

Changing frontiers

*The Peri Urban Interface
Hubli-Dharwad, India*

Edited by

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Introduction

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The peri urban interface: A meeting of the rural and the urban

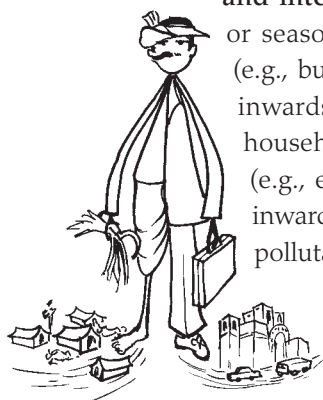
What is the Peri-Urban Interface?

At the outset it is important to define what we mean by the term 'peri-urban interface' (PUI). However, it might be easier to start by defining what we believe it is not. It is not primarily a location, although of course, it has a place where it exists. Thinking of the PUI purely in terms of a location that can be drawn on a map has led to a number of misconceptions. It is more appropriate to think of the PUI as a **process**, rather than a place. The sorts of misconceptions that arise from considering the PUI to be primarily a location are:

1. For urban specialists (e.g., academics, urban local authorities), it is regarded as having essentially urban characteristics and is administered and planned accordingly.
2. Rural specialists, on the other hand, regard the PUI as having predominantly rural characteristics, and they likewise treat it as such.
3. The PUI is considered by environmentalists to be the location which suffers the polluting effects of the nearby urban area.
4. For natural resource managers (e.g., agricultural, livestock, horticulture administrations), it is a problematic zone where buildings and roads encroach on productive land, farmers change their production systems or even abandon agriculture and where rural certainties no longer hold true.

To some extent, each of the above does contain some elements of the features that characterise the PUI; misconceptions arise when each specialist regards their own particular outlook to be the appropriate one without taking into consideration other viewpoints. However, the biggest misconception which arises from a largely spatial definition of the peri-urban interface is that it does not take **people** into account.

Sometimes the PUI is defined in terms of **flows and interactions**; flows of people (e.g., daily or seasonal commuters, in-migrants), goods (e.g., building materials, agricultural produce inwards, agricultural inputs, hardware and household consumables outwards), finance (e.g., earnings outwards and bank deposits inwards), pollution (solid, liquid and gaseous pollutants generally flowing outwards) and ideas or knowledge. These are certainly true, but are still only a part of the whole picture.



Mbiba (2001) summarised definitions of the PUI as falling under the following headings: **spatial/locational** (based on distance from the city, land use value and use land is put to, and administrative boundaries); **temporal** (those areas recently absorbed into a city); **functional** (those areas outside the city boundary but linked to the city by flows and interactions); **social exclusion** (inhabitants of informal settlements, or poorly served by infrastructure and services and so cannot truly be considered as urban); and **conflict** (where two or more systems clash instead of converging and harmonising, maybe agriculture vs built development, modern vs subsistence economies, formal vs informal).

It is clear from the foregoing that there is no single satisfactory definition of the peri-urban

interface, and moreover, different definitions will probably apply in different circumstances, and may even change in the same location over time; for example, as a medium sized city becomes a large one.

However, few of these definitions explicitly incorporate the notion of the PUI being a place where certain characteristically peri-urban processes take place. So, what is meant by saying that the PUI is primarily a process and not a place? The dominant process that takes place in the PUI is that people's livelihoods are changed, often rapidly, as a result of changes in the circumstances around them driven by urbanisation. Often this change is forced upon people as urbanisation overtakes the rural areas in which they live, whilst others adapt willingly as they embrace the opportunities that urbanisation affords. Although this book will consider many effects which at first sight may appear to have a strong spatial or functional theme; cropping and livestock systems, water resources, land sales, soil degradation; underlying it all is a recognition that each of these changes affect someone's livelihood (often as a result of people's own decisions), as a consequence of which they have to make choices about how to adapt to new circumstances. Accompanying these changes in livelihoods, are several concurrent and inter-linked change processes, both in land use and in natural resources.

This is implicit in the description of the PUI by the Department for International Development (DFID) Natural Resources Systems Programme as being "...created by urban development. Rural activities pre-exist. As urban activities proliferate and grow, linkages relating to them are built from either the town or the countryside. These cause changes to existing production systems and

create new ones that can affect the poor in urban and rural areas. Opportunities arise relating to easy access to markets and services, with ready supplies of labour. Problems arise from shortage of land and risks from pollution and continued urban growth" (NRSP, 2000).

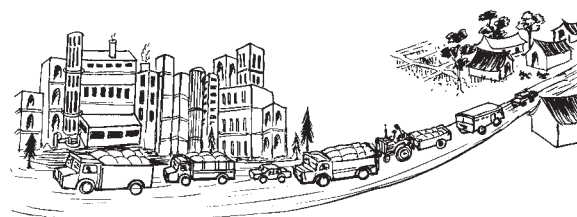
Nowhere have these processes driven by urbanisation been comprehensively characterised. The aim of the research described in this volume was to investigate some of these processes and draw them together. The approach was deliberately multi-disciplinary and with a systems perspective (i.e., the PUI was viewed as a whole, rather than several unlinked components).

Rationale for Research

The global urbanisation rate is 4.5%, compared to an annual population growth rate of 1.2% (US Census Bureau, 2000). Even in the least urbanised continents, Asia and Africa, both are expected to be 54% urban by 2025 (UN, 1995). Nearly all future growth in populations will be in Less Economically Developed Countries (LEDC), projected to be an additional 2 to 3 billion by 2050 (depending upon which estimate is accepted), two thirds of which will be in and around existing urban centres (Griffon, 2002), mostly peri-urban as new migrants will not easily be able to find space in already densely populated cities. Thus, the peri-urban population is expected to grow rapidly.

There is increasing worldwide concern about the effects of expanding cities upon the surrounding rural areas, principally, but not exclusively, being expressed in terms of degradation of the natural resource base. In response to this, in 1995, UK Department for International Development (DFID) included the peri-urban interface around

medium sized cities as one system to be investigated within its Renewable



Natural Resources Research Strategy. DFID conducts its natural resources research programme mainly through programmes coming under the Renewable Natural Resource Research Strategy (RNRRS). RNRRS comprises a number of programmes, of which the Natural Resources Systems Programme (NRSP) is one. Each programme has to address particular production systems, including the peri-urban interface system. A South Asia Scoping Study (project number R6463), conducted in 1996 in conjunction with Indian key stakeholders, identified Hubli-Dharwad as a suitable location for such research.

More recently, several governments, including those of India and the UK, have expressed commitment to the reduction or eradication of poverty. As a consequence, the research emphasis has shifted towards a pro-poor agenda and the management of natural resources within this context. Since research began in Hubli-Dharwad in 1997, much data and information have been collected but nevertheless, critical gaps in knowledge remain, particularly concerning impact of change upon the poor. The project described in this volume followed on from a previous one (project number R7549) which identified questions remaining about the PUI that had to be filled before any projects that sought to alleviate poverty could be formulated (Brook and Dávila, 2000). The aim of the project described in this book was to fill identified critical gaps in knowledge about the PUI, particularly in the areas of response of farmers in adapting

cropping and livestock systems, what produce marketing systems operated, whether the presence of a large urban area influenced the availability of ground water in surrounding villages, some of the factors influencing natural resource degradation, and how the foregoing changes affected household livelihood strategies. This study was not an end in itself; it was in fact one link in a series, the overall objective being the development of natural resource management and livelihood strategies for the peri-urban area, benefitting the poor, which at the time of writing is still being implemented.

Background to Hubli-Dharwad

Hubli-Dharwad, located in Karnataka state, southwest India (Figure 1.1), is a conurbation comprised of the urban areas of Hubli and Dharwad which are separated by a distance of some 20km. It is 427km north-west of the state capital, Bangalore, and approximately 600km

south-east of Mumbai (Bombay). The two were brought together under the Hubli-Dharwad Municipal Corporation (HDMC) in 1962, thus making it the third largest urban agglomeration in Karnataka State (after Bangalore and Mysore). "Hubli is the larger city, a centre of commerce, trade and industry, and also the centre for transport within the region, due to its position on road, rail and air links with Bangalore and Mumbai, both important centres of trade and industry. Dharwad, to the north west of Hubli, acts as the administrative centre and hosts the city's higher education institutions" (Budds with Allen, 1999).

The Hubli-Dharwad city-region is an administrative area which encompasses both cities within a wider district comprising five surrounding *taluks*: Dharwad, Hubli, Kalghatgi, Kundgol and Navalgun, which together contain 372 villages. In 1991, Hubli-Dharwad had a population of 1,428,174 inhabitants, while that of the city-region was 648,298. The population

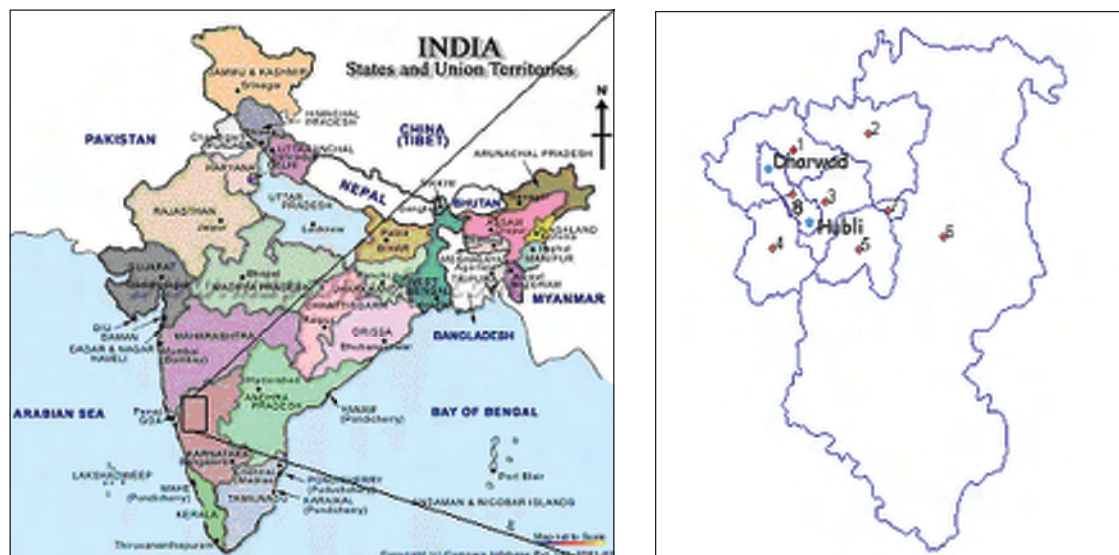


Figure 1.1. Study area

of the city had grown by the time of the 2001 census to 786,018. Hubli-Dharwad is characterised by a low population density by Indian standards (3,395.3 inhabitants/km²), yet is experiencing high rates of population growth in some parts of the surrounding area (Universities of Birmingham, Nottingham and Wales at Bangor, 1998).

Hubli-Dharwad is located in a predominantly rural region where agriculture is the principal economic activity due to the productive nature of the soils. Within the region there are local differences particularly with regard to soil type and rainfall. The area to the north of the city-region is characterised by medium black soils, south by mixed red and black, west by paddy soils (inceptisols) and east by deep black cotton soils (vertisols). The rainfall from west to east declines from 1000–650mm whereas north and south receive around 700–800mm.

Concerning information about the peri-urban interface around Hubli-Dharwad, almost nothing exists at a fine (e.g. village level) resolution. For example, there is little information on the level of poverty in the Hubli-Dharwad city-region, particularly among smaller-scale farmers in the PUI, nor about the gender dimensions of poverty. In fact, according to Rakodi (1999), there has been little explicit work to date on the impact of peri-urban processes on household livelihood strategies, anywhere. There is some, limited information about scheduled castes and tribes aggregated at a taluk (sub-district) level. An initial Baseline Study (project number R6825) in 1997 analysed data in five taluks closest to Hubli-Dharwad taken from 1991 census data. It was found that only 61,077 (8.6%) of the population in the five taluks were members of scheduled castes (who are likely to be poor). Only 23 villages,

6.5% of the villages in these taluks, had over 20% of their population classified as scheduled castes and 12,789 (1.8%) of the population in the five taluks were classified as scheduled tribes. Some villages, however, have higher concentrations of scheduled castes and tribes than others. However, no work has been conducted on levels of poverty among these groups, nor has spatial analysis been conducted at a resolution finer than sub-districts.

Thus, conditions pertaining around Hubli-Dharwad have to be inferred from what is known elsewhere in India. In an analysis of DFID's contribution to poverty reduction in India, the following conclusions about the poor in India were made:

- Most of the poor are casual workers, particularly rural workers, both agricultural and non-agricultural. Wage rates are a prime determinant of poverty.
- Within the poor, female-headed households and households with large numbers of children, were especially vulnerable.
- Scheduled tribes were the most economically destitute within the rural population.
- Scheduled tribes and castes together had a significantly higher extent and severity of poverty than the population as a whole (Shepherd *et al.*, 1998).

The study also found linkages between income poverty reduction and the initial level of female labour force participation. It was concluded that:

- Where women are part of the waged labour force, poor households have more working members, may be less vulnerable to shocks and so may be able to take more risks and make investments.

- Men are more free to migrate for employment, an important strategy for poor households especially in the remoter areas.
- Women, and therefore girl children, may be more highly valued (Shepherd *et al.*, 1999).

These secondary sources of information informed the present study, guiding the team in what aspects of livelihoods should be studied. Similarly, there are no data on trends in cropping systems other than at a taluk or district level, so it is not known to what extent farmers are changing farming practise to take advantage of accessibility of urban markets.

A Brief Overview of the State Structure in India and Hubli Dharwad

One aim of this research was to surface issues particular to the PUI and evolve an understanding of the policies needed to address these issues. However this implied looking at the different rural and urban authorities. Thus a brief overview of existing rural and urban government structures operating within Hubli–Dharwad and their relationship to the state and central government authorities follows (Figures 1.2 and 1.3).

At the national level broadly speaking are the Ministries for Rural and Urban Development under which are the National Departments. For instance, examining the rural administrative structure under the Ministry of Rural Development, falls the Department of Panchayati Raj, Government of India at the national level. At the state level, also there is a State Ministry and a state department for Rural Development and Panchayati Raj. At the district level, for the rural agencies, the three tier panchayati Raj system operates at district, block, and village

levels and for the urban, the municipalities and urban development authorities.

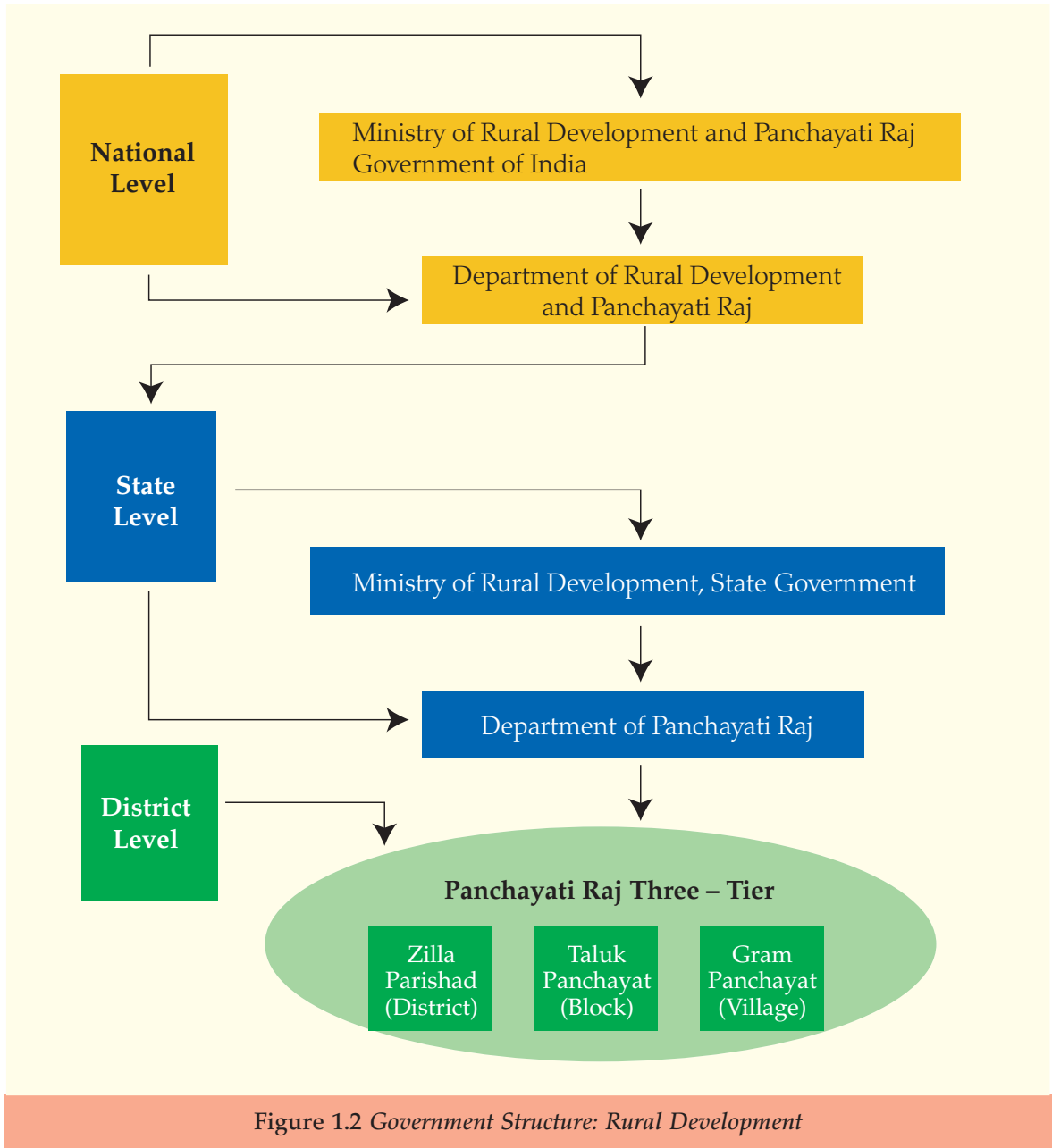
In Hubli–Dharwad this system operates as follows: “There are three levels of government administration present in Hubli–Dharwad in addition to central government: state, municipal (urban) and rural. The state level comprises the Karnataka State agencies including the Town Planning Department, the Karnataka Industrial Estate Development Authority and the Karnataka Pollution Control Board. The two principal bodies active at the municipal level are the Hubli–Dharwad Municipal Corporation (HDMC) and the Hubli–Dharwad Urban Development Authority (HDUDA). The rural level is governed by the Panchayati Raj (rural local self-government) system, divided into three further sub-divisions, Zilla Panchayat, Taluka Panchayat and Gram Panchayat” (Budds with Allen, 1999).

“Within the Hubli–Dharwad city–region, the HDUDA takes an urban-oriented, medium to long term, physical town and country planning approach, with emphasis on forward (strategic) planning. It is responsible for the planning of urban areas including areas of urban expansion and takes the stance of accommodating urban growth rather than making specific land use decisions. Each ten years it devises a strategic Regional Development Plan, which appears to give little attention to sustainability of the environment. The role of the HDMC is the implementation of the plans produced by HDUDA”.

“In the rural-oriented three tier Panchayati Raj system, the Dharwad Zilla Panchayat (DZP) is primarily concerned with short-term socio-economic planning and adopts a non-spatial planning approach, with no attention to land-use

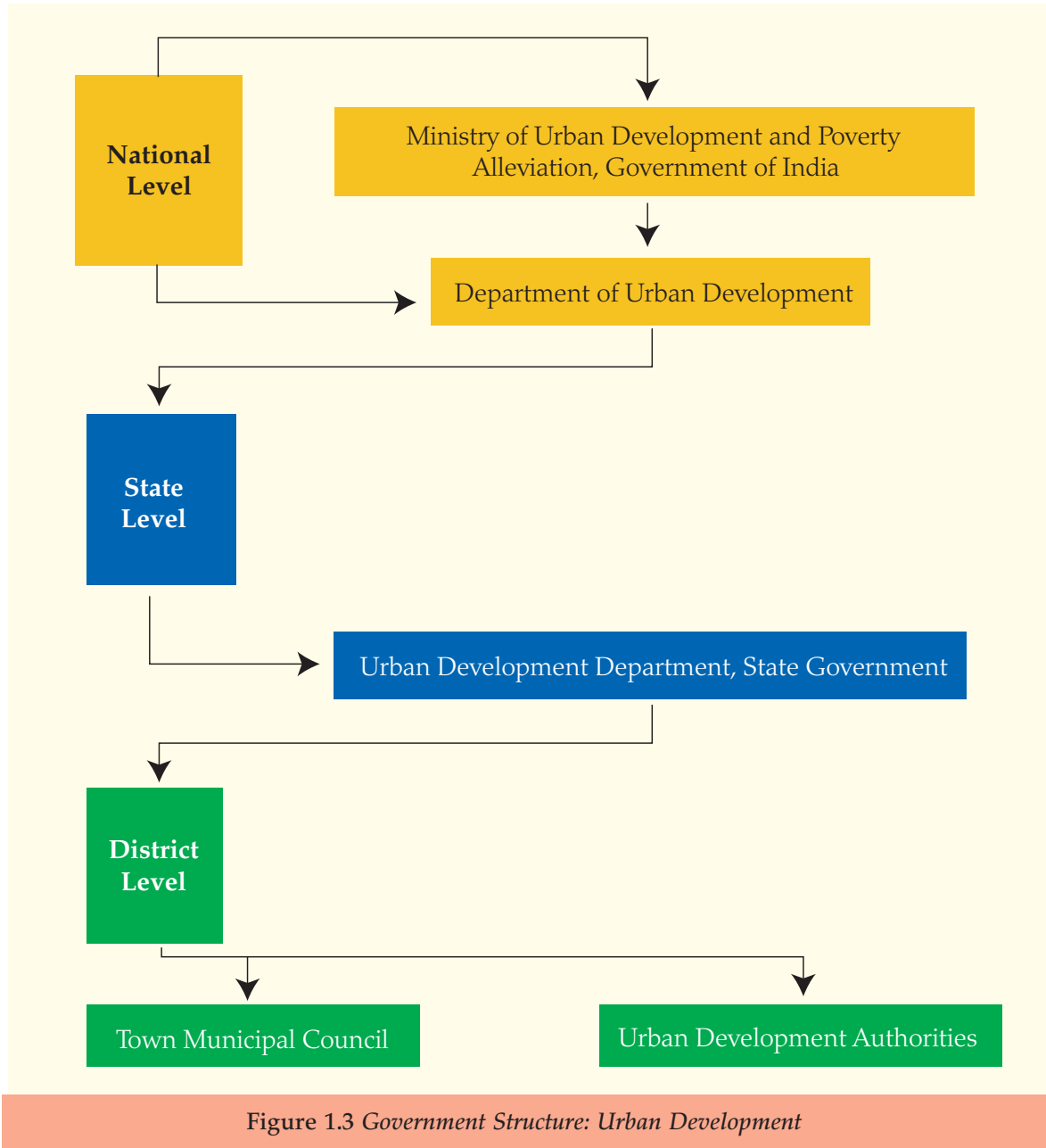
decision-making, physical planning or environmental concerns. The role of the DZP is to allocate financial resources to specific project proposals by Village Development Committees at the Gram Panchayat level (lowest level village

authorities) in accordance with Central and State government directions” (Budds with Allen, 1999). There is little co-ordination between these various bodies, and although the 74th Amendment to the Indian Constitution stipulates the setting up of



District Planning Committees, around Hubli–Dharwad, this has not happened.

How the Research was Conducted
Eight case study villages were selected according to their distance from the cities of Hubli and



Dharwad along four transects (north, east, south, west) upon which the research focused (Table 1.1). Transects radiating out from Dharwad and Hubli were approximately 10km long, but the exact length was determined by the location of villages. In each chapter therefore the four villages closer to the city (Kelageri, Dasankoppa, Gabbur and Bidnal), along each transect, were compared to the four further away (Mandihal, Pudakalkatti, Inamveerapur and Shiraguppi) (Table 1.1) This transect approach was used to determine the spatial effects of urbanisation. Some villages were selected from amongst their neighbours according to features of particular interest or impact, such as the presence of a particular industry (e.g., quarry). Otherwise, villages were selected to try to include as wide a range of variables that may affect livelihoods as possible, for example, population size, soil types and various facilities such as transport.

Other sampling patterns were used for two components of the project. For the land transactions study, the whole of Dharwad and Hubli taluks were surveyed, and a sewage irrigated farming systems study concentrated on transects running along two natural water courses flowing from Dharwad and Hubli. The livestock study also included two further villages south of Hubli, Channapur and Varoor.

Survey methods varied with the type of information sought. Although the research team subscribed to participatory approaches, these were only considered to be relevant in the case of the livelihood component. Data in most cases were quantitative, and this determined methods used. For example, for cropping system transects, crops were mapped along a linear transect without directly seeking any information from farmers. On the other hand, when cropping systems were being mapped in villages, a key

Table 1.1 Villages by Transect		
Village	Distance from the city (km)	Transect
Near villages		
Kelageri	5.5	Dharwad west
Dasankoppa	8	Dharwad north
Gabbur	4	Hubli south
Bidnal	3	Hubli east
Distant villages		
Mandihal	11	Dharwad west
Pudakalkatti	18	Dharwad north
Inamveerapur	12	Hubli south
Shiraguppi	15	Hubli east

informant, the Village Accountant (known locally as the 'Walikar') was used. For cropping patterns, four further villages along the same transects were chosen for the purpose of comparison with the peri-urban villages, Palikoppa, Umachagi, Kalle and Kogilgeri villages. The livestock survey used extensive, formal interviews, and the land transaction study required the transcribing of details of thousands of land sales from registers

held in the Hubli and Dharwad Land Registry Offices. For the livelihoods component, four socio-economic categories were determined by a participatory wealth ranking procedure. Eight households per village were selected from each of the eight villages, and semi-structured interviews were conducted with these households concerning their livelihood strategies and options.

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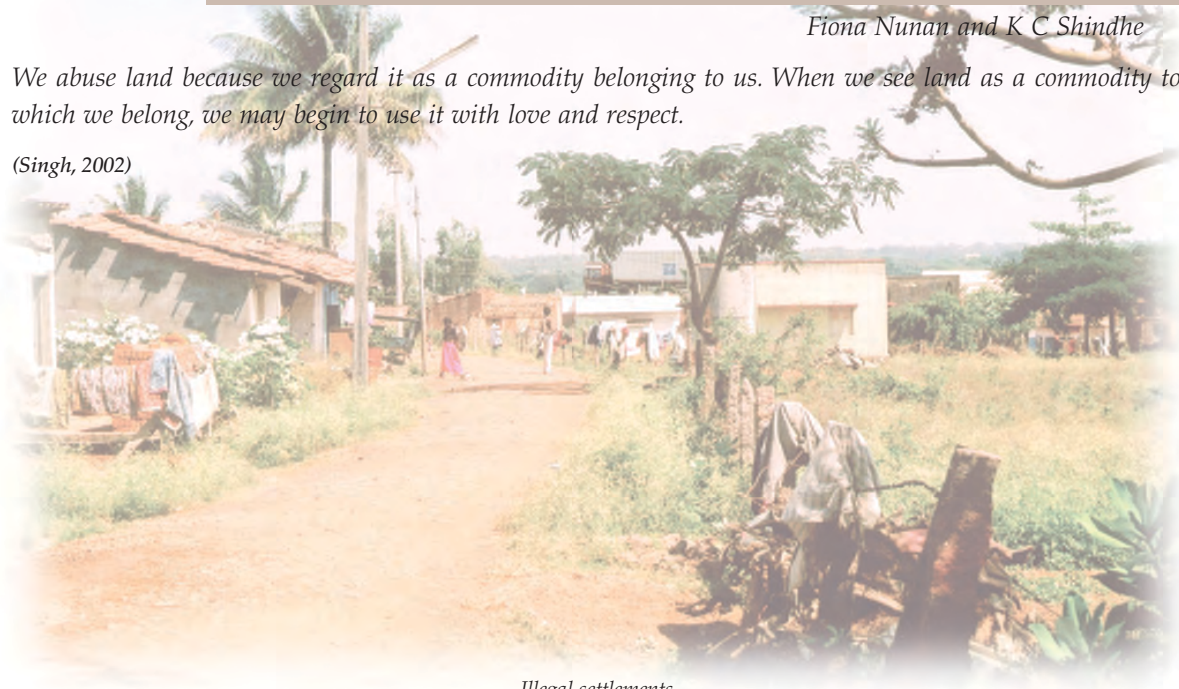
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Urbanisation Leading to Changing Land Use Trends

Fiona Nunan and K C Shindhe

We abuse land because we regard it as a commodity belonging to us. When we see land as a commodity to which we belong, we may begin to use it with love and respect.

(Singh, 2002)



Illegal settlements

Introduction

The peri-urban interface is characterised by rapid land use changes. This chapter discusses the nature of land use in the peri-urban context while simultaneously contrasting it to land use in urban and rural areas. It discusses the effects of urbanisation such as the growth of urban infrastructure like roads and by-passes on land transactions contextualising these changes within the dynamics of urbanisation and concurrent speculation. The article examines the effects of the development of roads on land use, seen here as directly linked to urbanisation. Finally the need for new types of policies which address land use in the peri-urban areas is posited.

Need for Land Use Planning

Considering the increasing demand for food production, it is an essential task to promote optimum land use and its conservation, given the different types of uses in India's land resources and the resulting need for resettlement and rehabilitation. Historically, land use planning has largely been an economic concern. However, in recent years, a comprehensive land use plan is required to focus integration of economic, ecological, social and cultural values in order to develop options so that informed choices can be made.

Box 2.1 Evolution of Land Use Planning in the Five Year Plans

The Second Plan (1956–61) stressed a more studied effort to introduce a planned approach in agricultural development, which is one of the main elements of 'land use planning'. The third plan (1961–66) recommended the establishment of Land Use Planning Cells at the Centre (national level) and states to take up this work. Fully realising the urgency of the production, it was decided in the fifth plan (1974–78) to strengthen the organisations and programmes relating to land and water management. The states were asked to prepare 25-Year Perspective Plans for the optimum management of their land and soil resources and establish the order of priorities based on which various soil conservation, land development, drainage, flood control and reclamation programmes should be undertaken. This ensured the setting up of Land Use Boards in the states.

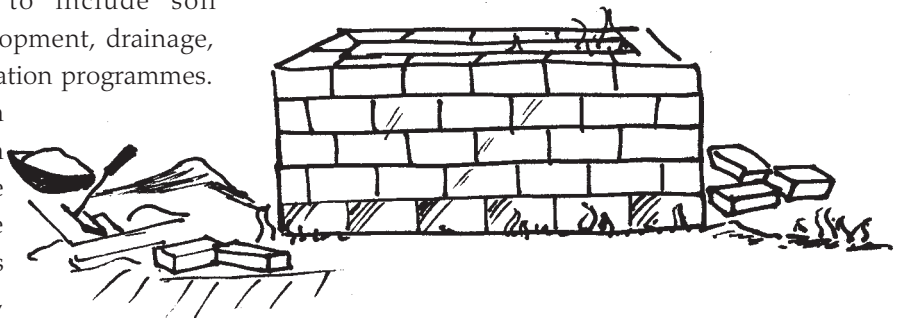
In the sixth plan (1980–85) the State Land Use Boards assisted by the Central Land Use Commission were to pay priority attention to the re-orientation of current pattern of land use on the cited lands. With a view to placing proper emphasis on the objectives of proper land use and development of watersheds, the National Land Use and Wasteland Development Council (NLWC) under the chairmanship of the Prime Minister of India, was set up in May 1985 in the seventh plan (1985–90). The mandate of NLWC included:

1. formulation and implementation of National Land Use Policies through State Land Use Boards (SLUBs)
2. preparation of perspective plan for conservation, development and management of land resources of the country
3. review of land-based programmes/progress
4. sponsoring of special/evaluation studies
5. organising national/regional seminars/conferences
6. review of working of SLUBs, etc.

Source: Singh (2002)

Land use planning trends, as reflected in the changing priorities of the five-years plans show a wider comprehensive perspective (Box 2.1). The trends reflect that land use planning in the second five-year plan had a narrow focus on agriculture alone which changed slightly to increasing agricultural productivity in the third five-year plan. As the five-year plans progressed the emphasis broadened to include soil conservation, land development, drainage, flood control and reclamation programmes. Towards long-term sustainability, the seventh plan built further on these areas to create institutional structures and policy frameworks,

emphasising land use programme review, research and dissemination of its findings and awareness building. The previous five-fold classification of land use expanded to include new categories recognising permanent pastures, tree groves and culturable waste (Box 2.2).



Box 2.2 Classification of Land Use

In 1948, the technical committee on Coordination of Agricultural Statistics, of the Ministry of Food and Agriculture, recommended a nine-fold land use classification (ICAR, 1980: 96) outlined below:

1. forests
2. land put to non-agricultural uses
3. barren and uncultivable land
4. permanent pastures and other grazing lands
5. miscellaneous tree crops and groves
6. culturable waste
7. fallow land, other than current fallows
8. current fallows
9. net sown area.

Net sown *agricultural area* in India was 41.8 per cent of land in 1950–51 and increased to 46.6 per cent in 1991 due to increased irrigation, easy availability of agricultural inputs, improved crop production and protection techniques. Forest area also increased from 14.9 per cent in 1950–51 to 22.3 per cent in 1991–92. Comparing this increase with rural population and labour force growth rates, there is a concurrent rise in the agricultural labour force¹ despite a decrease in the overall rural population (from 82.7 per cent in 1951 to 74.3 per cent in 1991), increased out-migration and mechanisation.

Source: Goutam et al. (2002); Singh (2002)

A comprehensive land use plan thus integrates institutional frameworks that support strategic policies and actions such as guidelines, permits, financial incentives, education and monitoring/enforcement. Land use decisions should take into account the goals of achieving regionally balanced economic development. The land use plan should be flexible dealing with the geographical environment such as natural resources, human settlements, protected areas and water and the aquatic system. The rights, responsibilities and circumstances of local people in land use issues and management greatly influence the strategy for public and private lands. The present land use policy should set up institutional mechanisms with the task of preserving natural and cultural heritage. Such initiatives use the regional environment and natural resources in a way that does not harm the prospects of their use in the future.

Land Use in the Peri-Urban Interface

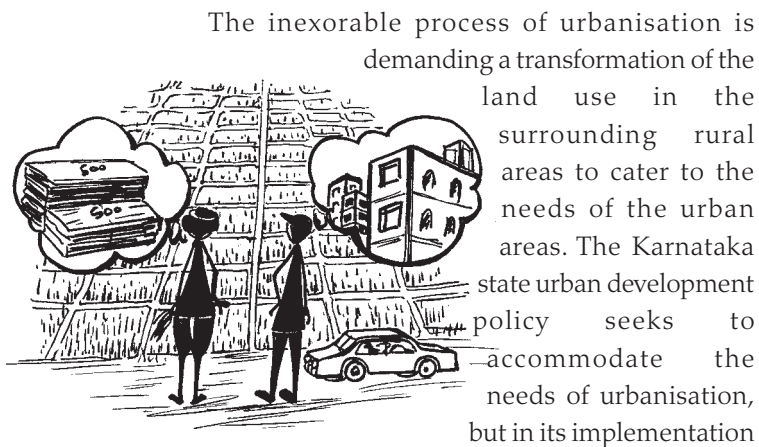
The peri-urban zone is a location of high level of capital investment and new activity in any economy. The PUI of Hubli-Dharwad is not an exception to this. The PU area of Hubli-Dharwad can be characterised as the areas undergoing changes due to growth of the twin cities and increased connectivity between these cities. This has resulted in changes of livelihoods, land use and social structures.

The twin cities have quite different characteristics. Hubli the more commercial trading centre, is very well connected by national highways in all the four directions. The two state highways make Hubli more easily accessible to the surrounding districts than Dharwad. As a result Hubli city is the more commercial trading centre, whilst Dharwad is more of an educational centre, with two universities based in the city.

Box 2.3 Land for Sale? The Navalur Case

A previous study conducted in 1999 compared costs and benefits involved in converting agricultural land to housing plots in Navalur village, 7km south east of Dharwad within the Navanagar area. Over 90% of the total village land was devoted to intensive semi-mechanised agriculture, almost all of it rainfed crops. This land, however, was gradually being encroached due to demand for housing close to the city along the highway. The study involved the valuation of land for crop cultivation, fruit production and animal husbandry. These values were compared with land purchased for housing development. It was found that whatever approach was taken to ensure common units of comparison and applying an appropriate discount rate, the value of land for housing exceeded its value in agriculture. The study concluded that private individuals would prefer to push for development as long as the value of land for housing is greater than its value for farming. Public authorities may have other objectives, however, such as supporting work for landless labourers and maintaining a 'green belt' around a built-up area.

Source: Nunan et al. (2000)



does not adhere to environmental assessment procedures as legally mandated. One example is Navalur, (Box 2.3) situated between the twin cities, where the land was under heavy demand in 1999 for housing and today for many more institutional and infrastructural uses. Today a medical college and some industries have been established in this area. This has resulted in the trends described below in land use in the Hubli Dharwad PUI (distinct from rural and urban land use trends as seen in box 2.4).

Box 2.4 Rural and Urban Land Use Features

Rural: Land is mainly used for agriculture, grazing, and horticulture. Large industries and quarries also exist in the rural areas. Large industries are set up in rural areas because of government incentives to locate industries in industrially underdeveloped areas which also prevent pollution and congestion of urban areas. Changes in the rural landscape driven by urban development include road and highway construction, and infrastructure development such as irrigation projects, power plants and so on.

Urban: Land use is for residential as well as commercial purposes and small industries. There are also green belts where there are parks and playgrounds. In addition institutional structures of particular government and educational institutions tend to be concentrated in the urban areas. Simultaneously, urban areas demand heavy infrastructure to cater to specific needs of large urban populations such as transportation, health and so on.

Source: Singh (2002)

- **Increase in non-farm employment:** The greatest increase is in construction workers working outside their villages due to improved urban access and better wages than in farm employment. As a result labour is not available for agriculture and people are forced to abandon agriculture or shift to less labour-intensive activities such as horticulture or change the land use. Interviews have revealed that, for example, people from Dasankoppa commute to Dharwad to seek employment as construction labour. In Navalur village farm labour is not available because they get more lucrative employment in industries which are close by.
- **Development of unauthorised housing colonies with inadequate water supply, electricity and sanitation to accommodate people displaced by inner urban development¹.** Illegal colonies also develop to accommodate migrating people from relatively far off rural areas. For instance, in Dharwad an unauthorised layout Sri Ramnagar, is housing factory labourers who earlier used to stay in the city on rental basis. In Kelageri, Anjaneya Nagar is a colony housing tribal migrants (*sudugadu sidhas*).
- **Commercial activities such as poultry, dairying, brick making and quarrying catering to the urban needs take place in the peri-urban interface.** Poultry units are not allowed in the city because of bad odour and noise. As agriculture becomes unviable due to high labour wages small farmers seek alternate livelihoods and their land is leased for activities like brick making and quarrying. Building contractors take such lands on lease to make bricks. The quarries have benefited from the construction of a four-lane highway

Brick kilns near Kelageri: Loss of Top-Soil



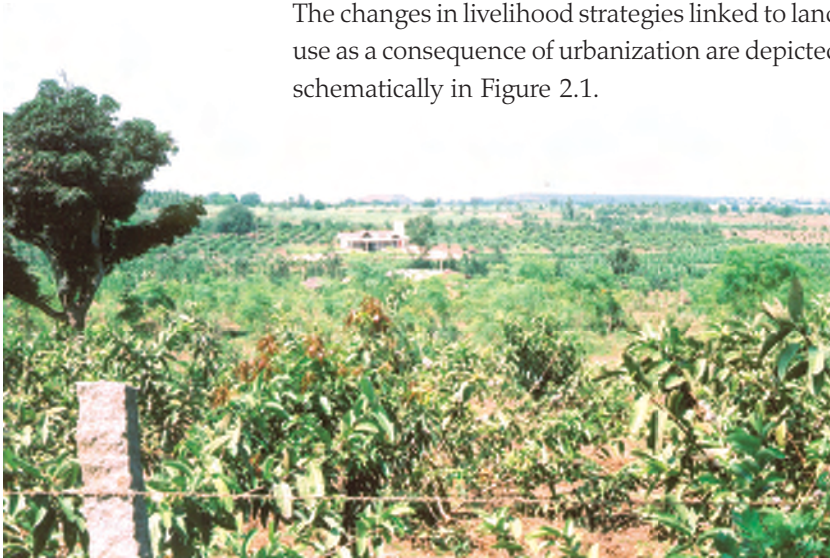
where there is a great demand for stone grit. Though there are quarries even in rural areas there are more quarries in the peri-urban areas because there is a greater demand from the cities. Brick industries tend to be located as close as possible to urban areas to reduce transport costs.

- **Land markets are characterised by speculation and escalating land prices and urban investment to avoid taxation.** Agricultural income is not taxed and therefore land transaction records tend to show agriculture as the main activity so as to avoid tax payments. Wherever proposed urban development like a by-pass or industrial estate or large government establishments take place, the speculation on land is higher. For example land around Navanagar situated between Hubli and Dharwad is subject to high speculation



because of the increasing number of government offices being located there. Educational institutions, industrial areas, airports and other institutions related to urban areas but located in the peri-urban interface develop here because of the need for large amounts of land, unavailable in cities.

The changes in livelihood strategies linked to land use as a consequence of urbanization are depicted schematically in Figure 2.1.



Horticulture farms – investments for tax avoidance

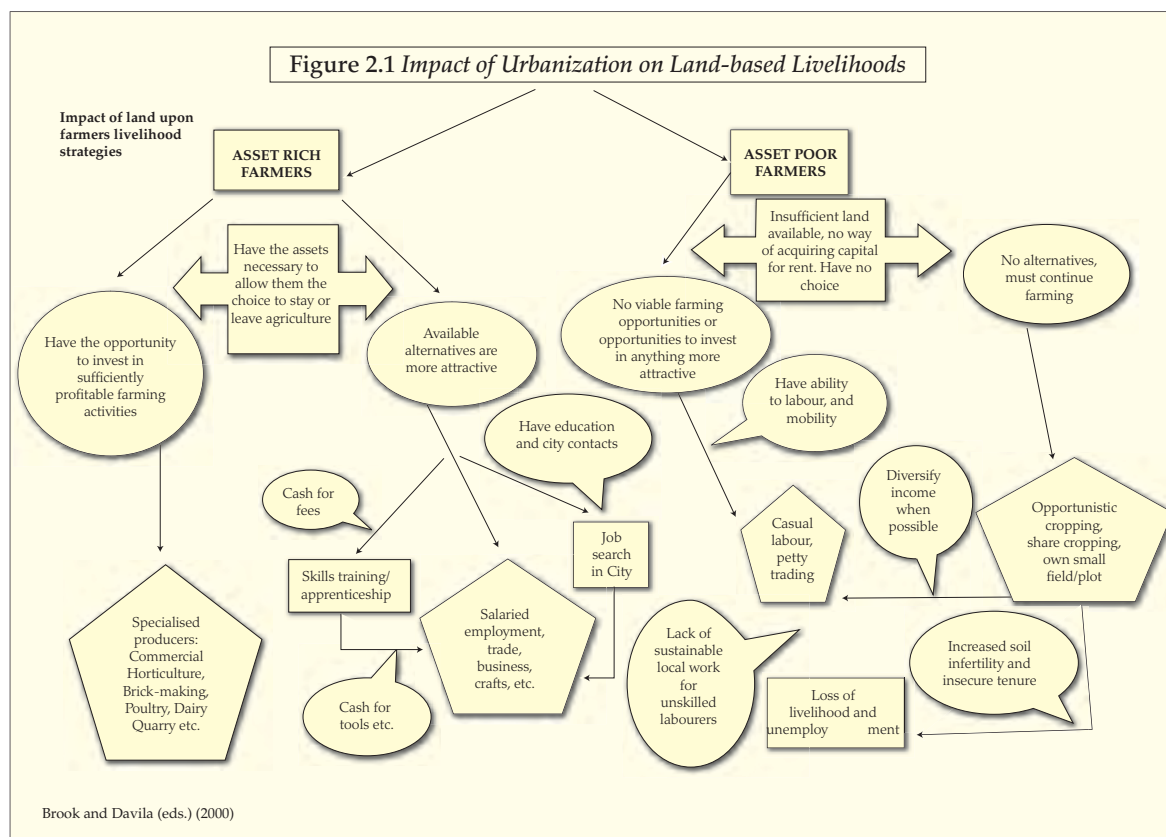


Poultry farms close to Dharwad city

In the early stages of urban influence and/or the outer parts of the peri-urban interface the opportunities for farm enterprises exceed the threats of loss of livelihoods for those in the PUI. Those who benefit tend to be the larger farmers, while those who are least able to take advantage of the opportunities are smaller farmers who lack capital and surplus land, leading to increased polarization. Thus in the initial stages increasing access to credit for small farmers and to other farm inputs would enable them to increase productivity and benefit from increased sale of surplus produce.

In the later stages of urban influence on the urban fringe areas or the outskirts of the built up area, the threats to farm enterprises from declining labour availability and higher labour costs outweigh the opportunities, leading to increased abandonment of farming. Those who benefit from this process are those who can either sell land to speculators or developers or have the capacity to develop it. Those who lose tend to have little or no land, are dependent on wage labour in other farms for all or part of their incomes, and are unable to take advantage of alternative economic opportunities in the urban labour market. This is because their households and its members lack labour, skills, contacts, capital, or freedom of movement. Those who have insecure rights to land, or who have little to sell, and who are excluded from urban labour market opportunities may be impoverished and, in any case, polarization between the rich and poor is likely to increase. Women in particular are likely to be disproportionately affected.

Farmland may be converted from subsistence food production to either commercial production for the urban market or urban development. If the food producers are unable to access alternative income generating activities,



households will suffer from increased food insecurity, which will be associated with increased malnutrition and poorer health status.

Those seeking new economic opportunities are likely to face barriers to entry erected by those already pursuing particular income generating activities. As a result, those who are forced to abandon cultivation and related activities on their own land will become more reliant on casual work or the less lucrative informal sector trading and service occupations, and unemployment rates will increase.

The Impact of Urbanization on Land Transactions

Urbanisation inevitably affects the value of

agricultural land and the number of land sales surrounding an urban area. The influence of the urban centre is not, however, uniform in all directions and at all distances, consequently the relationship between urbanisation and agricultural land sales is complex. Therefore in this section the link between land transactions and urbanization is examined. The intensity of land transactions is measured in terms of price per acre, number of transactions and acres sold. Reasons identified for the variation in land transactions include the distance of the village from the city, the distance in combination with the direction of the village from the city and the main type of road that connects the village to the city.



Stone quarry in Mandihal

Information was collected on all recorded land sales around Hubli and Dharwad between 1995 and 2000. Details of land transactions in 61 villages in Dharwad taluka (sub-district) and 44 villages in Hubli taluka were recorded. Data was also collected on potential explanatory variables, such as distance from Hubli or Dharwad and direction of village from the city. The main type of road leading to each village was also recorded from a district map to explore relationships between land sales and accessibility to the land.

Possible Reasons for Variation in Land Sales around Hubli-Dharwad

Land transactions that took place between 1995 and 2000 were examined to identify further reasons for variation in land prices and to identify trends. There are clear differences between Hubli and Dharwad (See Table 2.1). On the average,

there have been more land transactions around Hubli city, at a higher price per acre and more acres sold than around Dharwad.

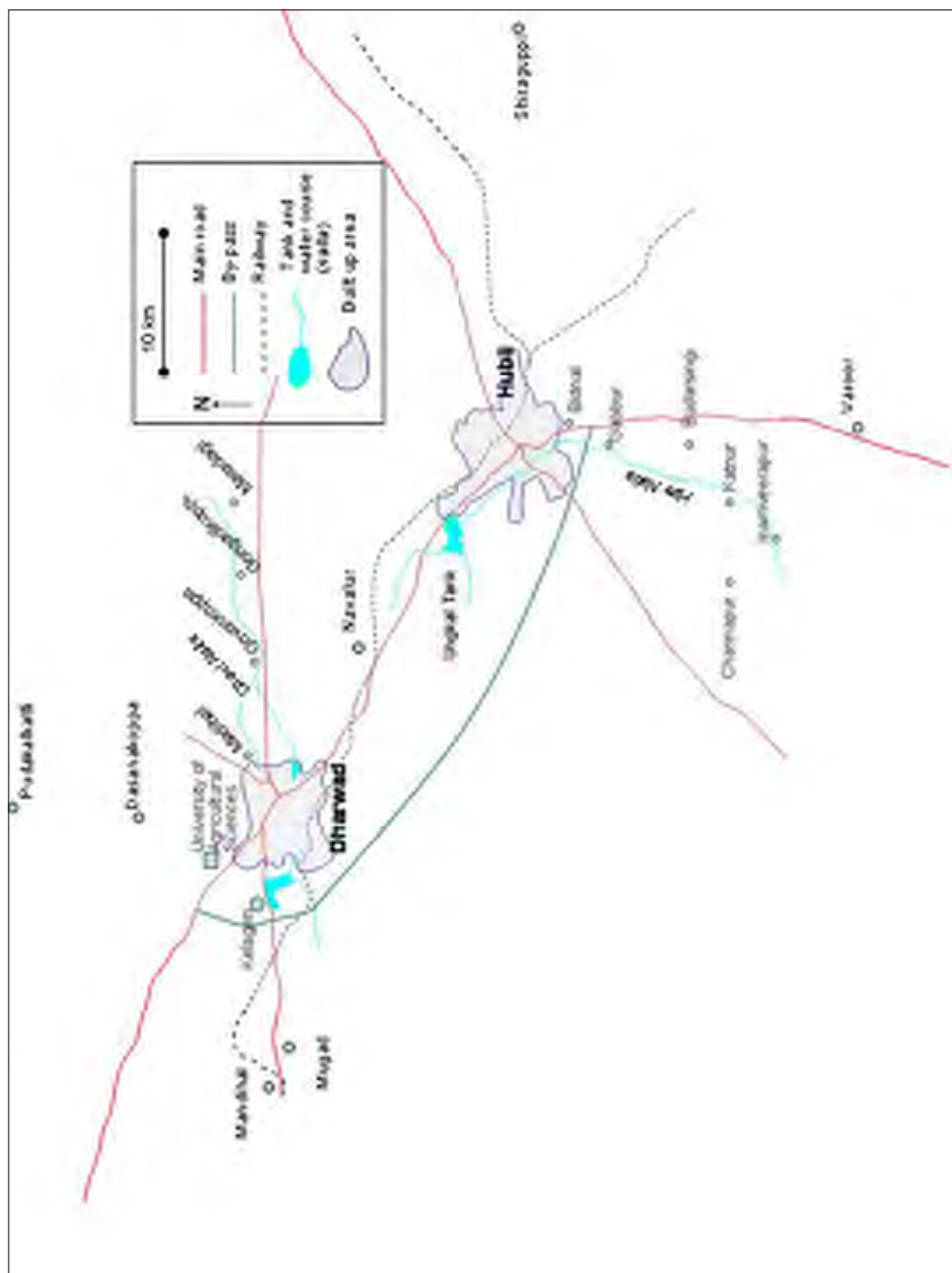
This higher degree of activity around Hubli reflects the more commercial nature of the city compared to Dharwad, since land is in demand for commercial enterprises, as well as for housing. Commercialization is accentuated here due to better access to roads with the National highways NH-4, NH-63 and NH-218 all passing through Hubli covering all the four directions. In addition Hubli is a railway junction and is the headquarters for the proposed South-Western Railway Zone.

Dharwad on the other hand has only one highway passing through it and an ordinary railway station. (Hubli has better access to other blocks in Karnataka than Dharwad, as more roads radiate from the former. Map 2.1).

Further Analysis of the Influence of Distance and Direction

Distance from Dharwad or Hubli and direction from the cities were the main explanatory factors examined. Distance was measured 'as the crow flies', rather than actual road distance.

Distance and price were found to be inversely related though the level of significance was low. It can be observed that the development does not take place uniformly from any city but there are preferred directions. These preferences in direction are determined by factors such as accessibility (determined by presence of by-pass and state and national highways and railways), railway zonal headquarters which bring about massive infrastructure development to support the scale of operations and soil type. This supports the observation of Fazal (2001) that Indian cities



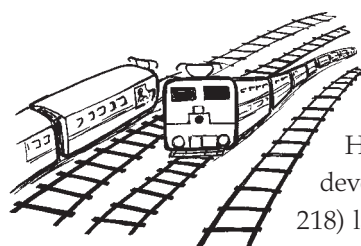
Map 2.1: The Hubli-Dharwad twin city region

Table 2.1 Mean number of land transactions, mean land price per acre and mean number of acres sold per village, 1995–2000

Year	Mean number of land transactions		Mean land price per acre per village (Rs)		Mean number of acres sold per village	
	Dharwad	Hubli	Dharwad	Hubli	Dharwad	Hubli
1995-1996	3.39	4.86	29637	41766	10.39	18.12
1996-1997	3.32	5.07	34024	42358	12.73	19.11
1997-1998	4.05	6.09	40523	54814	13.71	21.13
1998-1999	3.24	4.18	38757	58613	10.88	13.76
1999-2000	3.48	6.35	40314	72325	11.44	19.29

tend towards linear development, with ‘ribbon-like urban development along main roads’.

The shape of urban development around Hubli–Dharwad is inevitably linear, as there are two city hubs and urban development is prevalent along the 20km national highway between the city centres. The expansion of the urban area closely follows the main roads, with the exception of the by-pass, where development has been constrained by fencing (see section on By-Pass). For Hubli, however, the direction of the village from the city does not significantly affect the price, though it does affect the number of transactions taking place and the number of acres sold. This can be attributed to the fact that Hubli is a city which has national highways in all the four directions and as a result there is uniform development of land all-round Hubli. (Map 2.1)



Along the old highway (NH-4 connecting Hubli and Dharwad), no more land is available for sale.

However, along the recently developed highways (NH-63 and NH-218) land transactions are increasing for

housing and offices. This is accentuated by increased activity by the railway authorities around Hubli along the railway tracks.

For Dharwad, the highest prices were found in the south-east, the preferred direction i.e., towards Hubli. Along this direction, industrial estates, government offices and dental college have come up, while a medical college is still coming up. The lowest prices, however, were found to the north-east, where there is only a district road surrounded by farm land with black soils. Generally, for more commercial uses, red soils are preferred. This is because construction on black soils is expensive as foundations have to be deeper due to the swelling and shrinking properties of these clay-rich soils. Also for horticulture, red soils are more suitable (see Cropping Systems chapter).

By-Pass

Increased urbanization and growth of Hubli and Dharwad cities resulted in the national highway connecting the twin cities becoming an internal part of them. Increased traffic congestion and accidents and the need for a smooth, uninterrupted flow of traffic between the cities and beyond, led to the construction of a by-pass in 2000. A private company, Nandi Highway Developers Limited, was awarded a contract for 26 years to build, operate and transfer the by-pass.

During 1997-98 when it was decided to construct a by-pass, land prices of villages along the proposed route began to soar. Land sales also increased (Fig 2.3 and 2.4). This is in line with the peri-urban feature of speculative land prices. In 1998–99 the land prices remained high but there was not much land left for sale around the by-pass. People held on to the land expecting the price to continue to grow and that commercial

enterprises could be set up. However, the Ministry of Surface Transport (MOST) stipulated that fences be constructed along both sides of the road to prevent people and livestock crossing the road, to ensure smooth flow of traffic and to prevent accidents. The road has to be patrolled by security guards to prevent any problems. Underpasses, culverts and pipelines had to be constructed to facilitate the movement of traffic, people, livestock and water. A service road is yet to be constructed along both sides of the by-pass for local traffic.

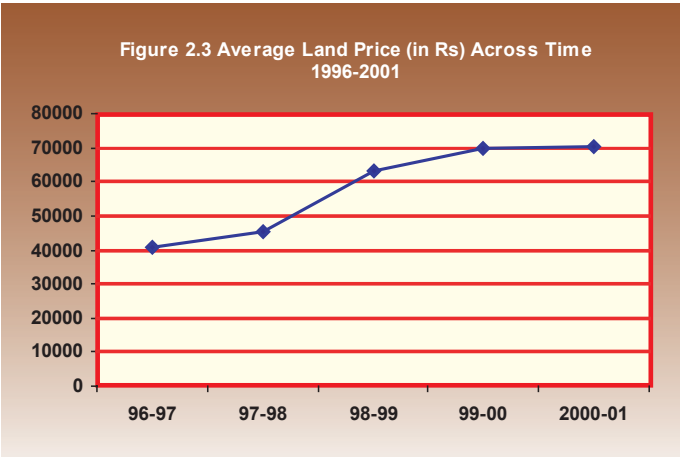
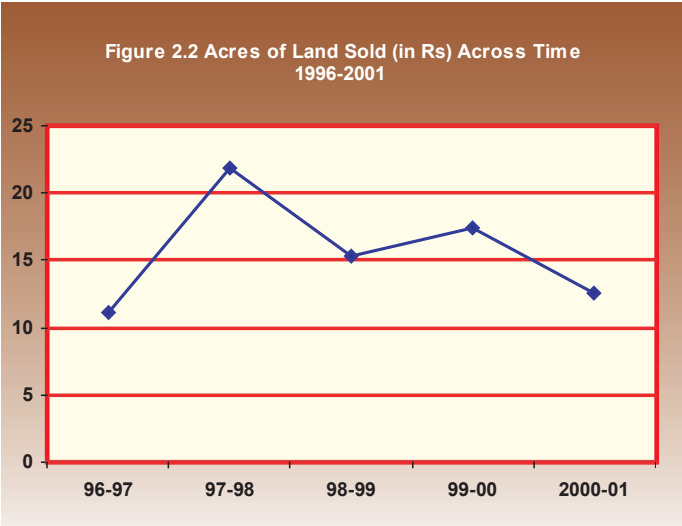
This fence prevented any access whatsoever to lands adjoining the by-pass, hence any commercial activity along the by-pass became economically non-viable. This resulted in a sudden increase of land sales but only a marginal increase in land prices. This is because people bought the land in the hope that they could establish hotels and other commercial ventures along the by-pass. When access was not possible they started to sell the land. There was only a marginal increase in price as there were only few buyers. This finding is supported by data on average land price per acre of land.

Effect of Road Type

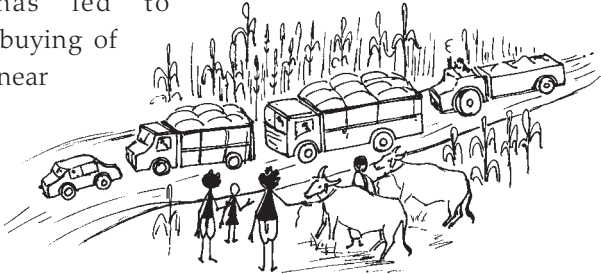
The process of urbanization includes development of better infrastructure.

Prices in general are higher around Hubli compared to Dharwad. Also the value of land is the highest around the national highway. All three parameters representing land use activities, average price per acre or number of transactions, or acres sold are higher around Hubli relative to Dharwad (Table 2.2). This supports the overall findings relating to a higher degree of urbanisation in Hubli.

The highest number of transactions was around the by-pass for Dharwad and on the district road



for Hubli. This is because the highway passes for a greater distance through Dharwad taluka than in Hubli taluka. In Hubli the proposed conversion of a district road to a highway has led to speculative buying of lands. Also, near Hubli one state highway is being converted



to a national highway. This therefore could affect the lands up to 1km away, as lands adjacent to the state highway have been sold long ago.

Table 2.2 *Effect of road type on land transactions, 1995-2000*

Located adjacent type of road	Mean number of transactions/ year		Mean average price per acre (Rs)		Mean number of acres sold/yr	
	Dharwad	Hubli	Dharwad	Hubli	Dharwad	Hubli
National highway	1.60	6.35	50211	71177	4.52	20.46
By-pass	6.87	4.60	29175	66477	29.83	28.41
State highway	4.00	5.00	28960	69431	14.56	14.90
District road	4.20	7.35	44255	40472	12.80	27.40
Village road	3.25	2.25	30288	33943	11.47	7.25

The value of land was the highest around national highways for both Hubli and Dharwad. For Hubli this is followed by lands around state highways and the by-pass. Around Dharwad, a district road is being converted to a state highway hence the high prices around the district road. Land around village roads are lowest in price.



Fencing on the by-pass between Hubli and Dharwad

The highest number of acres of land sold for both cities is around the by-pass. There is also a greater number of acres sold around the national and state highways and this trend is accentuated for Hubli. Where the by-pass and highway meet this trend is accentuated (Box 2.4).

Box 2.4 *The Case of Gabbur*

The by-pass joins National Highway 4 at the village of Gabbur. Gabbur was strongly affected by the sale of land for the by-pass around Hubli-Dharwad. Price per acre doubled between 1996-97 to 1998-99, but did not rise thereafter. After the by-pass was completed in 1999-2000 people realised they had no access to the by-pass and the land was no longer seen as commercially viable as was originally envisaged. Consequently land sales increased to 23.25 acres as compared to 6.63 in the previous year due to resale of the land.

Institutional Structures and Decision-Making Processes

In addition to central government, three levels of government administration are present in the city region of Hubli-Dharwad: state, municipal (urban) and rural. The two principal bodies active at the municipal level are the

Hubli-Dharwad Municipal Corporation (HDMC) and the Hubli-Dharwad Urban Development Authority (HDUDA). The rural level is governed by the Panchayat Raj (council) system, divided into three further subdivisions, Zilla (district), Taluk (sub-district) and Gram (two or three villages) Panchayats. The Zilla Panchayat has some land use functions but planning is not one

of them. The Panchayati Raj tiers are primarily responsible for the allocation of resources and the implementation of programmes and schemes defined by the Central and State government. The line departments such as watershed development, forestry, mines and geology, industry are more concerned with land use planning and natural resource management. Comparing the urban and rural contexts land use plans are formulated by the HDUDA for the former and do not exist for the latter.

From an institutional point of view, the decision-making arrangements and mechanisms affecting peri-urban production activities appear to be highly fragmented and lacking attention to environmental and poverty concerns. However, this does not mean that there is an institutional vacuum concerning the management of peri-urban productive systems.

In relation to urban development, the main institutions directly involved in land-use planning have been characterized in the DFID funded R6825 Baseline Study (Subhas M S, 1997). The Hubli-Dharwad Urban Development Authority (HDUDA) is responsible for the planning of urban areas including areas of urban expansion and takes the stance of accommodating urban growth rather than making specific land use decisions. The Hubli-Dharwad Municipal Corporation (HDMC) is responsible for implementing urban plans and the maintenance of urban public utilities.

The rural-oriented Dharwad Zilla Panchayat (DZP) is primarily concerned with short-term, socio-economic planning and adopts a non-spatial planning approach, with no attention to land use decision-making, physical planning or environmental concerns.

Each government department has its own sources of information, which are not shared with other departments, and each has their own separate linkages with other levels of government. The Zilla Panchayat Chief Executive Officer is responsible for co-ordination and together with the Planning Unit and the Deputy Secretary (Development) appears likely to be able to facilitate contacts with stakeholders in the district. The state tends to impose a top down approach, with state wide policies on industry and urbanization drawing little resistance from the rural authorities. Although the panchayat has the right to approve (or reject) requests for land conversion, in practice the state government has the power to acquire the land and overrule the lower-level panchayat authority.

In general, there is an absence of communication and co-operation between the planning authorities, especially the HDUDA and HDMC bodies, in spite of the fact that their realms overlap to a certain degree. In order to counteract this, the state government set up a District Planning Board with representatives from all local planning authorities on paper. Previous research done in the Hubli-Dharwad region highlighted the need for the integration of planning mechanisms of the HDUDA and DZP (Subhas M S, 1997). However, little is known about the specific role and responsibilities of the Board and also about the factors that hamper its implementation.

The main policy mechanisms identified to guide land-use and ameliorate the impact of urban expansion on peri-urban areas are the Comprehensive Development Plan, revised every 10 years by HDUDA, and more specifically a designated green belt within the plan, earmarked for agriculture and future expansion of

settlements. Both mechanisms appear to have taken little account of environmental considerations and also lack a broader vision of regional development to promote a more efficient use of renewable natural resources in the PUI.

Implications for Policy and Practice

The use of information technology would be a step forward in improving the understanding of urban growth and in informing the planning

process. Planning processes for sustainable urbanisation require consultation beyond the urban boundaries. It should also include people at the local level, including both farmers and industrialists of whom are concerned with land use. The role played by the broader citizenry and media is also important for determining land use. Government and community partnerships in sustainable environmental management is usually crucial to the success of initiatives (Boxes 2.5 and 2.6)



Brick making eating into agricultural land

Box 2.5: *Restoring the Oval Dream*

The Oval is a 22 acre recreation ground owned by the Government of Maharashtra in Mumbai, India. To encourage donations, the Oval Trust was registered whose main objective was to restore the Oval and to create infrastructure, a water supply system, plant palm trees to border the ground and improve soil cover. Professionals sensitive to urban conservation executed an effective fund raising strategy. No loans were taken. No survey plans of the Oval existed with any authority. Therefore a detailed survey of the land was commissioned. To determine usage patterns, trustees interacted with all stakeholders - residents; cricket clubs, football players, commuters, walkers and a cross section of all who used the Oval particularly the under privileged for whom no other free open space was available. All their needs were built into the restoration plan keeping in mind the Oval's heritage status, which allowed only limited interventions.

The rubble of decades thrown by errant contractors and careless citizens was removed. A new watering system was laid to green the ground and the land leveled. The quality of air in the Oval is noticeably cleaner and the temperature many degrees cooler due to this greening and planting of over 500 palm trees. Land is watered from a municipal connection and well fed by a perennial underground stream. Vegetable waste from the ground is composted and reused. Waste paper strewn by the public is collected for recycling.

Mobilising public opinion and community involvement was an important ingredient to success. Another lesson learnt was that greedy eyes are always cast on open spaces. Proposals made by the authorities for 'improvements' to the ground included the construction of a club house, a stadium, a shopping center, cafeterias despite the fact that their own plans show this area to be part of the green belt. The unrelenting objections by the public supported by the media stopped these plans from passing. Eternal vigilance is also the price of an open ground. Another lesson was on influencing government. It was inexplicable how government could not approve a project so pre-eminently in the city's interest, especially when citizens were to raise the funds and do all the work voluntarily. In other words, no commitment was asked for from government in terms of money, time or manpower. The government, however, sounded the trust to restore the adjacent recreation ground called Cross Maiden which is partly used for fairs and exhibitions. When not in such use, it is a decertified no man's land. The trust plans to restore it so that social activities can continue and between fairs the Maiden can also be used for recreation. The Oval Trust is creating a garden outside the library building of the state's Prince of Wales Museum, a grade 1 heritage building and has also been asked to restore vast campus grounds of the Grant Medical College, a grade 11B heritage building. It has established that qualitative improvements in the city can be made. This unique agreement between government, municipality and citizens, characterized by mutual good faith and motivated solely by public interest has pointed the way for other projects to improve this great city and its never-say-die population.

UN Habitat's Best Practices Database website: <http://www.bestpractices.org>

Box 2.6 *Operation Sunshine*

Garbage and filth was a common sight in Calcutta due to indiscriminate disposal of solid waste on city streets. It became almost impossible to keep the city clean. Calcutta Municipal Corporation (CMC) has adopted a two-pronged approach for improving the environment and health of the city: solid waste management and removal of unauthorized stalls from roadways. Private carriers transport nearly 40 percent of daily garbage. Of the remaining 60 percent, CMC employs three main systems: manual loaded vehicles, pay loader loaded vehicles and containerised vehicles. An average of 430 vehicle trips are performed daily to remove garbage from the city to the disposal ground.

Besides the city's 200 markets, over 100 roadside markets have sprung up. Most important road pavements were encroached by hawkers with make-shift stalls. There are over 3,000 bastees and slums with over flowing populations. Nearly 3 million people from neighbouring districts come to Calcutta everyday for their livelihoods. This huge population with large scale road encroachments, forced pedestrians to use the road which caused tremendous traffic jams particularly during peak hours. The average speed of vehicles came down to as low as 8km/hr adding high amount of air pollution from vehicle exhaust. Shops and business and people in general got into the habit of throwing waste on roads. Piling up garbage all over the city and increasing road encroachment provided the motivation to develop some correcting initiative. The average daily accumulation of garbage is of the order of 2,500 metric ton. There was no partnership between other institutions before the initiative began.

At the direction of the Government of West Bengal, CMC launched OPERATION SUNSHINE - removing large-scale encroachments numbering about 8,000 on the night of November 24, 1996. In subsequent operations, nearly 10,000 such unauthorised stalls were removed. From February 1st, 1998, CMC embarked on separation of clinical and bio-medical wastes at source of nearly 500 hospitals, nursing homes, laboratories, clinics in a scientific manner. This initiative is the first of its kind in India. It also established partnerships with the private sector for waste recycling.

The disposal ground is at an average distance of 12km from the collection points. Computerized weigh bridges have been installed at the check post of the disposal ground where all vehicles are checked and recorded to provide daily trips and weight. Bulldozers are deployed at the disposal ground to spread and compact the garbage. From September, 1995 Calcutta Municipal Corporation has been making great efforts to launch special cleaning drives and intensive awareness campaign. The culmination of all these programmes is the introduction of garbage Carrying Charge with effect from 1st January, 1997.

Towards the end of 1995 the House-to-House collection of waste system was started in a low key way which covered 70 per cent of the city area with the support of people, particularly in domestic areas. The Municipal Workers, after the initial road sweeping, moved in with hand carts, whistling to signal people to throw waste into their hand carts. The commercial areas are yet to cooperate fully in this system. In August, 1996 a two-day seminar on LOVE CALCUTTA was organised to focus on roads, with Ministers of State Government, Councilors of Municipal Corporation, officers connected with civic services and the general public to raise public awareness on the environment.

UN Habitat's Best Practices Database website: <http://www.bestpractices.org>

The HDUDA board consists of representatives from numerous organisations, notably the HDMC and agencies responsible for infrastructure, such as water supply and drainage. However, representatives of agricultural departments from the Dharwad Zilla Panchayat could usefully provide information on good agriculturally productive land for planning purposes. The planning process should not only be limited to Hubli-Dharwad city but should include all villages coming under the relevant blocks or taluks. Existing literature in India on the subject of land use policy links today's policy needs to Agenda-21 of the United Nations (Box 2.7).

This literature however is not cognisant of the peri-urban features and their specific policy needs. In the PUI, the continuous expansion of the city and rapid migration to the city needs to be better regulated (Box 2.9). Several national and international innovations point to new directions for policy formulation for the PUI which span zoning to taxation strategies.

- **Credit:** Increased access to credit for small farmers in the peri-urban interface and to other farm inputs could potentially increase productivity. Most importantly this would prevent migration. This must include farmers dwelling within the boundary of the municipal authority, who currently are classified as being 'urban' and are therefore not eligible for preferential credit terms as compared to farmers falling under the Panchayati Raj system.
- **Zoning:** Rapid growth without creating boundaries should not be allowed without creating green areas in between. In two cases, Nagpur in India and Vancouver and its satellite townships in Canada, urban sprawl has been contained using different strategies (Allen and

You, 2002 p75). In Nagpur the city authorities refused to allow the sale of land around the city. In Vancouver an incentive structure was used where concentration of mid-income housing and employment creation in satellite townships with green areas in between the satellite townships and the city were created to attract residents and preserve the environment.

- **Taxation:** Another strategy that can be used for better land utilization is a land taxation policy with built in incentive and disincentive structures. Vacant land in the city should be highly taxed to prevent the non utilisation of these lands. Taxes for renovations and modifications in the city should be lowered so that people will not leave them vacant (Allen and You, 2002 p95).
- **Ratio of Built to Vacant Land:** A third strategy for more effective land use in the city includes the fixing of a higher ratio of the building to the site. If these limits are violated then the vacant land should be taxed highly.
- **Labour Creation and Labour Sharing:** A final strategy to prevent rural urban migration revolves around creating more employment in the villages by setting up rural based industries. Alternatively employment can be generated by community labour participation and sharing on different people's lands as described in the Pragathi Bandhu Model (Box 2.8). Such kinds of labour sharing concepts if adopted in the peri-urban interface could result in the cultivation of fallow lands of asset poor farmers, thereby encouraging them not to migrate to cities for employment as casual labourers. This additionally could provide a more secure livelihood and enable farmers to retain their assets in the form of lands.

Box 2.7: Prerequisites of a Good Policy

Given the rapid increase in urbanisation combined with increased migration and urban population, the pressure on land in and around cities will increase. This, if left unattended, will result in illegal settlements, poor sanitation conditions, improper facilities and depletion in natural resources, especially in the peri-urban interface. In turn unchecked sprawl results in a toll on urban populations in the form of increased commutable distances, more air, noise and water pollution. According to Agenda-21 the biggest problem is the rapid population growth which reduces the land availability to a great extent and also generates environmental degradation directly or indirectly.

More stress needs to be given to:

1. Involvement of people at local level including industrialists who are concerned with land use; use of land properly, keeping in view its capability and owner's need;
2. Encouragement of users/owners for best possible land use specially in hilly areas;
3. Review of regulatory and legal framework for local panchayats and the entire country;
4. Ecosystem/watershed approach in land use;
5. Demonstration/development of efficient land use plans versus traditional methods;
6. Making of more accurate evaluation of land use;
7. Development and implementation of low cost management system;
8. More research regarding land resource use potential and then interaction study with farm and farmers;
9. Education and training of beneficiaries according to land use needs and comprehensive integrated approach;
10. Encouragement of public participation (since hills and plains conditions are quite different);
11. Adoption of a comprehensive approach for land use for environmental and economic gains.

Source: Singh (2002)

Box 2.8: Pragathi Bandhu Model

Belthangady Taluka, in Dakshina Kannada District of Karnataka State comprising of 81 villages has 18,000 families of small and marginal mostly illiterate farmers with landholdings ranging from 0.5 to 1.5 hectares, whose lands were left fallow. Family members worked as farm hands for the local landlord. SKDRDP, an NGO with twenty years of experience, created the Pragathi Bandhu Model for integrated rural development with small farmer participation. Pragathi Bandhu Groups comprising of five to eight neighbourhood families were created whose aim was to develop an efficient system enabling small farmers to cultivate their lands, develop other infrastructure and gain access to credit for land development and information on new cultivation. The strategy used was sharing of labour and financial resources.

Over eight years the initiative improved living conditions of almost 10,000 families. About 4000 ha. of uncultivated lands have been brought under cultivation. Through water harvesting and building tanks and good rains, 8000 ha. of lands were brought under irrigation enabling permanent crops. The infrastructure and labour for cultivation and irrigation was generated through a concept called labour sharing where group members contribute one day a week towards working on each member's lands.

The results are that the villages have sufficient resources to be independent. Those who worked on other people's lands now have their own plantation gardens. Illiterate farmers, talk eloquently on organic farming, soil conservation and ecological balance. Raised awareness towards protecting natural resources in these communities is reflected in afforestation, community medicinal gardens, cultivation of roadside trees, and school garden initiatives. The programme has been replicated in the neighbouring taluka easily as it utilises the natural capacity of its stakeholders and promotes growth through people's participation.

Similarly in another model in Rajasthan the Tarun Bharat Sangh has developed 300 water harvesting structures called Johads using traditional knowledge systems and local experience. This has resulted in converting vast areas of barren land into fertile agricultural land simultaneously reducing migration due to increased employment.

UN Habitat's Best Practices Database website:
<http://www.bestpractices.org>

- **Green Rating of Industry:** One solution to reversing the trend of rural to urban migration is to generate employment by setting up industry in rural areas. To prevent the consequent risk of industrial pollution a green rating of potential industrial units can be conducted. Here the industrial process has to be scrutinized before and after it is set up to ensure minimal environmental damage.
- **Encouraging the Participation of Voluntary Organizations in the PUI:** Here community based strategies to manage natural resources, to prevent the misuse of land, to rate industry and to create employment sharing by the community is only possible with the active participation of NGOs in this area.

Box 2.9: Reversing Rural-Urban Migration: The Delhi Case

As a result of urbanization in the post-independence period, the rural-urban composition of population in Delhi has undergone one of the sharpest changes. It was 47.24:52.76 % in 1901, which became 17.60:82.40 % in 1951 and 7.3:92.7 % in 1981. During the period 1981-91, the share of rural population has increased for the first time. It is now 10.07:89.93 % as rural population has more than doubled from 452,000 in 1981 to 943,000 in 1991. The main reasons for this abnormal increase seems to be:

- The population in urban areas has reached a saturation point and migrant population is settling in rural areas of Delhi;
- Rents/rates of property in urban areas are much higher than in the rural areas; and
- Many industries have been set up in rural areas; thereby a large number of working force has shifted to nearby rural areas.

Source: Boorana (2002)



END NOTE

- 1 Data collected as part of this study.

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Cropping Systems

Robert Brook, Chandrashekar Hunshal, B Basavaraj, Paul Smith



Growth of horticulture in the PUI

Introduction

Box 3.1: Agriculture in the PUI

Peri-urban agriculture occurs surrounding the boundaries of cities and includes crop and livestock production, fisheries and forestry, as well as the ecological services they provide. Two-third of peri-urban populations are involved in agriculture for home consumption or catering to local markets. Peri-urban agriculture competes for resources – land, water, energy, labour – to satisfy requirements of the urban population.

Source: FAO (1999)

The cropping system in any location is governed by the soil type and climatic conditions. Other factors that are important are social and economic. In the context of the PUI, it was hypothesised that proximity to urban areas may influence the crops being grown, driven by factors such as market opportunities, labour availability and cost, access to resources (including knowledge), amongst others.

An investigation was carried out to test the hypothesis that urbanisation influences cropping systems, and to gain a better understanding of changes in the cropping system in the PUI.

Eight paired peri-urban villages along four transects (northern, southern, eastern and western directions) were selected, located either

near the periphery of the urban area or around 10km from the periphery. Two villages to the north (Dasankoppa and Pudakalkatti) and the west (Kelageri and Mandihal) of Dharwad and two villages to the east (Bidnal and Shiraguppi) and the south (Gabbur and Inamveerapur) of Hubli were selected. (Map2.2)

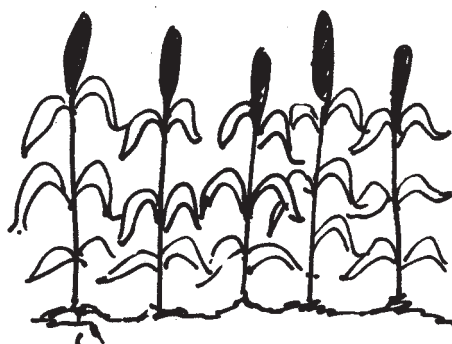
In each of the eight villages, with the aid of revenue maps from the Directorate of Survey Settlements and Land Records of Dharwad and Hubli and the village accountant (a key informant), area of crops grown were recorded for both the monsoon (*kharif*) and the post-monsoon (*rabi*) seasons. From this, the proportion of land in each village devoted to specific cropping systems was calculated.

Recognising that eight villages is a small sample out of more than 100 that could be considered to be peri-urban, cropping systems were also recorded along linear transects connecting the paired villages named above. A global position system (GPS) receiver was used to plot positions on a map and transects were covered by walking in as straight a line as tracks, field boundaries and natural obstacles permitted, starting from a village near the city and ending at the more distant village. Cropping systems were recorded at 100m intervals, whereas soil samples were collected at 500m intervals.

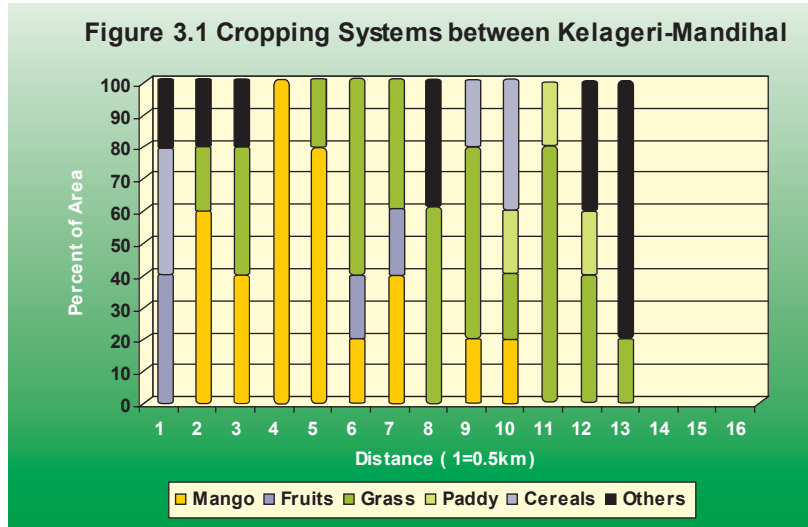
Soil and Climate

1. The study villages lie in 3 different climatic zones, i.e., hilly zone receiving rainfall of about 1000mm (Mandihal), transitional zone receiving rainfall of about 700–800mm (Kelageri, Dasankoppa, Pudakalkatti, Gabbur, Inamveerapur and Bidnal) and northern dry zone receiving rainfall of about 650mm (Shiraguppi).
2. The rainfall in these zones is bimodal (*kharif* and *rabi* seasons), received during June to October with two peaks as high as 150mm per month. In general, the rainfall declines sharply from west to east and less markedly from north to south of Hubli-Dharwad.
3. In each transect the soil and climate were different. Very broadly, the soils of north Dharwad transect were medium black (vertisols), the west transect were paddy soils (inceptisols), east of Hubli were deep black soils (vertisols) and south of Hubli were mixed red and black.

The fact that variation in rainfall patterns and soil types ran in different directions made selection of sample villages difficult, particularly as a transect approach to determining influences of urbanisation was considered to be important.



Spatial Differences in Cropping along Transects



Kelageri to Mandihal Transect¹

- Each bar on the graph is a mean of five points, recorded at 100m interval.
- There is not a smooth transition from one cropping system to another: much 'patchiness' is evident. Nevertheless, broad trends are evident.
- This transect is dominated by mango and grass cover with mango grown largely within 5km from Kelageri. The red soils found here are more suited for mango cultivation.

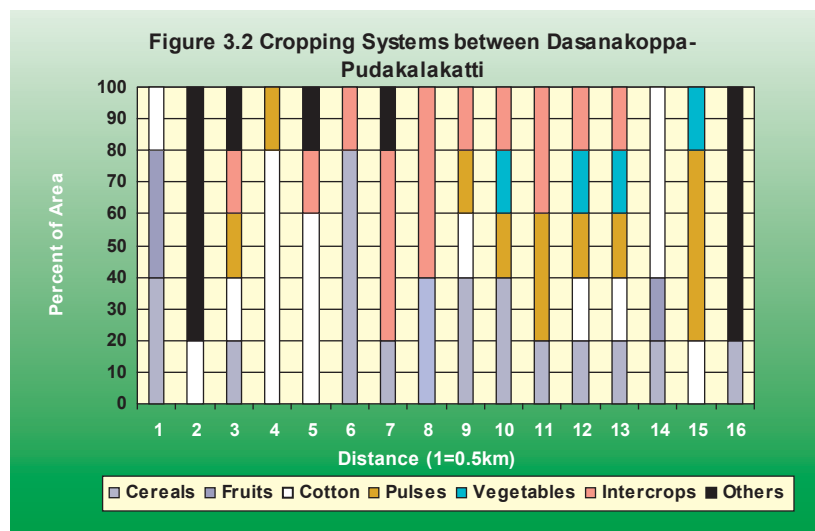
- The large area of grass cover along the transect is due to the hilly terrain which is usually uncultivated.

Urbanisation effect

- Mango cultivation is due to urban market demand, good roads and its low labour requirements compared to annual crops.
- More villagers seeking urban employment creating a labour shortage for agriculture.
- The affluent urban class buy up large tracts of land for commercial horticulture, to avoid taxes.



Dasankoppa – Pudakalkatti Transect



This transect is dominated by cotton, pulses and intercrops. At the far end of the transect (beyond 5km) vegetables are cultivated due to irrigation facilities being available.

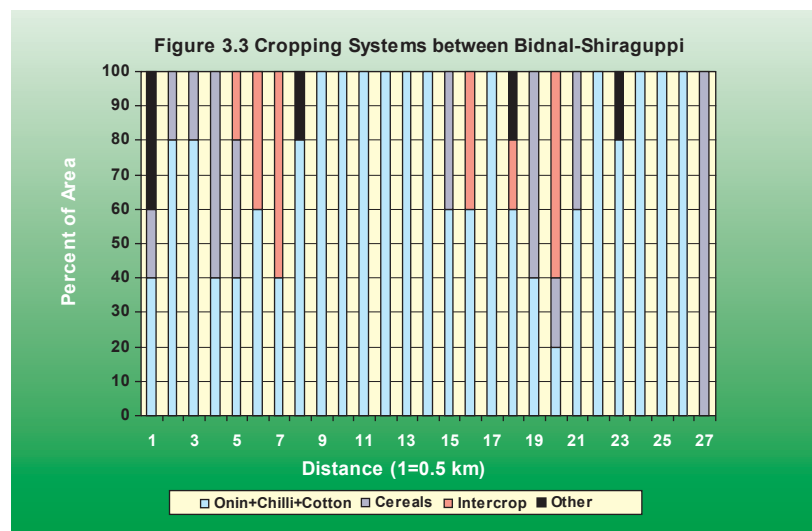
Urbanisation effect

- Vegetables, highly perishable products are in continuous demand from urban centres.
- Thus vegetable production here is a function of market forces as well as the availability of bore well irrigation, and good road transportation to Dharwad market.



Vegetable cultivation through borewell irrigation, Pudkalkatti

Bidnal – Shiraguppi Transect²



- This transect is dominated by an intercropping system where onion + chilli + cotton are grown.
- Traditional cotton is grown here because it is well suited to rainfed conditions. Farmers do not use pesticide on local cotton.
- The soils being deep with high moisture holding capacity, allow the cropping period

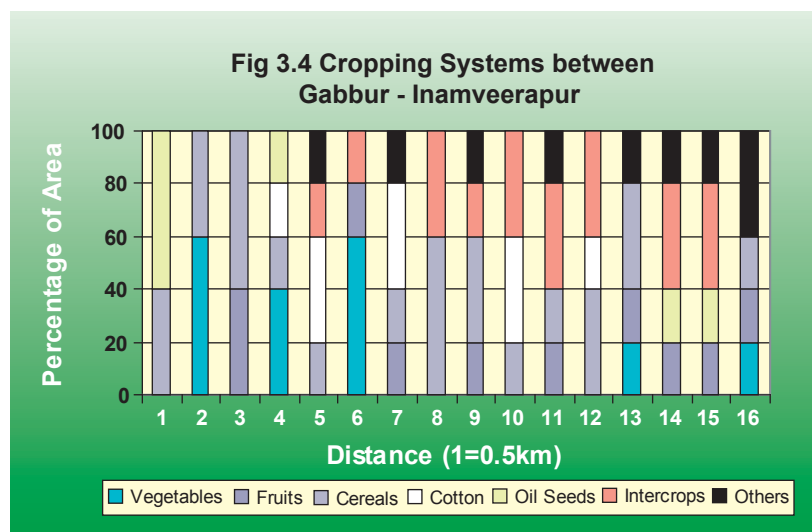
to be extended into the *rabi* season, despite scanty *rabi* rains. This is in contrast to Mandihal on the western transect, where rainfall is 50% higher, but the soils have a low water holding capacity.

Urbanisation effect

- Cropping here is influenced by soil and climate rather than urban development



Chilli cultivation, eastern transect



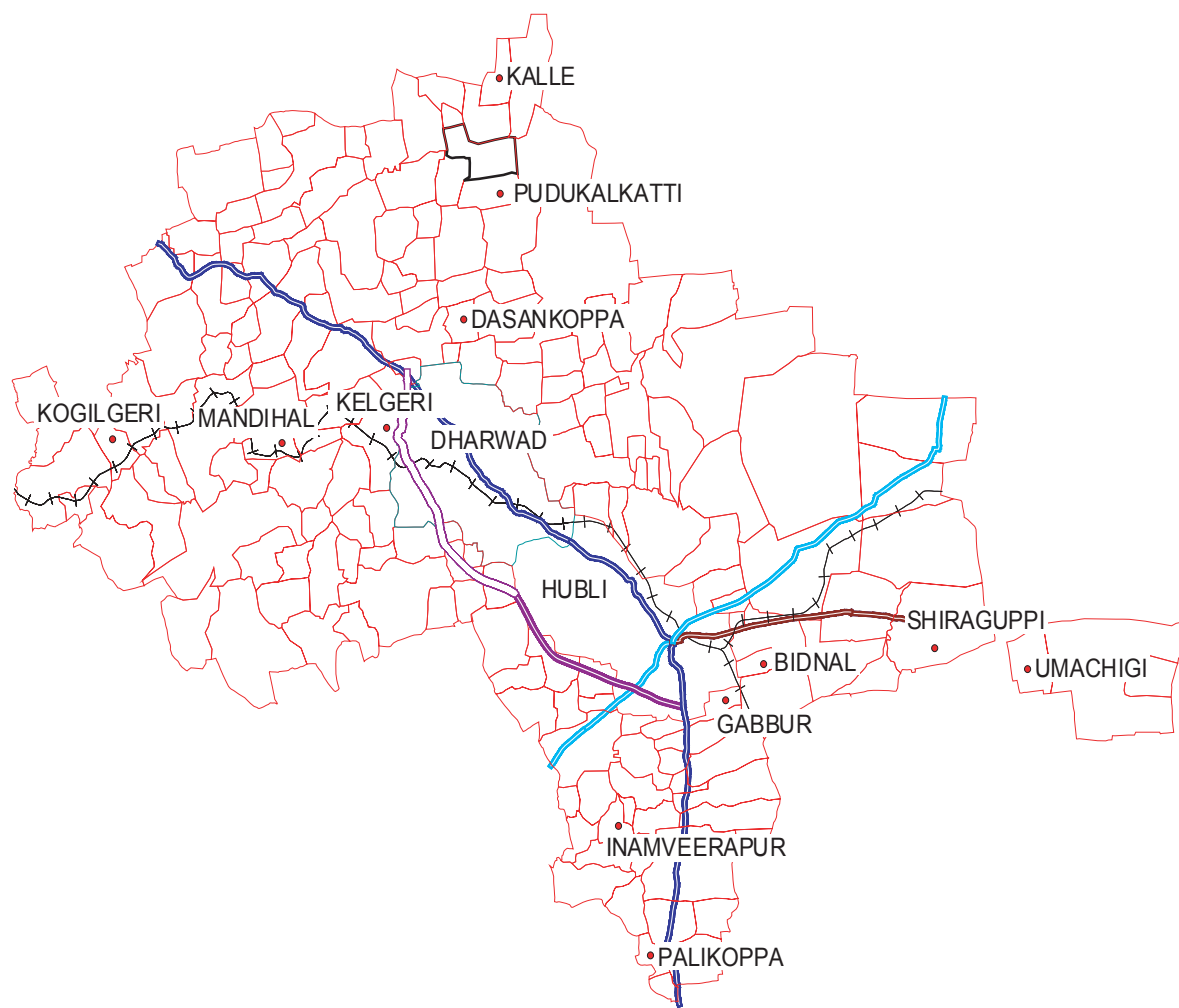
- This transect lies along a *nalla* (natural water course) into which sewage contaminated waste water flows. In villages as far as Inamveerapur, this permits year round irrigation of vegetable crops, although in summer the *nalla* dries up at Inamveerapur.
- Vegetable cultivation was observed up to 3.5km from Gabbur and again between 6 and 8km.
- All along the transect, fruit crops such as sapota and guava are grown.

Urbanisation effect

- Vegetable and fruit production is strongly influenced by the presence of the urban market.
- Other contributing factors include the presence of Hirehalla stream joined by Hubli sewage and good roads, especially the national highway 3.

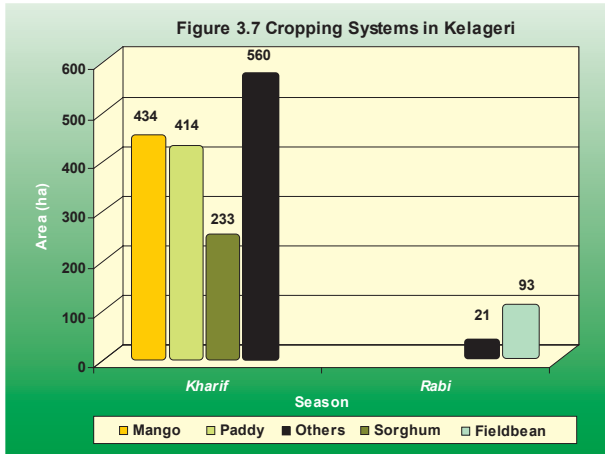
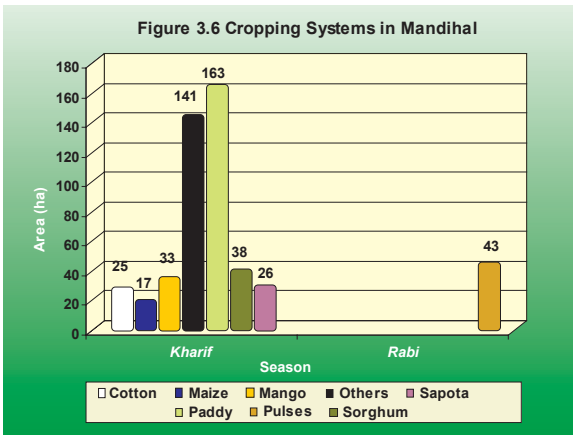
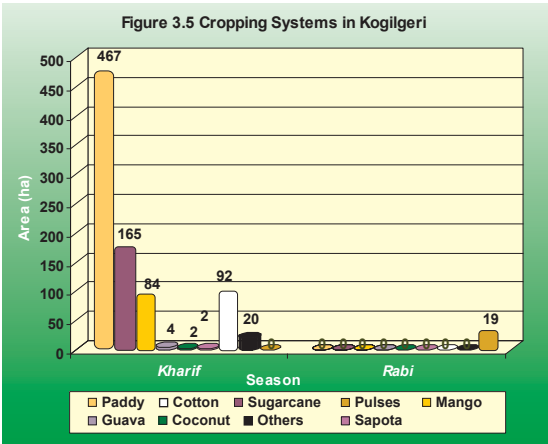


Fruit production under sewage irrigation, Inamveerapur



Map 3.1

Village Cropping Systems (Western Transect³)



In each of the four transects, a village farther away (beyond 20km) which is rural (less influenced by urbanisation) was also studied to provide a comparative urban – peri-urban – rural perspective. These villages were Kogilgeri, Kalle, Umachagi and Palikoppa (Map 3.1).

Western Transect Villages

Kogilgeri (23km) (Fig 3.5)

Majority of the cultivated area is under field crops with 56% paddy. Plantation crops cover about 11% of which mango occupies 10%.

During *rabi* hardly 2.16% of area is cultivated of which the major area is occupied by field bean grown on low land paddy soils.

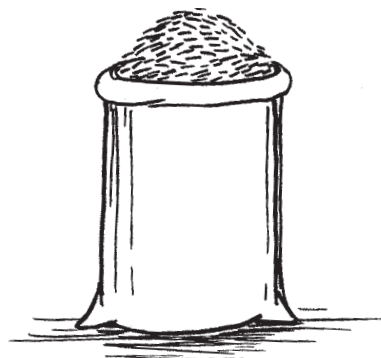
Mandihal (11km) (Fig 3.6)

Cultivated area in this village is 92% of the total village area. The major crop is paddy (37%) by virtue of soil type (paddy soils) and higher rainfall (hilly zone). Rest of the area is under annual crops: sorghum, cotton, maize and fruit trees: mango, sapota, and timber trees.

During *rabi* pulses dominated in the lowlands (8.5% of the area), utilising residual moisture.

Urbanisation effect

- Mango and sapota gardens are owned both by local as well as city dwellers.
- Landholdings are smaller and few people (especially men) commute to Dharwad. As such agricultural crops are predominant.
- During off season poorer villagers are engaged in stone quarries.



Kelageri (5.5km) (Fig 3.7)

Cultivated area is 78.3% of the total village area. The major cropping system in *kharif* includes mango, paddy, grasses and sorghum.

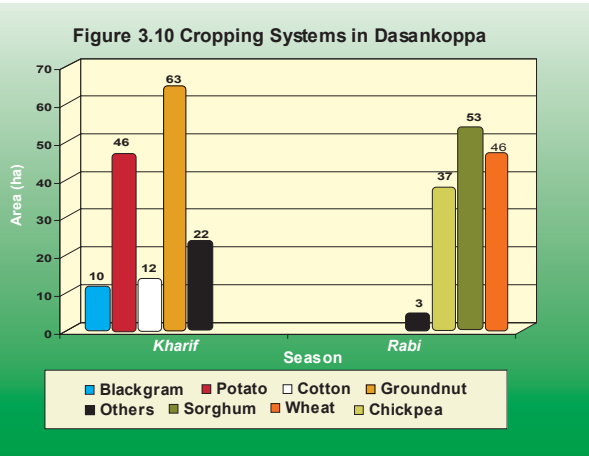
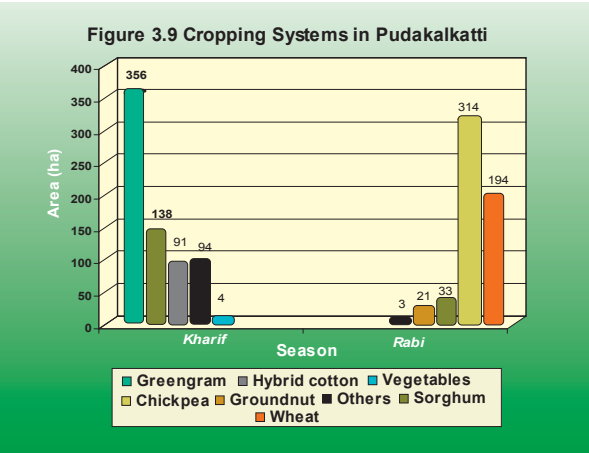
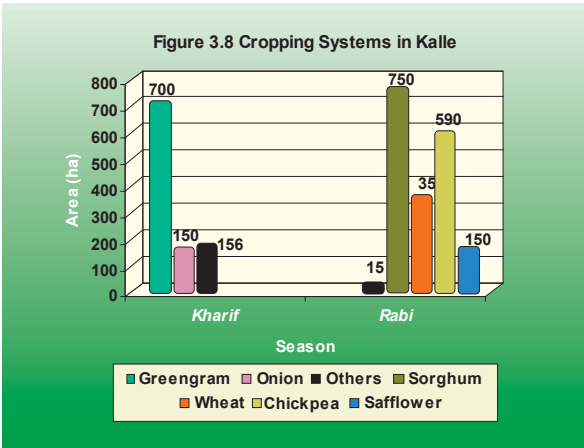
During *rabi* only 4.5% of area is cultivated; the major annual crop grown being field bean in low land paddy soils.

Urbanisation effect

- Mango is dominant in Kelageri, being closest to the Dharwad market where there is demand for mango variety 'Alphonso', both for local consumption and export.
- Soil and climatic conditions are highly suitable for mango cultivation.
- Due to the large number of people commuting (both men and women) to Dharwad, less labour intensive crops like mango are preferred.
- Large proportion of land under grass cover (including grass under mango) supports dairy enterprises (another predominantly peri-urban activity) in the village (since there is no nearby forest and common lands).

Note: Kelageri is situated within the Dharwad city on the western side, 5.5km from the city centre

Village Cropping Systems (Northern Transect⁴)



Northern Transect Villages

Kalle (32km) (Fig 3.8)

During *kharif* 70% of cultivated area is under greengram and 15% under onion grown on black soils. During *rabi* 82% area is cultivated with sorghum, chickpea, wheat and safflower due to more assured rains in *rabi* and high water holding capacity of soils.

Pudakalkatti (18km) (Fig 3.9)

During *kharif* greengram (52%) is the major crop followed by groundnut (20%) and cotton (13%) with a small but increasing area under vegetables.

During *rabi* 82% of the land is cropped with chickpea, wheat and sorghum with a small area again under vegetables.

Urbanisation effect

The village is accessible to Dharwad by 5 different roads facilitating vegetable cultivation under irrigation. Vegetable production is increasing, but from a negligible base.

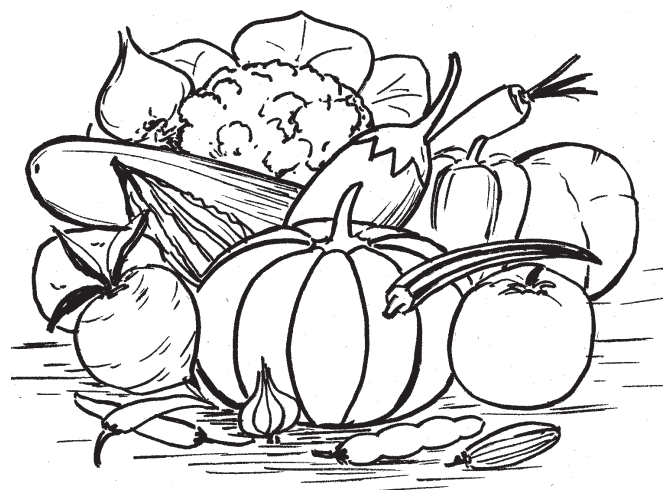
Dasankoppa (8km) (Fig 3.10)

During *kharif* groundnut, potato and cotton are the major crops grown.

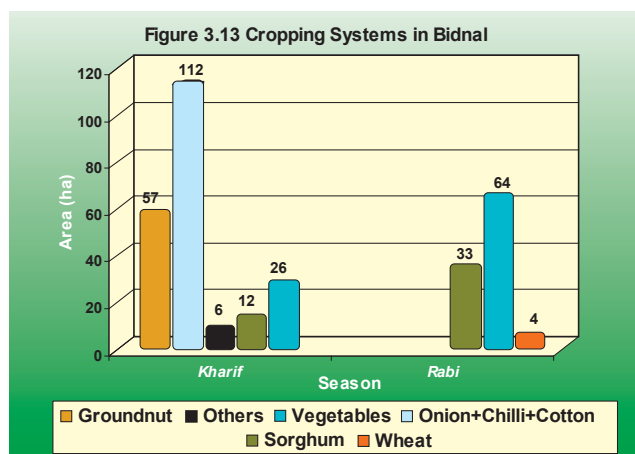
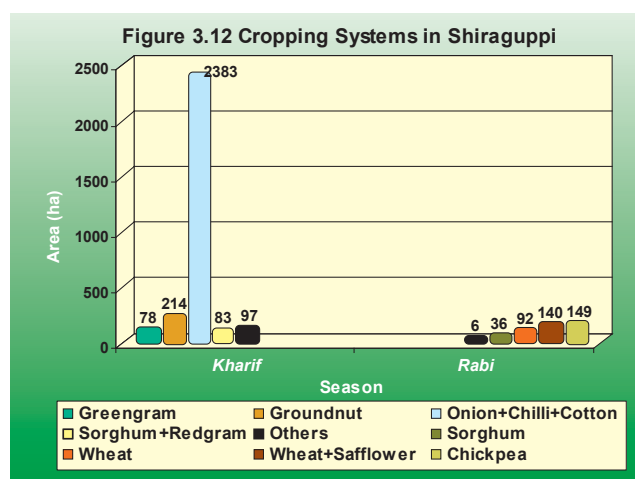
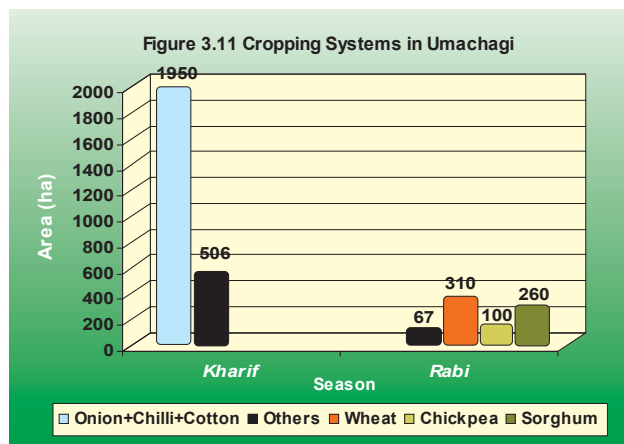
During *rabi* 86.5% of the area is under sorghum, wheat and chickpea grown due to better distribution of rainfall across the seasons and high moisture holding capacity of black soils.

Urbanisation effect

- The village is situated off the main road on a poor quality village road and discourages public transport. Irrigation provision is poor, so vegetable cultivation is not feasible. Soils are not suited for mango cultivation.
- Overall, the effects of urbanisation are limited to commuting and are not evident in cropping systems.



Village Cropping Systems (Eastern Transect⁵)



Easteren Transect Villages⁵

Umachagi(32km) (Fig 3.11)

A similar situation as that of Shiraguppi exists with respect to cropping, onion + chilli + cotton intercrop being the major cropping during *kharif*.

Chickpea and wheat are the major crops during *rabi*.

Shiraguppi (15km) (Fig 3.12)

Nearly all cultivable area is cropped during *kharif* with onion + chilli + cotton intercrop occupying 83%. Groundnut, greengram and sorghum + redgram intercrop occupy the remaining area.

During *rabi*, chickpea, wheat + safflower intercrop and sole wheat are the major crops.

Urbanisation effect

- No urbanisation effects and hence traditional cropping exists based on soil and climatic conditions.

Bidnal (3km) (Fig 3.13)

About 57% of cultivated area is cropped with onion + chilli + cotton intercrop and the rest with groundnut (29%), sorghum, cotton and vegetables during *kharif*. More favourable rains during *kharif* and the presence of deep black soils have favoured onion + chilli + cotton system.

During *rabi*, sorghum occupies more than half the cultivable area, vegetables occupy 41% and wheat the remainder.

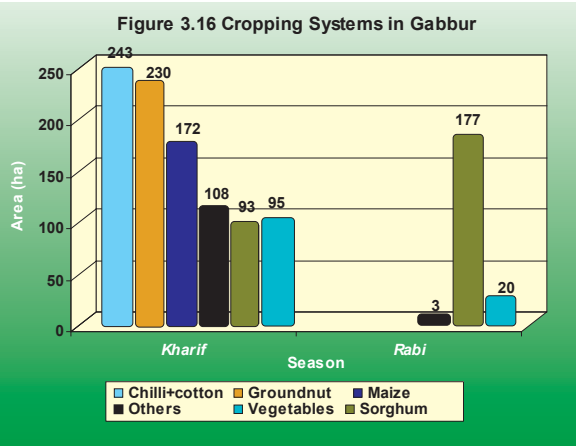
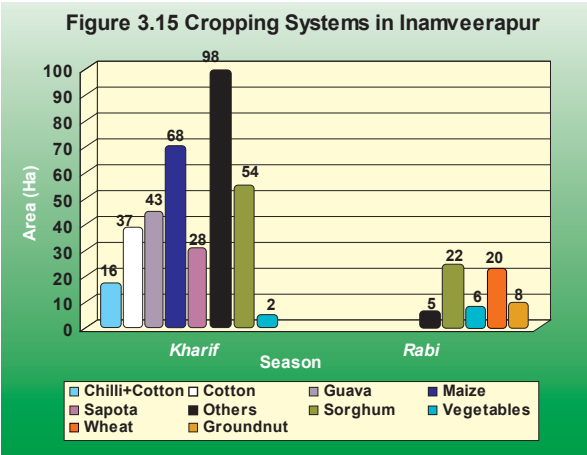
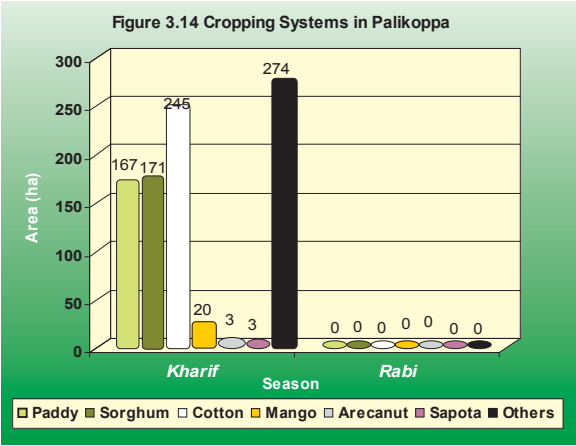
Urbanisation effect

- Sewage irrigation from Hubli allows vegetable cultivation year round. Other factors include strong market demand for vegetables from the Hubli market with easy transportation facilitated by the national highway. Bidnal is within the Hubli-Dharwad Corporation boundary.

Note: In Bidnal few varieties of vegetables of longer duration are cultivated compared to Gabbur. In Bidnal vegetable producers have larger holdings and are better off than Gabbur farmers who have smaller holdings and prefer to grow short duration vegetable with multi-cuts to gain quicker returns.



Village Cropping Systems (Southern Transect)



Southern Transect Villages

Palikoppa (22km) (Fig 3.14)

In *kharif* cropping area is more because of red soils wherein paddy, cotton and sorghum are dominant. However, mango, arecanut and sapota are grown in very small proportions.

Inamveerapur (12km) (Fig 3.15)

It has a wide diversity of crops with 88.5% of the area cultivated during *kharif* with sorghum, maize, cotton as the major field crops and sapota, guava and vegetables as horticultural crops.

Urbanisation effect

- Presence of sewage irrigation as well as borewells, along with easy accessibility to Hubli market has facilitated production of vegetables and fruit crops.
- Landholdings compared to Gabbur being slightly higher has facilitated growing fruit tree crops.
- Borewells supplement the sewage irrigation during summer.

Gabbur (4km) (Fig 3.16)

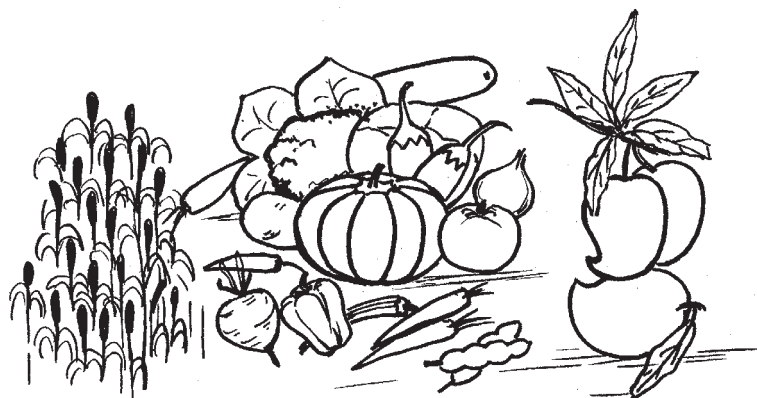
More than 90% of the village land area is cropped during *kharif* with major cropping under chilli+cotton, groundnut, maize, sorghum and vegetables.

During *rabi* 19% is cultivated with major area under sorghum and the rest with vegetables.

Urbanisation effect

- Presence of sewage has diversified the vegetable production during *rabi* and summer.
- Village being located on the outskirts of Hubli with good transport facilities has facilitated marketing of vegetables.
- Vegetables are grown exclusively by pumping sewage water.

Note: Many of the landholdings in Gabbur are owned by people from Hubli. The sewage is available to Gabbur all through the year whereas the quantity decreases as it flows through Inamveerapur in summer. Accordingly, many borewells have been sunk to supplement irrigation to vegetables and fruit crops. In Inamveerapur the area under sapota is increasing, replacing guava, because of fewer diseases and pests, and a better price than guava which is more perishable than sapota.



Box 3.2 Vegetable Cultivation around Cities

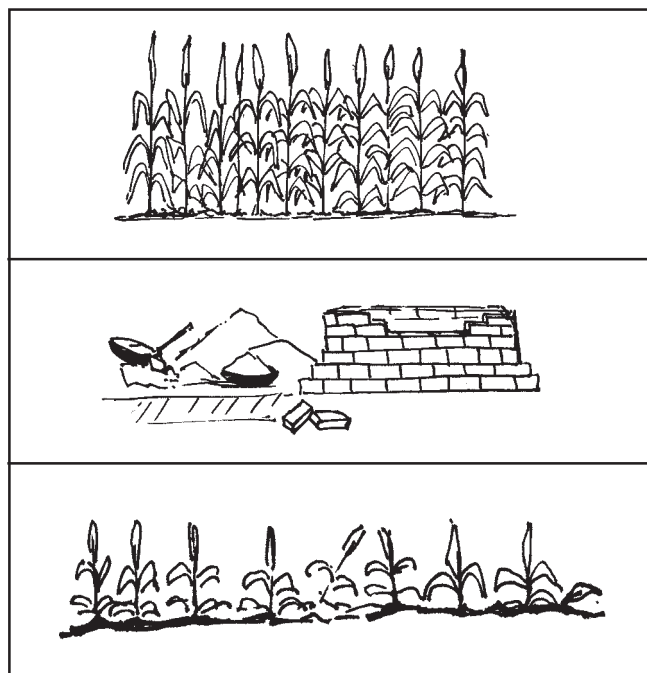
Vegetable production has expanded around cities in many developing countries. The broad diversity of horticultural crop species allows year-round production, employment and income. Also, short production cycles of 60–90 days provide a quick response to emergency food needs. Leafy vegetables provide a quick return for farming households to meet their daily cash needs to purchase food.

Source: FAO 1999

In Gabbur especially, leafy vegetables are predominantly grown by small and poor farmers whose landholdings are very small and for whom quick returns on their produce is very important.

Box 3.3 Soil Fertility along the Transects

In the western transect to a distance of 3.5km the nitrogen status of soils is lower compared to soil at the far end due to removal of top soil for brick-making and also mango cultivated nearer to Dharwad, which is not fertilised as frequently as the field crops like rice at the farther end. In the southern transect, nitrogen and potash status of soils decreased with distance from Hubli, probably due to a decrease in the nutrient load in the sewage and lower availability of sewage water for irrigation. There were no discernible fertility trends along the northern or eastern transects.



CONCLUSIONS

Although the soil and climatic conditions determine the cropping system of any location, proximity to the urban area results in changes in cropping systems, depending on the demand for the commodity and availability of transport and irrigation facilities. Some of the urban effects observed on cropping systems are indicated below.

The shift in cropping from field crops to mango (principally along the western transect) is due to a combination of very favourable soils and climate along with a tax break for establishing orchards, and greater number of people commuting to Dharwad. This leads to less labour intensive cropping (tree crops) which has a good market, aided by good transport facilities.

Good accessibility to Dharwad coupled with the good underground water sources for irrigation have led to growing vegetables in Pudukalkatti throughout the year.

Availability of sewage irrigation throughout the year coupled with good transport facilities provides greater opportunities for production of vegetables and fruit crops as noticed in Bidnal, Gabbur and Inamveerapur. However the quantity of sewage decreases during the summer making its availability lower at the far end, which has led to more underground water extraction in Inamveerapur to supplement irrigation in summer. People in Inamveerapur are ready to risk the capital costs of installing borewells since they are able to market vegetables and fruits.

The poor who are unable to maintain their agriculture for various reasons and have found alternative livelihoods, as in Kelageri, sell the top soil of their lands for brick-making which is financially lucrative. This leads to mining of nutrients and ultimately poor fertility of soils, resulting in weed-infested waste areas.

Box 3.4 National Agriculture Policy 2001–02

A major thrust will be given to development of rainfed and irrigated horticulture, floriculture, roots and tubers, plantation crops, aromatic and medicinal plants, bee-keeping and sericulture for augmenting food supply, promoting exports and generating employment in the rural areas.

Emphasis will be laid on development of marketing infrastructure and techniques of preservation, storage and transportation with a view to reducing post-harvest losses and ensuring a better return to the grower.

Source: Chapter on 'National Agriculture Policy', Annual Report 2001–2002. Department of Agriculture and Cooperation, Ministry of Agriculture, GOI, 2002

Policy Recommendations

Need for Specific Peri Urban Policies

- Given that urban and peri-urban agriculture are on the rise, there is the need for a separate agricultural policy for urban and peri-urban areas.
- Given that cities are constantly expanding their boundaries and including more and more villages within the jurisdiction of the municipalities, there is the need for credit terms for farmers included in the municipal boundary similar to credit terms available to rural villages falling under rural authorities (Zilla Panchayat).

- Informal sector programmes often overlook such enterprises and more attention is needed for provision of training, management assistance, credit and marketing information to micro and small entrepreneurs in the PUI.
- Marketing policies for peri-urban agriculture are needed.

As shown in Box 3.4, the National Agricultural policy emphasis on marketing infrastructure will require that specific planning and assessment take place in the peri-urban villages where the effect and linkages to markets are highest.

- Thus for the PUI, marketing infrastructure would require easy transportation and storage of crops that dominate this area.
- Adequate post harvest technology with specialised cold storage units, transportation infrastructure and packing materials should be made available especially to vegetable and fruit producers. This will protect them from market fluctuations.
- Changing urban needs and demands for chemical free and cleaner produce can provide a potential market niche for peri-urban

producers. Therefore training on value addition to their produce can help increase the profit margins on crops like vegetables and fruits.

- Facilitate the organisation of producer collectives and marketing societies to deal with large markets (Box 3.5)

Agricultural Land Use Policies for Peri-urban Areas

Given the rise of brick kilns around cities and the growth of the construction industry, peri-urban villages are experiencing a degradation of agricultural land due to top soil removal for brick making.

- The brick making industry catering to urban areas need to find alternate raw material to replace top soil which is currently in use
- Selling top soil for brick making results in a long gestation period before top soil can be restored. Till that time the productivity of land is very low. Thus awareness needs to be created among farmers that the short-term gain from selling top soil is uneconomical.

Box 3.5 Producers - Marketing Societies

This is an innovative system facilitated by Agragamee, an NGO in Orissa, where producer societies are federated into marketing societies to facilitate the bargaining power of small producers. Tribal women in Orissa, India, belonging to the poorest sections of society had limited access to resources, employment or to markets. This endeavour on entrepreneurship development helps tribal women in these communities to capitalise on their own resources and skills, empowering them to fight poverty. Grass-roots groups have been federated into producer groups at village, block and district levels. They save in various forms, creating cash, seeds and food banks which cut out middlemen and moneylenders at crucial stages of production and marketing, especially during lean periods. Grass-roots groups have also turned from using their collective savings for thrift and credit to increasing producer bargaining power in the local market, and for value addition to their products. The market network of 'Ama Sangathan' is thus assured for all these groups. Women's collectives, proving self-reliant in decision making are first encouraged to identify and initiate income generating

projects. They are encouraged to generate resources through savings and linkages with the government and banks. One such collective, for example, the 'Mandibisi Mahila Mandal' mobilised \$5,000 to be trained in processing forest products from the Centre for the Advancement of People's Action and Rural Technology (CAPART), Government of India.

Strategically, different producer groups have combined into one marketing society, the 'Ama Sangathan', in order to compete in the market and facilitate licensing, trade marks, and so on, essential for these groups to compete in large markets. The producer society collectively bargains for higher prices for their products, adding value to their products. This simultaneously minimises groups competing with each other on the same products or engaging in price wars. Thus, they take on the responsibility to control their capital and resources, and decide on its use, profit sharing, reinvestment and so on.

Panchayat level groups are the working groups into which individual producer women are invited for membership, which is done through meetings and camps. The groups are encouraged to identify their own leaders and committee members and identify development priorities and define their own initiatives.

Local groups of men and women are taking up the initiative started by the efforts of Agramamee. The women's collectives in the different Panchayats manage the funds, with backup support given by Agramamee personnel for book keeping and accounting. Educated local youth have now begun to take up management of the practice, and through training, and experience, it is envisaged that in a short period, it will be completely self-sustaining. Skill development training has been taken up at various periods of time, to enable groups to command better skills in processing and management. The initiative is sustainable as the products are cultivated by the community traditionally using locally available skills and resources.

Other valuable linkages have been formed with government institutions. Through the Forest Department, women now influence decisions on common resources such as minor forest produce. Minor forest products which were once completely controlled by the state, and business corporations are now being handed over to women's groups for commercial use; land rights are being accorded in tribal areas, over tracts previously under government control. Thus women are gaining access to land and to the produce from this land.

The impact has been state-wide. The department of forests and environment has agreed to help the women build a processing centre for minor forest produce. The tribal welfare department has agreed to fund them for storage space for their stock. The Panchayati Raj Department of the State Government has assured support to market their products and provide finance when necessary.

Women are advisors for tribal development. They sit on various committees to determine forest policy and development policies. They have been able to bring about a liquor ban on tribal regions, and ensure proper wage payment.

The major lesson learned is in understanding how to deal with a large market - how to package products, how to add value, ensure that the products are biologically clean and devoid of pesticides and chemical usage, and thus create a market niche for themselves. This however needs complementary awareness raising among consumers on the value of these products. This initiative is already being replicated by other organisations, although on a smaller scale.

Source: Agramee, UN Habitat's Best Practices database, www.bestpractices.org

Policies for Crops Produced in Peri-Urban Areas

Given that peri-urban villages meet most of the demand of urbanites for highly perishable items, like fruits and vegetables, these producers experience more vulnerability because of the market gluts and resultant wastage. To absorb this waste or ensure that these producers do not simply dump their produce at a very low price, agro processing units can be set up in the PUI.

- Set-up agro processing (i.e., food preparation, packaging, milling, drying and others) industries and value addition to the horticultural produce in the peri-urban villages (Box 3.6).
- Creation of Horticultural Growers Board to regulate prices and facilitate marketing

whereby gluts can be overcome and middlemen avoided.

- Creation of short-term credit linkages to vegetable growers and long-term to fruit growers especially to the small farmers.

Box 3.6 Agro Processing

Setting up of agro-processing units in the producing areas to reduce wastage, especially of horticultural produce, increased value addition and creation of farm employment in rural areas will be encouraged.

Source: Ministry of Agriculture, GOI, 2002

Policies to Restore Natural Resources in the PUI

Due to higher urban wages, labour commutes from the PUI to cities thereby resulting in labour shortage in the former and a resultant neglect of agricultural lands.

- Focusing on a strategy for poor farmers by promoting agri-horti-forestry (Box 3.7) can restore natural resources and stop migration to the city.
- Watershed development for better natural resource conservation will help increase the water resources in the PUI. There should be a simultaneous enforcement of existing rules for groundwater exploitation.



Rice processing unit: Puffed rice production

Such policies can reduce the labour shortage. It can also enhance the natural resource base and ultimately lead to sustained agricultural production in meeting the ever increasing

demand for food from the urban areas. It can also help promote vegetable production in the peri-urban areas.

Box 3.7 Agri-Horti-Forestry

To generate employment, stop migration and improve the quality of life of people BAIF promoted agri-horti-forestry cultivation on wastelands owned by these families. The strategy included a focus on alleviation of poverty among low income families in 5–6 years; generating gainful self-employment; encouraging people's participation through community organisations and identify problems and search for suitable solutions. The new farming system has regenerated forests and conserved bio-diversity. Tree planting has increased green cover and created a cleaner environment. More food and fuel availability have reduced the dependence on natural forests. Soil and water conservation have facilitated groundwater recharging and increased agricultural production.

Source: BAIF, UN Habitat's Best Practices database, www.bestpractices.org

END NOTES

- 1 The effects of urbanisation are discussed in greater detail in the section entitled 'village cropping system'.
- 2 Here it is important to note that the starting point of this particular transect was from the eastern side of Bidnal village while the sewage irrigation farming system of the village existed on the western side across the road closer to Gabbur. Thus no vegetables were recorded.
- 3 Village crop survey data was collected for the year 1999–2000.
- 4 Notes:
 1. In Dasankoppa the underground water resources are very poor and there is great shortage of labour for agriculture activity. Labour is brought in from outside the village during peak demand.
 2. In Pudukalkatti several borewells have been sunk (due to poor monsoons in the last few years) leading to cultivation of vegetables to an extent of 20 ha throughout the year.
- 5 Vegetables grown during *rabi* continue during summer depending on availability of irrigation. Apart from perennial horticultural crops, long duration crops like chilli, cotton, redgram continue from *kharif* into the *rabi* season.

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4 Sewage Irrigated Farming

Andrew Bradford, Chandrashekar Hunshal, Robert Brook



Sewage irrigation in the peri-urban interface

Urban areas generate large volumes of sewage¹ depending on their population, most of which is untreated in India. Sewage usually flows for a long distance, often entering natural water courses. The sewage passes through peri-urban villages and if

the volume is large enough it flows even through rural villages. The villages closer to the city get a greater volume of water for a longer period than more distant villages. Often, crops are grown which depend on sewage availability and urban demand for food. Although urban

generated sewage is a waste product, it is still an opportunity for farmers

to grow crops. Sewage irrigation can lead to health and environmental hazards when the sewage contains heavy metals as a result of industrial pollution and pathogenic micro-flora.



Box 4.1 Hazards of Sewage

In hot climates, sewage can soon lose its content of dissolved oxygen and become 'stale' or 'septic'. The septic sewage has a most offensive odour, usually of hydrogen sulphide and mercaptans. Sometimes a major concern in using sewage effluent for irrigation is the presence of high concentration of hazardous constituents, such as heavy metals, stable organics, complex micro-pollutants and pathogenic microbes. These are harmful in nature and dangerous to public health. This makes the economic and sanitary disposal of sewage a problem of far reaching importance.

Source: Salakinkop (1999)

Around 60 million litres of waste water is produced per day from Hubli-Dharwad, none of which is treated. The waste water flows along natural water courses from Hubli towards the south and from Dharwad in three different directions because of the undulating topography. Along its route(s) farmers exploit this resource for irrigation, especially for fruit and vegetable production. The climate of Hubli-Dharwad is semi-arid (800mm rain per annum), and so cultivation of vegetables in the summer (off season) is a profitable enterprise. Apart from sewage irrigation, vegetable cultivation in the summer in this area is restricted to farms with borewells. However, as borewells are expensive to install and the water table is subject to fluctuations in depth (Chapter 7 on Water Resources), sewage irrigation represents a more reliable alternative. The content of heavy metals in waste water in Hubli-Dharwad is minimal, due to the absence of heavy industry.

Advantages of Waste Water Irrigation

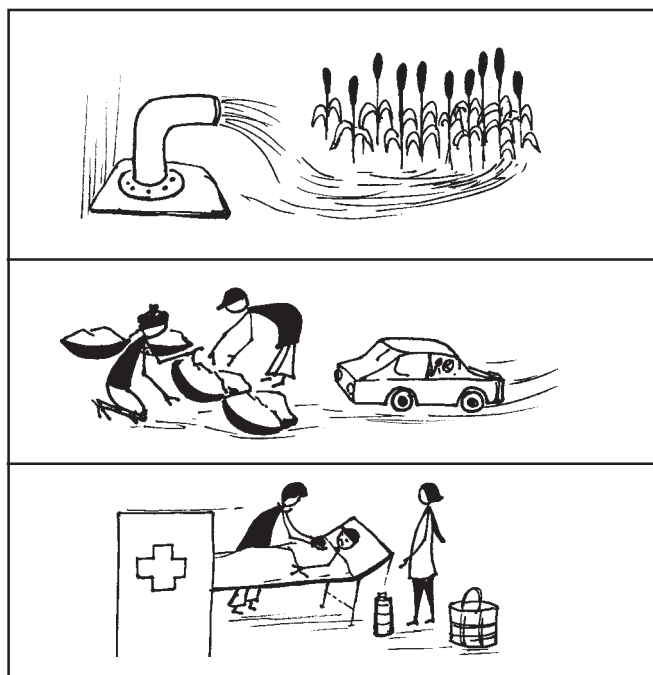
- Higher crop yield (20-25%) compared to borewell irrigation due to high nutrient load in sewage
- Lower fertiliser inputs needed
- A safeguard from erratic rainfall

- Vegetable market prices increase three- to five-fold in the off season

Disadvantages of Waste Water Irrigation

- High nutrient load in the sewage results in vastly increased incidence of weeds and pests
- Due to greater incidence of pests, systemic organo-phosphate pesticides are used and usually farmers do not wear protective clothing
- 'Soil sickness', soil and groundwater contamination, phytotoxicity, offensive odours, and severe mosquito infestations are examples of sewage-related environmental and health hazards
- Sewage causes risks to public health as it is a major source of sewage borne pathogens. For instance, often farmers are barefoot while irrigating their farms and are infected easily through open wounds on the lower legs and feet.
- Surface and endo-microflora (coliform) in leafy vegetables enters the food chain and causes public health risks.





- Crops cultivated by sewage irrigation, especially vegetables do not fetch the producer a high margin and secondly, during a glut the prices drop sharply leading to heavy losses. Thus the markets for sewage irrigated products are poorly articulated.

Cropping Systems Using Sewage Irrigation

A survey was undertaken during May to July 2001 of farmers utilising sewage water for irrigation in eight villages, located along two *nallas* flowing from Dharwad and Hubli. A summary of the farming systems encountered is presented in Table 4.1

The dominant feature of sewage irrigated cropping systems located nearest to both cities was the continuous cultivation of vegetables. These production systems are predominantly found at Madihal on the outskirts of Dharwad and at Bidnal on the outskirts of Hubli. The ease

of access to local urban markets and high urban demand ensure a secure market for vegetable production, particularly during summer when vegetable market prices are three to five times higher (Hunshal *et. al.*, 1997). Once beyond Madihal on the Dharwad *nalla* the remaining cropping systems are predominantly field crops with a lower proportion of vegetables; these cropping systems are found at Govankoppa, Gongadikoppa and Maradagi and also on the Hubli transect at Gabbur. The larger the farm size, the more land is put over to field crops, as vegetable production generally requires greater labour inputs. Beyond Maradagi village, the cropping systems are rainfed and sewage irrigation ceases as during the dry season the insufficient quantity of sewage flowing in the Dharwad *nalla* at this point makes it an unreliable source of irrigation. Budarsingi and Katnur in the Hubli transect mainly grow orchard fruit crops such as sapota and guava.

Quality Parameters of Sewage of Hubli and Dharwad

A study of the quality of sewage water was conducted from November 1998 to October 1999 by Renukaprasanna (1999). The samples were collected at monthly interval at one km intervals to a distance of 10km starting from the outskirts of Hubli and Dharwad.

Values of the various parameters were generally higher during summer (dry season) and lowest during rainy season (June–October) (Table 4.2). All the parameters² except residual sodium carbonate (RSC) were found to be below critical limits. The RSC values during summer were higher than critical limits for irrigation more so in Dharwad. Thus the water is not fit for irrigation during summer, which may cause sodicity (the accumulation of sodium in soils) and /or salinity

Table 4.1 <i>Spatial variation of predominant sewage irrigated cropping systems</i>			
Transect	Village	Distance from city centre	Main cropping system
Dharwad	Madihal	2.0km	Vegetable production
	Govankoppa	5.4km	Field crops & vegetables
	Gongadikoppa	9.2km	Field crops & vegetables
	Maradagi	11.8km	Field crops & vegetables
Hubli	Bidnal	2.5km	Vegetable production
	Gabbur	8.9km	Field crops & vegetables
	Budarsingi	10.7km	Fruit crops
	Katnur	13.5km	Fruit crops

(Distance = length of the sewage nalla from city source to village including any meander).

(the accumulation of soluble salts) of soils decreasing soil productivity.

The presence of heavy metals was below the permissible limits in both the sewage streams. The biological oxygen demand (BOD) (which indicates the decomposable organic matter) showed that sewage of both Hubli and Dharwad had values well below the critical range (81-305 mg/l) for irrigation as indicated by Mara (1976)

which implied that the waste water is safe for irrigation. Tests conducted for pathogens revealed that vegetables were contaminated with coliform bacteria. Samples taken from brinjal and amaranth showed that the *E.coli* were not only present on the surface but also within the vegetables studied (Table 4.3)



Table 4.2 Chemical parameters of sewage of Hubli and Dharwad

Distance (km)		pH	EC (ds/m)	SAR	RSC (me/l)		Total suspended solids (TSS) (mg/l)
					Mar to May (Summer)	Nov- Feb and Jun-Oct	
Hubli	1	6.78	1.69	3.32	5.57	1.92	228
	2	6.82	1.68	3.32	5.62	1.98	205
	3	6.84	1.67	3.33	5.63	1.86	192
	4	6.90	1.63	3.30	5.59	1.69	181
	5	6.94	1.61	3.34	5.31	1.91	167
	6	6.97	1.60	3.33	5.29	1.61	150
	7	7.03	1.60	3.34	5.01	1.69	131
	8	7.07	1.58	3.38	5.13	1.65	117
	9	7.12	1.57	3.37	4.76	1.50	100
	10	7.16	1.56	3.35	4.60	1.46	94
Dharwad	1	6.82	1.44	3.04	7.05	3.12	189
	2	6.91	1.42	3.03	7.10	3.05	174
	3	6.94	1.40	3.01	6.86	3.01	157
	4	7.25	1.20	2.54	6.85	3.72	102
	5	7.10	1.33	3.00	6.93	2.95	122
	6	7.17	1.33	2.97	6.90	2.84	105
	7	7.21	1.32	2.96	6.90	2.74	88
	8	7.29	1.31	2.95	6.77	2.56	77
	9	7.37	1.30	2.94	6.48	2.43	70
	10	7.42	1.30	2.96	6.40	2.53	53

Safe limits of irrigation water: pH 6.5–8.5; EC 2dS/m; SAR 10; RSC 2.5 me/l

Note: There is no limit for TSS but BOD is used as a measure for TSS.

Table 4.3 Surface and endo-micro-flora of sewage irrigated crops³

Location and Crop in field	Surface micro-flora (coliform units per gram of sample)		Endo micro-flora (coliform units per gram of sample)	
	Total micro-flora	<i>E. coli</i>	Total micro-flora	<i>E. coli</i>
A ₁ Aubergine ⁴	16.5 × 10 ²	2 × 10 ²	1000	35
A ₂ Aubergine	nil	nil	nil	nil
Z ₁ Amaranth	165.5 × 10 ²	nil	405	10
Z ₂ Amaranth	160.0 × 10 ²	nil	225	35

(A = taken from ridge; Z = taken from basin; 1 = nearest to sewage source; 2 = furthest from sewage source)

Note: values above 30 c.f.u./g of sample pose direct risk to human health if eaten raw. The lower *E. coli* counts obtained on the surface samples are due to sunlight exposure and desiccation killing the bacteria (Alagawadi, 2001).

Conclusions and Policy Recommendations

1. Vegetable production is more concentrated in nearby peri-urban villages whereas fruit crops dominate in farther off villages.
2. The vegetables are invariably sold in Hubli-Dharwad market whereas orchard fruits are sold elsewhere depending on the price.
3. Soils of Hubli transect are more suitable for fruit crops than Dharwad soils
3. Application of 'polluter and user pays' for the services which will help in maintaining the sewage plant.
4. Develop a sustainable irrigation management in conjunction with cropping system.

Policies

1. Treatment of sewage would greatly solve the problems of health hazards. Treatment could be done through fish culture providing employment and food production (Box 4.2)
2. Research is needed on biological control of weeds and pests to reduce pesticide application.



Box 4.2 Integrated Wetland System for Low Cost Treatment, Calcutta

The East Calcutta Wetlands stretch on the eastern margin of Calcutta, India. Calcutta has grown as a metropolis without any sewage treatment plant where all its sewage is drained into the wetlands where garbage is also dumped. Wetlands play a significant role in treating sewage and converting municipal wastes into resources. Three activities that transform garbage and sewage to wealth are 1) Sewage Treated Fisheries (STF), 2) Garbage Farming (GF) and 3) Sewage Farming (SF).

Sewage Treated Fisheries: Due to siltation, the Irrigation Department of Bengal officially declared the Bidyadhari river dead which then became a vast abandoned swamp. Due to increased sewage flow from Calcutta into this area, the original salinity of 800-1200 ppm dwindled down to 500-600 ppm creating an ideal condition for fresh-water fish culture. Thus 11,570 acres were used for sewage-fed fisheries which yielded an average of 3.40 quintals of fish per acre. By 1985, the area reduced to only 7500-8000 acres while the yield of fish increased from 3.40 to 10 quintals with scientific management.

Garbage Farming: Garbage farms in Dhapa span 800 acres in 9 villages. Garbage dumping and farming dates back to the 1870s. The ground level has risen after continuous dumping of garbage over 100 years. Dumping garbage in rows on either side of water strips has a double advantage. Garbage rows are used for garbage farming while water strips contain sewage irrigated crops and vegetables grown on the garbage farms. A village-based study reveals that a little more than half of agricultural land (720 acres) uses municipal garbage and sewage to produce vegetables, fruits and paddy.

Sewage Farming: On the whole, about 8000 hectares of land in East Calcutta are covered by sewage-farms. The daily average production of fresh vegetables is about 147 tonnes, growing about 15 varieties of vegetables, besides paddy. Paddy cultivation with nutrient-rich fishery effluent used for irrigation is known as Sewage Farming. Two varieties of paddy are grown, Aman in the rainy season and Boro in the winter. Compared to fisheries, which produce fish all the year round, overall production from the sewage farming is poor as the land has to lie fallow after the first harvest.

Economic activities in East Calcutta wetland areas, include piscicultural, agricultural and rag-picking. Sewage water has increased fish production. The fish effluent in turn is used for vegetable and crop production. Land reclaimed through garbage dumping has also increased the area under cultivation and therefore overall production of vegetables.

The Calcutta Sewage fed Fisheries model has national implications as the largest source of river pollution in the country is untreated municipal sewage discharge which can be treated by establishing sewage fed fisheries. The process is carried out, owned and managed by the local community groups mostly comprising joint families. This folk technology option is low-cost, location-specific and, more importantly, in no need of any institutional subsidy or transfer of high-skill expertise to run the system. Thus the wetland of Calcutta effectively addresses three major challenges facing developing nations: waste treatment, employment generation and food production.

UN Habitat's Best Practices Database

END NOTES

- 1 Defined as liquid waste discharged from human settlements changing significantly in output, strength and composition as a result of spatial and temporal variations.
- 2 Measure of soil reaction, pH (US Salinity Lab Staff, 1954); electrical conductivity (EC), sodium adsorption ratio (SAR) and residual sodium carbonate (RSC) (Central Soil Salinity Research Institute, Karnal, 1992); total soluble solids (TSS) (Food and Agricultural Organization, United Nations, 1985)
- 3 Samples taken on 31 May, 2001 from Madihal, Dharwad and tested at the Department of Agricultural Microbiology, University of Agricultural Sciences, Dharwad, under the supervision of Dr Alagawadi, Professor of Agricultural Microbiology.
- 4 Aubergine is also known as Brinjal.

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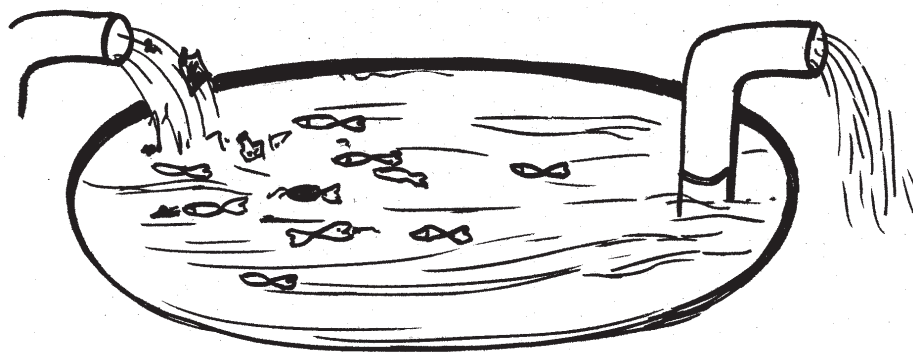
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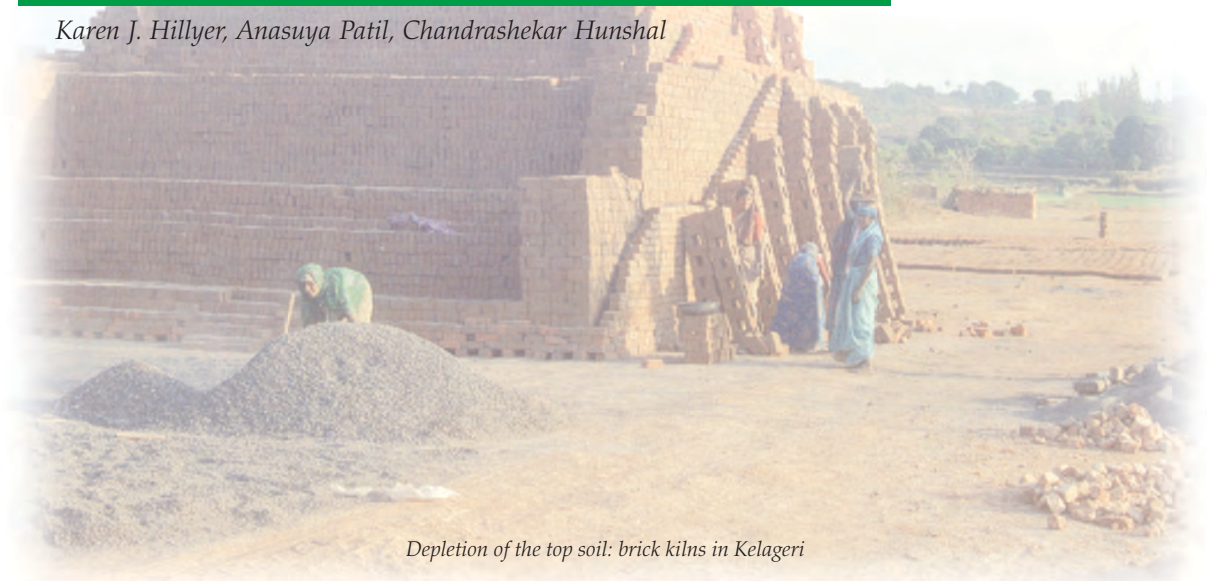
UN Habitat's Best Practices database website: <http://www.bestpractices.org>



5

Effects of Urbanisation on Livelihoods of the Peri-Urban Poor

Karen J. Hillyer, Anasuya Patil, Chandrashekar Hunshal



Depletion of the top soil: brick kilns in Kelageri

With one out of every five households in the world living in extreme economic poverty (defined as living on less than \$1 per day), poverty alleviation continues to be one of the greatest challenges facing the world today.

Heidi Albers, Urvashi Narain, Shreekant Gupta, and David Zilberman¹

Introduction

Poverty with reference to a country, may be defined as social phenomenon in which a section of the society is unable to fulfill even its basic necessities of life. When a substantial segment of a society is deprived of the minimum level of living and continues at a base subsistence level, the society is said to be plagued with mass poverty (Madan, 1990).

Poverty is now recognized to go well beyond a lack of income and to have multi-dimensional characteristics and causes. Case studies conducted in peri-urban villages of Hubli–

Dharwad characterised poverty highlighting socio-economic classes, the importance of livelihoods and diversity among the poor, changes in the livelihood strategies, vulnerability and coping strategies which are adopted and achieved by the poor.

The peri-urban interface (PUI) is a highly dynamic area. People in the PUI may experience a sudden loss of land, assets or livelihoods. Industries and associated livelihoods prominently catering to urban markets, like stone crushing, brick making, mining, among others are subject

to market forces. Livelihoods such as brick making are equally conditional on the depletion of natural resources, upon which they are dependent, in this case, the top soil and firewood from forests to which access is being increasingly restricted by the government.

Rapid land use changes witnessed in the PUI results in land being usurped for various urban uses: land acquisition by industrialists to build factories, construction by the public authorities, public infrastructure such as roads, highways, aerodromes, railway junctions, conversion of land for brick making and quarries by the private sector, urban residents acquiring land for private residences, as well as contractors investing in building housing colonies (Chapter 2). These land use changes result in scarcity of land and consequently a scarcity of agricultural by-products such as fuel and fodder not easily available to the peri-urban poor compared to the rural poor.

Peri-urban poverty, thus, is multi dimensional in nature where the poor are subject to shocks and stresses caused by rapid urbanization, many of whom lack access to land and resources. In wealth characterization exercises conducted for this study and in follow up studies² on the poor, very poor, medium and rich families in the PUI, a wide range of characteristics emerged. These included the poor and very poor being described as those who are often unable to educate their children, those who were forced to send their children to work, families who had a higher number of people who are sick or handicapped or dependent, families with bad habits many of which are induced through urban contact such as alcoholism, increased debt and gambling. Other characteristics included a weakening of family and social ties as depicted by the fact that many leave their families without any notice for long periods of time. Female headed households



A long journey: Woman gathering fire wood in Kelageri to sell in Dharwad market

where there are no earning male members, families with higher ratios of dependents to earning members, high influx of dependent relatives due to urban opportunities such as jobs and medical treatment all constitute part of the fabric of the peri-urban poor. Majority of the poor could be characterized as semi skilled or unskilled. Several engage in circular migration where they commute to the cities on a daily or weekly basis for labour. Migration is becoming one of the major coping strategies of the agrarian poor (Box 5.1).

Consequently, the PUI can be characterized as a space with high opportunity, high potential for upward mobility and a mix of populations who both have high survival skills and those who fall between the cracks. Changing market opportunities such as increased demand for flowers, fruit crops, dairy and other natural resources and their products from urban areas also result in rapid changes in livelihood strategies. Livelihood strategies here are strongly driven by the markets which determine both labour and commodity production.



Unloading rice for rice puffing units, Dharwad: Agro processing in the PUI

Poverty Characterisation in Peri-Urban Villages

Box 5.1. *Brokered Livelihoods: Debt, Migration and Development in Tribal Western India*

Seasonal labour migration is an increasingly important aspect of rural livelihoods in tribal areas of Western India. Such migration can no longer be viewed merely as an adjunct to an essentially agrarian way of life, but has to be seen as integral to the coping, survival and livelihood strategies of tribal farming families. Rural to urban migration is often viewed as a consequence of environmental crisis in which migrants as 'ecological refugees' are forcibly displaced by processes of deforestation, soil erosion, water scarcity, land fragmentation, declining agricultural productivity and population increase. Increasing pressure on a fragile resource base has indeed

contributed to widespread failure to meet subsistence needs among tribal households. The social experience and consequences of migration are far from uniform, but shaped by class and gender. For a minority of Bhil households migration offers positive opportunities for saving, investment and meeting contingencies. For the poorer majority, migration is a defensive coping strategy covering existing debts and extreme economic vulnerability. In combining unequal and individualised income accrual with the need for joint livelihood strategies, migration has a major impact on intra-household relations.

Mosse (2001)

Wealth ranking exercises were conducted, asking village representatives themselves to identify the poor and define the characteristics of the four economic classes: rich, medium, poor and very poor in each of the eight villages. Village representatives were then asked to sort all households in the village into these four categories. Based on the overall results the broad characteristics of the four socio-economic classes have been made.



Wealth Ranking: Poverty Characterization



RICH
Own more than 14 acres of rainfed land, own house,

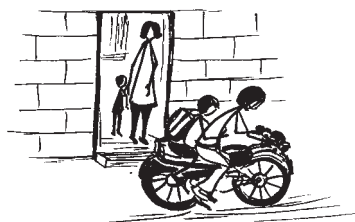
and tractor; highly paid salaried employment (of more than Rs10,000 income per month), own businesses and have savings.



POOR
Own below 3 acres of rainfed land; are agricultural labourers, or factory workers.

MEDIUM

Own 5–13 acres of rainfed land, engage in small enterprise or are low salaried employees (of Rs5,000 per month or less)



VERY POOR

Landless, do not always live in their own homes, lack assets and are agricultural labourers.



Two villages at either end of each transect were paired on the basis of distance from the city to facilitate comparison and characterisation of poverty (Table 5.1). Poverty in all eight peri-urban villages is caused by less diversity, lack of access to government programmes and services, and the lack of capacity to avail of urban jobs and opportunities. By and large, the type of soil, cropping patterns, proximity to the city and skill levels of the population influence the extent of poverty. In general, there are lower proportions of

the very poor category in villages close to the city (Gabbur being the only exception).



Table 5.1 Comparison of extent of poverty between villages along each transect

	Near the city	Far from the city	Reasons
Dharwad West	Kelageri (5.5 km)	Mandihal (11km)	<ul style="list-style-type: none"> • Mandihal has lower agricultural potential due to lower water holding capacity of soils and poorer access to markets and employment alternatives. • Consequently there is a larger proportion of the poor and very poor in Mandihal compared to Kelageri. • Even landowners who were poor had to supplement income from production with wages from labour. • In Kelageri even the very poor could afford to send their children to school unlike Mandihal where only medium and rich households could afford education.
Dharwad North	Dasankoppa (8 km)	Pudakalkatti (18 km)	<ul style="list-style-type: none"> • Dasankoppa, a small village, has poorer transportation, very little irrigation and the poor here who tend to be landless commute to the city for work. • Pudakalkatti is on the main road and well connected by state and private buses, has good irrigation and therefore rich and medium farmers grow vegetables, fruits and flowers catering to the urban markets. • Availability of work locally provides agricultural employment to the poor in Pudakalkatti.
Hubli South	Gabbur (4 km)	Inamveerapur (12 km)	<ul style="list-style-type: none"> • Both Gabbur and Inamveerapur have sewage irrigation, a peri- urban feature. • Although falling within the city limits, Gabbur is neglected in terms of infrastructure and services including transport and government programmes as it is administratively 'urban'. Whereas Inamveerapur comes under the Zilla Panchayat (district level government). • Gabbur has lost lot of land for the by-pass and industrial development. • Gabbur's main economic activity is vegetable and milk production. Land holdings are often small, wastewater irrigation is available, so short duration leafy vegetables are grown. • Due to larger holdings, Inamveerapur has a more diversified production: orchards, staple crops and some vegetable production. • An attempt was made to relocate people to new Gabbur, a place less affected by development of the highway and sewage channels, but many villagers refused to move or migrated back.
Hubli East	Bidnal (3 km)	Shiraguppi (15 km)	<ul style="list-style-type: none"> • Bidnal is almost a part of Hubli, lying within corporation limits. • Due to lower cost and greater convenience, more agriculture workers commute to Hubli resulting in an acute agricultural labour shortage in Bidnal. • More poor and very poor of Bidnal have taken greater advantage of markets and commute to the city for jobs than in Shiraguppi. The high cost of transportation prevents Shiraguppi residents from commuting to Hubli. • Because of proximity of Bidnal to Hubli, the large land holdings, labour shortage, and access to sewage irrigation, the types of crops grown include longer duration vegetables, which are less labour intensive.

Characteristics of the Poor in Urban, Peri-urban and Rural Areas

Characteristics of the peri-urban poor were contrasted to characteristics of the urban and rural poor¹ (Table 5.2).

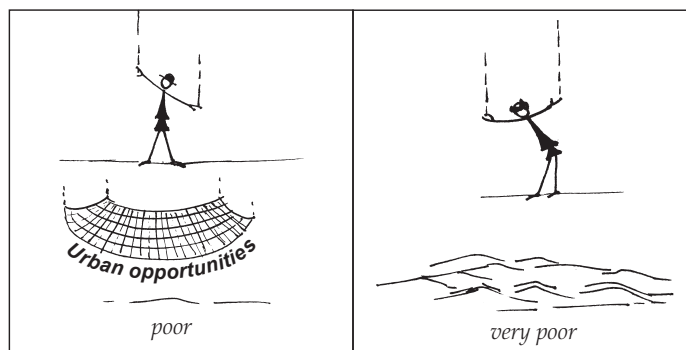
Livelihoods	Poor in urban	Poor in PUI	Poor in rural
	Poor are concentrated in the informal economy, trades and as domestic labourers.	Poor are involved in both agricultural and in the urban informal sector. The very poor in the PUI are typically agricultural labourers.	Poor are involved mainly in agricultural work.
Nature of and reasons for migration	The urban poor do not tend to migrate back to villages. When they migrate it is permanent and often to other cities in search of urban jobs such as the construction industry.	The peri urban poor are involved in circular migration commuting back and forth from cities to villages for shorter period from daily to weekly commuting.	The rural poor migrate due to distress factors, sometimes seasonally, sometimes permanently.
Type of wages	Wages are paid in cash	Wages are paid in cash for labour in staple crops and in kind for perishable crops.	Wages are paid in cash and/or in kind
Opportunities	There are more opportunities to find work throughout the year	Some of the poor have the opportunity to work both in agriculture or take advantage of urban and peri urban opportunities. Others cannot avail of urban opportunities due to lack of skills, health, alcoholism, no mobility, particularly to female headed households. This group also suffers the negative consequences of urbanization in the form of insufficient well paid work in the PUI.	Work is agriculturally related and completely season bound. The majority do not work in the off-season periods, but a small minority engage in small enterprises (such as minor forest produce).
Human capital	The poor have varied skills relevant to petty business and jobs in the informal sector.	The poor who seek urban opportunities may not be as skilled as their urban counterparts. The peri-urban youth try to pick up urban skills or skills related to agriculture which they can encash in the cities (gardening).	The poor have skills relevant to agriculture.
Government programmes	Government programmes are designed to target the urban poor.	Villages in the PUI have a mixed scenario. Those under the Municipal Corporation have no access to rural government programmes or subsidised credit, but some urban facilities are provided. They enjoy only partial benefits compared to the truly urban population but also have to pay higher taxes than rural villages. Villages under the Panchayati Raj System have access to all the rural development government programmes.	Government programmes cater to the needs of the rural poor.

Characteristics of the peri-urban poor³

- Some of the poor are characterized by homelessness, lack of access to land and resources, thus they have less capacity to protect themselves against the shocks and stresses caused by rapid urbanization. In contrast the wealthier groups were seen to sell or lease their assets during emergencies.
- In the villages, the poor and the very poor both work as agricultural labourers and coolies. There are two groups who work either in agricultural operations or engage in work on the farm such as cleaning animals and sheds as well as cleaning the house. In the second group fall blacksmiths, carpenters, priests, barbers, cobblers, potters, men and women engaged in washing, among other such localized occupations. Since agricultural activities are seasonal, the poor unlike the very poor, are often able to get manual labour in the cities. The very poor on the other hand either are unable to work, or work as contract labourers for landlords or depend on others. Many of them work in very low paid occupations such as livestock

herders and domestic workers.

- In urban areas, they work in the informal sector, in hotels, in mason work, or as fruit and vegetable vendors.
- The poor are unable to educate their children because they are forced to send their children to work, despite free education opportunities provided by the government.
- The poor use old clothes handed down from the rich.
- The poor are not eligible for loans or formal credit.
- The poor do not have job security.
- The poor lack knowledge and skills.
- The poor are mainly wage earners or work on a contract basis.



The peri-urban poor face more stress than the rural poor. Their livelihoods strategies therefore have to be more diverse and coping skills greater than the rural poor in order to survive. They also have greater opportunities from both rural and urban sectors of which not all can avail. It is this distinguishing feature of the lack of capacity to avail of urban opportunities that separates the poor from the very poor in the PUI.

Livelihood Strategies of the Poor

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base (Carney, 1998).

Table 5.3 shows the range of livelihood activities⁴ across different wealth classes. Within each class, the total number of people working in particular occupations aggregated across the four near urban villages is provided. As can be seen, the degree of diversity of livelihood activities is less among the rich with emphasis on fewer activities: agricultural production, followed by dairy production and to a very small extent, brick production. The rich need not diversify their activities and agriculture is a traditional occupation where they are familiar with the skills required for this activity.



Boys working in a garage in Dharwad

Clear differences emerge when comparing the modes, where the largest number of people in the further villages still remain in agricultural labour while in the nearer villages, the largest concentration of labourers is in construction and commercial labour.

Table 5.3 Comparison of livelihood activities of different socio-economic groups: Near vs Far villages								
	Rich		Medium		Poor		Very Poor	
	Near	Far	Near	Far	Near	Far	Near	Far
Agricultural production	32	40	20	36	4	8	0	0
Dairy	12	7	8	15	3	2	1	0
Artisan	0	0	1	0	3	2	2	0
Commercial construction labour	0	0	1	1	8	0	11	3
Brick/quarry labour	0	0	1	1	2	5	1	0
Agricultural labour	0	0	2	4	8	17	7	10
Trade	1	3	0	0	0	3	2	1
Brick production	2	0	1	0	0	0	0	0
Others	1	3	3	0	2	2	4	2
Total	48	53	37	57	30	39	28	16

For people falling into the medium wealth class, there is a similar pattern as the rich, except for a greater degree of diversity in the nearer villages with people also engaged in driving, petty business, artisans, professional positions, construction labour, brick and quarry labour and government jobs. People in the medium category have a slightly higher diversity being involved in activities requiring lower skill levels and fewer resources, such as driving, petty business and artisans, and even labour work.

The choice of occupation of the poor and very poor depends mainly on regularity of work and wages. The peri-urban poor are involved in agricultural labour, dairy, artisan activities, commercial and construction labour. Additionally the poor also work in agricultural production, brick kilns and quarries. Some of

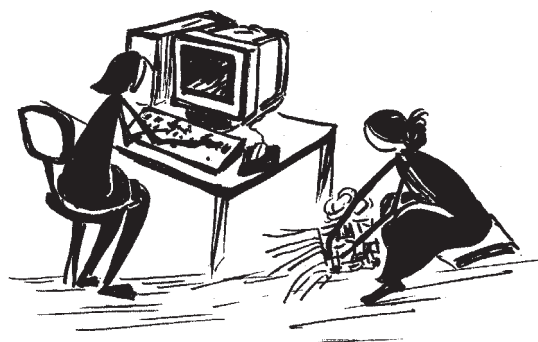
the poor are also involved in other activities such as driving, petty business, and religious activities. Some have government jobs and rear small livestock. Despite ample opportunities to work in quarries and brick kilns the very poor are less involved compared to the poor, which could be a function of skill levels, health or family commitments where they cannot take advantage of these opportunities. However for both the poor and the very poor, a larger number of people are involved in agricultural labour in the further villages compared to the nearer villages. Another clear difference emerges while comparing the modes, where the largest number of people in the further villages still remains in agricultural labour while in the nearer villages, the largest concentration of labourers is in construction and commercial labour.

Box 5.2 Conditions for diversification of livelihoods of the poor

Research shows that agriculture continues to be the most important source of livelihoods for the poor. But this is not necessarily from choice. Often, it is because they are trapped in low return employment and rainfed cultivation, due to a lack of other remunerative options and the inability to break away from impoverishing agrarian arrangements. The poor are trying to diversify both within agriculture and away from it. The factors that have enabled the poor to pursue these options include access to informal credit and political patronage, social networks, entrepreneurial skills, education and access to information. The factors that limit them are their caste status, gender and location.

Deshingkar *et al.* (2002).

Thus in peri-urban areas, the very poor and poor have more diversified livelihood activities with a lesser reliance on agriculture. In contrast the rural poor still show a strong concentration in agricultural labour and production (Boxes 5.2 and 5.3).



Box 5.3 *Diversification of Livelihoods for the Rural Poor*

In most countries in South Asia, the majority of rural poor are still primarily engaged in agriculture. But there has been a trend in all countries for people to move from rural to urban areas and, within rural areas, to move out of agriculturally-based occupations, often due to growing pressure on natural resources, declining terms of agricultural trade and other broad ranging trends in society. These transitions are neither simple nor painless: some people are able to accumulate wealth and climb out of poverty by diversifying out of agriculture, taking on new more lucrative activities that enable them to invest in, and reduce the risks of, agrarian livelihoods. Sometimes this involves subsequent specialisation into secure, full-time occupations. Other people, however, may diversify into coping activities, often part-time and casualised with low returns and low security. While these are essential to ensure survival, they are often associated with increasing poverty and vulnerability. Both routes of diversification, either positive or negative, may involve taking up some activities and dropping others as circumstances allow; a process of 'portfolio management', though often with very restricted options or choice. At the heart of these choices and constraints is the ability to gain access to new resources and opportunities, and climb out of deepening poverty traps. Yet the economies, societies and institutions that determine who wins and loses are also undergoing change.

DFID (2002).

Prioritization Among Different Livelihood Activities

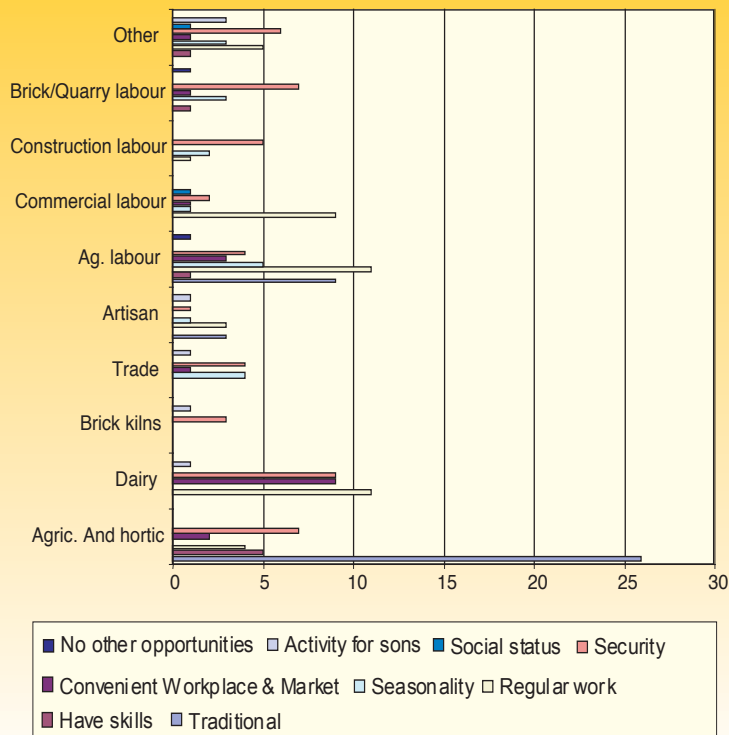
As families ranked the various livelihood activities, they were asked to explain the relative advantages and the importance they attribute to each. The single most important reason attributed to employment activities was regularity of work and security, except for agriculture and horticulture, where tradition was the most important reason (Figure 5.2). Security (food, financial advantage) is another reason to opt for a livelihood. Being in peri-urban villages, the poor have the advantage of taking up different activities depending on the season. For example: the poor do agriculture labour throughout the year except during summer, when there is no agricultural activity. Then they go for construction and commercial labour. Other reasons include convenience of work place, payment provided in cash and kind and to a lesser extent social status,

activities for sons and no other employment opportunities.

Reasons attributed for being engaged in particular activities:

- Given an option, the poor prefer commercial labour compared to agricultural labour due to regularity of work.
- Between commercial and construction labour the poor prefer the latter due to financial gain.
- Fruit and milk purchase and selling are preferred if there is a convenient market
- For the poor, agricultural labour is easily accessible and they have the skills.
- The rich on the other hand prefer agriculture because of tradition and security.
- For example the rich are engaged in dairy because it is convenient in terms of workplace, they have the skills and it is a secure activity (a guaranteed market).

Figure 5.1 Importance of Activities



Agriculture and agricultural labour are more important in the further villages compared to the nearer villages, as were brick and quarry labour. The availability of construction labour has given the poorer people of the nearer villages alternatives and demonstrated the difference in the importance attributed to this type of activity.

In the further villages there is a greater level of importance placed on trades that may have more limited markets in villages nearer to the city due to competition or easy access of consumers or producers in those villages to the city markets.

The proximity to the market is one reason for a greater importance of dairy production in the nearer villages, as milk can be sold directly, avoiding the cut of the middleman and transportation is easier. This is not to say that milk vendors do not operate in the near villages, merely that there is a greater probability that families will sell their own milk if they have sufficient family labour to do so. This information

Peri-Urban Effects on Livelihood Strategies and Options

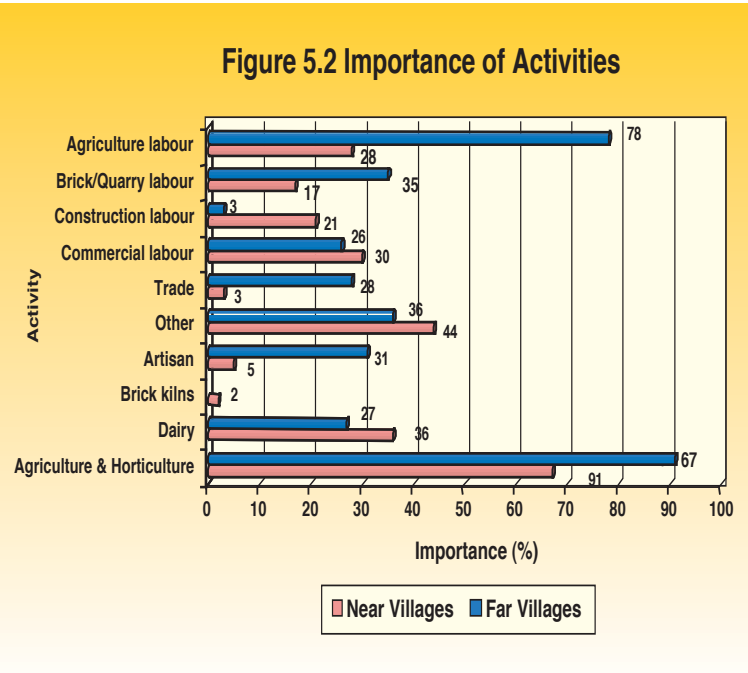
Comparison was made between the importance attributed to different livelihood activities by all four socio-economic groups together. Next the four more distant villages (12–18 km) from the city were compared with the four that are nearer (3–6 km from city) in Figure 5.2.



Attraction of the labour force by the construction industry, housing development, near Kelageri village

should be considered in respect to the costs of fodder and availability of land for grazing. From livestock survey data (Chapter 7) wealthier households have their own grazing fodder and feed sources from their own land, but for the smaller land holders or those with no land, it is costly to meet these requirements. However, fewer poorer families have milch animals in the further villages according to the household studies and the market survey data. It is difficult to see how the poorer families involved in dairy, who can not rely on their own land for grazing and dry fodder and must therefore purchase it, make a living out of the activity.

Proximity to the market also facilitates vegetable and fruit production and sales. Thus dairy and vegetable production and sales are opportunities available more to the peri-urban poor. Box 5.4 provides an example of how the peri-urban poor use urban opportunities as a coping strategy.



Box 5.4 Migrant worker to vegetable farmer

The case of Rana Sana, a migrant agricultural labourer of Tankarupara village in the drought prone district of Bolangir, Orissa state is an interesting one. With increased responsibilities at home after the death of his father and brother, Rana had no option but to stay at home and to try other alternative livelihoods. He considered various options and opted for vegetable cultivation as a few families in the village were already into it. With vegetable cultivation, Rana has been able to feed and take care of his family, his widowed mother and his deceased brother’s wife and son. He does not have to resort to migration anymore, which was his regular practice before he took to vegetable cultivation.

The first shock was the death of his father. He and his brother had to borrow money at high rates of interest to perform the last rites and ceremonies. Unfortunately, his brother also passed away, causing him to incur further debts. He now had to manage his brother’s share of 2.60 acres as well. He had the added responsibilities of a wife and the son of his deceased brother. It became difficult for him to migrate for two reasons. The first was that he could not stay away for so long leaving behind his wife, his nephew, his old mother and his brother’s wife. The second was that the income from migration was inadequate to meet the expenses of a larger family back at home.

He considered various options and opted for vegetable cultivation in 0.60 acres, as a few families in the village were already into it. Soon he realised the need for irrigation and excavated two small wells which cost him Rs 600 each, in addition to his labour and poles which he procured from his own land. Every year, desilting costs Rs 60 per well. Excavated silt is added to the vegetable beds. Vegetable cultivation is highly labour-intensive and keeps Rana busy throughout the year. In fact, he requires 40-50 personal labour days for vegetable cultivation on 0.60 acres. With no helping hands available, Rana leaves about 1.5 acres of sandy and less fertile land fallow, on account of the high cost of cultivation and high risks.

Kumar (2002)

Diversity of Livelihood Strategies

Based on the information available, the poor and to a slightly lesser extent the poorest groups show a greater degree of diversity than the wealthier groups, and in the same way the medium families show greater diversity than the rich. The Shannon-Weiner Index (SWI) has been calculated to assess diversity.

Four factors seem to have influenced levels of diversity in livelihoods strategies:

Number in the family and the need to occupy all of the working members: In joint families there are a far greater number of people dependent on fewer or more specialised activities (although the

resources and revenues are greater), which is reflected in the SWI for the rich and medium categories (Fig 5.3).

However, as the capacity of the agricultural activities to absorb the family labour

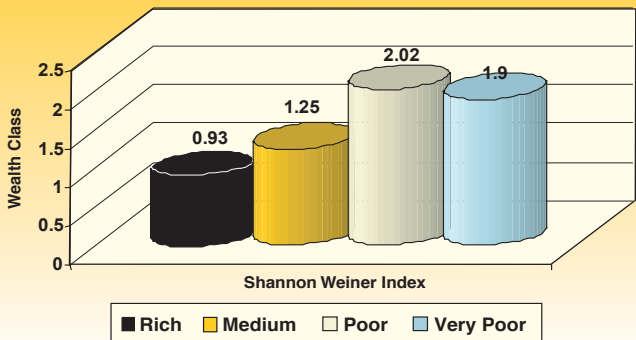
is reached, alternatives are sought for sons, and the range of livelihood activities within the joint family becomes more diverse.



Need to supplement income in addition to the one main regular activity: Poor or medium families with small land holdings may need to supplement their income from their farms with additional activities, such as agricultural labour, running general stores or selling bangles during festivals for extra cash.

Need to find a series of seasonal activities to provide work throughout the year: In Mandihal people prefer stone quarry work because it is better paid, but they work as agricultural labour in the *kharif* season when quarry work is not available. In Kelageri, the poor are involved in brick making from December to June, then during the *kharif*

Figure 5.3 Comparing Diversity of Livelihoods Between Socio-Economic Groups



season, June to October, they work as agricultural labour after which they do contract work such as installing pipelines in Dharwad from October to November. Some are also involved in loading and unloading of trucks in Dharwad from June to October.

Capacity to work amongst family members: The aged, widows, wives of disabled and fathers of young families have fewer opportunities to diversify livelihood activities, and such families represent 50% of the poorest group. Women are reluctant or unable to venture far from home to find opportunities, particularly if they have young children to care for by themselves or are alone without family. The aged might find lighter activities such as sheep grazing to supplement their incomes, but are otherwise dependent on agricultural labour near their homes, or on the income of their sons. Even a man with a young wife and babies might find it difficult to venture further from home to look for better opportunities. These factors have contributed to

a lower level of diversity in the poorest group than in the poor group.

Ellis (1999) reported that, ‘Diversification contributes positively to livelihood sustainability because it reduces proneness to stress and shocks”, which from a policy perspective indicates the importance of developing an enabling environment for diversification through appropriate policy and service provision, thus facilitating the poor to gain access to increased opportunities.

To determine if there was any difference between nearer and further villages, diversities of household livelihood strategies were averaged across all wealth classes and a Shannon-Weiner Index calculated. This was 1.7 for nearer villages and 1.8 for those further away. There is no obvious difference attributable to proximity to Hubli-Dharwad. This indicates that socio-economic class has a greater influence on livelihood diversity than does proximity to the cities.

Table 5.4 Number of changes in livelihood activities of the peri-urban poor: Near vs Further Villages					
Nearer villages	Kelageri	Dasankoppa	Gabbur	Bidnal	Total
	10	6	8	6	30
Further villages	Mandihal	Pudakalkatti	Inamveerapur	Shiraguppi	Total
	4	7	4	3	18

Results presented in Table 5.4 show that in nearer villages, among the poor and very poor there is a greater tendency to change or add activities (30) than the further villages (18). Looking at the differences along each transect the nearer villages show at least twice as many changes except for Pudakalkatti and Dasankoppa. Dasankoppa is

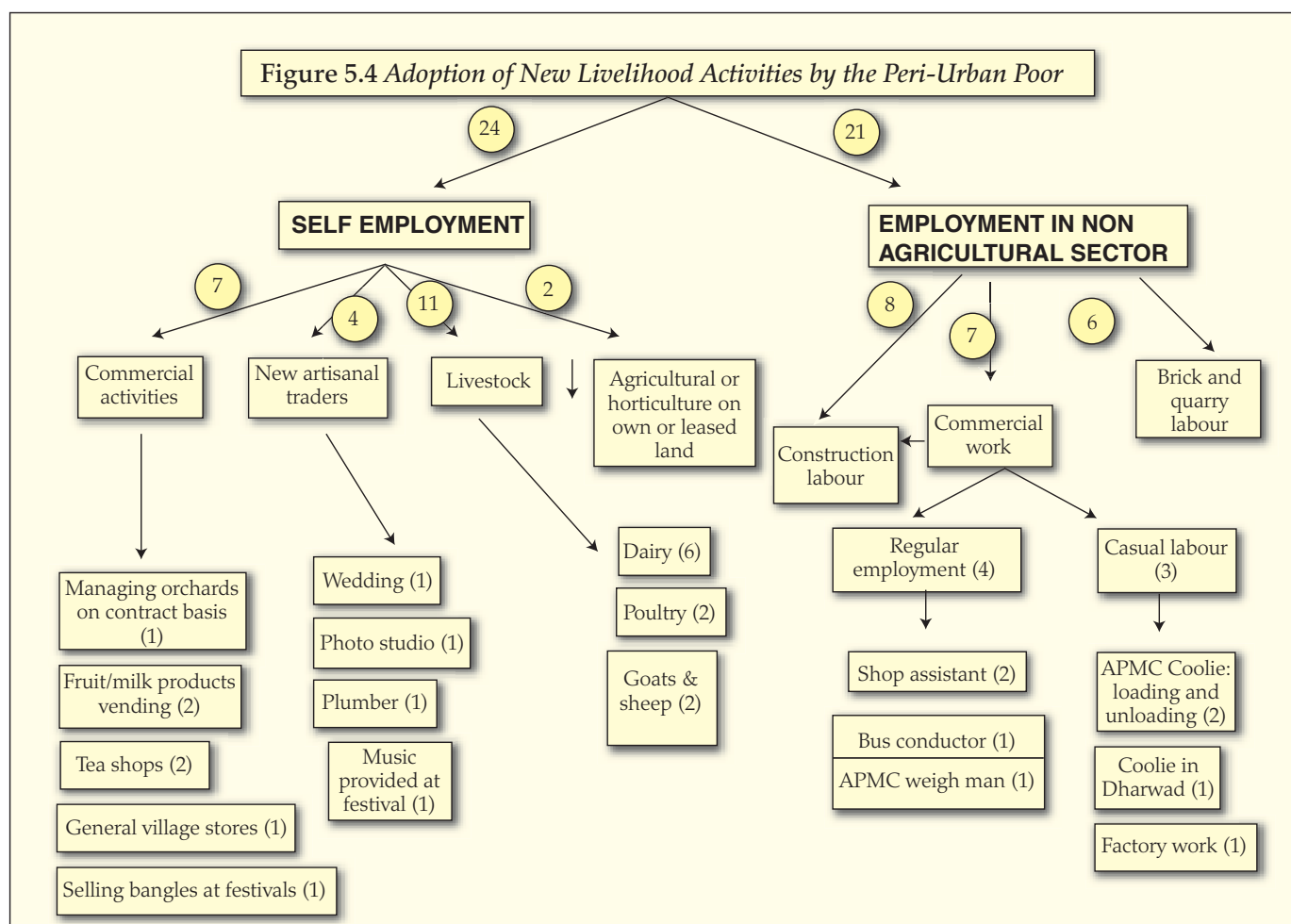
small and has poor transport facilities while Pudakalkatti though further away has better transportation facilities (Map 3.1, Chapter 3).

The reasons given for changing livelihood activities within households over the years reflect to a large extent the changes in family

circumstances (e.g., aging, death of family members, joint families dividing, sons becoming old enough to work) and the reasons for preference for different activities already discussed above.

Figure 5.4 shows the options that members of the poor and very poor families have taken up over the past 30 years. Many have adopted “non

agricultural” employment opportunities that pay higher wages than agricultural labour, while others have found opportunities where they can earn a living or contribute to it, from independent activities (self employment). This figure highlights the importance of non-farm incomes and the diversity of incomes in the household livelihoods strategy in the peri-urban areas.



Numbers in Fig 5.4 indicate livelihood activities adopted by members of the poor and very poor households over the past thirty years

Vulnerability and Coping Strategies

In depth interviews of the poor households in all the villages indicated the following as the factors creating vulnerability in families (Table 5.5).

Illnesses and accidents increase vulnerability. Work related illnesses included respiratory problems from carpentry, stone crushing and quarry work. This problem is well known amongst the quarry workers, but as wage levels are higher and agriculture in Mandihal is quite poor, many derive the main part of their income from this activity. Women are particularly vulnerable as they have fewer alternatives due to their preference to work within the village, closer to domestic duties. The same can be said of other hazards such as that of exposure to the risks of sewage irrigation of vegetable crops. Women are involved to a greater extent in the husbandry of the crop, especially weeding (Bradford, 2001).

Another hazard that could be considered work related is the danger presented by the poorly controlled road traffic. Several fatal accidents were observed in a ten day period on the road between Dharwad and Hubli, one of which involved a bus which ran into women selling fruit by the road side, killing them and many of the passengers. This concern was expressed by a person who had taken up the opportunity to add to his income by collecting the bus fares on a private bus service running from Pudukalkatti.

Conclusions

Due to rapid urbanization and changes in the peri-urban interface the poor and the very poor are subject to greater shocks than their rural counterparts. While they have the distinct advantage of falling back on urban employment



Women and children working in the construction industry



Women in agricultural labour in the PUI

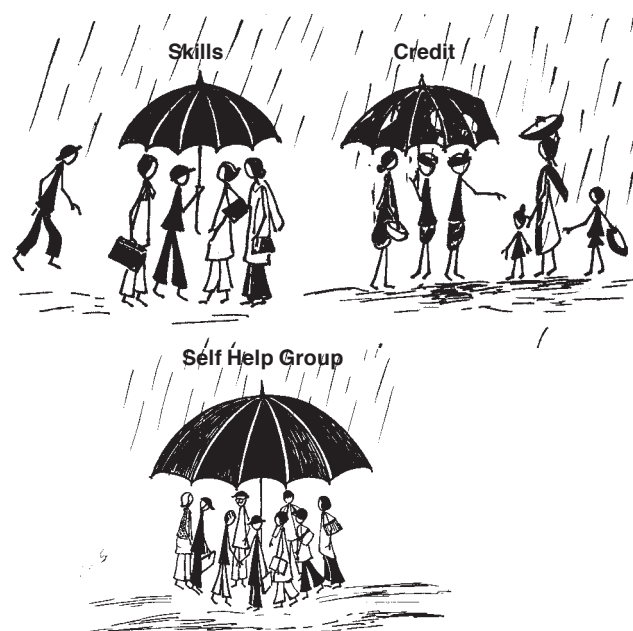
opportunities and diversifying their livelihood strategies, not all are able to avail of them, which is what separates the poor and the very poor. One more disadvantage is that rural and urban authorities that exist in the PUI do not provide the types of support, programmes and services that the peri-urban poor require. Many of the peri-urban villages that fall within the municipal boundaries, no longer have access to rural programmes and charge their populations with urban taxes.

Table 5.5 *Coping strategies and vulnerability factors reported by the peri-urban poor*

Vulnerability factors	Coping strategy	Impact on security of livelihoods
Drought Large family with high dependency ratio	Left agricultural work for manual labour in Dharwad city Also obtained an extra job as a temporary bus conductor	Earns more money than agriculture labour However, agricultural land is neglected Risk of road accidents
Insecurity due to old age	Involved in religious activities (begging in the name of god)	Begging allows meeting of basic food needs
Death of working member	Support from relatives Widow developed tailoring skills but not yet been able to work	Depression Dependency
Alcohol abuse	The women and children have to work	Reduced income Children not attending school More pressure on women and children Family conflicts increase
Dowry system and marriage ceremonies	Leased out land	Members work as labourers on contract basis on other's lands Debts
Ill health	Support from relatives	Dependent on others
Urban market price fluctuations (mango prices crashed and lost money from mango harvest)	Recovering slowly by selling fruits and curds as supplementary to agricultural labour	Reduced income and savings Unrealised intention of returning to contracting mango orchards
Quarry work occupational hazards resulted in loss of health	Now doing agriculture work Son working in quarry	Less pay but poor health does not permit anything else Child labour is perpetuated

The peri-urban poor and very poor also choose livelihood strategies based on tradition, regularity of work and security. Based on these reasons, the activities where the peri-urban poor are concentrated include agriculture, construction labour, livestock rearing, dairy production and vegetable and fruit production.

Government programmes for poverty alleviation are tailored either for the rural or the urban scenarios. For the peri-urban areas these programmes need to have a combination of both rural and urban features and should be based on an activity rather than on a particular geographical area. Thus any intervention should focus on countering the barriers faced by the peri-urban poor to make use of urban opportunities. Furthermore, for peri-urban villages which fall within the municipal boundaries it is important for government to recognize their rural characteristics and provide the support required for rural sustainable livelihoods.



Subsequent work by the research team has demonstrated the empowering effect of establishment of self-help groups (SHGs).⁵

Other experiments and success stories have also emphasized the importance of community based organization (Box 5.5). Lessons from these experiences show that providing resources to NGOs to facilitate community mobilization, provision of a larger amount of seed money to the self-help groups should also focus more on capacity building so that the peri-urban poor can better compete with their urban counterparts. Capacity building should include building technical skills, credit management capacities, alternative income generation and marketing skills. Policies should also aim at utilization of local natural resources to make livelihoods sustainable. Therefore capacity building of the peri-urban poor on natural resource management is needed.

Box 5.5 *Strategies to Combat Poverty*

Despite several anti poverty programmes implemented by the Kerala government, poverty still exists in Kerala cities due to the 'top-down' planning approach used. Kudumbashree, the State Poverty Eradication mission aims to reduce poverty and empower poor urban women in Kerala in a time bound (20 year period), sustainable manner. The strategy adopted included forming a strong network of community-based organizations (CBOs). The Community Development Societies (CDS) movement reached out to the community through women to identify poor families who are then grouped into grass root level Neighbourhood Groups (NHGs), consisting of 15 to 40 women. The NHGs are federated into an Area Development Society (ADS) at the ward level, which are further federated at the urban local body level into a Community Development Society (CDS).

These neighbourhood groups prioritize the needs of the community to inform micro level planning. The micro plans of various NHGs are combined to form mini plans at the ADS level and further combined to form the anti poverty sub plans of the urban local bodies through the CDS. Once the anti-poverty sub-plans are finalised, resources are pooled from various government programmes such as Swarna Jayanti Shahari Rozgar Yojana (SJSRY) and National Slum Development Programme (NSDP) and the plan fund of urban bodies which are converged through the community based organizations (CBOs). Consequently, 21,987 houses and 20,049 toilets have been built for the urban poor.

About 200,000 poor women from 58 Urban Local Bodies of the State have been organized into 7,848 NHGs thus ensuring that poor urban women are actively involved in the planning and implementation processes. NHGs also promote savings which now amount to Rs.154 million (3.27 million US\$). Micro Enterprise Promotion has resulted in 12,991 micro enterprises under the CDS system in various fields ranging from information technology to mat weaving and rabbit rearing to biotechnology. Remedial Education Centres enhance the educational standard of poor children and help them prepare for public examinations and also give gainful employment to educated poor women.

The significant aspect of this initiative is bottom up gender sensitive planning which starts at the grass root level. About 100 members from CBOs have been elected as representatives of the council of the urban local bodies. This ensures that both economic and political decision making gets decentralized.

Kudumbashree, UN Habitat's Best Practices Database

END NOTES

- 1 (http://www.rff.org/proj_summaries/00files/narain_natwealth_india.htm)
- 2 Wealth characterization exercises conducted in six peri-urban villages in a follow up project in January 2003 entitled *NAJA: Enhancing livelihoods and natural resource management in peri-urban villages near Hubli Dharwad*.
- 3 Focus group discussions with other researchers working in Hubli Dharwad, and with urban businesses in Dharwad in October 2002.
- 4 In Table 5.3, trade includes fruit and milk selling, fuel wood sale and auxiliary agricultural enterprise (flour mills, hiring out tractors and leasing out land). Others include rearing of small livestock (sheep, goats, chicken), religious activities (devotees of goddess Yellamma who beg for a living), government service, driving, and business.
- 5 In two subsequent action research projects (Participatory Action Planning Project, 2001 and NAJA, November 2001 onwards) in Hubli Dharwad in six peri-urban villages self help groups were formed which were found to be an extremely effective strategy for dealing with both planning and implementation of community-based action plans.

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6

Marketing Systems for Agricultural Produce in the Peri-Urban Interface

J. A. Mulla and J. C. Tuson



Daily market

Introduction and Background

This chapter analyses marketing systems of agricultural produce in eight villages in the peri-urban interface, Hubli-Dharwad. Building upon the Hubli-Dharwad Baseline Study,¹ a brief market survey was undertaken for this analysis which focuses on marketing of produce and analysing the supply chain from farmer to consumer. It reviews and compares marketing structures and systems with respect to:

1. Different economic classes of agricultural activities within and between villages.

2. Different products from most to least perishable.

In the villages closest to urban centres, fruits, vegetables and milk production, all perishable goods, are more prevalent because of the following advantages:

1. The strong and increasing demand from the urban population and urban growth
2. Market access and good roads make vegetable and milk production attractive.

3. Sewage irrigation is available in all three 'vegetable growing villages'.
4. Financial factors: Urban investors are attracted towards investment in land in peri-urban villages for cultivation of fruit orchards (a high investment-high value, less labour demanding crop).

These distinct peri-urban features are strongest in the four villages close to the city (Map 2.1).

Box 6.1 *Local vs Regional Markets*

Markets can broadly be classified into two types based on the type of commodity: local or regional.

Local Markets: A market in which the buying and selling activities are confined among the buyers and sellers drawn from the same village or nearby villages. This market exists mostly for perishable commodities in small lots, e.g., local milk market or vegetable market.

Regional Markets: A market in which buyers and sellers for a commodity are drawn from a larger area than the local markets. Regional markets in India usually exist for food grains.

Mamoria (1999)

In contrast with the villages further away from the city, milk production is less important and the marketing chains are distinctly different. Vegetables, particularly leafy vegetables, are grown less.

Among the staple crops cultivated in all villages, sorghum (jowar), wheat, paddy and maize are the most important subsistence crops typical of poorer, less fertile soils in rainfed areas. Vegetable and fruit

crops, specifically summer crops supported by sewage irrigation, are particularly common in Gabbur, Bidnal and Inamveerapur², i.e. the villages best connected to the city. Grains compared to the more perishable items such as vegetables and fruit crops cater to different markets (Box 6.1)



Daily market

The methodology used included interviewing villagers where data was collected on a questionnaire proforma. During the analysis the economic classes were condensed into two categories combining rich and medium farmers (those with access to land), and poor and very poor farmers (those with little or no land). Preliminary findings revealed that rich and medium farmers grew a larger variety of crops for sale than did poorer farmers. The study shows how marketing chains too have different routes for these two categories of farmers.

Marketing Structures

Urban Markets

These include the daily markets of Hubli and Dharwad cities. These larger markets cater to

the local urban populations, especially the larger southern region. These markets deal in wholesale and retail sales. They procure consumables from both the peri-urban and rural farmers and sell in turn to retail outlets and consumers.



Weekly market

Weekly Rural Markets

The rural population, sells and purchases commodities in weekly or 'sandy' markets which take place on a fixed day of the week. These markets cater to a cluster of surrounding villages supplying consumer durables as well as inputs related to agriculture. Middlemen also come to these markets to procure agricultural produce but have a smaller role to play than in the urban markets. In the urban markets in contrast, middlemen both buy and sell produce on larger scales. Rural wage earners normally get paid on a weekly basis and hence these markets suit them. This population due to a limited purchasing and storing capacity, spends their weekly earnings in these markets. On the other hand, the urban population procures staples on a monthly basis and only perishables are bought on a regular basis.

Agricultural Produce Marketing Committee (APMC)

The APMC and Taluka Agricultural Produce Marketing Committee (TAPMC), Government bodies, have the functions of offering price support, providing storage and marketing facilities. The two bodies never co-exist in the same place. The APMC which is located at the district head quarters is managed by elected members who have to be farmers and own land in the area covered by the particular APMC. The APMC is monitored by a Secretary, appointed by the government. This is a regulated market. One such market situated between Hubli and Dharwad where licensed agents, farmers and traders from across the state meet. The agents are provided space for pooling



Daily market

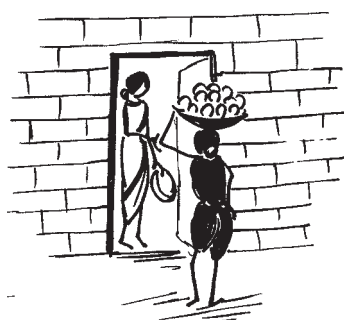
and displaying the commodities within the APMC premises. They are stationed at the APMC and approached by the farmers who develop a rapport with these agents and bring their produce to them to facilitate sale through auctioning or tendering systems. The agents often advance money to the farmers which they recover as and when the produce is auctioned off.

This system exists both at the block (TAPMC) and district level (APMC) where the former caters to the rural populations and the latter to both the peri-urban and rural populations. The APMC deals in bulk sales based on tenders submitted by large buyers.

While the TAPMC is one outlet for small farmers. However the TAPMC is not an option for small farmers in peri-urban villages which are located and have transportation and road access to district headquarters where the APMC is located, making this market outlet, the APMC, a distinct peri-urban phenomenon.

Direct Marketing

Direct marketing is done mainly by farmers with immediate cash needs and less produce. They can go house to house catering to daily consumption needs or to wholesale shops and to a smaller extent to retail shops and hotels. Milk, vegetables and fruits are sold to households and shops and hotels. Shops and hotels in addition also procure



staples on a small scale. The advantage with this type of marketing is that the payments are immediate, and there are no middlemen and



Entrance to the APMC, Amargol, Hubli

therefore the price is advantageous for both the producer and the consumer. The disadvantage is that they have to do the marketing themselves which takes them away from their farms, which many farmers can ill afford. Direct marketing is not done by large scale producers be it for perishables or for staple grains.

Urban and weekly village markets provide all essential goods including perishables (milk and vegetables) and goods such as food grains. The APMC and TAPMC, on the other hand, represent a regional market system covering a large area, and they do not sell perishables. Direct marketing, deals more with perishables and consumable crops and caters to a small area, thus fitting the local market concept.

The advantages of weekly markets is the short distance that farmers and consumers from nearby villages have to travel. The advantages of the urban market are the variety, regularity and large scale of operation which lends to better economies of scale and better prices. The advantage of the APMC and TAPMC are its specialization, its high degree of concentration of buyers, agents and sellers and the reputation for fair dealing. Both are regulated by the government. The APMC has

further advantages of its capacity and scale which attracts buyers and sellers across the state boundaries and caters to bulk producers and consumers.

Findings from interviews³ with farmers from peri-urban villages near Hubli such as Bidnal, Gabbur, Inamveerapur and Shiraguppi confirm that vegetables are sold to commission agents (or *dalals*) who in turn sell these to the urban markets while the non perishable crops are sold to the APMC agents. Interviews in Dasankoppa, Pudakalkatti, Mugad, Mandihal and Kelageri, all peri-urban villages in Dharwad taluk, showed the same. Kalle and Kogilgeri villages are more distant, so do not grow vegetables, but sell their other produce to the APMC, Dharwad.

Urban agricultural markets have different requirements and opportunities stemming from the needs of urban populations compared to rural markets where processing is not as necessary for the rural consumer. Urban and peri-urban agriculture also requires a service delivery enterprise, unlike the rural. Also the credit and financial requirements needed for the peri-urban need to be tailored to these specific requirements. Conditions of existing credit programmes for the urban informal sector are often not the most adequate for peri-urban farming enterprises. There are ample opportunities for the peri-urban producers to specialize their skills towards processing, packing, and delivery networks. See Box 6.2.⁴

Box 6.2 Urban Agricultural Marketing

A major challenge for the coming years is to prepare extension services to provide relevant advice to urban farmers, since most of their knowledge is based on rural experiences and does not necessarily apply in the cities. This applies both to the methodologies used as well as to technical knowledge diffused. The available literature on marketing focuses mainly on marketing from the rural areas to the cities and exports, with an emphasis on the formal and central city markets.

The area of micro and small enterprises related to urban agriculture is a very interesting one that is worth much more attention. Business opportunities in urban agriculture abound, resulting in different kind of enterprises that can be classified into three major categories (apart from the agricultural production enterprises):

- Processing enterprises (i.e. food preparation, packaging, milling, drying and others),
- Input delivery enterprises (i.e. agricultural supplies such as fertilizers, compost, soil media, seeds, pesticides, water, tools, feeds),
- Service delivery enterprises (i.e. special labour services such as milking, animal health assistance, book keeping, transport and others).

Informal sector programmes often overlook such enterprises and more attention is needed for provision of training, management assistance, credit and marketing information to these micro and small entrepreneurs.

UNFPA (1996)

Marketing Chains

The marketing chains described here include those of highly perishable produce such as milk and vegetables as well as less perishable produce such as cotton and paddy. If the peri-urban producers deal with perishables, rural producers deal with non perishables. These distinctly different chains need to be outlined in order to understand the different market forces each type of producer faces.

Marketing Chain of Vegetables

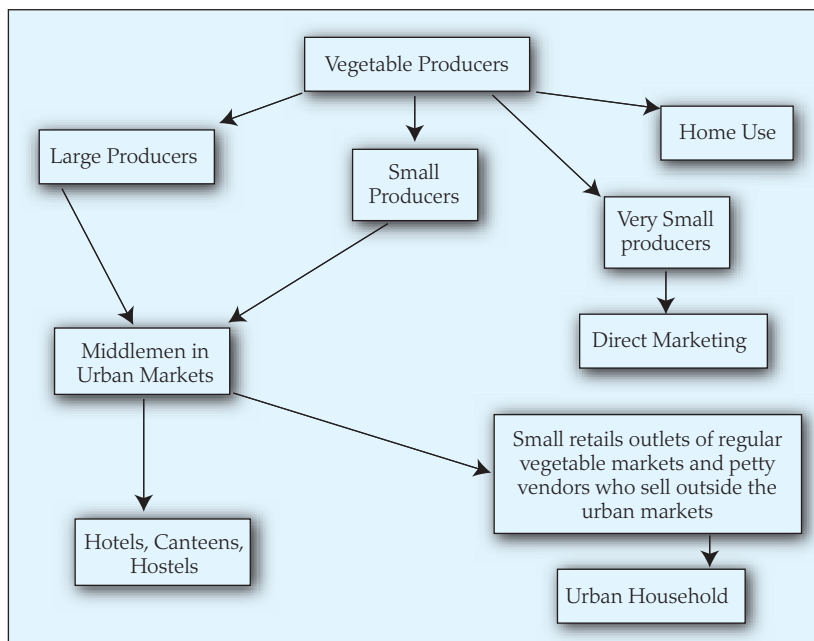
This marketing chain is depicted in Figure 6.1. Small and medium farmers tend to concentrate on their own agricultural activities as they cannot generally afford to spend their own labour towards full-time marketing. Whatever they produce they bring it to the urban markets and sell to middlemen in the markets.

Only very small farmers do direct marketing. Problems related to direct marketing faced by such farmers when they come to markets are the following:



Vegetables loaded to be transported

- They usually have only one product⁵ but urban consumers prefer to



approach sellers where they can do one stop shopping and have a larger choice.

- They do not get the best locations in the market place. Prime locations are always occupied by those who specialize in marketing activities.
- Thus villagers have to sit the whole day to sell their product.

Direct marketing also has an opportunity cost of being unable to attend to farms in addition to the cost borne in the form of a municipality tax levied daily for the rental of space in the markets.

Thus it is cheaper and more efficient for the small, medium and larger farmers to accept the price offered by a middleman and thus dispose of their produce immediately. Medium and larger



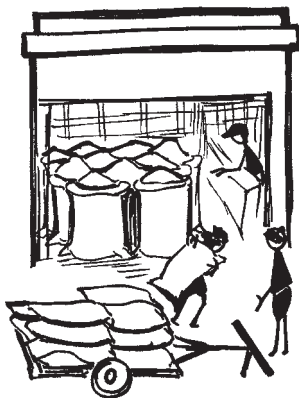
Direct marketing

farmers producing perishables tend to call markets to find out where they can get the best price. The produce is then taken to those markets, not necessarily Hubli or Dharwad, but the larger coastal markets even as far as Goa, Mangalore, or Karwar.

Price is determined largely by market forces. Based on the previous day's supply and consumer demand, the prices get determined. Agents are the ones who are the key persons in price determination.

In Hubli and Dharwad, middlemen are of two types, licensed and unlicensed. The licensed middlemen are called *dalals* or agents and have

a small shop. Farmers usually sell their vegetables through dalals with whom rapport has been built. From the sales proceeds of vegetables dalals take a 6% commission in Dharwad market and 8% commission at Hubli market. Hubli is highly commercial, due to its large scale of operation which attracts producers with bulk produce, and they are willing to sell their produce at a higher commission where they have the advantage of



agents being able to fetch a better price for their produce. Unlicensed middlemen also conduct the same activities for the same rates but are not registered with the government and pay no fees.

Milk Marketing Chain for the Peri-Urban Producers

Milk and milk products are either retained for home use or sold through a variety of mechanisms (Chapter 7). The milk supply chain is represented in Figure 6.2. The more common routes reported were to urban markets, where 50% of raw milk is sold through house-to-house sales, hotels, and via local vendors including the gowlies⁶, a group located mainly in cities primarily involved in livestock activities. Urban dairies including Karnataka Milk Federation (KMF) account for the remaining 50% of the Hubli-Dharwad milk supply chain.⁷ Urban dairies have middlemen through which they procure pooled milk in bulk. Milk producers either sell to middlemen or directly to customers. Alternatively they process the milk into butter or curds, which they then sell to urban households. KMF does not feature in the marketing chain in Figure 6.2 since in the peri-urban villages KMF societies do not operate because producers have access to urban markets where they receive a much higher price.

In interior villages middlemen including gowlies are the major milk distribution option for producers. Where gowlies do not operate due to distance or accessibility, Karnataka Milk Federation (KMF) societies have been set up. Due to KMF's low prices, this option is the last resort for milk producers (Chapter 7 on Livestock). However KMF has acted as a check to exploitative prices quoted by middlemen in certain instances. The KMF price thus raises the minimum price of milk acting as a support price. Fifty to sixty thousand litres of milk is sold daily in Hubli

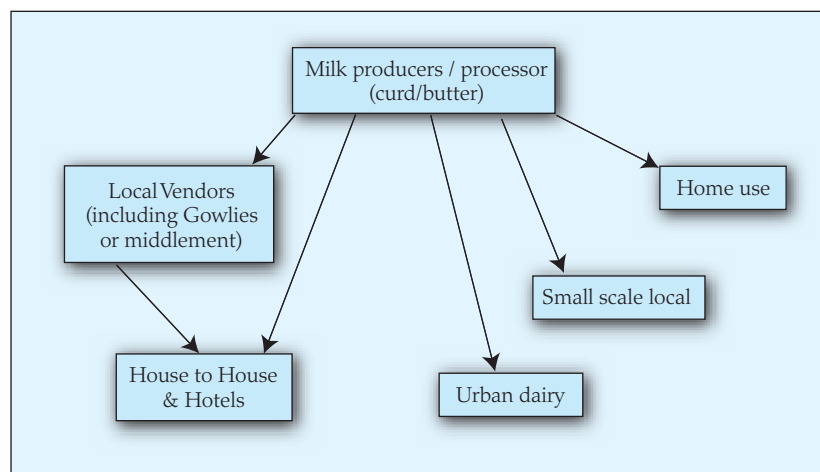
Dharwad in half litre and one litre sachets by KMF. KMF is set up in the form of a three tier system, the state level Apex body, stationed at Bangalore, coordinates the Milk Union Limited (MUL) at district levels. At the village level, milk producers set up Dairy Cooperative Societies (DCSs).

The problems with KMF as reported by farmers is that the purchase price is not high and the payments are often delayed. Second, milk from all sources are pooled and the price is based on the quality of pooled milk. Some of the advantages of KMF are that it provides emergency veterinary services and feed for animals at a minimal cost to members on credit basis. They also have fodder production and development programmes. KMF is trying to improve its quality of services by procuring buffalo milk and cow milk separately priced according to fat content.

In interior villages, unlike the PUI, the Milk Union Limited remains a major milk procurement route. The Dharwad Milk Union Limited (DMUL), specifically in Dharwad caters to milk shed area in North Karnataka and has a processing unit unlike other MULs. DMUL has a unique milk handling unit, where apart from normal milk sales, milk is processed for whole milk powder and skimmed milk powder and to make butter, sweets, and curds.

Producers also use gowlies if there is a lack of other marketing venues. Gowlies have settled in Daddikamalapur village (8km from west of Dharwad). They collect milk from Mandihal and neighbouring villages, which they sell door to door in Dharwad to known customers. The direct sale to the customer is almost certainly a function of the perishability of milk, as its daily requirement is in limited quantities.

Figure 6.2 Milk Marketing Chain



The landless for whom dairy is a primary occupation sell door to door. However farmers who have dairy as their secondary occupation find door to door sales time consuming and depend on gowlies. Furthermore for some farmers it is below their stature to be involved in door to door sales especially for those for whom dairy is a secondary occupation. Basically direct sales involves a great deal of bargaining and criticism from consumers on the quality and quantity of milk, which is potentially demeaning. This type of activity is viewed as low status particularly for families, who have lost their ancestral property and wealth. In both villages, Gabbur and Bidnal, being close to Hubli, the gowlis use bicycles as their primary mode of transport. The smaller farmers on the other hand use public transport and sell on foot. Motorised modes of transport are preferable when procurement is from a more distant village.

Alternatively, there are large-scale sales directly to urban markets in Hubli and Dharwad. Hubli used to have a special butter market which has been taken over by other wholesale products such as electrical goods and plastics but is still called



A gowli from a peri-urban village directly selling milk

the butter market and continues to be graced by sellers of butter and curds at the entrance. Hubli also has a milk market which is unique. Buffaloes are brought here and milked according to the requirement of the customer in front of him or her. It fetches a premium price which can be as high as Rs. 20-25 a litre since it is clearly unadulterated and fresh. Animals here are conditioned to be milked several times within a

span of a few hours, a unique feature of the urban markets. Dharwad has private dairies for collection and sale. In Dharwad, milk is also sold to hotels, canteens, sweetmarts and hostels. Dharwad, unlike Hubli, does not have either a special butter market or an animal milking market. Hubli is a commercial city with a larger North Indian population (Gujaratis, Punjabis and Rajasthanis) having greater purchasing power and food habits with high demand for milk and milk products.

Finally, and whilst relatively unimportant in economic terms but vital in social and health terms, is the small-scale milk sales to the local poor. The urban poor cannot afford to buy good quality milk. They therefore purchase cheaper watered down milk, mainly supplied by peri-urban villages. This helps the poor, both socially and health wise as they can now afford milk at a very low price.

The process of selling dairy produce shows some interesting patterns. In Gabbur and Bidnal, families prefer to sell the majority of milk (51% and 58% respectively) directly to hotels and households in Hubli, which provides a better price than vendors or retailers. In Gabbur, the price of buffalo milk sold directly is Rs 15-20 per litre but only Rs 7-11 when sold to vendors and retailers. Price received is higher for PUI producers. This, and a ready urban market, has had a direct effect on livelihoods making dairy a viable economic option for many farmers and even the landless (Chapter 7).

The process described in Box 6.3. of strengthening linkages by providing inputs and better procurement prices has made dairy based livelihoods a success story which could be followed elsewhere. Hubli Dharwad milk requirements amount to 2,00,000 litres per day

out of which about a fourth is supplied by KMF and half by peri-urban producers and the remaining share is being catered to by the

neighboring state of Maharashtra. This could potentially be an area for improvement through better forward and backward linkages.

Box 6.3 Milk Marketing in Pondicherry

Milk procurement has increased in Pondicherry due to a union that prices milk based on fat content. It would be most appropriate to review and revise the procurement price of milk by the milk cooperative union (PONLAIT) as it happens to be a major player in the milk-marketing network of Pondicherry. Milk Co-operative Societies (MCS) are the most important market outlet for cattle keepers in rural areas. At present the cattle keepers do not have an alternative to selling milk for the price given by the MCS. The milk producers in the peri-urban and urban areas who depend on milk vendors for marketing receive better procurement prices.

PONLAIT at present supplies compound cattle feed (which has oilcakes as one of the important ingredients) to the members of the MCS. This is being used by at least 50 percent of MCS members. In addition, they also purchase oil cakes and wheat bran from the local shopkeepers to feed their cattle.

Milk producers suggested that the extension infrastructure in the Animal Husbandry Department (AHD) needs to be improved. The AHD needs to formulate and implement more production oriented extension activities for the welfare of the landless.

A study of The National Bank for Agriculture and Rural Development (NABARD) showed that the landless cattle owners suggested that increased milk production is the major reason for rearing crossbred cows. The study also revealed that for majority of these farmers, returns from sale of milk is an important livelihood income. In spite of the poor feeding, the farmers get more milk from crossbred (CB) animals, which helps secure their livelihood. A crossbreeding programme is being successfully implemented in Pondicherry. The present policy is of maintaining an average exotic inheritance of 62.5 percent. Appropriate genetic production potential, suitable to the region and the owners need to be further identified. Many members felt that the cattle owners especially the landless lack knowledge on rearing of the CB cows in a hygienic and profitable manner and their access to information is limited. The majority of these cattle owners are women.

Sadamate (<http://education.vsnl.com/vetextn/workshop.pdf>)

Cotton Marketing Chain

Raw cotton is bought by various types of buyers, small manufacturers, big ginning mills, spinning mills as well as middlemen. The cotton contains seeds and some vegetation which needs to be cleaned and then compacted into cotton bales. Farmers put the cotton in gunny bags which is brought to the market and sold. From here small manufacturers who make home utility cotton based products like mattresses, pillows, cushions and so on have their own small traditional and improved ginning units for processing the raw cotton. The bigger agents of spinning mills, and middlemen sometimes send this cotton for

processing to ginning mills or sometimes the ginning mills directly purchase raw cotton which they then process and sell.

There is substantial variation in price (Fig 6.3). Poorer farmers reported receiving a higher price for their cotton than the rich. While the price reported by them in some instances is higher, there is a possibility of poor farmers being cheated in terms of weight and measurement. Some farmers reported a price of Rs300 but these later were excluded as they were implausible. Also the poor tend to sell small amounts of 100 or 200kg to small scale manufacturers (for cotton beds, pillows, and quilts) for a better price while the rich obtain a wholesale (lower) price in regulated markets, but are able to simultaneously reap economies of scale. Small farmers in the peri-urban interface have access to manufacturers whose factories and outlets are located in urban centers.

There are different distribution modes for the rich and the small farmers (Fig 6.4). Due to the lack of credit and small quantities of produce, the small farmers are forced to sell to the local sandy market or to middlemen where they get immediate payment.

The rich auction their produce in large quantities in the regulated markets (Agricultural Produce Marketing Committees) typically at a wholesale rate based on the quality. Often the buyers delay the payments to the APMC who in turn delay payments to the farmers. The APMC provides a regulated environment for bidding according to market forces. Therefore while it does not provide a support price it provides a transparent set of procedures by which prices announced through the bidding procedure are adhered to. It also provides an alternative selling space for farmers to dispose of their goods without which they would be subjected to exploitation by middlemen.

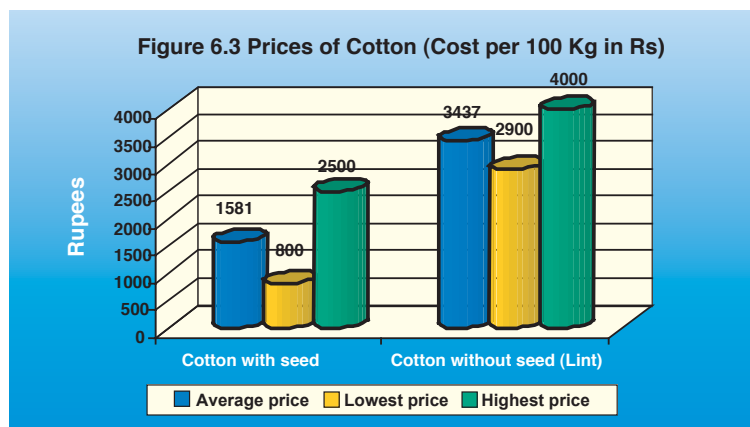
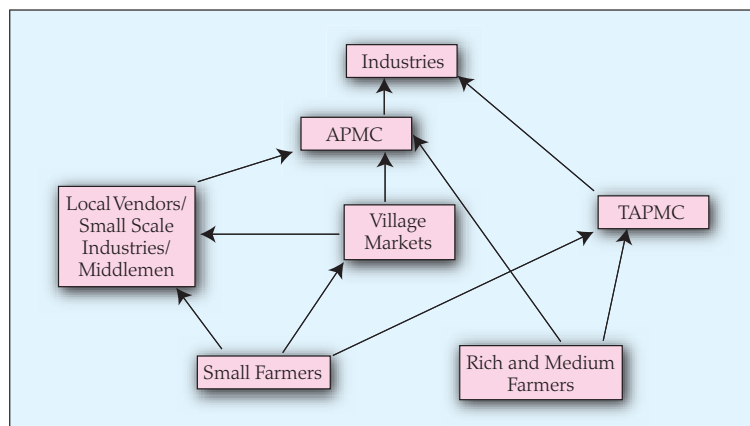


Figure 6.4 Cotton Marketing Chain



Both buyers and middlemen who are involved in the purchase and marketing of cotton, operate a significant control on the price of goods at different points of the marketing chain. Middlemen control the price given to medium and small farmers by acting as creditors, supporting farmers with loans where the price is fixed at the time the loan is given, irrespective of the quality. Often middlemen have direct or indirect links to manufacturers who add value to the products. Middlemen thus have ready markets as they are already linked to buyers and know their demand.



APMC: A major outlet for cotton and groundnut

APMC cess and through not paying the APMC agents' commission, the buyer and seller both get a better rate. Sidestepping the regulated markets is not good since these add to the tax base, and provides a platform for competitive prices, for better quality and distribution of bulk produce.

Some clear policy directives that support small farmers stem from the above situation:

- Peri-Urban small farmers do not have recourse to the regulated market and thus have to rely more heavily on middlemen. The TAPMC is accessible to the rural small farmer. Strengthening the TAPMC and creating awareness and developing confidence among small farmers to link to the TAPMC is vital.
- A second policy option to support small farmers would be to create cooperatives or other facilities to facilitate purchase at the village level.
- Price regulation mechanisms need to be put in place to protect small farmers. Cotton having very high production costs, requires special credit facilities to be created for small farmers to avoid middlemen.



Cotton being sold at the APMC, Amargol, Hubli

Cotton mill agents exert a different form of control at the APMC which affects the large cotton producers. They may together offer a lower price in tacit agreement with each other creating what is referred to as a 'ring', commonly seen in scrap dealers, timber dealers and government tenders. The buyers and their agents thus create monopoly effects lowering prices for sellers.

Sometimes industry representatives bypass the regulated market and lift the produce directly from farmers. While this avoids the tax payment of

Paddy Marketing Chain

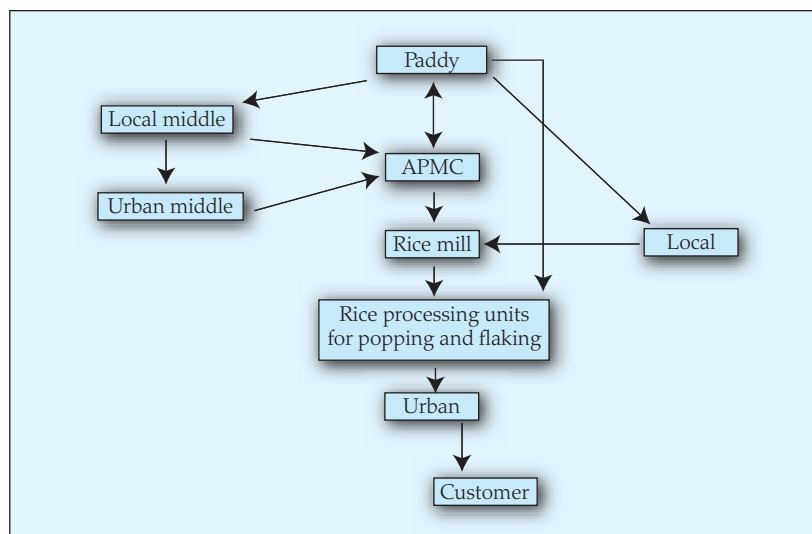
The most obvious feature of Figure 6.5 is that marketing systems for rice are relatively complex compared to other marketing chains. The reason is because unlike other crops, paddy has to be processed first and therefore cannot be marketed directly to the consumers or the urban markets.

The core of the paddy marketing system is the chain from paddy growers through local or village level middlemen and urban middlemen to the APMC (where relevant), mill, the processing unit and subsequently to the urban markets and customers.

With the exception of Dharwad, the APMC is heavily involved in this chain. In Dharwad paddy farmers grow a particular variety of

paddy (Intan) which is suitable for processing into puffed and flaked rice. They are directly connected with processing units so they need not trade through the APMC. Here paddy growers are doing relatively well despite the APMC's lack of support.

Figure 6.5 Paddy (rice) Marketing Chain



Note: The APMC does not deal with paddy in Dharwad but the APMC does play an important role in paddy marketing chains in other districts where paddy is the main crop. In Dharwad paddy is not a major crop. Wherever paddy is grown in the PU of Dharwad district it is sold to the middlemen and they in turn sell to the rice processing units and mills.



Contract workers from Pudakalkatti unloading rice at the rice mill in Dharwad

Policies to facilitate the formation of self help groups among producers for credit and marketing are needed. Policies are also needed which facilitate the APMC's capacity to deal with all major crops in the region. The Mandibisi Mahila Mandal (Box 3.5) has made an effort in forming a marketing society through which they are able to enter into the larger markets avoiding middlemen.

Review of Commodity Marketing Systems

Farming activities are strongly influenced by market forces. The rich sell while the poor consume a greater proportion of their produce. For some commodities, middlemen exert a large control on prices as well as credit arrangements.

Vegetable and milk production is more common in villages close to the urban centres or in villages well connected to urban markets by public transportation, as might be expected for perishable produce. Each of the peripheral villages have their own particular sets of circumstances that determine crops grown.

Marketing chains of perishable and less perishable crops show some commonalities and differences:

- For all crops, perishable and less perishables, middlemen play a key role. In both cases with smaller quantities direct sale is possible. In the case of perishables where the quantities produced are small, direct sales through door to door household marketing and vending is an option. For less perishables, with smaller produce only direct marketing is possible to value adding units such as paddy popping units and cotton based household products.
- The APMC plays a very important role among the less perishable commodities.
- Role of processing units is also significant among the less perishable crops. The need for processing impedes the producer's ability to sell directly to the consumer and therefore creates the space for a buyer's monopoly and for their control of the price.
- Among perishables, as the consumption has to be immediate, producers cater to local urban markets.

- Direct marketing for both perishables and less perishables, results in immediate cash flows, are typically small scale in nature and therefore it is the landless, small and marginal farmers that are involved.
- For APMCs, the waiting periods are much longer for receiving payment because of the tendering and auctioning procedures. Therefore credit given by APMC agents to farmers is the norm. Bulk sales and purchases and delayed payments result in only large producers and buyers being involved in these chains as only they can withstand such financial pressures.
- Middlemen in the marketing chain of perishable goods are largely unlicensed and therefore their activities are less regulated where sales are made on the spot and all transactions are completed within an hour or two. Since the goods are not stored, but disposed of quickly, the middlemen do not sit at their stores for any length of time.
- On the other hand for the less perishable crop chains, middlemen deal with crops for a longer duration and cannot dispose them off quickly. They have to operate within the APMC which requires licensing and due to the clientele being larger farmers, they require larger financial flows.

Prices for most agricultural commodities vary greatly. This suggests that the role of the APMC in controlling the fluctuations in prices is unsuccessful as it is undermined by the strong control of middlemen on prices. Higher prices were gained for commodities in villages around Hubli. This finding corresponds with higher prices for land around Hubli (Chapter 2). Hubli also has a higher population with greater market

demand compared to Dharwad. Price differentials show some interesting patterns. Cotton appears to be more expensive closer to the urban centres with the poorer classes reporting a higher price received.

Small villages away from major transport routes rely very heavily on the APMC - middlemen association to sell their produce rather than local markets. Because marketing is more costly for farmers in more distant villages, middlemen can secure a lower price than in other villages that have a more strongly competing market and better transportation. On the other hand the larger villages such as Kelageri and Shiraguppi have more diversified marketing arrangements and better prices due to saving on transport, time, and labour.

The systems for each commodity are very different. The milk systems show a necessary integration between the producer and the consumer due to the perishability of the product. Rice can be stored for long periods, and thus there is an increased complexity of the marketing system. There is a very complex interaction

between a variety of stakeholders, including the producer, two sets of middlemen, two sets of processors, and a variety of selling outlets for all stakeholders.

Fruit, which is intermediate in perishability between milk and paddy, has a marketing system that is fairly simple. Here the standing crop is leased to contractors who market to processing units directly or through commission agents. Vegetables on the other hand are sold largely by the farmer in the local or urban markets either directly or through commission agents. Vegetable producers endure relatively high packaging and transportation costs that limits their production to those villages near urban centres.

Policy Implications

Policy on price: Reporting of price information in different markets should be made available through radios and TV marketing channels to farmers to avoid glut and deficit in the supply and corresponding price fluctuations in certain markets (Box 6.4).

Box 6.4 *The Need for Market Information*

Market information and intelligence is important for farmers and traders to balance supply and demand in the marketing system and avoid gluts and deficits in supply and corresponding price fluctuations. This is all the more important in India, since there is no price control for horticultural produce - it depends largely on supply and demand. In wholesale mandis (markets), price is determined by auction. This auction system is not transparent and manipulation is the norm: farmers invariably lose out in the process. Recently, government agencies like the National Horticulture Board and Agriculture Product Marketing Committees of state governments have started reporting market and price information but the time lag in the reports reduces their relevance. They can be assessed more as historical data for statistical purposes rather than a mechanism to regulate the market.

Post Harvest Technology: Making the Most of What We Grow, Market Watch.⁸



Farmers' market (Hubli)

Establishment of farmers markets: In Hubli the latest development is the creation of the "*raithara santhe*" or farmers markets established by the government. This provides farmers a space in the urban markets for direct marketing to the urban consumers thus shortening the marketing

chain and avoiding middlemen. More of these types of farmers markets should be promoted.

Post harvest technology: Perishable commodities such as fresh fruits, vegetables and milk are increasing in surpluses. These need to be carried from production areas to consumption centres or commercial processing units to increase their shelf life. Specialized cold storage units, transportation infrastructure (which regulate temperature) and packing materials are available today albeit in limited supply and should be made available on larger scale.

Credit: Small farmers need special programmes that provide easy access to credit. This would under cut the control exercised by middlemen on small farmers over price and credit arrangements.



Raithara Santhe: Farmers' market (Hubli)

END NOTES

- 1 R6825; Universities of Birmingham *et al.*, 1998: 50 - 60
- 2 See Chapter 3
- 3 Interviews conducted with farmers in November, 2002
- 4 UNFPA, <http://www.unfpa.org/swp/1996/CH596.HTM>
- 5 Interviews with farmers
- 6 A caste which specialises in the dairy industry, either producing or vending, although milk production and sales is by no means limited to this group
- 7 Interview with KMF
- 8 <http://www.postharvestindia.com/market/market.htm>

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Livestock: Promising Livelihood Opportunities for the Peri-Urban Poor

P Bhat, A Nitturkar and J A Mulla



Women in Channapur getting ready to board the bus to Hubli to sell curds

Background

Peri-urban areas are characterized by change, often rapid, resulting from urban development. There is also a lack of coordination between agencies concerned with natural resource management in urban and rural areas. This results in the absence of strategies to utilize the opportunities for new livelihoods and thwart threats to existing livelihoods. These characteristics mean that some people, particularly poor, are unable to respond effectively to change and may find their household livelihoods under threat. Well planned and targeted interventions are required to enable people to make the best of new opportunities

and overcome the threats. This requires understanding of the intense interactions between urban and rural areas characterizing the peri-urban interface. One aspect, which needs thorough understanding, is the livestock in the peri-urban area.

Many factors influence the management of livestock in these areas. One factor is the demand for milk and dairy products that increases with increase in the urban population. Since most urban populations are made of 'non-productive consumers', the increase in demand has to be met by increased production around the city. Large organised dairies procuring and supplying milk

from distant production pockets meet part of it. However urban populations, being diverse, have diverse tastes and diverse demands. One such demand is for fresh milk sold directly by the producers and vendors. The other is the preference

of Indian taste buds for buffalo milk. The urban milk consumers also have diverse preferences for the milk price that they would like to pay. These demands though small (Boxes 7.1 and 7.2) are the forces that make peri-urban dairy thrive.

Box 7.1 Livestock in Peri-Urban Systems

In peri-urban systems, urban residents engage in livestock production to supplement their incomes. Very little is known about these systems, but they appear to be a growing phenomenon, at least in Africa and the Middle East. According to one evaluation, women's peri-urban farms are generally much better run than those of men. In Iran, the peri-urban livestock sector is controlled by a commercial elite rather than by the middle class or urban poor; the sector is mostly in the form of private feedlots and fattening operations around major towns, owned by people who are also livestock traders, butchers or owners of large breeding herds. In those households where the men also have off-farm work (in construction, as water or vegetable sellers or as middlemen), women have to perform the men's as well as their own tasks of raising animals. In these peri-urban communities of displaced people, women can no longer rely on kinship and social-reciprocal networks.

Source: IFAD (1994)

The study therefore assumed that the livestock based livelihoods are greatly influenced by urban growth. It follows that understanding the trends of these influences will help in better managing the livelihood shifts in these villages. This study was an attempt to understand the changes in the livestock

system in the PUI driven by urban development by looking at ten villages around Hubli-Dharwad. The villages included four near¹ and five far² villages and a village (Varoor) much further but connected well to the city.

Box 7.2 Urban Dairies in Hubli-Dharwad

In and around the city there are large and small dairies. About twenty commercial enterprises keep between ten and twenty buffaloes and crossbred cows, while a number (30-40) of smaller dairies keep crossbred cattle. By far, the largest number of urban dairies belong to traditional buffalo keepers, known as *gowlies*. Some of these households rely solely on the milk produced by buffaloes as their source of income, others may rely more on urban-based work, but keep one or two buffaloes as a source of milk for their family and as an additional source of income. Keeping buffaloes is also part of tradition. Animals may be impounded in a *vaada* or *go-shaala*, which are cattle shelters, including pounds where roaming cattle are taken. Owners of cattle have to pay a fine for the latter.

The main source of fodder for the urban dairies is from the adjoining rural areas. The urban dairies purchase sorghum and grasses during the harvest season and store it for use during the year. The owners of large urban dairies have their own resources for growing fodder, including cereals and legumes. Additionally, food waste from hotels and cafés and vegetable waste is fed to the buffaloes.

Milk is sold once or twice a day in Hubli-Dharwad, depending on demand. There are several different methods of marketing the milk. Gowlies sell their milk directly to hotels, boarding houses and households. Some gowlies milk the buffaloes in front of the consumers, to assure them of the freshness of the milk, which is also carried out in certain locations, for example at fixed hours in the morning and evening. A premium price is paid for such fresh milk. Sometimes loans are given to the gowlies for the purchase of buffaloes, with the loan repaid in the form of milk. A further marketing route involves vendors collecting milk directly from dairy owners and delivering the milk to organised milk booths in Hubli-Dharwad.

The milk collected by the Karnataka Milk Federation (KMF) from the rural areas, along with dried milk, poses a significant source of competition to the traditional urban dairies. People can obtain milk when they want it, rather than wait for it to be delivered, and its sale appears to be increasing, despite the fact that, in some cases, it is a little more expensive than buffalo milk, retailing at around Rs11 a litre (approximately Rs41 = 1 USD).

Milk produced in the urban areas is, however, not a substantial source of supply to the city. From livestock census data, it is possible to estimate approximately how much urban dairies contribute to the milk supply of the city, working out at 0.03–0.06 litres per person per day in 1997. Although these figures are estimates, and the numbers of cows and buffaloes given in the census may not be entirely reliable, the figures are quite low. Milk from KMF and more commercial dairies dominate the market, and these dairies are likely to increase their dominant position if the constraints on urban dairies are not reduced, and if consumers increasingly prefer pasteurised milk and modern forms of purchasing.

Source: Nunan (2000)

The respondents were selected on the basis of land holding as a proxy for wealth classes, based on the general assumption that the people holding most land are the richest, and those holding less land and landless are poorer and the poorest respectively.

This classification was used because there was no other quick and guaranteed method to classify the respondents. Government institutions also use this

assumption. The categories considered in this study are big farmers (BF)³, small farmers (SF)⁴, marginal farmers (MF)⁵ and landless (LL).

A maximum of 40 families in each village with 8–10 families of each category were surveyed using a structured interview. A list of 20 families of each category was prepared with the help of the village accountant, panchayat secretary and village leaders and the first available 8–10 families of each

category were surveyed. It is recognised that selecting the first available families introduced a bias against those families who for whatever reason were absent from the village, but in the time available it was considered that this was a reasonable compromise if sufficient data were to be collected. Those families that have or had any time in the past, livestock of any form, were considered for the survey and the families that never had livestock were excluded. The survey was done door to door personally interviewing the head of the family or key informant from the family. Details of numbers of respondents per village are presented in Table 7.1.

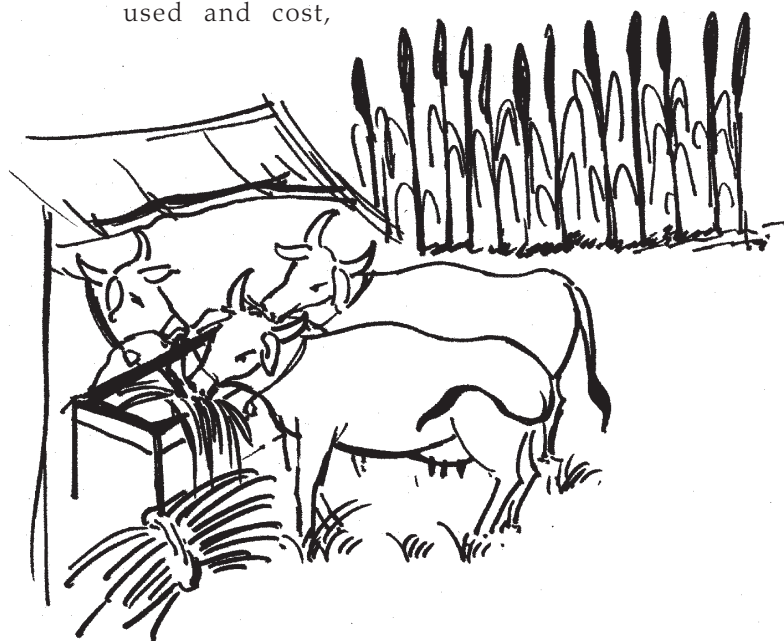
Data on livestock number, household milk consumption, use of livestock for draught purposes and management practices were collected for the year preceding the survey (2000) and for the year 10 years before the survey (1990). Data on quantity of milk and number of animals sold, income from it, number of animals bought and amount spent, quantity of feeds and fodder used and cost,

diseases and veterinary care were collected only for the year 2000.

Questions addressed in the study of the livestock system in the PUI were:

- Has dairy production increased in importance as a livelihood option over time?
- Do the characteristics of dairy production differ in peri-urban villages compared to non peri-urban villages⁶?
- Are there changes in management systems with urban growth over time and are they influenced by urban growth?
- Where are the markets located for milk, milk products and livestock?
- What are the temporal and spatial (near and far from the city) differences in livestock population? Is it likely that urban growth has influenced it?
- Are the changes in livelihood opportunities creating opportunities for the poor in the villages?

It needs to be stated at the outset that urban livestock enterprises, such as poultry units, pig keeping and urban dairies, fall outside the scope of this study. However, their importance is recognised, and they are considered elsewhere by Nunan (2000).



Livestock

Dairy Animals

In general, the buffalo is the preferred milking animal, as consumers prefer its high fat content. However, cows are also present, as they are required to produce bullocks for draught. It is clear that there is an increase in number of local buffaloes and a decrease in number of local cows over time and that buffalo numbers increase with proximity to the urban area (Table 7.1).

Livestock rearing is gaining importance in peri-urban villages with more families involved over time. Out of 321 families studied, only eight did not have any type of animals in the year 2000 where as 37 families did not posseses any type of livestock in 1990.

Livestock rearing is not the primary occupation for the rural population but serves instead as a support enterprise to agriculture in the rural belts of

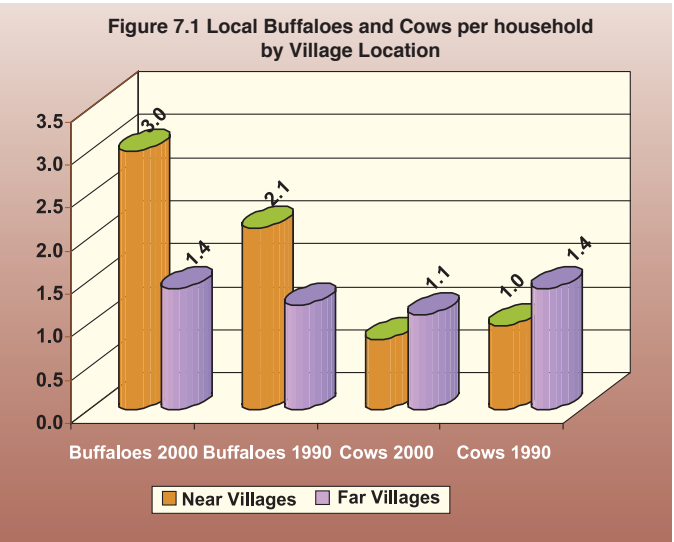
Table 7.1 Number of respondents interviewed per village, by land holding

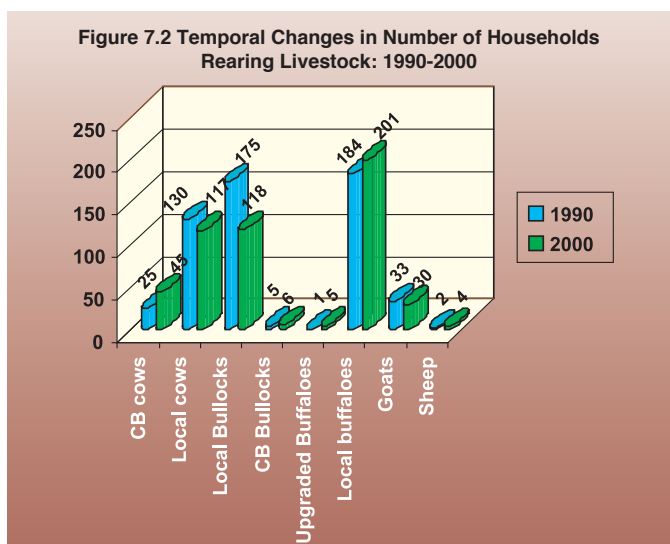
Name of village	Number of respondents interviewed					
	Total	BF	SF	MF	LL	NA
Bidnal	40	12	13	6	9	0
Channapur	40	9	10	11	10	0
Dasankoppa	19	7	2	4	6	0
Gabbur	37	7	10	10	10	0
Inamveerapur	34	6	4	11	13	0
Kelageri	40	10	10	10	9	1
Mandihal	32	8	8	4	10	2
Pudakalkatti	39	10	13	11	5	0
Shiraguppi	40	10	12	10	8	0
Varoor	40	7	8	8	7	10

NA - Wealth class not determined.

Dharwad district. Cattle⁷ are the most commonly reared component of livestock. Cattle are reared primarily for draught power and for manure, rather than for milk. Buffaloes, on the other hand, are reared primarily for milk and milk products, as consumers prefer its high fat content and as a result the milk fetches a better price, and their numbers increased slowly over the decade. Ignoring those categories with low numbers (Cross bred bullocks, upgraded buffaloes, sheep), the trend for CB cows is sharply upwards, albeit from a low base, whilst local cows and bullocks are declining.

Vegetarianism being the predominant dietary feature of the area, livestock rearing for slaughter is not common. Some communities, poor farmers and the landless, practice goat and sheep rearing for additional income. 'Backyard poultry'





Note: Multiple responses are possible; i.e. some households kept both cows/ bullocks and buffalo.

exists in small numbers where a few local chicken are raised for consumption and sale. Other types of livestock are not commonly reared in rural Dharwad. In one of the villages surveyed there was a large scale poultry unit, but such units are not common around Hubli-Dharwad (approximately 20 within 10 km radius of the centres of both cities).



Buffalo: Important livestock for the peri-urban poor

Box: 7.3 *It's not Just Distance that Makes a Village Peri-Urban: Varoor*

Varoor is a village at a distance of about 17 km from Hubli towards the south on the Bangalore road. A survey of Varoor was conducted to get information about an apparently less peri-urban village to compare with the data from peri-urban villages near and far from the city. But the analysis of data shows that Varoor has characteristics of a peri-urban village.

The reasons for this were traced and it was found that

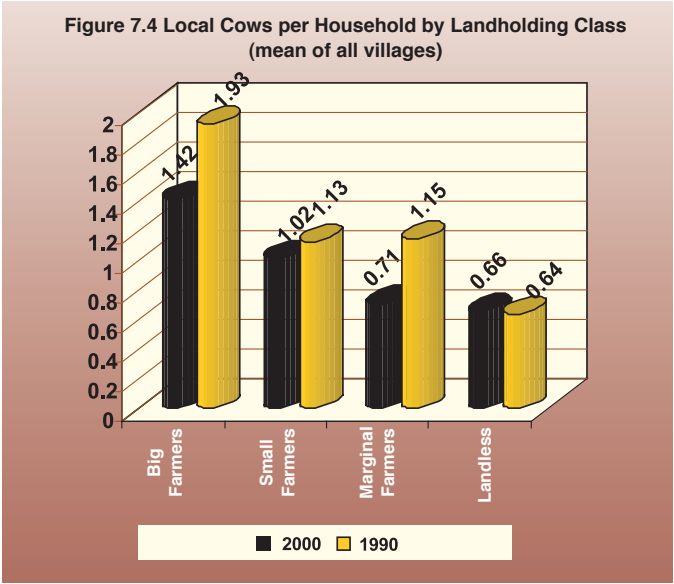
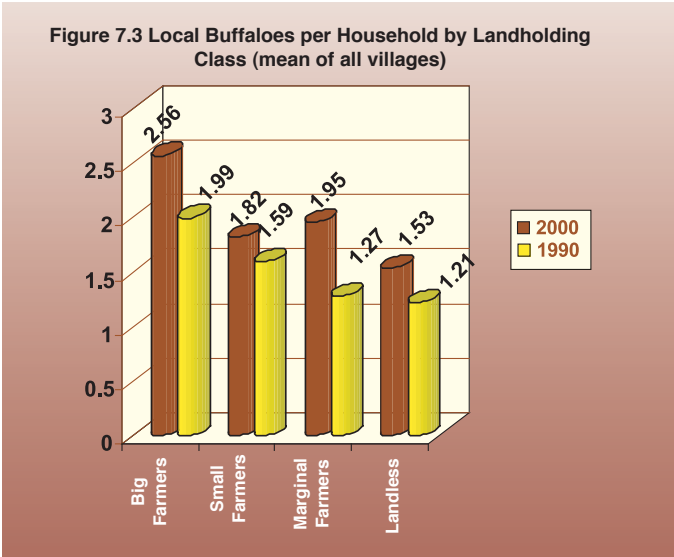
- It is on the Bangalore-Pune National Highway 4.
- It has many hotels and shops, which cater to the needs of passers on this road. Many trucks and buses stop here for meals.
- There are many small industries and commercial establishments coming up in the vicinity of this village, bringing in many outsiders to the village daily.
- Many of the residents have business establishments in Hubli and in turn have employed many from this village in their establishments. All the employees commute daily to Hubli.
- There are petrol pumps near to the village on the road where many vehicles stop for fuel.

In villages close to the city mean number of buffaloes per family was double the number in distant villages. Over time, buffaloes increased by 50% in near villages and only marginally in villages further away from the city. This is an

indication of farmers investing in buffaloes as specialized dairy animals. This is particularly so in villages near the urban centres where access to markets is better and a high demand for buffalo milk prevails. There are however examples of distant but well connected villages behaving similarly.

Big farmers on an average owned the highest number of dairy animals and the landless the least (Fig 7.3). The number of local cows has decreased for all the economic classes except the landless where it remained the same (Fig 7.4). This could be because the landless consider cattle as an encashable asset to be sold in times of need. In all other classes there is a preferential shift from cows to buffaloes retaining only a minimum number of cattle for draught, manure and milk. This overall shift to buffaloes is accentuated in the peri-urban interface.

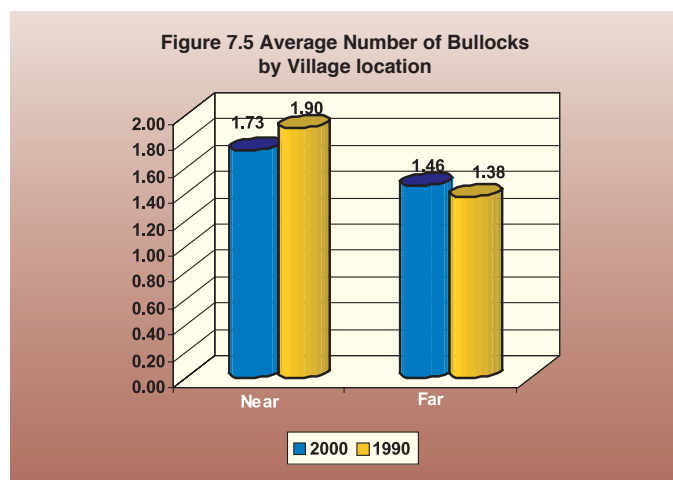
From poor to wealthier, there is a steady increase in mean number of dairy animals, except for marginal farmers. The marginal farmers own more buffaloes than small farmers who depend



more on agriculture and less on dairy for their incomes. Marginal farmers view dairy as their primary occupation since their land holdings tend to be smaller and less productive.

Bullocks

In general the number of bullocks in the peri-urban area has either decreased over time or remained the same for all classes in near villages. This is an indication that agriculture in these villages is becoming less important; or perhaps is a result of tractor purchasing or leasing. On an average each family in near villages owned 1.9 bullocks in 1990 which declined to 1.73 in 2000. The trend in far villages is the reverse of this. There was a slight increase in the number of bullocks in 2000 (1.46) as compared to 1990 (1.38). This is as expected because agriculture still remains the most important economic activity.



One interesting peri-urban feature driven by market demand is that even landless households on the average maintain over two animals (cows and buffaloes).

Sheep and Goats

Sheep rearing in particular is not common in the area. Goats are found in larger numbers in all the villages except Bidnal, and are largely confined to the landless sector. This is because they need not



Goat the poor man's cow, Channapur, a peri-urban village

be confined to the house and can be grazed on wastelands or field bunds. But it is interesting to note that their number has increased over the last 10 years, both in near and far villages. The reason for this increase is probably due to prolificacy and easy liquidity of goats.

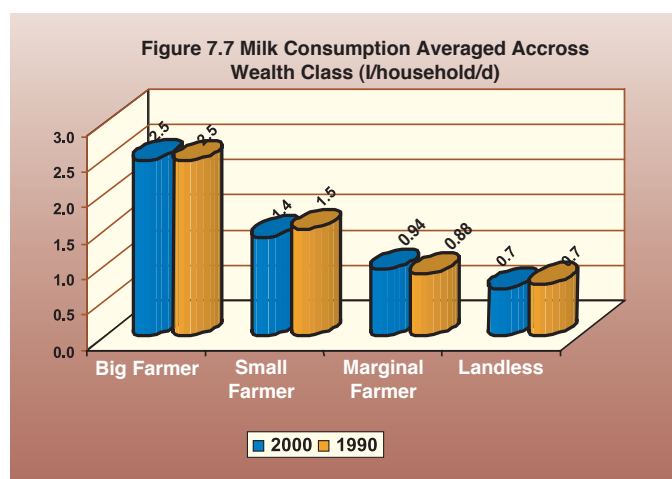
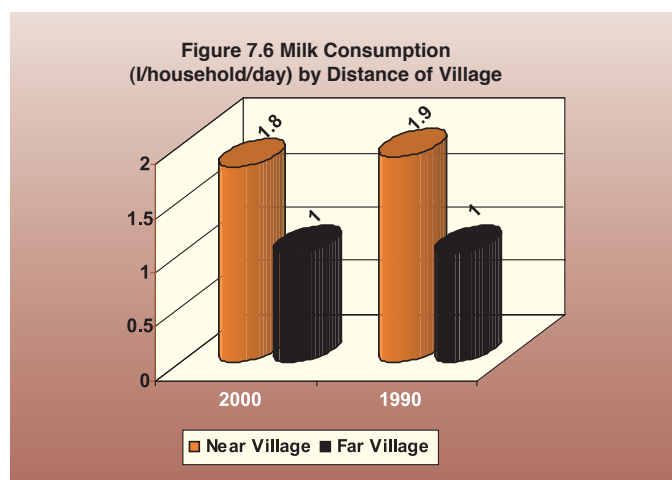
Poor communities keep poultry in backyards though in small number. Surprisingly, the sample of households interviewed in Mandihal village did not have any poultry. This is a village with a commercial hatchery with parent stock. With urban growth some organised poultry farms have been established in the last ten years in all villages near the city except Gabbur (This may be because Gabbur has lost much of its land due to the national highway and by-pass running past the village)

Household Consumption

Milk

Households in nearer villages on an average consume more milk than those in distant villages (Fig 7.6). In Varoor, the farthest village, the consumption of milk was slightly more than the far villages but less than the near villages (1.4 l/day in 1990 and 1.3 l/day in 2000). This is presumably a function of availability of milk for household consumption, but the slight decline over time in all villages is an interesting phenomenon, given the increase in buffalo numbers. The consumption of milk could have declined as the market for milk sale improved.

The milk consumption when averaged over all classes showed a slight decline over the last decade (Fig 7.7). Figures clearly show inequity between the wealth categories, revealing a more than three-fold difference in consumption between large farmers and the landless.



Households with larger land holdings are able to consume more milk whilst landless families have to sell as much as possible to maintain their livelihoods. There was, however a slight increase in daily milk consumption for marginal farmers (from 0.88 l/d in 1990 to 0.94 l/d in 2000).

Egg and Meat Consumption

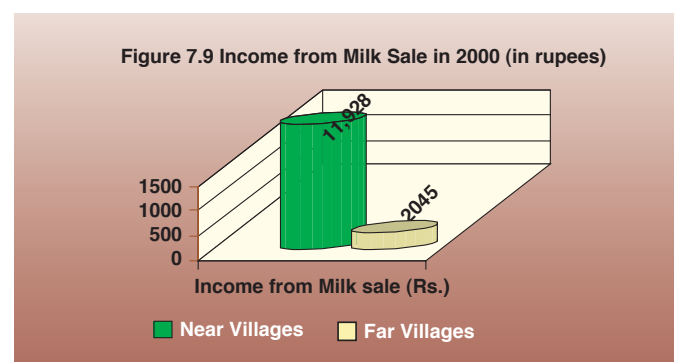
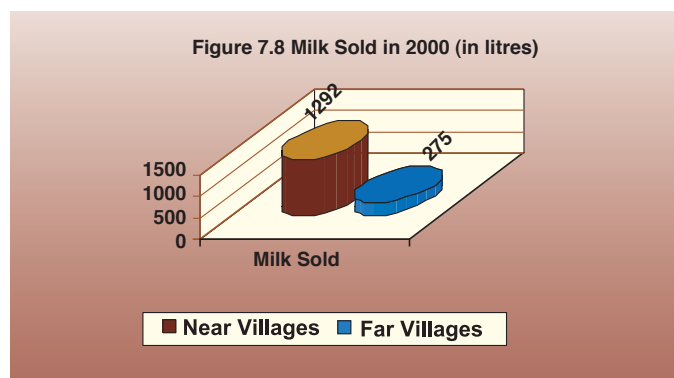
Very little meat and eggs are consumed. There is a tendency to sell them to earn money in the city. Muslims and other communities do consume meat and eggs but still in very small

quantities. The data on this factor were sparse, so no firm conclusions could be drawn.

Milk Sales and the Milk Market

Urban dwellers, are the main consumers of milk and milk products produced in peri-urban villages (chapter 6). Figure 7.8 illustrates that in the near villages, especially the three villages within HDMC (Gabbur, Bidnal and Kelageri) most of the producers market milk door to door in the urban area. For the far villages it is less. This is because of good demand, higher rates, payments when required, personal rapport with customers (who sometimes help producers purchase animals by paying in advance) and the option to adjust quality of milk according to the price offered by the customer. Producers closer to the city can directly market their produce by-passing the middlemen, thus obtaining even higher revenues.

However, the use of middlemen such as Gowlies is high in both near and far villages. In the near villages for some farmers the effort to go to urban markets to sell a limited amount of milk is not worth it and therefore they use middlemen. In the far villages middlemen are used for lack of any other alternative for external marketing. In the villages far away from the city, the internal market is not negligible. However, in villages close to the city families clearly prefer to sell their produce to urban markets or even to middlemen than to local markets (the hotels). Hotel owners often produce their own requirement of milk.



Overall dairying is an important occupation in the PUI. The average milk sales per family per year in villages close to the city is five times higher than that of a family from a distant village (Figure 7.8). The average income from these sales is even higher (close to six times) (Figure 7.9). This emphasises the high demand in urban areas.

Mean retail price of milk is higher for near villages (Rs9.2/l) compared to distant villages (Rs7.4/l). These mean values hide extremes. Cow's milk from far villages fetches a price as low as Rs 6/l while fresh buffalo milk sold in the city can sell for Rs15/l, a 2.5-fold difference.

The data clearly show that a location near the city creates more lucrative opportunities for dairying to become an important livelihood option. Moreover, the poorest (landless) benefit the most from it. In the PUI the landless sell more

milk compared to any other category, becoming the biggest stakeholders in dairy production. The reason is clear. An animal that can be stall-fed or grazed on field bunds is a viable livelihood option for a landless family given the better prices in the city for buffalo milk. In the three villages lying within the HDMC boundary, each family on an average marketed 1,465.5 litres of milk per year bringing a gross income of Rs14,405. The much lower corresponding figure for distant villages is Rs2,044/year, averaged across all wealth classes. In some suburbs, particularly Bidnal, these enterprises are effectively urban dairies, where the mean number of buffalo per landless household was 4.0 in 2000 and the mean quantity of milk sold a year was 4,000 litres earning a gross income of more than Rs40,000.

On the other hand in distant villages, the landless sell the least amount of milk. The farmers in far villages who do not have such easy access to the urban market, prefer to convert the milk into milk products such as curds and ghee before selling them in the urban areas because the milk may get spoiled by the time they reach the city. Marketing of evening milk is a problem in the far villages. Curds and ghee selling is a solution. It is more profitable for producers than working as agricultural labourers in the village. Many women from Channapur travel by bus to Hubli every day to market curds and ghee. In Bidnal there was only one household surveyed (a landless widow who cannot go daily to sell milk in the city) that sells curds and ghee.

Some distant villages (Shiraguppi and Pudukalkatti) have milk co-operative societies and are located on the KMF milk collection route (Chapter 6). These societies provide producers an outlet for selling their milk at a price fixed on the basis of fat and SNF⁸ content

in the milk. In the absence of this the farmers here would have to resort to middlemen for marketing in urban areas or sell to village consumers whose demand is typically low⁹ and in both cases fetching a low price.

In contrast, in the PUI, producers have a market that offers several options. Here milk can be diluted and sold to different market segments for different prices. Thus peri-urban producers cater to a wide range of consumers including the poorest at prices affordable to them by adjusting the quality of milk. Cooperatives are not a

preferred option in the PUI because of the easy access to urban markets and better prices. Among the near-urban villages, the exception to this is Dasankoppa, where little milk is marketed due to its poor road connection to Dharwad. In many respects, this village is similar to distant villages, and shows that bad roads add to 'frictional' distance, an indicator of the difficulty of moving goods and people irrespective of actual distance. Milk collection remains a problem in the PUI and the accuracy of the quality assessment is another issue (Box 7.4).

Box 7.4 *The Potential of Technology in Milk Collection*

Previously all milk collection activities at the farmer-owned, grass-root Dairy Cooperative Society (DCS), in Kolkata, India were performed manually. Due to climatic conditions, milk would often get spoilt, as producers had to wait in long queues. Secondly, the payment for the milk sold would get held up resulting in farmers trust towards the system declining.

Akashganga is a new methodology to collect milk in a timely, scientific, accurate manner which enables speedier collection of milk, timely payment and roots out corrupt practices. A group of seven dynamic, young entrepreneurs founded Akashganga with less than US \$5,000 as seed money. It comprises computer hardware, software and milk testing and interfacing equipment. The interface equipment is a microprocessor based electronic unit, and the milk testing equipment consists of an Electronic Weighing Machine and a Fat Testing Machine. The electronic interface allows the data about the milk to be transmitted to the PC. The data, which is transmitted, is also displayed on the display board, connected to the milk testing equipment. The complete interface mechanism of electronic unit with the PC is innovative and at the same time cost effective and offers transparency of operations. This microprocessor based Automatic Milk Collection System enabled integrating various equipment, using different technologies, to deliver value and speed to the farmer.

This project was conceptualized more than six years ago, when IT awareness in the country was limited to big cities. The fact that illiterate and semi-literate farmers accepted the system and are operating it confidently is an achievement in itself. The key success factor is the ease and efficiency of the milk collection system. Elimination of the middleman and accurate fat measure of milk, thereby enabling the producer to get a higher profit are the basic pillars on which the cooperative system is built. The farmers are benefited because their payment is now based on an accurate measurement of fat content and weight. In the earlier system the fat content was calculated a few

hours after the milk was received because the process of measurement was cumbersome. Also the payment to the farmers was made every ten days because of the inability of the collection centres to calculate the payment immediately. The IT system enables prompt, accurate, immediate and transparent payment. A significant impetus was provided when two entrepreneurs offered the integrated system to milk societies. They marketed their systems aggressively, sometimes offering to install the system free of cost initially until the customers were satisfied. These entrepreneurs now have a turnover of 10 million rupees from this product with the system now in place in 500 locations.

MYTH: Rural citizens will not accept IT.

REALITY: Even as far as four years back, they accepted the system, once the value was realized.

MYTH: Small private companies cannot undertake such projects.

REALITY: Private enterprise is essential to make such mammoth projects thrive on a sustainable basis.

MYTH: People need to be IT savvy to operate software applications.

REALITY: The workers at the DCS are semi-literate (passed grade 4 or 5) but are totally adept at working the system.

MYTH: Villages in India need heavy subsidy to enable them to procure IT based systems.

REALITY: All the DCS using AKASHGANGA have spent money from their own coffers.

Best Practice from the UN Habitat's Best Practices Database

Sale and Purchase of Animals

More cows are sold than bought and the number of buffaloes bought is more than those sold (Table 7.2). This indicates people's overall preference for buffaloes.

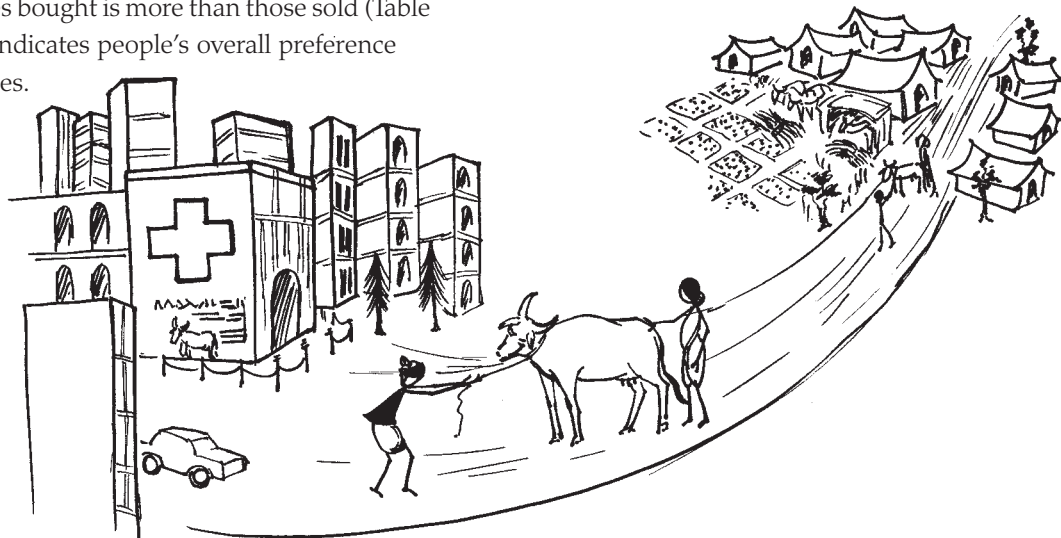


Table 7.2 Cows, Bullocks and Buffaloes Sold and Purchased during the Year 2000

Village	Type	Sold		Purchased	
		Number	Av. rate per animal (Rs)	Number	Av. rate per animal (Rs)
Near	Cows	5	3100	4	2600
	Bullocks	58	4600	63	6637
	Buffaloes	21	3652	26	7346
Far	Cows	17	853	7	6800
	Bullocks	31	3768	42	4107
	Buffaloes	10	4210	10	4245

Market for the Sale of Livestock

Animals are sold by families primarily in three ways (Table 7.3)

- Urban and rural markets
- To middle men
- To local households

Slaughter houses buy cattle either from middle men or from the urban markets, and hence do not figure in this household based survey.

Table 7.3 Market for Livestock-Number of Animals Sold

	Near	Far
Local household	14	7
Rural markets	1	10
Middlemen	0	1
Urban households	4	4
Urban market	48	37
Slaughter houses	0	0
Total animals sold	67	59

The urban market is the major outlet for sale of livestock with close to two thirds of animals being

sold here. It is however used more by families living in near villages. The urban market is a preferred option for wealth catagories. Big farmers sell 66 percent animals, small farmers 71 percent, marginal farmers 66 percent and landless 50 percent of their animals in the urban market. The urban market provides a wide range of customers, guarantees sale of animals and a better price. Other market options for selling the animals are considered only in case of emergency or in case a better price is offered.

The second main outlet is the local household, followed by local markets and then by urban households. The role of middlemen is minimal. For further off villages the second major outlet is the rural market while for near villages the next option for cattle sales is the local household.

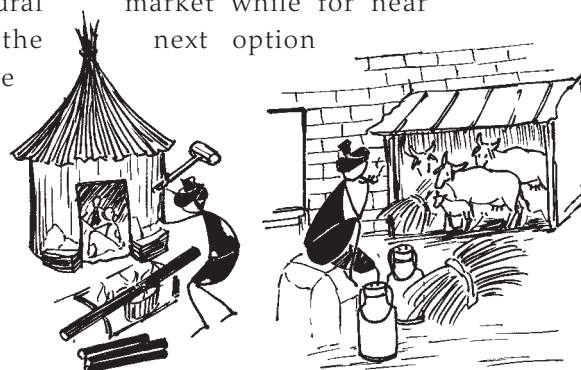


Table 7.4 Use of Fodder				
Villages	Number of families interviewed	No of families using green fodder	Average per family per year in tons	Average cost per family (Rs)
Near	136	66	15.7	2351
Far	185	87	1.5	720

Villages	Number of families interviewed	No of families using dry fodder	Average per family per year in tons	Average cost per family (Rs)
Near	136	127	8.9	8903
Far	185	169	6.6	5643

Feeding

Dry fodder is the main source that sustains the livestock in all villages (Table 7.4). Near villages use a greater quantity of dry fodder (8.9 tons per family per year) as compared to far villages (6.6 tons per family per year). The common fodders used are sorghum and maize stalk, paddy and wheat straw, groundnut haulm and grass hay. This is generally collected, stacked in the harvesting season and used in dry seasons. Dry fodder may come from their own lands, leased



Stacked dry fodder

lands and others’ lands. The landless in near villages have to buy this and in far villages some of them exchange it for farmyard manure (FYM).

Green fodder is also fed to animals mostly during the wet season. The near villages feed more green fodder to their animals. On an average each family feeds 15.7 tons of green fodder per year. Green fodder comes from own or others land purchased. The far villages feed 1.5 tons p.a., most of it during the rainy season. This high amount of green fodder fed to livestock in near villages reflects the greater importance given to dairy as a livelihood. Besides this, grazing land is scarce in the villages nearer the city compared to those further out. The green fodder commonly fed is sorghum, maize, grasses naturally growing on waste lands and weeds from agriculture land. Cultivation of green fodder is not common in any of the villages except one or two families in near villages who grow fodder using sewage irrigation.

Concentrates are fed in small quantities, mostly to milch animals and working bullocks. In near villages 59 per cent families feed concentrates as compared to 37 per cent in far villages. The

average quantity of concentrates fed in near villages, far villages and farthest villages is 3,308kg, 1,154kg and 533kg per family per year, respectively. In the near villages, big farmers (5,085kg) on an average use the highest amount of concentrate followed by the landless (3,559kg) and then by small farmers (2,890kg) and lastly marginal farmers (1,165kg). The major feed ingredients are maize, sorghum, wheat, cowpea and other pulses, rice bran, groundnut cake, and other husks. Farmers usually use materials produced by themselves or which are locally available, as they are less expensive than commercial concentrates.

Free grazing of animals is common in all villages but intensity and type varies greatly between villages. Among the most urbanised villages, Bidnal, has limited and controlled grazing and a considerable amount of fodder is 'cut and carried' (dominantly sorghum, but also forage maize and hybrid napier grass) to feed stalled animals.

In the other two villages falling within HDMC, Gabbur and Kelageri, the dominant source of fodder for livestock is free and uncontrolled grazing. The proportion of land used for *rabi* cropping is low (Chapter 3), and these summer fallows are used for grazing of dairy herds. Grazing often takes place on 'others' land'. As might be expected, the reliance on others' land increases with decrease in landholding. Most of the landless graze their stock on others' lands whereas among the big farmers, only half graze their stock on others' lands. The marginal and small farmers rely on a combination of others', government and their own land. Leased land is not a major option for any category. This is supplemented by all farmers with dry fodder, predominantly paddy, sorghum and maize stovers, but in much lower quantities than reported for Bidnal.



Eucalyptus planting of forest land: One reason for fodder shortage

In more distant villages grazing is the dominant feeding practice, where adequate grazing land still exists. A community-grazing scheme operates here, with a herder paid to tend the cows by the owners. In the crop growing season livestock are partly stall fed with forage sorghum and maize. The dry fodder used in these villages are sorghum and maize stalk, paddy and wheat straw, groundnut haulm and grass hay, most of them available locally. Loss of access to the forests has resulted in fodder shortage.

Draught use

The other main use of cattle is for draught power. The region is still relatively unmechanised, and even where tractors are owned, bullocks are still preferred for some tasks such as crop sowing and weeding. Surprisingly, number of local bullocks is greater in the near villages (1.72 per household in 1990 and 1.54 in 2000) than in the more distant ones (1.34 and 1.32 respectively), although numbers are decreasing over time in near villages. When desegregated into land holding class, as anticipated the farmers with most land have most bullocks. In descending order from large farmers down to the



Cattle for draught

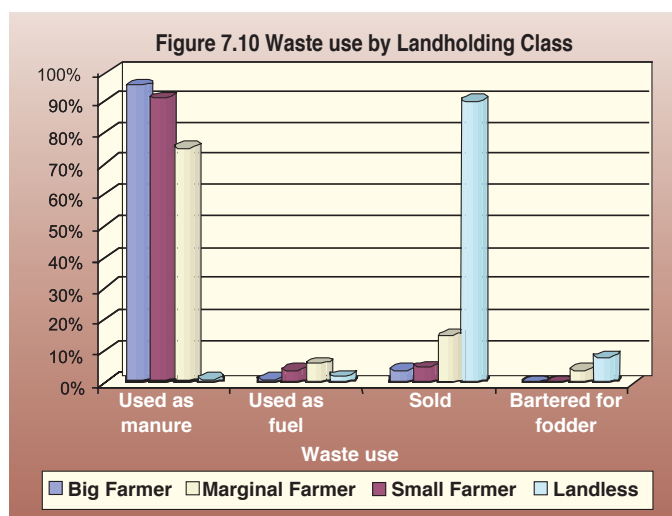
landless, the numbers of bullocks per household in 2000 were 2.70, 1.64, 0.92 and 0.37 respectively. Landless households keep bullocks to work the land that they have taken on a share-cropping basis. The highest numbers of bullocks per household are for the largest farmers in Bidnal and Shiraguppi. This is the zone where the profitable chilli+cotton intercropping system is practised, and clearly in that system the bullock is still an important animal. Owning bullocks also seems to be satisfying the urge to be considered prosperous. This is manifested in farmers keeping more than the required number of bullocks. Even big farmers owning tractors keep bullocks, as in case of Bidnal.

Diseases

Health awareness was found to be poor in both near and far villages. Vaccination and health care was found to be low even in villages like Bidnal which has a veterinary aid centre, and was similar for both rich and poor farmers.

The disease of which people have awareness is foot and mouth disease (FMD). The animals are generally vaccinated against this disease. In 2000, outbreaks of this disease were observed without any mortality. Out of total families surveyed, 172 families had vaccinated their animals against FMD and animals in 92 families were infected.

The other diseases found are hemorrhagic septicemia (HS) and blackquarter (BQ). Sporadic cases of these diseases were reported (HS=3 and BQ= 4) resulting in mortality of 2 animals due to HS and 1 due to BQ. Only 41 families reported having their animals vaccinated against these diseases. It is interesting to note that vaccinations against these diseases are done free of cost by the government veterinary department whereas vaccination against FMD is charged (the market price of each dose is Rs7 while the government subsidised rate is Rs2.50 per dose). Fewer vaccinations against these diseases is due to lack of awareness among the farmers and non-accessibility of the services. Vaccination and veterinary care is more in villages, which have veterinary aid centres like in Bidnal, Shiraguppi, Pudukalkatti and Inamveerapur (served by BAIF). Awareness of disease and health management is better in the near villages compared to far villages despite them not having access to



veterinary aid centres, Bidnal being the only exception. No other diseases except minor ailments like wounds, non-specific fever, bloat and impacting were treated.

Use of Waste

Dung is a very important by-product in the Indian rural economy. Every household has a compost pit or a heap near the house, and compost is used on the land as fertiliser or is sold if the household is landless. Dung cakes are also used as cooking fuel even in some of the houses where kerosene or bottled gas is used, as it is considered to provide the best temperature for cooking milk. Stalling of livestock facilitates collection of dung.

On average, 65–70 per cent of the dung is used as manure, 2–5 per cent as fuel, 17–25 per cent is sold and 0.5–5 per cent is bartered for fodder. The landless sell most of their manure while the rich use it on their lands (Fig 7.10).

Management

The study of management of the animals reveals a clear division of labour among the family members. The male members mainly graze the animals, whereas the majority of other works such as milking, cleaning, feeding, sale of milk and milk products are done by female members of the family. This division of labour is more prominent in far villages, where animal husbandry is not the primary livelihood.

As dairy has gained more importance in the peri-urban economy over the last decade, the trend is changing with men being

involved more in animal management. This change is most evident in near villages where dairy has become an important livelihood activity. In the near villages, where dairying has become a male dominated activity, women still continue to do milking and cleaning work. Except for the wealthier farmers, animal husbandry is a family activity where the family members do all management and very little hired labour is involved.



Cowdung cakes used as fuel

Breeding

Breeding of animals is an important activity in dairy farming. But in the villages awareness about breeding is found to be poor. Bull service is the major method used for breeding of animals in all villages except Inamveerapur, which has

BAIF's¹⁰ artificial insemination service (Box 7.5). Almost all breeding in other villages is done by natural service. This is because of lack of awareness about the success of other alternatives and non-accessibility of other breeding services.

Box 7.5 BAIF's Dairy Livestock Production Programme: Turning Liabilities into Assets

A local cow or buffalo is a potential asset that most of the families in rural areas, even the landless have. However, poor maintenance and management systems have converted these resources into liabilities. A dairy livestock programme started to address this problem in 1967 in Urulikanchan near Pune in Maharashtra State, India.

Producing good quality dairy animals using high quality frozen semen in artificial insemination is the key to the success of this programme. The salient features of this programme are timely delivery of artificial insemination service at the doorstep of farmers, regular follow up, fodder development, animal health care, training of farmers and capacity building.

BAIF reaches over one million families from 12,000 villages through 841 centres in eight states of India. About 0.8 million cows and buffaloes, mostly owned by the poor, are bred and 200,000 female calves are born. The calves so produced will start yielding about 2,100–2,700 litres of milk per lactation at the age of 28–30 months. Presently, about 4,25,000 cows and buffaloes contribute about 0.95 million litres milk every year.

A herd of elite Jersey and Holstein breeds of cows is maintained along with native cattle breeds like Gir, Sahiwal, Hallikar, Amrit Mahal, Dangi and Ongole. Elite buffalo breeds include Surti, Murrah, Jafarabadi and elite goat breeds such as Sirohi and Osmanabadi, are maintained. Bull mothers of the elite herd produce bulls for semen production. Processed at the semen-freezing laboratory, which is certified under ISO 9002, about 2 million doses of frozen semen are produced annually. To improve dairy profitability, research on non-conventional forages and feed is undertaken and relevant technologies disseminated.

Source: Multidisciplinary programme: Livestock Development, BAIF pamphlet, BAIF Development Research Foundation, Pune, (2002)

Conclusions

- Livestock, particularly dairying, emerges as the most important natural resource based livelihood option for the poor in the PUI, especially the landless (Box 7.6).
- Landlessness does not exclude households from this activity. On the contrary, the proportion of landless families involved in dairy activity increases near the city.
- Buffaloes are the preferred species influenced by a specific demand for buffalo milk. Existing skill in the community has facilitated it further.

- Dairy enterprises become economically brighter nearer the cities.
- Other livestock (except goats for some people) do not form a substantial part of livelihood in the PUI. Goats, though still small in number, seem to be increasing. But it is a more general than exclusive peri-urban phenomenon.
- Grazing pressure on land increases nearer the city as increasing numbers of landless families are involved in dairy farming.
- Healthcare of animals is an area of concern despite better economics and accessibility to services.
- Breeding of animals remains traditional and unplanned.
- It puts an indent for peri-urban development programmes tailor made for this locale.
- Fodder resources need urgent attention if the landless PU dairy farmers are not to abandon the activity and convert themselves to full-time urban wage workers. Attention needs to be given in preserving or promoting cropping patterns that produce sufficient fodder. Certain sections of land in the villages absorbed by the city need to be preserved as agricultural land.
- Marketing of milk and its products has a 'personal touch' that benefits both producers and consumers. The concept of 'choosing your milk' from a quality and price matrix seems to be satisfying both parties. The system needs to be preserved without 'development interventions' affecting it. Innovative marketing strategies like the one adopted by Aakashganga may be of use in streamlining the marketing efforts (Box 7.4).
- Credit is a major constraint (as was indicated in subsequent Participatory Rural Appraisal) in the villages inside the city, especially while replenishing/ replacing the livestock. No longer being considered rural, these urban villages were cut off from rural credit based programmes advanced through banks.

Implications

- The effect of urbanisation is **real** as far as livestock is concerned. There are distinct dissimilarities between the near and distant villages in composition of livestock population, livestock management, milk marketing and consumption.
- Development programmes need to recognise that the peri-urban situation differs from rural and urban ones.

Box 7.6 *Animals Benefit the Poor*

The baseline, or "most likely," IMPACT projection is that developing country growth rates for aggregate consumption of meat and milk over the 1992/94 to 2020 period will be 2.8 and 3.3 percent per annum respectively, compared to 0.6 and 0.2 percent in the developed countries. Similarly, additional milk consumption in the developed countries of 13 million tons of Liquid Milk Equivalents (LME) will be dwarfed by the additional consumption in developing countries of 227 million tons. The experience will vary widely among different parts of the developing

world, with China leading the way on meat with a doubling of the total quantity consumed. India and the other South Asian countries will drive a large increase in total milk consumption. By 2020, people living in developing countries are projected to produce on average 38 percent more meat and 54 percent more milk per capita than in the early 1990s.

Far from being a drain on the food purchasing power of the poor, increased consumption of animal products can be a major cause in increasing the incomes of the poor on the production side. There is considerable evidence from in-depth field studies of rural household income generation strategies in Africa and Asia that shows that the rural poor and landless presently get a higher share of their income from livestock than better off rural people. The exception tends to be in Latin America, where relative rural wealth correlates more clearly with cattle holdings. In most of the developing world, a goat, a pig, some chickens, or a milking cow can provide a key income supplement for the landless and otherwise asset-poor.

However, there is a danger that rapid industrialization of production could harm this major mechanism of income generation for the poor. There are large economies of scale in processing livestock-origin food products, but relatively few in production beyond a fairly low threshold in most cases. It is therefore critical for poverty policy to seek vertical integration of small producers with livestock food processors, through contract farming or participatory producer cooperatives. The alternative might be that industrial livestock producers drive out the poor and the one growing market they presently compete in will be closed to them.

Over-grazing is often the result of inadequate property rights development or enforcement mechanisms, or politically motivated subsidies to large producers. Policy needs to focus on the overt distortions that produce problems and also on how to let financial incentives to producers and consumers better match the full costs and benefits intrinsic in livestock production, a sector well-known for its many non-market externalities.

Livestock products presently contribute about 40 percent of the value of food and agricultural production in the world, but receive a disproportionately small allocation of public investments for facilitating production. Inappropriate livestock development patterns such as high cost and highly capitalized industrial pig, milk, and poultry production in the peri-urban areas of developing countries are often the effect of distortions in domestic capital markets. Urban piggeries and dairies that cannot adequately dispose of waste materials are often the result of poor regulatory environments, distortions in the marketing chain that prevent competition from rural areas, and lack of legal accountability of economic agents for pollution.

Governments and development partners seeking entry points to facilitate the participation of the poor in commercially viable activities need to follow the Animal Food Products Revolution (AFPR) closely. The stakes are high, and the probability of success is enhanced by rapidly growing demand for output. The worst thing that well-motivated agencies can do is to cease public investments that facilitate economic, sustainable, and small-operator oriented forms of market-oriented livestock production. A lack of action will not stop the AFPR, but it will help ensure that the form it takes is less favorable for growth, poverty alleviation, and sustainability in the developing countries.

Source: IFPRI (1999)

Policy

1. Inclusion of any village within the municipal limits makes the community suffer in several ways. While the taxes are to be paid at urban rates, government administered development programmes stop and credit availability especially through the cooperative sector ends. This makes the population, especially the poor, depend on money lenders. Whenever municipal authorities expand their city limits, they need to keep the existing population in the area in mind, which by no means is urban in its nature.

By a mere administrative decision, these villages should not be prevented from accessing existing support programmes of credit, veterinary services, fodder development and agriculture extension services. This normally happens because of a shift of responsibility from the Zilla, Taluk and Gram Panchayats to the corporation or the municipality. As the Panchayati Raj system is more development oriented than the municipal administration, the 'villages inside the cities' have the service support to their existing livelihoods withdrawn. The urban development programmes need to recognize this and plan appropriate infrastructure and services for these villages. Livelihoods of the village and the overall economic and socio-cultural well being are likely to change with the shift in administrative structures. Participatory studies can help understand the potential negative effects of these changes.

2. The community at present does not seem to have any say in the decision to be part of the city, rendering them unable to bargain for the double loss through lost facilities and increased tax. It is necessary that they are

consulted and allowed to frame the plan for themselves in the new setting.

3. Land is lost for non-agricultural purposes, eroding the natural resource base of the community. Livestock emerges to be more important a livelihood than agriculture as one approaches the city. This means, more livestock have to be managed with less land. But this inverse proportion of livestock and land can not go beyond a limit without both being affected. Hence a strategy to preserve a certain minimum area of agricultural land to support livestock, needs to be put in place. Efforts to increase the carrying capacity of land by shifting to tree based farming system and incorporating watershed development will help in sustainable livestock management (Box 7.7)
4. Livestock (buffalo in case of Hubli-Dharwad PUI) development should become the core of livelihood programmes in the peri-urban context. The study shows beyond doubt that this is what happens naturally. Any drastic shift in livelihood may find the community to be inadequate in its skill. Though modern development programmes tend to believe that any skill can be imparted in the short term, such examples are rare. Skills take generations to be honed. Time-tested and relevant skills in livestock rearing should be preserved and upgraded.
5. Diversity of demand in the milk market has helped the community to develop its niche based livelihood strategy. Temptations to 'modernize' dairy industry, making every one buy pasteurized milk, should be resisted if these livelihoods are to be preserved (Box 7.8).
6. The need for organizing the community to control free grazing is urgent. This being an area of social engineering needs to be done

involving the NGOs and other social organizations. Half-hearted efforts could be more harmful than no efforts. Fortunately there are examples where communities have developed controlled grazing and are committed to it.

7. Government veterinary health care and breeding services are grossly inadequate. There seems to be no way by which the governments

can improve it until the norms change for veterinary staffing and the funding increases. Hence it is imperative that the community be empowered to take care of these services themselves. Training of local youth as para-vet to perform vaccinations, artificial insemination, pregnancy diagnoses and first aid will be of immense use in achieving this.

Box 7.7 Tree Based Farming System: The BAIF Model

Agriculture systems with the complex relation between different enterprises are referred to as farming systems. The synergism between different crops, animals and trees makes the system sustainable. The synergistic effect makes the system more than the sum of all enterprises it consists of. Modern agriculture, with its tendency for monoculture, has in several ways weakened these systems.

Trees are an important link in the energy cycle of the system. Trees yielding biomass for manure, fodder, fuel and timber make the system more self reliant in its input supply.

Tree based farming, developed by more than a thousand small and marginal farmers associated with BAIF Development Research Foundation, is a good example of making the system versatile. Farmers near Sushettykoppa and 20 other villages near Hubli-Dharwad are experiencing the benefit of such systems.

Each farmer develops a single acre of his land on the following lines:

- Live hedge fence around the farm
- Soil and water conservation by physical and live bunding across the slope
- Harvesting of runoff water in farm ponds
- Planting horticulture plants (40 plants per acre) for diversification
- Planting of 500 forestry plants of about 15 species per acre

Entire communities work together on common lands and each others' lands to achieve this..

Within three to four years, things that are normally difficult for a small farmer start happening as if on their own:

- Availability of fodder makes farmers confident of taking care of more and better livestock
- Availability of biomass and dung results in more and better manure
- Better manuring results in better crops and decreased import of inputs.

Source: BAIF

Box 7.8 Critique of India's Livestock Policy

India's livestock legacy has four dimensions:

1. Cows and bulls are treated as sacred and hence are protected.
2. The conservation of farm animals is essential for the sustainability of agriculture and the survival of small farmers.
3. The conservation and utilisation of farm animals is based on diversity - both diversity of breeds as well as diversity of function of farm animals.
4. The sustenance of cattle comes from diverse sources of fodder and feed - agricultural by-products such as straw and oil cake, fodder trees planted on farms and common property resources such as village pastures and forests.

The indigenous approach to livestock is based on diversity, decentralisation, sustainability and equity. Our cattle are not just milk machines or meat machines. They are sentient beings who serve human communities through their multidimensional role in agriculture.

This policy proposal recognises that the livestock economy is the economy of the poorest households in India.

As stated in Section 2.3 (of the Livestock Policy Perspective 1995-2020 developed by the Government of India and the Swiss Development Cooperation) : About 630 million people reside in rural areas (74% of total population) of which 40% have incomes which place them below the poverty line. Some 70 million households (73% of total rural households) keep and own livestock of one kind or another and derive on average 20% of their income from this source. Small and marginal farmers and landless labourers constitute almost two-thirds of these livestock keeping households. The importance of the livestock sector can therefore not be measured purely in terms of its contribution to Gross Domestic Product (GDP) but it plays a very crucial role in generating income and employment for the weaker sections of the economy.

However, all the analysis in the policy is totally insensitive to the systems which allow cattle to serve the needs of the poorest. As a result the recommendations are a direct assault on this survival base of the poor.

For the livestock policy to be ecologically sound and socially just the following elements must be urgently addressed.

1. Protection of native breeds and conservation of animal biodiversity
2. Strengthening the role of farm animals in sustainable agriculture
3. Stopping the slaughter of cattle for exports.
4. Stopping the export of oil cake and cattle feed
5. Taking urgent steps to improve the fodder situation through planting appropriate crop species and trees and by rejuvenating the commons-
6. Preventing the import of environmentally unsound methods of intensive factory farming of animals which degrade and pollute the environment and cause health hazards to consumers

Shiva, (1996)

END NOTES

- 1 Within 8 km from city - Gabbur, Kelageri, Bidnal and Dasankoppa.
- 2 Between 10 to 18 km from city - Inamveerapur, Pudakalkatti, Shiraguppi, Mandihal and Channapur.
- 3 Big farmers (BF)- Land holding above 2 hectares.
- 4 Small farmers (SF)- land holding between 1 to 2 hectares.
- 5 Marginal farmers(MF) –Land holding less than 1 hectare
- 6 By this is meant villages less influenced by urban centres.
- 7 Cattle includes cows and bullocks.
- 8 SNF stands for Solids-not-Fat, which is the remnant content after removal of water and fats.
- 9 In villages most people produce their own milk and this low demand as well as the low price paid by middlemen in the villages both drive down the price.
- 10 BAIF Development Research Foundation, an NGO.

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Water Resources Around Hubli and Dharwad

M Hollingham and S G Joshi



A village open tank

Introduction

Concerns have been raised in recent years that groundwater levels are dropping, groundwater quality is worsening, and additionally the existing main water supply is unable to provide sufficient water to the cities, especially in summer. It was hypothesised that excessive water abstraction within Hubli-Dharwad was resulting in lowering of water tables in the surrounding peri-urban villages. The objective of the study reported here was to assess whether the above were true for Hubli-Dharwad and the surrounding district, as other research has indicated for other peri-urban areas (Box 8.1). This was achieved through surveys, interviews, village visits, a survey of water quality at the point of supply, and secondary data sources.

Topographically, Hubli-Dharwad is situated upon a broad ridge running north-west to south-east on the north Karnataka plateau inland of the Western Ghats. The elevation of the study area ranges from 600-755mm. This information is important, in that no surface water flows into Hubli-Dharwad. The NH4 highway between Hubli and Dharwad marks the watershed between rivers flowing to the east and the west. Dharwad occupies the high ground, 710m on average, which extends to the north and west. Hubli is situated on lower ground (620m). Hubli is primarily drained by the Hire nalla (stream), and Dharwad by the Chaul nalla and the Biratikal nalla. Bidnal and Gabbur lie directly on the Hire nalla, and Inamveerapur lies on a separate tributary.

The main water sources for the cities of Hubli and Dharwad and the surrounding district are a combination of traditional and modern. Before 1956 there was little difference in water sources between urban and rural areas. Both relied on hand dug wells and tanks (large water harvesting dams). Most villages had a tank to collect the surface runoff during the monsoons. Since 1956, Hubli and Dharwad cities have relied on piped

reservoir sources, while the rural areas have increasingly relied on borewells, pumped first by hand pumps (HP) and then motorized pumps as electricity became available to the villages. Motorized borewells that supply water to storage tanks around the village are known as Minor Water Supplies (MWS), while those borewells that supply a piped network are known as Piped Water Supplies (PWS).

Box 8.1 *Water Resources in Peri-Urban Areas*

The need for water is universal, for domestic and industrial uses, for irrigation, etc. Water is an essential element, becoming increasingly scarce due to contamination and other circumstances and is not always easy to conserve. A water system consists of the water resources, conveying and distribution systems and the sewage systems and can be a cause of contamination itself. A large urban center including industrial areas and nearby intensive agricultural production systems, may cause contamination of the aquifer by nitrates coming from cow sheds, poultry houses, city garbage, from excess nitrogen fertilizers and from products derived from the decomposing process of plant residues. Contamination may also come from chemical solubles used in industry and from heavy metals found in industrial sewage.

If the resource is underground water, it will be distributed by pumping from wells. Intensive pumping of water can lower the groundwater levels and, if the aquifer is close to the sea, the intrusion of saline water will be allowed. These factors will eventually cause salinization of the aquifer and reduce the quality of the water for drinking, industrial or farming purposes.

The intensive use of water has led to water shortages in many areas. As a result large water supply projects have had to be constructed, carrying water over great distances, and also making water more expensive. Other water resources, such as lakes and rivers, are also facing deterioration due to the common occurrence of drought years. The main problem, however, remains contamination caused by sewage water produced by the population and by industrial activities.

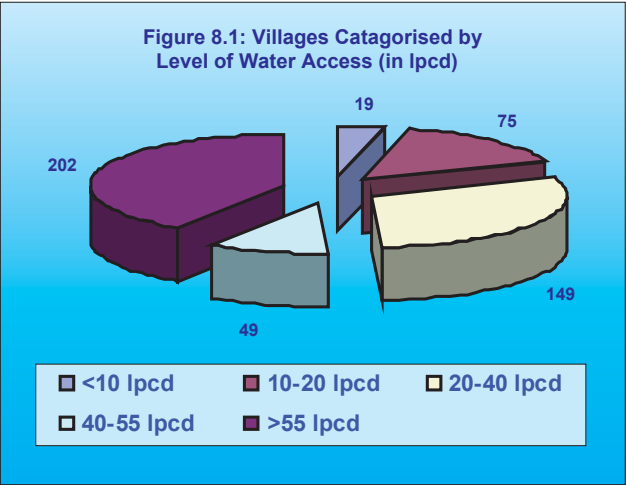
Normally, the sewage from cities and industry reaches the lakes and rivers, located in low lying areas, by discharging into them. As a result of the sewage water reaching surface aquifers and rivers and lakes, an intensive growth of algae is produced. Later, with the decomposition of the algae, oxygen is absorbed from the water, destroying microorganisms and other living agents in the water, causing it to become sterile. Such a situation will prohibit the use of this water for human consumption. Sewage water also contains detergents and salts, due to human use, and usually the salinity rate is higher than the original water.

Katzir (1996)

Water Provision

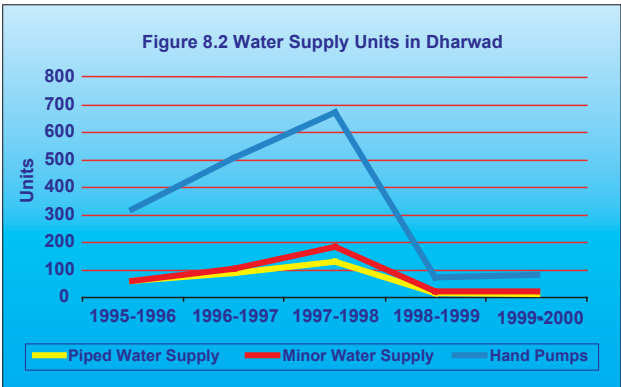
There is a wide variation in the supply and availability of water across Dharwad district, and within rural and urban areas. The provision of sufficient household water of reasonable quality helps prevent disease. The World Health Organization (WHO) recommends a daily minimum of 50 lpcd¹ (WHO, 1984), and the Indian Government (OM Consultants, 2001) has set a minimum target of 40 lpcd.

The availability of water across the Dharwad district is severely limited by availability of electricity. Despite assurances of the Karnataka Power Transmission Corporation Limited (KPTCL) (Joshi, 2001), load shedding does occur across the district. As many water supply systems depend upon electricity, water at best is only available for a few hours each day from water sources that depend on electric pumps. In Dharwad district, half the villages (49%) do not even meet the government standards of 40 lpcd (Fig 8.1), and 4% of the villages have less than 10 lpcd.



A total of 2,341 water supply units (inclusive of hand pumps, PWS and MWS) have been installed in Dharwad district from 1995-2000 (Fig 8.2).

Among the villages in the district, whilst every village has at least three hand-pumps, only two out of three villages and four out of five villages have a PWS and MWS respectively (Om Consultants, 2001).

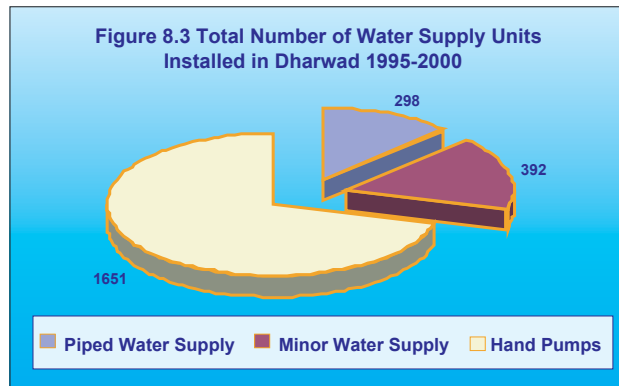


Water Supplies for Hubli-Dharwad

Initially Hubli and Dharwad had only two tanks as sources of water supply; Unkal Tank for Hubli and Kelageri Tank for Dharwad. As both cities grew the existing water supply became inadequate and newer sources had to be developed.

Neersagar reservoir supplies drinking water to a part of Hubli city. Malaprabha reservoir meets the water needs (both drinking and irrigation) of both Dharwad and Hubli (Fig 8.3). Currently about 10,000-12,000 m³/day is lost from the Malaprabha source due to leakage and power failure, before reaching Hubli-Dharwad². The water main was constructed of concrete, which was easily damaged and readily broken by villagers along the pipeline trying to gain access to free water. These pipes have now been replaced with bitumen lined steel pipe considerably reducing the leakage. Although steel pipes are less prone

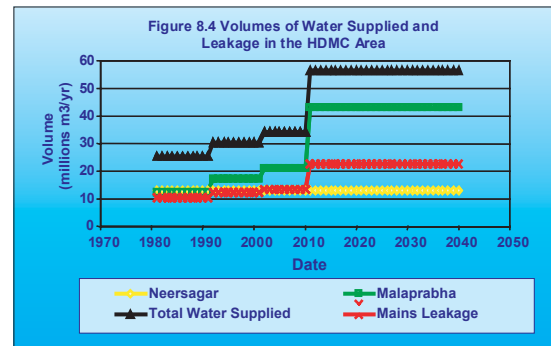
to deliberate breakage, they may corrode, so mains leakage may continue to rise, as indicated in Figure 8.7. Current resources are not considered adequate and a third stage of the



Malaprabha reservoir has now been approved and is designed to supply a further 61,000 m³/d by approximately 2003 (Kulkarni, 2001).

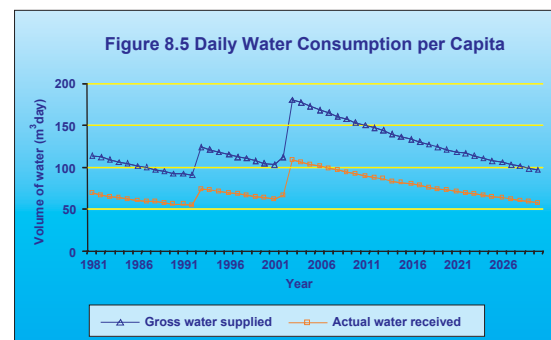
The population of the HDMC area has grown at a rate of 2.5% p.a. from 525,000 in 1981 to 786,000 in 2001 (Census of India, 2001), and water use per head is also increasing, as modern plumbing fittings and water using machines are installed. The projected population figures of the twin cities will reach 1 million by 2010 and demand for water is expected to reach 150,000 m³/day at 150 lpcd. Industry only uses a small amount of water (approximately 4500 m³/day) compared to household water consumption. Figure 8.5 shows the amount of water available per person allowing for losses from 1981–2020. The figures used assumes that 10,000m³ is supplied to villages along the Malaprabha pipeline and that there is also another 10,000m³ estimated loss along the pipeline from Malaprabha to Hubli Dharwad.

The actual amount of water supplied per person is scheduled to reach the 150l/d, the minimum recommended by the Ministry of Urban



Development (Kulkarni, 2001) by 2004 when the third stage of the Malaprabha scheme begins to supply water, and then will fall below this by 2009 due to population increase (Fig 8.5). The gap between gross water supplied and actual water received is due to leakage from the water reticulation system within the city, which is notoriously difficult to control. As the population increases, it may be assumed that many will live in new housing developments in the space between the twin cities, in which case new pipes will be laid which will be less prone to leakage, so it could be argued that the assumption of leakage within the urban area may be a slight over-estimate.

Mains water is normally only piped every two to three days during the monsoon, increasing to every five to seven days at the end of the summer (Deccan Herald, 2001). Because of the intermittent water supply, most buildings have large tanks on the roof to store water. Households at the top of



hills find themselves with inadequate water pressure and are the last to be supplied with water (Polisgowdar, 2001). When water is not supplied, people obtain water free from a 3m³ government tanker or pay Rs 125 for a private tanker (Polisgowdar, 2001). In districts without a well or a piped supply, water is tankered and people get as much water as they can collect at a cost of Rs 20 /month (Goroji, 2001).

Irregular water supply has led citizens of Hubli and Dharwad to look increasingly at groundwater as an alternative supply. At least two boreholes a week are drilled by one well drilling company alone. There is no borehole-licensing scheme and boreholes can be installed and abstract as much water as they like with no regard for neighbouring boreholes or the amount of recharge available. Boreholes cost between Rs 25,000-50,000 to drill and install a pump and water treatment equipment (Basavaraj, 2001). Typically the wealthier people and those living in apartment blocks have private boreholes.

Public boreholes are used where there are no water mains. Nearly 600 boreholes were drilled by 1991 by the HDMC and the KSWsDB (Karnataka State Water Supply and Development Board), of which two-thirds are not in working condition, because the hand pumps are broken, and a majority of the electric powered pumps do not work (Polisgowdar, 2001). The number of private wells far exceeds the number of public wells.

The remaining tanks in the cities are still used by the inhabitants for washing clothes, watering animals and washing vehicles. However, many tanks within Hubli and Dharwad have become derelict. As the tanks silt up, the catchment areas are developed for housing. Hirekeri tank in

Dharwad is now partially filled by a landfill site. Barakotri and Saraswatpur are being covered by housing developments. On the other hand, Unkal Tank near Hubli has undergone restoration, sewers have been diverted and people are discouraged from washing vehicles in the tank. Kelageri tank is now owned by the University of Agricultural Sciences and no water is allowed to be abstracted by anyone other than the university. These urban developments have direct implications on ground water levels and recharge for the surrounding PUI. The Government of Karnataka has a World Bank funded tank desilting programme to improve surface storage capacity and recharge aquifers for irrigation and drinking water and dilute any existing chemical contamination. However recent experience has shown that where the actual watershed is located both in the urban and peri-urban areas, urban authorities are not willing or able to do the work which the rural authorities have been assigned to undertake in watershed development.³

Domestic Rural Water Supplies

It is generally reported that water levels in the wells in more distant villages are dropping. In Pudukalkatti it was reported by respondents that the dug wells still had water in them during the *rabi* season five years ago, but by 2001 they tend to be dry by the end of the monsoon. Alongside this trend, overall village water consumption is increasing. This is largely due to the introduction of modern bathroom and kitchen fittings. Population growth rates vary with each village, some of the remoter villages having static or declining populations, while others especially those near roads and Hubli-Dharwad are increasing.

Rural villages typically have several water supplies. The traditional supplies are hand dug



Women taking water from the village tank

wells mainly 4-5m wide and 15m deep, and tanks which are impounded by small water harvesting dams. These sources are still used, predominantly for watering animals and washing. However in some villages water from the tank is drunk, as the villagers prefer the taste to groundwater, as this tends to be brackish.

There have been many successive government water supply projects.

The first government schemes installed the Indian made hand pumps (HP) with a concrete apron and a channel to remove spilt water away from the pump. In the last 20 years minor water supply (MWS) schemes have been implemented. These consist of 2–3m³ tanks sited around the village, supplied from a single pumped borehole powered by electricity. Piped water supplies (PWS) have also been developed for villages



An overhead tank

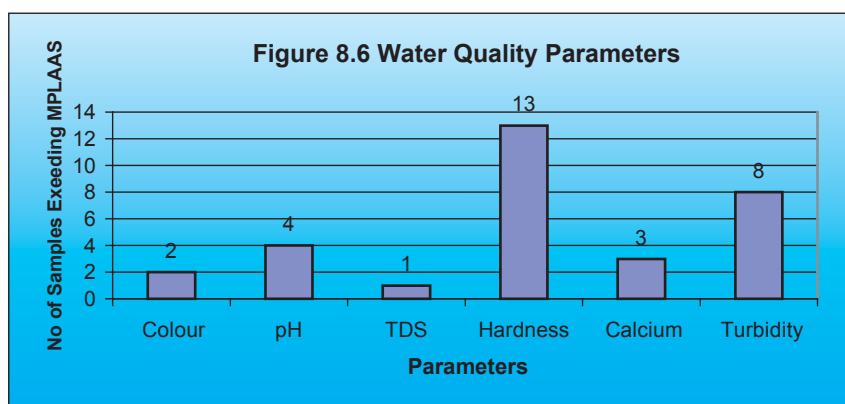
without a suitable borehole, some like Kelageri and Gabbur are supplied sporadically with water from the city, and others like Shiraguppi obtain water from boreholes situated outside the village.

The storage tanks and standpipes around the villages are reliant on electricity for their operation. When there is no electricity, hand pumps are used. Electricity is generally supplied for 4 or 5 hours a day in villages, and the time of supply is not consistent each day. As a result people leave taps open, as it is difficult to detect when water is being supplied if the taps are closed. Water is collected when it flows from the pipes until everyone has enough, and then the remainder is allowed to flow to waste.

Some of the wealthier rural households have opted for a piped supply costing Rs500 for installation. Water is free but there are plans to meter the water supply and charge Rs250/m³. Water supplies are constructed and maintained by the Gram Panchayats (village councils), and a small annual fee of Rs 5 is charged per household. Villagers have little incentive to maintain and repair their water supplies as they see this as the responsibility of the Gram Panchayats.

Rural Drinking Water Quality

The water sources in the eight project villages were tested in 2001 as part of this study. It was found that excluding HDMC treated water supplies, the majority (71%) of drinking water supplies failed the Government's Maximum Permissible Limits in the Absence of an Alternative Source (MPLAAS) (BIS, 1991) and as such were not suitable for drinking. This was mainly because the faecal coliform counts, conductivity, total hardness or calcium concentrations were too high (Fig 8.6); all non



HDMC treated water supplies failed the GOI's Highest Desirable Limits (HDL) (BIS, 1991).

Quality of water in the eight project villages is based on the quality of ground water found in borewells and in the village piped water supply. Based on a sample of 34 drinking water points, in near urban villages 29% of the water is potable compared to 27% of water being potable in more distant villages. It should be noted that there is treated water from HDMC being supplied in some villages that fall within its boundaries. In the villages close to urban areas, groundwater has lower mineral content compared to more distant villages. This implies that in near-urban areas more recharge than abstraction is occurring relative to the rural areas causing a dilution of solutes. This could be a result of mains water and sewage leakage within the HDMC urban area, and over-abstraction for irrigation in the rural areas.

Agricultural Water Supplies

Irrigation is mainly required in the '*rabi*' (post-monsoon) and summer seasons. The main sources of water during this time are pumped boreholes and public tanks. Some water is also abstracted from dug wells, industrial sewers and perennial nallas. Private boreholes have no costs

other than installation, but public boreholes cost Rs 300 per hand pump per annum. Water can also be bought by the hour from those with boreholes, the price is typically Rs30/hr. Water is supplied from public boreholes for 4–12 hours a day when there is electricity. Timings change every 15 days. The erratic

and limited supply of electricity accentuates the water shortage and ironically even leads to water wastage.

The main irrigation method used is furrow irrigation, which is very inefficient. Farmers have little appreciation of the correct amount of water to apply and tend to irrigate whenever power for their pumps is available. The gradual drift from labour intensive arable crops to tree crops also has increased the length of the irrigation period from 240 days to 360 days. The average crop water requirement is 300 mm /120 days in the '*khariif*' (south west monsoon, or main growing season) season and 350 mm /120 days in the '*rabi*' and summer seasons.

Statistics of the different types of groundwater abstraction structures for irrigation for the Hubli and Dharwad taluks are shown in Table 8.1. Assuming an annual growth of 2%, by 2001 the number of borewells had increased by 164 in seven years. However, this would appear to be an under estimate, as one drilling company based in Dharwad installs at least two borewells per week (one for irrigation and one domestic) (Basavaraj, 2001).

Table 8.1 Numbers of groundwater abstracting structures for irrigation in the Hubli and Dharwad taluks, historic and projections⁴

		Borehole	Dug well	Dug cum borehole	Others	Total
1994	Hubli	414	111	3	49	577
	Dharwad	1102	222	19		1343
1999	Hubli	457	123	3	54	637
	Dharwad	1217	245	21		1483
2001	Hubli	476	128	3	56	663
	Dharwad	1266	255	22		1543
2011	Hubli	580	156	4	68	808
	Dharwad	1543	311	27		1881
2021	Hubli	707	190	4	83	984
	Dharwad	1881	379	33		2293
2031	Hubli	862	232	5	101	1200
	Dharwad	2293	462	40		2795

The conductivity of the groundwater is generally high (1500–3000 $\mu\text{S}/\text{cm}$) and presents a significant salinity risk requiring careful management to prevent adverse effects on some crops (Lenka, 1999).

Tanks are the other main means of irrigation. Water from tanks has low conductivity ($<600 \mu\text{S}/\text{cm}$) and can be used for all crops. Smaller tanks are maintained by the Zilla Panchayat (District Council), however, the Minor Irrigation Department has responsibility for tanks irrigating areas larger than 40ha. There are about 100 such tanks in the Dharwad district, mainly to the west of Hubli and Dharwad. Many tanks are not maintained by the villagers and have fallen into disrepair as the maintenance is seen as the responsibility of the Zilla Panchayat. The Zilla Panchayat does not have sufficient funds to repair tanks unless there is a specific aid for this purpose. Tanks are mainly used to irrigate rice crops, but are also used for watering animals and washing clothes.

Industry

There are five main industrial sites located along NH4 highway at Tarihal, Sattur, Rayapur, Lakamanahalli and Belur. The site at Belur, north west of Dharwad, is expanding and is utilising about 607,660 litres per day (0.22 million m^3 a year or 0.018 million m^3/month), a fraction of which is used domestically in the cities of Hubli and Dharwad. The details from other industrial areas were not available.

Other industries in the cities include tea blenders, granite cutters, edible oil refiners, wheat and rice flour mills, electrode manufacturers, mosaic tile makers, limestone pulverizers, cotton ginning, pressing and spinning. There was a tanning factory at Lakamanahalli, which operated for two years. Before closing, it used to produce chromium. All these industries are capable of causing localized pollution if there is no provision for the correct disposal of effluents and waste. New larger scale industries need to have

measures specified by the Karnataka State Pollution Control Board (KSPCB) for proper waste control, before they commence operations.

Future Groundwater Prospects

The general opinion of hydrogeologists and villagers is that the water table in rural areas is dropping and water quality is worsening. The shale aquifer to the north-east is known to be saline and in the west the situation is also deteriorating (Hegde, V S, 2001). The Department of Mines and Geology in Dharwad is worried that all ground water will become saline especially to the north-east. As sweet, fresh water is limited to a small pocket in the west and water demands are increasing, they have plans to develop within the HDMC area two water supply systems, one for brackish water for washing, and one for sweet water that would be reserved for drinking (Hegde, G, 2001).

To mitigate the drop in water levels and the increase in salinity of ground waters, the Department of Mines and Geology, Dharwad, is currently experimenting with a recharge well in Mungol that catches runoff and filters it through a horizontal roughing filter before flowing down a well filled with stones (Hegde G, 2001).

Estimation of Artificial Recharge in the City due to Leakage

Artificial measures to improve recharge in rural areas based on detaining runoff are as yet only minor; however large amounts of artificial recharge are occurring within the HDMC area because of leakage from the water mains, sewers and cesspits. Figure 8.4 gives details of the net

water balance for the whole land area of Hubli and Dharwad taluks. Calculation of leakage is based on the amount of water supplied to HDMC area. Leakage from water mains is assumed to be 40% based on an estimate made by Anglian Water (Reddy, 2001). Leakage from the sewers can be assumed to be far worse, however leaking sewers can also act as drains for the water table, so the net effect may be nil. The total amount of sewage generated is assumed to be equal to the amount of mains water supplied by the city, of which 30% goes to cesspits, the remaining 70% flows through the sewers to the nallas (Hegde, V 2001). For the purpose of estimating total leakage it is assumed that leakage from cesspits is contained within the Hubli and Dharwad taluks. Leakage from the sewers is ignored, for the reasons given above.

Figure 8.4 shows the net water balance between abstractions and total leakage. Generally the net balance over the area of Hubli and Dharwad taluks is 0 to 10 million m³/yr, as the volume of mains and cesspit leakages is less than net abstractions. When the third stage of the Malaprabha scheme starts to supply water the net balance becomes briefly positive, increasing to 5 million m³/yr. However this is predicted to last for eight years before the net balance becomes negative again and by 2025 would be back at the same level as 2001. From then on the amount of sewage will be slightly more than half the mains leakage.

However, the effects of this leakage locally within the HDMC area would be much greater than this, as these calculations are averaged out over the entire area of Hubli and Dharwad taluks. Combined mains and cesspit leakage is a significant volume of water if concentrated within the HDMC area. In 2001 this was equivalent to 64mm of rainfall, or about two thirds of natural

recharge. This will result in rising water tables within the HDMC area. Leakage will take time to permeate into the ground and migrate to outlying areas. The majority of this water will have lower conductivities than the natural groundwater. In terms of dissolved mineral content, groundwater around the HDMC area would be expected to improve; however pollutants from sewage could make the groundwater non potable. Results from the water quality survey shows that villages near the HDMC area have water with lower conductivities (lower mineral content) than those more distant. Meanwhile in the areas more distant from HDMC especially in Dharwad taluk, where abstractions are greatest, water tables would be expected to fall and groundwater quality worsen. This contrast between the urban and rural areas will increase as water supplies to the city and abstractions in rural areas increase. Further research is required to assess the situation.

Conclusions

The water supply situation in and around Hubli–Dharwad is unsatisfactory in a number of respects. Drinking water is limited in rural villages and is often not potable. In some villages people prefer taking water from the open tank as it is less brackish, despite high levels of pollutants arising from watering and washing livestock, laundry and vehicles. Water tables are falling in peri-urban villages, particularly more distant from the city, but this is not a direct effect of urbanisation rather is due to excessive local abstraction. Indeed, leakage from mains and cesspits and possibly the sewers in the city is calculated to be raising the water table within the city and is flowing underground out to near-urban villages.

Due to Hubli–Dharwad’s topographic location astride a broad ridge, water flows outwards, both below and above ground. Evidence for underground flow is the decreasing conductivities in boreholes in villages near to the city boundary. However, this underground flow is likely to be contaminated with sewage, and there was evidence for this (increased chloride levels) in some village borewells. Wastewater flow into the nallas that drain the city is perennial due to discharge of the sewers into them. As the supply of mains water increases, flow through the nallas will increase, as will availability of this water for farmers who use it for summer irrigation of vegetables. This will result in a cash benefit for the farmers (Chapter 4 on Sewage Irrigation) but the health implications are very serious for both farmers and consumers. However, given the likely positive ground water balance within the HDMC area (due to mains and cesspit leakage, possibly leading to flooding), it might be worthwhile to assess the feasibility of lowering the water table under the city by sinking bore wells and piping the water to villages where currently irrigation with sewage contaminated wastewater is practised, to be used to irrigate vegetable crops. This would have the advantage of lowering the water table within the city, supplying cleaner water for irrigation of vegetables, and the run-off from fields would flow into the nallas, so diluting the wastewater stream. The capital costs would be significant, but these could be discounted against the health benefits.

It is probable that the findings of the study in Hubli-Dharwad will be applicable to many other locations. For example, in every city leakage from mains and cesspits is likely to be significant. The issue of water resources is a good example of where division of responsibility for management

between urban and rural authorities hinders progress towards improvement of supply for all citizens. Inevitably, it is the poorest sectors of society who suffer most from inadequate supplies

or low water quality. Increasing community ownership and management of water resources is an essential first step towards addressing this issues (Box 8.2).

Box 8.2 *Water Harvesting*

Tarun Bharat Sangh (TBS) has done pioneering work building over 300 water harvesting structures (called Johads) in rural Rajasthan. In 1984, the economy and the ecology of the area were both in shambles. People were alienated from the natural resources of the area. Industrialisation and modernisation had further destabilized livelihoods. With forest cover fast depleting, the groundwater level receded at an alarming rate and the area was declared a 'dark zone' (where ground water falls below recoupable levels). Distress migration to urban areas resulted as people were deprived of their traditional occupations which were critically dependent on water. The crisis intensified as people lost motivation to maintain their Johads and the land became barren.

The main purpose in reviving Johads is to bolster three fundamental livelihood systems, i.e. agriculture, forest produce and livestock. Since water is critical to all three systems, they built on people's traditional wisdom to evolve a sustainable technology for water resource management. As the idea of reviving Johad system of water management emerged from the people in a remote village, Gopalpura, in 1985 every household felt a need for a collective effort. The initial success at Gopalpura bred further success as people could see for themselves the radical changes brought about by Johads.

Migration was the first hurdle that the organisation had to encounter as there was a dearth of able-bodied men and women and people were suspicious about getting involved in fresh construction work. The key strategy in achieving the goal was to work through a process of community mobilisation and ownership. Villagers contribute the major share of construction cost through cash, voluntary labour and locally available materials. All the technical and human resources needed for the construction of Johads came from within the community as the initiative was geared towards reviving a native system rather than introducing any external concepts. This also imparted a sense of ownership on the part of the village community and ensured post construction maintenance of the structure.

Within a year of the construction of Johads, water availability for drinking and irrigation increased. The increased water and fodder availability improved economic status and saved women's time spent on fetching water. With recharged wells people who used to migrate to cities have returned to cultivate their lands which were earlier lying barren. Besides increasing food production, improving soil and water conservation and increased biomass

productivity, the cumulative effect of Johads in the catchment of at least 5 rivers have converted seasonal rivers into perennial rivers giving them a new lease of life.

People found employment locally, and migration to urban areas has considerably reduced. This has benefited the ecology of the area. Since the work has been done in and around Sariska Tiger Sanctuary, it has benefited the flora and fauna a great deal. The water policy of the State and the Central Government is being influenced to accommodate building smaller water harvesting structures due to a far-reaching advantageous impact. The most important lesson learnt by TBS while working on Johads has been the realisation that the solution to people's problems lies in their own traditions, knowledge and systems. Traditional and simple technologies have an edge over modern techniques in solving people's problems and also giving them stakes and ownership over the initiative.

The UN Habitat's Best Practices Database website: <http://www.bestpractices.org>

END NOTES

- 1 Litres per capita per day.
- 2 A recent survey by Anglian Water UK estimated that 40 percent of water supplied to the distribution network was lost through leakage and illegal connections (Reddy, 2001).
- 3 Personal communication with the watershed development officials in Dharwad district (February, 2003).
- 4 Based on the Department of Mines and Geology (1995) census of ground water abstraction structures in 1994.

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9

Conclusions

Robert Brook, Sangeetha Purushothaman and Simone Purohit



The peri-urban interface: A meeting of the rural and the urban

A great deal of literature, research, policy analysis and implementation exists on either the urban or rural spheres. Where the two meet however is no man's land, where it is most needed for urban and rural institutions to cooperate. Instead what is found is that both sets of institutions tend to neglect the PUI. The PUI thus represents a space crying out for attention. However for policy makers to address the peculiar needs of the PUI, first and foremost is that its specific needs, characteristics, and features should be known and better understood. This book has attempted to bring out the uniqueness of the PUI with respect to natural resources and livelihoods and this chapter tries to bring together the inter-relatedness of the issues and the most important policy highlights.

Agricultural Systems

As mentioned in Chapter 1, Hubli-Dharwad lies in a predominantly agrarian zone, so it is pertinent to first consider what perturbations arise from the location of an urban conurbation of almost 0.75 million in this rural scenario.

The first observation to be made about cropping systems is their great diversity. This diversity can be attributed to soil type, rainfall, irrigation and urban demand. In particular, irrigation is the major determinant of vegetable production in the PUI. Hubli-Dharwad lies almost astride a change from 'red' inceptisol (paddy) soils in the west to 'black' vertisol soils to the east. Additionally, climatically the city is situated in a transition zone from the well watered west to the semi-arid east, but the isohyets (i.e. the contours that link

locations with the same rainfall) run south to north. So two major factors that determine cropping systems are orientated in different directions to each other. Superimposed upon this are the effects of urbanisation and availability of irrigation. Therefore, almost any village sampled would have a number of unusual or even unique characteristics, so detecting changes against such background variation was not easy. Thus, to an extent, this project can only be regarded as filling gaps in knowledge in those villages actually studied. Despite the diversity, it is notable that staple crops were not an important use of land, particularly in the *kharif* season (south-west monsoon, when most rain falls), except in Mandihal where rice dominated (Fig 3.6., Chapter 3). Most crops grown were arable cash crops, particularly pulses, cotton and chilli, and orchard fruits. It should be noted that Hubli-Dharwad is not a major marketing centre for either cotton or chilli, so these crops are not necessarily evidence of effects of urbanisation. Indeed, the reverse might be the case, as both crops are harvested by hand in this area, which is very labour intensive (see below on wage rates).

Nevertheless, some trends were evident. To the west, two land uses dominated: mango and grass (post *rabi* summer fallow used for rough grazing). Area devoted to mango rose to a peak 2.5km from Kelageri (occupying 100% of land for one 500m stretch) and rapidly declined to 20% or less of land by 5km (Figure 3.1, Chapter 3). There are several reasons for the intensity of mango cultivation. The soils and the rainfall regime to the west of Hubli-Dharwad are considered to be particularly suitable for cultivation of mango. The most widely grown variety, 'Alfanso', is valued as a dessert fruit and is consumed locally and is also exported. Besides fresh sales in the market or at

roadside stalls, there is a mango canning factory in Hubli. Orchards benefit from a favourable taxation regime and is a favourite form of 'annuity' for retired high ranking public servants who live in the city. Instances of this have been recorded around Delhi (Bentinck, 2000), where wealthy urbanites buy country properties, retaining the designation 'farmhouse' to suggest agricultural land use because the owner intends to maintain it as untaxed agricultural property.

Around Hubli-Dharwad, there is also evidence that tree fruits are being planted by farmers due to labour shortages. Contractors take on management of the orchards and supply labour from more distant areas to harvest the crop, and this is shared between the owner and the contractor on a mutually agreed basis. This is a consequence of competition for wage rates between urban and rural areas. A typical daily wage rate for unskilled labour in the city is Rs80 for men and Rs60 for women, whereas the respective rural rates are Rs50 and Rs25.

The other main effect of urbanisation evident was cultivation of vegetables and fruits. Vegetable production was observed at Gabbur, south of Hubli, where irrigation with sewage polluted waste-water was practised, and north of Dharwad where farmers around Pudukalkatti had invested in borewells (Fig 3.2, Chapter 3). In both villages, vegetables were raised in the summer months when prices were three to five times those obtained during the monsoon.

In Kelageri and Inamveerapur, fruit production is important (Figs 3.7 and 3.15, Chapter 3). Thus, the presence of



urban markets combined with availability of irrigation created an opportunity for farmers to raise cash crops.

The other system where a clear effect of urbanisation was evident was dairying, which has turned out to be an important livelihood for the peri-urban landless. Near the city, buffalo numbers have increased over the past decade (Figs 7.1, 7.2 Chapter 7), particularly in landless households. This phenomenon has a number of parallels with vegetable cultivation, which is also on the rise. Both products are perishable, particularly milk, and so need to be produced near markets. Also, efficient marketing chains exist (Figs 6.1 and 6.2, Chapter 6). For the peri-urban poor, direct sales have helped cut out middlemen allowing them a better price and greater profit margins.

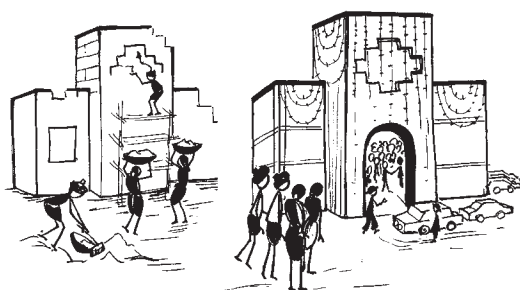
In 2000, the mean number of buffalo per household in distant villages was 1.4, whilst in villages near the city it was 3. In 1990 the respective figures were 1.2 and 2.1, (Fig 7.1 Chapter 7) but in Bidnal, the landless sector owned an average of 4.0 buffalo per household in 2000. Buffalo can be stall-fed or grazed on non-cropped land such as field margins and so are suitable for households with little or no land. Indeed, within the city urban dairies exist where all fodder is bought and animals are stall-fed (Nunan, 1999). Hubli-Dharwad is a huge market for milk which is not being met by current supply

chains and thus represents a significant opportunity, but the major constraint for the peri-urban poor is lack of fodder availability and

grazing land. Thus for the fodder bottleneck to be addressed, a fodder belt is required in the PUI. Formal credit is available to peri-urban producers through rural credit schemes. Informal credit is typically available to peri-urban milk producers from their customers, free against the future supply of milk. However, for the peri-urban poor coming under the municipality, formal credit becomes a bigger constraint than for those villages outside the municipal area.

The peri-urban milk producer is flexible in addressing market demands. For the urban poor who can only afford small quantities or low quality (adulterated) milk, peri-urban producers are the only source which caters to these requirements, while for other classes as well, these producers cater to all sections of market demand. Programmes to promote dairy production that facilitate milk delivery credit, fodder and veterinary care for peri-urban areas may be a factor which will increase livelihood opportunities for the poor in the PUI.

Implications for poverty reduction exist for both milk and vegetables. Irrigated vegetables require both land, a bore-well or a pump for lifting waste water from open streams. Thus, the landless are excluded directly from this activity, although they may be employed as agricultural labourers or in marketing of vegetables. However, keeping buffalo for milk does seem to be a livelihood strategy adopted by the landless sector. In rural areas in India, the landless are traditionally regarded as being among the poorest. In the peri-urban interface this is not always true. These results contrast with those from more rural environments in India (Thomas *et al.*, 2002), where the landless and those with little land (< 0.2ha) keep few ruminants per household, but thereafter the number of large ruminants



increases with size of land holding, these changes being related to availability of crop residues and by-products. Like milk, vegetable demand is currently not fully met by peri-urban producers. Therefore there is scope for increasing vegetable production to meet urban demand and promoting vegetable selling by the peri-urban poor. Promotion of this livelihood option could be through revolving funds of SHGs (Self Help Groups or Sanghas) or cooperatives or forming of vegetable boards. For women in particular, promotion of dairy, vegetable selling, goats, and sheep rearing are important livelihood options. Exposure of women to markets and the role of NGOs becomes important (Box 3.5, Chapter 3) in mobilizing women and building their capacities in this regard.

Livelihoods

Consideration of livelihoods showed that in the description of characteristics of the poor (as perceived by others in the village), the landless or small land holders were often assumed by others to be agricultural labourers (Chapter 5). Other occupations, apart from construction and quarry labour, were rarely mentioned. In the livelihood analysis study it was found that the poor tended to rely on a far more diverse range of activities but continued to depend more significantly on others for employment. This is an indication that even within the same community, perceptions of the poor and their actual circumstances may differ to quite an extent. It also indicates that knowing the poor and their circumstances takes some effort; a point which government departments need to heed, and even less is known about the peri-urban poor. For example, many landless or small landholders were found to have developed their own dairy

or vegetable production enterprises, even on very small plots of land, gaining advantages of independence.

In general, the poor and the poorest in the PUI had the following characteristics:

- No or few productive assets, or assets that could be used for security (land, houses, cattle); i.e., low natural assets.
- Low skilled, low waged labourers; those more dependent on others for source of income, insecure casual work, seasonal; i.e. low human assets, but may be taking advantage of social assets. Social assets may be stronger in rural areas compared to the PUI but the opportunities for the peri-urban poor to use these social assets are higher.
- Dependence on diverse sources of income to earn a living throughout the year and/or to supplement income from main occupations; i.e., insecure financial assets.
- Households with high dependency ratio, and/or physical weaknesses are poorest, often having no choice but to rely on one source of income only; i.e., low human assets.
- Those who have incurred large debts to be paid back through provision of labour to the money lender; i.e., low financial assets.
- Opportunities to spend money in the city is another cause of poverty in the PUI. Furthermore these groups reported that being close to urban centres, attracted in-migrating relatives seeking employment, which required that they spend even more towards family consumption which further impoverished them.
- Diversity of occupations, where the poor and very poor relied on urban employment in

times when agricultural employment was unavailable.

It is concluded that the poor and very poor were characterised by deficiencies in a whole range of assets, not just financial.



Did proximity to the city have an effect upon the proportions of rich to poor? Following a comparison made

between the pairs of villages along the four transects, it was not possible to say that the relative extent of poverty was greater nearer to or further from the cities (Table 5.1, Chapter 5). Factors such as:

- Access to transport and markets and consequently the availability of better livelihood alternatives (physical assets),
- Agricultural potential (natural assets),
- Ability to utilize urban opportunities or not (skills, health and mobility);

were found to have a greater influence than just distance from the city. However, a note of caution must be sounded: it should be noted that between-village comparisons were made by using wealth ranking. This method is comparative and so cannot provide data on absolute levels of poverty. Indeed, in research work conducted more recently in another large peri-urban village, those considered to be wealthy in one part of the village were considered poor in another part.¹ Quantitative estimates of poverty were not made in this study, but such discrepancies indicate that it would be appropriate to include these measures, also, to enable direct comparisons.

Livelihood activities of the poor and very poor derived from case studies of 32 such households

in the eight case study villages had the following characteristics:

- Livelihood strategies composed of small scale agricultural or livestock production, trading of products (craft, wood, dairy products, fruit or vegetables), labouring activities (in agriculture, construction or commerce) or artisanal trades such as carpentry or plumbing (Table 5.3, Chapter 5).
- More of the poor category households were involved in activities with a greater level of independence and higher rates of income and greater diversity than the very poor group.
- The very poor had fewer employed in the better paid unskilled labouring jobs such as brick making and quarry labour than the poor, and less diverse sources of income, mostly because they had less capacity to carry out the more arduous work, fewer working members in the family and/or fewer alternatives due to reduced mobility.

Therefore one way to address poverty in the PUI is through capacity building of the very poor, increasing livelihood opportunities which can be carried out in or near their homes. One mechanism is by formation of SHGs which can provide the financial, moral and marketing support needed.

One effect of urbanisation was that of the 32 poor and very poor households, nearly twice as many changes in livelihood activities were made in the nearer villages than the further villages (30, compared to 18), demonstrating a faster rate of change closer to the urban centres (Table 5.4, Chapter 5). However, there was no difference between the nearer and further villages in terms of diversity of livelihood strategies, as estimated by the Shannon – Weiner index. Twenty-one of the poor interviewed had changed their

occupations away from agricultural labour to non-agricultural unskilled employment, and another 24 moved into self employment, into commercial activities or new trades (11) or their own livestock (11) or agricultural (2) enterprises. This indicates that at least some of the poor may be benefiting from opportunities arising from urbanisation rather than becoming poorer, although some of the very poor remain intractably poor due to home circumstances (e.g., high number of dependants, infirmity). Therefore one option for the peri-urban poor is to increase the capacity and skills to take advantage of market demand driven opportunities.

Environmental and Health Effects

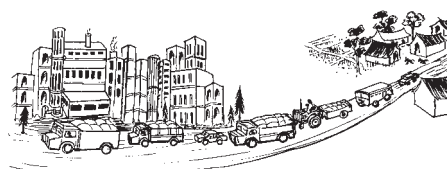
The effects of urbanisation processes upon health need to be understood. Some effects are obvious, such as faecal bacterial contamination or high organo-phosphate pesticide residues in sewage irrigated vegetables (Table 4.3, Chapter 4). These two factors should be of considerable concern to consumers, but there is no means of notifying purchasers of vegetables in the market of the circumstances of their cultivation. These include the cultivation of crops through sewage irrigation and the use of chemical pesticides in sewage cultivation. Thus advising urban consumers to cook well or disinfect vegetables before consuming them is one solution. In the long term however, treatment of sewage is a requirement and treatment plants are most important for safer vegetables and for the health of vegetable producers. There were also some indications (but not proven) of sewage contamination of ground water underneath Hubli-Dharwad finding its way along fractures in the aquifer rock strata to peri-urban wells and bore wells. Additionally, pressure

to market produce to earn money may have adverse dietary effects. Data on consumption of milk by the landless

showed that in villages near the city, they sold nearly all their produce and their household consumption had declined (Chapter 7). This occurred against a background of consumption of milk and milk products in India increasing by 6 percent p.a., more than three times the annual population growth rate (Delgado *et al.*, 1999).

The study also found evidence of environmental degradation attributable to influence of the city. Two examples are mining of clay in fields for making bricks (particularly prevalent in Kelageri) and quarrying for building blocks and road stones (particularly in Mandihal). These result in degradation of the top soil and loss of some land for farming. Data procured during the livelihood strategies component showed that in Mandihal there were 21 quarries occupying a total of 22.2ha, which is 5 percent of the cultivated land lost directly, but villagers complained that the dust coated vegetation over a wide area.

In Kelageri there were 23 operating brick kilns at the time of the survey. Area affected was not determined, but annual output of bricks from this village alone was 10 million, equivalent to 17,000m³ of baked clay removed every year, or 0.6ha (1.5 acres) mined to a depth of 1m. The volume calculation does not allow for shrinkage during the baking process nor for shallower pits occupying a larger area, but it does give a first order approximation of the scale of land lost to productive use every year by this means. This effect is by no means confined to Hubli-Dharwad, and similar brick kilns may be observed near any



urban area in south Asia where suitable clay can be mined. Bentinck (2000) described how leasing of land for brick making operates near Delhi. Operators lease in about 5ha of land, and mine 1.5ha a year to a depth of 1.5m. He found that despite the removal of the most productive horizons of soil, about half the clay mining sites in Alipur Block, Delhi, were returned eventually to agricultural use. In 1997, by order of the Supreme Court, all kilns within the National Capital Territory boundary were forced to close down for being polluting industries (Bentinck, 2000). This is not the case within the Hubli-Dharwad Municipal Corporation boundary, as brick making continues unhindered in Kelageri.

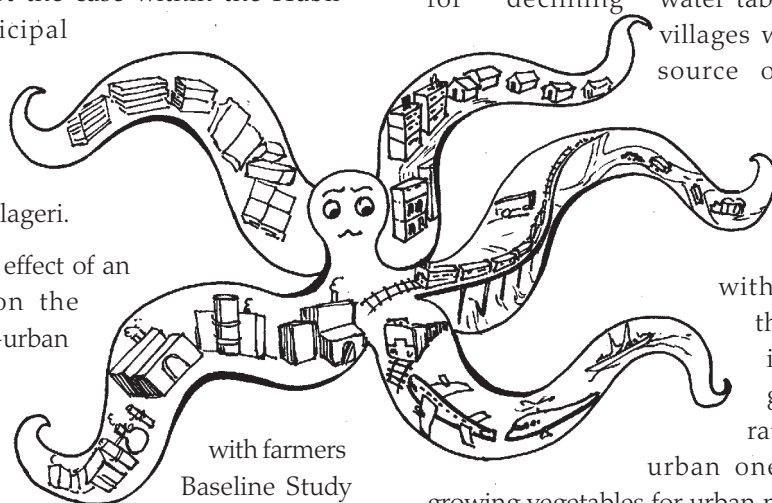
Another possible effect of an urban area upon the surrounding peri-urban zone would be on water supply. Conversations during the (project R6825) with farmers Baseline Study revealed that the water table in peri-urban areas was falling, and tube wells were having to be sunk deeper to access ground water. Besides an unknown number of private, domestic borewells within Hubli-Dharwad, there are a number of industries with a requirement for water, and all these have their own wells as the municipal supply is irregular. It was hypothesised that the reason the water table was falling in peri-urban areas was because of abstraction within the city (Chapter 8).

In contrast, the water resources study found strong evidence that there is considerable

recharge of the aquifer under the city due to leakage.

Calculations of leakage from the municipal water reticulation system and septic tanks (Fig 8.4, Chapter 8) indicated that rather than groundwater being depleted under the city, there was a net recharge of the aquifer. This was supported by data indicating dilution of groundwater beneath near-urban villages, but also with possible faecal contamination from septic tanks and leakages from the sewage system. Therefore, the hypothesis that abstractions within the city was responsible for declining water tables in peri-urban villages was rejected. The source of the reported declining water table levels must have been due to over-abstraction within the villages themselves, which is likely to be a general rural issue rather than a peri-urban one (except where growing vegetables for urban markets is a strong incentive to sink boreholes; Table 8.1, Chapter 8).

Sewage irrigation was found to be a lifeline for vegetable producers but resulted in what farmers refer to as "soil sickness", leading to poor crop growth, low seed germination and lower water infiltration rates into the soil. Furthermore the attraction of pests resulted in excessive use of pesticides which further contaminated vegetables used by urban consumers. Unlike other urban centres, in Hubli Dharwad fortunately industrial effluent is not a major source of contamination although hospital waste does continue to contaminate the sewage used for irrigation.



Land Use

Increases in urban populations and the need for better connectivity to the cities results in the growth of urban related infrastructure in the PUI. Thus the expansion of housing developments, railways, highways, by-passes and other roads are the “push” factors that lead to changing land use patterns in the PUI. This tends to drive up land prices and change land use patterns (Fig 2.3, Chapter 2). The concurrent shortage of labour is also a “push” factor in the PUI and can lead to the neglect or abandonment of land or increased land sales.

“Pull” factors that change land use would include increasing land prices as urban infrastructure develops, better urban employment opportunities for those who would be otherwise engaged in agriculture, tax holidays for urban investors (examples include farm houses and horticultural plantations), and selling or leasing of the land or the top soil for brick making and quarrying due to the demand from the construction industry. It is interesting to note that Hubli appears to be a stronger force for change than Dharwad. Land prices around Hubli are higher (Table 2.1, Chapter 2), as is the number of land sales. It is the larger of the two cities and is more commercialised, which may be the reason for the effects described.

The issue that needs to be addressed is the impact of these push and pull factors on natural resources in general, and on land use and the top soil in particular. A second factor is the impact on livelihoods, on urban sprawl and on poverty. Routing of the by pass, for instance, sometimes cut a productive piece of land into two sections, making it difficult and more expensive for farmers to cultivate. The shift to horticulture has decreased employment among agricultural labourers. Thus

during the construction of urban infrastructure authorities need to pay heed to the livelihoods of peri-urban populations as much as attention is given to urban needs.

Spatial Extent of Urbanisation

How far does the influence of urbanisation extend? The effect of urbanization is not purely a function of distance from the city. The effect of urbanization on perishables can be seen in villages close to the city. For instance, milk and vegetable production is higher in villages close to the cities, given their perishability. The more perishable the product, the greater the concentration of production activity close to the city, as was observed for dairying.

In contrast, the effect on labour flows is far reaching well into the interior. Anecdotal evidence gathered during the DFID Baseline Study (project number R6825) indicated that in the village of Gudageri, 25 km south east of Hubli, larger landowners were not able to find sufficient local labourers for harvesting crops (at a wage they were willing to pay) and they had to bring in workers by tractor-drawn trailer from even further away². This was because unskilled labourers were commuting to Hubli each day to work for higher wages, both by train and bus.

The impact of urbanization can be felt directly in terms of distance or indirectly in terms of degree of connectivity to the cities, by which is meant the degree of transportation infrastructure, be it in the form of roads or railways.

Thus, ‘frictional distance’ may be a more important factor than linear distance (Map 2.1). Thus this results in villages experiencing a high “frictional” distance when badly connected despite being close to the city in terms of linear distance. Varoor for

example represents the converse case where the actual distance is 17km south of Hubli, however it has all the peri-urban characteristics of villages closer to the city because it is situated on the Bangalore to Pune NH4 (Box 7.3, Chapter 7) There are also petrol pumps, small industries and commercial establishments such as shops and hotels that bring urban influences into this village. Like Varoor, Pudukalakatti, to the north of Dharwad, also lies on a main road connected to NH4. The roads in both villages greatly assisted marketing of milk and vegetables respectively. There was little evidence of these activities in Dasankoppa, within 8km of Dharwad, due to its poor road access.

Some villages also are less suitable for certain aspects of urban influences for various reasons. For instance in Bidnal, black soils (which swell when wet and shrink when dry, therefore damage deep building foundations) are not conducive to construction. Similarly the lack of underground water in Dasankoppa does not allow vegetable production. Also for example, farmers in Channapur, while being 12km from Hubli, due to poor access roads cannot transport fresh milk but have adapted their production systems to deal with this frictionality by supplying curds instead. Thus what would seem at the outset to be distinct peri-urban features may or may not all exist in any one village. Rather it is various processes of change that defines the extent to which a village is more or less peri-urban. Thus the “peri-urbaneness” of a village depends not only on actual distance, but also on the existence of urban infrastructure, the conduciveness of the village to particular peri-urban developments, and the effect being considered. Not only that, but the frontier moves as the urban area expands and the effects of urbanisation ripple outwards.

This inability to state categorically which effects of urbanisation will be present at any particular distance from a city, and to what degree, complicates matters when a dichotomous system of administration (urban and rural) operates, as in the case of Hubli-Dharwad. Management of such an inherently complex interface requires more flexible administrative structures than exist around most cities.

Processes of Urbanisation

In Chapter 1 it was argued that the peri-urban interface is not best defined as being a location, it is better regarded as being a process. The evidence produced in this study shows that urbanization processes are largely market driven. These processes have resulted in simultaneous processes of change in livelihoods, land use, natural resources including water, soil, and forests, and often reactive changes in local governance. The market forces are of two kinds: one that caters to the needs of individuals and urban households and the second that caters to urban commercial institutions from small hotels to large industrial/commercial complexes.

Urban needs and the resultant market demand leads to a series of changes in the peri-urban production systems to meet these demands. In agricultural systems, the most tangible peri-urban feature is the increase in production of perishables such as vegetables, fruit, milk and other dairy products. A feature of milk and vegetables is that of direct marketing for small scale producers, given their proximity to urban consumers. A large amount of natural resource use also caters to urban industrial and commercial activities including brick making, quarries, paper mills and agro processing units.

These changes in production systems result in concurrent changes in livelihood patterns for the peri-urban communities. This is reflected more starkly in the shift in employment of the peri-urban labour force or through a simple diversification of products or even through an expansion of sales of the same product for peri-urban producers. The shift or expansion of dairy production in the PUI for instance is due to easy market availability. The shift towards urban employment due to the seasonal nature of agricultural employment is an option for workers with the right skills, good health and mobility.

Consequently poverty takes on a different set of characteristics in the PUI. It becomes a function more of the capacity of the peri-urban population to utilize urban opportunities, in contrast to determinants commonly observed in rural areas such as low social status and stocks of natural capital. Thus the poverty in the peri-urban interface is more a function of poor health, high levels of dependents, less mobility, poor connectivity to the cities, or skills sets that do not match urban needs.

Urban needs also result in changes in land use patterns whereby urban residents start to buy up land for residential or commercial purposes or to avail of tax holidays. Commercial needs from the construction industry result in setting up of brick kilns, paper making units, quarries and so on. This then has an effect on the use of natural resources, often in terms of their degradation or neglect.

Finally the outward expansion of municipal boundaries often results in areas being transferred to new instruments of local governance. In the Indian context this means a change from the rural based three tier Panchayati Raj system to the municipal administrations. This

leads to incongruities. This project found farmers leading essentially rural lifestyles but within the municipal boundary, thus being deprived of access to extension services and rural credit schemes on favourable terms. Lack of access to rural credit sources and government programmes potentially results in greater impoverishment of the very poor peri-urban populations that fall within the municipality. Another example of incongruity is where one sub-catchment (Mangundi) is divided between the Hubli-Dharwad Municipal Corporation and Dharwad District administration. The 'urban' part of the sub-catchment falls within an administration that has no watershed management policy whilst the 'rural' section is within the remit of the Watershed Development Department. The only sensible approach to catchment management is to treat it as a whole.

Policy Implications of the Study

Although it was not the primary purpose of this study to inform policy, some individual chapter authors have made some policy suggestions and in any case several findings do have relevance to management and administration of the peri-urban interface, particularly in regard to natural resources and livelihoods of people that depend on them. This volume will end by considering some broad principles applicable to policy, rather than attempting to be prescriptive.

Firstly, it has to be recognised that a **dichotomous** approach to administration and planning (i.e, administrations largely divided into urban and rural) is inappropriate in peri-urban areas. In India, the 74th Amendment to the Constitution³ stipulates the setting up of District Planning Committees (DPCs) and Metropolitan Planning Committees (MPCs) for integration of

rural and urban planning and spatial and economic development for the entire district. The Karnataka manifestation of this is the Joint Planning Boards, which were created (at least in theory) to bridge urban and rural planning within each district. In practice there is only one example of such a Board (also referred to as a District Planning Committee) having been effectively constituted in Karnataka, in Bellary⁴. The Hubli-Dharwad Urban Development Authority (HDUDA; section on Institutional Structures Chapter 2), whose scope extends several kilometres beyond the boundary of HDMC, is almost exclusively focused on physical aspects of planning. As demonstrated by this study, a holistic approach to planning and administration of the peri-urban interface is required, cognisant of economic factors, people's livelihoods and aspirations, use of natural resources, environmental and health issues, and zoning and physical planning.

Secondly, the study discovered a great deal of diversity within the PUI, in terms of agricultural systems, dominating characteristics, access to resources, levels of wealth and consequent livelihood strategies, of each village. There is some evidence of greater diversity in villages closer to the city than those further away (the poor change livelihood strategies more frequently and cropping systems show more diversity). One consequence of diversity is that a 'one size fits all' approach to management is unlikely to be effective in achieving objectives. Programmes to alleviate poverty ought to take into account the different nature of poverty in the PUI compared to rural areas and the very diverse livelihood strategies of the poor here, particularly as they seek to take advantage of the opportunities that urbanisation provides. Similarly, agricultural

development programmes will be more effective if they take into account diversity in farming systems and sometimes the rapid changes that occur. For example, would it be possible to devise a programme to encourage risk-averse small scale farmers to experiment with new cropping systems by under-writing the risks involved? Such schemes to encourage people to remain on the land will contribute to lessening the numbers of rural dwellers who migrate to cities in an attempt to escape poverty.

Thirdly, the **non-static** nature of the PUI needs to be factored into administration. As the title of this book implies: the frontier moves on. Today's peri-urban area will be tomorrow's suburbs; today's rural area will be tomorrow's peri-urban interface. Thus, for a given locality, the peri-urban interface is a temporary state. Additionally, it is important to recognize that the extent of the effects of urbanisation depends on the nature of the influence. For milk production, for eg., there is evidence that the reach into the interior is quite shallow, whilst competition between rural and urban wage rates extends much deeper. Therefore, any administrative mechanism developed will have to allow it to expand over time; otherwise it risks becoming fossilised as another anachronistic tier of administration.

No one pretends that addressing the issues raised above will be a simple matter. But ignoring the existence of the peri-urban zone is not an option either. It is not just a matter of correcting the negatives such as health risks arising from sewage irrigation of vegetables, for instance; but ignoring the special circumstances prevailing in the PUI runs several risks. The first of these, concerns the fact that most existing solutions are piece meal. These address at best half of the problem. Urban solutions often have serious

rural repercussions and vice versa.. Thus, integrating rural and urban planning will first and foremost result in more holistic solutions. The second is that of future expansion and the need to plan effectively for the future PUI. The third is around the need to address poverty in the PUI, and to plan poverty reduction by facilitating new enterprises such as zero-grazing dairying and vegetable vending, to take but two examples.

If this volume has stimulated some to think afresh about that belt that surrounds all our cities, if it has sparked the idea of some new line of enquiry in a researcher's mind, if it has encouraged a government officer working with farmers to find ways of helping them make the most of opportunities presented by living near the city; then its purpose will have been achieved.

END NOTES

- 1 Survey conducted by the University of Agricultural Sciences, Dharwad and India Development Service, Dharwad, in Mugad village in 2002.
- 2 Interviews of land-owning farmers by R. M. Brook, 1997.
- 3 The Constitution (74th Amendment) Act 1992, Government of India
- 4 Personal communication: Secretary to Government of Karnataka, Urban Development Department, to A. Allen, October 2002.

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Glossary and Abbreviations

APMC	Agricultural Produce Marketing Corporation	KSPCB	Karnataka State Pollution Control Board
BH	Bore Hole	MF	Medium Farmer
BF	Big Farmer	MoST	Ministry of Surface Transport
BIS	Bureau of Indian Standards	MPC	Metropolitan Planning Committees
BOD	Biological Oxygen Demand	MPLAAS	Maximum Permissible Limits in the Absence of An Alternative Source
BQ	Blackquarter	MUL	Milk Union Limited
CB	Cross Bred	MWS	Minor Water Supplies
CEO	Chief Executive officer	LL	Landless
Dalal	Commission Agents	Nalla	Natural water course
DfID	Department for International Development	NGO	Non-Government organisation
DPC	District Planning Committee	NH	National Highway
DMUL	Dharwad Milk Union Limited	NRM	Natural Resource Management
DSCs	Dairy Cooperative Societies	NRSP	Natural Resource Systems Programme
DZP	Dharwad Zilla Panchayat	OECD	Organisation For Economic Cooperation and Development
F&MD	Foot and Mouth Disease	OVI	Objectively Verifiable indicator
FYM	Farmyard Manure	PRA	Participatory Rural Appraisal
GIS	Geographical Information System	PUI	Peri-Urban Interface
GP	Gram Panchayat	PWS	Piped Water Supply
GPS	Global Positioning System	Rabi	Post-monsoon season with light rain, some crops grown on soils which retain moisture
GoK	Government of Karnataka	RNRRS	Renewable Natural Resource Research Strategy
Gowli	A caste which specialises in the dairy industry, either producing or vending, although milk production and sales is by no means limited to this group	RSC	Residual Sodium Carbonate
HDMC	Hubli-Dharwad Municipal Corporation	SF	Small Farmer
HD	Hubli-Dharwad	SGH	Self Help Group
HP	Hand Pump	TAPMC	Taluka Agricultural Produce Market Committee
HDUDA	Hubli-Dharwad Urban Development Authority	TDS	Total Dissolved Solids
HS	Hemorrhagic Septicaemia	TI	Target Institution (typically a government line department)
IPM	Integrated Pest Management	TP	Taluk Panchayat
Kharif	Monsoon season, main rain fed crop growing period	UAS	University of Agricultural Sciences, Dharwad
KPTCL	Karnataka Power Transmission Corporation Limited	WHO	World Health Organization
KMF	Karnataka Milk Federation		



With urbanization, the frontiers of Indian cities are continuously expanding. Accompanying this expansion are also processes of change in livelihoods, in land use and values, and in the environment. Researchers and policy makers alike are divided broadly into urban and rural sectors, as are governments. However little is known about the space where the two meet, namely the peri-urban interface. This book represents the first of its kind in India on the peri-urban interface and brings together a range of subjects related to natural resources and livelihoods looked at holistically in the PUI framework.

Natural Resources Systems Programme (NRSP)

NRSP is one of ten natural resources (NR) research programmes of the UK Department for International

Development (DFID). The programme aims to 'deliver new knowledge that can enable poor people, who are largely dependent on natural resources, to improve their livelihoods' (NRSP, 2000). The new knowledge centres on changes in the management of the NR base can enhance the livelihood assets of the poor over a relatively long timeframe, thus providing greater livelihood security and opportunities for advancement of poor individuals, households or communities.

Integrated management of natural resources is central to the research. In concept, for NRSP's purposes, the term 'integrated management' comprises three inter-related fields – firstly, the NR base itself, viewed in a holistic way rather than as its component parts (landforms, soil, water, vegetation and organic residues); secondly, the integrated and dynamic nature of people's livelihood strategies and how these affect their decision-making and capacity to use and manage the NR base; thirdly, the institutional environment in which NR management strategies are designed and implemented.

The intended outcome of the research is that NR-related strategies (i.e., ways and means for transacting change) for improving people's livelihoods, that are of proven relevance to specified groups of poor people, will be delivered in forms that could be taken up by the poor themselves and/or by development practitioners operating at a range of levels, from grassroots to senior policy.