Moving Frontiers, New Chances

Land use change in the rural-urban fringe of Hubli-Dharwad, India




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Preface

This thesis about the land use change around the city of Hubli-Dharwad is the result of the graduation assignment for completion of the study Human Geography at the Faculty of Spatial Sciences at the University of Groningen. The research was conducted during a 4 month fieldwork stay in Dharwad, Karnataka, South India.
The project has been made possible by a cooperation between the Faculty of Spatial Sciences of the University of Groningen, the Netherlands and the Department of Geography of the Karnatak University Dharwad in Hubli-Dharwad, Karnataka, India.

The title of the thesis is: *Moving Frontiers, New Changes: Land use change in the rural-urban fringe of Hubli-Dharwad, India*. The first part of the title refers to the fact that urbanisation moves the frontiers of city, creating new changes for the population around a growing city. The second part shows the focus of the research: land use change in the rural-urban fringe area around the city of Hubli. It is the land owners in this area which gain new changes by finding new ways for using their land as the city's frontiers move towards them.

For those who are interested in the land use change around the whole of the twin-city of Hubli-Dharwad, I would like to refer to the thesis of Bas van der Wal who has conducted fieldwork on the land use changes around Dharwad during the same period.

In this preface I would like to take the opportunity to thank Dr. P.C.J.Druijven for guiding me through the research process. I would like to thank Dr.S.R.Nidagundi, Professor and Chairman of the Geography Department at Karnatak University Dharwad for introducing me to Hubli-Dharwad and its surroundings and his advice during the fieldwork. I also would like thank him and his family for being always welcome in their home, giving me and Bas an Indian home away from home.
I want to express my gratitude to Avinash Desai, Basavaraj Talwar and Nagesh Duganavar for their translation work and good company during the interviews for the fieldwork. I also want thank Bas van der Wal for his companionship and support during our stay in India.
Finally, I am grateful to my family and friends for taking interest and supporting me during the finishing of this thesis.

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Glossary

APMC	= Agricultural Products Marketing Corporation
borewell	= a privately owned pump-driven bored well
cash crops	= commercial crops
cereals and millets	= cropgroup containing crops which produce edible grains
Corridor zone	= the part of the rural-urban fringe area of Hubli lying in between Hubli and Dharwad city
District	= sub-state level administrative spatial unit
floriculture	= a form of plantation culture with flowers
HDMC	= Hubli-Dharwad Municipality Corporation
HDUDA	= Hubli-Dharwad Urban Development Authority
hingary	= the part second part of the rainy season in Karnataka from October to January
horticulture	= a form of plantation culture like fruit orchards
HYV's	= High Yielding Variaties crops, scientifically developed to improve cultivation and harvest
intercropping	= a type cropping in which different cops are spatially mixed
mungary	= the part of the rainy season in Karnataka from June to September when most of the rain falls
Nalla	= a natural watercourse
North Maidan	= the climatical zone which roughly covers North Karnataka
oilseeds	= cropgroup containing crops which produce edible and non-edible oil from the seeds
pulses	= cropgroup containing crops which produce edible seeds
rainfed farming	= a type of farming in which rainfall is the only watersource
subsistence farming	= a type farming with crops which are for the most part for home consumption
staple crop	= the most widely grown food crop of a region
Taluka	= sub-district level administrative spatial unit
tank	= embanked tank, a man made lower area functioning as a lake, tradionally used in Karnatakan villages to retain water after the rainy season
TCA	= Total Cropped Area in year
transect	= the research villages representing part of the rural-urban fringe
village accountant	= civil servant funtioning as administrative head of a village area
village area	= sub-Taluka level administrative spatial unit containing a central village and its agricultural land
Ward	= Census/ revenua area within an urban muncipality

Summary

This thesis is based on fieldwork research conducted during a 4 month stay in Hubli-Dharwad, Karnataka, India in 2003/ 2004. Hubli-Dharwad is a twin-city, with the two urban centres at a distance of some 20 km from each other. The research is about the land use changes in the rural-urban fringe of Hubli city. In this research twenty villages within Hubli Taluka in a radius of 20 km around the city were selected to get a cross-cut of the land use in the fringe area of Hubli. Six villages which represent the different distinctive land use patterns found in the fringe (based on specific interaction forms with Hubli) were selected for another round of interviews with land owners in the field.

The idea for the research topic follows out of the rapid growth of urban areas which is taking place in developing countries like India. This process of city growth occurs along the so-called “rural-urban fringe”. This concept is used to describe the diffuse area between an urban centre and its surrounding rural area.

Ramachandran has described the urbanisation in India in a stages- model. In this model he describes the rural-urban fringe as an area in which land use forms and economic activities move from rural to urban through several stages. This transition entails a shift from traditional agriculture to commercial agriculture, an occupational change from agricultural to non-agricultural activity and finally a change from agricultural to urban land use. During this transition the different rural and urban land uses and economic activities can be found side by side in the fringe area.

This model led to focusing the research on land use dynamics in the fringe, resulting in the following research goal: *To describe and analyse the recent dynamic change in the land use and economic activities of land users in the villages in Hubli-Dharwad’s rural-urban fringe in Hubli Taluka area.*

Thus the model of Ramachandran is used as the necessary theoretical base for the analysis of the land use changes around Hubli. A critical note regarding the use of this model is that Ramachandran has based his model on the urbanisation process around large metropolitan areas in India such as Delhi, while Hubli-Dharwad is a secondary city functioning as a regional centre in a predominantly rural area.

Traditionally, the regional development discourse has been divided in an urban approach and a rural approach. In reaction to this the rural-urban fringe concept has been developed. The

definition of the rural-urban fringe is however, also still open to debate. Through the years, the focus of the definition of the peri-urban (or rural-urban) interface has shifted from a spatial definition (assuming a central urban point surrounded by a de-densifying periphery, such as in Ramachandran's model) to a functional focus on diverse flows between rural and urban sectors. The changes in the peri-urban interface are then linked to flows between urban and rural areas of people, goods, income, capital, information, natural resources and waste (Allen and Dávila 2002).

To see how agricultural land use in the fringe of Hubli as a whole has developed, *rainfed agricultural land use patterns* in the fringe were compared to trends in rainfed agriculture which took place over a period of time in a wider region (because there is no reliable data available on past agricultural land use in the fringe).
The research results show that there clearly is a big difference between rainfed cropping patterns in the fringe of Hubli and rainfed cropping patterns in the wider region. A common trend was the shift away from the traditional crop group cereals and millets and the early commercial crop cotton. Farmers nearer to the city have also dropped these traditional crops but on a larger scale and in favour of further rainfed commercialisation. Resulting in the dominance of cotton, chillies and especially onion in the fringe, instead of oilseeds and pulses which gained popularity in the more rural parts. The reasons for this difference might be that farmers are possibly influenced by the early large scale commercial cotton farming in the area around Hubli, due to the suitable black (cotton) soils and the presence of textile industries in Hubli in the past. These results seems to confirm the first stage of Ramachandran's model: commercialisation of agriculture, it also complies with Von Thünen's classic model of agricultural land use changes when moving closer to a city.

A distinctive feature of Hubli's rural-urban fringe is its strong heterogeneity in soil type, rainfall, location relative to urban areas and main roads. This leads to differences in land use developments and interaction with the city within the fringe area. To analyse these differences the fringe was divided into three transects: the northeast, the Corridor zone (the area of Hubli Taluka located in between the two cities) and the southwest. In these transects the cropping patterns and other forms of land use were analysed.

In the Northeastern transect of the rural-urban fringe, cropping patterns are quite one-sidedly developed. The distinctive cropping pattern of rainfed intercropped chillies, onion and cotton,

starts directly at the eastern border of the city and continues to dominate the rest of the eastern area of Hubli Taluka. The only frequent interaction between this area of the fringe and the city is limited to some commuters via public transport

The Corridor Zone is as an area characterised by commercial rainfed farming -which continues to take place on quite a large scale in between the two cities- mixed with rapid non-agricultural land use development. A form of commercial farming developed in the Corridor which is directly related to urban markets, has been the concentration of large scale rainfed potato cultivation. For urban functions such as residential colonies, government agencies and commercial enterprises the area located in between the two cities provides an attractive location. This has resulted in a high level of interaction of this part of the fringe with the city. The abundance of non-agricultural activity in and nearby the original villages has created many opportunities for villagers to diversify their income sources.

Conditions in the Southwestern part of the fringe provide the most scope for development of agricultural land use, therefore a frequent and diverse interaction between local agriculture and the city has developed. Horticultural land use is the most important agricultural land use development to come out of this increased interaction. As a result the southwest provides the city with fruits, flowers and vegetables, while urbanites form Hubli have chosen this area for investment in land in the form of horticultural farming.
Furthermore, the geology and soil type offers landowners opportunities for excavation of their land to supply materials to Hubli's growing construction market. Finally, the good road connections have made roadside areas in the southwest an attractive location for industries/ commercial enterprises an so forth, which find the city to be too congested or polluted. The rise of these non-agricultural activities, together with commuting and the direct marketing of fruits, flowers and vegetables in Hubli have diversified available income sources in this area.

Non-agricultural land use development in the fringe of Hubli is only taking place on a limited scale and concentrated in a few areas. This is due to the fact that Hubli (-Dharwad) is a medium sized city with a slow population growth and a small industrial sector. This makes Hubli incomparable with metropolitan cities in India with rapid unchecked urban expansion. Instead, urban land use development in the fringe of Hubli is mostly government induced. The biggest factor in the built-up urban land use development in this part of the fringe is the Navanagar Township project, situated in between Hubli and Dharwad. This project is an

initiative of the HDUDA and is meant to turn the whole area in between the two cities into urban land use.
Infrastructural and most industrial land use development is in the fringe of Hubli is government planned, in both cases from State level. These industrial areas are stringently planned and are generally situated far from the city, as these plans stem from the period that the Indian economy was planned (before 1991).The most important infrastructural projects around the twin-city are the newly built highway by-pass and Hubli Airport. Both projects are located west of Hubli in the Corridor Zone, while the by-pass also runs through the Southwestern transect

Following these research results it can be concluded that there is definitely an urbanisation effect of Hubli city on land use and economic activity in its rural-urban fringe. With regard to agricultural land use development, the effect of the city on agricultural land use has been a general increase commercial crops and a shift away from traditional crops, thereby also shifting the nature of agricultural activity from subsistence to commercial.
However, the heterogenic character of the fringe has meant that most of the ongoing commercial development of agriculture has been concentrated in the southwestern parts of the fringe which have access to irrigation. Here, interaction with the city has increased and agricultural goods are produced for the urban markets. In other parts of the fringe agriculture has remained stagnated in rainfed commercial farming and levels of frequent interaction of agriculture with the city are low, or limited to a few commercial crops such as rainfed potato cultivation.
Urban land use development is also unevenly spread through the fringe area. Due to the government planned nature of most of the urban expansion, directing most of the built-up land use. The effect of the urban development has been an increased pressure on agricultural land use, mainly in the Corridor Zone, as more land is being bought up for urban uses, such as residential purposes or for speculation, which can leave lands fallow which previously were used for farming. The effect of the concentration of urban land use development in the Corridor Zone is that this area now reaching the stage of integration into the urban area/ economy, rather than interacting with the city.
Other forms of non-agricultural land use such exploitation of land for producing construction material are also leading to increased off-farm employment and increased interaction with the urban economy. But this development is concentrated in only a few areas in the southwest and

for the most part scattered throughout this transect. In this way this development is not contributing much to the urbanisation of the fringe.

Maps, Graphs, Tables, Figures and Boxes

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Chapter 1: Introduction

1.1 Introduction

When moving from one city to another by train or car one notices the changes in landscape. The urban areas characterised by their dense use of land, such as flats and infrastructural nodes make way for less intense land use like agriculture, pastures and fields full of crops can be seen and the horizon becomes visible again. On first sight the difference between rural and urban seems quite clear. But the actual border between the two remains difficult to pinpoint. This border is a fringe area between rural and urban and is under constant change.

In the developed countries this *rural-urban fringe area*, as this area will be called from now in this thesis, is an area that is under change due to new plans for housing or industry, that is if a city or town is growing. The growth of the urban population in the developed countries has slowed down and it's fastest growth is already long in the past. This is not the case in the developing countries.
In the developing countries, where the biggest share of the population is still lives in rural areas, the urbanisation process is moving fast. The urban population in developing countries is growing in at a rapid pace and in an uncontrolled and haphazard way, quite contrary to developments in developed countries where the government often regulates the development of the urban areas. In the developed countries regulating *suburbanisation*- the (re)settling of the population outside the city (core)- has become the main focus of most of the government policies the last decades. In developing countries on the other hand, governments are trying to cope with a natural population growth and the migration of people from rural areas to the city. This lead to the growth of urban areas, which in turn leads to an uncontrolled-led rapid spatial growth of the city, resulting in the sprawl of urban activities and settlements in the fringe area around the cities.

With a global urbanisation rate of 4,5 % compared to an annual world population growth of 1,2 % (US Census Bureau 2000), the growth of urban areas is moving fast. Even the least urbanised continents, Asia and Africa, are expected to be 54% urban by 2025 (UN, 1995).
In the near future ever more people in the developing countries will be living in urban areas, as people from rural areas move to the cities or in some cases the city borders will move towards the people in the rural areas (a process which Brookfield et al. call "*in-situ*

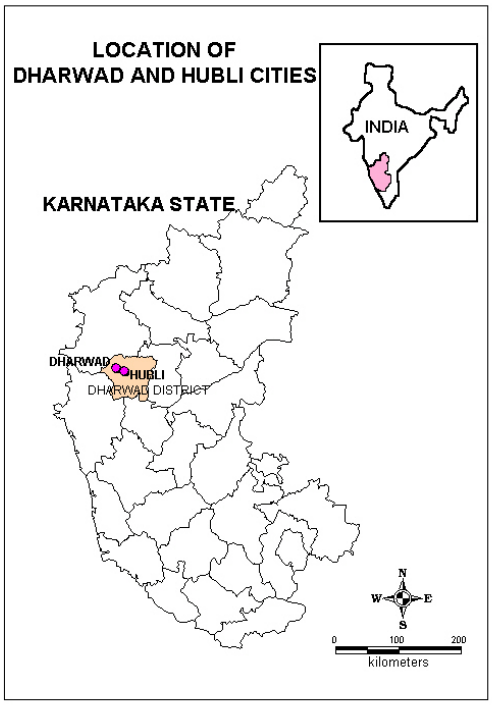
urbanisation", 1991). The resulting growth of the cities will occur along its moving border: *the rural-urban fringe*. Especially in the large metropolitan cities this process is taking place beyond imaginable proportions and there is hardly any authority to guide it. In this area the livelihood of the people changes from rural to urban ways of living and working.

In this thesis the rural-urban fringe of Hubli-Dharwad, a city in the south of India has been researched, this twin-city is located in the northern part of the State of Karnataka (see Map 1.1). The research has focussed on the change in land use and occupation in the fringe area of this city. These changes include changes in agricultural and non-agricultural land use within the fringe area and changes in economic activities of the various land users in the fringe.

An example of such a change in agricultural land use and economic activity in the fringe is the change from a rural self-supporting way of living- such as subsistence farming- to a more commercial and diversified way of making a living -such as commercial orchard farming and/ or doing a job for monthly salary.

In order to do this research, models that describe the way urbanisation takes place (in India) have been used to formulate research questions and determine research variables.

Map 1.1 Hubli-Dharwad in the north of Karnataka State (source: Tinnemans, 2003)



1.2 Models of the urbanisation process

Urbanisation can be described as the process by which the city expands into the rural-urban fringe area, it is a spatial-temporal process which means that in the course of time the rural landscape around the city gets transformed from the urban areas outwards (Bentinck 2000, p 19). This transformation is spatial, the changes in land use, and structural, the changes in society due to the new opportunities it gives to the residents of the rural-urban fringe (Douglass, 1998).

Morphologically the outlook of the fringe area changes in the course of time as new residents settle (legally or illegal) on a patch of land, developers start residential and industrial projects and all sorts of economic activities –big and small, formal and informal- see the fringe as a good location for their enterprises. The fringe develops all kind of economic, social and demographic ties with the city as well as the rural area.

According to the classic geographical *distance decay*-model of Von Thünen the land use (change) around a city is based on an optimal allocation of land uses according to a bid-rent curve of maximum returns. In which the distance to the urban market is the most important factor. This model is particularly valid for agricultural land use, in which crops which are perishable need to be located more close to the urban market (Bentinck 2000, p19). This theoretical approach on urbanisation is therefore also quite valid in the case of the fringe of Hubli-Dharwad, which is surrounded by a rural region with traditional agriculture with low-tech techniques and transport possibilities.

Ramachandran (1989) has developed a more modern and useful concept of the transformation to from rural to urban. It classifies the stages of urbanisation of villages in the rural-urban fringe in India (p 310-318). The classification is based on two aspects of change: changes in land use and changes in occupation. He has defined the 5 stages as follows:

1. The rural stage:

   At this stage the village is completely rural, it has no daily interaction with the city and traditional agricultural land use and traditional occupations prevail.

2. The stage of agricultural land use change:

   The first sign of transformation is the change in agricultural production, this means that farmers start producing more commercial crops for the city market. Daily interaction increases in order to move the products to the city.

3.The stage of occupational change:

In this stage, the village population is drawn to the city by the employment opportunities. On the whole the villagers diversify their activities. People from the villages seek employment in unskilled work in factories, self-employment as hawkers in the informal sector, but also in the village itself people may start shops and other enterprises. In general the share of non-agricultural activities increases drastically.

4.The stage of urban land use:

Agricultural lands are being changed into urban land uses, in the beginning only lands near the main roads and land that is unsuitable for agriculture will be taken. Eventually more land will be transformed and a mix of urban and agricultural land appears.

5.The urban stage:

In this stage the village is completely urbanised. All agricultural land has been changed into urban uses, the village is now a part of the city.

During the process of transformation the transport connection improves from no daily interaction in stage 1, up to the point that the village gets incorporated in the city infrastructure in stage 5. In this spectrum stage 1 and stage 5 are extreme opposites, being rural or urban, these stages are not part of the rural-urban fringe zone.

When studying the description of urbanisation of Ramachandran, it becomes clear that the two aspects of (spatial) change in land use and in economic activity are based on the interaction process between rural and urban areas. This functional interaction consists of flows of people (commuters), goods (agricultural and non-agricultural), capital (urbanites buying up land in villages, machinery from the city making its entry in villages) and information and so on. These flows are made possible by improved transport and communication networks between the rural and urban areas.

As a final distinct feature of the rural-urban fringe Ramachandran (1989) points to: ".... the presence of both rural and urban people in the revenue villages around the city" (p298). This happens when for example: "The peripheral parts of the village near a main road, perhaps, may be developed into residential colonies, which brings into the village urban people whose socio-cultural background may differ significantly from those residing at the village site" (p299, Ramachandran, 1989). This difference in background may result in minimal contacts between the two communities. Their socio-economic situation may also

differ a lot, with the poorer sections of the providing services such as domestic work, washing of clothes, supply of milk and vegetables, and so on while the urban community often works in the city (Ramachandran, 1989). Apart from the settling down of urbanites in new residential colonies, the village can also experience the buying up of land by urban people for speculation purposes, industrial development or agricultural land use as a form of investment. In this last case this is supported by the fact that agricultural land and its produce is un-taxed under Indian Law.

In this research the focus has been on land use and land users in the rural-urban fringe, so all villages should fall in stages 2 to 4. The effects of urbanisation on the land use seem clear from this model, but in the field they may vary from village to village and besides "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 the stages"(Druijven 1996).
In the case of the villages surrounding the city in Hubli Taluka area this is surely a consideration, because the city of Hubli-Dharwad is not a metropolitan area but is merely secondary city functioning as a regional centre. Thus it has a much less rapid expansion as in the case of for example Delhi Metropolitan area and other major cities which were examined in Ramachandran's research. With it's approximately 750.000 inhabitants (of which some 500.000 live in Hubli) Hubli-Dharwad doesn't qualify as a metropolitan area and in this thesis it will be researched if the aforementioned stages of transformation occur in the fringe of Hubli. The twin-city functions however as regional centre of North-Karnataka and has a relatively large sphere of influence for its size.

Another consideration in the case of Hubli Taluka should be the fact that Hubli-Dharwad is located in a predominantly rural region where agriculture is the principal economic activity. Additionally, there are local differences within the region, particularly with regard to soil type and rainfall which vary quite a lot (Brooks et al., 2003).
This leads to paying some extra attention to developments and trends in agriculture in North Karnataka and the wider region around the city, in order to distinguish between general trends in agriculture in wider area and the influence of the nearby city market.
Furthermore, the role of the big differences in soil type and rainfall (within quite a small area) in influencing changes in agricultural land use around the city are specifically examined. The

influence of this particular background on the rural to urban transformation will also be analysed in this thesis.

1.3 Research objective and research questions

The stages-model and the setting of Hubli Taluka leads to the framing of a number of central research questions in order to reveal the impact of urbanisation on the land use and activities of land users in the villages in Hubli-Dharwad's rural-urban fringe in Hubli Taluka area:

Research objective:

To describe and analyse the recent dynamic change in the land use and economic activities of land users in the villages in Hubli-Dharwad's rural-urban fringe in Hubli Taluka area.

Central research questions:

1. What is the effect of Hubli city on agricultural land use development in the villages in the rural-urban fringe?
2. Is there a difference in the effect the city has on agricultural land use in rural-urban fringe villages if there are differences in climatical conditions and physical conditions such as soil type?
3. What is the effect of Hubli city on non-agricultural land use development in the rural-urban fringe?
4. What is the effect of Hubli City on economic activities of land users in the rural-urban fringe?
5. How do the villages in the rural-urban fringe in Hubli Taluka fit into stages of urbanisation-model?

These questions can be expanded into several aspects of change and specific research questions which are investigated on two different levels: the level of villages in the rural-urban fringe and on the level of the various land users in a village in the rural-urban fringe. It should be mentioned here that these land users are a very heterogenic group making use of rural-urban fringe. They can be local as well extra-local, make a living from only agriculture or have a day job in the city etc... However, the land users in the fringe which were interviewed were all landowners and thus exclude groups like landless labourer, industrial workers and other landless groups which are located in the fringe.

Cropping patterns on the level of villages:

- What are the physical, infrastructural, administrative and (socio-) economic conditions of Hubli-Dharwad's rural-urban fringe?
- Is there a difference in type of cropping patterns in the villages in the rural-urban fringe?
- What agricultural land use development has taken place in the cropping patterns since the time of traditional subsistence farming?
- Is there a difference between developments in agricultural land use around Hubli Taluk and (general) trends in agriculture in India and Karnataka?
- What possible factors could influence the cropping pattern on village level?

Crop choices on the level of land users:

- What factors determine if a land user is effected by the demand of the city market?
- What is the influence of non-residents on agricultural land use in the villages?
- What changes in agricultural practices in the rural-urban fringe take place due to the demand of the city market?
- How and where are the agricultural products distributed and sold?

Non-agricultural land use on the level of villages;

- What forms of non-agricultural land use can be seen in the rural-urban fringe?
- Where are these non-agricultural land uses located?
- What factors influence the location of non-agricultural land use?

and on the level of land users:

- Which type of land users are involved in /effected by non-agricultural land use?
- What factors determine if a land user's choice for non-agricultural land use?

Economic activities on the level of land users:

- What economic activities do the land users do in villages in the rural-urban fringe?
- What is the importance of non-agricultural activities in villages in the rural-urban fringe?
- How are these non-agricultural activities connected with the city?

1.4 Research area

For the research an area was selected around the twin-city Hubli-Dharwad in Dharwad District. The choice was made for Hubli Taluka area. The Taluka is an administrative area around Hubli it consists of revenue village areas. Revenue village areas are the smallest administrative units of the Indian authorities, they contain the village and its agricultural lands.
Within Hubli Taluka (in a radius of approximately 20 km from the city) 20 village areas were selected to get an overview of the region around Hubli by means of interviewing key-informants: village accountants.

From these 20 villages 5 were selected to do household surveys with farmers and other land users. The 20 villages were selected in order to represent the region around Hubli in all four directions and at different distances from the city.
The 5 villages which were selected for further research represent villages with different soil types, amounts of rainfall and distances to the city. Apart from these criteria the findings of the first survey round were used to select villages which highlight certain forms of land use-agricultural and non-agricultural- that were considered important for this research.

1.5 Methodology and data sources

The research started in the Netherlands where a research proposal was set up. Although not knowing what to expect a choice was made early on that the research would focus on land use changes around the city, particularly changes in agricultural land use. Before hand the corridor between the twin-cities was considered the most important area for research on this aspect of change in the rural-urban fringe.

After arrival in Dharwad exploratory field trips by means of two-wheelers and public bus transport were made together with students and professor Nidagundi of the Geography Department of Karnataka University Dharwad. After a period of two weeks of getting to know the surroundings of both Hubli and Dharwad sufficient knowledge was gained to set up a research form.

The initial plan for focusing on the corridor was let go because of the dominance of non-agricultural land use forms and the specific cropping pattern due to local soil characteristics. The area between was therefore not representative of the land use developments taking place

in the fringe. It was then decided to attempt to get an overview of the development around the city of Hubli in all directions by means of interviewing village accountants. This in order to compare the differences between villages in each direction and their specific features of development. After this first phase the second phase consists of going to the most interesting villages and doing questionnaires with individual land users.

Secondary data sources

Secondary data on the area was limited and sometimes difficult to find. The census of India information on the area was collected at the local District Statistics office. Secondary data on urban and industrial development comes from the Hubli-Dharwad Urban Development Authority (HDUDA), the Karnatak Industrial Area Development Board (KIADB) and the Hubli-Dharwad Municipality Cooperation (HDMC), secondary data on agriculture comes from the Department of Agriculture of the HDMC.

Maps of the area were also quite difficult to find, maps of Dharwad District and of village areas in Hubli and Dharwad Taluk were obtained from a former employee of the HDMC. One digital map was found at the HDUDA. Remote sensed information was also sought for but not available, remote sensed information is only available for Karnataka's state capital Bangalore.

Near the end of the 4 month-stay it was discovered that Agricultural University of Dharwad was working on a Peri-Urban Interface project on Hubli-Dharwad in cooperation with the Universities of Wales, Birmingham and Greenwich, a copy of a book of the report could be obtained and it provided a valuable secondary data source.

Primary data sources

Primary data was collected through a number of questionnaires with key-informants and land users in several villages. In the first phase village accountants (the key-informants) were interviewed and on the basis of this collected data the villages were chosen to conduct the second phase of questionnaires with the individual land users.

Phase 1

To get an overview of the location and concentration of land use forms around Hubli 20 village accountants were interviewed. After getting permission from the head of the village accountants in Hubli Taluka, the Tehshildar of Hubli, 20 villages were selected out of the total

of 58 villages in Hubli Taluka. These villages were chosen from all directions and ranging from ½ km up to 20 km away from the city.

The village accountants are each administratively responsible for their revenue village area and have a lot information on the area, for example each has a map of the area in question, these maps were always asked to explain the location of certain forms of land use, location of the village to main roads, nearness to irrigation sources such as *nalla's* (streams) and tanks, morphology and soil types. A rough drawing of this was made during each questionnaire.
But the most important information the accountants provided were the records on the areas under certain crops for *mungary* and *hingary* season (the two monsoon seasons in this area, these two seasons are commonly known in India as *kharif* and *rabi*). Apart from this information questions were asked about the presence of industries and their importance for the villagers, level of amenities, number of shops and other commercial enterprises and development of irrigation, land use and infrastructure.
Often the information also came from the personal knowledge of the accountants of their village. Back in the Netherlands the data was used to sketch a picture of the cropping patterns of the villages and the situation of the village in general, the collected data has been entered into SPSS for representation of the information and further analyses.

Phase 2
After this first research phase the second phase consisted of some 78 questionnaires with land owners/ farmers in the field in order to verify earlier information and to shed some light on the process of land use change on the individual level. These questionnaires were conducted in 6 different villages which were selected from the first 20 villages. The idea behind this selection was to highlight certain forms of land use around Hubli (agricultural and non-agricultural), which were considered important for this research.

The respondents were chosen on the basis of forms of land use and land size. Land users with small, medium and big plots (varying from 1/2 acre up to 60 acres and more) have been interviewed. In these questionnaires questions on family size, occupations of family members, irrigation, cropping, crop history, crop choice and motivation, use of agricultural implements, ways of selling product and future plans were asked. The form of interviewing was one of mostly open questions, due to the fact that desired data is mostly qualitative in nature and many answers were possible in the case of personal choices and situation of a landowner.

After returning to the Netherlands the data were for the most part categorised if possible, within the range of given answers it was possible to categorise the data. For categorising and analysing the data SPSS has been used. Hereafter this data was analysed. Table 1.1 shows the number of questionnaires and distribution.

Table1.1 Respondents and distribution

Respondents	Number of interviews	Number of different villages
Village accountants	20	20
Land users	78	6

Problems and limitations

At the start of the second phase of interviewing the aim was to select interesting villages in the rural-urban fringe of Hubli. This choice is obviously quite arbitrary, but was made on the basis of the first phase of interviewing. Villages were selected that represent areas where certain aspects of rural to urban change occur around Hubli city such as for example areas with a lot of horticultural land use.

The sample of questionnaires which was taken in each village was chosen with different sized land owners/users in mind and also with idea to get a diverse mix of different type of land use such as irrigated and rain fed lands, traditional and commercial crops, agricultural and non-agricultural land use etc. In the field this choice was somewhat restricted by availability and willingness of land users and remaining time for the research.

This same consideration goes for the number of questionnaires per village. In certain villages more questionnaires were conducted than in others. This was due to a (too) high number of questionnaires per village initially (which could not be achieved within the remaining time) and to the characteristics of the village. Some villages were more the same than others and some had more interesting features, such as non-agricultural land use and more commercial agriculture. Again this is quite arbitrary but based on earlier information and field observation. In any case the number of questionnaires is too small to give a statistical representation of a village and the questionnaires thus serve to give a picture of the situation in a village.

The exact numbers of acres under non-agricultural land use forms were not always reliable as numbers had often not been correctly updated or registered. This could be checked by asking the nature of the non-agricultural activities, date of the start of these activities, approximately how many people were employed in these activities and requesting the accountant to make an estimate of the size of the used areas. The credibility of the given numbers is somewhat undermined by the fact that under current Indian law agricultural land is untaxed. So agricultural land is a favourable land use form for landowners to have registered with the local government. In most cases however it was clear that the village accountant understood this information would only be used in this thesis and they did not hold back anything, in some cases this was not completely sure.

The reliability of the numbers of the acres under certain crops can be considered to be quite high. This is due to the fact that since 1999 the government has introduced crop-insurance-measures against drought, which assures that the farmers are keen to give the correct acres per crop, as otherwise they could be subject of investigation when they claim a (false) failure of harvest due to drought.[1]

A complicating factor which appeared during the field work was that the region of Hubli-Dharwad has been under severe drought the last 3 to 4 years. Agriculture in the region has been suffering a lot, frequently cases of farmer suicide were reported in local newspapers and often during questionnaires it was mentioned that sowed crops had not grown more than a few decimetres (often for the second year in a row). Many farmers were in serious debt and had no financial room for new investments. This often resulted in spoiling questions, when asked about a motive for choosing this or that crop, irrigation form or future plan the answer would often be: “Because of the drought” or “That depends on if the drought lasts”. How this effects the ongoing process of urbanisation and land use changes is hard to pinpoint but in some cases the effects were clear such as a faster growing influx of land labourers into city (because there is much less work on the fields in the rural areas). When clear and relevant these effect were incorporated in the research text.

[1] Teams of government taxation agents were touring the area during the research period because of the damage due to drought in 2003-2004.

1.6 Structure of the text

The structure of this thesis follows the above mentioned specified research questions and their themes. In chapter two the *concept of the rural-urban fringe* will be explored and the way it has been defined in the development discourse. It also goes into the role of different aspects within the urbanisation process in the rural-urban fringe, notably the aspects land use change and changes in economic activities. Furthermore, the (importance of) land use change around Hubli is explained in order to link theory with the research area. At the end of the chapter the rural-urban fringe of Hubli is introduced by means of short description and a display of the location of fringe within the conurbanisation Hubli-Dharwad.

Chapter three gives a detailed description of the twin-city and the rural-urban fringe. It deals with the demographic, socio-economic and physiographic features in order to give insight into the broader context of the researched land use changes in the fringe. In addition, agricultural and urban land use development around the city, the nature of agriculture in the fringe (under the semi-arid conditions and heterogenic physiography that prevail) and government policies and projects affecting urban land use in Hubli-Dharwad and its fringe will be discussed.

After describing the context chapter 4 will move on to the main focus: agricultural land use change in the fringe of Hubli. The differences in the location and development of the cropping patterns in the rural-urban villages will be examined against the backdrop of trends in agriculture in the wider region and North Karnataka. Then the fringe area itself will be discussed, taking a look a the highly heterogenic fringe conditions and their effect on agricultural land use developments.

The analyses of non-agricultural land use development in the fringe is the topic of chapter five, albeit in much less extensive way than the analyses of agricultural land use development in chapter four. The different types of non-agricultural land use development which can be found in the fringe are discussed, and the location and development of the different types of non-agricultural land use are analysed.

The final chapter answers the central research questions on the basis on the research results.

Chapter 2: The Rural-Urban fringe

2.1 Introduction

This chapter will deal the concept of the rural-urban fringe, an concept which has already been introduced in the first chapter. In the paragraph below some of the different names and definitions of the rural-urban fringe are presented. The origin and growth of the concept of the rural-urban fringe within the development discourse will feature in the third paragraph. The fourth paragraph deals with the development discourse regarding the aspect of change in the rural-urban fringe that is the focus of research of this thesis: land use change. After introducing the fringe area of Hubli-Dharwad, a broad picture land use dynamics in the fringe of Hubli-Dharwad and the actual location and situation of the two cities is given. The twin-city and its rural-urban fringe will be described in more detail in chapter 3.

2.2 The fringe: where rural meets urban

Within the development geography discourse the area where 'the rural' meets 'the urban' has been given different names with sometimes different definitions. Examples of this diverse terminology are: *the rurban fringe* (Schenk 1997), *rural hinterland of the city* (Kundu 1991), *peri-urban fringe* (Swindell 1988), *desakota regions* by McGee (1991). Terms used in other languages then English include the Dutch term *ruraal-urbane overgangszone tussen stad en platteland* (Druijven 1996 in Bentinck 2000) and French equivalents such as *rurbanization* (Bauer and Roux 1976 in Adell 1999) and *périurbanization* (Dupont 1997 in Bentinck 2000). A research team of the Peri-urban Research Project (part of the Development Planning Unit, University College London) which has done research in Hubli-Dharwad referred to the *peri-urban interface* of Hubli-Dharwad.

These different names which have been used to describe this zone owe their differences to the fact that the names are used to fit in with regional characteristics such as *desakota regions* from McGee (which has been modelled on Indonesian case studies). In other cases the different names support different development perspectives.
What all these definitions have in common is that they refer to an area which is neither strictly 'rural' nor 'urban', but still- as can be noticed from the term *rural-urban fringe* the descriptive concept of this area stems from the idea of a dichotomy between areas which are distinctively 'rural' or 'urban'. This view of areas being either 'rural' or 'urban' means that

areas fall into a category ‘rural’ where agriculture is the main economic activity or ‘urban’ where manufacturing and services are the principal activity. This (traditional) view of a spatial and sectoral divide does not correspond with the complex and changing reality in the developing world, although it is still widely used by governments in less developed countries to shape planning policies (Rabinovitch 2001 in Van Veenhuizen).

Defining this dichotomy also raises some questions about the accuracy of the defined areas, because the changing features of areas can be seen as moving along a continuum from rural to urban (or vice versa). For example where to demarcate the urban boundary in the case of an Extended Metropolitan Region (common to Southeast Asia) which has agriculture, cottage industry, industrial estates, suburban developments etc..up to a 100 km radius with a highly mobile and commuting population (Firman, 1996 in Tacoli 1998). It becomes clear from this example that administrative boundaries don’t always coincide with boundaries between ‘rural’ and ‘urban’ which are often blurred and dynamic.

Furthermore the definitions used for defining settlements of ‘rural’ and ‘urban’ used can vary per country. With each country using it’s own definition in its administration based on local concepts or historic conditions. Making international generalisation and comparison on settlement patterns problematic.
An example of this is the difference in urbanisation-levels between countries and continents. Asia is considered a ‘rural’ continent with two-thirds of its population living in rural areas in 1990. However, if India and China were to change their definition of urban centres to one based on lower population threshold of 2000 or 2,500 inhabitants (as used in Latin America and Europe), a large proportion of their population would change from ‘rural’ to ‘urban’. Given the size of China and India relative to the rest of Asia’s population this could change urbanisation-levels in Asia significantly (Tacoli, 1998).

Some of examples below will show how arbitrary the use of the terms ‘rural’ and ‘urban’ is within the official government frameworks of the different countries. In India the definition of an ‘urban’ area has been determined by the Census of India, their definition lays an emphasis on demographic criteria. This central government institute has defined an urban unit for the whole of India on the basis of the following definitions:

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;
- 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

(Census of India 2001)

The 'rural' areas are simply defined as: " Any area, which is not covered by the definition of urban" (Census of India 2001). Furthermore, within the areas classified as 'urban', any urban centre officially 'changes' from town to city when passes the threshold of 100,000 inhabitants (this number is equal to 1 *lakh*, a commonly used Indian measurement unit).

India makes use of a mix of administrative, demographic and functional criteria to designate places as urban, Indonesia makes use of similar types of criteria but has for example no actual threshold number for an urban area and makes use of a number selected 'urban' facilities to define an area (Champion and Hugo et al. 2004). Apart from administrative centres such as municipalities and regency capitals (which are obviously considered urban settlements), in Indonesia the status of each settlement is determined on the basis of three criteria:

- Population density;
- Proportion of households engaged in agricultural production and;
- The number of facilities in the village out of a list of 15 designated 'urban' facilities

such as the presence of a primary school, junior and senior high school, hospital, cinema, clinic, a road negotiable by motorised four-wheel-drive vehicle, bank…etc (Biro Pusat Statistik 1979 in Champion and Hugo et al. 2004)

The ranking of settlements according to their 'urbanness' results from a grading of each area on each of these criteria and summed to produce an overall score resulting in an index of 'urbanness' (Champion and Hugo et al. 2004). A striking difference between India and Indonesia is the fact that Indonesia doesn't make use of the population size as a criterion to define an urban place and has a classification of 'urbanness' to differentiate between urban areas.

More definitions of 'urban' settlements among Asian countries, which show the variation in criteria, are found in for example Malaysia and Thailand. Malaysia's definition of 'urban' is:

gazetted areas with their adjoining built-up areas and with a combined population of 10,000 persons or more. Thailand only makes use of administrative criteria and only municipalities are considered 'urban', resulting in some settlements not being recognised as urban (up till 1999) while their populations were exceeding 20,000 (Champion and Hugo et al 2004). It becomes clear from these various definitions that there is no such thing as an international standard typology of urban and rural, making comparison difficult.

A final important point of critique on the clear-cut distinction rural-urban is the fact that it doesn't take into account the way in which households support their livelihoods. An increasing numbers of 'rural' households rely on non-agricultural activities while 'urban' households can depend on 'rural' resources and sometimes do 'rural' activities such as agriculture in urban areas (a phenomenon called "urban agriculture"). This critique is very relevant for the situation in Hubli-Dharwad for example. Here the unification of the two urban centres into one 'urban' municipality area has meant that the all the (good) agricultural land in between the cities, on which a large number of people depend, has been classified as 'urban'. As a consequence there is no policy framework for agriculture in this areas, as policies regarding agriculture are only for 'rural' areas. The farmers in between the cities could now be considered as making a living of "urban agriculture".
Additionally, households can also move in both 'urban' and 'rural' areas for livelihood activities, for instance in the case of household members living in the city and sending back resources to the family in the countryside and vice versa. Temporary and seasonal migration is also the type of livelihood support that transcends administrative boundaries. All these 'multi-spatial households' are often not accounted for within the urban-rural dichotomy.

These arguments, which show the blurrings of the rural-urban, divide, are know being recognised. Especially in the case of predominantly urban areas where boundaries are getting blurred, the simple urban-rural divide is inadequate "…primarily because people are moving about more and dividing their lives between areas conventionally designated 'urban and rural' to a large extent on a daily basis… in particular, the extent of commuting has increased dramatically" (Champion and Hugo et al. 2004). And so "the interface between urban and rural domains… is under continuous change, driven by the expanding urban areas and the (still) strong linkages with the rural hinterland"(Van Veenhuizen 2002).

The importance of dealing with these peri-urban areas which have both rural and urban features is generally accepted, only discussions about definitions and names for these areas are still ongoing (as the different names at the beginning of this chapter showed). There are different methods of defining the peri-urban areas-as the interface between urban and rural is most often called- according to the Municipal Development Program (cited by Van Veenhuizen 2002) there are four main classes of definitions 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; and
- Administrative criteria covering the local authority boundaries.
- In addition, to these criteria there is of course the dominant economic activity which is neither fully agricultural ('rural') nor fully non-agricultural ('urban').

Most definitions of the peri-urban area lay emphasis on one or more of these five criteria, yet one aspect that all definitions have in common is the notion of the heterogeneous and dynamic character of the peri-urban areas. This heterogeneity is seen in land use, economic activities, modes of production and social and political interactions. The heterogeneity is also found in its social composition, although lower income groups seem to prevail (Allen 2001 cited in Van Veenhuizen 2002). Furthermore, a peri-urban area is also characterised by its dynamism. *"The urban fringe is therefore a zone of transition in a permanent state of flux in both space and time"*(Druijven and Singh 1998).

In this permanently changing zone the outcome can be seen as a product of the interaction of state intervention and policies (programmed action, specific projects or "laisser faire") with the action and practices of the inhabitants seen as everyday use and appropriation of spaces, land and housing strategies and self-building practices (Schteingart in Adell 1999).
In the case of Hubli-Dharwad the specific interaction between government and inhabitants has lead to a situation in which the HDUDA (Hubli Dharwad Urban Development Authority) has designated large areas in between the two cities for urban development (with residential and governmental functions), while many local villagers in these areas still consider themselves to be farmers. As a result there is (odd) mix of land use forms like the development of new large

government complexes such as medical colleges, next to pieces of land which are still farmed in a rather traditional way.

Other definitions of the peri-urban areas include a negative way of viewing of the developments. Considering them problematic and chaotic areas because they are characterised by a lack of 'urban' values, such as the lack of adequate infrastructure, services, regulations (especially concerning environmental degradation) etc., or the vanishing of 'rural' values like high land prices, loss of fertile soil, social cohesion etc..(Van Veenhuizen 2002).

Most views on the peri-urban areas acknowledge the fact that problems and opportunities arise when going through the process of change, the change consisting of transformation of the areas to ultimately a state of full urbanisation. Ramachandran (1989) has created a model of this transformation of villages on the edges of Indian cities, these stages of transformation have been explained in the first chapter.
Ramachandran calls the peri-urban area the *rural-urban fringe* and defines it as: *"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"* (1989, p297). The two criteria used in the stages model to define the rural-urban fringe area are land use and occupational features. Bentinck (2000) makes use of a similar definition*: "The rural urban fringe extends from the contiguous built-up area of the city (no rural land use) to the area where most villages show a majority of workers engaged in non-agricultural occupations (many of whom commute)"*.
An adaptation of Bentinck on Ramachandran is that the 'border'of the rural-urban fringe in his research is decided by the occupational characteristics (percentage of non-agricultural employment), while in the model of Ramachandran changes in agricultural land use (commercialisation) also form part of (the transformation of) the fringe. This second stage of the model is central to this thesis, because it (just like this thesis) has agricultural land use change as its central theme[2].

The views which acknowledge changes in the peri-urban areas as part of a transformation to full urbanisation take as their starting point a physical definition which "seems to be under

[2] Bentinck drops this second stage due to the local characteristics of the region around Delhi.

pinned by a conception of the city as a central place dense and growing continuously over a static countryside"(Alllen 1999). "Through the years, the focus of the definition of the peri-urban (or rural-urban) interface has shifted from a spatial definition (assuming a central urban point surrounded by a de-densifying periphery) to a functional focus on diverse flows between rural and urban sectors".
The changes in the peri-urban interface are then linked to flows between urban and rural areas of people, goods, income, capital, information, natural resources and waste. These flows occur on three interconnected levels: on local, regional/ national and international level. From this point of view a region in another country which sends goods to a (in this case, Indian) city is connected to the peri-urban interface, vice versa a diminishing international demand for agricultural goods may result in changes in the peri-urban interface of a city. This model which takes into account the broadest perspective of influences on the peri-urban interface tries to adapt to "…recent developments both in theory and real world contexts-such as space-time compression and globalisation- which point to the need of a reassessment of the changing nature of the rural-urban divide" (Allen 1999).

Ramachandran's definition of the rural-urban fringe can be see as both spatial and functional. It is spatial in the sense that the land use changes when coming closer to the city, yet there is also a emphasis on the increase in functional interaction which stretches (far) beyond the areas with visible spatial features such as land use. This increase in flows of people, goods, income, capital, information, etc.. are also an integral part of the model.
In the case of the rural-urban fringe around Hubl-Dharwad, there are certain developments which encompass both spatial and functional elements. There is for example an increase of horticultural land use taking place. This leads to spatially located agricultural land use change, in combination with an increase in interaction as increasingly more quantities of fruits are taken to the urban markets in diverse manners by the different inhabitants of the fringe.
Von Thünen's classic model of changing patterns of land use at increasing distances of the city is an example of a spatial model of assuming a central urban point. This model will be used as an addition to Ramachandran's model, to compare rainfed cropping patterns in the fringe of Hubli with cropping patters in the wider region around the twin-city (see paragraph 1.2 and 4.1).
The Peri-urban Research Project Team (part of the Development Planning Unit-DPU from University College London) has done research in Hubli-Dharwad and is an example of a

recent functional approach (Buisman 2003). The peri-urban area is called “peri-urban interface” in their research:

The peri-urban interface is where urban and rural activities meet. Peri-urban areas are a mosaic of 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, because local government agencies have either rural or urban focus (Allen and Dávila 2002).

Defining the border of the peri-urban interface can also be dependent on the type of research being done (Buisman 2003). An important functional criterion that can be used is the transport network. Budds and Allen in their research around Hubli-Dharwad have delimited the peri-urban interface “as an area surrounding the twin cities within which urban bus services are extended, thus distinguishing it from rural areas” (1999). Thus laying the focus on the interaction between the city and its surroundings, defined by a functional criteria as the public transport connection.

In this thesis the area surrounding the city will be called the “rural-urban fringe”. The definition of Ramachandran will be used as basis, with changes in land use and economic activities in villages serving as criteria to measure transitional change. This model was supplemented with Von Thünen’s classic model of changing patterns of land use at increasing distances of the city (see 1.2 and 4.1) and the functional models which lay emphasis on the flows between rural and urban areas.

Therefore, the research results will be analysed on the basis of the changes in land use and economic activities in the fringe, and increased interaction between the city (of Hubli) and its fringe.

2.3 Land use dynamics in the rural-urban fringe

Around a growing urban area the increasing linkages with the urban centre generate changes, one of the most important aspects of change is land use change. In remote rural areas, the use of rural land is quite straightforward: it is almost exclusively related to agriculture or forestry (Bentinck 2000). In these areas with traditional agricultural practices, government policies and changes at the highest level of the agricultural market such as the national market or

global market determine demand and prices and so cropping patterns. For such rural areas consistent physical indicators can be applied.

In the rural-urban fringe, however, this is more difficult, for it is characterised by dynamic land use. The land can be used by - or is useful for - many different individuals, groups of people and interest groups leading to a high heterogeneity in (possible) land uses. In the rural-urban fringe there are many actual users and potential users of the same land. The most beneficial use of land varies from place to place and from user to user, depending on its location specific context. Moreover, there are multiple options for using land, and there are many that could be more beneficial to the owner than agricultural land use. The preferred or desired use for land is arbitrary, being a complicated sum of uses by many different users (Bentinck 2000).

Urbanisation consumes agricultural land and takes up lands from the nearest villages (Bentinck 2000). Barrow draws attention to the following: “It is not unusual for urban extension to take some of the best agricultural land for the simple reason that towns (and villages) have tended to grow up in lowlands or on plateaux, especially near rivers where the soil is good”(p238, 1991). Bentinck (2000) makes use of an example of Khan (1997) to indicate the trade-off between rural and urban interests: in Aligarch in the rural-urban fringe of Delhi, some 100 km from city 98% of the urbanised land was of good agricultural quality.

The most influential factor in land use change in the fringe is the direct influence the city has on the fringe area surrounding it. Through acquisition by the government or speculation by urbanites agricultural land use gets overtaken, as the original inhabitants of the fringe often do not have the economic or political power to resist these developments. This can lead to rapid conversion of (good) agricultural lands, followed by different forms of land use related to the of the plans of government authorities or investors from the urban areas. Even in some cases lying fallow for many years if this suits the interests of the owner of the land.

Besides the direct conversion of farmland into built-up urban areas, there are other effects that have an impact on a much wider area outside of the urban border. The issue of soil excavation by brick kilns and mining for certain types of stone are other processes contributing to the disappearing of agricultural lands (Nusrath and Mahadev 1991).

Among the negative consequences of the urban expansion on peri-urban agriculture are land conversion and pollution: “Rich agricultural lands were transformed into urban land use, and irrigation waters polluted by industries and urban households, which led to considerable production decreases in agriculture” (Vleugels 1990 cited in Bentinck 2000). Generally speaking land degradation and environmental concerns are characteristic of the rural-urban fringe. Although the term degradation is value-laden and therefore arbitrary (Blaikie 1996), the environmental concerns seem justified as in the rural-urban fringe the lack of government regulations and amenities such as sewage and garbage disposal and the co-existence of different land uses next to each other (industrial beside agricultural for example) can lead to an environmental health hazard.

The effect of the city on agricultural land use development can be seen in the form of commercialisation of agricultural land uses which is the supposed second step in Ramachandran’s model of urbanisation around Indian cities.
This model was however based on the metropolitan type cities in India. An example of the Latin American city Asuncion, shows that the effect of the city are not always evident. “Beyond the immediate vicinity of the city, Asuncion shows less influence on cropping patterns; the effect is neither positive (intensification) or negative (loss of productivity) ”(Zoomers and Kleinpenning 1996 in Bentinck 2000).

2.4 Land in the fringe of Hubli-Dharwad

In the case of Hubli-Dharwad land is the foremost important resource of households in the fringe as agriculture is still the most important economical activity (Davila et al 1999). This land is getting exposed to new opportunities and constraints.
In the case of Hubli-Dharwad the changes in land use in the rural-urban fringe are influenced by the local characteristics, as one major feature of the fringe area of Hubli-Dharwad is its heterogenic character. The fringe area around the twin-city varies in climate, elevation and soil type.
Furthermore, the city is -as was mentioned in the first chapter- not a metropolitan area but merely a secondary city functioning as a regional centre. This influences the development of the city which turn influences developments in the fringe.

Apart from land, labour is also an important resource for people in the fringe of Hubli-Dharwad. As improved transport connections have opened up the possibility to commute to

the city for work and the arrival of non-agricultural activities has brought non-agricultural employment to the fringe, diverse non-agricultural income activities are increasingly supplementing the income of agricultural land.

Hubli-Dharwad is not experiencing a rapid expansion like many of the big cities in India and the pressure of urban built up land pushing out farmland is not very dominant. In the case of Hubli Taluka area, the city of Hubli is an industrial and trading centre, this is not a strong influence on land use because industrial land use demand is limited and often planned in industrial areas outside the city.
Infrastructural works, residential and governmental land use development however, have taken up quite an amount land. (HDUDA 2003). These last two land use forms are being developed in between the two cities and here a lot of good agricultural land is being conversed to built up land use. While the transport network of the twin-city has broadened around the city, as (interstate) transport connections have improved. A new highway by-pass has been west many kilometres away from the city. All agricultural lands on the city side of the road have been hauled in the municipality, in this way the city further tightened its grip of on the agricultural surroundings.

Another factor contributing to land conversion is speculation. City folk and entrepreneurs with capital tend to buy up land just before or after land has been designated for (mostly) residential purposes by the government. The land will then be marked as taken and left fallow until the owner decides to cash his investment. This obviously reduces the amount of available agricultural land, although bought up land may be left unused for years. This type of land conversion is concentrated mostly in the area between the two cities.
In the fringe area of Hubli-Dharwad a common and popular type of land use investment for people from the city is the setting up of orchards. This type of land use falls under the tax-free status of agricultural land under the Indian Law and increases the value of the land over the years as the fruittrees increase in size and harvest in the course of time.

In a wider area around the city, agricultural land is being conversed to brick kilns and open mines for producing building materials. This type of land use development depends strongly on local physical properties such as soil type and groundwater table, but its products are aimed at the city’s construction market.

Agricultural land use development is also a big contributor to land use change in the fringe of Hubli-Dharwad. The process of agricultural commercialisation (intensification) under influence of the city leads to shift in cropping patterns in the fringe area of the twin-city. But, as the climatological and physical properties in the fringe vary considerably, so do the possibilities for the different types of agricultural land use change. This is a dominant factor in the agricultural land use dynamics in the twin-city's fringe

In this thesis this *agricultural land use change* has been the main focus of the research due to dominance of this source of income and form of land use in the fringe zone in Hubli Taluka. The choices of the many types of different land users which can be found in the rural-urban fringe to *use their farmland for certain agricultural crops, convert it to non-agricultural land use, buy, sell or lease it, irrigate it or supplement their income from it with diverse economic activities* has been researched.
Apart from these agricultural land use dynamics, non-agricultural land use development has been chartered and researched on the basis of secondary data sources and two village cases of fieldwork research. Although researched much less extensively than agricultural land use, an *overview of non-agricultural land use types and their development* was included to complete the picture of land use change in the fringe of Hubli city.

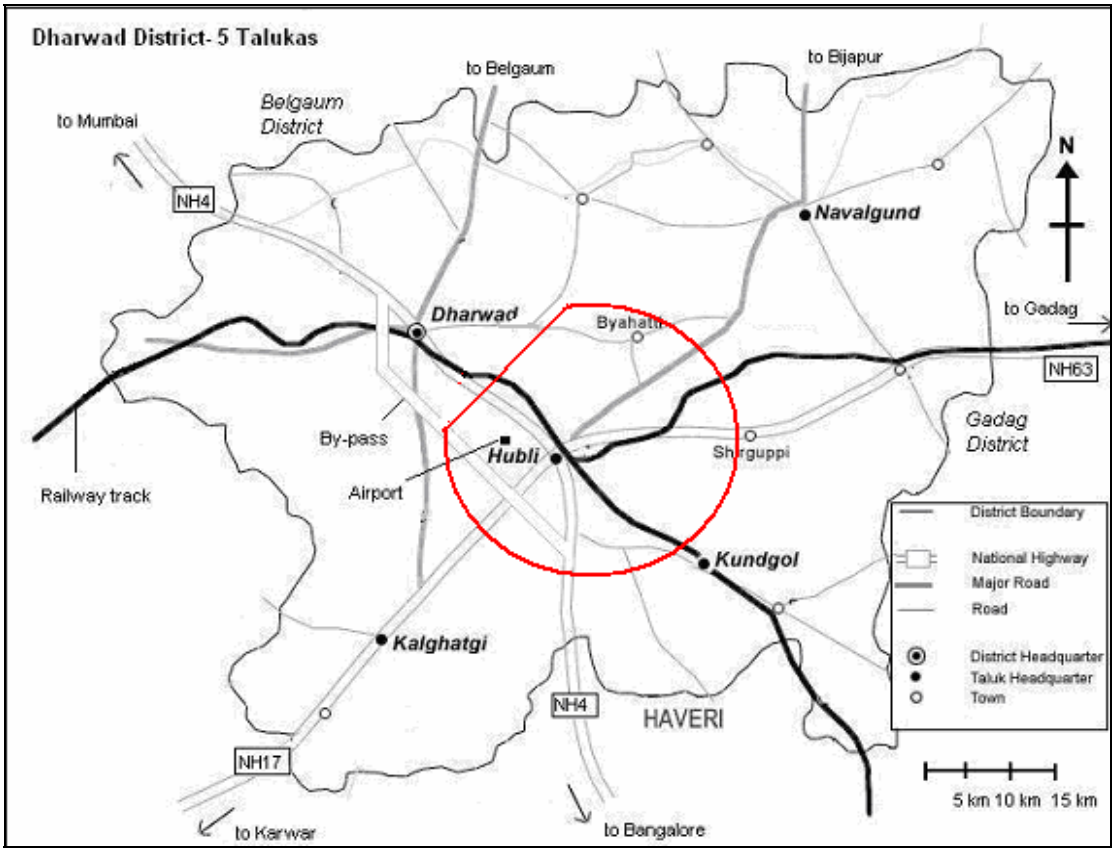
Both land use types have been researched in twenty village to all sides around Hubli, all within a supposed fringe area border reaching up to 20 km from the city. Villages with different levels of city influences were selected to give a sort of cross-cut of the rural-urban fringe of Hubli-Dharwad (see Map 3.2 for the location of the research villages).
In these villages cropping patterns were analysed and compared to trends in a broader region around the city. Subsequently, the differences in agricultural land use within different parts of the rural-urban fringe are analysed and further described by means of actual cases of land use developments within a number of villages. The non-agricultural land use types encountered in these villages were chartered and in two village cases researched.

Map 2.1 below, shows Hubli-Dharwad the twin-city, lying at heart of Dharwad District. It gives the position of the cities relative to each other and the surrounding transport network. The transportnetwork depicted consists of the main roads, the railway track, the airport, the National Highway 4 (and the recently finished by-pass) and other National Highways which

branch of the NH4 in Hubli. When looking at the map, it becomes clear how the two cities have ‘sealed the faith’ of the agricultural area between them.

Map 2.1 also shows the radius of the rural-urban fringe boundary (red line) as defined in this research, it is a roughly radius around Hubli city (but within Hubli Taluk), reaching up to roughly 20 km east, north and south, and 10 km westward were its delimited by the boundary with Dharwad Taluka. This rural-urban fringe boundary is not actually concentric but merely gives an idea of the area in which the range of twenty villages were selected to research the influence of Hubli city.
The other towns which are shown on the map are the Taluka headquarters of the other three Taluka’s: Kalghatgi to the south, Navalgund to the northeast and Kundgol to the west (see Map 3.1. for Taluka area borders within Dharwad District).

Map 2.1 Dharwad District and Hubli Dharwad (source: www.mapsofindia.com)



2.5 Conclusion

After the discussion of the theoretical discourse on the spatial concepts rural and urban at the start of paragraph 2.1 it became clear that the these concepts -still in use in many countries- are no longer sufficient in describing the urbanisation process around cities. Especially in the

case of fast growing metropolitan area such as can be found in Asia, the urban and rural activities are spread and mixed in vast area around the urban core.
In a reaction to this development new names and concepts have been launched to describe this form of urbanisation on the fringe of the city more adequately. Names include the rurban fringe, the peri-urban fringe and the rural-urban fringe, in this thesis the last name will be used.
Characteristics of the rural-urban fringe area the dynamism under influence of the changing and strengthening of the interaction between the city and its surroundings.
Ramachadran who has researched urbanisation around the Indian (metropolitan) cities has defined the rural-urban fringe as an area in which land use and economical activity changes are the parameters of urbanisation.

It is therefore that in this thesis land use change in the fringe area of Hubli city has been researched. In the case of Hubli city, the most important economic activity and land use form in the region around Hubli is agriculture. Therefore agricultural land use change is the main focus of this thesis, non-agricultural land use has also been researched but much less exhaustively than agricultural land use dynamics. The research area has been defined after consideration of the aforementioned parameters of change and fieldwork observation, leading to the selection of 20 villages in radius of 20 km around Hubli, in all directions. The results of the research of land use in these villages is featured in chapter 4 and 5. First however the broader context of the Hubli city and its fringe will be discussed in chapter 3 which describes the characteristics of the twin-city and the environment in which it is embedded.

Chapter 3 Hubli-Dharwad: the city and its fringe

3.1 Introduction

In the previous chapter the definitions of the geographical terms rural, urban and the rural-urban fringe in the development geography have been introduced. The aim of this chapter is to provide a description of the region in which Hubli-Dharwad and its fringe are embedded. Therefore, it will deal with some aspects which make up the broader context in which the changes in land use and economic activity in the fringe area are taking place.

These aspects are the arrangement of the twin-city municipality, growth of the city, socio-economic characteristics of the region, physiography of the fringe and agricultural and urban land use development around the city. These first three aspects are dealt with in the following paragraph.
In paragraph 3.3 the nature of agriculture under the semi-arid conditions and heterogenic physiography which prevail in the region will be described in some detail. This serves as necessary background information for the analysis of agricultural land use change in chapter 4. Furthermore, government policies and projects affecting urban land use in Hubli-Dharwad and its surroundings will be discussed shortly in paragraph 3.4. In this paragraph the effects of unifying the two cities are discussed, as well as industrial and infrastructural developments induced by the government. This paragraph forms the introduction to the non-agricultural land use development around Hubli, which will be analysed in chapter 5.

Paragraph 3.5 translates the settings and developments to the research area: the rural-urban fringe around Hubli (within Hubli Taluka). Explaining the heterogenic character of the fringe area, the location of the researched rural-urban fringe villages and the functional division of the fringe area into three distinctive areas.

The final paragraph ends this chapter with the conclusions about the Hubli-Dharwad and the rural-urban fringe around Hubli.

3.2 The conurbation and its region

In the first sub-paragraph the administrative units that constitute Hubli-Dharwad and its surroundings rural areas will be explained. Demographic characteristics will also be presented.

3.2.1. Administrative arrangement

Hubli-Dharwad, located in Karnataka state in south-west India, is a conurbation comprised of two core urban areas, Hubli and Dharwad. It is situated 427 km northwest of the state capital, Bangalore, and approximately 600 km southeast of Mumbai (Bombay) (see Map 1.1).

Hubli and Dharwad were actually two separate cities approximately 20 km apart and got twinned in a single municipality in 1962, following a reorganisation of the municipal boundaries. Thus making it the third largest urban agglomeration in Karnataka state (after Bangalore and Mysore) and the premier city of North Karnataka (Brook, Purushothaman and Hunsal 2003)[3].

Nowadays, the residents still refer to the two urban areas as separate cities, even though the approximately 20 km which separate them is being transformed into a built-up urban area, merging the (formerly separate) cities into one in the near future.

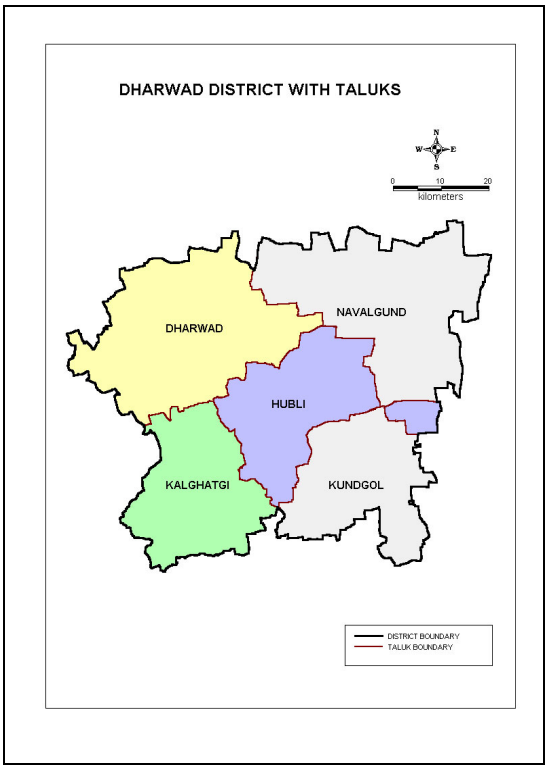
Hubli is the larger city of the two and a centre of commerce, trade and industry, and also a transport node within the region, due to its position on road, rail and air links (see Map 2.1) with Bangalore and Mumbai (NH4), both important centres of trade and industry. Other urban centres connected through the national highway network are the mining centres of Hospet-Bellary (NH63) and the port of Karwar (NH17). Via several state highways, which intersect at Hubli, the surrounding rural areas are also well connected.

Dharwad, lying 20 kms to the northwest, acts mainly as the administrative centre and hosts the city's higher education institutions. Dharwad is the district headquarters, housing all district level offices and the higher education institutions include two Universities: Karnatak University and the University of Agricultural Sciences, three medical colleges and an engineering college. Hubli also has a medical college/ hospital and workshops of the South Central Railway (Budds and Allen 1999). Currently, more educational institutions and government offices are being developed in the area between the two urban cores.

Hubli-Dharwad city is situated in the middle of Dharwad District (see Map 2.1), which is an administrative area comprising of five *Taluka's* (sub-district) areas: Dharwad, Hubli,

[3] The interdependence between the two cities was recognized as far back as 1925, when they were constituted in a common Municipal Borough with a combined population of 69,940 inhabitants (HDUDA 2003).

Kalghatgi, Kundgol and Navalgund Taluka (Map 3.1) (see Appendix A to get a complete overview of the different levels of administrative units and government structures in India).



Map 3.1 Dharwad District and Talukas (source: Tinnemans, 2003)

Hubli and Dharwad Taluka together form the *Hubli-Dharwad Municipality area.*
These two Taluka's contain the two cities and surrounding rural-urban fringe areas. Both Taluka areas can be considered to be under the direct influence sphere of the two cities, which are changing over agricultural lands here and also draw migrants from the other three Taluka's. Although the northern part of Kalghatgi Taluka is also under direct influence of the twin-cities and experiencing in-migration due to its close location nearby the urban areas (see paragraph 3.2.3).

Below Taluka-level, areas considered a direct part of the city are sub-divided into *Wards,* (also called *Community Development Blocks,* C.D.B.'s). Together these *Wards* make up the *Hubli-Dharwad Municipal Cooperation* (*HDMC*) area. The *Ward* areas include the two urban cores and some of the rural-urban fringe areas around and between the two cities. These Ward areas are not necessarily a full part of the city, but they (already) fall directly under the city's administration. Several of the rural-urban (research) villages have been thus already been turned into *Wards,* due to the urban growth of Hubli-Dharwad. Mostly those villages located on the edge of the urban areas or in between the two cities (for example the villages of

Gabbur and Unkal, see 3.4 and Map 3.2). The remaining (surrounding) areas in the Municipality area that are considered rural are sub-divided into *Village areas* (e.g. villages and their lands). Most of the other rural-urban (research) villages have the status of *Village area*

3.2.2. Demographic characteristics

In 2001, the city of Hubli-Dharwad had a population of approximately 786,000 while that of the whole Dharwad District was 1,604,000. The distribution of the population between the cities Hubli and Dharwad is roughly 5:2, with Hubli (Taluka) having 536,000 inhabitants and Dharwad (Taluka) 246,000. About 45 % of the population of Hubli-Dharwad was classed as urban in the 1991 census (Budds and Allen 1999), indicating the importance of (still) rural areas within the area around and between the cities.

Table 3.1. Population growth of Dharwad District and Hubli-Dharwad, 1981-2000

Year	Dharwad District	Population increase	Hubli-Dharwad	Population increase
1981	N.A	-	527,108	-
1991	1,428,174	N.A.	648,298	22,9%
2001	1,603,794	12,3 %	786,018	21,2%

(Budds and Allen 1999, Census of India 2001, HDUDA 2003).

From 1981 to 1991 Hubli-Dharwad experienced a growth of 22,9% (see table 3.1), which is a slow growth compared to the average growth of urban agglomerations on Karnataka State level (36,3%) and national level (37,3%). Compared to the average growth of urban agglomerations in Karnataka and India from 1991 to 2001, respectively 29,1% and 41%, the growth of Hubli-Dharwad over this period is again relatively slow.

Hubli-Dharwad is characterised by a low urban population density by Indian standards (see table 3.2), mainly this is due to the fact that between the two cities- but within the municipal boundaries- there are still areas of farmland, this is a direct consequence of the unification of the cities in one municipality.

The twin-city (HDMC area) covers 191 sq. km., of which 40- 45% was developed as fully urban in 1991, indicating the importance of agricultural land use *within* the conurbation area (Brook 1999).

Table 3.2 Population densities in urban areas 1991

	India	Karnataka	Hubli-Dharwad
Urban population density	5953 persons/ sq. km	4985 persons/ sq. km	3395 persons/ sq. km

(Brook 1999, Budds and Allen 1999 and Census of India 1991)

The rural area around Hubli-Dharwad (e.g. excluding HDMC area which is urban) has a moderately high population density compared with other parts of rural Karnataka (see Table 3.3.). This is due to the productive soils and availability of arable lands in the region (Brook, Purushothaman and Hunsal 2003).

Table 3.3 Population densities in rural areas 1991

	Karnataka	Dharwad District	Dharwad taluk	Hubli Taluk
Rural population density	166 persons/ sq. km	181 persons/ sq. km	177 persons/ sq. km	180 persons/ sq. km

(Budds and Allen 1999 and Census of India 1991)

Furthermore, the population in the rural areas is growing quite fast, faster than the urban population (between 1981 and 1991, the population in the rural areas of Dharwad District grew at a rate of 2,7% per year, while the population in the (urban) HDMC area grew at an average 2,1 % per year) (Budds and Allen 1999). The growing population in the rural areas, which are already relatively densely populated, will assure a constant stream of migrants to (the fringe of) Hubli-Dharwad city in the future. This process will be strengthened by events such as the (re-occurring) droughts which have hit the region the last three to four years.

An interesting feature which goes for the villages in the region around twin-city and also for the villages in the rural-urban fringe is that the average village size varies with the physiography of the area. In Hubli Taluka the average village numbers 2,115 inhabitants, while in Dharwad Taluka this is 1,651 inhabitants. The drier black cotton soils (which dominate most of Hubli Taluka) have bigger villages, which are spread over larger areas, compared to the wetter, red soil area to the area west of the city (Birmingham University Baseline study 1998). Therefore, the western parts of the rural-urban fringe are already more evenly populated and are thus more easily fit to urban activities and land use then the eastern parts with their vast (empty) plains. This situation is further strengthened by migrational patterns.

At this moment it seems that migration is not such a big contributor to the population growth of Hubli-Dharwad and it's rural-urban villages (this could not be measured exactly since the Indian census data does not contain information on key components of population change such as migration levels or birth rates, thus the in-migration could only be measured by setting of growth in villages against the average natural increase in India over the period 1981-1991[4]). This is a difference with other (bigger) cities in India which are experiencing a more rapid influx of immigrants.
However, from the data arises a specific migrational pattern in which the western red soil areas in the fringe are experiencing in-migration, while the rural black soil areas to the east are experiencing out-migration (Birmingham University Baseline study 1998).

This is indicated by the fact that Dharwad Taluka stands out as having a concentration of villages, which have grown through in-migration; 75% of the villages had grown more than the national average growth. These villages are generally located to the southwest of the city in the wetter, red soil zone, whereas villages to the north on the drier black cotton soil have shown a relative decline over the decade.
Some 45% of the villages in Hubli Taluka experienced in-migration, these villages tended to be clustered just west of Hubli, the villages east of the city generally lost population.
On the scale of the whole district, in Kalghati Taluka (to the west of Dharwad) 41% of the villages experienced in-migration, mostly in an area closest to Dharwad. In the other Taluka's Kundgol and Navalgund, which are covered by black soils and are located more the east (and farther away from the city) a large majority of the villages lost inhabitants (Birmingham University Baseline study 1998).

Although reasons for these migration patterns have not been researched, it seems evident that life in the farther away rural villages becomes less economically sustainable. Especially in combination with the droughts that hit the region (which impacts the drier areas to the north and east hardest), with investments in agriculture arrested and crop failures resulting in a decrease in agricultural work. All this can lead to an increase of people from rural areas seeking a new livelihood in (rural-) urban areas where there's a demand for non-farm unskilled labour or in villages near the city where farmers need cheap land labourers.

[4] For 1981-1991 in India the average growth is 24%. When increase in villages was more than this, it had experienced in-migration, when growth was less then 24% a village experienced out-migration.

Summarising this information one can say that the twin-city and its surrounding district are both not experiencing the high growths or population pressures as can be seen in other parts of India. The rural areas have a relatively high densities of population, while Hubli-Dharwad is a medium sized city with a low population density due to its unique history of unifying two urban areas in to one. Migrational movements seems to take the shape of out-migration in the drier black soil areas north and east of the city (and farther away from the city), and in-migration in the case of villages located in the southern and western fringe areas, which are the wetter, red soil areas. The growth of the city was slow in the past but seems to be increasing, a contributor to this growth is the stream migrants to the city from the rural eastern areas which swells further in time of drought.

3.2.3 Socio-economic characteristics

Hubli-Dharwad is located in a predominantly rural region where agriculture is the principal activity due to the productive nature of the soils and agricultural land forms the basis of the livelihoods of most households in the region. Even much of the commercial and industrial development in the region is related to agriculture directly or indirectly (Brook and Davila 2000), an example of this was the presence of large cotton-textile industries in Hubli, these have long since declined.

Agriculture in the region around Hubli-Dharwad is a more important source of employment than in other parts of India and Karnataka (see table 3.4). Although some 70% of the population are engaged in agriculture, it only contributes 30% to the district's income. This is related to the fact that agriculture in the region is quite traditional with above average size land holdings, the vast majority of which are still rainfed (see table 3.4). Furthermore, the region has a semi-arid climate in combination with very low levels of irrigation. The level of mechanisation is also low and the traditional agricultural techniques are labour intensive. Thus the agricultural productivity is relatively low and even vulnerable to dry spells, in the case of failure of the monsoon.

Subsequently, the economy of the fringe areas around Hubli-Dharwad is still largely based on agriculture, which is quite traditional and has a low productivity. Developments in agricultural and non-agricultural land use and economic activities can therefore have a big impact on the livelihood of the rural-urban fringe population.

Table 3.4 Agricultural characteristics at different administrative levels

Agricultural characteristics	India	Karnataka	Dharwad District
Mean size of agricultural holding	1,69 ha	2,41 ha	3,14 ha
Proportion of workers employed in agriculture	66%	67%	70%

(Birmingham et al. 1998)

Being a predominantly rural region, levels of literacy are low: around 50% for men and almost 25% for women in 1991. In the more dynamic areas such as the rural-urban fringe literacy tends to be lower because of the absorption of unskilled and uneducated migrants by the demand for low paid unskilled labour such as construction work etc.. In the more agrarian and stable areas literacy rates are generally higher (Budss et al 1999).
Labour in the rural-urban fringe of Hubli-Dharwad has a strong gender dimension. Over the last fifteen years employment opportunities have increased in the fringe due to a number of factors. A feminisation of agricultural work has taken place: whilst men have increasingly gained non-farm employment, the vast majority of the female labour is still engaged in agricultural production. This is the lowest paid sector, and like in general in India, women in it are paid less than men (Brook and Davila, 2000).

3.3 Climate, soil types and agriculture

On the basis of climate and soil type(s), Karnataka State is subdivided into four agricultural zones: the North Maidan, the South Maidan, the Malnad and the Coastal region. The North Maidan corresponds roughly with North-Karnataka, within which Hubli-Dharwad is situated (Sharma, 1999).
This subparagraph will start with a short description of some of the characteristics of agriculture in Hubli Taluka. After discussing some of the general characteristics of agriculture, the crops will be introduced and classified into groups. This grouping op crops is based on the share of the produce which is used for food purpose and the share which is used for commercial marketing. Within agriculture in this semi-arid region there is also an important distinction to be made between irrigated and rainfed land, on the irrigated land the commercialisation of agriculture is at its peak. Irrigated land use cropping is therefore in a separate category.

3.3.1 Soil types and Rainfall

Soils in Hubli Taluka fall into two main types, black and red soils. These last soils have a dark coloration, high clay content and are moisture retentive. The black soils are fertile and can give good yields if rainfall is adequate. They are generally classified as *Vertisols* in Ustert sub-order. Examples of crops which thrive on these 'heavy soils' are sorghum, wheat and cotton. The deeper soils permit cropping on residual soils moisture in the (second) north-east monsoon. East of Hubli there are predominantly these deep black soils (Birmingham University Baseline study, 1998)
South and west of Hubli City there are mostly mixed red and black soils, to the southwest the red soil dominates and the area becomes hilly, this area borders on the West Ghats. These red soils overlie acidic bedrock. They vary in sand and clay contents, the red coloration is derived from the presence of ferric oxides. Generally, they are classified as *Alfisols*. These red soils are specifically suited to rainfed-irrigated paddy growing.

The climate of Hubli Taluka is semi-arid with a bi-modal rainfall pattern. The annual periods of the two main cropping seasons are: from June until September (*mungary*) during the heavy south-west monsoon, and from October until January (*hingary*) during the drier north-east monsoon. Summer in Karnataka starts in February and ends when the first rains come in May. On the scale of the region surrounding the twin-city there are some differences in rainfall from (south)west to (north)east and these differences are quite significant. In Dharwad Taluka, villages about 10km west of Dharwad City receive roughly 1000mm. The whole area between Dharwad and Hubli and south of Hubli City receive between the 700 and 800mm, with the most southwestern parts of the Hubli Taluka receiving some more rain than this. The east -that is the black soil plains east of Hubli- receive about 650mm annually (Brook, Purushothaman and Hunsal, 2003).

Concluding these physical geographical differences for the area around Hubli city, there are black soil areas east of the city which receive the least rainfall (650mm per year). These soils can retain a lot of moisture, therefore when rainfall has been adequate cropping in both seasons is possible in the east. West and south of the city there are red and black mixed soils and southwest of Hubli there are red soils, the more southwest the higher the annual rainfall (between 700-800mm).

Figure 3.1 Traditional ox-driven agriculture on the black soil plains (source: fieldwork)

However, there is one final significant difference between the two soil types: the availability of groundwater for irrigation. The groundwater levels in the red soil area are high and quality of groundwater is good for irrigation, this makes digging of borewells possible in these areas. In the black soil dominated eastern parts the groundwater level is much lower and the groundwater is contaminated with minerals like natrium, making irrigation in these areas impossible. These factors make agriculture in the east completely dependent on the annual amount of rainfall, which can be stored as residual moisture for the first and second growing season. Whereas, farmers in the southwest with red soils, can irrigate certain crops all through the year, or can give there crops an early start by watering them before the first rains start.

3.3.2 Agricultural characteristics

The dominance of moisture retentive black soil plains in the east of Hubli Taluka, with their low and level relief makes the Taluka -despite its low rainfall and poor irrigation development- agriculturally very intensively used. It has a high percentage of the total area surface sown with crops (due to the abundance of arable land on the plains). The net area sown as percentage of the total geographical area is therefore among the highest in Dharwad District and the North Maidan region (see Table 3.5)[5].

[5] The net area sown in Hubli Taluka and the whole North Maidan is strongly influenced by the fluctuating annual rainfall and the lack of irrigation development: in case of delay or failure of the (southwest) monsoons the net area sown in a particular year can decline significantly.

Table 3.5 Net area sown, cropping intensity and irrigation levels in 1991 compared.

	North Maidan	*Dharwad District*	*Hubli Taluka*	*Dharwad Taluka*
Net area sown (as % of total area)	73 %	73-95 %	94,5 %	> 73 %
Cropping intensity (% of TCA* sown more than once)	12 %	17,5 %	20-30 %	< 10 %
Irrigated area (as % of TCA)	16,7 %	9,4 %	1.9 %	2,6 %

(Adapted from Sharma, 1999 and University of Birmingham Baseline study 1998) * TCA = Total Cropped Area

In Table 3.5, cropping intensity gives an indication of the intensity of land use, it shows how much percent of the agricultural land is sown more than once a year. Hubli Taluka has a relatively high percentage of its farmland cropped more than once: 20-30 %. This is again due to the dominance of moisture retentive black soil plains in the east of the Taluka, on which certain rainfed crops can be grown very well in the second season (after the north-eastern rains). The sowing of agricultural land for a second time in a year is an development of the last thirty to forty years. For example the cropping intensity in Dharwad District was only 2,5 % in 1969, compared to 17,5% in 1991 (see Table 3.5). Sharma (1999) sees the introduction and expansion of varieties of crops (new HYV's for example) which can be grown rainfed during the second season (*hingary*) in combination with the increase in population pressure, as the most important development which has led to the increase in cropping intensity.

Sources of irrigation water in the fringe of Hubli are tanks, open wells, canals and borewells. Open wells and embanked tanks (which retain the rainwater after the monsoons) are the traditional sources of irrigation and are present in every village.
To the northwest of the city region there's a big canal irrigation scheme: the Malaprabha Right Bank Canal. The villages further to the north of Hubli have access to this source of irrigation. Since the 1980's advances in technology have made the sinking of borewells possible. This has lead to a sharp increase of total area irrigated by borewells, nevertheless irrigation levels have remained low.
Therefore, agriculture in the fringe of Hubli (and the whole Taluka) stands out as having a very low level of irrigation (see Table 3.5). The percentage in Table 3.5 is even somewhat

misleading, considering the fact that a large share of the irrigated land is located near the canal irrigation scheme in the north, outside the fringe area.
Furthermore, these irrigated areas in Hubli Taluka consist of small pockets of land. This is indicated by the fact that in 1991, only seven of the fifty-eight villages in Hubli Taluka had more than 5% of their land irrigated (Birmingham University Baseline study 1998).

During the interviews with village accountants in the twenty research villages it became clear that all research villages with access to good groundwater (villages in the red soil areas southwest) had experienced a strong increase in the number of borewells the last ten years and especially the last 5 years. With the number of borewells in these villages tripling since ten years back. This increase was attributed to failure and/ or delay of the monsoon the last 4 years, in combination with a drop in the groundwater-table causing old borewells to dry up, making new borewells necessary. However, the increased popularity of horticultural crops (noted during the fieldwork research) -which need watering all-year round- must surely be a factor as well. In any case, since the numbers of 1991 mentioned above, there has been an strong increase in irrigation (by borewells) in order to expand irrigated areas or to buffer the drop in the amount of rainfall.

A final note on irrigation around the twin-city is the use of wastewater as an irrigation source. The twin-city produces an estimated 600 million litters per day and this is likely to increase in the future. Coming from the city through natural watercourses (*Nallla's*) near both Hubli and Dharwad, this provides farmers along these *Nalla's* with a perennial source of water.

Figure 3.2 A borewell irrigated field (source: fieldwork)

3.3.3 Crop-groups and commercialisation of crops

On the specific soils and under the semi-arid conditions which dominate agriculture in Hubli Taluka there are a (limited) number of crops which can be grown rainfed. These rainfed grown crops cover by far the largest part of TCA (Total Cropped Area), as levels of irrigation are very low in Dharwad District and Hubli Taluka (see Table 3.5).

Within the rainfed grown crops, there is a distinction between traditional crops which are (partly) used for home consumption (jowar, paddy, wheat, groundnut) and crops which are grown as commercial cash crops. All the produce of these commercial crops is aimed at market demands and will be sold for either industrial processing (sunflower, safflower, cotton) or for further agricultural marketing by agents and traders (onion, chilly, potato). Furthermore, if there is any irrigation, this is used to grow remunerative commercial field crops which need extra water and care such as hybrid cotton, maize and sugarcane. Or irrigation is used for growing extra valuable products: fruits, vegetables and flowers, products which are (always) in demand is the city.

The table below shows the percentage of the harvest of the crops which is used a marketable surplus. It must be noted here that although the crops which are also used for home consumption are always the same, the commercial worth of certain commercial crops can vary according to prevailing market conditions, making them more or less attractive.

Table 3.6 Marketable surplus of main crops per crop-group.

Marketable surplus (%)	
Staple food crops- cereals and millets:	
Jowar	15-25 %
Wheat and paddy	20-40 %
Pulses:	
Green gram, bengalgram, tur	70-90 %
Oilseeds:	
Groundnut	90%
Sunflower, safflower, soyabean	95-99%
Rainfed commercial crops:	

Onion, chilli, cotton, potato	95-99 %
Irrigated commercial crops:	
Hybrid cotton, maize, sugarcane	95-99 %

(Adapted from Birmingham University Baseline study 1998)

These characteristics of the crops have led to the forming of the following crop groups:

1. *Cereals and millets*, these include the staple food crops, these crops traditionally dominated agriculture in the area.
2. *Pulses*, which are only for a small part used for home consumption.
3. *Oilseeds*, used mainly for oil production, but in the case of groundnut can also be used for direct (home) consumption.
4. *Rainfed commercial crops*, the crops in this group are a mixed bag of types of crops grown rainfed that produce a more commercially valuable product than the crops featured above, which produce bulk- and traditional food-products.
5. *Irrigated commercial crops*, these include water-wanting commercial field crops and valuable perishable products.

Below some of the characteristics of each crop-group will be explained and the most important crops of each group are described (based on Sharma, 1999).

1) *Cereals and Millets*:

This group contains the staple food-crops in the region. All crops are edible grains and these crops - traditionally- covered most of the agricultural land. The most important crops are *Jowar, Wheat, Paddy*.

- *Jowar* (*Sorghum*) is a millet, and the main food crop staple crop in the North Maidan. It is the traditional subsistence crop and the most important crop in areal size (it covers roughly 50 % of the TCA in the North Maidan).
- *Wheat* is the most important food crop after *Jowar*. It is grown almost exclusively on the black soils. Both *Wheat* and *Jowar* are grown rainfed, rendering their yields vulnerable to fluctuations in rainfall. Both cereal-crops also have a very low percentage under hybrid varieties/ HYV's[6].
- *Paddy* can be grown rainfed in hilly red soil areas in the southwestern parts of Hubli

[6] Farmers are not inclined to fit HYV's into their cropping patterns, because in the case of failure of the monsoon -in this largely unirrigated area- the extra investments in agro-chemicals necessary for the HYV's would be lost (Sharma, 1999).

Taluka. There, paddy is a staple food crop and is therefore included in this group.

Figure 3.3 Paddy cultivation in the red soil areas (source: fieldwork)

2) Pulses:

The crops in this group all produce edible seeds. These edible seeds form an important source of protein in the vegetarian Indian kitchen. Traditionally, pulse-crops are grown purely rainfed, no HYV's pulse-crops have been introduced . The most important pulse crops are: *Tur*, *Bengal gram* and *Green gram*.

- *Bengal gram* (Chick Pea) is especially suited to the black soils plains which retain sufficient moisture for this crop in the second season.
- *Green gram* (Mungbean) is a pulse crop which is grown especially around Hubli-Darwad on the red and black soils.
- *Tur* is a traditional pulse crop which can be grown on both soil types.

3) Oilseeds:

Oilseeds are cultivated for the production of (edible and non-edible) oil from the seeds. The most important oilseeds in Karnataka are *Groundnut, Sunflower, Safflower* and *Soyabean*.

- *Groundnut* (Peanut) is by far the most important of all oilseeds, it is a traditional rainfed crop which can grown on both the red and black soils.

- *Sunflowe*r is an oilseed that was successfully introduced in the early 1970's and has spread quickly, it can be cultivated on both types soil.
- *Safflower* is grown rainfed during the second growing season, mostly on black soils. In comparison with *Groundnut* and *Sunflower* it gives low yields.
- *Soyabean* was found quite a lot around Hubli-Dharwad during the fieldwork period, it is a recently introduced crop. Here it is cultivated on the red soils.

4) Rainfed commercial crops:

The major commercial crops are the non-food crop *Cotton* and the rainfed grown vegetables *Chillies, Onion* and *Potato*. *Chilly, Onion* and *Cotton* are usually grown intercropped and *Chilly* (with its short maturity-period) gets removed followed by *Onion*, while *Cotton* grows on into *hingary* before being harvested. It should be mentioned here that these commercial crops are grown irrigated in most other (dry) parts of India and Karnataka (Sharma, 1999).

- *Cotton* is an important commercial crop. It is cultivated on the black soil plains and historically it was the number one cash crop in the twin-city region. The most cotton is grown rainfed is of a local variety (*Desi*), its rainfed conditions render unstable yields. A HYV-cotton has been developed: *DCH-cotton.* This HYV gives much higher yields but needs irrigation and investment therefore around Hubli however, it did not catch on (Sharma, 1999) (see also group 5).
- *Chilly* is a commercial cash crop vegetable grown rainfed on the black soils.
- *Onion* and *Potato* are two commercial (cash crop) vegetables which can be grown rainfed. Both are grown preferably on the black soil plains during, a difference between the two crop is that potato is more water-wanting than onion.

5) Irrigated commercial crops:

This group consists of crops which need extra watering to survive under semi-arid conditions, field crops in this group are *Maize* and *DCH-cotton.* The other crops are *fruit-trees, vegetables, floriculture* and *sugarcane,* these crops these need continuos irrigation.

- *Maize* and *DCH-cotton* are both remunerative commercial cash crops. Maize is only

grown as a HYV and was successfully introduced in the 1970s in Karnataka. DCH-cotton gives much higher yields than local variety cotton, but it needs a lot of water. Therefore, it can only be cultivated (during *mungary*) in areas with more rainfall or with irrigation.

- *Fruittrees* need a permanent water source for extra watering. The most important examples of fruittrees are: *Mango,* grows best on red soils, *Sapotha* which can be grown on both soil types but grows best on black soils and *Guave* for which goes the same as sapotha. Minor fruit- and other horticultural trees are *Coconut*, *Acreanut*, *Banana*, *Papaya*, *Lemon, Pomegranate*, *Curry leaf* and *Teak*. These last five tree species are mostly used for bordering the plots.
- *Vegetables* need a lot of extra watering, have a short growing cycle and produce a valuable perishable product. Examples of vegetables are *Brinjal (Aubergine), Tomato, Cucumber, Cabbage, Cauliflower, Beetroot, Peas, Beans, Spinach beet.*
- *Flowers* have the same requirements as vegetables, they need permanent watering, have a short growing cycle and produce a valuable but perishable product. The flowers grown in the city-region are *Roses* and *Chrysanthemums.*
- *Sugarcane* is the most traditional of all water-wanting crops and is pretty wasteful compared to the previous crops. It needs constant watering and produces the bulky sugarcanes, which are then further refined to sugar.

Figure 3.4 Teak- and Coconut trees used for bordering plots (source: fieldwork)

3.4 Urban development of Hubli-Dharwad

The urban development of the conurbation is not as rapid and large scale as can be found in many other Indian cities. In fact, urban land use development in Hubli-Dharwad is mostly government controlled, directed urban growth. The fact that Hubli-Dharwad is not experiencing the fast urban development -which is so often associated with Indian cities -is due to the limited size of the city and the slow pace of population growth.

Furthermore, there are no large scale industries which take up a lot of land and pull many migrants to the area. This mainly due to the dominance of Bangalore, as the *prime city* of Karnataka State and the location from Hubli-Dharwad far away from this metropole.
An additional severe constraint on the growth of industries is the lack of investment in infrastructure needed to raise the availability of the resources water and electricity. The twin-city is frequently struck by water shortages and electricity blackouts, especially in the dry season (power plants run mostly on hydro-energy installations)[7]. In Hubli-Dharwad water comes from two sources; from borewells and from pipelines originating from reservoirs. The pipelines often fail to work because of power cuts; more distant villages often depend on borewells (which- when operated by electrical pumps- also suffer from powercuts) (Brook and Davila, 2000). During the drought of the last 3 to 4 years many water reservoirs meant to supply the city have dried up and even water from farther away lying canal schemes can not reach the cities.
In this regard Hubli-Dharwad can be considered representative for medium-sized cities in South Asia having problems with water and power supply (Birmingham et al.1998).

Due to a slow population growth and a lack of industrial development the pressure of urban development is thus limited and can be directed by the government. Urban land use development in and around the two cities is directed by the local government authorities, while the state authorities are responsible for infrastructural land use development and industrial land use development.

Since the 1990s there are two main urban land use developments effecting land use in the rural-urban fringe area of Hubli-Dharwad. First, there is the recently finished by-pass of the NH4 national highway, which runs west of the twin-city. This relieves the twin-city of the

[7] Generally, water supply in the *urban* areas is available only every three days (during the dry season), and even then water is available for a few hours. Data on water in peri-urban and rural areas is unavailable.

interstate traffic which used to cross through first Dharwad and then area between the two cities and then through Hubli. This new infrastructural line running west of the city was used by the local planning authorities to shift the border of the HDMC to the west. Now the whole area in between the cities and east of the by-pass falls under the municipality area.

This whole area in between Hubli and Dharwad connected, through Hubli-Dharwad road (the old NH4), and lying east of the by-pass has been designated since the start of the 1990s as the main area for urban expansion of the city. The Hubli Dharwad Development Authorities (HDUDA) have made it an area for residential development as well as the location for many of the local government agencies. Most of the urban development is taking place here and it is quickly overchanging the area in between the cities which used to be rural and where agricultural land use is still the largest type of land use.

As can be concluded in this paragraph Hubli-Dharwad is not experiencing rapid growth or fast unruly urban land use development. Nevertheless, peri-urban villages have experienced changes in land use due to the population growth and industrial development of the city, and furthermore the commercialisation of agriculture. This has increased both land prices and land pressure, mostly west of the twin-city and in the area between the cities (Budds and Allen 1999). This goes specifically for lands in these areas along the main roads and for lands which are suited for commercial agriculture like horticulture and have good water availability (Brook and Davila 2000).
The land use change which is going on within agriculture in the rural-urban fringe, is the most widespread land use development going on in the fringe area and is therefore the focus of the main chapter of this thesis chapter 4. In the final paragraph below the rural-urban fringe of Hubli City is described shortly, the research area is highlighted and a functional distinction between certain areas of the fringe is explained.

3.5 The rural-urban fringe in Hubli Taluka

What does this description of Hubli-Dharwad and its rural-urban fringe mean for the research area of this thesis? In this thesis the rural-urban fringe was defined as a radius around Hubli city (but within Hubli Taluka), reaching up to roughly 20 km to the east, north and south, and 10 km westward where it is delimited by the boundary with Dharwad Taluka (see figure 2.1). Out of the total of 58 villages in Hubli Taluka 20 were selected for the survey, these villages represent the changes along the fringe of Hubli.

The major characteristics and developments affecting the fringe area were already discussed in the two foregoing paragraphs. The differences in soil types and climate and the specific (al)location of non-agricultural land uses *within* the fringe area however, have lead to diverse types of developments which are *unevenly* spread throughout the fringe.
In order to represent this heterogeneity in the rural-urban fringe of Hubli various villages were selected. Some villages are representative of more than only one type of area and so house several forms of land use change (e.g. the presence of industrial land use in a humid red soil area which also has horticultural development), while villages in other areas seem to be hardly influenced by the city at all.

Below, the 20 villages will be fit into three transects or groups which represent three distinctive areas of the fringe around Hubli where the land use dynamics are specific to that area. The division of the fringe is the best way to describe and analyse the land use dynamics and the factors which lead to these specific land use developments.
Below the transects and their location are featured shortly as an introduction of the three different areas, full details on physical conditions of the areas, the villages and the local land use developments are featured in paragraph 4.3.3., the three transects are:

Northeastern transect (villages nrs 1-7) :
The area north and east of the Hubli city forms an rather homogenic area which is dominated by black soil plains and low levels of irrigation making it fully dependent on annual rainfall. These characteristics lead to a limited number of crops which can be grown there (rainfed), this leads to a typical cropping pattern which covers the whole of the north and east of the fringe. Another difference of the north and eastern black soil with the red soil is that they can support a second growing season due to the moisture keeping capacity of the soil, contrary to the red soil areas which have only one growing season. Finally, the area is less densely populated as villages are bigger are far between in the north and east compared to the area south and west of Hubli. This feature means that this area is fairly open and empty, making it is less suited for urban activities. The dependence on rainfed agriculture means that people have to move to the city if they want to improve their economic situation. This leads to a permanent resettlement of villagers in the (rural-urban fringe of the) city or people who commute for work via the (relatively good) bus connection. This process is further strengthened by in the case of a drought.

The 7 researched villages are situated at different distances of Hubli. In fact 3 of the 7 are already incorporated in the city's eastern urban border, as they were located very near to the city's edge. While the other 4 villages all lie between the 10 and 20 km of Hubli.

Corridor Zone (northwest, villages nrs 8- 12):

The area northwest of Hubli, between the two cities (up to the border with Dharwad Taluka) has been distinguished because of its transitional soil type structure and because of the fact that it has been designated as the focal point of urban (land use) development by the planning authorities. The soils in the Corridor Zone are a mix of black soil in the north of the Corridor and red soil in the south, in combination with its central location this has lead to a cropping pattern specific to this area.

Through the Corridor Zone runs the Hubi-Dharwad road, along which most of the development is taking place, along this road 4 of the 5 villages are situated, the soil type here is a mix of black and red. The fifth village is situated just west of Hubli in the area dominated by red soils.

The 4 villages along the road are representative of the rapid conversion to urban land use development of Hubli city towards Dharwad. This project is called Navanagar Township and is being developed by the HDUDA through acquisition of large parts of land and allocation of urban land uses such as residential colonies and government agencies. This development in turn draws private buyers of land to this area. They use the land for setting up commercial enterprises along the road, for speculation -which can leave land vacant for years- or (legal and illegal) residential development.

Figure 3.5 A village scene in the original village area of Amargol in the Corridor Zone (source: fieldwork)

Southwestern transect (villages nr 13-20):

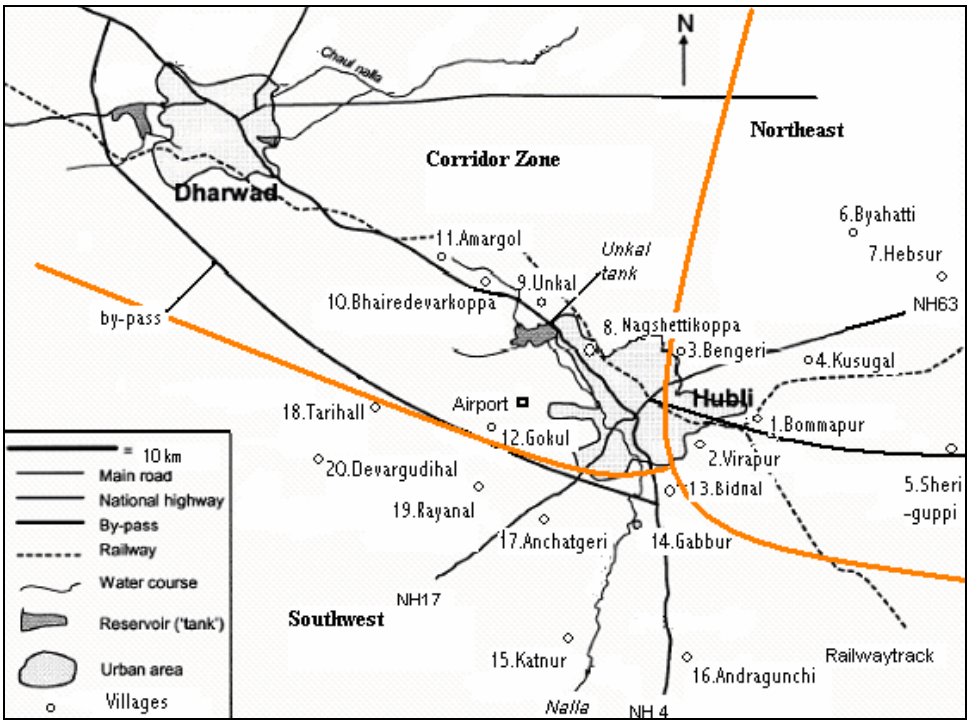
The area south and southwest of Hubli is agriculturally the most dynamic area of the fringe. To the south of the city there are red mixed black soils, further to the Southwest the area becomes dominated by red soils. The area is more densely populated than the north-eastern transect, as in the hilly areas to the southwest there relatively many villages

The access to irrigation makes that the area has better possibilities for agricultural diversification leading to more different types of (more commercial) agricultural land use. Furthermore, there is a natural watercourse running south of the city carrying wastewater offering an extra water source for farmers along it.

Two main roads run through the area the newly built NH4 by-pass connecting with the old NH4 from Hubli south of the city and the NH17 running southwest to Karwar. The good road connection brings some non-agricultural activity to this area like a number private industries located along the NH17. Furthermore, along the NH17 the soil type makes exploitation of the soil for brick making a lucrative business. The local geology has lead to stone mining and crushing industries further south along the NH4.

The 8 villages are located at varying distances and locations, 3 villages are located at ascending distances along the natural watercourse carrying wastewater. There are 2 villages

situated along the two highways and there are 2 villages located deep in the red soil hilly areas west of the by-pass.



Map 3.2 The rural-urban (research) villages and transects (source: adapted from Brook, Purushothaman, Hunshal 2003)

3.6 Conclusion

Hubli-Dharwad is the largest urban conglomeration in North Karnataka, it is however medium sized which is experiencing a relatively moderate pace of growth. Especially, when compared to other Indian cities. The population growth is slow in pace and the industrial activity in the twin-city is also very limited in scale, as a result there is no massive influx of immigrants, a feature common to most Indian cities.

Hubli-Dharwad consists of two cities Hubli, the industrial centre and transport node, and Dharwad, the administrative and educational centre. These two cities have been unified into one municipality in the 1960s and are further merging into one city. The total population is roughly 750.000, of which about 500.000 are in Hubli and 250.000 are in Dharwad.

The twin-city is situated in a predominantly rural area, where traditional agriculture is still dominant and the principal economic activity. The rural area around the city has a relatively high population density, while the city itself has a low population density. This last fact is due

to the unification of the two cities, including the large agricultural area between the cities in the municipality. In the fringe area, just like in the wider region, (rainfed and traditional) agriculture is still the most important source of income. Thus the development of different forms of (agricultural and non-agricultural) land use and economic activities can have a big impact on the livelihood of the rural-urban fringe population.

The area around the twin-city is rather heterogenic in climatological and physical conditions. The climate of the area is semi-arid, with an annual average rainfall in the whole District of 700mm. However, to the west of the city there is a significantly higher rainfall than in the eastern parts. The soil types also change from red soil in the west to black soil plains in the east. These differences are a big influence on cropping patterns in the rural-urban fringe (around the twin-city and) Hubli.

Despite having good (and recently improved) transport connections the city is lagging behind in industrial/ economic growth. This is mainly due to its location, rather far away from the metropolitan state capital of Bangalore which is the economically most developed area of the state. Furthermore, the city is suffering from a failing power- and water-facilities, it is often hit by power-cuts and water-shortages.

Due to this limited economic and demographic growth of the twin-city the urban land se development is not as rapid and haphazard as in most other Indian cities. In fact, most of the urban land use is developed by the government. The two most important (recent) developments being the development of the two cities into one through urban development of the area between the cities and the newly built highway by-pass to the west of the city.

The picture that now arises from the description of the twin-city, the fringe area and the wider region is that of a medium sized city without rapid urban growth, situated in a semi-arid rural region where agriculture is the most important activity. Making agricultural land use the most important land use in the fringe area, especially since non-agricultural land use growth is limited and highly localised.

Within the fringe area the differing physical conditions have a big effect on agricultural land use development. Thus in order to best describe and analyse the land use developments in the fringe, the fringe area has been divided into three distinctive transects. These transects

represent the specific land use dynamics taking place in those areas. In the next chapter these agricultural land use development(s) in the rural-urban fringe of Hubli and each of the transects will be described and analysed in full detail.

Chapter 4 Agricultural land use changes around Hubli

4.1 Introduction

This chapter deals with the changes in land use taking place around the City of Hubli. On the basis of data collected during the fieldwork research and secondary data sources, an analysis will be made of the changes in the land use around the city.
Hubli-Dharwad, the twin-city, is the largest urban conglomeration of North Karnataka. Consequently, Hubli is surrounded by a rural region, where agriculture is still the principal economic activity. This is reflected in the land use around Hubli, which is still predominantly agricultural. Therefore, the focus in this analysis chapter will be on agricultural land use change.

The analysis of the developments in agricultural land use around Hubli will start by giving a broad picture of the dominant cropping patterns in the wider region of North Karnataka and Dharwad District at the end of the 1960s, and the changes therein up to the end of the 1980s.

According the classic model of *distance decay* of Von Thunen (see paragraph 1.2) land use changes when coming closer to the city. In the case of Indian cities, the *stages of urbanisation-model* of Ramachandran (see paragraph 1.2), predicts a change from traditional agricultural forms of land use to more commercial forms of agricultural land use, as the first step in transforming the countryside around a city.
Therefore, after discussing the above mentioned general developments up to the end of 1980s, these cropping patterns of the wider region around the city will be compared with the cropping patterns of Hubli Taluka and the rural-urban fringe area of Hubli.
Thus, cropping patterns at regional-, districts- and Taluka-level at the end of the 1980s and the cropping patterns in the rural-urban fringe at the start of the millennium are comparatively analysed.

Finally, within the rural-urban fringe area of Hubli City there are significant physical geographical differences (in soil types and the availability of water), leading to distinctively different cropping patterns within the rural-urban fringe area. These different cropping patterns and their development will be explained through comparison of three areas/ transects of the rural-urban fringe. The differences between the transect areas is further explained

through an analysis of the villages which make up each transect by means of a typology of the villages. In the description of these developments the local importance of non-agricultural activities is also included.

The chapter will finish wish the description of actual land use developments in three rural-urban fringe villages, further explained through several cases of land use development of individual landowners.

4.2 Cropping patterns near Hubli City and its wider region compared

In this paragraph the cropping patterns of a wide region around Hubli will be compared with ever closer agricultural areas around Hubli city, in order to see if there is a 'distance decay' factor with regard to farming around the city. This comes down to comparing the crop groups in the North Maidan, Dharwad District (which surrounds Hubli-Dharwad), Hubli Taluka and the rural-urban fringe (research villages) of Hubli. The spread of traditional and more commercial crop groups indicates the level of commercialisation.

First an analysis will be made of the trends in crops in the more wider region during the period 1966-69 to1987-90[8] for the North Maidan and Dharwad District.
After this brief history and analysis, the cropping pattern of the North Maidan, Dharwad District and Hubli Taluka at the start of the 1990s will be compared with cropping patterns in the rural-urban fringe at the start of the millennium. In the analysis of the rural-urban fringe the spread of irrigated crops will be discussed, as figures on these were not available on other spatial levels, for the same reason as is mentioned in the footnote below.

Trends in the North Maidan and Dharwad District during the period 1966-69 to1987-90 are presented below.

[8] In the research of Sharma (1999) only the most dominant crops per crop-group (taking up at least 1% of the TCA) at North Maidan-level are featured. From these data, figures on crops relevant to Dharwad District were taken and are presented here in Table 4.2.

*Table 4.1 Distribution of dominant cropgroups in the North Maidan and Dharwad District 1966-69 to 1987-90**

	North Maidan 1966-69	***North Maidan* 1987-90**	***Dharwad District 1966-69***	***Dharwad District 1987-90***
Cereals and Millets:	**55 %**	**47,2 %**	**46,7 %**	**38,8 %**
Jowar	34,4 %	28,4 %	23,6 %	21,1 %
Wheat	5,4 %	3,4 %	9,5 %	6,5 %
Paddy	3,8 %	4,1 %	8,8 %	6,1 %
Pulses:	**12,1 %**	**15,3 %**	**10,5 %**	**12,5 %**
Bengalgram	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 (1980-90)	1,5 %	8 %	0,5 %	4,5 %
Safflower (1974-90)	0,6 %	1,7 %	0,2 %	0,9 %
Commercial crops:	**14,1 %**	**8,4 %**	**23,2 %**	**13,5 %**
Cotton	13,2 %	6,9 %	20,6 %	6,8 %
Chillies	0,9 %	1,5 %	2,6 %	6,7 %
Total percentage:	**96,1%**	**94,7%**	**95,8%**	**85,5%**

*Percentages are the share of Total cropped Area (TCA) covered (Adapted from Sharma, 1999)

The most important trend noticeable in Table 4.2 is the falling share of the cereals and millets at both spatial levels during the twenty-year time period. Jowar experienced the largest decrease in share of the cropped area, its share in Dharwad District is also significantly lower than in the North Maidan. Wheat and paddy have also fallen in Dharwad District. This trend of a declining share of traditional staple food crops is due to a shift from subsistence farming to more commercial farming and an increase in production per hectare making, less area under food crops necessary (Sharma, 1999)

Oilseeds were the fastest risers during the period. This was mostly due to the successful introduction of sunflower, which was however much less successful in Dharwad District than in the North Maidan. Groundnut its share decreased somewhat, it remained a strong crop in Dharwad District. Pulses experienced a slight increase at both levels. The introduced oilseeds

formed an alternative for food crops in these rainfed areas, as did commercial growing of pulse crops.

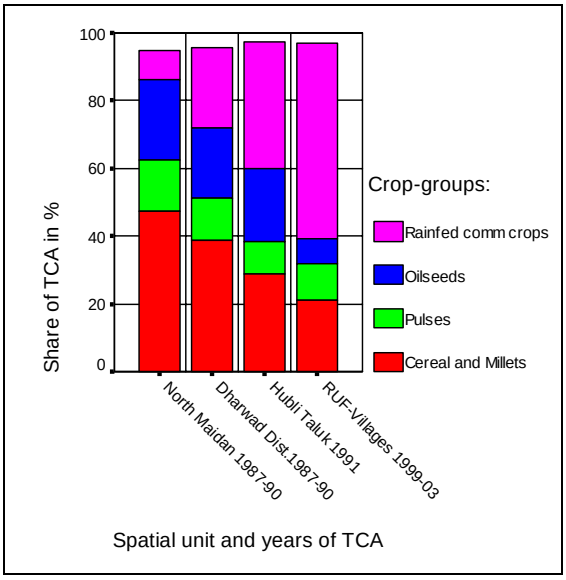
Cotton used to be an important commercial crop in the North Maidan and especially in Dharwad District, but has fallen sharply over the two decades. The share of chilly has increased sharply in Dharwad District, this is remarkable because in all other districts of the North Maidan the share of chillies has dropped (Sharma ,1999). The demise of the textile industries in Hubli during this period is seen as possible factor for the decrease of cotton, a loss which was countered by rainfed commercial farming of chillies, a product in which the district has specialised itself in, as it did before with cotton (Sharma ,1999).

This concludes that in the North Maidan cereals and millets (mostly jowar) and cotton have lost ground to sunflower and to pulses. In Dharwad District (all) cereals and millets and cotton's share declined, while chillies, sunflower and pulses increased their share.

According to Ramachandran cropping near the city is different from agriculture done in more isolated interior areas. Therefore, in order to see if there is a difference between cropping near Hubli city and the more distant surrounding region the cropping patterns of the North Maidan (in 1987-90), Dharwad District (in 1987-90), Hubli Taluka (1991) and the (researched) rural-urban fringe villages (for the period 1999-2004) are compared below in graph 4.1.

The comparison of the cropping patterns at these different spatial level and during different time periods was born out of necessity, since certain other data sources were not available or found reliable. However, the comparison of such large areas is justifiable due to the fact that the North Maidan, Dharwad District, Hubli taluk and the fringe area are all very similar in physical geographical respect, being dominated by mostly black soil and rainfed agriculture. Also the area around Hubli is predominantly agricultural, comparable in that sense with the wider region. The District's and Taluka's only difference is the *low levels of irrigation* (see table 4.1), *which should favour more traditional rainfed crops*.

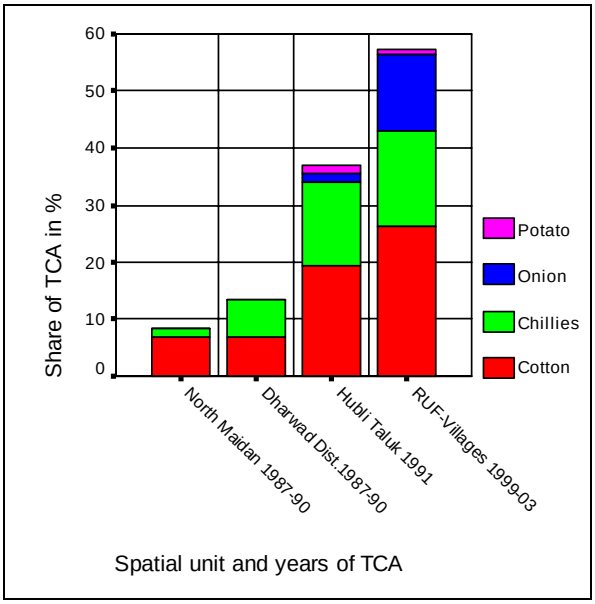
Graph 4.1 Rainfed crop-groups distribution (source: fieldwork research)



But, when comparing the cropping patterns at short(er) distances from the city of Hubli with those of the wider agricultural region the decreasing share of cereals and millets (the traditional rainfed crops) becomes immediately clear, as does the increasing share of commercial crops. Quite clearly, cereals and millets, and to a lesser extent pulses, are dropped in favour of rainfed cultivated commercial crops.

In the rural-urban fringe, cereals and millets cover only a small share, as do the oilseeds, compared to Hubli Taluka and other levels. Rainfed commercial crops –again- command a larger area. These commercial crops are grown rainfed in the areas in the District, Taluka and fringe area, but are mostly grown irrigated in the rest of the North Maidan.

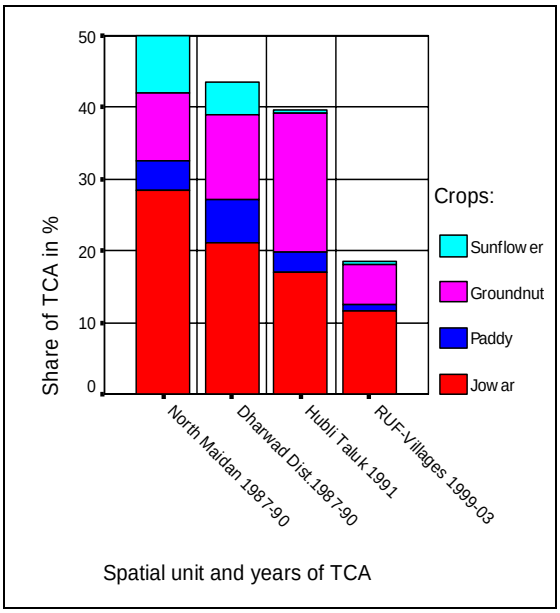
Graph 4.2 Rainfed commercial crops distribution (source: fieldwork research)



Graphs 4.2 and 4.3 show which specific crops of the respective crop-groups have become more popular with farmers nearer to the city and which have been dismissed. Graph 4.2 indicates that rainfed cultivated commercial crops are cultivated more near the city. The area around Hubli stands out as a major area for rainfed cotton and chilly cultivation, when compared to the North Maidan and Dharwad District. In the rural-urban fringe the share of rainfed cultivated commercial crops has become even larger than that of Hubli Taluka. Especially onion has developed itself as a major cash crop vegetable cultivated rainfed in the fringe, the share of cotton is also larger than in Hubli Taluka.

Figure 4.1 Chillies and onion intercropped, some vegetables in front (source: fieldwork)

Graph 4.3 Declining shares of cereals and millets and oilseeds (source: fieldwork research)



This rise in the rainfed cultivation of commercial crops nearer to the city has been at the cost of the more traditional (low-yielding) rainfed staple crops which are depicted in Graph 4.3. Among the cereals and millets, it has been mostly (local) jowar which' share has diminished, the importance of paddy is also reduced near the city. The importance of jowar and paddy in the rural-urban fringe also declines further. Among the oilseeds, sunflower seems to be wholly ignored in Hubli Taluka in favour of rainfed commercial crops. Possibly through the fact that sunflower is a more labour intensive crop than groundnut -a traditional oilseed – which is more popular in Hubli Taluka than in the North Maidan and Dharwad District. Groundnut is a flexible crop, has a long storage capacity and can be kept to be sold for food purpose (in small quantities) or be stored until market prices rise. This makes this crop more popular in the city's Taluka. In the rural-urban fringe however, it seems farmers have abandoned the crop *en masse,* its share drops sharply in the fringe.
The conclusion regarding rainfed farming in Hubli Taluka and in the rural-urban fringe of Hubli is that commercial crops are favoured over the more traditional low-yielding rainfed foodcrops such as jowar and paddy and oilseeds such as sunflower. This tendency becomes even stronger in the rural-urban fringe. Groundnut is a traditional but flexible crop, it remains relatively popular in the city's Taluka, but is abandoned in favour of more commercial crops in the fringe.

When comparing cropping patterns nearer to the city with trends in the North Maidan and Dharwad District, some of the general trends in North Karnatakan agriculture are also found around the city, such as the declining share of cereals and millets, most notably jowar. In Hubli Taluka and in the fringe however, they are replaced by commercial crops, such as chillies which have become a specialisation of the twin-city area. Hubli Taluka is one of the areas in Dharwad District which has carried this development. Cotton has remained a popular cash crop in Hubli Taluka, contrary to the North Maidan and Dharwad District, it seems farmers have stuck to cotton, preferring it over oilseeds such as sunflower. It must be mentioned however, that the rainfed cotton grown in Hubli Taluka is mostly local cotton, contrary to most other parts of the North Maidan where half of the cotton is (irrigated) hybrid cotton (see paragraph 3.3.3).

In the rural-urban fringe, the tendency towards rainfed farming of commercial crops is even stronger than in Hubli Taluka area with a larger share of land under cotton and chillies. In the 1990s the next step in this process was the start of rainfed onion cultivation, which has caught

on in large scale. Although this expansion of onion is somewhat in line with more general trends in North Karnataka, the rise of onion in the fringe area compared to Hubli Taluka in 1991 is remarkable[9].

Rounding up these findings it can be said that agriculture in the Taluka of Hubli city and in the rural-urban fringe of the city has underwent some changes which are in line with general developments in North Karnatakan agriculture such as leaving the more traditional rainfed (staple/ food) crops. In the Taluka and in the fringe however, farmers have obviously chosen to replace these with more commercial cash crops such as cotton and vegetables such as chillies and onion. Even under the semi-arid conditions and with a lack of irrigation, farmers have chosen to grow cash crops which are normally grown irrigated in other parts of the North Maidan. This shows that farmers near the city have a commercial outlook and are in this respect more commercial than farmers further from the city despite being hampered by a lack of irrigation facilities.

4.3 Cropping patterns in the rural-urban fringe of Hubli

This paragraph will analyse the cropping pattern(s) of the rural-urban fringe in order to see if there is a commercialisation /urbanisation effect of Hubli City on cropping in the fringe. To do this the cropping patterns of the twenty rural-urban (research) villages for the period 1999-2003 are analysed.

These twenty villages are divided into three distinctive transects (Northeast, the Corridor Zone between the two cities and the Southwest), as the rural-urban fringe area around Hubli is very heterogenic. This has a specific out working on cropping possibilities. The cropping patterns of each transect will be discussed. Table 4.4 shows the number of villages and the total size of the village lands per transect.

*Table 4.2 Research villages and area per transect**

Transect:	Northeast	Corridor Zone	Southwest
Research Villages	7	5	8
Total village area in ha	18.662	7.248	6.856

*The total area of Hubli Taluka is 63.358 ha and the total number of villages is 58

(source: Birmingham University Baseline study and fieldwork research)

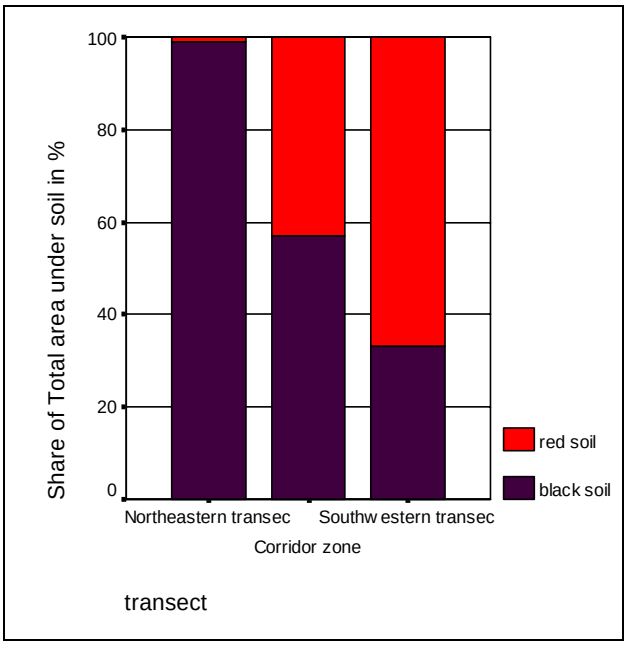
[9] The total production of onion in India increased from 2.5 million tonnes in 1980-81 to 4.4 million tonnes in 1998-99. Most of the onion produced in India comes from the states of Maharashtra, Gujarat, Uttar Pradesh and Karnataka. In the state of Karnataka, north Karnataka accounts for the bulk of the total onion production (73.20 per cent of onion area in the state during 1996-97) (Balappa and Hugas, 2002)

The Maps 4.1, 4.2 and 4.3 show the location of all villages and their transects. There are significant differences between the transects regarding soil types, amount of rainfall and availability of irrigation water. Furthermore, there are some differences regarding population density, transportnetwork and location relative to the city and its development. All these differences are discussed below (non-agricultural land use developments in the fringe will be featured in detail in Chapter 5).

4.3.1 Characterisation of the three transects

The amount of rainfall over the rural-urban fringe area varies from west to east, and to a lesser extent from south to north. In the Southwestern transect the annual rainfall is between the 700 and 800mm, with the southwestern villages receiving some more rain on average than the villages just south of Hubli. The Corridor Zone receives about the same amount of rain as the Southwestern Transect. The villages to the north and east of Hubli receive about 600-650mm of rain per year. Below a short characterisation of each transect will be given.

Graph 4.4 Soil types per transect (source: fieldwork research)

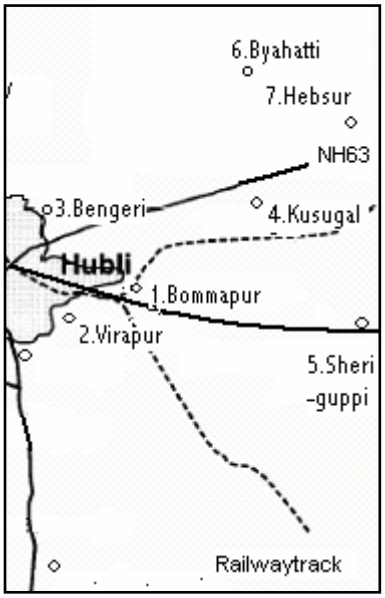


The Northeastern Transect

The Northeastern transect is characterised by flat black soil plains (see Graph 4.4) and relatively low rainfall. The limited *hingary* rains (coming from northeast) provide some extra moisture for the deep black soil to retain enough moisture to turn the dry soils into fertile cropland. Farmers in the (north)east generally have larger farms and more fertile land then

farmers in the (south)west and therefore produce large harvests, making these farmers better off than their counterparts on the other side of the twin-city. However, when the rains fail the situation in this area becomes critical. Because there is no possibility to use borewells for irrigation because of a mineral (natrium) contamination of the groundwater and a very low groundwater-table (this contamination irrigation impossible because it will cause salination of the soil). As they are completely dependent on the annual amount of rainfall -in case of failures of the (southwest) monsoon or the northwestern rains for some years in row-agriculture in the northeast becomes practically unviable. This was the case during the fieldwork period. Most villages have only a few borewells for domestic use and an embanked tank for the livestock. In some parts the groundwater is also too rich in natrium and other minerals to be used even for drinking water. The area is not densely populated and villages are relatively large and far between, subsequently the villages have large areas of agricultural land (see Table 4.4). Only a few major roads pass through the area, the most important being the NH63 which goes from Hubli east to Gadag –the nearest other city - and from there to Hospet-Bellary. The other major road runs northeast to the town of Navalgund.

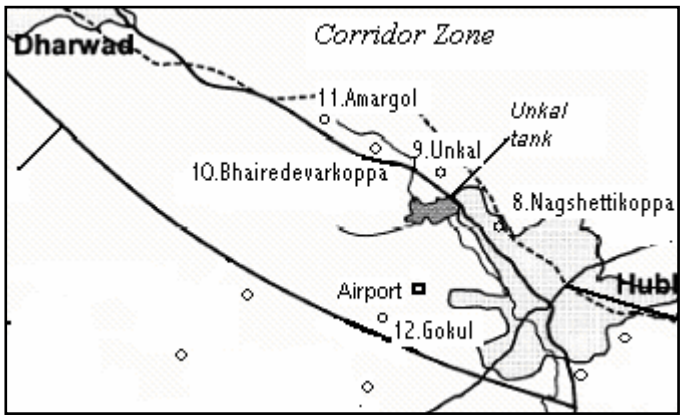
Map 4.1 Northeastern villages (adapted from Brook, Purushotaman and Hunshal, 2003)



The Corridor Zone

A main feature of Hubli is the connection it has with its 'twin-city' Dharwad situated some 20km to the northwest. The area in between can be seen as a corridor connecting the two cities. Through the corridor run a railwayline and a major road, the NH4. This part of the NH4 used to be part of the interstate highway network, connecting Mumbai and Bangalore. Since 2001 a by-pass west of the twin-city has been constructed, relieving the corridor of interstate

traffic. The Corridor Zone as defined in this research, covers half of the area between the cities up to the border of Hubli Taluka with Dharwad Taluka, 10 km northwest of Hubli. Its border with the Southwestern transect is the highway by-pass. The corridor has been the focal point of non-agricultural land use development around the city, such as residential projects, government agencies and private commercial and industrial settlement (see Chapter 5).
The land use in the Corridor Zone is however, still for the most part agricultural. The area has both red and black soils (see Graph 4.4). In the area southwest of the railwayline (see Map 4.2) the soils are red and there is some relief, which increases further southwest. The area above the railway has mostly black soils and merges into the black soil plains of the Northeastern transect. In this transect there is irrigation although not on a large scale, borewells are dug mostly in the red soil areas. The black soils are generally cultivated rainfed, although in some places they can be irrigated.
Of all three transects, the Corridor Zone is the most dynamic in its land use changes. The corridor is in a state of flux with all sorts of non-agricultural development development taking at a rapid pace, in combination with intensive and traditional agricultural land use.



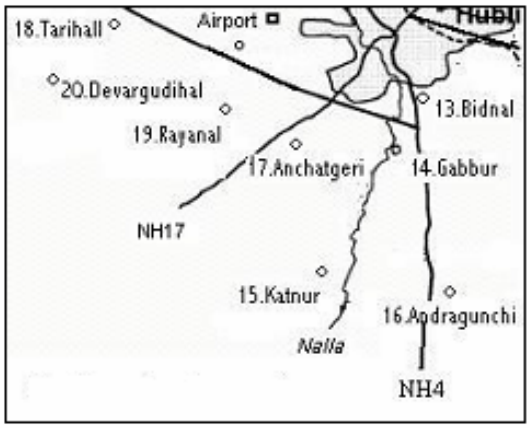
Map 4.2 The Corridor Zone villages (adapted from Brook, Purushothaman and Hunshal, 2003)

The Southwestern Transect

This area covers the villages south and southwest of Hubli, which are situated outside of the area between city and the NH4 by-pass. Two important roads run through this transect. The NH4 by-pass connects with the old NH4 coming out of Hubli and goes down further south (to Bangalore) and the NH17 to Karwar running southwest. The villages which are not located near these two main roads are only accessible through unpaved roads. To the south of Hubli the villages have predominantly black soils (Gabbur and Andargunchi). All other villages to the west of the NH4 have red soils and the terrain is more hilly. Of all three transects, the south-west receives the most rainfall. The high rainfall in combination with the high ground-

water table in the red soil area makes it suited for cultivation of water-wanting crops. Since some decades this area has developed itself as the main area of continuos agricultural commercialisation, in choice of crops as well as agricultural techniques.

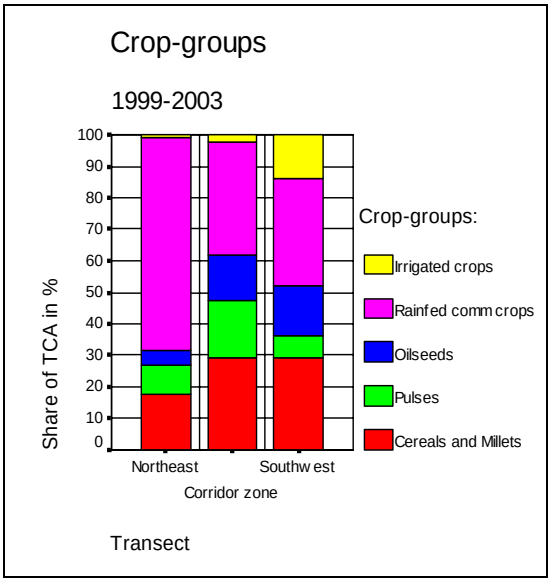
Map 4.3 Southwestern villages (adapted from Brook, Purushothaman and Hunshal, 2003)



4.3.2 Cropping patterns per transect

Graph 4.5 shows the crop-group composition per transect, this time including the irrigated crops as an extra group. When looking at the graph, it becomes clear that the Northeastern transect stands out as having quite an one-sided developed cropping pattern. The area is completely dominated by rainfed grown commercial crops, these crops cover nearly 70% of the agricultural land. The Northeast represents the vast area around Hubli (to the north and east) where the rainfed commercial farming takes place, which was already noticed in the analysis in the previous paragraph. In Graph 4.5 it becomes even more clear -with the red soil areas left out - that cereals and millets and the oilseeds (i.e.jowar and groundnut again) have been dropped and that rainfed commercial farming dominates the black soil plains.

Graph 4.5 Crop-group distribution per transect (source: fieldwork research

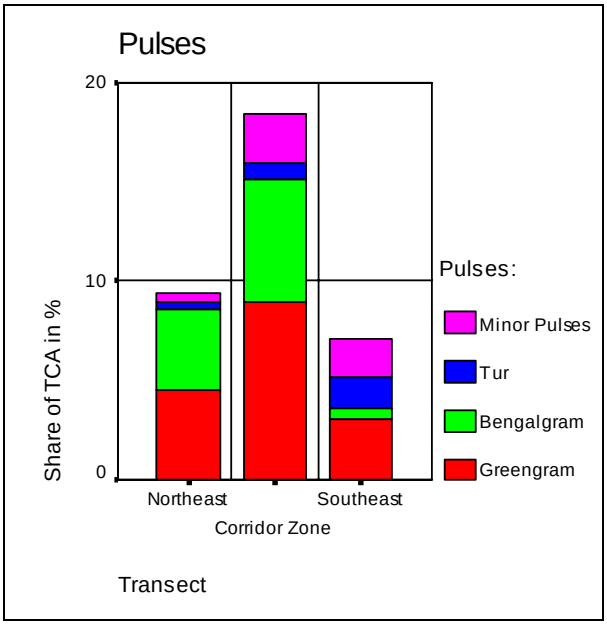


The Corridor Zone shows a much more even distribution among the rainfed crop-groups. In the crop-group distribution in the Corridor, the relatively large share of land covered by the crop-group pulses is remarkable, in combination with the limited importance of rainfed grown commercial crops. In the Corridor these cover about the same share of agricultural land as in the Southwestern transect, while it has a considerably larger area with rainfed black soils than the latter. A similarity between the two transects is the nearly equal share of land covered by cereals and millets and oilseeds.

Nevertheless, the southwestern part of the rural-urban fringe has the most diversified cropping pattern, this becomes clear just by looking at the distribution of the general crop-groups. The most striking feature is the share of water-wanting crops cultivated here. Their share is much larger than that of the other two transects, where horticulture and irrigated crops are nearly negligible.

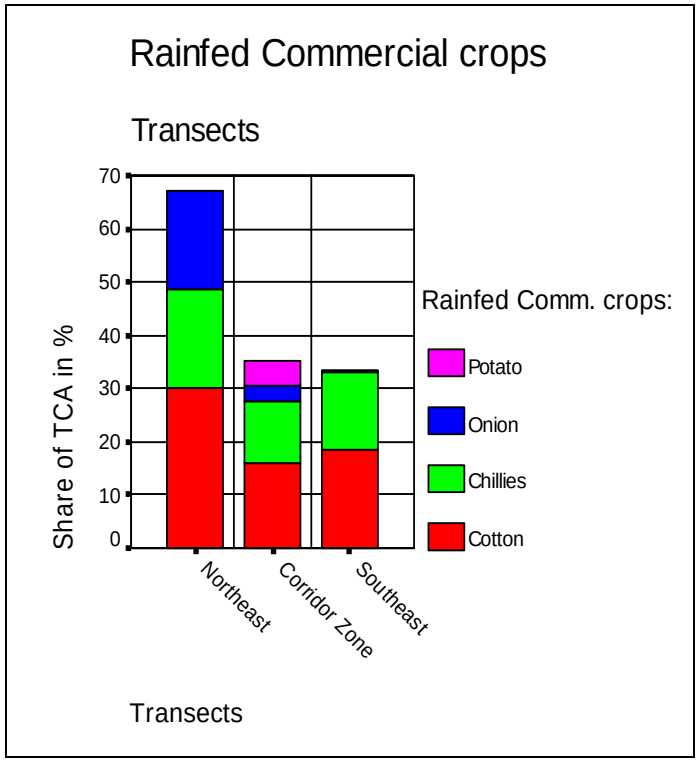
Below the most important crops of the crop-groups which'shares differs the most between the transects are discussed. Graph 4.6 shows the importance of the pulses. The Corridor Zone stands out among the transects as having particularly large area covered by the two pulses greengram and bengalgram. From interviews it became clear that these grams have become more popular recently, because of a severe decrease in (large scale) potato cultivation over the last 3-4 years, because of the drought, a drop in marketprices and diseases. Therefore farmers have switched back to drought resistant crops as greengram and bengalgram.

Graph 4.6 Distribution of pulses per transect (source: fieldwork research)



Graph 4.7 Shows the distribution of the rainfed cultivated commercial crops per transect. As expected is the Northeast dominated by cotton, chillies and onion. The Southwest and the Corridor both also have considerable amount of land covered by chillies and cotton. It needs to be remarked here however, that the cotton grown rainfed in *hingary* in the Northeast is local cotton and the cotton grown in the other two transects is mostly hybrid (DCH-) cotton cultivated rainfed during *mungary* (see also next subparagraph). The Corridor Zone also has some onion and potato cultivated rainfed, especially potato is concentrated in the Corridor. Potato used to be grown on large scale in the corridor zone between Dharwad and Hubli (for the most part near to Dharwad city), but has recently decreased.

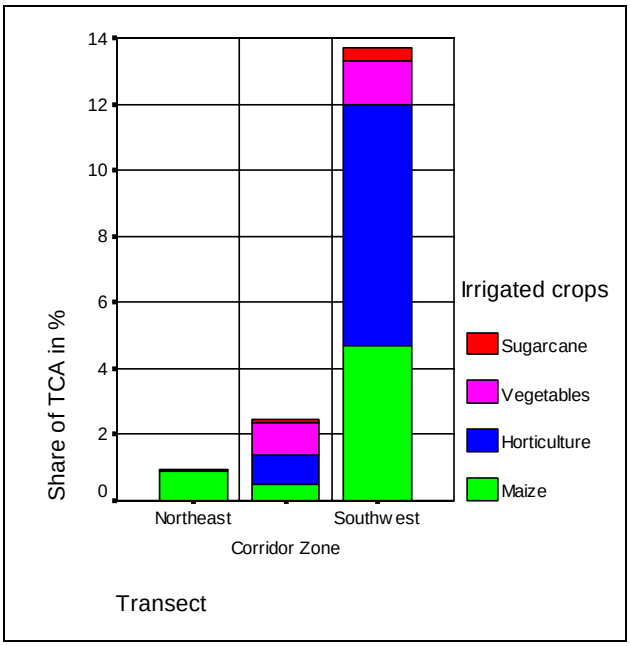
Graph 4.7 Rainfed commercial crops distribution per transect (source: fieldwork research)



Graph 4.8 below displays the distribution of the irrigated crops per transect. These are clearly concentrated in the Southwestern transect. There is some limited horticulture and vegetable cultivation in the Corridor Zone, but the lion's share of irrigated farming is done in the southwest, with fruittrees and maize as the most important watered crops (there is also irrigated floriculture in the southwest, but this was not included as the area was so small it did not show up in the graph, it will be discussed below). Finally, the relatively small area under sugarcane – the most traditional of the water-wanting crops- is noticeable and gives an indication of the commercial priorities of the farmers in the southwestern fringe.

Maize is a favourite commercial fieldcrop which is grown preferably irrigated, just like DCH-cotton (which is not included in graph 4.8, because in administrative figures of the village accountants it falls under cotton, in the discussion of transects below its location is mentioned). In the southwest it is grown on a part of the irrigated plot, just like vegetables. From interviews with farmers it became clear that on irrigated field both commercial field crop such as maize and DCH-cotton and vegetables are increasingly being left out in favour of fruitcrops.

Graph 4.8 Irrigated commercial crops per transect (source: fieldwork research)



Mango, sapotha and guave are the major fruit crops grown in the rural-urban fringe of Hubli-Dharwad. Other minor fruit crops include coconut, banana, pomegrenade, citrus and papaya. The commercial development of horticulture in the twin-city area started at the start of the 1970s with intensive mango cultivation and Dharwad District, along with Kolar, Bangalore, Bidar and Tumkur are now some of Karnataka's best known mango producing areas in Karnataka (Birmingham University Baseline study 1998).

From the 1990s onward there has been an expansion of mango cultivation west of Hubli-Dharwad, where conditions are favourable. The eastern fringes of Hubli are not favourable to cultivation due to the properties of black cotton soils. Around the twin-city mango cultivation

is concentrated in Dharwad Taluka, sapotha and guave are the dominant fruit crops in Hubli Taluka, grown mostly southwest of Hubli where conditions are more favourable[10].

Although very little reliable data was available on the areal increase of horticulture, its increase was mentioned everywhere in the region. This is confirmed by the areal increase of mango in eight of the research villages (see Table 4.5). This information also confirms the trend of the spread of different types of fruittrees throughout the fringe with mangos now being cultivated more near Hubli and sapotha and guave spreading to areas around Dharwad.

Table 4.3 Area under mango in eight of the research villages in 1996 and in 2003

Research villages	Area under mango 1996	Area under mango 2003	Increase in %
8	287 acres	408 acres	29,6 %

(source: Birmingham University Baseline study 1998 and fieldwork)

During the fieldwork, especially sapotha seems to be the most popular fruitcrop for farmers starting horticulture in the fringe of Hubli. It has the advantage over mango that it is less sensitive to diseases and strong winds, sapotha also gives two yields a year instead of one and even does well on black soils.

In the interviews with the village accountants of the south-western villages, it was mentioned that horticulture had sharply increased over the last 10-15 years. This is directly related to increase in the number of borewells which have doubled or tripled in the (south and southwestern) villages over the last 10 years according to the village accountants. This increase is attributed to the lack of good rains of the last 5 years or so. However, most of the irrigation water is used for irrigating fruittrees intercropped with field crops and vegetable growing. The reasons for the increase in horticulture are multiple (source: fieldwork research and Birmingham University Baseline study, 1998):

- an increase in the export market for mango
- low prices for other agricultural crops and low yields of alternative crops
- reduced rainfall, making cultivation of non-tree crops more risky
- orchards form a long-term investment, producing more harvest every year, after the initial three to four years of raising the siblings
- proximity to a large local market, the Tarihall mango pulp factory, 12 km west of Hubli

[10] In 1996, Dharwad Taluka had 1574 ha under mango, 84 ha under sapotha and 88 ha under guave, in Hubli Taluka this was 484 ha, 507 ha and 260 ha, respectively) (Birmingham University Baseline study 1998).

- high labour prices in the fringe caused by the higher wages in off-farm employment, this leads to farmers choosing the fruittree crops which have a lower labour requirement for farmers because much of this requirement can be passed on through pre-harvest contractors.
- People from Hubli who buy up land in the southwest to do commercial farming

These last three factors could be identified as being related to the rural-urban fringe situation. First, the location of a factory in a fringe area is a common phenomenon, but in this case provides farmers with nearby market for their agricultural product.
The second reason - the high labour prices in the fringe caused by the higher wages in off-farm employment- makes many farmers favour the long term solution of horticulture. Whereby most of the farmers make use of pre-harvest contractors for watching, harvesting and marketing of the fruits. In this way they decrease labour requirements and the physical risk involved in harvesting, watching, transportation and marketing. These contractors transport the fruits to Hubli and Dharwad, from where the products are taken to metropolitan cities like Bangalore and Mumbai. In this way farmers sell off about half of the harvest.
Finally, there are urbanites from Hubli who buy up land around the city for investment purposes, because there is no taxes on agricultural land and produce. These people prefer the area southwest of the city because of the good possibilities for irrigation and horticulture. They have enough money to dig a borewell and start intensive commercial farming such as orchards, or spatially mixed fruittree fieldcrop farming.

Figure 4.2 Spatially mixed Sapotha trees and fieldcrops on black soil (source: fieldwork)

Flower cultivation is not featured in graph 4.8 because it is only concentrated in small pockets of area around Dharwad and Hubli. In the case of Hubli fringe, flower cultivation is concentrated around Devargudihal village, which is the main rose producing area of North Karnataka. Flower cultivation around Hubli-Dharwad started during the 1980s and is characterised by a reliance on investment capital, irrigation, knowledge of the (short-cycle) growing process and reliable marketing channels (because it is highly perishable product). Hubli is the main market for flowers, followed by Belgaum. The marketing of flowers depends heavily on the marketing route used by small farmers for vegetables and fruits: 85-90 % of the flowers is being taken to Hubli in small (head) loads by bus, only 5-10% is taken by carts or tractors to the city (Hiremath, 1997). Where the flowers are for the most part sold to wholesalers (95%) and retailers, only the small farmers sometimes sell the flowers themselves.

4.3.3 Agricultural land use and economic activities in villages in the fringe

In order to better understand the specific local conditions which have led to the heterogenic forms of (agricultural) land use in the rural-urban fringe of Hubli and the varying levels of interaction with the city, the villages of each transect have been put in a typology.

This typology depicts the villages as research units, showing the variation among the villages within and between the transects. In the typology some of the factors which influence the spatial and functional aspects of rural-urban fringe development on village level are shown. These factors indicate per village the population size, location of the village relative to the built-up urban areas and roads, and local conditions such as availability of irrigation sources and the dominant type of soil.

The outcome of the mix of these factors is given in the last two columns which show the dominant agricultural land use in the village and the level of non-agricultural activity. These last two variables are indicators of the spatial land use development of the village and the level of functional interaction (indicated by non-agricultural activities in the village which is the result of increased interaction between the village and the city).

Table 4.4 The Northeastern Transect typology (source: fieldwork research)

Village	**Popula-tion***	**Locatio n****	**Roads**	**Irrigatio n**	**Soil**	**Crops*****	**Non-agric. activities**
Bommap ur	HDMC-ward	East, village	Part of city	-	Black	M: Chillies, groundnut,	Dominant: city life

		is a city suburb				onion. H: Cotton and jowar	
Virapur	HDMC-ward	East, village is a city suburb	Part of city	-	Black	M: Chillies, groundnut H: Cotton and jowar	Dominant: city life
Bengeri	HDMC-ward	North, village is a city suburb	Part of city	-	Black	M: Chillies, jowar, groundnut H: Cotton, wheat	Dominant: city life
Kusugal	14.000	12 km northeast	Along road to Navalgund	Contamina-ted ground-water	Black	M: Chillies, onion, green gram, groundnut. H: Cotton, wheat, bengalgram	Small number of commuters
Sherigup pi	5.600	15 km east	Along NH63 highway (to Gadag)	-	Black	M: Chillies, onion, groundnut, greengram. H: Cotton, wheat, bengalgram	Small number of commuters
Byahatti	12.728	16 km northeast	Along road to Navalgund	From canal: +-100 ha irrigated	Black	M: Onion, chillies, jowar. H: Cotton, wheat, bengalgram, Safflower and jowar	Small number of commuters + agro-industry
Hebsur	8.000	20 km northeast	Along road to Naval-gund	From canal:: +-650 ha irrigated	Black	M: Chillies, onion, (irrigated) maize, DCH-cotton. H: Cotton, wheat, bengalgram and jowar	Small number of commuters

*The number of inhabitants of a village is only available for villages which are not part/ ward of the HDMC area

**The location is mentioned relative to Hubli city and the Hubli Dharwad Municipal Cooperation (HDMC).

***M: stands for the crops during *mungary* (in order of share of TCA), the H: shows the *hingary* crops.

The Northeast, represented here by the cropping pattern of seven villages, is the most homogenic region of the rural-urban fringe area and agriculture here is conditioned by a lack of irrigation through the dominance of black soil plains. The city of Hubli has incorporated three of the seven research villages into the built-up city area. These villages are now municipality *ward* areas, their (agricultural) lands border with the city on east and northeastern sides. There the cropping pattern is no different from the villages situated further away from the city and no significant effect of being adjacent to the city is noticeable. Thus the villages and their land use have remained in the stage of basic rainfed commercial agriculture, while forms interaction with the city have remained almost undeveloped, apart from the commercial agricultural goods for Hubli's agricultural market.

All villages in the northeast have roughly the same cropping pattern with two growing seasons during which there is rainfed farming (apart from Byahatti and Hebsur, which are connected to a large canal irrigation scheme from Navalgund Taluka). The dominant cropping system is intercropping with chillies, onion and local cotton, other *mungary* crops are greengram and groundnut. Local cotton, wheat, bengalgram and jowar dominate in *hingary*. Both chilly and onion are grown rainfed on a very large scale. Rainfed onion cultivation has risen sharply during the 1990s and Hubli has become one of the (two) biggest onion markets in North Karnataka, while chilly cultivation rose in the 1980s. The expansion of both rainfed grown chillies and onion in this transect, can be seen as a response of the farmers in the northeast to the challenge of commercialising agriculture in semi-arid conditions without irrigation. Chillies as well as onion are grown with traditional (labour intensive) practices and purely rainfed. Therefore, input-costs are low, but yields are very poor[11]. The fact that farmers still grow these crops – despite very low yields- indicates that they are willing to further commercialise agriculture. But, that widespread commercialisation of agriculture north and northeast of Hubli city is severely hampered by the poor levels of irrigation. The lack of available water in the northeast is most visible in the Kusugal. Here villagers have to rely on tankwagons from Hubli for drinking water due to natrium contamination of the groundwater and dried up wells during the drought (see figure 4.3).

[11] The average yield for chillies in Dharwad District in 1997 was 239 kg/ha, compared to the Karnataka State average of 292 kg p/ha (Sharma, 1999). Yields per hectare for onion, cultivated irrigated in other Districts of North Karnataka (Gulbarga and Bijapur for example), were about three times the average yield per hectare in Dharwad District (Balappa and Hugas, 2002)

Figure 4.3 Villagers in Kusugal with their pots waiting for tankwagons from Hubli (source: fieldwork)

Apart from these clear indications of commercialisation of agriculture in the northeast, the role of the nearby city in this process is hard to detect, apart from the fact that Hubli is one of the biggest onion and chilly markets in the state and used to house cotton-textile industries. During fieldwork research it became clear that there is only limited interaction between agriculture in this area and the city. Because all non-agricultural activities stop at the city's eastern border, where the population density drops and the (large) villages are far and between. Any forms of frequent interaction with the city were aimed at commuting for work and goods, rather than for supplying agricultural goods on demand in Hubli city. The importance of non-agricultural activities is limited to a small number of villagers who make use of the (good) bus connection and commute daily to Hubli as jobholders or labourers.

Table 4.5 The Corridor Zone typology (source: fieldwork research)

Village	**Popul a-tion**	**Location**	**Roads**	**Irrigatio n**	**Soil**	**Crops**	**Non-agric. activities**
Nagshett i-koppa	HDM C-ward	Northwes t, village is a city suburb	Part of city	-	Black	M: Chillies H: Cotton	Dominant: city life
Unkal	HDM C-ward	5 km north-west turning into city suburb	Along NH4	A few borewells	Black (60%) Red	M: Chillies, groundnut, Jowar and DCH-Cotton, potato, Maize and Vegetables. H: Cotton, wheat,	Abundant: 25 to 50 % of villagers off-farm employed

						jowar	
Bhairedevarkoppa	HDM C-ward	6 km northwest	Along NH4	-	Black	M: Chillies, greengram, Groundnut and Potato, DCH-cotton H: Cotton, wheat	Abundant: 25 to 50 % of villagers off-farm employed
Amargol	12.000	8 km northwest	Along NH4	-	Black (60%) Red	M: Green gram, Groundnut and Potato, DCH-cotton And vegetables H: Bengalgram, jowar	Abundant: 25 to 50 % of villagers off-farm employed
Gokul	2.000	8 km west	Near NH4 by-pass	Borewells , +- 50 ha	Red	M: DCH-cotton, jowar, Paddy, horticulture, Maize, vegetables, floriculture.	Abundant: 25 to 50 % of villagers off-farm employed

Land use in the Corridor zone is really a mixture of agricultural land use and non-agricultural development, which starts at the west side of Hubli and grows towards Dharwad further northwest. The village of Nagshettikoppa, east of the city, has already been turned into a suburb of Hubli. The central part of the Corridor - consisting of the villages of Unkal, Bhairedevarkoppa and Amargol - is characterised by a mix of (still quite large scale) rainfed farming done by original villagers and rapid non-agricultural land use development.

The farmers depend on rainfall as there are only limited possibilities to dig borewells in these mostly black soil covered areas. The crops they grow are for the most part the same as in the northeastern transect with crops like chillies, cotton, groundnut and green gram and bengal gram (see table 4.5). Due to the slightly higher rainfall than in the northeast and the fact that the area is a transitional zone between black soil plains and red soil hilly area, farmers can diversify their cropping somewhat more. This results in the limited scale cultivation of DCH-cotton, onion and maize, coriander and vegetables and horticulture. A crop which was grown on large scale in the area was potato. Which is a good cash crop and just like vegetables can also be sold to hotels and restaurants next to the nearby road and in the city. But since several years potato cultivation has decreased, mainly because of diseases and drought, and farmers have fallen back on (more traditional) crops which require less water such as green gram, groundnut and jowar.

Altogether, it is hard to detect much commercialisation of agriculture under influence of the nearness of the city (s) in the centre part of the Corridor. Because farming here resembles rainfed farming in the northeast, apart from potato cultivation which has decreased recently. The area is best characterised by a relatively traditional type of (rainfed) farming by original villagers in combination with a rapid influx of urban functions on the land. The scale of this non-agricultural land use development has however resulted in an abundance of off-farm employment possibilities. Most of the original villagers have therefore at least some family members engaged in non-agricultural activities, as a supplement to the income of the agricultural land. These villagers are all too aware of the land use developments in the area and many expect to be bought out soon, only very few farmers/land owners counter this by starting of fruit tree orchards which can not be encroached by government.

This contrast with Gokul village, which lies west of Hubli and south of the road to Dharwad. Here red soil is dominant and borewell irrigation is possible. This has resulted in a cropping patterns similar to the southwestern villages, with DCH-cotton, maize and paddy supplemented with horticulture, vegetables and even some flowers. This development started some ten years ago and has been steadily increasing ever since. The development is carried by people from Hubli who buy up land and start a fruit orchards or spatially mixed fruit tree-fieldcrop combinations.
Furthermore, Gokul village area is situated at the western border of Hubli and the village itself lies some kilometres further west along the road to Tarihall industrial area and Hubli Airport. On the edge of Hubli's built-up area there is an industrial area for light industries (which has been there for many decades, see chapter 5) and some (legal and illegal) residential development. This is however on a relatively small scale when compared to urban development along Hubli-Dharwad road. The arrival of these urban functions on the village land and the possibilities for villagers to commute have all been part of the increased interaction between Gokul and Hubli, increasing the share of non-agricultural employment in the village.

Summarising land in the Corridor, one can say that this part of the fringe has big differences in land uses. Near the road to Dharwad there is rapid non-agricultural land use development, with urban functions such as residential colonies and government agencies and large areas of vacant plots enclosing original villages. On the (remaining) lands of these original villages

however, the farmers still do fairly traditional rainfed farming. When one moves somewhat more south in the Corridor, agricultural intensification is taking place because of the access to irrigation sources, spurred on by urbanites buying up land and using it for agricultural purposes. Along the outgoing road running southwest there are urban functions in the form of an industrial area and residential development. The existence of these very different types of land use so mixed up and close to another is a common feature of rural-urban fringe areas in India and other developing countries.

Table 4.6 The Southwestern Transect typology (source: fieldwork research)

Village	**Popul a-tion**	**Location**	**Roads**	**Irrigatio n**	**Soil type**	**Crops**	**Non-agric. activities**
Bidnal	HDM C-ward	East, village situated on the edge of city	Part of city	Wastewat er irrigation +- 30 ha	Black	Vegetables near the wastewater stream all-year round M: Chillies and groundnut H: Cotton and jowar	Abundant, 50-75% of villagers off-farm employed
Gabbur	HDM C-ward	2,5 km south	At junction of NH4 by-pass and road from Hubli	Wastewat er irrigation +- 50 ha	Black	M: Maize, chillies, Groundnut, DCH- Cotton and horticul- ture and vegetables. H: Cotton and wheat	Limited available, 10-25% off-farm employed
Katnur	1.460	10 km south	Only unpaved roads	Wastewat er irrigation and borewells +- 150 ha	Red (80%) Black	M: Horticulture (guave, Sapotha) and maize, Paddy and vegetables	Limited commuting
Andar-gunchi	18.000	9 km south	Along NH4	A few borewells	Black (80%) Red	M: Chillies and groundnut H: Cotton and Wheat	Stone crushing, transport services: 10-25% off-farm employed
Anchat-geri	2.871	6 km southwest	Along highway NH17 (to Karwar)	Borewells +- 100 ha irrigated	Red (50%) Hills	M: DCH-cotton, paddy, Horticulture maize, soja and vegetables and	Brick kilns and factories, 10-25% off-farm employed

						floriculture	
Tarihall	1.400	12 km west	Next to NH4 by-pass	Borewells +- 50 ha irrigated	Red	M: DCH-cotton, paddy, horticulture maize and vegetables.	Industrial area: 10-25% off-farm employed
Rayanal	3.000	7 km west	Only unpaved roads	A few borewells	Red	M: DCH-cotton, paddy, Horticulture and Maize. Limited Vegetables and Floriculture.	Limited commuting
Devar-gudihal	2.000	11 km west	Only unpaved roads	Borewells +- 100 ha irrigated	Red (70%) Hills	M: Horticulture (mango, sapotha), paddy, DCH-cotton,exten-sive floriculture	Limited commuting

This transect is without a doubt agriculturally the most dynamic and diverse of all three transects. Within this transect some villages have varying conditions of access to water sources, soil type and transport connections, which have lead to specific local developments in agriculture.

The first three villages in the typology, Bidnal, Gabbur and Katnur, all lie along 'Hire Nalla'. This is a natural watercourse coming from Unkal tank (in the Corridor), running through Hubli city and carrying (sewage contaminated) wastewater south out of the city. As there are no heavy industries in Hubli, there is no severe pollution of the water. Thus it provides these villages with a perennial source of irrigation water, as villagers can lift wastewater from the *nalla* by means of a pump (Bradford, Brook and Hunshal, 2003). Along the *nalla*, at increasing distances of Hubli, different cropping patterns can be found (see table 4.6).

Bidnal, on Hubli's southern outskirts, lies closest to the wastewater canal and therefore has a reliable supply of water, which is used to grow vegetables all year round. The vegetables are grown spatially mixed with fruit tree-crop combinations. The vegetables are then sold on the local urban markets, especially in the summer (when vegetable prices increase between two-fold and six-fold) this is a profitable business for the (urban) farmers in Bidnal.
Gabbur lies some 2,5 km further south, here the wastewater is used for less intensive cropping. That is, a combination of (when) irrigated more renumerative field crops such as

maize, DCH-cotton and chillies (no staple crops like jowar or wheat) with crops that need permant watering like fruits, vegetables, sugarcane and even some flowers.
In Katnur, the third village along the *nalla*, fruit trees dominate the cropping pattern. Guave and sapotha cover over half the farmland, with vegetables, maize and jowar grown intercropped between the trees. This cropping pattern is also called 'agroforestry', it can also be found along wastewater streams in fringe areas around other cities in India (Bradford, Brook and Hunshal 2003). According to the village accountants of these villages these forms of wastewater irrigated commercial farming were started on a large scale some 10 to 15 years back. Before that time commercial crops, vegetables and fruit trees were only cultivated on a limited scale, since then there has been a steady increase of these type of crops in the villages of some 5-10 acres per year.
Many urban functions can be found in Bidnal and Gabbur, as the villages lie at the border of Hubli's built-up area, villagers can also easily commute to the city for work. As a result the level of non-agricultural activity is high and forms an important source of income for many villagers. The village of Katnur lies at a further distance of Hubli and is quite is isolated as it only connected through an unpaved road. Therefore there are no urban functions and villagers must commute to Hubli for off-farm work, thus levels of non-agricultural activity are low.

Figure 4.4 Intensive irrigated agriculture: wheat (in the foreground), chillies and cotton (left), and sapotha trees mixed with vegetables (on the right) (source: fieldwork)

Andargunchi is situated next to the interstate highway to Bangalore. Black soil dominates the village land, therefore only rainfed crops such as chillies intercropped with local cotton,

groundnut and wheat are cultivated. However, the specific geology of Andargunchi has allowed some land owners to turn their lands into open mines for black-stone mining and crushing, delivering materials to the construction industry in Hubli (see paragraph 5.2). This quite large scale (local) industry and the transport services next to the highway are the most important non-agricultural activities in the village and provide possibilities for villagers for off-farm employment.

The southwestern villages of Anchatgeri, Rayanal, Tarihall and Devargudihal are all dominated by red soils and here borewells are the main water sources. Traditionally, *mungary* single season rainfed cropping was conducted and paddy was the staple crop grown rainfed in between the hills along with jowar and pulses. Since the last ten to twenty years, the villagers have put an increasingly larger share of their lands under with fruit trees. These are mostly mango, sapotha, coconut and betalnut trees grown spatially intercropped with DCH-cotton, groundnut, sojabean, maize, vegetables and (sometimes) flowers (see table 4.6). The development of this more commercial type of farming varies per village. Some have only a limited area under borewell-irrigated commercial crops (Rayanal), while a village like Devargudihal makes use of many borewells for irrigation and has specialised itself in flower cultivation (intercropped with fruit trees) for the city market. Both Rayanal and Devargudihal are only connected through unpaved roads, therefore there are no industries located nearby. Villagers can make use of the good bus connection for commuting for work, agriculture is however still the dominant source of income. In Tarihall, just west of the by-pass, there is an industrial area stemming from the time that industrial development in India was stringently planned. The area has several dozen small factories and one large aluminium factory. This area provides about 250 to 300 jobs, but over the last five to ten years about a third of the factories have been closed down.

In Anchatgeri land use is influenced by the presence of a certain quality soil suitable for brick making and a high groundwater table. These two factors have caused many local villagers to start brick industries. The proximity to the city and the good road connection have caused entrepeneurs and industrialists from Hubli to favour the village as a good location to buy up land for commercial farming and/or industrial settlement. Local farmers have also increasingly started to do horticulture spatially combined with fieldcrops. The thriving brick industry and the settlement of urban functions has increased the interaction with city and

provides the villagers with possibilities for non-agricultural sources of income, as does the possibility to commute to nearby Hubli for work.

Rounding up this description of the transects and the various villages it can be concluded that the spatial land use development varies considerably between the different transects and villages. The differences in local conditions such as soil type and access to irrigation (through borewells and wastewater) have stronlgy directed the spatial development agriculture.
The southwest has developed forms irrigated agriculture such as horti- and floriculture and land excavation forms such brick kilns and stone mining, which has transformed the area and its interaction with the city. Located along the main outgoing roads there are urban functions such as industries and transport services. These developments in land use and economic activity are the result of the increased and diversified interaction with the city. This part of the fringe has the most complex interaction between agricultural and non-agricultural land use forms and the city, with a flow of fruits, flowers and vegetables and construction materials to the city and a flow of capital from the city into the local (agricultural) land market.
The Corridor Zone has developed a limited further commercialisation of agriculture due to its dependence of rainfall, but has developed large scale potato cultivation for the urban markets. Yet, the most important development has been the influx of urban functions which found an attractive location in the Corridor Zone, due to its location in between the cities and the planned initiatives of the urban development authorities. This has conversed large tracts of agricultural land, leading to haphazard mix of traditional farming and urban land use.
The northeastern transect's land use development has been stagnated in rainfed commercialisation due to its complete dependence on rainfall. This land use form is not influenced by the distance from the city at all, as this type of land use starts directly at the eastern border of Hubli. The low population density (empty open plains with villages located far from Hubli and each other), its transport connections which only lead to the more rural, interior parts of Karnataka and the lack of possiblities for land excavation (no brick kilns etc..) has meant that there is no non-agricultural land use activity development in the area. The only frequent interaction between Hubli and the northeast consists of commuters from the villages via the good bus connection.

4.3.4 Individual land user cases in three rural-urban fringe villages:
In this subparagraph a description is given of the individual land users' situation in three rural-urban fringe villages, based on interviews with local farmers held during fieldwork.

These three villages have been selected because they typify some of the land use developments going on in the (agriculturally most dynamic part of the) fringe area: the southwestern transect. Individual land owner cases have been added to shed some light on the actual land users and their agricultural techniques and motives regarding certain land use choices.

The villages each have specific features related to their rural-urban fringe situation which have spurred on their spatial (land use) development and functional interaction with Hubli city. Due its location near Hubli Gabbur has urban land use development and access to wastewater irrigation leading commercial farming. Devargudihal has specialised itself in horti- and floriculture because of the availability of borewell irrigation, soil type and a local history of interaction with Hubli. Anchatgeri, has a mix form of commercial agricultural land use and industrial settlement plus a thriving brick industry due to access to borewell irrigation, a certain quality of soil and a good road connection.

Gabbur village: urban development and wastewater irrigation

Gabbur is situated 2,5 km south of Hubli at the junction of the old NH4 coming from the city and the newly built NH4 by-pass (finished in 1998). It lies along the wastewater stream from Hubli and as such is one of the three villages in the typology (see table 4.9) making use this irrigation source.

The lands around the village are black cotton soil plains. Its lands lie up to the outskirts of Hubli and at all sides of the road junction and the village has been a HDMC-ward since the 1960s. Several storehouses ("gowdans"), 3 metalworking factories, a construction material dealer (marble) and some motor repair shops have settled on the village lands.

Apart from the large infrastructural development, there has also been (a slow) residential development on the lands of Gabbur. East of the old NH4 a residential colony "New Gabbur" (10 ha) has been developed since twenty years and in between the by-pass and the old NH4 a residential project of some 30 ha is about to start. The whole HDMC-ward area houses some 20.000 inhabitants, most of which live in the new residential areas.

Old Gabbur is lying southwest of the junction, along the "Hire Nalla", a natural watercourse used as a wastewater stream coming from Hubli. Most of the people in the original village, which counts about 3.000 inhabitants, here are still engaged in farming, making use of the "Nalla" as a perennial water source for irrigation. They have increasingly made use of this

water source over the last decade. On the lands without access to the wastewater farmers grow the traditional rainfed crops such as jowar and groundnut.
On irrigated land the farmers preferably grow maize in *mungary* and sunflower in *hingary*. Most farmers grow these crops since some years and consider these to be the best crops because of the good market prices, good fodder production and they are easy to grow and well suited to the black soil. Other irrigated crops are vegetables, fruittrees, sugarcane, wheat and chilly. Vegetables such as cucumber, tomato, coriander and cauliflower are all sold on urban markets in Hubli. Fruittrees are gaining popularity, these are mostly sapotha-trees which grow best on black soil, although only the large(r) farmers are planting them. Small(er) farmers grow mostly traditional crops, maize and vegetables. The buying up of land by people from Hubli was also noticeable in Gabbur, they would use this land for irrigated sapotha-trees intercropped with fieldcrops (see box 4.1).

Diversification of income was only found with small farmers families who supplemented their the income from agriculture with non-agricultural activities performed by some of the household members, mostly in Hubli. Noted activities were small scale milk selling (as a "gowdie") taking milk from Gabbur to Hubli, or performing unskilled labour as loaders on the market. Younger family members having more education were sometimes earning a monthly salary by working in shops in the city or in factories, or (in one case) as plumbers. The large(r) farmers were mostly depending only agriculture for their income, the renting out of agricultural implements was the only source of extra income a larger farmer was making use of.

Box 4.1 Urbanites from Hubli buying up land for horticulture in Gabbur

In "New Gabbur" there was an good example of urbanites buying up agricultural land in the rural-urban fringe. Appu Patil (28) is managing the land in New Gabbur for his father, he drives down from Hubli in half hour on his new two-wheeler every few days or so to check up on the four permanent labourers there. He and his father and his two brothers live in Hubli and have a money-lending office in the heart of the city. They have chosen to invest in land in the villages around Hubli, they own four farms around the city with a total aerial size of 37,2 acres of farmland and employing eleven permanent labourers.
Two of these farms have been in family possession for long and two have been acquired ten years back. One farm is located 3 km to the east in Virapur (5acre) which is used for fruittrees, another is situated 10 km south in Belgeli and consists of 2 acres used for rainfed farming. In Mavanur which lies along the "Nalla" at 9 km from Hubli, the land (14,2 acre) is used for horticulture and brick kilns.
In (New) Gabbur they own 16 acres of black soil, from which they use 13 acres for spatially-mixed fruittrees and fieldcrops intercropping irrigated by one borewell. Banana covers 4 acres, sapotha 6 and curryleaf 2 acre, in between these trees jowar, groundnut are grown in *mungary* and bengalgram and safflower in *hingary*. The conversion to horticultural crops they

started in 1997, because it is an improvement of the land and gives good produce. An acquaintance of them is an agricultural advisor at the University of Agricultural Sciences in Dharwad he advised them to start horticulture. After studying the process, they might start flower cultivation.
According to Appu, the last 3 to 4 years more people from Hubli have started to invest in horticultural land use around Hubli. This is because there has been no business improvement in city these last years because of the drought, he says that business in Hubli is dependent on the agricultural sector which has suffered a lot under the droughts. People from Hubli (now) buy up land 40 to 60 km from Hubli and only to the south of the city in the red soil areas. These areas are said to be even more attractive for investment than the areas (south)west of Hubli-Dharwad because of a good soil quality and a high(er) groundwater-table.

Devargudihal village: specialisation in horticulture and floriculture

The village of Devargudihal lies some 11 km west of Hubli in a hilly, red soil area, the village population numbers 2.000 inhabitants. The west of the village area is bordered by a mountain range of the West Ghats, a third of the total village area is covered by rocky hillside, the rest is covered by red soil. The village is connected with Hubli only through a unpaved road, which comes to a dead end in the village, nevertheless there is a good (frequent) bus connection. Because the village is fairly small and situated quite isolated there is hardly any non-agricultural activity, making agriculture the only source of income for most villagers.

Agricultural land use in the village is characterised by the dominance of horticulture (mango and sapotha) combined with floriculture (roses and chrysanthemums) and fieldcrops such as paddy, jowar, DCH-cotton and vegetables. Both small, medium and large farmers are engaged in horticulture and floriculture. Due to a high groundwater table in the area, the use of borewells for irrigating the water-wanting fruittrees and flowers is widespread. The village also has a huge embanked tank (of nearly 100 ha) which was used for irrigation some years back, but during the drought the tank has completely dried up.

The farmers in Devargudihal have specialised themselves in both horticulture and floriculture, the village has the highest share of its land covered with fruittrees and flowers among all the researched rural-urban fringe villages. Only Katnur, situated along the wastewater *nalla* from Hubli (and also only connected through unpaved roads), had a similar high share of its agricultural lands covered with fruittrees. But whereas Katnur is dominated by guave and sapotha, Devargudihal is dominated by mango and sapotha. The mango-orchards in the village were among the oldest and largest encountered around Hubli during the fieldwork, comparable only with the old mango-orchards west of Dharwad. Mango-cultivation in

Devargudihal goes back several decades, whereas widespread sapotha-cultivation is something of the last ten to fifteen years. Small farmers start with planting between twenty to sixty fruittrees on their plot and expand after four to six years when the first trees give harvest (see Box 4.2). During the first years fieldcrops or flowers can easily be intercropped between the small young trees, thereby preventing big losses in earnings. A medium size farmer will start with hundred to two hundred trees and possibly expand after that, while large farmers start by putting about a third of their land (for example 10-20 acres) under fruittrees.
The cultivation of flowers on a large scale is a trend started of some ten years ago, this has taken such a flight that Devargudihal has become the main rose-producing area in North Karnataka, with flowers being transported to Hubli and even further to Belgaum and Goa. Rose- and chrysanthemum-cultivation has become an important source of income for small, medium and large farmers. Providing them with an intensive short-cycle cropping system with a valuable (but perishable) product which needs to be transported fast, but therefore giving (nearly) immediate cash returns (see Box 4.2). The characteristics of this cropping system provide especially the small farmers with an improved source of income. Because they always need fast cash returns and can do short-cycle (labour) intensive farming on their small plots.

Figure 4.5 Drip-irrigated rose-cultivation spatially mixed with young sapotha trees (source: fieldwork)

Box 4.2 Small farmers doing mango-, sapotha- and rose-cultivation

The small joint-family Hukker (5 members) lives of only 2.5 acres of land, but are a good example of the effect of the change from traditional crops to flower-cultivation. The family has leased out 1.5 acre of their land, because it is dry land and they can not cultivate flowers on it and therefore they have no interest in maintaining it. On the 1 acre they can irrigate (from one borewell they share with other family members) they grow ½ acre of red roses and

½ an acre of yellow chrysanthemums ("Galati" in Kannada). They started growing flowers five years back, previously DCH-cotton and jowar were grown. The chrysanthemums they grow only three months a year during *mungary*, while they use the irrigation water the rest of the year for rose cultivation. The rose plants require intensive fertilising, irrigation and pesticides and have to be replaced every eight years. Currently, they have 2.000 rose plants, these rose plants get plucked daily. Early morning they are plucked and are then taken by the sons of the family in headloads on the bus or in "tempo's" (small private buses) to Hubli. There the roses are sold by themselves on the street or to private street vendors, dependent on the marketprices, at noon they can be back in the village. Daywise the number of plucked roses varies between the 500 to 1000 and on a bad day maybe only 50. They sell the roses at about 20-40 rps per hundred, in this way they make a very good income, even being able to hire their own land labourers (two) at 50rps a day.
The idea for cultivating roses they got from their uncle, who brought the young plants (at 7rps each) from Bangalore. Their uncle was the first one in the village to start doing rose-cultivation sixteen years back, after having been one of the persons who was selling roses for Mr.Babusheller, the man who introduced horticulture and floriculture in the Devargudihal long time back (see Box 4.3).

The joint-family Savasi consists of a grandfather and his wife and three sons of which two are married and have children. Their only sources of income are their 2 acre of land and the work they do as land labourers on other farms. On these acres of land they have planted 40 mango-trees and 40 sapotha-trees spatial mixed with 1000 rose plants, the plot is irrigated by one borewell. Before they used to grow only rainfed jowar, maize and tomato. Then six years back they planted the mango-trees, at first the young trees were watered by bringing water from the tank in buckets. Since four years they have dug their own borewell and planted the sapotha-trees, the cultivation of roses started two years back. The mango gets picked up by agents, while they take the roses to Hubli themselves on a daily basis via bus, tempo's or jeeps which leave from the village often.
The idea for these crops came from neighbouring farmers who were already engaged in this type of farming. They chose to grow these crops because it gives more income than the previous crops, they now buy their food instead of growing it. Furthermore, the tree crops are an investment, because they grow bigger, only the first 3 to 4 years the young trees need a lot of water and care and do not yet produce any fruits. Another factor for choosing these crops is that the soil in Devargudihal is particularly well suited to the fruittrees and flowers.

Devargudihal has - since several decades- had an exceptionally high share of agricultural land under mango, sapotha and flowers compared to other villages in the rural-urban fringe and even neighbouring villages. This can be explained through the role of a key-person, who introduced the tree-crops and flowers long before anyone else was practising these types of agriculture in the village (see Box 4.3).

Box 4.3 Agricultural innovation in Devargudihal: the story of Mr.Babusheller

During the fieldwork in Devargudihal, farmers were asked about the factors which led to the widespread cultivation of fruittrees and flowers in the village and why this practise has been started earlier than in other villages southwest of Hubli. Many farmers mentioned that a single particular person had introduced fruittrees (mango) and flowers (roses) in the village many decades ago: Mr. Babusheller. His grandson still ownes the land in the village and told about the practises of his grandfather.

Mr. Babusheller was a businessman from Hubli, originally from Gujarat, who owned a textile shop in Hubli. Out of love for (plantation) farming he bought 35 acres in Devargudihal in the 1950s, situated at the end of an unpaved footpath which ran through the village and was back then the only transport connection with Hubli. There he started experimenting with mango- and sapotha- cultivation and eventually made a specialised mango-orchard containing 52 varieties of mango, which was unique in India. He developed new grafting techniques and even managed to grow a bonsai-mango tree, later on he also started to grow roses. Farmers in Devargudihal eventually started to take notice of these types of plantation-farming and he informed them about the necessary agricultural techniques and from about the 1980s more and more farmers started to grow mango- and sapotha-trees and later on roses, leading to a headstart in horticulture and floriculture for farmers in Devargudihal compared to other villages. Ultimately, this has led to a situation where most of the villagers have been able to improve their income by growing mango, sapotha and/or roses- of which the village has become the main supplier in North Karnataka.
On the land in Devargudihal the family Babusheller still grows plantation crops: there are some 500 mango (spaced at 40 feet and not at 60-70 feet which is more common practice) and 300 sapotha-trees intercropped with fieldcrops, furthermore there are some 4.000 rose plants. The grandson, who now runs the textile shop and the farm in Devargudihal reflects on the spread of innovation among farmers. According to him there is a lack of practical education, technical know-how and infrastructure for the farmers by the government to support innovation. For example, the government has increased the taxes on borewells since two years putting them out of reach of small farmers. Furthermore, the marketing channels for fruits and flowers are controlled by a syndicate of agents and big private companies who have set up a monopoly. The agents for instance buy up flowers at 20-40 rps per hundred roses and sell them at 80-100 rps per hundred. Private companies have a monopoly in the mango-industry since about two years, as a result prices have come down from 13-14.000 rps per ton to 8.000 rps per ton. He himself is planning to change his cropping pattern to banana and aromatic plants such as vanilla which are much less common at this point in time, he also plans to set up a Cooperation for Devargudihal.

The (special) history of events in Devargudihal shows how most of the farmers are dependent on examples of innovation taking place in or near their own village -(often) started by larger farmers who can take more risks- before these new agricultural practices become more common in the village and are not any longer seen as “risky” undertakings jeopardising steady income. A similar concentration of agricultural innovation was observed in Katnur, where most farmers have used the wastewater for growing guave and sapotha. This is also done in other villages further down the *nalla* from Hubli, according to Bradford, Brook and Hunshal (2003): “This process (of experimenting with successful cropping patterns of larger neighbouring farmers, author) is clearly occurring in Budarsingi and Katnur, where wastewater-irrigated agroforestry systems have spread as a direct result of farmers observing

the practices, then adopting them once they are confident they work; in this case 'change' is no longer perceived as a risk and thus agroforestry practices are freely adopted" [12].

Anchatgeri village: Mixed agricultural and non-agricultural land use

In this case the focus is on a form of mixed non-agricultural and agricultural land use development. This specific mix form was found in the southwest of the rural-urban fringe of Hubli, in the village of Anchatgeri. Below the land use patterns containing both agricultural and non-agricultural land use are discussed. Although the next chapter is dedicated to non-agricultural land use, it was found more fitting to discuss this mix form here in a separate case which deals with the village where this specific land use form was found.

The land use patterns in Anchatgeri village area are influenced by both local land owners and land owners from Hubli. The high groundwater table has made widespread borewell irrigation possible, leading to possibilities for horticultural development. The loamy red soil -in combination with the availability of water- is ideally suited to the brick industry.
These physical conditions and the good location of Anchatgeri, 6 km southwest of Hubli, along the quiet and good State Highway (NH17) to Kalgahati has made it a very good location for business man from Hubli to buy up land. These people from Hubli can invest in agricultural land, since there is no tax on agricultural land and produce in India. Therefore, the buy up plots preferably in places like Anchatgeri where they can do borewell- irrigated horticultural farming (coconut, mango, sapotha etc..) in combination with spatially mixed fieldcrops. This trend started in the 1980s, as a result there is large scale commercialisation and considerable experimentation going on in agriculture in the village. Consequently, local farmers also got engaged in limited scale fruittree cropping mixed with fieldcrops.

Eventually developing non-agricultural settlement on a part the plot (see paragraph 4.4.4). Commercial agricultural land use by these urbanites is often technologically advanced (drip-irrigation), intensive (fruittrees mixed with commercial fieldcrops) and experimental (fume irrigated green houses for flowers for example).

[12] From a paper "Wastewater irrigation: Hubli-Dharwad, India" presented at the International symposium on water, poverty and productive uses of water at the household level, 21-23 January 2003, Mulderdrift, South Africa

Currently, agricultural land use in the village is characterised by a mix of the traditional food-crops paddy and jowar with commercial cash crops such as hybrid (DCH) cotton, chilly and soybean (which has increasingly replaced paddy during the drought), spatially-mixed with fruittrees. Other forms of commercial farming include some two dozen hectares under vegetable- and flower-cultivation. The smaller and medium sized farmers grow a combination of traditional rainfed food crops (jowar, paddy and groundnut), together with an irrigated patch of hybrid (DCH) cotton, chilly, vegetables and soybean and at the border of their plots they have planted some fruittrees. The larger farmers grow the same crops, but have a large part of their completely cropped with the fruittree fieldcrop combination. Popular fruittrees in the village are mango, sapotha, guave and coconut.

Apart from raising their income by commercialising agriculture, many local land owners in Anchatgeri have increased their income by starting brick kilns (see box 4.4). This exploitation of land for brick kiln excavation is done by both medium, large and even smaller local land owners. The concentration of brick kilns starts west of the by-pass in the Hubli municipality Cooperation area (HDMC). The brick kilns then continue all along the NH17 for about ten to fifteen kilometres, into Antchatgeri village area and beyond, into Kalghati Taluka. Anchatgeri is the centre of the brick making area and the industry started as far back as the 1960s, it is for the most part (approx.75%) controlled by local villagers. Along the whole stretch of land from the interchange with the NH4 by-pass near Hubli up to Kalgahti Taluka there are approximately 150-200 brick kilns, situated mostly near the highway. The brick industry around Anchatgeri has become so big that it draws labourers from other areas, notably from a Tibetan exiles camp 20 km further south down Kalghati road.

Box 4.4 Local farmers mixing field crops with horticulture and brick excavation

The family of B.H.Walakar is a joint family owning 14 acres of land. The household consists of four brothers and their wives and children. One of the brothers works in an engine factory in Hubli, the other three take care of farming. Of the 14 acres, 4 acres are covered by red soil and 6 acres by red mixed black soil. Since three years they have dug a borewell, because of the drought, the borewell irrigates 4 acres of land. Some ten years back they used to only grow rainfed jowar, paddy, groundnut, chilly and cotton. Before two years, vegetables were grown on the irrigated land but these were difficult to cultivate during the drought and prices were not that high as to make this viable any longer. Now they grow irrigated DCH-cotton surrounded by thirty mango-trees, the fruittrees were planted four years back. A further fifty sapotha-trees have already been ordered from the Agricultural University in Dharwad in order to expand the fruit cultivation. On the remaining rainfed land soybean, chilly and paddy is grown in *mungary* and jowar in *hingary*.

In addition to their income from agriculture, the family has started a brick kiln since two years taking up half an acre of the (red soil) land. They got the idea from other villagers and wanted to make of the nearness to Hubli construction market, particularly since agriculture had not been fetching them much during the drought(s) of the last years. For the transport of raw materials (coal) to the kiln and for delivery of bricks to construction sites in Hubli self-owned truck is used. They employ 10 to15 brick kiln labourers on a daily basis, paying them 200 rupees per thousand bricks. The brick kiln is operational for only several months a year. The brick production stops during the monsoon (when rain water fills the kilns) and the summer (when the summer heat dries up the premature mud bricks).

As was mentioned earlier, land use in Anchatgeri is influenced by business men from Hubli who buy up land and try different new types of intensive commercial farming. Since the 1990s however a new mix of non-agricultural land use on part of the agricultural plot has become popular. Business men started to set up their own industry on the plots or rent out a part to industrial users. This creates a land forms with plots of 5-10 acres, with on these plots small to large industries on 2-3 acres of land surrounded by the old orchards. This mix form of horticulture and industrial/ commercial land use on a single plot owned by one person from Hubli is common all along the roadside in Anchatgeri.

In this way the good transport connection and physical properties of the area has drawn a few dozen industrial or commercial settlements next to the road side (see box) on originally agricultural plots. Examples of such settlements being storehouses (“gowdans”), poultry farms, small factories (a plywood factory, a distillery etc..) and several mechanical engineering- and construction-units located in factory halls. There are even a few large factories situated on old agricultural plots. One of which is a large wheat producing factory and another a brand new factory complex which produces export quality canned cucumbers for a Dutch multinational food company (Unilever) (see box 4.6) All these commercial and industrial units in Anchatgeri were located on plots of land which were for the remaining part covered by irrigated (old) orchards, sometimes intercropped with commercial fieldcrops (see box 4.6).

The particular mix of land use forms found in Anchatgeri village - and further highlighted below in boxes 4.5 and 4.6 by means of cases of land use on plots owned by urbanites- goes to show that the model of Ramanchandran of chronological land use change from one category of land use to another does not always fit with specific local developments.
In the case of Anchatgeri the specific local conditions have triggered a special interaction with the city which over time has created a mixture of land use categories - rural and urban- on a

single plot. Furthermore, the (same) physical properties, location and transport connection have in turn made the village a suitable site for the location of export product producing factory, which is part of multinational company strategy. This example also goes to show the high spatial levels of interaction taking place near a city, which can impact on land use in the rural-urban fringe.

Box 4.5 Entrepreneurs from Hubli mixing commercial farming with industrial land use

Just at the start of Anchatgeri village next to the road side, a steel working unit is housed in a factory hall on a plot of land covered for the remaining part by fruittrees intercropped fieldcrops. It is owned by a well-to-do family (the head of the family is a lawyer) from Hubli - the family Nadger- and run by a one their sons who is a mechanical engineer. He ownes the steel working company and takes care of the intensive commercial farming on the plot.
They have bought the land (15 acres of red mixed black soil) in 1982 with plantation farming in mind. In 1985 coconut, betalnut and mango were planted, this was the trend back then in this area. Currently, the area is cropped with 250 coconut trees, 100 mango-, and 50 betalnut trees and some nime trees. Since 3 years they have added 100 sapotha-, 50 curryleaf and 2000 teak trees and some bamboo bush. For watering *drip-irrigation* is used. This is an efficient form of irrigation where drop by drop water will fall at certain intervals through holes in the hoses. These hoses are spread so that the water will fall at the root of the trees. Underneath the coconut and betalnut palms wheat and "African grass" (*Napier grass*) is grown and between the mango- and sapotha trees fieldcrops such as groundnut and jowar are grown. The "African grass" (a green bushy plant which can be cut and will grow back even bigger) and jowar are grown strictly for fodder for the six cows on the premises. The feeding of *green fodder* instead of dried fodder to the cattle is said to double the milk-production (Hunshal and…).
For the daily work on the land two families are permanently employed.
According to Mr. Nadger, trends in land use in Anchageri area include a decline in coconut plantations, because of diseases which cause a sharp decline in harvest. A new trend in commercial in the area - by urbanites from Hubli- is *fume irrigated flower cultivation in green houses*. In the back of the plot he has reserved half an acre for this purpose. This trend started one year ago and so far already six other green houses have been constructed in and around Anchatgeri.
His own *steel valves-components unit* - situated at the roadside of the plot- covers about half an acre and was started in 1992. The valves are used in the food-and petrochemical industry and are constructed through use of sophisticated technological machinery, his unit employs two permanent steel workers. The site for the steel unit was chosen because of the good location and the fact that the land was already owned by the family. Especially the road connection is very good, the NH16 highway is broad and of much better quality than the infrastructural network in Hubli, which is very congested and has not been improved since the 1950s.

Box 4.6 A (Dutch) multinational food company in the southwestern fringe of Hubli

At a distance of 8 km southwest of Hubli, next to Kalghati road, a factory of Ken Agritech.Ltd. is located. This factory unit produces 'snacksize' canned cucumber on vinegar for export to Europe. It is situated in a former paper factory, owned by a industrialist from Hubli who leases it out. Since six years the terrain and the building have been changed into a

factory unit. The site has been completely transformed, the whole area is now fenced off and permanently guarded. On the terrain -covering some 8 acres - a small complex has been created and strict hygienic codes are applied. The built-up area covers about 2 acres while the rest of the terrain is covered by old orchards of mango- and coconut trees, neatly maintained to create a pleasant 'green' atmosphere (the trees are not harvested any more).
The factory is a joint-venture of an Indian industrialist, a Belgian company and Unilever (a Dutch multinational). Unilever has designed the whole production process and managers are specially trained. The factory is the only one of its kind in North Karnataka. The factory is located central to four growing areas, which all lie within a radius of 100 km around Hubli. These areas all have specific agro-climatical conditions which are suited to different types of cucumber. The intercontinental transport goes via the port of Vasco in Goa, to the ports of Antwerp and Le Havre. The factory employs between the 100 and 150 people, all of which have at least PUC (10th standard) level education, most of the workers come from surrounding villages.
The reasons why Hubli/ Anchatgeri was chosen as the location for the factory are multiple. Around Bangalore there are already several of these type of factories, but the situation around the State capital is getting less attractive because of increasing costs of land and labour and so forth. Therefore Hubli was chosen, it has a favourable agro-climate, a good transport connection and is located relatively near to the coast.
The village of Anchatgeri -in the fringe area of the city - was chosen for several reasons. First of all, Anchatgeri is situated west of the city and trucks can easily run between the coast and the factory without having to enter the congested city. Kalghati road (NH16), running through Anchatgeri also offers a good quality road connection to Vasco, Goa. Furthermore, the site is far from industrial pollution and haphazard (legal and illegal) residential development (such as in Gokul road industrial area). The labour and water availability on the site are also good. Finally, the local government has provided special support for the factory in the form of the same reliability in power supply as is available in the municipal cooperation area, technically and judicially the site is part of the cooperation area, enabling the factory to be located outside of the city cooperation area.

4.4 Conclusion

Agricultural land use is the most important form of land use around Hubli, even in the rural-urban fringe of the city. Therefore, first trends in agricultural land use at the level of the North Maidan and Dharwad District were sought and the researched changes in Hubli Taluka and the rural-urban fringe were compared to these trends. Secondly, the variation in cropping patterns within fringe area was examined. The concluding results are as follows.

Farming in the region around Hubli is still fairly traditional and due to low level of irrigation, mostly rainfed. This type of farming used to be dominated by subsistence staple (food) crops, mostly cereal and millets. During the period from 1966-69 to 1987-90 cropping patterns in the climate zone of the North Maidan (roughly covering North Karnataka) shifted away from these cereals and millets and the early commercial crop cotton, to pulses and new oilseeds such as sunflower. This trend is also noticeable in Dharwad District, but here these crops were

for a large part replaced by chilly, which rose sharply. Dharwad District is unique in this respect, as all other districts in the state had recorded a decline in chillies.

When comparing the North Maidan and Dharwad District in 1990 with cropping in Hubli Taluka in 1991 and the rural-urban fringe villages from 1999 to 2003, the above mentioned trend of falling shares of cereals and millets is again visible. But in Hubli Taluka and more so in the fringe an even larger share of traditional crops are dropped in favour of further *rainfed commercialisation*. In the form of rainfed cultivation of cotton, chillies and especially onion, which dominate farming in Hubli Taluka and the rural-urban fringe villages.
Even under the semi-arid conditions and with a lack of irrigation, farmers have chosen to grow these cash crops which are normally grown irrigated in other parts of the North Maidan. This shows that farmers near the city have a commercial outlook and are in this respect more commercial than farmers further from the city, despite being hampered by a lack of irrigation facilities.
This commercial outlook of these farmers is possibly influenced by the early large scale commercial cotton farming in the area around Hubli, due to the suitable black (cotton) soils and the presence of textile industries in Hubli.

The finding that (rainfed) agricultural land use in the fringe of Hubli is more commercial than agriculture in the wider region seems to confirm the model of Ramachandran of a commercialisation of agricultural land as the first stage in transforming the countryside around a city.
Even if local conditions are adverse to agricultural development (low levels of irrigation), the interaction with the nearby city through the demand of the agricultural market in Hubli (for the commercial crops chillies, onion and cotton) and the history of interaction between (textile-industries in) the city and the black cotton soil fringe areas has influenced farmers into doing a more commercial form of farming than in areas further from the city.

However, this conclusion is based on the result of comparing rainfed cropping patterns on a high spatial level (Hubli Taluka and the whole rural-urban fringe) and thus it gives only a rough picture of agricultural land use in a wide area around the city. When the rural-urban fringe is looked at more closely and irrigated cropping is also included a picture of more varied land use in the fringe area arises. Then, certain areas in the fringe with specific land use patterns and forms of interaction with the city, can be identified.

This is caused by the fact that the rural-urban fringe area around Hubli is characterised by a high heterogeneity in climate, soil type and landscape. These physical differences have a strong influence on cropping patterns and also on the way the city effects agricultural land use development in the fringe.

In the Northeastern transect of the rural-urban fringe, cropping patterns are quite one-sidedly developed. The distinctive cropping pattern of intercropped chillies, onion and cotton, starts directly at the eastern border of the city and continues to dominate the rest of the eastern area of Hubli Taluka.
Apart from having three villages fully incorporated in the built-up city area, the (agricultural) land use development in this area of the fringe has stagnated in rainfed commercial farming. Making this area comply with only the first stage of urbanisation of Ramachandran's model: commercialisation of agriculture. The only interaction between this area of the fringe and the city is limited to some commuters via public transport and the demand of agricultural markets in Hubli for the rainfed commercial crops. There has been no development of any non-agricultural activities or industries under influence of the nearness to the city.

The Corridor Zone has been identified as an area characterised by commercial rainfed farming -which continues to take place on quite a large scale in between the two cities- mixed with rapid non-agricultural land use development. This has resulted in an abundance of non-agricultural activity in and nearby the original villages, providing more opportunities for villagers to diversify their income sources.
In the area between Hubli and Dharwad there used to be large scale potato cultivation, made possible by the slightly higher rainfall in this more western part. Recently, potato cultivation has ceased because of the drought and diseases and has been replaced by pulses. This potato production was aimed at the nearby city markets and hotels and restaurants. In the red soil areas more south in the Corridor Zone, cropping patterns resemble more those of the Southwestern transect.
The Corridor Zone is under a strong influence of its location in between the two cities, which is designated for urban development. As a result, the stage of commercialisation of agricultural land is only developed to a limited extent, moreover it has been surpassed by urban land use, jumping to the fourth stage of Ramachandran's model of mixed agricultural and built-up land use. The attractive location has also meant that a lot of urban functions have settled along the road which runs through this area. This development provides the local

population with an abundance of opportunities to diversify their income. Off course, the location close to the city also provides plenty possibilities for commuting to the city for work or the direct marketing of agricultural goods.

Agricultural land use development in the Southwestern transect is the most dynamic and diverse of the whole rural-urban fringe. In the hilly red soil areas rainfed paddy cultivation used to be dominant, as rice was the main staple crop. Nowadays, horticulture intercropped with hybrid cotton, maize and vegetables and floriculture are among the most important developments. The availability of borewells and a wastewater course from Hubli makes irrigation of these water-wanting crops possible.
The most important reasons for the rise of irrigated crops are good market prices for these crops, the possibilities for small farmers to gain fast returns by direct marketing in Hubli and the fact that orchards provide a long term investment and require less labour (which is scarce in the fringe). Another factor in the rise of horticulture are urbanites from Hubli, who buy up land and start horticultural farming as an tax-free investment.
Land excavation through brick kilns and stone mining are two important forms of non-agricultural land use developments found in the Southwest. Furthermore, different urban functions such as industries and other enterprises have settled along the main roads in the area. Both these forms of non-agricultural activities have provided opportunities for off-farm employment for local inhabitants.
Fieldwork interviews in the Southwest revealed that on the level of individual land users agricultural innovations in a village are often influenced by local large land owners or extra-locals experimenting with new agricultural techniques. These are then eventually adopted by other (smaller) farmers. Examples of the influence of urbanites on land use were found in two cases of land use development in Devargudihal and Anchatgeri.
In the first village a textile merchant from Hubli came to the village decades ago and started all types of irrigated commercial farming before it became common practice in the fringe area. Eventually, Devargudihal now has one of the largest areas under mango of all the fringe villages and is the main rose-producing area in North Karnataka.
In Anchatgeri entrepreneurs from Hubli started to buy up land in the 1980s started to experiment with irrigated horticulture. In the 1990s the business men started to combine horticultural land use with industrial and commercial settlements on their plot.
This mixed land use form can be found all along the highway through Anchatgeri nowadays.

Through the fact that conditions in the Southwestern part of the fringe provide the most scope for development of agricultural land use, it has developed a frequent and diverse interaction between local agriculture and the city. The southwest provides the city with fruits, flowers and vegetables, while urbanites form Hubli have chosen this area for investment in land in the form of horticultural farming.
Furthermore, the geology and soil type has meant that this area provides landowners with opportunities for excavation of their land to supply materials to Hubli's growing construction market. Finally, the good road connections have made it an attractive location for industries/ commercial enterprises an so forth, which find the city to be too congested or polluted.

As a result the area has a diverse land use pattern covering stages three and four of Ramachandran's model, that is commercially highly developed agricultural land use mixed sometimes with non-agricultural and industrial land use forms.
This situation has lead to a diverse and quite intense interaction between this area and the city. Leading to a diversification in income sources from agricultural production (marketing of fruits and flowers), non-agricultural uses of the land as well as from the arrival of non-agricultural employment opportunities.

Summarising the research results on agricultural land use change it can be said that the analysis of rainfed agricultural land use patterns on a high spatial level (trends in Hubli Taluka and the whole fringe against the District and North Karnataka) already indicated a significantly more commercial agricultural land use pattern around Hubli. This could be seen as Ramachandran's first stage of land use change around a city, although it gives only a very rough picture and the level of interaction with the city was not researched on this level.

On the level of different parts of the fringe it becomes clear that in the fringe there are various areas with specific land use patterns and forms of (functional) interaction with the city. These different parts of the city are in different stages of urbanisation (such as described in Ramachandran's model) and are having different forms/ levels of interaction with the city. The spatial spread of the development of land use and interaction in the fringe of Hubli is however strongly influenced by local conditions such as location relative to the two cities and main roads, soil type, geology and access to irrigation sources.

The next chapter will now deal further with the non-agricultural land use development and its location, in order to see what factors influence the spread of this (more) urban land use type.

Chapter 5 Non-agricultural land use development around Hubli

5.1 Introduction

In this chapter the focus will be on non-agricultural land use development in the rural-urban fringe of Hubli. As explained in the model of rural to urban transformation of Ramachandran (see paragraph 1.2), the next step after commercialisation of agricultural land use would be the arrival of non-agricultural forms land use in the fringe area. This includes any form of non-agricultural land use. Such as the exploitation of the ground as a resource itself, by means of excavation of the soil or mining of rocks, as well as urban development which takes the form of built-up land for residential, industrial or infrastructural purposes.

This chapter is not intended to give a full or complete overview of all non-agricultural developments taking place in the rural-urban fringe around Hubli. It is merely meant to give an idea of the most common forms of non-agricultural land use in the fringe and the general development of urban expansion around Hubli. On the basis of fieldwork research, a description of the process of non-agricultural land use development in two rural-urban fringe villages is given, further explained through some individual cases of non-agricultural land use changes and their effects.

The selection of the sites and types of non-agricultural land use is somewhat limited in that it is based on a number of observations and interviews during fieldwork visits to villages and on Hubli Dharwad Municipal Cooperation planning reports. It is therefore not representative of all the sites and types of non-agricultural land use development in the fringe.
However, the selected built-up sites represent some of the largest residential and industrial clusterings in the rural-urban fringe of Hubli and their development, plus the largest infrastructural projects of recent years.
Other types of non-agricultural use, such as excavation of the soil or mining of rocks, are dependent on local conditions and as such are representative of areas in the rural-urban fringe where this is happening. In the case of Anchatgeri (brick industry) and Andargunchi (stone crushing), both villages were the largest concentration of these activities found in the fringe of Hubli. The further spread and location of these forms of land use was not researched.

5.2 Overview of non-agricultural land use development

This paragraph will give an overview of the types of non-agricultural land use development in the rural-urban fringe of Hubli city. Some types of non-agricultural land use encountered

around Hubli were found to be localized in certain areas and along main roads or in single villages. Below an overview is given of the types of non-agricultural land uses per transect. Their location of the types of non-agricultural land use relative to Hubli and to the major roads is mentioned, as well as their presence in some of the research villages. Non-agricultural land use in the Corridor Zone Transect starts at the edge of Hubli city and sprawls to the northwest, therefore no distances in kilometres are given.

Table 5.1 Non-agricultural land use types and location in the rural-urban fringe of Hubli.

Non-agricultural land use:	**Research Transects**	**Location and description**	**Date of start**	**Research villages**
Brick kilns	Southwest	Brick industries situated along NH17 highway, 6 km southwest	1960s	Anchatgeri
Stone mining	Southwest	Black stone mining and crushing industries along NH4 highway, 9 km south	1980s	Andragunchi
Residential colonies and plots	Corridor Zone Southwest	*Navanagar township* development: residential projects along Hubli-Dharwad road Residential colony next to old NH4 south from Hubli, 2 km south	1990 planned	Unkal,Bhairedevar-koppa, Amargol Gabbur
Government facilities	Corridor Zone	Navanagar township: Government agencies such as tax offices, police office etc.., the APMC, hospitals and educational institutions along Hubli-Dharwad road	1990s	Unkal,Bhairedevar-koppa, Amargol
Commercial private sector	Corridor Zone Southwest	Shops, showrooms, hotels and restaurants next to Hubli-Dharwad road Industrial and commercial settlement along NH17 highway	1990s 1990s	Unkal,Bhairedevar-koppa, Amargol Antchatgeri
Infrastructural Projects	Corridor Zone Southwest	Hubli Airport development next to Gokul road, 5 km west of Hubli NH4 by-pass development	1998 2001	Gokul Tarihall, Rayanal
Industrial areas	Corridor Zone Southwest	Gokul road industrial area, 2km west Tarihall industrial area, 12 km southwest	1973 1983	Gokul Tarihall

(source: RCDP rapport, HDUDA 2003 and fieldwork research)

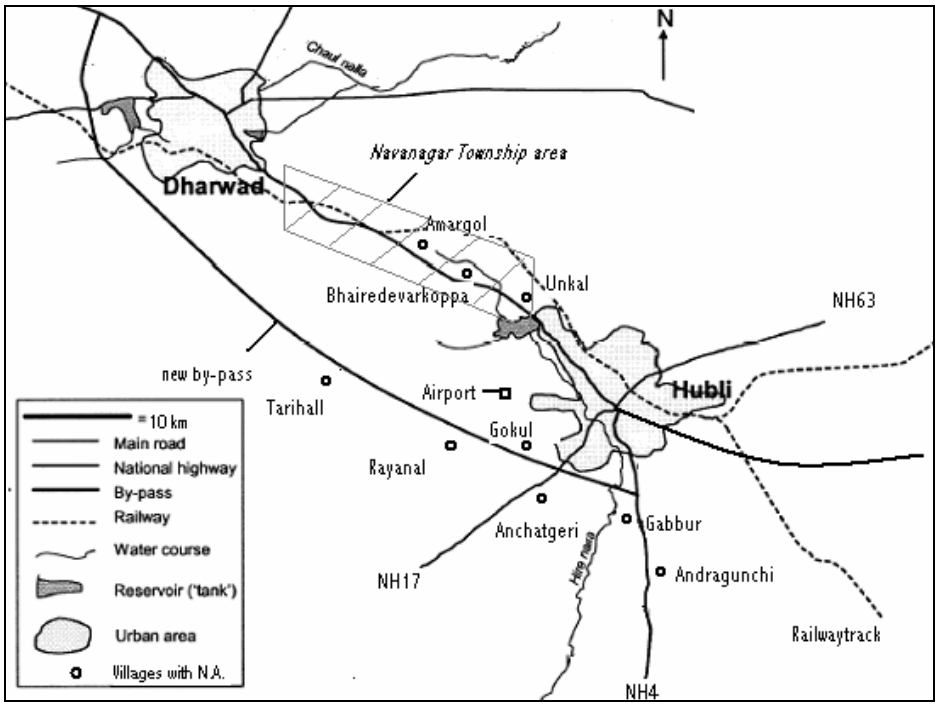
Table 5.1 gives a broad idea of the types on non-agricultural land uses in the fringe area around Hubli. Most notable is the location (and direction) of urban development in the area between Hubli and Dharwad (the Corridor Zone, as defined in this research, covers half of

this area up till the border with Dharwad Taluka). This area forms the focal point of all urban development around Hubli-Dharwad, with a concentration of residential, industrial and governmental development which in turn draw private commercial development to the area. The development of this area, called Navanagar township, is a direct result of government planning policies. This is not to say that illegal private residential development is not taking place, but the extent of that development was not researched.
Other government induced built-up land developments are recently developed infrastructural projects, located south of the major road between Hubli and Dharwad: the NH4 national highway by-pass west of the twin-city (which forms the border between the research transects Southwest and the Corridor Zone) and Hubli Airport developed near Gokul. Finally, there are the industrial areas around Hubli which are all (state) government appointed areas meant for factories and industrial complexes, around Hubli these are located in Tarihall and Gokul.

Apart from the government induced land developments there are also some examples of privately developed forms of non-agricultural land use featured in table 5.1. These developments are the settlement of industrialists and entrepreneurs along the NH17 state highway which runs through Anchatgeri and the concentration of brick industries around Anchatgeri (see case study Anchatgeri in paragraph 4.3.4), plus the black stone mining and crushing industries in Adargunchi.

Figure 5.1 Brick kilns in the red soil area southwest in the fringe (source: fieldwork)
Below these developments will be discussed on the basis of information of government rapports on Navanagar township development, industrial area development and infrastructural projects around Hubli and Dharwad. This is supplemented with fieldwork data collected in Amargol village which is situated in the Corridor Zone. But before dealing with the actual

built up land development, the development of the stone crushing industry in Adargunchi will be discussed based on data collected during fieldwork.



Map 5.1 Rural-urban research village (areas) with non-agricultural land use development (source: adapted from Brook, Purushothaman and Hunshal, 2003)

5.3 Stone crushing industries: Andargunchi village

Andargunchi lies 9 km south of Hubli along the NH4 highway to Bangalore. It is one of the largest villages around Hubli with a population of 18.000 inhabitants, black cotton soils cover 80% of the land. Its location nearby Hubli and next to the highway (to which there is direct access) has drawn non-agricultural activity in the form of four “dhaba’s” (restaurants/ hotels for truckdrivers), two garages, a transport service station, a petrolstation and one big transport company. Furthermore in Andargunchi there is also a livestock market, one day in the week. It is organised by the APMC, it used be in Hubli city but since 5 years it has been moved to the rural-urban fringe village of Adargunchi. On the field of about 2 acres there are hunderds of animals being traded between farmers and agents from Hubli (who buy animals for trade or for slaughterhouses for muslim customers). But in Adargunchi the most striking form of non-agricultural land use is the large black-stone mining- and crushing-industry situated at the heart of the village. There are fourteen other villages with these types of query-sites around the twin-city , ranging up to a distance of 30 km. The main areas are to the north and west of Dharwad and further south and southwest of Hubli. The query-site in Adargunchi is the closest site to Hubli, it is also one of the largest black stone mining areas.

The black stone mining-and crushing has become a large industry in Adargunchi over the last decade. In the 1950s the government opened up mining here because there was a need for construction material for the Karnataka Medical College in Hubli, since then the industry has been present on a small scale in the village. Throughout the 1990s the stone-crushing industry around the twin-city started to expand rapidly. According to one large query-owner who started in 1985, there were only 10 companies member of the stone crushers union back then, in 2004 there are 85 companies active in querying and crushing around the twin-city and yearly 5 to10 new companies are started. This increase is mostly due to the demand for construction material for the development of residential and governmental buildings (such as in the Corridor) and improvements in infrastructure, such as the construction of the new airport, the railway and the broadening of the NH4.

In Adargunchi this has also lead to an increase of activity, up to the 1980s there was only one company in Adargunchi now there are five companies. The total number of labourers employed has risen from 100-200 workers in 1992 to 600-700 workers in 2004, of these only 400 come from Adargunchi, the other labourers come from more interior villages. The companies are mostly of the richer and large land owning families in village. The process is quite complex and becomes more mechanised if a producer has been engaged in the business for a longer period (see box 5.1).

Figure 5.2 Black stone mining: an old and very deep quarry (source: fieldwork)

Box 5.1 The process of black stone mining and crushing

In Adargunchi the government has been opened up exploitation at the end the 1950s, since then the area was open to exploitation by private companies. Before starting companies must lease the land from the Mining and Geology Department or get a license to start exploiting their own land. In Adargunchi all companies are owned/ run by families from the village.
The mining and crushing of black stone produces handsize rocks ("jully") used for buildings and the foundation of roads and railwaylines, small parts of stone rubbish - the by-product of the process- are further crushed to produce cement powder. After removing the top (red) soil the black rock is drilled with bores and then blown into smaller rocks, waterpump keeps the query dry. The pieces of rock are then crushed further by a stone-crushing machine or by manual labour. The men handle the drilling, blowing up and cutting of large rocks, the women deal with the manual cutting of slabs of rock into smaller rocks (because they have more patient for this type of work one query-owner informed us) (Figure 5.2). The collecting and loading of the small rocks is again done by the men.
There are 10mm, 25mm and 40mm thick rocks, the query-owner will get an order for a certain size rock. The 10-25mm rocks for example are mostly used in ACC-slab (concrete slabs) and for road foundations, the 40mm rocks are used for making a bedrock for buildings. According to one query-owner there has been a sharp increase in the demand for 40mm stones the last five years. The query-owner has his own trucks and employs truckdrivers, together with some loaders they deliver the stones to the construction site in the city (Figure 5.3).
When a query is just started most of the labour is done manually, later on the process becomes more mechanised and machines are brought in, specially for the crushing of stones into cement powder, the loading of the trucks is always done by (manual) labourers. The industry as a whole stops for 3 months during the monsoon, as the mining pits fill up so fast that work becomes impossible. Below there are two examples of families who have started their own stone crushing company.

Figure 5.3 Women handeling the blown of rocks for further cutting (source: fieldwork)

Box 5.2 Rural-urban fringe villagers engaged in stone crushing industries

Hanuman Stone Crushing Industry was started by a local large land owning family in Adargunchi in 1985. The family ownes 60 acres of land, of which 5 acre is irrigated (and cropped with sapotha and coconut) and 55 is cultivated rainfed. The family is a joint family and consists of 15 householdmembers, one father and three sons and their wives and children. One of the sons manages agriculture, another is a high level politician and the third one runs the company. They got the idea for stone crushing from another villager who was already in this business.

Their query area covers 5 acres, of which 2 acre is for digging the rocks and 3 acre are for crushing and transporting. The land is leased from the Mining and Geology Department for a period of 5 years. Some 20-25 manual labourers are employed on a daily basis for crushing the rocks. For transport the company ownes 5 trucks and 3 tractors manned by 8 drivers and 4 manual loaders. The process relies mostly on manual labour, they have a few machines for producing cement powder.

The wages for drilling and cutting for male labourers is 100rps per day, the women who sort and cut it further make 40-50 rupees. The truckdrivers and loaders get paid per trip, the drivers make 100rps per trip and the loaders 65rps. In this way they provide a good source of income for local and non-local villagers compared to agricultural labour which pays about 25-50 rps a day.

The main market for the rocks is Hubli, in 2003 there was a large demand for stones for infrastructural works, such as the improvement of the highway and the railway, but the authorities pay low prices. The market conditions are so good at this moment, that the company can afford to ignore the government projects and it has made better contracts with private construction companies in Hubli for the next two years.

Figure 5.4 Labourers loading of lorries for transport to Hubli (source: fieldwork)

The rise of the number of companies the last decade and the examples of good market conditions for stone crusher industries (see box 5.1) can be seen as an indication of a (strong) increase of built-up urban development around the twin-city by the government and the private sector (mostly allocated in the Corridor Zone, it was concluded earlier). Consequently, this has induced the development of this type of rural-urban fringe industry in villages around the city, creating non-agricultural land use and off-farm employment which draws extra-local labourers from more distant villages to the fringe.

5.4 Government policies effecting urban land use development in the twin-city.
Land use in Hubli-Dharwad is affected by government policies springing from national and state level policies, which intervene directly in the rural-urban fringe (in the case of State agency projects) or indirectly, via the level of urban development authorities (which have to comply with state policy).

In the urban conglomeration of Hubli-Dharwad the local spatial planning unit is the Hubli-Dharwad Urban Development Authority (HDUDA). The HDUDA is responsible for the planning of urban areas, including areas of urban expansion, and takes care of accommodating urban growth, rather than making specific land use decisions as part of an environmental management plan or strategy (see also Appendix A for an complete overview of local government structures) (Brook, Purushothaman and Hunsal 2003). Basically, the HDUDA just facilitates and directs urban development without any other policy framework.
In the context of urban development around Hubli and Dharwad, the policy aim of the HDUDA is: “To direct the trend of development of Hubli and Dharwad towards each other. Ultimately, there should be contiguous developments in between Hubli and Dharwad as they are coming under single civic administration” (pg.11, RCDP rapport, HDUDA 2003). In this way the HDUDA acts in an anticipating way with the goal unifying the two urban areas rather than being forced react to the spontaneous urban growth.

In order to do this large areas of land been acquired by the HDUDA, after which the land is made ready by conversion of the original land use to vacant areas, ready to be built-up into urban structures. After acquirement and conversion of the land the HDUDA distinguishes areas into zones in which certain types of urban expansion will be facilitated. This process of designating areas and land acquirement leads to a rise of land prices in the vicinity of the new development zones as this reduces the amount of remaining available land, pushing up prices.

5.4.1 Navanagar Township: Urban land use development between Hubli and Dharwad

One major planning initiative towards the above mentioned policy goal is the development of the township of Navanagar, midway between Hubli and Dharwad. Originally, this plan was developed by the Town Planning Department of the Karnataka State in the 1970's. The planned areas for this township cover large parts of the villages of Unkal, Bhairedevar-koppa and Amargol in Hubli Taluka and Rayapur, Navalur and Sattur in Dharwad Taluka. All these villages lie in between Hubli and Dharwad. Other measures taken to further the merging of the two cities are the introduction of local trains between the cities and city buses with short frequencies.

Since the late 1980s, the HDUDA acquires hundreds of hectares yearly - next or near to the main road that connects the two cities (the NH4)- for allocation of residential, industrial land use or governmental facilities. The building construction in these areas was started at the end of the 1980s, currently, there are hundreds of hectares in the area between Hubli and Dharwad which are under non-agricultural land use.

Residential development and government agencies take up most of the land. Especially residential development, in the form of big residential colonies, housing schemes for landless groups and individual plot layouts covers large areas. In 1991 the newly allocated population in the residential areas of Navanagar was already 20.892 and by 2001 it had increased to 43.621 inhabitants. Government facilities include municipal offices, medical facilities and educational institutions. These facilities have one by one been developed in the Navanagar area, since the start of the 1990s. Among the industries settled in Navanagar is a large refinery of Hindustan Oil in Rayapur village (Dharwad Taluka) adjacent to the railwayline. Despite these developments the growth of the industrial areas in Navanagar falls short of expectations (of the HDUDA), as new industries still tend to prefer Bangalore, which has huge location-advantages, compared to a medium-sized city like Hubli-Dharwad (RCDP rapport, HDUDA 2003).

The lion's share of the urban growth of Hubli-Dharwad has been allocated by HDUDA to the Navanagar township area. An example of development outside this zone is the development of a housing scheme (of some 55 acres) in Gabbur village area. This housing scheme is situated 2 km southwest of Hubli, in a triangle between the by-pass, the NH17 leading to Karwar and the old NH4 coming out of Hubli (see Map 5.1).

5.4.2 Land use change in Corridor Zone villages

On the Hubli Taluka side of the Navanagar area- that is the Corridor Zone area- the non-agricultural land use development is the most intense just west of Hubli city. Here Nagshettikoppa has already been fully incorporated in the built-up city area. Some 5km further to the west the village area of Unkal is urbanising very fast. The original village has been completely submerged in the non-agricultural development. The last ten years there has been large scale residential development around Unkal, combined with the settlement of medical and educational institutions such as colleges and hospitals. A rough estimate of the local village accountant is that some 630 ha have been converted from agricultural to non-agricultural land use (some 75% for residential purpose) over the past ten years in Unkal, which is about 20% of the total village area. For the most part this development is located within 1 to 2 kms of the road.

The next villages to be swept up by this urban expansion are Bhairdevarkoppa and Amargol situated several kilometres further west from Unkal along the road. In these villages the residential development is stepping up the pace, but this development has not yet reached the large scale of Unkal village area.

In Bhairedevarkoppa the APMC dominates the part of the village area west of the road. It covers the whole western area behind the original village (which is situated next to the roadside), from the road up to the railwayline (see Map 5.1). The APMC commands a total area of 150 ha, of which roughly 100 ha lies in Bhairedevarkoppa and the remaining 50 ha in Amargol village area to the west. The APMC is the government trade centre for agricultural produce, it was allocated here by the end 1980s, to replace the two APMC ‘s in Hubli and in Dharwad. Apart from the APMC there is only some 20 ha under residential use in Bhairedevarkoppa, in total roughly 14 % of the village area is covered by non-agricultural land use, all situated near the road.

Apart from 50 ha of APMC area there is a government agencies complex in Amargol village area covering some 40 ha. It houses the head office of the HDUDA, the Karnataka Electricity board and several government offices such as the Tax office and the Agricultural office. Near this complex a residential area and a hospital have been developed in total covering about 70 ha. These developments were all started at the beginning of the 1990s as part of the Navanagar project. In total about 11% of the village area of Amargol was used for non-agricultural land use, all of which was again located within the vicinity of Hubli-Dharwad road.

Commercial private development has sprung up in the strip of land next to Hubli-Dharwad road. In all the village areas of Unkal, Bhairedevarkoppa and Amargol it has rapidly taken over the land next to the road since the government started the Navanagar development. It has become the favourite location in Hubli for this type of development.
All along the road real estate is fastly being developed for commercial enterprises such as (large) hotels, (garden-) restaurants, banks, shops (for car-batteries, mechanical waterpumps, agricultural implements and so forth) and two-wheeler showrooms. The whole area is brimming with commercial development, even during the fieldwork period commercial enterprises could be observed mushrooming in between Hubli and Dharwad, especially the two-wheeler showrooms.

In the hinterland behind this commercial line, in between official residential colonies and the original villages, there is illegal residential settlement in the form of private plots, slum areas and self constructed tea and motor repair shops and so forth. These illegal forms of non-agricultural land use do not however cover large areas, although they become more common nearer to Hubli, in the Unkal and Nagshettikoppa village areas. The large tank west of Hubli, Unkal Tank, has steadily decreased to about a third of its original size (80 ha) over the past decade or so. This is due to illegal development taking place while the tank is drying up during past years of drought (The Hindu, 31-10-2003).

All this rapid land use development has taken over and fragmented the original villages and their agricultural lands. Many farmers have sold part of their land and only own land located far away from the road. Mostly in the black soil plains to the east, behind the railway track where they do rainfed farming (with the crops found in the northeastern transect, such as cotton, chillies, green gram and bengal gram). These villagers are all too aware of developments in the area and many expect to be bought out soon, only very few farmers/ land owners counter this by starting of fruittree orchards which can not be encroached by government.

The final result of all this development is a haphazard mix of development area layouts with vacant plots, residential colonies, slum areas, new government agency areas and medical complexes, and shops, hotels and showrooms next to the roadside. With in between these developed areas the original villages, pockets of agricultural land not (yet) encroached and further away from the major road large areas of remaining agricultural lands. Most of this

development has taken place on good quality agricultural land, mostly red soils, while the black plains east of the railway line have remained.

Figure 5.5 Agricultural land turned urban: vacant plots in the fringe (source: fieldwork)

Below some of the effects of these developments on village life in the Corridor Zone are explained through some case studies gathered during fieldwork interviews in Amargol.

5.4.3 Effects of land use change in Amargol village case

Amargol village is situated 8 km northwest of Hubli. The original village is situated at about a kilometre northeast from Hubli-Dharwad road. Currently ,the total population of Amargol HDMC-ward area is about 12.000 inhabitants, the original village accounts for some 5.000 of the total inhabitants of the ward area.

The village lands are situated at both sides of the road, but most of the land lies above (north) of the road and is covered by black soil. On both sides next to the road there has been a lot of non-agricultural land use development. Northeast of the road the village itself has nearly been cut-off from the road by these developments and south of the road there are only small areas of agricultural land left. The HDUDA has acquired the land by buying up a dozen or so hectares every few years. All the land use development initiatives of the HDUDA has driven up land prices sharply. Back in 1993 land prices were lying at the level of about 2-3 lakhs per acre near the road side and village. Currently, prices offered for land in the corridor vary from 5 lakhs near the village up to 8 lakhs per acre next to the roadside, further away in the interior prices fall to 3-1,5 lakhs per acre. This sharp rise in prices has tempted or forced many land owners in the original villages to sell part of their land. An example of how this process works is given below in box 5.3.

Box 5.3 The land acquisition process

Two to three years back the HDUDA send letters to some farmers in Amargol approaching them for sale of part of their land, in all 12 hectares from 30 farmers. The farmers then got together to set out a price, after negotiation the farmers got 5 lakhs (500.000 rupee) per acre and 1 plot each (worth 1,5 lakhs) in the residential area which they could sell, rent or build upon. This is an example of how the farmers organised themselves and got a relatively good deal from the government. But the land acquisition process can have varying results. Sometime farmers agree (too) eagerly and only get government estimate prices for the land, which are far below market prices. While other farmers do not agree and go to court, where they often win and get higher prices. However this process can take many years and smaller farmers mostly need money on a short term. Therefore, they tend to settle too quick for government deals and lose land - their only economic resource- and may end up working as unskilled labourers. The details of the land acquisition process have not been researched further to draw any definitive conclusions. But it is clear that it can have varying effects on the economic situation of the original villagers and these effects vary for different sized land owners.

Figure 5.6 A farmer in the fringe, there is already vacant land in the background (source: fieldwork)

Next to their income from the agricultural land, households in Amargol often supplement their income with off-farm labour which has become more in demand. A by-effect of increased off-farm employment in the fringe has been an increased women's participation in agricultural labour (see figure 5.7).The small farmers (less than 2 ha) who used to work as agricultural labourers on other farmers' lands now also do unskilled labour as "amali's" at the APMC in the periods outside the sowing and harvesting season. Other forms of off-farm found in Amargol were small milk businesses. One larger land-owning household was making most of their location by renting out or selling agricultural implements in a shop near the road. Below these cases of non-agricultural employment are described in box 5.4.

Box 5.4 Non-agricultural activities in Amargol

The family Patil has 22 acres of black soil land in Amargol village. They are a joint family consisting of two brothers (in their sixties) and their wives and children. They are an example of an agricultural family who started their own business near the road.. Two of the families sons are engineers. After gaining some experience in other companies they decided to start their own business. Since five years they started to manufacture agricultural implements such tractor trailers, cultivators and harvest-crushers, they have a shop near the main road. One of the brothers has business connections and chooses the locations, they are now further expanding their business and have recently opened up a shop in Belgaum.

Mr.Horakeri owns 8 acres of black soil land on which he grows the regular rainfed crops. Since some twenty-years he has been selling milk in the city. He picks up milk in the village, where most farmers have a couple of cows for domestic use, the extra litres they sell to him - the "gowdie"- and he goes on the sell in Hubli or in the nearby (recently developed) residential colony. He used to have six buffalo's himself but due to the drought he had a lack of fodder and had to sell them. Mr.Horakeri says it has been a good source of income for him, over the years he increased his business from 30 to 50 litres per day. He buys the milk at 10 rupee a litre and sells it at 12 rupee a litre, earning him an additional income of 100 rupee per day next to his income of farming.

Mr.S.B.Pagad owns 3 acres of black soil land on which he grows the regular rainfed crops. He provides the income for his wife, his mother and his two children. He does so by farming his 3 acres during sowing and harvest time, outside these periods he works at the APMC as an "amali". He unloads the tractor trailers which the farmers bring to the APMC and reloads the trucks of the agents. It is heavy work, per quentel (100 kg) he gets 1 rupee, in this way he makes 50 to 100 rupee a day (more than the daily income of a land labourer which is between 25-50 rupee). The demand for "amali's" varies with seasonal agricultural production, in a season with bad rains and therefore less harvest there is less work for him and his fellow "amali's".

Figure 5.7 Women's participation in agriculture in the fringe: women plucking chillies in Gabbur (source: fieldwork)

Finally, an interesting phenomenon was noticed during fieldwork concerning an *urban to rural* interaction of labour during harvest time. While farmers complained about the lack of availability of land labourers during harvest time due to high wages off-farm employment, caused by the nearness of the APMC which hires unskilled labourers ("amali's"). It was also mentioned that during harvest time a lot of so-called 'sweepers' (low paid, unskilled labourers who clean toilets and so on) from Hubli come to the village(s) to do the harvesting while getting a part of their pay through free food from the harvest, such as groundnut which can be consumed right away. The fact that urban labourers still come down to do agricultural work during harvest time can be seen indication that the pull of/ demand for urban labour provided by Hubli city is limited and in this way probably not comparable to large metropolitan areas such as Delhi or Bangalore.

5.5 Industrial land use

From national/ state level several industrial areas and one industrial growth centre have been allocated in Hubli-Dharwad area. The areas being designated as industrial areas by the Karnataka Industrial Areas Development Board (KIADB) are Tarihall and Gokul in Hubli Taluka and Lakkamanahalli, Sattur, Rayapur in Dharwad Taluka. Belur in Dharwad Taluka has been designated from nation level as an industrial growth centre (see Appendix B for full details of industrial areas location and government policy). The location, size and year of acquisition of each area near Hubli-Dharwad is featured in Figure 3.1

Table 5.2 Industrial areas in Hubli-Dharwad Municipality area

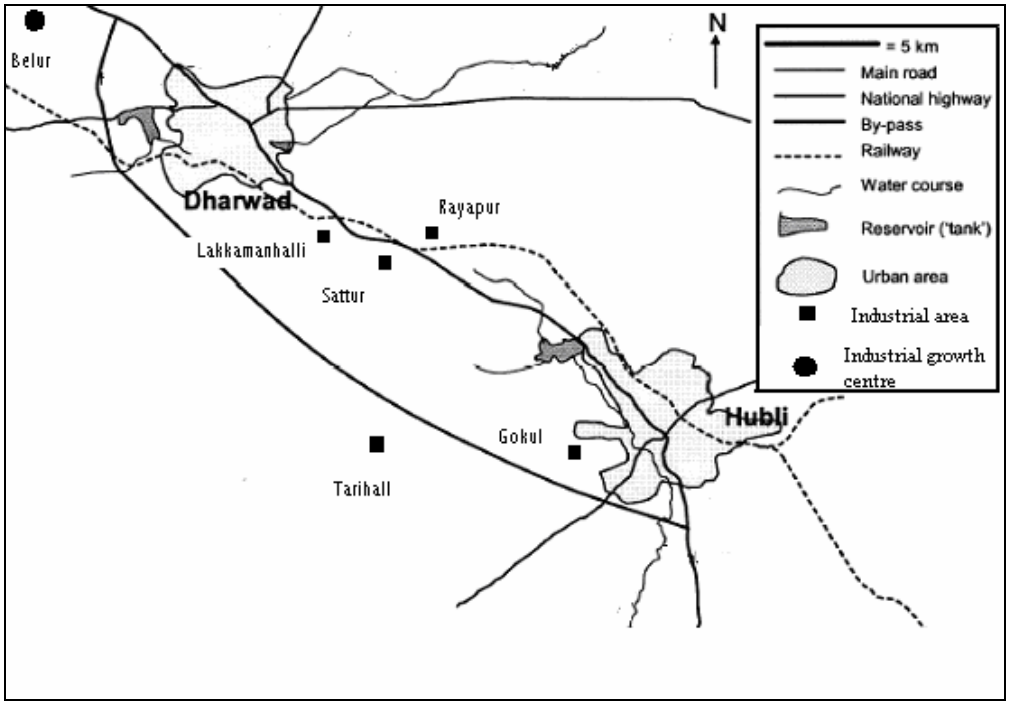
Industrial areas	Location relative to nearest city	Number of acres	Year of acquisition
Belur	12 kms northwestt of Dharwad	1312 acres	1985-86
Tarihall	10 kms southwest of Hubli (east side of the by-pass)	312 acres	1982-83
Lakkamanhalli	4 kms east of Dharwad (along the road between Hubli and Dharwad)	73 acres	1972-73
Sattur	9 kms east of Dharwad (along the road between Hubli and Dharwad)	54 acres	1974-75
Rayapur	8 kms east of Dharwad (along the road between Hubli and Dharwad)	94 acres	1975-76
Gokul	2 kms southwest of Hubli	33 acres	1972-73

(source: A brief note on industrial areas, KIADB 2000)

A first noticeable feature of all industrial areas, is that they are all fairly old. This has to do with the fact that they are all planned during the era before the opening up of the India and the liberalisation of its economy, by Rajiv Gandhi in 1991. Before 1991, India was by and large a planned economy, with industrial policies leading to a (rigid) spatial planning of industrial areas.

The table shows that the industrial areas meant for large scale industries, Belur and Tarihall, are located well outside the twin-cities. This particular feature is partly a result of the location of raw materials, availability of electricity and water (which are constrained in Hubli-Dharwad) and roads, but partly also a result of the government policy to allocate large-scale industries in areas outside the city. This is a feature common to India in general, related to the above mentioned industrial policies for 1991. As a result these areas are islands of industrial activity in rural areas and as such do not contribute to the urbanisation process.

Map 5.2 Industrial areas and Industrial growth centres around Hubli-Dharwad



(source: adpated from Brook, Purushothaman and Hunshal, 2003, A brief note on industrial areas, KIADB 2000)

In Tarihall, located in the rural-urban fringe of Hubli, there are several factories, of which a steel- and aluminium factory is the largest, This is a capital intensive industry offering only some 40 jobs. In the surroundings of Hubli and Dharwad, these areas meant for heavy/ large scale industries have not drawn many factories. This is mainly due to the dominance of Bangalore as the prime-city of Karnataka State and the far distance of Hubli-Dharwad from the state capital. An additional severe constraint on growth is the lack of investment in

infrastructure needed to raise the availability of the resources water and electricity. The twin-city is frequently struck by water shortages and electricity blackouts, especially in the dry season (power plants run mostly on hydro-energy installations). The other industrial area in the rural-urban fringe of Hubli is Gokul road industrial area, situated 2 km west of Hubli. This area is meant for settlement of smaller industries. It has however also not lived up to expectations and is now partly over taken by residential development.

5.6 Infrastructural land use

Another important form of land conversion in Hubli-Dharwad has been the development of the infrastructure. The main infrastructural development that has recently taken place in Hubli-Dharwad is the construction of a by-pass for the National Highway 4 connecting Mumbai and Bangalore. It is part of a project from the national government, with the aim of improving the national highways connecting the biggest cities in India. In 1997 the construction was started and the end of 2001 the by-pass to the NH 4 was completed. Previously it took highway traffic 1 hour and 20 minutes to pass through the twin-cities and a number of serious accidents used to take place.

As part of the improvement of the interstate transport network, the NH4 highway was also being widened from two lanes to four lanes north and souh of the twin-city (the by-pass was already four lanes).

Now the NH4 passes by on the west side of the conurbation. The length of the by-pass is 30.35 kms, there are only three interchanges and the trajectory is fenced-off to ensure a smooth flow of traffic (KIADB 2000). The fence prevents any access whatsoever to lands adjoining the by-pass. Therefore nearby villagers will have no access to the road and no advantage of a better transport connection, a service road is yet to be constructed on both sides of the by-pass for local traffic. The setting up of fences resulted in arresting the rise of land prices of adjacent lands; the land prices had been soaring since the by-pass had been officially announced. Because any commercial activity along the by-pass is impossible because of the fencing (Brook, Purushothaman and Hunsal 2003). All together the effect of the newly built highway by-pass on rural-urban fringe villages (research villages along the by-pass include Tarihall, Rayanal and Gabbur) has been marginal (apart from providing jobs during construction,) there is not yet any improved transport connection, nor any possibility for non-agricultural activity along the highway. A by-effect of the highway by-pass has been

the hauling in of all land between the city and the by-pass into the HDMC (see Map 5.1). In this way further tightening the grip of the city on its surroundings

Figure 5.8 The by-pass cutting through old mango-orchards, west of the twin-city (source: fieldwork)

Finally, another important infrastructural project to improve connections with other urban centres in India is the recently finished Airport southwest of Hubli some 5 km west from the city situated in Gokul village area in the Corridor Zone. The airport covers 217 acres and was finished in 1998. It was set up by State agencies in order to provide internal flights to other cities in India, Bangalore and Mumbai again being the foremost destinations. The lies quite far from Hubli city and isolated from any village or urban expansion and has therefore not much effect on the rural-urban economy.

Future prospects for government plans include a plan by the railway authorities develop a new railway line connecting Hubli and port of Karwar, coastal Karnataka. This project, called the "Seabird project" would see the new railway line connecting with the present track east of Hubli, running southwest from there to Karwar. This project is in an initial stage and further implementation is to be announced. Additionally, there are plans to improve the local road network and build a ring-road, which will runs from the main road northeast of Hubli to the west connecting with the NH4 halfway in the corridor zone, in Navanagar. Finally, there are plans to set up a lorry terminus in Gabbur next to the NH4 under Hubli, the area will be developed for allocating truck-owners, garages and automobile shops (Deccan Herald, 11-22-03).

5.7 Conclusion

Non-agricultural land use development in the fringe of Hubli is taking place on a limited scale or concentrated in a few areas. This is due to the fact that Hubli (-Dharwad) is medium sized city with a slow population growth and a small industrial sector. This makes Hubli incomparable with metropolitan cities in India with their large influx of immigrants and industrial activities, leading to unchecked urban expansion. Instead urban land use development in the fringe of Hubli is mostly government induced.

Private non-agricultural land use development is limited and scattered throughout the fringe. In the agricultural areas of the fringe, the exploitation of land for non-agricultural use is found in areas where physical conditions are suitable like in the red soil areas. In some area there is a concentration of these activities, like the concentration of brick industries in the southwest and a concentration of stone crushing industries in the south of the fringe. These types of industries provide off-farm employment opportunities for local labourers. Both types of industries are controlled and developed by local land owners who serve the construction market of Hubli.

The biggest factor in built-up urban land use is the development of Navanagar Township, in between Hubli and Dharwad. This consists of residential colonies and government agency complexes and is meant to turn the whole area in between the two cities into urban land use. It is part of the HDUDA policy to merge the two urban areas into one. As a result the still mostly agricultural land use is rapidly being conversed into vacant or urban land.
This has changed live in the rural-urban villages in the Corridor Zone dramatically. Original villages and their agricultural lands are getting enclosed by residential colonies, government agencies and commercial development. The livelihood of the villagers has also changed. Income sources have diversified as land is sold or rented out and off-farm employment opportunities have become abundant. Changing the livelihood of the villagers who up till recently were depended on farming. The final result is an area where traditional agricultural land use and economic activity is (haphazardously) mixed with urban land use and non-agricultural employment.

The infrastructural and industrial land use development in the fringe of Hubli is also government planned, in both cases from State level. The most important infrastructural projects are the newly built highway by-pass and Hubli Airport. Both are located west of

Hubli and are a part of the government policy to improve connections between Indian cities. A by-effect of the highway by-pass has been the hauling in of all land between the city and the by-pass into the HDMC. In this way further tightening the grip of the city on its surroundings.

Industrial land use is concentrated in industrial areas outside of the city. The industrial areas around Hubli(-Dharwad) all stem from before the economic liberalisation (in the 1990s) of the Indian economy and are all stringently planned. Planning goals where however not achieved and industrial development in these areas is limited. In the fringe of Hubli, there is one large industrial area west of the by-pass, and one industrial area for lighter industries on the western border of the city. This area is not very accessible due to the congested (old) roadnetwork of the city.

The lack of locational advantages of the above mentioned industrial area has caused several factory owners and business men to set up activities along the highway southwest of Hubli. Here they have privately developed a mix form of industrial/commercial settlement on agricultural plots, which for the remaining part are covered with horticulture. Recently, even a factory unit of a (Dutch) multinational food company was set up here, as it offered a better location than the industrial areas.

It is clear after this discussion that the urbanisation process in the fringe of Hubli in the form of urban land use development is moving at different speeds in different parts of the fringe. This is due to the top-down government planning of most of the urban expansion and built-up land use around the city. When the results are linked to the urban development model of Ramachandran it seems that the spatial non-agricultural land use development is spreading from the urban area of Hubli. But the direction of non-agricultural land use development is severely conditioned/ directed by the policy framework of the government, local circumstances and the transportnetwork in the fringe.
As a result the city is expanding rapidly to the (north) west due to the development of the township area and the growth of the infrastructural network around the city. In this area of the fringe urban and rural elements (in land use and economic activity) are existing side by side and this area seems to be entering the final phase of complete urbanisation, as it will be taken up in the urban area/ economy. Thus the most complex stages of urbanisation are concentrated

in the area in between the cities, which are to be fused into one according to government planning.
In other parts of the fringe there is no non-agricultural land use development, like in the northeastern transect. Or this form land use development is still in an early stage, such as in the southwest, where urban land use is concentrated in a few roadside areas near the outgoing main roads, or in (more agricultural) areas where physical conditions are favourable for the specific non-agricultural land use exploitation.

The development of the functional interaction of the fringe area with the city also differs per transect. The Corridor is transforming into a settlement area for urban functions, supplying the urban centre with land and workers, while the urban development brings capital and diverse economic activities to the area. Leading to a more complex and intense interaction between this area and the fringe, indicating that it will soon be integrated into the urban area.
The southwestern part of the fringe is an area where the interaction mainly consist of goods produced in the fringe (bricks etc..) to the urban market. In some areas (mostly near outgoing roads) the southwest also provides settlement areas and workers for urban functions, these functions bring more diverse economic activities to the fringe.
One general effect of the increased interaction between the city and the Corridor Zone and the Southwest has been an influx of capital, leading to increase of land prices and pressure on agricultural land use.
In the Northeast there has been hardly any development of the interaction with the city. Non-agricultural land use development for urban land uses such as residential or industrial functions is completely lacking. This is possibly due to the fact that in this (open plain) area the villages are few and the roads passing through are leading to the more interior parts (and not to metropolitan areas like the roads in the western fringe area) making them unsuitable for urban development. Furthermore, the black soil or geology does not allow any land excavation. Finally, agricultural land use development is limited due to the dependence rainfall and thus unattractive for investment leading to neglect of this area by city investors.

Chapter 6 Conclusions

In this concluding chapter the findings of the research will be brought into relation with the central research questions. The answers of the research findings on these questions are then used to describe the impact of urbanisation on the land use and economic activities of the land users in the rural-urban fringe of Hubli City**.**

With regard to the theory on agricultural land use development there are two geographical models which have been used in this thesis. According to classic model of *distance decay* of Von Thünen land use changes when coming closer to the city, especially in the case of agriculture as it takes advantages of its location by producing for the city market. In the case of Indian cities, the *stages of urbanisation-model* of Ramachandran, also predicts a spatial change from traditional agricultural forms of land use to more commercial forms of agricultural land use, as the first stage in transforming the countryside around a city.
The functional development of the relation between the fringe and the city is also an important aspect of the descriptive models of urbanisation. This entails an increased interaction between the fringe and city through functional relations which would serve the city as well as the fringe with flows of goods, workers, capital etc…This ultimately leads to (among other things) a change in the land use and economic activities in the fringe areas.

Therefore, research has been done on the question: *Is there an effect of the city (Hubli city) on agricultural land use in the villages in the rural-urban fringe?* To answer this question cropping patterns of rainfed crops over a period of time in the wider region around Hubli were compared to rainfed cropping patterns at *decreasing distances of the city*.
Thus a comparison of cropping patterns in the North Maidan, Dharwad District, Hubli Taluka and the researched rural-urban villages was made.

The research results show that there clearly is a big difference between rainfed cropping patterns in Hubli Taluka and in the fringe of Hubli and rainfed cropping patterns in the wider region. A common trend was the shift away from the subsistence crop group cereals and millets and the early commercial crop cotton, in Dharwad District the share of both dropped further than in the North Maidan. Farmers nearer to the city have also dropped traditional staple crops –the cereals and millets- but on a larger scale and dropped these crops in favour of further *rainfed commercialisation*: proved by the dominance of cotton, chillies and

especially onion, in Hubli Taluka and the rural-urban fringe villages. Instead of oilseeds and pulses which gained popularity in the more rural parts.

This difference shows that farmers near the city have a commercial outlook and are in this respect more commercial than farmers further from the city, as even under the semi-arid conditions and with a lack of irrigation, farmers have chosen to grow cash crops which are normally grown irrigated in other parts of the North Maidan.
The reasons for this difference might be that farmers are possibly influenced by the *early large scale commercial cotton farming* in the area around Hubli, due to the suitable black (cotton) soils and the presence of textile industries in Hubli.

The answer to the research question is affirmative. There is clearly different more commercial farming going on near the city when compared to the further away from the city. This confirms the assumptions of the models of both Von Thünen and Ramachandran, of commercialised agriculture around the city.

Now, research results regarding specific agricultural land use developments within the (heterogenic) fringe area of Hubli are discussed. These results answer the research question: *Is there a difference in the effect the city has on agricultural land use in rural-urban fringe villages if there are differences in climatical conditions and physical conditions such as soil type?*

In the Northeastern transect of the rural-urban fringe, cropping patterns are quite one-sidely developed. The distinctive cropping pattern of intercropped chillies, onion and cotton, starts directly at the eastern border of the city and continues to dominate the rest of the eastern area of the rural-urban fringe. In the Northeast the direct effect of the city is not clear, as there is no frequent interaction between the rural-urban fringe area northeast of the city and Hubli.

There used to be large scale potato cultivation in the Corridor, made possible by the slightly higher rainfall in this more western part. Potato cultivation has ceased because of the drought and diseases and has been replaced by pulses. This potato production was aimed at the nearby city markets and hotels and restaurants. In the red soil areas in the south of the Corridor Zone, cropping patterns resemble those of the Southwestern transect.

Agricultural land use development in the Southwestern transect is the most dynamic and diverse of the whole rural-urban fringe. In the hilly red soil areas rainfed paddy cultivation used to be dominant, as rice was the main staple crop. Nowadays horticulture intercropped with hybrid cotton, maize and vegetables and floriculture are among the most important developments. The availability of borewells and a wastewater course from Hubli makes irrigation possible.
The most important reasons for the rise of irrigated crops are good market prices for these crops, the fact that orchards provide a long term investment and require less labour and the possibilities for small farmers to gain fast returns by direct marketing in Hubli through the good transport connection (mostly the improved bus connections). Finally, there are urbanites from Hubli who buy up land and start horticultural farming as an tax-free investment.

The differences in cropping patterns between the respective transect show that a heterogenic fringe area – in both a physical and locational sense – as found around the city of Hubli, contributes strongly to directing the interaction between the fringe and the city. This specific interaction in turn influences agricultural land use developments in specific parts of the rural-urban fringe and thus the process of urbanisation.

A third research question was: *What is the effect of Hubli city on non-agricultural land use development in the rural-urban fringe?* The answer to this research question is fairly straightforward, the main effect of the nearby city on non-agricultural land use is the government induced urban land use development/ expansion. The pressure of private uncontrolled urban land use devilment is limited in scale, due to the fact that Hubli(-Dharwad) is not experiencing a fast population growth.

In the agricultural areas of the fringe, privately developed exploitation/ excavation of land for non-agricultural use is found scattered throughout the fringe areas where physical conditions are suitable, like in the red soil areas, only in some area there is a concentration of these activities.

The biggest factor in built-up urban land use is the development of Navanagar Township, in between the Hubli and Dharwad, which is meant to turn the whole area in between the two cities into urban land use. As a result the still mostly agricultural land use is rapidly being conversed into vacant or urban land. These land use changes have placed different forms of

land use next to each other in a haphazardous way, with original villages and their agricultural lands located next to large areas of urban built-up land use.

The infrastructural and industrial land use development in the fringe of Hubli is also government planned, in both cases from State level. The most important infrastructural projects are the newly built highway by-pass and Hubli Airport

The industrial areas around Hubli(-Dharwad) all stem from before the economic liberalisation of the Indian economy and are stringently planned. This has resulted in industrial locations which do no always comply with wishes of the private sector and industrial development in these areas is therefore limited.
The lack of locational advantages of the above mentioned industrial area has caused several factory owners and business men to set up activities along the highway southwest of Hubli.

The effect of the city on urban land use development is that this phase in the urbanisation process is moving at different speeds in different parts of the fringe. This is due to the top-down government planning of most of the urban expansion and built-up land use around the city.

The fourth research question related to Ramachandran's modal of urbanisation is: *What is the effect of Hubli City on economic activities of land users in the rural-urban fringe?*
In assessing the effect of the city on economic activities of rural-urban fringe land owners, a distinction should be made between villages located (very) near to the city and along the main roads, and villages located at a further distance in the more interior parts.

The last group of villages are mostly located in the northeast. The good bus connections between Hubli and the rural-urban fringe villages, which have been improved in the 1990s have opened up possibilities for villagers to commute to Hubli for work. In the fringe area to the northeast, where rainfed agriculture is the only economic activity, this has provided villagers with a valuable extra source of income.
In the south and southwestern villages located at some 10 kilometres of Hubli and only connected through unpaved roads, the bus connection to the city is valuable. Offering them the possibilities to commute or market their commercial agricultural products like fruits, flowers and vegetables directly on the urban markets.

In the agricultural areas of the fringe where physical conditions are suitable (the Southwest), the brick industries are found scattered throughout. The concentration of brick- and stone crushing industries in two villages in the Southwest and the south, have provided hundreds of off-farm jobs for unskilled labourers in the vicinity.

In the areas of the fringe nearer to the city and along the outgoing roads the urban development of Hubbell has had a bigger impact on economic activities. In the south and Southwest where the NH17 and the NH4 leave Hubbell there are several factories and transport related activities in the villages providing off-farm employment. In the Corridor Zone between the two cities the rapid non-agricultural land use development has brought residential colonies and government agencies to the area, opening up many possibilities for villagers to seek off-farm jobs nearby.

Subsequently, in answering the research question one can say that, the good bus connections offer the possibility for more distant villagers to commute, although this is only happening on limited scale. While it offers small farmers in areas with irrigated farming the possibility to market their produce in the city. In certain areas the production of construction materials for the Hubli, offers unskilled employment locally. But most of the off-farm employment can be found in the direct vicinity of the city, in areas of urban development or along the main roads.

Finally, after the rounding up the answers to the previous research questions, *the way in which the villages in the rural-urban fringe fit into Ramachandran's stages of urbanisation model* should be formulated. The three transects that were distinguished, can now be used to express the level of urbanisation according to the model.

The Northeast with its low population density, lack of non-agricultural land use and activity and dependence on rainfed agriculture can be seen as going through *the first stage of urbanisation by means of rainfed commercialisation of agriculture*. It seems however likely that the villages in this part of the rural-urban fringe will remain in this stage as there is no further agricultural development possible at this moment. The northeastern transect's land use development has been stagnated in rainfed commercialisation due to its complete dependence on rainfall. This land use form is not influenced by the distance from the city at all, as this type of land use starts directly at the eastern border of Hubli, although crop choice is influenced by the demand of agricultural markets in Hubli for the rainfed commercial crops.

The only frequent interaction between Hubli and the northeast consists of commuters from the villages via the good bus connection.

Through the fact that conditions in the Southwestern part of the fringe provide the most scope for development of agricultural land use, a frequent and diverse interaction between local agriculture and the city has developed. The southwest provides the city with fruits, flowers and vegetables, while urbanites form Hubli have chosen this area for investment in land in the form of horticultural farming.
Furthermore, the geology and soil type has meant that this area provides landowners with opportunities for excavation of their land to supply materials to Hubli's growing construction market. The by-pass also passes through here, as does the N17 and the old NH4 highway coming from Hubli connecting with the by-pass. These good road connections have made it an attractive location for industries/ commercial enterprises an so forth, which find the city to be too congested or polluted. Finally, this area provides a good location for urban expansion of the city, with limited scale residential land use development just south of Hubli city.

Regarding land use development and occupational change as modelled by Ramachandran, the *Southwestern transect is going through the stages 2, 3 and 4*. *Stage 2 being a commercial transition of agricultural land use,* which clearly taking place. While *stage 3 is the occupational change* taking place through the cultivation *and* marketing of agricultural products like flowers and a diversification of income sources with the development of with brick kilns locally and the arrival of jobs in factories and construction sites etc..near the city. Finally, the Southwest also has features of *stage 4,* the stage of *the arrival of urban land use.* This takes the form of exploitation of land for making construction materials, an expanding infrastructural network, residential projects and industrial/ commercial settlement along the main roads.
From the perspective of interaction it can be concluded that a diverse and quite intense interaction between this area and the city has developed. Leading to a diversification in income sources from agricultural production (marketing of fruits and flowers), non-agricultural uses of the land as well as from the arrival of non-agricultural employment opportunities through settlement of urban functions along the main roads.

When the changes in land use in the *Corridor Zone* are put in the model of Ramachandran it is clear that this area with its *rapid urban development mixed with agricultural land use is*

in stage 4 (urban land use) and soon to enter stage 5 (fully urbanised part of the city). The villages in the Corridor situated just outside of Hubli are nearly in stage 5 as they are developing into outskirts of the city. While the villages located further (away) west along Hubli-Dharwad road are still in stage 4, where urban land use and agricultural land use are mixed. Some villages in the Corridor Zone have even by-passed stage 3, as there has been only limited commercialisation of agriculture before urban land use took over. This urban development provides the local population with an abundance of opportunities to diversify their income, the location close to the city also provides plenty possibilities for commuting to the city for work or the direct marketing of agricultural goods.
Only *the southern parts of the Corridor*, where there is (irrigated) *commercialisation of agriculture through horticultural development can be categorised as going through stage 3.*

The interaction of the Corridor Zone with Hubli lead to only a limited further commercialisation of agriculture due to the dependence of rainfall, but the area has developed large scale potato cultivation for the urban markets. Yet, the most important development has been the influx of urban functions which found an attractive location in the Corridor Zone, due to its location in between the cities and the planned initiatives of the urban development authorities. Thus the area provides land and labour to the urban economy, which expanded into this area.

The pattern of urbanisation effects encountered in the fringe of Hubli differs strongly per transect due to the heterogenic physical conditions in the fringe and these spatial factors seem to be a dominant force in the development of agricultural land use and non-agricultural land exploitation. The transport network in the fringe, in the form of public transport and roads seems to be an important spatial factor influencing the spread of non-agricultural activities and non-agricultural land use development. Furthermore, the location relative to the urban area(s) is also decisive in the planning of urban expansion/ land use by the government in the case of Hubli-Dharwad. In this sense one can say that the urbanisation process (as described by Ramachandran) through a spatial spread from the urban areas is severely distorted through these factors.

The functional relations perspective on urbanisation says that urbanisation in the fringe area is directed through the nature of interaction between fringe and city. In the case of Hubli's fringe this is maybe a better explanation (model) for encountered research results. As the

functional relations of Hubli with the red soil areas have developed the agricultural and non-agricultural land use forms there. While the government planned urban expansion is a result of the need of the city for suitable settlement areas for urban expansion. This bring non-agricultural land use and urban functions to the Corridor area creating a specific interaction/integration of this part of the fringe with the city. Finally, the lack of land use development and non-agricultural activity development in the northeast seems follow out of the fact that the interaction of this area and Hubli have been undeveloped under influence of the local conditions which prevail in this area.

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