gram (23,7%) Groundnut (19,7%)
Lokur	16 km / North	*23,1%*	Cotton (7,9%) Potato (3,3%)	*76,7%*	Green gram (26,1%) Groundnut (16,5%)
Amminbhavi	15 km / North-east	*14,5%*	Onion (10,0%) Cotton (2,0%)	*85,5%*	Green gram (26,7%) Groundnut (13,9%)
Lakamapur	10 km / East	*27,8%*	Cotton (11,4%) Potato (9,6%)	*72,2%*	Groundnut (33,0%) Green gram (13,7%)
Hebbali	14 km / East	*25,9%*	Onion (21,6%) Cotton (9,4%)	*74,2%*	Sorghum (20,5%) Green gram (15,7%)

Source: Own data

4.5.2. Commercial vs. Subsistence Cropping in transect South

Transect South is dominated by red soils, but has black soils in the village areas of Navalur, Rayapur and Lakmanhalli, next to the NH-4 in the corridor. Table 4.6 displays the shares of commercial and subsistence crops for all villages. In these villages *potato* is the main commercial crop. From interviews held with farmers in the field it came clear that this area has traditionally been a potato-area, but due to erratic rainfall *potato* is often replaced by *groundnut*. In the red-soil area *fruit-orchards* are the main commercial crops, with large areas covered, especially close to the city. Besides the fruits, *cotton* is often the second commercial crop cultivated.

Looking at the subsistence crops cultivated on the red soil *rice* is the dominating crop, with shares up to 83% at the end of the research area in Devarhuballi. The share increases as the distance to the city increases. The black soil-areas have similar subsistence crop-patterns as transect North.

Table 4.6: Percentage of commercial and subsistence agricultural land-use with the main crops for the research villages in transect South.

Village area	Distance/ location	Share of TCA		Share of TCA	
		Commercial	**Crops**	**Subsistence**	**Crops**
Navalur	8 km / South-east	29,5%	Potato (18,3%) Fruit-orchard (4,0%)	73,7%	Groundnut (23,1%) Green gram (21,9%)
Rayapur	10 km / South-east	17,1%	Potato (11,0%) Vegetables (2,6%)	70,5%	Groundnut (35,2%) Green gram (26,4%)
Lakmanhalli	2 km / South	26,1%	Potato (9,8%) Fruit-orchard (8,5%)	82,9%	Groundnut (32,8%) Sorghum (10,8%)
Jogellapur	7 km / South	54,9%	Fruit-orchard (34,9%) Cotton (15,4%)	45,1%	Rice (29,1%) Sawi (5,8%)
Manigundi	12 km / South	24,5%	Cotton (19,1%) Fruit-orchard (2,4%)	75,9%	Rice (56,3%) Groundnut (8,1%)
Salakinkoppa	8 km / South-west	29,1%	Fruit-orchard (21,2%) Cotton (6,0%)	70,9%	Rice (55,3%) Sorghum (7,0%)
Baad	11 km / South-west	12,4%	Fruit-orchard (8,2%) Cotton (3,8%)	87,6%	Rice (68,4%) Fodder (16,0%)
Nigadi	12 km / South-west	12,7%	Fruit-orchard (6,5%) Cotton (4,5%)	87,3%	Rice (78,2%) Horse gram (3,1%)
Devarhuballi	13 km / South-west	13,6%	Sugarcane (5,4%) Cotton (3,7%)	86,4%	Rice (83,8%) Soja beans (0,7%)

Source: Own data

4.5.3. Commercial vs. Subsistence Cropping in transect West

Transect West has similar soil conditions as transect South and has therefore similar crops grown. In this transect the villages of Yattinguda and Narendra have mixed soil conditions with red and black soils available, while the other villages are red-soil areas. The different share of commercial and subsistence crops are given in table 4.7. *Cotton* and *maize* are the main commercial crops cultivated in the red-soil villages, with *maize* having the highest share in the village of Hiremalligwad, closest to Dharwad, while in the villages further away *cotton* is the main commercial crop. The large share of commercial crops in the villages next to the NH-4 stands out. In the village of Devageri, which is located away from any major road, sugarcane is the second commercial crop cultivated. On the black soils of Narendra and Yattinguda *potato* is a main commercial crop, only defeated by the total share of *cotton* in Narendra.

Table 4.7: Percentage of commercial and subsistence agricultural land-use with the main crops for the research villages in transect West.

Village area	Distance/ Location	Share of TCA		Share of TCA	
		Commercial	Crops:	Subsistence	Crops:
Hiremalligwad	6 km / West	22,2%	Maize (9,8%) Cotton (6,1%)	77,7%	Rice (25,6%) Fodder (23,2%)
Chikkamallig-wad	7 km / West	11,6%	Cotton (5,6%) Maize (2,4%)	88,5%	Rice (59,7%) Fodder (11,9%)
Devageri	16 km / West	9,1%	Cotton (6,8%) Sugarcane (1,3%)	90,9%	Rice (86,2%) Green gram (2,9%)
Yattinguda	4 km / North-west	17,7%	Potato (11,4%) Maize (2,6%)	82,1%	Groundnut (50,4%) Bengal gram (8,0%)
Narendra	8 km / North-west	25,9%	Cotton (8,3%) Potato (7,4%)	74,1%	Wheat (19,4%), Groundnut (13,0%)
Mummigatti	10 km / North-west	30,5%	Cotton (14,5%) Maize (6,9%)	69,5%	Rice (32,2%) Sorghum (9,2%)
Belur	14 km / North-west	28,1%	Cotton (14,8%) Maize (5,3%)	71,9%	Rice (42,0%) Sorghum (9,8%)

Subsistence crops in this area are *rice* on the red-soils and *groundnut* on the black-soils. The share of *rice* increases with the distance to Dharwad for the villages Hiremalligwad, Chikmalligwad and Devageri, while the other villages close to the NH-4 have a lesser share of *rice*. The crop *sorghum* is the second subsistence crops in these villages.

4.6. Characteristics of two main commercial crops cultivated in the research area

After a first analysis of the different crop-groups and the main crops in the cropping patterns of the research area, it is now time to go into more depth in the trends of two specific rural-urban cropping patterns. The first, the fruit-orchards are characteristic for this area with numerous farmers transforming their plot of agricultural land in to mango-orchards. This has been the case since long as can be observed by the amount of mango trees in between the build-up areas of the city. The second, the flower cultivation is small in absolute size and confined to only one village in the rural-urban fringe of Dharwad. But there is a yearly increase in the area covered with flowers and there is potential as Hubli-Dharwad is the third biggest city in Karnataka. These two specific crops are chosen here for a case study, as they are good examples of profitable rural-urban fringe cropping-patterns with both different input and yielding characteristics.

4.6.1. Fruit-orchard characteristics in the research area

Fruit cultivation has been a tradition in many parts of India, including Dharwad. The trees of fruit-orchards are increasingly being planted as an investment to reduce tax burdens and as a response to urban

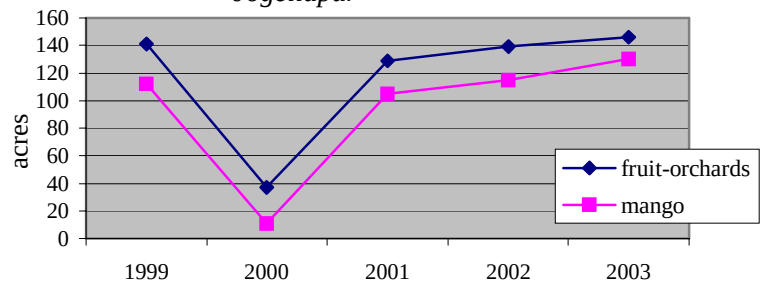
influences. The main species planted in the research area is *mango* (*Mangifera indica*), along with smaller numbers of *sapotha* (*Achras zapota*) and *tamarind* (*Tamarindus indica*). In 2002 Dharwad Taluka had 1977 acres under mango-orchards, compared to 274 acres of sapotha (Horticulture Department, Dharwad, 2003). There are many such orchards being planted close to the city of Dharwad, taking advantage of local markets, the existence of a processing plant and marketing routes to other states in India (Nidagundi 1999).

Hunshal and Nidagundi (1999) observe "A tremendous increase in the area under mango in Dharwad, especially at the western side". The increase in the number of mango-orchards around Hubli-Dharwad appears to be due to factors including the fact that mango trees require less moisture than staple crops, increasing the likelihood of producing a good crop in times of increasingly erratic rainfall. Labour requirements are also lower; therefore competing with urban-based employment is not as difficult as for vegetable and flower cultivation. Orchards therefore represent a response to urban influence over agricultural conditions, though tax incentives are also responsible for people investing in orchards (University of Birmingham 1998). In the research area large plots of mango trees can be observed next to the by-pass and the NH-4 and in the villages on the south and south-west side of Dharwad on red-soils. One of these villages is Jogellapur, with 130 acres under mango-orchards.

4.6.2. Mango-orchards: the case study of Jogellapur

The village area of Jogellapur is located 8 km south-west of Dharwad, between the newly build by-pass and the city of Dharwad. It is located within the urban borders of the HDMC, due to the by-pass running through the area of Jogellapur. Mango-orchards account here for 35% of the TCA. Farmers started cultivating mango on a commercial basis around 75 years ago. Apart from the cultivation of mangoes some farmers also have the knowledge of grafting mango trees. The preparation of grafted seedlings started in the same period and approximately 10.000 seedlings are being produced yearly (Nidagundi 1999). The trend of all fruit- and the mango-orchards is displayed in figure 4.7 and shows that mango is the main fruit in Jogellapur. The downfall in 2000 in the figure can be explained by loss of land due the newly drawn borders of Jogellapur village-area. The village-area was cut by the new by-pass and lost land to

Figure 4.7: Trend in fruit and mango-orchards in Jogellapur



Source: Own data

Yerikoppa. But there is still an increase in area under mango-cultivation visible. From another research done by the University of Birmingham (1998) in the village together with information received from interviews with farmers in the village it can be claimed that every year about 10 acres of agricultural land is converted into mango-orchards. The large number of small mango-trees in the field can see a visible conversion to mango-orchards. From interviews with landowners next to the NH-4, it came clear that plots of land were bought by city-entrepreneurs and converted into mango- or fruit-orchards as a more long-term investment. As agriculture is exempted from income tax, it is attractive for businessmen to invest in mango-orchards and new regulations make it difficult for the government to acquire land with trees from their owners.

In the village-area of Jogellapur 7 farmers (random selected) who were willing to co-operate were interviewed with the farmers household questionnaire to get more insight in the possibilities and constraints of the mango-orchards. The village is divided in the landowners on the front side and the land labourers on the backside of the village. All seven farmers (landowners) had mango-orchards on their land with some farmers also cultivating other fruit like *sapotha*. The mango-plots varied between 1 and 12 acres and had bore wells (up to 3) to irrigate the trees. This is vital for the trees in the growing stage and increases the yields. One farmer did not have a bore well and bought truckloads of water to irrigate. In between the trees the land is cultivated in the first 8 years when the trees are still small.

Box 4.2: Progressive farming techniques of an urban farmer in the village area of Jogellapur.

Outside the village with access to the by-pass a farmhouse is located, owned by a businessman from Dharwad, who has three more farms in the vicinity. The plot of 10 acres of land is covered with all kind of fruit trees, from mango to drumstick and from sapotha to coconut and with a dairy of 15 cows. Furthermore he is experimenting with different vegetables in which he sees a good future due to good profits. The farm uses new farming techniques, like the cultivation of fodder on the farm on land irrigated by the dairy. Due to this the fodder is more green and the animals produce more milk. With the cow dung, natural gas is produced for cooking and a newly build well can be used as recevoir for irrigation water and for swimming. On the plot he has multiple new irrigation techniques. There is pipe-irrigation for the large trees, a sprinkler for the vegetables and drip-irrigation for the seeds of vegetables. A battery-manufacturing unit is planned on the plot due to the good location next to the by-pass. (Source: Interview with mr. Kulkarn, 2003)

Common crops cultivated in between the trees are *sorghum, soja bean* and *green gram*. The trees start producing mangoes after 5 years and can remain to 100 years. With good management good economic yields starts after 12 years. This is possible with irrigation, but without this it will take some more time for the trees to grow. So it is important to understand that mango-orchards are a long-time investments for the future, economically viable only after 12 years. A mango tree gives yield only once in two years. In

Box 4.2 (next page) a detailed picture of a farmers household interview with a businessman from Dharwad is displayed.

The main reasons for farmers to start mango-orchards in Jogellapur are:

- to get a regular income (mentioned by 2 farmers)
- to get more profit, while other crops give poor yields due to poor land (3*)
- labour constraints for cultivating other agricultural crops (2*)

(Source: Interviews with farmers in Yogellapur, 2004)

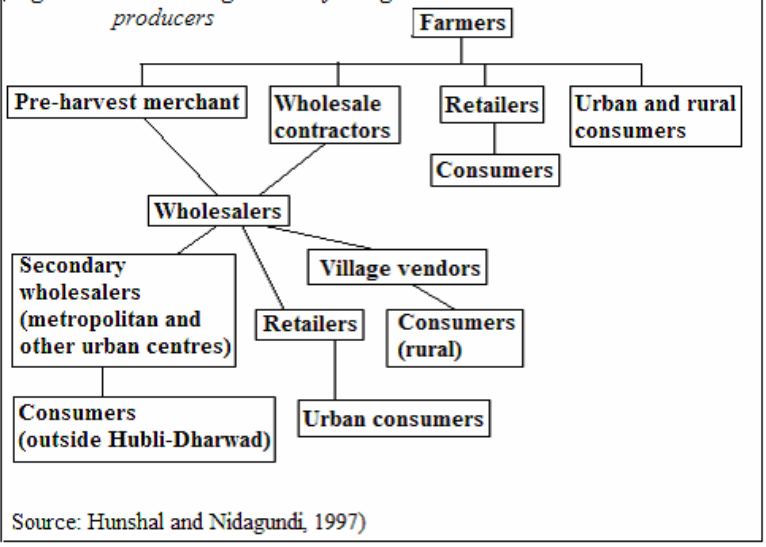
The labour constraints in this village are due to the fact that a large proportion of labourers is engaged in marketing of fruits in almost all seasons or in the brick-making industries. Furthermore jobs in the city or winemaking are more profitable activities than agricultural labourer (Hunshal and Nidagundi 1999).

The problems with mango cultivation start with the weather. When the tree is flowering, powdery mildews can spoil the growing of the fruit. This can reduce the yield with 50 to 70%. Another problem is the requirement of a constant watch and ward for the last 45 days of the yielding, as there is much theft of mangoes. This is often a problem of the contractor, who has to take care of the yield.

4.6.3. Marketing strategies for mango cultivation in the research area

The big hub of harvested mangoes is either sold directly or indirectly to the Tarihal processing industry or is contracted by 'bhagwans' (pre-harvest contractors). Some of the small farmers also take the fruit to Dharwad and sell it directly to consumers. In figure 4.8 a schematic overview is given of the different marketing strategies. Because of the weight of the fruit transport is usually done by tractor or truck. Only small quantities are taken to the market by bus.

Figure 4.8: Marketing chains of mango producers



Source: Hunshal and Nidagundi, 1997)

The contracting of the mango-orchard often takes place at January, when the tree starts flowering (the pre-harvest contracts). The flowering and age of the tree are important to establish the contract price.

Contract prices are given for every 100 trees. Once contracted, the rest of the activities like irrigation, spraying chemicals, harvesting and watch and ward are taken up by the contractor. He will pay 50% in advance and 50% when the fruit is harvested. So the contractor takes a large share of the risk of a bad yield away from the farmer.

4.6.4. Floriculture Characteristics in the research area

The Karnataka State is the leader in floriculture, accounting for more than half of India's total flower production. The traditional floriculture is practised in all the districts of the state on about 20,000 hectares with a production of over 1.24 lakh tonnes, annually accounting to nearly 30 per cent of the country's production of flowers (Deccan Herald, 18-07-2003). However Dharwad District accounts for only a small proportion of this percentage with 156 hectare under floriculture.

The demand for flowers goes throughout the year in the State, because in the traditions and religions practised in the society, the flowers are main items. This demand picks up more during festival days and in the marriage season (summer). So this highly urban demanded, perishable commodity has a good market throughout the year. The advantage for the flower cultivators is the very short growing cycles of the flowers. Once the plant starts flowering it will continue for seven months. So they can have a weekly income out of it. However, the cultivation of flowers is a more risky enterprise than the production of other value crops. It is heavily reliant on investment capital, irrigation, reliable marketing channels and labour availability at key points in the growing cycle.

In Dharwad District the key flower types grown are *chrysanthemums, rose* and *gylardia* and these have emerged in the last 25 years as important commercial crops. The land covered in Dharwad Taluka grew steady up to 68 hectares in 2002. In Dharwad Taluka the flower cultivators mainly produce the chrysanthemum flower on the black soils. The village of Kurabagatti, around 10 km to the north of Dharwad is a main producer of chrysanthemums, which is grown on 64 acres of land (2003). In the rest of the transect a few scattered small plots of floriculture were also observed or traced back in the collected data, about 0,5 to 1 acre plots and no more than 10 in number in the 5 year research period

4.6.5. Floriculture: A case study of Kurabagatti.

The village-area of Kurabagatti in transect North stands out with a good number of farmers who cultivate the chrysanthemum flowers on parts of their land. Kurabagatti is the only village area where continuation and even development in the area under floriculture was observed, from 22 acres in 1999 to 64 acres in 2003 (own data). The cultivation of the chrysanthemum flowers started in 1995 in the village, after a farmer came to know the floriculture and the advantages of it from another farmer from the neighbouring village of Shibargatti. When the farmer introduced the flower cultivation on his field and other farmers saw the possibilities, they started copying him and in 2003 about 50 farmers cultivated chrysanthemum on (parts of) their irrigated land. The cultivation of flowers in Shibargatti did not continue. In the household interviews they explained it by the less appropriate soil conditions and diseases he came across.

Seven household interviews with farmers in the village -five of those were chrysanthemum farmers in Kurabagatti- were held to get an impression of the possibilities and constraints for farmers to cultivate flowers and the farmer his decisions to do so. Furthermore in paragraph 4.6.5 an impression of the marketing strategies is given.

The foremost important aspect, which enables the farmer to start cultivating flowers, is the access to irrigation facilities. With this comes directly the access to capital to invest in irrigation systems. Small farmers with less than 5 acres of land will not get a loan from the bank and lack the capital to invest. So large farmers have an advantage.

In all the cases but one (see box 4.3) floriculture was practised only on a part of their irrigated land. The farmers with floriculture ranged in size from 6,2 up to 32 acres, with an irrigated area between 0,2 and 5 acre. Floriculture plots size varied between 0,2 and 2 acres, with at least two farmers spoken who had future plans to increase the area under flowers. The rest of the irrigated land was covered with vegetables and field crops, such as potato, cotton and maize.

The main constraint for floriculture farmers in the research area to develop and increase their size is the availability of agricultural labourers. The claim from the Baseline Study, University of Birmingham that: “The many small floriculture units rely heavily on household labour and, as a result,
the availability of waged off farm employment may have future implications”, can also be recognised in the case of the Kurabagatti. All the floriculture farmers spoken in Kurabagatti relied in the first place on household labour. No family members had off farm employment. The floriculture farmers experienced a

decrease in availability of agricultural labourers and an increase in the wage they had to pay for them. From the interviews it is understood that during key points in the growing process the labourers are brought in from another neighbouring villages, while in the maintenance periods (weeding, spraying) the labourers are available in the village itself.

Box 4.3. Farming strategies of a small farmer's household cultivating flowers.

A joint farming household, consisting of 10 members has 6,2 acres of land and no bore well. Since 4 years they rent the bore well from a neighbouring farmer to irrigate 20 guntas (half acre) of black soil for flower cultivation. They have to pay half their income from the floriculture to the bore well owner for using it. The information about floriculture and the cultivation techniques was received in the village. They made use of crop loans to be able to buy the necessary inputs for cultivating chrysanthemums. On the rain fed land the household cultivated potato and cotton for the market, but since three years groundnut, green gram and sorghum are grown, because there is less rainfall and it requires less labour. All the members of the farmers' household are engaged in agriculture on their own land or as labourer on others land. The family sells their flowers in the village itself or in Dharwad, where one of them will sit in the market. No long marketing chains in this case, but small-scale direct marketing to get a better price for their small flowers produce.
(Source: Interview with Mr. M.Nekar, 2003)

4.6.6. Marketing Strategies for Floriculture in the Research Area

The flowers grown in Kurabagatti are marketed almost entirely in the cities of Hubli and Dharwad. When there are large quantities of produce (2000-5000 quintel) they will be marketed in Belgaum, where better prices can be obtained. Research done in the Hubli-Dharwad City Region by the Baseline Study (1998) note that floriculture cultivation tends to capture a low proportion of the total retail price as they have failed to form marketing co-operatives or any other type of intermediary organisation. A reason for this can be the small-scale of operation, with only small plots of floriculture. As a result wholesalers, commission agents and retailers capture a high proportion of the retail price.

Picture 4.1: Floriculture in the village of Kurabagatti.

The price farmers in Kurabagatti received for their produce was between 5 and 50 Rp a kg, with 50 Rp when there is a peak demand and 5 when there is a price-fall in the market. In general the price is around 15-20 Rp. It must be said that all floriculture farmers spoken made use of yearly crop loans to invest in the input necessary for flower cultivation. Repayment will be there after yielding. Due to this the farmers are forced to bring their produce to the commission agents, where they won't get the best price and direct payment. Farmers told that commission agents would take 12,5 Rp for every 100 Rp traded commodity.

On of the responses of the farmer to the poorly developed agricultural produce markets in the area is the small-scale producer marketing. The floriculture farmers carry small quantities of produce in to the city, often by bus where they will sell it themselves in market. From research done by the University of Birmingham (1998) in the Hubli-Dharwad City Region can be concluded that floriculture depends heavily on this type of marketing route. Between the 80 – 85% of the flower produce is taken to the markets in Dharwad, Hubli and Haveri by bus and only 5-10% is taken by bullock carts and tractors (for large quantities). The floriculture farmers in Kurabagatti told that they went once a week to the market to sell their produce.

Chapter 5: Conclusion

The research in this thesis concerned the dynamics in agricultural land use in the rural-urban fringe of Dharwad, India. The research was executed by observing is the cropping-patterns of 26 selected villages within a 16km circle around Dharwad. The setting in which the research has taken place has been described in terms of location, physical landscape, soils, climate, rainfall and irrigation. These are important natural determinants for the agricultural use of the land. As there are differences in these determinants for different locations around the city of Dharwad, the observed cropping patterns were also diverse. The cropping patterns are discussed on village level.

The urban centre of the research area, Dharwad, was described in terms of available infrastructure, development of land-use and size, demographic growth and planning institutions present. The urban influence on the selected villages for this research varies. Ramachandran his 'stages of urbanisation' classification for villages in the rural-urban fringe –with a slight modification as explained in chapter 2- can know be used to identify in which stages the selected villages in this research are located.

Transect North

In the 10 selected villages of transect North the land-use is dominated by agriculture. This black-soil territory is in the directives of the HDUDA even excluded from conversion of land-use into build-up area to conserve the fertile black soil land. The total cultivable area of these villages is therefore close to the 100%, even for the villages inside the city boundaries of HDMC, with no non-agricultural land-use developed under the influence of Dharwad. As there is no national infrastructure network in this transect, no urban developments are coming up next to the roads.

The villages differ more from each other in their agricultural cropping patterns. The most urban demanded cropping patterns are the vegetables and flowers. Vegetable cultivation is practised in the village-areas of Dharwad Rural, Malapur and Kamalapur, close to the city. Their shares decrease from 5,3% of the total cropped area in Dharwad Rural to 1,3% in Kamalapur. In all other research villages the share of vegetable was below the 1%.

For the flower cultivation one village in particular is specialised in it. The village of Kurabagatti stands alone with 64 acres of chrysanthemum in 2003. The number of acres under floriculture increases every year, as it was only 22 acres four years back. About 50 farmers are cultivating flowers, selling them every

week in Dharwad. Main criteria for cultivating these profitable flowers are the availability of irrigation and enough labour supply, as it is a labour-intensive crop. Together with the aspect of irrigation also comes the aspect of capital, as this cultivation acquires investments to start a flourishing flower cultivation.

All the villages in this transect are still in the second stage of urbanisation, having urban influences on the agricultural cropping patterns. The urban influence counts most for the villages close to the city. The influence on non-agricultural land-use is practically nil in this transect, only in the village area of Dharwad Rural some residential developments have come up.

Transect South

Transect South has the national highway crossing the area. The area is located between two urban cores, Dharwad and Hubli. The villages of Lakmanhalli, Navalur, Rayapur and Jogellapur are incorporated in the HDMC. The villages in this transect are more different in their land-use. The urban influences, especially on the villages within the city boundaries can be seen in their land-use. The village-area of Lakmanhalli is for 65% build-up area, with residential, commercial and industrial land-use. Rayapur has large industrial developments in their area, covering 54% of the territory. The area of Navalur has large residential developments, especially near the highway planned by HDUDA. The cultivable areas of the other villages vary between 74 and 93%, due to the hilly character and the forest-areas in this part of the research area. In the village area of Salakinkoppa a new residential plot for about 20 houses was developed 5 years back. For the villages of Baad, Nigadi, Manigundi and Devarhuballi no transformation of agricultural to non-agricultural land-use has taken place. Rural-urban land-use like brick kilns were observed in the ‘hingary’ season in the villages of Salakinkoppa and Jogellapur.

The main commercial cropping patterns of this transect are the fruit-orchards. The village of Jogellapur stands out with 35% of the total cropped area covered with mango-orchards. Except two, all other villages have fruit-orchards -mostly mango- ranging from 4 to 21% of the total cropped area, with an upward trend. Plots varying in size are transformed in to fruit-orchards as can be observed by the large number of small fruit trees in the village-areas. This transformation can be seen as a response of the city expansion and attraction. Agricultural land covered with fruit trees cannot be claimed by the urban planning institutions. Furthermore the lack of sufficient agricultural labourers is countered, as mango-orchards require fewer labourers and by pre-harvest contracting to mango-traders the maintenance and picking of the mangoes is done by the contractors.

The two villages not covered with an important share of fruit trees are Rayapur and Devarhuballi. The village at the south-west end of the research area, Devarhuballi has as main commercial crop sugarcane on 5% of the total cropped area. The demand for this crop is not urban-based, as it is mainly marketed and processed in factories in other districts. Rayapur, inside the HDMC is a black-soil area with potato as number one commercial crop. Vegetables are the main urban demanded crops cultivated on 3% of the area. It must be mentioned that in the village areas of Navalur and Rayapur the pressure on the land is highest with large urban developments. Farmers tend to go for field crops as the investments for these crops are relative low.

The urban influences on the village areas in this transect have not been spread evenly. The village of Lakmanhalli is completely incorporated in the build-up area of Dharwad. With only 35% of the village-area being cultivable land, this village is in stage 4 of Ramachandran his classification. The village areas of Navalur and Rayapur, a little further away along the highway are also in a process of becoming dominated by urban land-uses. While land near the railway in the village area of Rayapur is conversed into industrial area, Navalur has large residential developments in progress. Both villages can be classified in stage 4. The area of Jogellapur is classified in stage 2, but the large conversion of agricultural land to the more urban demanded mango-orchards show that this village is already far in its development. Salakinkoppa located just outside the HDMC-boundaries also experiences a large growth in area under the urban demanded mango-orchards. The villages of Baad, Nigadi and Manigundi, more distant to the city have smaller shares. These villages are just falling in the second stage of urbanisation. The village of Devarhuballi, by looking at the cropping pattern does not yet interact with the urban market. This village is placed in the first stage with no influence of some importance from the city.

Transect West

Transect West has the national highway crossing the territory and the recently opened by-pass. These are important generators for urban land-uses around the highway. Unfortunately, fences along the by-pass prohibit entrance to the road for commercial activities next to the by-pass, except at the junction with the highway in Hiremalligwad village area. Seven villages were selected for research, of which the village areas of Yattinguda and Hiremalligwad are already incorporated in the HDMC. The total cultivable areas of the research villages vary. Hiremalligwad and Narendra have large cultivable areas of about 90% of the total geographical area. Chikmalligwad and Devageri have low cultivable areas due to the hilly landscape with large forest areas. For the village areas of Yattinguda, Mummigatti and Belur the urban institutions are responsible for the low cultivable area. In Belur and Mummigatti large areas are acquired for industrial purposes. The HDUDA made two large industrial areas next to the national highway. In Belur

about 45% of the land was taken for this purpose. The village-area of Yattinguda and to a lesser extend Narendra have lost a large area of fertile agricultural black soils to the Agricultural University.

The cropping patterns in this transect are the most traditional of the research area. The level of specialisation in urban demanded crops is low. Main commercial crops cultivated are the field-crops cotton and maize. Maize has good market prices and the leftover of the plants can be used as fodder. Close to the city maize is the main commercial crop, whereas further away cotton is the number one commercial crop. Next to the national highway a small number of commercial fruit-orchards were observed, often in the hands of city entrepreneurs who see it as a good investment. On the black-soils of Yattinguda and Narendra potato is the major commercial crop. All these crops mentioned in this paragraph are field-crops.

The conclusion for this transect is that the developments in urban based cropping patterns is less in regard to the other transects. But transformations of agricultural land to build-up area have taken place on different places in this transect. Due to the developments in road-infrastructure Hiremalligwad its territory near the junction highway by-pass has seen transformations from agricultural land to commercial and residential plots. Hiremalligwad is knocking on the fourth stage of urbanisation, but yet still in the second stage. The urban land-use growth in Belur and Mummigatti is of such a scale that these villages fall in the fourth stage of urbanisation. For Yattinguda the city also had a large influence on the land-use by taking half their land for the agricultural university. Former farmers now work there. The village is in the fourth stage. Narendra has experienced some developments in their area, concerning an electric power station. As the area is not next to the highway, no other urban land-use developments have yet taken place. It is with its commercial cropping pattern a stage two village in Ramachandran's classification. Chikkamalligwad and Devageri are village areas with little commercial crop cultivation. There are also no urban land-use developments. Therefore these two villages are positioned at stage one of the model of urbanisation by Ramachandran.

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