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FINAL TECHNICAL REPORT

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Project title

Consolidation of existing knowledge in the peri-urban interface system

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NRSP Production System   *Date*

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Contents

List of abbreviations

ADP	Aerial (sometimes "Airborne") Digital Photography
BIRD	Bureau of Integrated Rural Development (Kumasi)
BOD	Biological Oxygen Demand
C:N (ratios)	Carbon to Nitrogen
CEDEP	Centre for Development and Education of People (Kumasi)
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développment
COD	Chemical Oxygen Demand
DAP	Diammonium phosphate
DEM	Digital Elevation Model
DoA	Department of Agriculture
DS	Distillers Sludge
DZP	Dharwad Zilla Panchayat
EIA	Environmental Impact Assessment (HD)
EMP	Environmental Management Plan (HD)
EPM	Environment, Planning and Management
FAO	Food and Agriculture Organisation of the United Nations
ff.	pages following
FYM	Farmyard manure
GATT	General Agreement on Tariffs and Trade
GIS	Geographical Information System
GOAN	Ghana Organic Agriculture Network
GPS	Geographical Positioning System
HD (or H-D)	Hubli-Dharwad conurbation
HDMC	Hubli-Dharwad Municipal Council (Corporation?)
HDUDA	Hubli-Dharwad Urban Development Authority
HRV	High Resolution Videography
IBSRAM	International Board for Soil Research and Management
ILMD (sometimes ILMAD)	Institute for Land Management and Development (Kumasi)
IT	Information Technology
KIADB	Karnataka Irrigation and Drainage Board
KLRT	Kumasi Lead Research Team
KMA	Kumasi Metropolitan Assembly
KMF	Karnataka Milk Federation
KNRMP	Kumasi Natural Resource Management Project
KSRSTUC	Karnataka State Remote Sensing Technology Utilisation Centre
KUPIS	Kumasi Geographic Information System
LPG	Liquefied Petroleum Gas
MC	Municipal Council
MMPO	Milk and Milk Products Order
MSW	Municipal Sewage Waste
NGO	Non-governmental Organisation
NRDMS	(Karnataka District) Natural Resource Data Management Service
NRSA	National Remote Sensing Administration (India)

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NS	Night Soil
OM	Organic Matter
PM	Poultry Manure
PRA	Participatory Rural Appraisal
PUI	Peri-urban Interface
UAS	University of Agricultural Science (Hubli-Dharwad)
UMP	Urban Management Programme
UNCHS	United Nations Centre for Human Settlements
UNEP	United Nations Environmental Programme
UST	University of Science and Technology (Kumasi)
USW	Urban Solid Waste
UWB	University of Wales, Bangor
VC	Village Characterisation
VCS	Village Characterisation Study
WTO	World Trade Organisation

Executive Summary

This summary is divided up into the seven criteria used by the research team to assess the utility of knowledge generated by NRSP funded peri-urban interface projects, and present the main findings.

Hubli-Dharwad

Are the major production systems in the PUI adequately characterised?

At a descriptive level, cropping and livestock systems are reasonably well characterised, but quantitative data (areas, number of stock) are available only at a course resolution. Soils are described at a large land unit scale only. Surface water supply is fairly well characterised, but little is known about underground water resources, access to which is important for poorer people. The waste handling stream, has been well characterised.
Are changes to these production systems that are driven by urban development adequately understood?

Prior to commencement of DFID funded projects, the concept of a peri-urban interface was unknown. Therefore, spatial description, still less analysis, of cropping and livestock systems and soil resources is not available. Therefore, there is no knowledge about changes driven by urban development, and the effect of what little planning for the peri-urban interface is not known. Depending on their objectives, this deficiency will have to be addressed by future projects.
Is the characterisation of the principal stakeholders in the PUI land use and natural resource based production systems adequate?
For one sector, the waste management and utilisation stream, stakeholders have been well characterised, and the principal stakeholders in the planning process are known. For other sectors, the knowledge is either absent or incomplete. New projects will have to characterise the stakeholders for their area of study.

Have the livelihood strategies of poor households affected by the PUI been characterised?

There is little explicit information on the level of poverty, who the poor are and what are their livelihoods. However, a number of indicators that could be used to identify poor households have been identified. This is a significant gap in knowledge.

Is the understanding of the effects of urban development upon the poor adequate?

Given the lack of information about the poor indicated above, it follows that little is also known about the effects of urban development upon them, particularly as the concept of peri-urban effects has been absent in institutional thinking until very recently. There is some knowledge about how solid and liquid wastes are used by peri-urban farmers, but an analysis of their level of poverty and how this is affected by access to such resources is unknown.
Is the knowledge of strategy options for interventions in land use and production systems adequate?

Strategies generated by NRSP funded research is limited to effects of composts based upon solid waste on crop performance. However, in the local research institutions, there is likely to be a significant body of knowledge on interventions, which could be adapted to suit particular circumstances.
What is known about ways in which this knowledge on interventions can be more effectively transferred to the peri-urban poor?

To date, transfer of knowledge has largely be via the participatory process, and very limited at that.

Official institutions are probably ineffective but could be encouraged to participate, but given the much greater interaction between NG0s and the poor, these would probably be the most strategic collaborators for effective transfer of knowledge.

Kumasi

Are the major production systems in the PUI adequately characterised?

Cropping and livestock systems and soil resources have been well characterised. Control of access to land has been adequately described.

Are changes to these production systems that are driven by urban development adequately understood?

Changes in crop and livestock systems driven by urban development have not been described systematically. There is some limited information on temporal changes, and spatial distribution at a very course resolution. Thus, changes to production systems cannot be said to be adequately understood. However, high resolution data do exist (from aerial digital photography) but have not been presented or even fully analysed, and may present the means to rectify this gap in understanding. Water supply, use and contamination have been well characterised.

Is the characterisation of the principal stakeholders in the PUI land use and natural resource based production systems adequate?

Characterisation of principal stakeholders in production and in use and control of access to land resources is good.
Have the livelihood strategies of poor households affected by the PUI been characterised?

At the community level, the poor have been adequately characterised, although there is some doubt about comparability between communities. There are some gaps in knowledge about decision making at the household level, and this has gender equity implications. Some issues surrounding livelihoods: e.g. what constitutes employment and unemployment, need clarification. The official planning process probably has limited effects upon the livelihood strategies of the poor. However, lack of planning (or at least, community participation) at the community level has a significant impact, and there is scope for action-research to address this issue.

Is the understanding of the effects of urban development upon the poor adequate?

The effects of urban expansion upon production activities engaged in by the poor have been adequately described. The biggest effects are upon access to land and opportunities for marketing and employment. However, see the point about gaps in knowledge about livelihoods in the previous paragraph.

Is the knowledge of strategy options for interventions in land use and production systems adequate?

NRSP funded work has not developed any intervention strategies for improving production or making livelihoods more secure. However, there may be scope for adapting results of research generated by the University or nearby research institutions, but the quality of that knowledge was not assessed. Community participation in village planning was investigated, but no outcomes described. There may be scope for action research into this area, and possibly on land allocation and land markets, and ways in which their more adverse aspects may be mitigated.

What is known about ways in which this knowledge on interventions can be more effectively transferred to the peri-urban poor?

The Government agricultural extension service appears to be able to mount intensive campaigns, which could be used to advantage once strategy options are developed. NG0s are also willing to participate.

Chapter 2.

Background

More than half the world's population lives in areas that may be classified as urban. In developing countries, a substantial and growing proportion lives in or around metropolitan areas and large cities, including the zone termed the 'peri-urban interface', where their livelihoods depend to some extent on natural resources such as land for food, water and fuel, and space for living.

The population pressure means that such zones are often over-exploited. Although heterogeneous in its social composition, the peri-urban interface (PUI) constitutes the habitat of a diversity of populations, including lower income groups who are particularly vulnerable to the impacts and negative externalities of both rural and urban systems. This includes risks to health and life and physical hazards related to the occupation of unsuitable sites, lack of access to basic water and sanitation and poor housing conditions. At the same time, environmental changes impact upon the livelihood strategies of these communities by decreasing or increasing their access to different types of capital assets (including access to natural resources such as land, water, energy).

In 1996, the NRSP peri-urban interface programme began studies in two medium sized city regions: Kumasi in Ghana and Hubli-Dharwad in India. The objectives were to understand peri-urban effects such as the extent to which urban pressures have led to exploitation of soil, water and forest resources and increases in environmental pollution, and to determine who the main stakeholders were, how they derived their living and ways in which research could help improve the livelihoods of peri-urban dwellers. Over the past five years, these projects have gathered a large volume of information. This has been translated into a number of interim documents, research reports, a few published articles, and a large database with a GIS interface for Kumasi and its region.

The new Labour Government's White Paper on "Eliminating world poverty: A challenge for the 21st century" set a new agenda for the British aid programme, and in 1999 led the NRSP to modify its research goals to encompass a poverty alleviation focus. Previous research on the PUI of the two cities had been guided by priorities set by the previous government's aid policy. These priorities were guided by the goal stated in the NRSP's logical framework of "Productivity and productive potential in the peri-urban interface production systems increased through the application of systems-based approaches". The shift in direction was thus reflected in a new goal defined as "Livelihoods of poor people improved through sustainably enhanced production and productivity of RNR systems".

NRSP commissioned the present report in response to these changes. The report is the result of three months of multi-disciplinary team work by a group of nine researchers based at the University of Wales in Bangor, University College London and the University of Birmingham. As described under Research Activities, the work comprised the review of over 90 written documents and other research outputs (e.g. CD-Roms).

The main aims of the exercise are to consolidate the knowledge generated by previous research, to assess whether this knowledge is adequate for development of new calls for research, and to identify any significant knowledge gaps resulting from the change of programme direction which must be addressed before the next set of activities outlined in the new PUI logframe can proceed.

In consolidating the existing knowledge and identifying gaps, the team was guided by the sustainable livelihoods framework developed by DFID (and published in a 1998 book edited by Diana Carney entitled *Sustainable Rural Livelihoods: What Contribution can we make?*). At the core of this framework lies the notion that individuals draw on five types of capital assets to build

their livelihoods: natural, human, financial, physical and social. Opportunities are constrained or enhanced by potentially transforming structures and processes which generally lie beyond the control of individuals, as they are the result of institutional factors (policies, laws, customs) and the operation of markets. A central tenet of the notion of sustainable livelihoods is that poverty is not a static or permanent situation but a condition into and out of which people move in response to the opportunities, shocks and stresses that they experience. In the context of the peri-urban interface, there is a need to understand the specific opportunities that arise from the meeting of urban and rural processes and how these impact upon the livelihood of the poor (for more information on the framework and its application to the peri-urban interface, refer to Appendix 5 of this report).

Chapter 3.

Project Purpose

This section should be read in conjunction with the background (Chapter 1), where the rationale for this research project is set out. Specifically, the objectives of this research were to:

- Collate all NRSP funded research on the peri-urban interface;
- Consolidate the knowledge contained in these reports,
- Appraise the adequacy of work produced under DFID-funded NRSP research for formulation of relevant strategies through extended interaction with principal stakeholders and for the implementation of pilot projects in the peri-urban interface of Hubli-Dharwad and Kumasi.

The output is a useable knowledge base for the Peri-Urban Steering Group and teams proposing research to formulate draft strategies in two city region of Kumasi and Hubli-Dharwad.

Chapter 4.

Research Activities

The first activity was to visit to NRSP offices at Huntings Technical Services, to collate and copy material for the consolidation of knowledge. Other material was procured from offices of team members and from researchers still conducting NRSP funded peri-urban interface research. Members of the R6799 Kumasi natural Resource Management Project were particularly helpful in this regard. Material was procured from a wider range of sources than anticipated, and some documents were still being found quite late into the project. Documents were held centrally in Bangor, and copied and distributed to various team members, according to their expertise.

The next activity was to refine the conceptual framework, presented below, and draw up the terms of reference for team members. These were used to help assess and consolidate the material collated. The criteria for assessment were:

- Are the major production systems in the PUI adequately characterised?
- Are changes to these production systems in the PUI that are driven by urban development adequately understood?
- Is the characterisation of the principal stakeholders in the PUI land use and NR-based production systems adequate?
- Have the livelihood strategies of poor households affected by the PUI been synthesised? In particular this will address what is known about the extent of their knowledge about how to intensify their production activities to take advantage of new marketing opportunities presented by the urbanisation process.
- Is the understanding of the effects upon the poor of changes to the PUI land use driven by urban development adequate? In particular this will consolidate what is known about the extent of their knowledge on: ways of increasing their security through improving their land tenure, marketing systems, access to credit.
- Is the knowledge of strategy options for land use and NR-based production systems interventions adequate?
- What is known about options for intervention in production systems in the PUI, and ways in which this knowledge can be more effectively transferred to the peri-urban poor?

Where appropriate, comparisons and contrasts were drawn between research findings in Kumasi and Hubli-Dharwad.

Brief field visits were undertaken by Robert Brook and Adriana Allen, to Kumasi and Hubli-Dharwad, respectively. The final workshop of the Kumasi Natural Resources Management Project (R6799) was attended from 9 to 11 February, 2000. The overall purpose was to gain an independent view of work reported upon to judge the extent to which outputs are relevant to the purposes of the new logical framework. Discussion with some key actors in the research were also held, and described in a Back to Office Report. Adriana Allen visited Hubli-Dharwad in February on an existing DPU PUI project to conduct a workshop, and stayed an additional three days to interview local stakeholders and collect information germane to completion of this project.

Regular team meetings were held, to discuss procedural matters and progress. These were held at IDD, University of Birmingham, at DPU, University College London, SAFS, University of Wales Bangor, and on one occasion via a video conference between Bangor and London. Correspondence and exchange of drafts of outputs was conducted by e-mail, but was particularly facilitated by setting up of a web site at Bangor on which the latest versions of outputs being worked upon were posted. Thus, other team members could down load the latest version of outputs at will. Given the complexity of the logistics, this greatly eased production of this report.

A de-briefing session was held with the PUI Steering Group to discuss the draft technical report on 27 March, 2000. At this meeting, it was decided that the body of this report would consist mainly of an extended summary of individual team members' reports. These reports would then be included as Appendices. The Appendices as appended are the contributions of each team member, substantially as submitted, except for reasonable harmonisation of style. Thus, in some areas there may be overlaps, as it was not simple to draw inviolable boundaries around subject areas. Thus, Appendices dealing with livelihoods inevitably have to make reference to those factors which influence livelihoods, including crop and livestock production, soil fertility, etc. Also inevitably, sometimes opinions expressed may be slightly at variance with each other.

Chapter 5.

Outputs

In the main body of this report, this Chapter on Outputs constitutes a summarisation of Appendices 2 to 12. These appendices are consolidations of knowledge generated by NRSP funded research in the peri-urban interface. Together, Chapter 5 and the Appendices form a usable knowledge base from which programme management can formulate future research plans, and researchers can use as a starting point when planning research proposals. This Chapter is divided up into the seven criteria used by the research team to assess the utility of knowledge generated by NRSP funded peri-urban interface projects, as described in Chapter 4, Research Activities.

5.1 Are the major production systems in the PUI adequately characterised?

5.1.1. Hubli Dharwad

Production systems - crops
Production systems around Hubli-Dharwad have been adequately characterised at the taluk (sub-district) level. Land use systems are dominated by soil types: red coloured alfisols to the north and west of the twin cities, and black vertic soils to the east and south (Appendices 2.1.1; 4.1.4). Rainfall also varies in approximately the same direction, decreasing in annual total from west (1000 mm) to east (< 700 mm); thus most of the city-region can be considered to range from sub-humid to semi-arid, and the main constraint to production is reliable water supply. Cropping intensity is high, with no fallowing in evidence; however, neither is a decline in productivity in evidence. Cropping systems are dominated by rainfed rice on the alfisols, and by sorghum – wheat systems on the vertic soils, although these generalisations conceal considerable variation, particularly due to specialisation in some villages, such as floriculture, mango orchards, chilli, cotton, potato, intensive vegetables irrigated using sewage water. As a consequence of these variations, cropping systems are only characterised in any detail for a few villages where research work has been conducted (in terms of crop types, rotations, husbandry, soil and water management, resource flows, productivity). Although this is a gap in knowledge, it is not critical in that such characterisation is a relatively straight forward task, depending on the level of detail required.

Production systems - Livestock
There appears to be adequate information on the systems of production around Hubli-Dharwad, although there is some doubt about the numbers of bovine livestock kept. Manure is efficiently recycled for maintenance of soil fertility, oxen are still widely used for draught power and buffalo for milk (Appendix 3.2.2). Pigs are not directly a peri-urban issue, but the presence of thousands (unquantified) roaming free in the cities has peri-urban implications (Appendix 3.3.1). Little work has been conducted on characterising this system, or those for small ruminants and poultry Appendices 3.4 and 3.5). These represent gaps in knowledge, but would not be difficult to address. There is no record of aquaculture around Hubli-Dharwad, although fish are caught in tanks (reservoirs) (Appendix 5.3.10).

Soil and land
Given the dominance of soil type in determining cropping system, little information other than at the coarsest resolution is available on classification and fertility, and this matter would have to be addressed if projects were to proceed, where this information is important (Appendices 2.1.1; 4.1.4). The role of land in major production systems in the PUI is probably adequately characterised (Appendix 7.1.1), yet there is confusion about the existence of a decline in fertility. Farm area per rural person is declining, but at a slightly slower rate than the mean population growth rate (Appendix 2.1.2). Discrepancies in land allocated to various uses were noted, particularly between census events; forests, irrigation, cultivable waste land, common grazing land.

These data are available at the village level, but although probably adequate for identification of candidate research sites, would probably need to be verified afresh.

Water
Surface water supply to Hubli-Dharwad is reasonably well characterised (Appendix 7.1.1). There is less information on underground water supplies, particularly quantity and quality (Appendix 4.1.4). Water flowing away from Hubli-Dharwad is usually heavily contaminated with untreated sewage, and numerous farmers take advantage of this perennial supply of water and nutrients for intensive off-season vegetable production. This enterprise has been well characterised for one locality near Dharwad (Appendix 2.1.1)

Waste
Solid waste (quantity, constituents, collection, disposal, use within peri-urban cropping systems) has been well characterised for Hubli-Dharwad, and the potential for utilising this resource has been explored (Appendix 4.6.5).

Planning
Current planning by the Hubli-Dharwad Urban Development Authority is aimed at accommodating urban growth and this must affect land use and therefore major production systems using land. Research has not obtained information on the nature and dimensions of these effects. The Baseline Study Report implies (without reference to any evidence or sources) that this planning has been and remains only negligibly effective (Appendix 8.1).

5.1.2.   Kumasi

Several projects have been conducted around Kumasi, but the largest, the Kumasi Natural Resources Management Project (R6799), and one other, R6880, although completed, have yet to submit their final reports. Thus, the assessment of knowledge generated was based upon interim outputs.

Production systems - crops and soil fertility
Around Kumasi, mean annual rainfall is variously cited as being 1,345 or 1,488 mm, and broadly the soil type is alfisolic, and soils are well characterised in six villages (Appendix 4.1.3). Considerable effort has been expended in characterising production systems. These included village characterisation surveys in 65 - 67 villages, participatory appraisals in six villages, and aerial digital photography over much of the peri-urban area (Appendix 2.2.1). Generally, the farming system is much more homogeneous than around Hubli-Dharwad, with little evidence of a specialisation of enterprises congregating within specific villages. The dominant system is low-input cassava, plantain and maize, with more intensive vegetable production in wetter areas such as valley bottoms. The primary means of maintaining soil fertility is by bush fallow, a system which has broken down near the city (Appendix 2.2.1).

Production systems - livestock
Livestock is much less in evidence than around Hubli-Dharwad, these being confined to small numbers of backyard poultry, small flocks of sheep (and goats to a much lesser extent), a number of intensive poultry units, other small livestock, and very few cattle or pigs and a little aquaculture (Appendices 3.6.1; 3.7.1; 3.8.1; 3.9.1; 3.10.1; 3.11.1; 3.12). The dearth of large livestock has significant implications for ease of maintenance of soil fertility, transport of inputs and produce, and cultivation. There is relatively poor integration between crop and livestock production (Appendix 2.2.2). The state of knowledge is greater than for Hubli-Dharwad, and further characterisation (other than to ascertain fine detail, if required) is probably unnecessary.

Land and water
Extensive research investment was made into investigations of the applicability of Geographical Information Sytems (GIS), Global Positioning Systems (GPS) and Aerial Digital Photography (ADP) for characterising land and to assist inventory processes for planning (Appendices 4.1.2 and 11). Although the potential was described, little use was made of these technologies for characterising the peri-urban interface.

Probably the knowledge available adequately characterises the role of land in major PUI production systems (Appendix 7.1.2). In general, land uses in those areas affected by the PUI are known, as is the production coming from these uses. Water supply, use and contamination around Kumasi have been well characterised (Appendix 4.1.3). Waste and its potential for enhancing outputs from production systems has been well characterised (Appendices 4.6.2; 4.6.3; 4.6.4).

Planning
There is little planning - physical or economic - effective enough to have a role in major PUI production systems. There are no broad strategic plans covering the peri-urban area, much less ones which cover both peri-urban and urban areas (Appendix 8.1).

5.2. Are changes to these production systems that are driven by urban development adequately understood?

5.2.1. Hubli Dharwad

Production systems - crops, land and markets
For Hubli-Dharwad, changes in production systems that have been described have largely been temporal, and are similar to trends over time in other parts of Karnataka. Virtually no data were collected for spatial effects of urban development on production or soil fertility: what information exists is largely anecdotal (Appendix 2.1.2). There has been no spatial analysis of cropping systems in relation to the city. Information on size of holding is available from census data, but there does not seem to be a clearly discernible relationship between these and proximity to the cities (Appendix 4.1.4). Sewage irrigated vegetable production is one response of peri-urban farmers to the availability of one resource flowing from the city, and this has been well characterised (Appendix 4.6.7).

Little is known about the operation of the land market or area of land converted to urban use, and data on changes in land prices over time are possibly flawed. Claims that there is pressure on the land supply are not well supported. Growth of urban Hubli-Dharwad has been lower than the mean population growth rate for India, and there are indications that this growth may not be a strong force for change (Appendix 7.2.1). Although Hubli-Dharwad is an important market for surplus staple crops and perishable vegetables, marketing of other major cash crops (flowers, cotton, chilli, potato, mango) is not wholly dependent upon the twin cities: these products are usually sent to well established markets elsewhere, where higher prices prevail (Appendix 2.1.2). It is concluded that there is a significant gap in knowledge about the effects and magnitude of urban growth upon farming practice, and that further information is required to minimise the possibility of misconception of future projects (Appendix 7.2.1).

Livestock
There is little information on the effect of urban growth upon near-urban livestock enterprises. Many peri-urban dwellers (including the landless) keep milch buffalo, as there is a considerable urban market for milk, but again, as for crops, a spatial analysis of buffalo populations in relation to urban areas is absent. One clearly identified urban pressure is the growing demand (from city dwellers) for removal of livestock from the cities (pigs and cattle) (Appendices 3.2.3 and 3.3.2). If this were ever to happen the implications are hard to foretell, but it is likely that effects upon urban – peri-urban resource flows would be considerable (fodder, dung, finance, labour). As for cropping

systems, it is likely that more precise data may be required to ensure accurate targeting of any projects involving the livestock sector.

Water
Data for water resources are available only at the district level (i.e. for Dharwad District), and no information on trends due to urban development was obtained. However, anecdotal evidence suggested that the water table is falling due to uncontrolled extraction by agro-processing industries in Hubli-Dharwad, and this is leading to shallower boreholes and wells drying up in the summer in surrounding areas. Any project which focused on this topic would need to collect data in order to accurately identify affected stakeholders.

Planning
The effects of the little planning of the PUI for urban development that is implemented are not known (Appendix 8.2).

5.2.2. Kumasi

Production systems - crops
Around Kumasi, changes in crop production systems driven by urban development have not been described systematically, but survey evidence was collected from sample villages at different distances from the city (Appendix 2.2.1). They showed that fewer people are involved in agriculture and that fallow periods, where they still exist, decreased in length with proximity to Kumasi and some farmers claimed that soil fertility has declined as a consequence, although opinions on this latter point were not unanimous (Appendix 4.2.1). At a resolution of 10 km concentric rings with Kumasi as the centre, the surveys showed that tree crops (mainly oil palm and cocoa) and intensification of staple cereals (mostly maize, some upland rice) increased with distance away from Kumasi, whereas maize grown for fresh cobs and backyard farming displayed the opposite trend (Appendix 2.2.2). Intensive poultry units and small scale (possibly short term) vegetable plots(particularly tomato) were most numerous between 10 and 20 km from the city. Within the city, in poorly drained valley bottoms between built-up areas, migrants from other areas of Ghana are conducting intensive cultivation of vegetables and cash crops (Appendix 2.2.2). No data were presented on land areas devoted to each cropping system in the peri-urban area, no spatial analysis was conducted, and thus it is not possible to describe changes to production systems driven by urban development at anything other than a very coarse resolution. This is despite the availability of scenes from aerial digital photography, which can discriminate between individual cropping systems.

Livestock
Urban livestock systems (cattle, pigs, sheep and goats) in Kumasi are adequately described (Appendices 3.6.2; 3.7.2; 3.9.2). Insufficient data on livestock (other than intensive poultry units) were collected to describe effects of urban growth on peri-urban systems. For Kwabre District, maps have been produced where villages with poultry units are identified, the main implication being the availability of poultry manure as a soil amendment (Appendix 4.1.2). Data for other districts exist from surveys of sample villages (approximately 15 villages per district).

The conclusion is that knowledge presented on changes driven by growth of Kumasi upon production systems is inadequate for accurate targeting of any future research projects, but the data do exist and presumably can be analysed.

Water
Although water supply, use and contamination around Kumasi have been well characterised, changes due to urban development have not been described, but are the subject of a project currently being conducted.

Planning
The effects on PUI production systems are not known of the planning for the expansion of Kumasi which is actually implemented. Given that so little planning is implemented, they could be minimal (Appendix 8.2).

5.3. Is the characterisation of the principal stakeholders in the PUI land use and natural resource based production systems adequate?

5.3.1.   Hubli Dharwad

Production systems
In Hubli-Dharwad, characterisation of the principal stakeholders is partial, having concentrated on the small sample of farmers involved with the waste management project and those farmers and rural dwellers interviewed for the baseline study (Appendix 2.1.3). Knowledge of producers of food crops is probably adequate to proceed, and some information about potato, chilli and mango growers is available, but significant gaps exist for producers of other cash crops, particularly large scale vegetables and flowers, and for actors in the marketing chain. Stakeholders in the waste collection and utilisation process are well characterised.

Land
There are records on land
ownership which seem to be difficult to access. Little information exists on who is involved in land transactions. Government actors in land planning and other land management activities are obviously known locally (Appendix 4.3), yet they seem to be largely ineffective and may not figure as important stakeholders (Appendix 7.3.1).

Planning
The principal stakeholders in the planning of the PUI are known (Appendix 8.3).

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. To try to counteract this, the state government set up a District Planning Board with representatives from each of the local planning authorities. However, little is known about the specific role and responsibilities of the Board and also about the factors that hamper its implementation (Appendix 9.3).

Solid waste
By law, local government authorities must arrange for road-sweeping and the disposal of solid waste. However this is not carried out effectively. Further analysis is required with regards to the role and capacity of several of the key stakeholders identified in the management of municipal solid waste (Appendix 9.3).

There is some recycling activity in Hubli-Dharwad, but there is a lack of information on this. Recycling units and associated industries are also key stakeholders to reduce the non-organic content of municipal solid waste and deserve further attention (Appendix 9.3).

5.3.2.   Kumasi

Production systems
In Kumasi, characterisation of the principal stakeholders in production is generally good, and no further systematic work on this is necessary, although clarification may be necessary in certain locations (Appendices 2.2.3; 3.6.3; 3.7.3; 3.8.3; 3.9.3; 3.10.3; 3.11.3;).

Land
Probably characterised enough. Most key stakeholders have been recognised (Appendix 4.3). In general terms, land ownership is known. In general, it is known that land ownership is divided among families, the Stool and government, and how access is gained to these lands (Appendix 7.3.2).

Planning
The principal stakeholders in the planning of the PUI are known (Appendix 8.3).

5.4. Have the livelihood strategies of poor households affected by the PUI been characterised? What is known about poor peoples' knowledge on how they can intensify their production activities so that they can take advantage of new marketing opportunities presented by the urbanisation process?

5.4.1. Hubli-Dharwad

Who and where are the poor?
There is little explicit information on the level of poverty in the Hubli-Dharwad city-region. Work undertaken in the NRSP PUI programme, however, has identified a number of indicators that could be used to identify poor households. These could be used to explore the extent and characteristics of poverty in the city-region. Other indicators of where poor households may live include the existence of slum areas within the urban boundary (Appendix 5.1).

Natural capital
Information has been collected on land use, water resources and forest cover. There is little information, however, on entitlement issues, that is the level of access to, and control of, natural resources (Appendix 5.3.4). Little is known about the extent of poor peoples' knowledge on how they can intensify their production activities, except for the small sample of farmers participating in projects, and even then only from the male perspective (Appendix 2.1.4). The amount of land used for agriculture and other purposes was provided in the Baseline Study report for the five taluka, but no information is given on access to land (Appendix 5.3.4). Little is known about how much land is being converted and for what purposes, whether the land is being converted for residential, speculative or industrial purposes (Appendix 7.4.1). Furthermore, there is no characterisation of who is buying land and for what purposes, whether it is urban dwellers buying land for investment or speculative purposes, farmers from other villagers or new industries buying agricultural land for industrial purposes. A major gap appears in understanding the coping strategies adopted by farmers to compensate for the loss of their farmland when it is sold. The main trends in terms of land use change and land use planning are briefly characterised in the Baseline Study, although they have not been investigated in depth. Further investigation of land market trends and their impact upon the poor in the PUI, as well as the developments of specific initiatives to strengthen the planning and monitoring capacity of local bodies to respond to these trends, are key aspects to address the issues of poverty and sustainability in the PUI of Hubli-Dharwad. Issues of management of, and access to, tanks around the city region have not been studied in depth.

Financial capital
Most information collected to date has been on income generating activities. Practically nothing is known about the role of women in the livelihoods of poor households. Very little information has been collected on access to credit by small farmers, though some of the farmers studied in the waste research have borrowed money from moneylenders and banks, whilst one was a moneylender himself. No information has been collected on remittances either from the urban area to rural areas, or to Hubli-Dharwad from family members in other cities or countries. Source of credit for small, poor, farmers or livestock keepers may be an area needing further investigation

(Appendix 5.3.5). The reasons why poor farmers do not take more advantage of new marketing opportunities need to be elucidated, and this represents a significant gap in knowledge, which if not addressed could lead to projects not achieving their objectives.

Social capital
Little information has been collected to date on the role of social capital in livelihood strategies through the NRSP studies. Reference has been made, though, to the role of extended families, with many members of a family often living in one house. The extended family does play an important role in providing opportunities and contacts in India. The caste system also remains important to some extent. Some of the villages studied have specific areas where members of low castes live. It is not clear, however, how the caste of a person affects their opportunities in responding to urbanisation. A four-village study recorded that there are good social networks in some villages. There is little discussion in the report, however, about the role of such networks and groups in the lives of poor households. At a local level, several community organisations appear to play a key role in terms of supporting and diversifying the local livelihood strategies, though little is known about the strengths and weaknesses of these organisations (Appendix 5.3.6).

Physical capital

Some information on physical capital (access to infrastructure, agricultural machinery, manufacturing tools, etc.) among the peri-urban poor has been collected and processed to date. One area of physical capital that has been researched is energy sources. One study shows that the six villages researched have biogas plants. A key determinant of continuing to use biogas is the availability of cow dung. In some areas, the cattle population is declining, partly due to the declining availability of common grazing land. In landless and small farm households, firewood makes up the highest proportion of total energy consumed for domestic purposes. Landless households use a slightly higher proportion of cow dung cakes than other income groups. Traditional fuel sources remain and there have been no substantial changes in the types of fuels used in villages (Appendix 5.3.7).

Human capital
Not much is known about the skills of the poor in the peri-urban area. However, data on levels of literacy are available from the ten-yearly censuses.

Structures and processes
The networks for marketing of farming products and the main stakeholders involved in these networks are characterised in the Hubli-Dharwad Baseline Study. Agricultural produce markets appear to be highly fragmented (Section 2.1.2), with weak links to the state and the national and international markets. Poor farmers were found to avoid harvesting crops of higher productivity and risk in order to avoid price and post-harvest and storage risk. Key factors that demand further consideration are the constraints to the access of poor farmers to credit and to marketing organisations and information (Appendix 9.2).

Planning
There is no knowledge of how planning for the PUI affects the livelihood strategies of the poor households, but as planning in general is so ineffective, it is suspected that effects on livelihood strategies are negligible (Appendix 8.4).

5.4.2.   Kumasi

Who and where are the poor?
At the community level the poor have been adequately characterised.   However between communities the distinction is not clear, as the wealth ranking was carried out on a community

specific basis. Food crop farmers were found to be amongst the poorest of the peri-urban dwellers, although the determining factors of poverty have not yet been identified (Appendix 6.4.1). There appears to be high unemployment in some villages (although no definition of unemployment was supplied). The determination of common indicators would have enabled a comparison of relative levels of wealth and poverty between areas. For example, what proportion of households in each village are able to meet their basic needs (in terms of clothing, housing, food, medicines, soap), then what proportion are able to meet higher needs (education of children, investment in livelihood strategies, such as training, tools, stock for trading), then what proportion have enough to give away, to purchase luxuries ie; exceed needs for sustainable livelihoods and even save. Alternatively levels of unemployment might be used but this may run into problems of definition and seasonality.

Natural capital

There is substantial characterisation of the growing land market and resulting insecurity of land tenure in the Kumasi peri-urban areas, and of the ways in which this is influencing the livelihood options of farmers (poorer and wealthier, men and women). Despite the trend away from farming as the main source of livelihoods, the continued importance of agriculture, particularly to women, was evident. It was clear that the poorest farmers were food crop farmers with a small area of land (more women fell into this category). Otherwise the information on land based livelihoods was very generalised and enough may not be known of the ways that the poorest households use land in the PUI for production or the ways the poorest participate in production systems using PUI land (Appendix 7.4.2).

With the exception of information on the importance of casual labour opportunities (including sand winning and vegetable farms), charcoal production and fuel wood collection, not enough is known about the exploitation, (or potential exploitation) of other natural resources and the livelihoods thereby secured, or the sustainability of such livelihoods.

Despite the availability of some information from a sample survey that disaggregated response by sex and marital status, the differences between men and women in terms of control over land (or other resources) are not clear, particularly at household level. Not enough is known about how the responsibilities within the household change with urbanisation particularly considering the increasingly cash orientated household economics and food supply. Gender analyses are necessary in order to determine the control of resources and the distribution of responsibilities within the household, how these vary according to wealth levels and how they are influenced by urbanisation.

Reasons given by food crop farmers as to why they do not engage in more vegetable crop production were dominated by lack of access to affordable credit. However, this cannot be divorced from secure access to land (collateral for lower interest loans) or access to land with a water supply to ensure production in the off-season. Homeless and un/underemployed people who aspired to vegetable production were unable to initiate this activity because they had neither the land nor the cash with which to rent it. The issue of secure access to land and its relation to investment in more remunerative enterprises requires further exploration, and it may be the critical constraint to improving both production and livelihoods.

Physical capital

Not much is known about the proportion of the peri-urban population with and without access to clean water and sanitation facilities, as well as other amenities such as electricity and health services (Appendix 6.4.3).

Human capital

The livelihood studies have indicated the lack of education and skills among the poorest groups. This is a major impediment for accessing adequate alternative livelihoods when land is not

available to go into farming (Appendix 6.4.2).

And yet, not enough is known about:
- The proportion of households of urban, peri-urban and rural communities able to send children to school. This is necessary to indicate the positive impact of increased availability of facilities while weighing it up against increased poverty preventing access of children from poorer families.
- The systems of apprenticeships used, the costs, length, obligations, the availability of opportunities and how they are found (through what connections).
- Lack of skills in a trade were identified as barriers to sustainable employment but current systems for the provision of these were not explored.

The ability to labour is one of the key resources that poor/poorest people rely upon for their livelihoods. However, not enough is known about the changing prevalence of disease associated with contaminated water and poor sanitation, or other pollution sources and how this varies between wealth groups.

Social capital
The current status of the traditional support network (family) and strength of customary leadership, although hinted at, is not really shown (Appendix 6.4.2).

Financial capital
A lack of finance and credit was reported in all the villages visited as a constraint to use of agricultural inputs and the diversification of livelihoods with other occupations or small businesses. Very little is known about the availability and access to credit, the successful or otherwise experience of CBOs and other NGOs in providing credit, and attitudes towards credit (Appendix 6.4.2). See note above about ability to take advantage of more remunerative cropping systems. Some information was provided on traditional forms of credit available but little on its comparative strengths and weaknesses.

Structures and processes
There is a need to look at the development of the job market. If people train in certain trades will they be sure of a sustainable livelihood? What are the prospects? What kinds of industries are the potential growth industries in peri-urban Kumasi? What are the possibilities for promoting village based industries/businesses?

The actual and potential non-farm alternatives for livelihoods have not been well researched in the studies, but rather hinted at. The impression given is that the only option for the resource poor is to continue farming (women) or to do labour on construction sites or farms (men), but there must be more unskilled labour opportunities than this (Appendix 6.4.2).

Further study should identify more examples of such local industries as described in the PRA, and determine the factors necessary for their initiation, success, their constraints and likely future. They will often be based on natural resources available locally and so may still be considered within the remit of the programme. Indeed the identification and testing of value added processing of agricultural produce was listed as a researchable theme in the inception main report but if this has been done no report has been seen. Also there is little reason why a natural resources programme should restrict itself to agricultural products; many crafts and small industries are based on non-food crop NR, leather working, for example.

Planning

There is no knowledge of how planning for the PUI affects the livelihood strategies of the poor households, but as planning in general is so ineffective, it is suspected that effects on livelihood strategies are negligible (Appendix 8.4).

5.5. Is the understanding of the effects of urban development upon the poor adequate? What is known about the extent of their knowledge on ways of increasing their security through improving their land tenure, marketing systems, access to credit?

5.5.1.   Hubli Dharwad

Employment
In Hubli-Dharwad, little is known about the effects of urban development upon the poor, nor about the extent of their knowledge on ways of increasing their security. There is some general knowledge about changes in the composition of the labour force, in that in three taluka close to Hubli-Dharwad, non-farm employment has increased, particularly for men, and more women have entered the labour market, but mostly in the lower paid farm sector (Appendix 5.3.1). Near the cities, agricultural wage rates have to compete with higher urban rates, leading to transportation of agricultural labourers from more distant villages by those farmers who can afford it, which has implications for incomes for landless rural labourers (Appendix 5.3.5). There is no knowledge about how households cope when family labour is lost due to competition from the non-farm employment sector, nor where families go or how they obtain their livelihoods when they sell their land. Farmers often criticise the profits made by marketing middlemen and informal money lenders, but seem not to know how to change these situations. These gaps in knowledge should be addressed before further work proceeds.

Land
Not enough is known. Given that little is known about livelihood strategies, it is not surprising that little is known about how they are affected by urban development. There is some indication that women may have more difficulty than men in managing a change which does not increase poverty. Some trends are related to changes in land tenure, with new (urban-based) land owners coming into the picture, and small holders seeking to minimise risks and improve security of market access.   Who sells the land and what happens to the proceeds are important questions that remain unanswered (Appendix 7.5.1).

Solid waste
The peri-urban interface is the chosen location for the cities' landfills, which are worked by waste pickers, although most of the glass and plastic is separated out of urban solid waste for resale before the waste reaches the dumpsite. Some urban waste is composted and used as fertiliser on agricultural land, although this mechanism is largely restricted to wealthy farmers, who can transport the waste from the dumpsites and hire labourers to separate the waste before application to the fields. There is possible contamination of groundwater from landfills. But water pollution has not yet been further investigated (Appendix 9.3).

Liquid waste
Although most of the urban areas of Hubli and Dharwad are covered by sewerage networks, peri-urban areas are characterised by a lack of sanitation infrastructure. No sewage effluent is treated, and there is a tradition of reuse of urban wastewater, sewage effluent and nightsoil as fertiliser on agricultural land, with some cultivation taking place alongside sewage channels (Appendix 4.6.5). This can pose an environmental health hazard if the effluent is not sufficiently decomposed; this requires further investigation (Appendix 9.3).

Structures and processes
When villages are incorporated into the Hubli-Dharwad Municipal Corporation (HDMC) boundary they lose their village council (*Panchayat*) and have to elect representatives to the Corporation.

The village council, made up of members from the village, is closer to the village in terms of decision-making, while the HDMC seems more remote and less accessible. This change of power must have impacts on people's ability to respond to urban influence. The incorporation into the HDMC boundary also means that people lose access to the State's Department of Agriculture and the associated agricultural assistants, meaning that farmers cannot easily access new information and cannot access rural credit schemes. Again, there must be negative impacts for small, poor, farmers in particular. This area of concern has been identified in the research process, but has not been researched in depth (Appendix 5.3.9).

Planning
There is no knowledge of how planning for the PUI for urban development affects the livelihood strategies of the poor, but it is suspected that the effect is negligible (Appendix 8.5). Land use planning is handicapped by the fragmentation and overlapping of institutions involved. Further research is required to better understand the nature of the driving forces behind land use changes and to examine whether they are a result of the poor planning capacities at the local level or an outcome of contradictory policy objectives at the state and central levels (Appendix 9.3).

5.5.2.   Kumasi

Production systems and land
In Kumasi, research conducted to date has adequately identified the effects of urban expansion upon the poor. Chiefs in many villages are disposing of land (long term leases) in an unregulated manner, thus depriving farmers of their usufructuary rights usually without compensation (Appendix 7.5.2). This process and the consequent effects upon the livelihoods of farmers are well characterised: less investment is made in land based enterprises, such as maintaining soil fertility and planting trees crops. Many peri-urban farmers wish to leave farming, and do; of those who are left, many are women who are too poor to change livelihood strategy. As was found in Hubli-Dharwad, producers are well aware of the high profits made by middlemen and informal money lenders, but lack the knowledge or power to do anything about it. In the face of the risk of loss of rights to land, many farmers seem to be resigned to the fact that this is the prevailing system, and there is little they can do to change matters.

Planning
There is no knowledge of how planning for the PUI for urban development affects the livelihood strategies of the poor, but it is suspected that the effect is very negligible (Appendix 8.5).

5.6. Is the knowledge of strategy options for interventions in land use and production systems adequate?

5.6.1.   Hubli Dharwad

Production systems
In Hubli-Dharwad, the only strategy option explored so far was the effect of application of composted and modified, sorted urban solid waste on a range of small scale farmers' crops (Appendices 2.1.5 and 4.6.5). Although this generated much useful knowledge about ways of collaborating with poorer farmers, the option explored was of limited use due to the expense of processing. Any strategy options explored by new projects will have to be based on knowledge other than that generated by the NRSP funded project. A general consideration of strategy options for using solid and liquid wastes is given in Appendices 4.6.1, 4.6.2 and 4.6.7.

Land
The research has not identified strategy options of this kind, except one or two aspects of strategies in passing (Appendix 7.6.1). Under the Karnataka land reform of 1974, laws were introduced in favour of land tenants, giving a person illegally cultivating the land belonging to another person

the status of tenant. The result has been that many large landholdings have been reduced and land has been redistributed among the landless (who are now tenants), resulting in an overall increase in production. Poor people who were working under landlords were also given tenant status, and this has improved their livelihoods. This was a very strong measure taken by the government for poverty alleviation but little is known about the current effectiveness of these policies and their impact on the poor (Appendix 9.2). There is insufficient information about the government policies in support of farming activities and their impact on the livelihoods of the poor.

Planning
Existing planning at the Panchayat levels and planning for the Hubli-Dharwad region do not appear to contain strategies to deal with the PUI in particular, especially ones which aim to benefit the poor (Appendix 8.6; Appendix 9.3).

5.6.2.   Kumasi

Production systems
In Kumasi, the only production system strategy options explored were the use of composts, poultry manure and leguminous cover crops as means of maintaining soil fertility and controlling soil borne pests and diseases (Appendices 2.2.4 and 4.6.9). As all the field experiments were failures, no knowledge of use to farmers was generated. As for Hubli-Dharwad, any strategy options explored by new projects will have to be based on knowledge other than that generated by the NRSP funded projects. A summary of the scope and options for utilising wastes around Kumasi is presented in Appendices 4.6.3, 4.6.4 and 4.6.8. A comparison with Kano, northern Nigeria, is provided in Appendix 4.6.6. Some strategy options at a watershed level were reviewed in Appendix 4.6.11.

The regional scale
Future development strategies for peri-urban Kumasi ought to be based on some degree of awareness about the economic potential of both the city and regional economy. And yet, authors agree that there is a dearth of information on both (Appendix 10.2). None of the documents consulted appear to provide a profile of the regional economy and only one provides a partial overview of the economy of the city (including its metropolitan area).

It is not clear how the 'region' might be best defined for the purposes of future stages in the NRSP. The Greater Kumasi City Region (GKCR) comprises the area in the jurisdiction of the Kumasi Metropolitan Assembly (KMA) and four adjacent districts (Ejisu Juaben, Kwabre, Atwima and Bosomtwe-Kwanwoma. Although not an administrative entity, the GKCR would appear to be a useful unit of analysis for the purposes of the research and any subsequent strategies developed as part of the programme. However, the peri-urban area is still a problematic concept, and any trends are likely to be influenced by wider economic developments in the larger Ashanti region. Thus, reference should be made as far as possible to wider processes such as in-migration from the Ashanti region into Kumasi, marketing of produce, substantial changes to infrastructure (e.g. transport, electricity, telecommunications), and other relevant indicators which might affect the economy and the livelihoods of the population in the GKCR (Appendix 10.2).

Several components of the Kumasi peri-urban region appear to have been adequately characterised in the different project documents. But because of the nature of the KNRM project, these documents have tended to focus on the natural resource-based economy, notably agriculture, livestock, mining, energy, land, water and waste.

Little or no attention appears to have been paid to non-NR sources of sustainable livelihoods that are appearing or rapidly changing, such as trade, construction, small-scale and medium-sized manufacturing, services (e.g. repair workshops, hairdressers), or to elements providing important support to the regional economy such as the regional infrastructure (electricity generation and

distribution, other sources of energy, roads, telecommunications), education, health and inter-regional transport (there is some information, however, on intra-regional transport particularly to and from Kumasi).

Similarly, there is no reliable picture of the changing composition of the labour force at a regional and metropolitan levels (Appendix 10.2).

Land
The research has identified very little in the way of strategy options of this kind for land. This was not among the activities of any of the previous work commissioned. Nevertheless, it is useful to draw attention to those options and related information which the research might have identified or generated in passing. Existing policies affecting land are generally known and they are few. Probably their key strengths and weaknesses are known, including those of the processes for implementation of these policies, although less may be recognised of the strengths and weaknesses of implementing land policies in rural areas (Appendix 7.6.2).

Planning
Existing district planning and planning for the metropolitan area of Kumasi do not appear to contain strategies to deal with the PUI in particular, especially ones which aim to benefit the poor (Appendix 8.6). Possible strategies are reviewed in Appendices 4.6.12 and 4.6.13).

5.7. What is known about ways in which this knowledge on interventions can be more effectively transferred to the peri-urban poor?

5.7.1.   Hubli Dharwad

Institutions
In Hubli-Dharwad, the means by which knowledge was disseminated to poor farmers was during the participation process, and its effectiveness was not tested. There seems to be justifiable to doubt the effectivenesss of the official extension agencies at reaching the poorer sectors or primary producers. It appears that links with NGOs might be more rpoductive, although this has not been tested (Section 2.1.6).

5.7.2.   Kumasi

Institutions
In Kumasi, the extension agency (Ministry of Food and Agriculture; MOFA) conducted a campaign to extend knowledge about fertilizing with poultry manure to urban and peri-urban farmers (Appendix 2.2.5). One of the objectives was to determine farmers' knowledge and attitudes before and after the campaign. However, there seems to be some doubt about whether this aspect was effectively conducted. Nevertheless, the campaign did take place, demonstrating the ability of MOFA to reach several hundred farmers, should appropriate interventions be identified in future. NGOs operating in the area have expressed interest in participating in disseminating knowledge of new interventions developed.

5.8. Conclusions: adequacy of existing knowledge of the two city regions for the formulation of relevant strategies through extended interaction with principal stakeholders and for the implementation of pilot projects assessed.

5.8.1. Hubli-Dharwad

Production systems
Around Hubli-Dharwad, although effects of the conurbation upon production systems have been identified, particularly upon wage rates and labour supply, and marketing opportunities, these have

not been characterised in any detail. These matters aside, the growth of Hubli-Dharwad may not be a strong force for change. Thus, the adequacy of existing knowledge would depend upon the nature of strategy options being formulated, and for many sectors, new knowledge acquisition would probably be necessary. The principal constraint to primary production is reliable supply of water, but the extent to which this disproportionately affects the poor has not been assessed. Knowledge is probably adequate for development of policy options and research to test strategies for improving access to water for the poor, and for minimising health and environmental problems for those who use sewage water for irrigation.

Land
It appears that not enough is known to formulate strategy options regarding land in the PUI which aim to benefit poor households. The changes to production systems caused by H-D affecting land in the PUI are not clear; they may not even be substantial. In any event, not much is known about the role of PUI land in the livelihood strategies of the poor or how these strategies are changed by the effects of H-D on PUI land. It is not known who gains and loses when land is converted to urban use, what these gains and losses are, and what households do as a consequence of these gains and losses (Appendix 7.7.1).

Planning
There is enough existing knowledge to consider the use the planning mechanisms in the Hubli Dharwad region for interventions. However, it is not at all clear why planning is so ineffective. Rather than undertake investigations into the poor performance of planning and to overcome the impossibility of learning about effects on livelihoods of planning that is not felt, it would make more sense to increase knowledge of these areas through action research which would formulate strategic interventions and attempt to implement them through pilot projects (Appendix 8.7).

5.8.2. Kumasi

Production systems
Around Kumasi, the adequacy of knowledge about production systems is much greater than around Hubli-Dharwad. However, there remains some doubt that the principal constraint to primary production has been identified. It is puzzling that land near to Kumasi is said to be under-utilised when it could be a major resource in livelihood strategies of the poor as well as others. The research literature does not actually provide evidence that such land is under-utilised for growing crops, raising trees and/or rearing livestock. Nevertheless, it is argued that this is so, and hypothesised that it is a consequence of a combination of poor access to finance and credit, crop pests and diseases and poor maintenance of soil fertility. The result is that production does not adequately reward the efforts of those who would farm for themselves, or those who would be employed as labourers. Declining fertility is said to arise from shorter periods of fallow and the failure to use soil amendments. The shorter periods of fallow are said to be a consequence of more intensive farming occurring as the conversion of land to urban uses increases the pressure on remaining farmland, breaking it into smaller units which are said to be more intensely used. If men and women leave farming to take part or full time work in the urban economy of Kumasi, why is there such an increase in demand for farmland around the city? The land is not in demand for production to be sold in Kumasi, for the research finds that the farming continues to provide foodstuffs mostly for household use. There is confusion here which may be germane to livelihoods of the poor (Appendix 7.7.2).

The pattern of agricultural intensification observed around other significant markets in Africa is curiously absent around Kumasi, and it may be that in fact the principal factor preventing such investment in land-based livelihoods is insecurity of access to land. The intensification of primary production evident in un-built urban areas and at greater distances from the city, where surety of access to land is greater, supports this hypothesis. The picture here is far from clear, and this should be a priority for future research. It may be that data adequate to answer to solve the issues

just outlined already exist, and await a more penetrating analysis. Otherwise, research to specifically address these matters is required. Knowledge is probably adequate to embark upon such a line of enquiry.

Land

A good deal is known of the livelihood strategies of farmers, of what they grow, how they deal with the soil and of how these strategies change when affected by the proximity of Kumasi. Less is known about the poorest of these farmers, although it seems that many of these are women, older ones, who continue to farm food crops for domestic use as long as possible and whose livelihood strategies thereafter are not known.

Little seems to be known about the livelihood strategies of those that raise animals or trees, but the tendency to nurture trees for fruit crops and/or fuel seems to decline with proximity to Kumasi. Neither does adequate information exist about those who extract sand and gravel, although they are probably a minority. The livelihood strategies of the poor who rent housing in villages are not known and nor are the trade-offs this involves, such as the quality of services obtained. Very little is known of how the livelihoods of other poor, indigenous, village residents are affected by the reduction in the adequacy of services and any environmental degradation as new residents take their places in the villages (Appendix 7.7.2).

Despite these areas of weakness in knowledge of livelihoods, there is probably enough known to begin the formulation of relevant strategies that will address some of the basic issues of peri-urban land use in livelihood strategies of the poor. Specifically, who gets the financial benefits of the sale of land rights, why land is under-utilised as a basis for livelihoods and how land in villages can be used for housing in appropriate ways, i.e. ways that are not disadvantageous to the poor (Appendix 7.7.2).

Planning

There is enough existing knowledge to consider the use of planning mechanisms in the Kumasi region for interventions. However, it is not at all clear why planning is so ineffective. Rather than undertake investigations into the poor performance of planning, and overcome the impossibility of learning about effects on livelihoods of planning that are not felt, it would make more sense to increase knowledge of these areas through action research. This would include the formulation of strategic interventions and attempt to implement them through pilot projects (Appendix 8.7).

Chapter 6.

Contribution of Outputs

As the project proposed was largely a desk study, its contribution to sustained elimination of poverty will be indirect, as this research is strategic. There are several completed and current projects addressing the PUI (Appendix 1), which so far have not addressed the issue of poverty reduction in peri-urban areas in a co-ordinated manner, although the concept of sustainable livelihoods was incorporated into later projects. Following the adoption of the new logical framework, this project presented the opportunity to consolidate foregoing research, and analyse it with reference to the new Purpose and Outputs. Knowledge has been consolidated (Appendices 2 to 12), gaps in knowledge identified, their importance assessed and suggestions made about how such gaps might be addressed. The PUI Steering Group will be able to use this review to aid planning of new work, the intention being that any new work so identified will be able to contribute more directly to sustained elimination of poverty.