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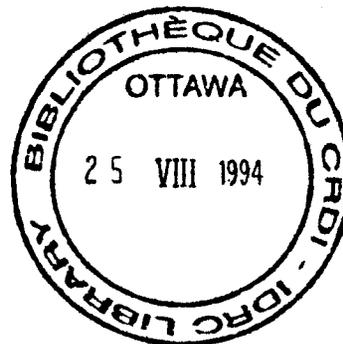
# Urban Environment Management

Developing a Global  
Research Agenda

*Volume 1*

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*Edited by  
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## INTRODUCTION

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### PERPSECTIVE

The Urban Environment Management or URB Program, housed in the Environment and Natural Resources or ENR Division, IDRC, was developed in 1992. It originated from a working group created in February 1992 and was confirmed in early 1993, a corporate decision to devote more systematic support to selected urban development problems, which various sectors of the Centre had addressed throughout the 1980s. The URB working group is currently composed of some 17 professional staff from various areas of expertise and various Centre Divisions, distributed roughly equally between IDRC's Ottawa headquarters and its regional offices. Its yearly budget for new research support is about 1 million CAD. Research activities can also be funded jointly with other Centre Divisions working on urban issues.

Between February and December 1992 an URB Program statement was drafted and revised many times by more than 30 specialists, from various Divisions of IDRC, and by external readers. It was discussed with each IDRC regional director in June 1992, then disseminated at corporate assemblies and shared with other external support agency representatives in meetings in Washington, New York, Stockholm, London, Nairobi and San José, Costa Rica.

Along with this in-house consultation, we believed we needed to do two things to ascertain and specify the URB Program's objectives and approach.

### IDRC PROJECT REVIEW

Firstly, in September 1992 we commissioned a systematic analysis of selected IDRC project literature on those issues retained by the URB Program at that time (urban water and urban waste management, urban agriculture, and urban environmental hazards); a list of descriptors was set up and revised, in consultation with IDRC staff in Ottawa and in the regions. This led us to identify, with IDRC Library's assistance, some 120 relevant projects (co)funded by IDRC since 1980. Project synopses were then scrutinised to come up with a shortlist of 30 projects most indicative of new URB Program directions. This list was revised by staff in Ottawa and in the regions. The project literature was evaluated for its contributions and challenges to the proposed URB program approach and objectives. (Appendix II reproduces the December 1992 version of the URB Program statement which served as the basis for this review and the subsequent program development workshop.)

A January 1993 draft report was circulated for review by Program staff and finalised in February 1993. This report will be reproduced for in-Centre distribution. This project review also enabled us to update and expand our directory of individuals and institutions with an IDRC track record, currently engaged in research on URB Program issues.

## **THE OTTAWA WORKSHOP**

The second action was to submit the URB Program statement to a systematic critique by the Canadian and southern research communities, as well as by interested external support agencies. This was to identify and specify a narrower and more operational set of research challenges and collaboration mechanisms to inform and influence problem-solving strategies over the next few years.

We identified and invited some 25 specialists from Latin America, Africa and Asia to assess the URB Program statement on three counts: (a) identify strengths and weaknesses of their region's research record on specific Program issues; (b) appraise relevant institutional capacities in their region; and (c) propose new ideas for future research. Between January 1993 and April 1993 the papers were written, submitted, reviewed both by URB Program staff and Canadian specialists.

Both review papers and related comments set the stage for a Program development workshop in Ottawa on 4-6 May 1993. During three full days some 53 participants (Appendix I) debated research needs and collaboration mechanisms in thematic and regional rounds of working groups. The participants represented a wide range of disciplines, private and public universities and research centres, governmental departments and non-governmental development organisations, bi and multilateral agencies (WB, UNCHS, UNDP, UNICEF, CIDA, IDRC), in 17 countries of North, Central and South America, West, Eastern and Southern Africa, the Middle East, South Asia, East and Southeast Asia. Group moderators shared in plenary their working group proceedings. A panel of representatives of external support agencies reacted to these reports and made substantive contributions to individual working group discussions.

## **THE REVIEW PAPERS AND WORKSHOP PROCEEDINGS**

This publication reproduces, under standardised format and with some editing, the papers commissioned and retained for rapid dissemination. Authors were given two weeks after the workshop to remit revised versions of their papers.

## Review Paper Summaries

### Seven papers were produced on urban agriculture:

Rev. Camillus Sawio just completed a doctoral dissertation on the subject and in his paper thoroughly reviews the research record and available expertise in Central and Eastern Africa; new studies should focus on small-scale methods and techniques for small-scale producers to better select crops and sites, to improve multi-food production systems in intra and peri-urban areas, as well as on legal and policy changes required to better support and control UA, on developing organic recycling systems to reuse waste and on solutions to related health risks.

To this, Davinder Lamba, of the Mazingira Institute, adds research to inform gender and ethnic empowerment, promote credit assistance, and to rigorously assess the fungibility benefits of UA.

Also supporting more thorough cost-benefit analyses of UA, Wekwete, recommends a careful examination of UA's economic significance as a land use and employer, of its productivity, returns and multiple impacts on household well-being.

In Chimhowu and Gumbo's well-documented review on Southern Africa, research on UA evolved from baseline and descriptive studies on land use aspects, to studies stressing UA as a survival strategy, finally to hybrid, more holistic analyses, still with scant attention to some countries. More research is needed to show how land use zoning systems can accommodate urban agriculture, to ascertain actual production levels, to reconcile inimical and promote enabling legislation for broadening support to UA, and to exploit UA as an effective and productive way of recycling and reusing urban wastes.

Diallo's West African overview highlights geographers' dominant contribution to UA studies in this subregion, a general need for clarifying terms and concepts, the neglect by current research of urban animal husbandry and of the synergy, competition and complementarity between UA and other land uses; specific research is needed on the nutritional impact of UA among low-income groups, with pre- and post-UA comparisons. Increasing producers' access to land and improving crop security are fundamental to enabling technological progress in the field and creative initiatives in Zaire and Nigeria need to be better understood and disseminated.

Yeung's detailed survey on research substance, expertise and institutional capacity in East Asia shows that technical developments here testify to human creativity in very high-density urban settings. Contrasts within the subregion are marked however and a

major challenge is to develop means and ways of making integrated and productive systems more accessible to low-income groups and countries.

In Latin America, Prudencio's review shows an organisational scene for UA which is more promising than often thought. NGOs are main promoters, encouraging UA often as part of food aid programs, jointly with specialised agencies. International cooperation agencies finance UA, with little technical expertise though and hardly any research promotion. So far, support has been less forthcoming from national governments but many regional authorities are dependable collaborators. Remarkably however, we have yet to produce a systematic account of what is happening in UA in Central and South America and the Caribbean.

Six papers were submitted on urban waste management:

Bushra shows that North Africa and the Middle East, Egypt in particular, have implemented innovative approaches to the collection and re-use of municipal waste by the informal sector, as well as appropriate technologies for solid waste composting. Still, the region lacks baseline information; an excessive reliance on management systems highly dependent on expensive, inappropriate equipment, has kept attentions away from alternatives making the best use of low-cost technologies and maximising waste reutilisation.

Syagga's account of Central and East Africa displays a broad range of disciplinary expertise and strong links between research and government institutions. He points to the lack of research on privatisation, on the industrial and economic significance of recycling, gender and basic needs dimension of waste management, and the persisting insistence, as in North Africa and the Middle East, on deficient organisational and technological models. It will be important for donors to complement each other's role in this subregion.

Tevera's detailed and abundantly documented assessment of Eastern and Southern Africa shows that, in contrast with Latin America, little research has involved or dealt with the role of local communities in urban waste management, a major challenge.

Diop's reading of West Africa's experience emphasises what other papers imply, that management strategies within cities must be differentiated in space and over time. We also need research to explain why, despite technical research advances, so little progress has been achieved on solving waste water problems on the ground.

Khyaju, Tuladhar and Shrestha's survey of South Asia reveals an impressive technical research capacity (36 institutions in seven countries) and a wide range of relevant expertise, sectors and levels of government involved. Regional strengths include risk assessment of disposal, siting rehabilitation, reuse and composting of municipal waste, biogas production; future research efforts should emphasise organisational more than technological development.

In Latin America Rodriguez, through a network of social researchers, assembled an extensive overview; some innovative management experiences include inter-municipal consortia, NGO achievements in the areas of community participation and cooperation between municipal and informal sectors. PNUD-Habitat and Ford have funded projects.

As regards urban water management, again six papers were delivered:

Mostafa and Helmi's assessment of North Africa and the Middle East is supported by regional data for the 1973-92 period and shows a rapidly growing concern over urban water problems in this subregion. While technical and economic research capacities are very good, integrated approaches have been disregarded so far, as in Latin America. Despite common use of groundwater throughout local history, research on conservation and protection remains scant. Community participation and public-private communication are weak and studies very limited, on sound management techniques, water harvesting, reuse and recycling.

Materu's review of Eastern and Central Africa echoes some of Mostafa and Helmi's concerns; we need to document the range of models and strategies involving communities in the region, including evaluations of IDWSS actions and the status of urban rainwater harvesting. On water pricing and cost recovery, Materu's paper implies that beyond conventional piped networks, a much broader range of technical and institutional options needs to be exploited for more prompt and effective provision. In order to do this we need to know more about people's valuation of clean water, their requirements for water of varying quality for different purposes, the strategies they currently use to satisfy those needs.

Biemi and Jouba's survey suggests that West Africa's technical capacity and expertise has been used well below its potential and needs to be complemented with social expertise. Research and training have made little impact on treatment and reuse of water, despite technologies at hand.

Yong's paper on South East Asia stresses that, increasingly people are perceiving a strong link between water management and waste management; institutional changes

underway favor research to explore this link more fully, before realistic urban water management plans can be developed. Training needs are greater in waste management but a very large institutional capacity can be mobilised. A proposed research approach for decision-making could inspire new initiatives.

Varghese's comprehensive paper on South Asia (India) shares with others the need for a differentiated approach to water management within metro areas: 30 percent of the Indian urban system's supply is now drawn from groundwater sources. She recommends research on ways to augment and protect supplies from conventional sources, including rainwater harvesting, efficient use of groundwater, improved leakage detection and repair, supply restrictions, regressively graded tariffs, waste water recycling) and innovative revenue-recovery mechanisms for community-based systems. Both Varghese and Alam stress the role of women as water managers.

As in North Africa and South East Asia, Panario recognises that Latin America has considerable technical and economic capacity and expertise; however, supply sources are better known or studied when these can be tapped by centralised systems, while others are not. Social aspects are neglected, there is little capacity to monitor drainage and to research renewability. Quality monitoring is insufficient and results hardly disseminated. He makes a case for research of superficial aquifers for non-potable domestic water uses, the rehabilitation and protection of water sources in ways involving local populations.

The theme of urban disaster prevention and mitigation was covered in four papers.

Towfighi's general assessment points to the lack of an integrated framework to deal with all aspects of disasters, particularly the behavioral and economic dimensions. We cannot avoid complex planning and management systems if we want to adequately understand behavior and to identify foci of attention. Such systems should focus primarily on the role of communities within these systems. In developing countries, new research is not needed primarily on specialised technological and hard-science knowledge, but rather should emphasise the more soft-core capacity-building. Collaborative efforts are proposed on community-based models for awareness-raising and vulnerability assessment, as well as participation in action programs.

Mubvami and Musandu-Nyamayaro's paper on Eastern and Southern Africa is very useful because many mitigative measures adopted or in the making are potentially relevant to non-drought situations as well, where the insufficiency of water supplies, their quality, reliability and affordability are increasingly problematic. Links between the various URB issues are well perceived; the need for recycling seems central not only to mitigating droughts but also to reinforcing longterm urban food security. The

study of drought impacts on urban resources merges disaster management concerns with solutions to other URB issues.

This view is also shared by Khondker, who recommends the systematic study of drought effects on urban supplies of water, energy and food, and related response strategies by urban groups most affected.

Lavell's paper on Latin America is particularly instructive; the basic conditions it lists which should frame action-oriented research on urban disasters also apply to initiatives on other URB issues. The comparative economic costing of *laisser-faire* and prevention/mitigation policies can well apply to urban vulnerability to water and food shortages.

Finally, Alam's paper looks at all URB issues in South Asia and is usefully referenced; although the human resource base seems limited, areas highly and lowly researched or ignored are listed, as well as those which should be given priority.

## **BUILDING ON WORKSHOP RESULTS**

This series is meant to be a source-book for building partnerships. It assembles recent numbers and references on major urban challenges in some of the less well-documented parts of the world. More importantly, most regional assessments of institutional capacities, professional expertise and current research activities, will greatly assist both national organisations and external support agencies in the North and South in their identifying and coordinating efforts among groups sharing common interests. Some regional surveys are quite revealing of often unsuspected capacities in many regions; more attest to the need of our coordinating energies within and across regions.

IDRC has already begun to follow up, with other donors, some challenging ideas put forth in papers and working groups. We hope this menu of resources and ideas (over 50 propositions contained in the 24 papers) will also contribute, along with other efforts, to more articulated interventions on the unfolding urban agenda in both the North and the South.

URB Program's current reading of recommendations found in review papers and moderators' reports, in terms of issue foci and research modalities under specific themes and regions, is as follows.

## Urban Agriculture

Urban agriculture is clearly not an invention of researchers, who have been observing it and try to explain it, Davinder Lamba reminded the audience of a panel in Toronto, subsequent to the Ottawa workshop.

There has been some favorable policy response to growing evidence on the significance of UA, though progress remains limited. A belief is still widespread that UA is not feasible, meets only survival needs, or entails health and other risks. This has tended to spring from and entertain constraining urban management policies, restrictive and punitive legislation, zoning codes, building standards, and the denial of readily available and critical institutional support to UA. Other constraints include gender and ethnic discrimination, adverse cultural attitudes and misunderstood and under-recognised linkages among food, fuel and energy needs.

As with squatter housing in the 1960s and informal urban employment in the 1970s, social research in LDCs defeated the invisibility of UA in the 1980s. This contribution must urgently be tapped and enriched by other disciplines' attention to the place of UA in urban planning and service delivery, the distinct technological needs of UA, the costs and benefits of UA to households, communities and cities, as a resource recovering and generating activity, as a value-adding use of certain urban water and land areas, as an employment multiplier, and as part of better urban food security and gender empowerment strategies. Hard facts must be documented across the wide spectrum of distinct UA settings, in terms of the afore impacts.

The intervention-oriented research modality, including selected policy-concerned surveys, is deemed best in the short term. This should allow all stakeholders to participate, with special emphasis on the underprivileged. Some of the key policy concerns should be: to document the real health risks and benefits of UA, in its production, distribution and consumption phases; to promote equity aspects, a levelling of the playing field for the urban poor; to devise planning strategies which accommodate UA differently within and between cities of different sizes; to research and adapt alternatives to centralised water and waste management systems that will strengthen their interface with UA and communities' control over these resources.

Institutional arrangements for this research modality must involve NGOs and CBOs, in order for strategies to enable the poor and the disadvantaged to survive and develop their full potential; the building of coalitions and networks nationally and internationally; the pooling of research funds and other needed resources.

## **Urban Waste Management**

Waste may not contaminate, can give work, be a resource, the political base for clientelist processes, a tool to distribute or concentrate wealth, stated Alfredo Rodrigues.

Waste management must be promoted as a community-based resource-generating activity which also enables local people to take control of and improve their living environment.

Agreed information needs are: people's perception, concern and valuation of urban waste problems and solutions, the technical, social and environmental impacts of performance by current systems, institutional arrangements for increasing collection and disposal efficiency, the consequences of organised recycling alternatives on the informal waste economy.

Recommended research modalities include: participatory research on waste audits, calling for and informing fora on how to establish priorities, negotiate solutions on tension points and devise action plans, adopt and implement pilot projects. The fora can initiate a dialogue to build consensus among different actors on how to best share responsibilities. To be more efficient and sustainable, management approaches must address linkages between urban waste, water and UA among others. People's conception of wastes and their degree of concern must be clarified; action plans must include environmental educational programs on urban waste, so that people can develop values, attitudes, knowledge, skills which empower them as responsible actors in their own environment. The fundamentals of turning waste management to the private sector must be carefully revisited, based on recent and ongoing experiences.

## **Urban Water Management**

In many cities water is becoming more a life-threatening than a life-supporting commodity, warned Dr. Raymond Yong.

We must assess systematically and support the development and adaptation of alternatives to centralised water management systems so as to make more efficient use of high-quality water and extend and protect (groundwater) supplies.

Urban community-based water systems clearly are a research frontier. Centralised systems for managing water (and waste) are often blamed for being expensive, vulnerable, with insufficient human resources support, maintenance problems,

technological dependence, inappropriate for marginal locations, monopolistic markets and exposed to politics and corruption. On the other hand, decentralised systems allegedly afford reliable multiple-source water supply, encourage community development, integrate more easily waste management at the local level (UA included); they may make it possible to act on water demand directly, specific technologies can be developed and applied which make use of local knowledge and skills; they could suit better the diversity of settings within and between large urban centres.

The hard truth is that we still know very little about decentralised water management systems. These must be documented and assessed through comparing strengths and weaknesses of centralised and decentralised systems in specific settings. Why should we prefer a decentralised over a centralised solution? If so, which type, where and for how long? Decentralised systems should be tailored so as to keep options open for subsequent adjustments, connection to, or replacement by centralised solutions, when and where this becomes feasible and desirable.

To design and run decentralised systems we need information on demand types and control, protection and renewal of supplies, real costing of interventions. Cost-benefit analyses must be refined to consider environmental spillover valuation, risk assessment, distributional effects and alternative institutional arrangements, as well as the economics of water reuse (production and disposal).

### **Urban Disaster Prevention and Mitigation**

This issue was retained by URB originally; given the need agreed in December 1992 for the Centre to concentrate its activities in fewer areas, URB accepted to rapidly disengage from supporting new research on natural disasters per se over the next years. Still, for workshop purposes we kept on schedule the papers already commissioned, invited their authors to the workshop and accommodated a working group on the issue, for three reasons. Firstly, a few major IDRC (co)funded collaborative and/or network projects on the issue will remain active over the next 2-5 years; this workshop would enable project leaders to adjust upcoming work so as to account as much as possible for the evolving contents of the funding IDRC Program. Secondly, paper authors pertain to research teams which have accumulated experience with urban community development (e.g. Lavell's paper) or Canadian collaboration and GIS expertise (John Rogge), both highly relevant to future initiatives on other URB issues. Thirdly, local action-research components of these projects will inevitably confront water and waste issues, when not UA itself; disaster experts stood to benefit much from exchanging with other specialists; many of the latter had already

granted much attention to the risk dimension in papers submitted (and would later do so in group and plenary discussions).

### **Regional Differences**

In Africa and the Middle East, research must concentrate on how to integrate urban water management with urban waste management, with a view to increase urban water and food security. Many challenges which cities around the world will have to cope with in the future, as traditional sources of urban water decline both in volume and quality, have been reality for some time in arid and semi-arid urban areas of Africa and the Middle East. In the short term research must prioritise key information constraints and bottlenecks to positive institutional and behavioural changes. Challenges include appropriate technologies for cost-effective and safe water management which incorporate the recycling, re-use and disposal of waste, the assessment of the true value of water, the optimisation of water collection (rain harvesting) and uses, hard facts on linkages between UA and food security, self-reliance, employment, gender empowerment, environmental sustainability (health risks and disaster reduction).

The research modality favored is to carry out diagnoses and use these to instruct appropriate responses, in terms of technologies, tools and methods. The research process must account for stakeholders' concerns and responsibilities so as to develop solutions through partnerships between public, private and community sectors. Initiatives must, to the extent possible, build bridges and use existing networks of urban expertise in the region.

In Asia, research is needed on the close links between water and land management, including waste management. Although technical capabilities are reasonably good in part of the Region, very little research has been conducted on surface water contamination and conjunctive water use (surface-subsurface), land-use based hydrologic models, water supply and demand management models and GIS-based decision-making tools combining all the preceding.

We need practical research on how to involve local communities into water/waste management strategies and on what communities can possibly do to improve the general urban environment. A short-term action plan stresses well-developed case studies at specific localities with common methodologies and objectives for comparative purposes.

In Latin America, as metropolitan growth tapers off in the Region, an opportunity must be seized to try and intervene more effectively in the larger centers while

beginning to address the needs of rapidly growing mid-sized cities. The waste water management - urban agriculture interface requires urgent attention. The two components and their relationship have externalities which must be identified and quantified from an economic efficiency and environmental sustainability viewpoint.

We need to develop a common framework to establish a typology of urban settings, and a common methodology to document typical cases on the importance of UA for family income and food security; on perceptions, attitudes and expectations of people regarding waste and water problems (willingness to pay for different solutions), risk assessment and public acceptability, decision-making and implementation processes of community-based solutions with multiple-stakeholder participation.

Following the Ottawa workshop, consultations within the various regions will further assist, where required, in developing specific research proposals to ensure that these account for regional interests and capacities.

## GENERAL CONCLUSIONS

Both the thematic and regional working groups recognised an urgent need to frame research in intervention-oriented processes and for action-guiding research to explore more fully the linkages between water, waste management and urban agriculture.

A consensus emerged that management systems need to be made more adaptive and flexible, in order to respond better to local constraints and opportunities, within and between major urban centers. Systems should be composed of locally differentiated subsystems which can evolve as urbanisation proceeds.

There is a widespread recognition that prevailing biases in management approaches owe much to the dominant, yet insufficient, role played by particular groups of disciplines, as well as to the still limited, when not minor, involvement of most stakeholders concerned.

Central to making the right decisions in any setting is the need to consider the externalities of particular technologies or institutional arrangements.

A major challenge for research resides in that, although centralised systems have well-recognised limits, we still know little on decentralised strategies currently at work on the ground, much less so on their potential; there are signs however that these often may be more equitable, manageable and affordable for very large segments of developing-city populations, at the same time that they could turn into more effective multipliers of urban development.

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At the workshop, Duncan Ellison, Environment Canada, and Christine Furedy, York University, issued challenging key-note addresses. My colleague Panduka Wijeyaratne volunteered a much appreciated opening talk on health dimensions of urban environmental problems. Drs. Jac Smit, Regional and Community Development Consultants, Jean-François Léonard, University of Québec in Montréal, Pierre Gélinas, University of Laval, and John Rogge, University of Winnipeg, reviewed background papers, skilfully steered group discussions and made much appreciated comments on their conclusions.

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## APPENDIX I

**Workshop on Urban Environment Management: a Global Research Agenda"**  
*International Development Research Centre (IDRC)*  
*Ottawa, Canada, May 4-6, 1993*

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## APPENDIX II

### URBAN ENVIRONMENT MANAGEMENT PROGRAM (URB)

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#### URB GPI problem statement

- 1 The recent pattern of growth seriously threatens what is rapidly becoming a mostly urban living environment for mankind; this pattern is also undermining the rural resource base. World development will continue to be sought over the next decade, largely through the growth of urban economies (now 60 - 80 percent of LDCs' GNP. *Dossier, 1992: 49*). While the rural population will stabilise over the next 20 years or so, for the first time in humanity's history the majority of people, and of the world's poor, will be living in the cities LDCs (*UNDP, 1991: 9, 19*).
- 2 By 2020 more than 4 billion people and their basic needs will be concentrated on less than 2 million square miles (*Jones and Kandel, 1992: 57*). A very likely prospect is that growth in urban demand for land, water, fuel, food and other rural-based resources may aggravate environmental stress, undermine the productivity of man-made capital and exacerbate social conflict within cities, between these and their rural hinterland and beyond.
3. Donor agencies, research institutions and publishers have been slow to fund, conduct and disseminate research on the environmental problems of Third World cities (*IIED-AL, 1989: 76*). In the 1980s the volume of urban research fell sharply in both developed and developing countries; urban research capacity has declined "just when many urban policy questions are becoming increasingly important" (*Cohen, 1991: 12*).

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<sup>1</sup> *Program Officer and URB GPI leader, Environment and Natural Resources Division, December 17, 1992. With contributions by James Hea, Danilo Anton, Stephen Tyler, Sylvain Dufour, David Brooks, Pierre Zaya, Denis Massé, Serge Dubé, Hartmut Krugmann, Luis Navarro, Eglal Rached, Olanweraju Smith, Aung Gyi, Joachim Voss, Anne Whyte, Brian Davy, Yianna Lambrou, Jean Michel Labatut, François Farah, Mario Torres, Denise Deby, Alcira Kreimer, Michael Cernea, Stephen Bender, Allan Lavell, Fawzy Kishk, Fernando Chaparro, Jingjai Hanchanlash, Vijai Pande, Pierre Sané, Gerald Bourier.*

4. To remedy this neglect, major donors either are creating or have recently created new urban funding facilities, while others are devoting more resources to existing activities. However, all this still makes up only a small fraction of total donor spending; very few such agencies actually possess a research agenda or support capacity building in LDCs for research on urban environmental problems. Not surprisingly, very few LDC research institutions have had the means to gain regional leadership in this area.
5. Both the academic literature and donor agendas consulted on urban environmental management converge on three major priority areas for the 1990s: water scarcity and quality, disaster prevention and mitigation, domestic and industrial waste (*IIED-AL, 1989, 1990, 1991; CUCS, 1991; Cohen, 1991; UNCHS, 1990; UNDP, 1991*).
  - a. **Water management:** Freshwater scarcity is largely a problem of limited local availability, caused by various factors, including human interventions such as misallocation, use inefficiency, constraints to supply increase (*WRI/IIED/UNEP, 1988: 129-133*). A common response has been to increase supply, as opposed to managing demand and consumption. Large cities in Africa, South and East Asia and even Latin America now depend increasingly on costly transfer from distant sources, with conflicts rising between urban and rural users, within and across borders (*Rached, 1991: 7; WB, 1991*). Freshwater quality deterioration is more difficult to curb. Interventions have aimed at point-source pollution while degradation seems largely due to non-point agricultural, mining and, increasingly, urban pollution of supplies, ineffective conveyance (losses are enormous), unselective use and insufficient pre and post-discharge treatment for lower-grade reuse (e.g.: irrigated crops, Quito, 1991; *Rached, 1991*). Less than 60 percent of LDC urban populations have access to adequate sanitation and only one third of households are connected to sewerage systems; where these systems exist, 90 percent of the waste water is discharged untreated into open rivers and oceans (*Laquian, 1991: 3*).
  - b. **Disaster prevention/mitigation:** Today a major and growing share of the world's urban population lives or works in degraded and hazardous environments. Settlement and water and land-use patterns are worsening exposure of people, facilities and activities to disasters. Vulnerability is worsening: disasters are more frequent and damaging than ever before. Between 1970-85, windstorms, floods and earthquakes cost 18.8 m USD daily; during 1980-5 they affected 216.8 million people (*Anderson, 1991: 21*). Economic costs of extreme weather events have jumped from 400 USD billion in 1950-59 to 90 times that value in 1980-89 (*Kreimer and Munasinghe, 1991:*

3). In some areas past losses and persisting vulnerability are so high that development assistance consists almost entirely of disaster relief and rehabilitation (*DRDE/OAS, 1991: 4*). Disastrous events currently claim at least 40 USD billion in global resources and at least 250 000 lives every year. Economic losses are more significant in LDCs and compounded in sites naturally prone to extreme events (*Bernstein, 1992*). Urban areas are particularly hard-hit and many high-risk metro areas are projected to have populations over 10 million by year 2000 (Baghdad, Bangkok, Beijing, greater Bombay, Buenos Aires, Cairo, Calcutta, Dhaka, Delhi, Jakarta, Istanbul, Karachi, Manila, Mexico City, Rio de Janeiro, Sao Paulo, Shanghai and Teheran) (*Parker, 1992:110-111*).

- c. **Waste management:** We only are beginning to address the role of - and relationship between - land, water and waste mismanagement in degrading urban resources and in generating urban disasters and hazards (*WRI/IIED/UNEP, 1988: 137; Kreimer and Munasinghe, 1991: 275-280*). Impervious surfacing affects peak flow, base flow, groundwater replenishment and non source pollution of water. It increases flood risks, as does inappropriate waste disposal. Less than half of the world's households have access to formal garbage collection, even fewer in slum and squatter areas; where there is collection, manual sorting and disposal are often inefficient; dumps pollute the environment but provide tens of thousands of jobs (*Laquian, 1991: 3*). Extensive open water degradation by urban organic wastes has affected fisheries, public health, and employment in the Philippines (*Jimenez and Velasquez, 1989: 54*). Water overextraction often generates hazards such as land subsidence, salinization of freshwater aquifers; in many more areas waste-polluted water is now a major cause of public morbidity and infant mortality (*IIED-AL, 1991: 10*), particularly among the poor. Water scarcity and quality problems are associated to waste mismanagement (sanitary siting on porous/permeable soils over aquifer, sludge accumulation, sewer clogging, inhibition of biological treatment) and to vulnerability to disasters (siting of infrastructure in flood or landslide-prone areas); sewerage plans can compete with flood control (see for e.g. Bangkok, in *Phantumvanit and Liengcharernsit, 1989: 32-34*).
- d. **Urban agriculture:** This is the fourth component of this GPI because it is being increasingly perceived as a major strategy to productively and equitably tackle water, waste and hazard problems in large urban centres, particularly as these affect the poor.

Urban farming is becoming an omnipresent, complex and dynamic feature of urban landscapes and socioeconomic reality in Africa, Asia and Latin America. It includes aquaculture, animal husbandry, orchards and various staple crops. It is being carried out in tanks, ponds, canals, rivers, coastal bays, basements, roof tops, backyards, roadsides, utility rights-of-way, vacant lots, institutional estates, floodplains, steep slopes, etc. (*Smit and Nasr, 1992: 141-2; van der Blik, 1992: 10*). While it involves people from all income categories, it represents the single most important survival strategy for the urban poor. Factors promoting its growth include: deteriorating national economies (reduced food imports, depressed wages, rising food costs), accommodating land-use policies and controls, unemployment and cheap labour, availability of technical and material inputs, and proximity of markets (*Mosha, 1991: 84-8*).

Urban food production has been downplayed by most municipal authorities for a long time. Often claimed to engender health hazards, traffic problems and environmental degradation, official reactions to its recent growth have ranged from overt repression to tacit tolerance, although encouragement is found in some cases. Its benefits however appear to have been widely overlooked. Proper urban farming can increase returns on land areas, water bodies or household surfaces which are either voluntarily undeveloped or physically unsuitable for construction. By recycling urban wastes into production inputs, it can also reduce urban demand for resources as well as contamination, both of which threaten the sustainability of urban systems. It can moreover improve collective nutrition, health, living environment, food security, employment (up and downstream), gender equity, household income stability, fungibility (household spending, demand on rural crops), and land reclamation in urban areas. It may also limit public area maintenance and other municipal service expenditures, in addition to food costs and losses due to handling, transportation and storage. (*Smit and Nasr, 1992: 151*).

6. In order to achieve impact, IDRC's (co-)support to research on water, waste, disaster management and urban agriculture must tailor its approach and objectives so as to complement other donors' activities on these issues. Very few donors' agendas address the prevention and mitigation of urban environmental degradation and these are mostly aimed at improving governmental capacity through technology transfer. For instance, the WB/UNCHS urban management program is to spend 50 m USD over five years to set up and run a system of regional expert groups to transfer primarily to country governments technical instruments aimed at improving their management capacity (*BM, 1991: 5-24. See also WB, 1991: 72-5; WB, 1992: 63*;

*Leitmann, 1992: 2-4; Laquian, 1991: 5*). Given the nature of the Bank, the process will be controlled by governments (unclear how NGOs will be involved; *BM, 1991: 24-27*) and the concern is with economics (i.e., land market registration and regulation to increase municipal financial resources, upgrade infrastructure, attract productive investments and, hopefully, alleviate poverty). Its environmental component concentrates on official regulatory and economic instrumentation (*Bernstein, 1991*). The UNDP's (*1991: 59*) agenda, for its part, is very much inspired by OECD and is also aimed at the governmental sector, though encompassing more issues than WB/UNCHS. As noted for groundwater (*Hea and Anton, 1992: 1*), UN-system support to disaster and waste management has emphasised more technology transfer than scientific research. The OAS has developed a number of techniques for hazard, vulnerability and risk assessment to be incorporated into the development project planning cycle of borrowing governments (*DRDE/OAS, 1991*).

7. The aforementioned efforts alone probably will not suffice to mobilise the public and introduce significant behavioral changes. Policy instruments have been aimed at protecting formal economy investments, but even so have had limited applicability and effectiveness so far, in water (*Hea and Anton, 1992*), disasters (*Lavell, 1991; Bernstein, 1992*) and waste (*Bernstein, 1991; Guibbert, 1990*). The IDRC-funded CSUCA network found that despite legislative norms and controls, or semblances of structural or nonstructural activities, risk and vulnerability are facilitated by current institutional/administrative arrangements in Central America (*Lavell, 1991: 13*). In the case of water, economic instruments have reportedly further marginalised low-income populations (*Laquian, 1991; Schteingart, 1989*). In the case of water and disasters, upstream intervention is clamoured to be urgent; emergency and rehabilitation funds cover a minimal and diminishing fraction of the mounting damages. But by and large interventions continue absorbed into reacting to water, disaster and waste crises (*DRDE/OAS, 1991: xi*). On one hand, recent research contends that environmental degradation and hazards reinforce each other, the contributing factors are both structural (policy) and behavioral (activity), local governments' crisis management capacity is declining, and collective action is becoming essential to curb both deterioration and vulnerability (*Kreimer et al, 1992; Parker, 1992; Guibbert, 1990*). On the other, donors in general keep insisting on government-led responses to environmental crises and far less on empowering communities with knowledge and expertise to press for and involve themselves with prevention and mitigation. My reading of papers for a FEB92 WB conference on urban vulnerability to water, waste and disaster problems (*Kreimer et al, 1992*) leads me to conclude that:
  - a. Accountability remains blurred: development policies at large are said to encourage degradation and hazards and/or increase vulnerability to these, but relationships between causes and land/water degradation processes (or

hazardous geo/hydro/air dynamics) remain to be shown. A major modelling and documentation effort is needed.

- b. Whatever information exists has rarely been timely and effectively communicated to, shared among, and used by sectors most affected, such as the communities at risk. A major dissemination effort is needed.
- c. Given (a) and (b), it has been difficult to assess or evaluate the respective contributions of public, private and community sectors to problems, to identify responsibilities, demand interventions, negotiate priorities, agree on management strategy mixes, and mobilise resources accordingly. A major prescriptive effort is needed.
- d. Few categories of policy interventions have succeeded (e.g.: land management instruments), probably because of the above and also because adjustment strategies of specific sectors often conflict one with another and are disregarded. This seems particularly true of the less represented and more vulnerable groups (literature heavily rural-biased and largely confined to drought - *Clarke, 1992*). These strategies have been rarely accounted for, when not hindered or repressed by official interventions which have remained highly centralised. A major participatory effort is needed.
- e. Still neglected is the need for a participatory research-action process for water, waste and land management strategies that will be socially and economically attractive to communities most affected and concerned, in order to achieve collective and effective action where it is most needed.

### **URB GPI mission statement**

8. Exchanges so far, among and beyond URB team members, point to the need to devise socially and economically rewarding strategies for reducing urban poor's vulnerability to environmental degradation and hazards. We should not support research unless it prioritizes the needs of the more vulnerable communities, unless it involves these and/or their representatives as central players, and unless results are applied to promoting desirable structural and behavioral changes:
  - a. Given other donors' agendas, we do not think we should support research primarily funded to, based in, controlled or conducted by, or benefitting the central governmental sphere or the large private sector. Bilateral and multilateral agencies with governmental and intergovernmental status have been providing massive and long-term institutional assistance to these sectors,

and are financially and procedurally endowed to do so. We think IDRC and similar donors can distinctively complement these efforts through supporting skill and capacity development in local governments, community organisations and the small/informal private sector. Depending on circumstances, governmental agencies will be involved in the research process to varying degrees.

- b. Because it will be aimed at policy changes, the research will need to be prescriptive, i.e., convincingly discriminate and document responsibilities, understand and assess the limits and potential for innovations or transfer of successful responses.
- c. Prescription will not be effective unless the research process involves actively those most affected by urban environmental problems (or their representatives), unless these can use the information to hold themselves and other sectors accountable for needed changes.
- d. A constructive and sustained dialogue between government and public will be largely enabled by developing the policy-advisory capacity of research centres using scientifically rigorous studies and a deep commitment to those most affected by the status quo. "Solving the brown urban-based environmental problems cannot be achieved without building political constituencies that demand a better quality of life" (*Leitmann, 1992:2*).

### **GPI research approach**

9. The GPI will support a research approach aimed at:
  - a. developing and documenting methodologies which will provide urban communities under severe environmental conditions with information, skills and capacity to assess problems and devise, transfer and argue solutions that can be implemented by them alone or jointly with the public and private sectors;
  - b. strengthening the policy-advisory capacity of research centres for promoting, monitoring, evaluating and disseminating such methodologies.
10. The research approach should enable the more vulnerable communities (or their representatives) to access, produce, disseminate and use information on processes which worsen their exposure and vulnerability to degradation and hazards, as well as

socially and economically rewarding adjustment strategies to avoid, curb, resist to, cope with and recover from their impact.

11. The research approach also should enable research centres working with community leaders, private enterprise and/or government authorities, to develop their policy-advisory capacity and to promote planning which incorporates risk assessment, accounts for people's adjustment mechanisms and encourages community risk and vulnerability reduction. Policy responses (incentives, regulation, technology transfers) should take advantage of the urban poor's talent and creativity by working with, not against, the informal sector. This means devising workable strategies of regulation, tenure, taxation, environmental controls, betterment, loans and grants, land acquisition alternatives (including resettlement), infrastructure provision, information and education, and employment, that will maximise participation for resolution of water, disaster, waste and food production problems in urban areas.
12. Participation is a distinctive dimension of this approach. The above problems will not be solved without participation of the communities concerned in the choice, implementation and management of solutions. These should be socio-technical processes empowering the communities a proper understanding of urban ecosystems, and organising responses of different actors to solve the problems of those more affected (*Guibbert, 1990: 32*). Strategies should bring policy changes to encourage behavioral solutions, including alternative decentralised systems, material cost reduction (often implies changing current norms, standards, regulations), new approaches to gradual mitigation, labour cost reduction via community participation for construction and maintenance (e.g.: ripple effect of low-cost sewerage) reuse of waste (e.g.: exports, construction, handcrafts, aquaculture, waste water in agriculture, husbandry, fuel). The research approach should avoid reinforcing technocracy-based choices, solution-marketing by dominant economic sectors and management by the official bureaucracy.
13. This will be sought through creating and expanding research networks that will develop trunk methodologies, enabling local communities, private developers, urban governments and international agencies to:
  - a. visualise and document structural and behavioral causes of specific urban water, disaster, waste and food production problems;
  - b. identify respective sectoral actor contributions to and policy responsibilities for causes and consequences;

- c. document, explain and evaluate constraints and opportunities to people's adjustment strategies and behaviours;
- d. based on (a) to (c), promote socially and economically attractive changes in structural and behavioral responses; these can be of technological and organisational nature;

### **Specific GPI objectives**

#### **14. In the case of water:**

14.1 To inform urban water development for sustainable solutions, through ensuring full knowledge on resource availability, a more comprehensive cost assessment and evaluation of urban water provision, and an integrated approach to coordinated and locally differentiated water management, via training, promotion of rational and equitable resource use and public awareness of limitations, vulnerability, actual cost and social value of water:

#### 14.2 Specifically:

- a. establish the relationship between available water resources and potential needs prior to committing investments;
- b. develop accurate knowledge of existing resources, potential needs, and short and long-term costs prior to committing investments; cost evaluation must account for maintenance, replacement, past and future investment requirements, as well as environmental, health, social and productivity costs;
- c. define and propose solutions (technical and policy oriented) for water contamination problems (sources, migration patterns in aquifers and surface water bodies). The potential of coastal freshwater aquifers has remained largely neglected by researchers and donors alike. Groundwater extraction is less expensive, can be more sustainable and locally more manageable than huge surface reservoirs, although rehabilitation is much more difficult;
- d. develop sound management techniques and train water managers and support water researchers; management must address neglected opportunities such as demand control, gradual treatment of waste waters for selective reuse, water harvesting, changes in consumption attitudes and behaviour, acceptable and attractive incentives and institutional support;

- e. promote appropriate water policies, through raising public awareness via participatory and educational research process and via feasibility studies for co-funding result application. Measures to reduce scarcity could improve quality and vice versa, as well as benefit populations in other ways (on Bogota, see *Castaneda, 1989: 17-18*; on Alexandria, see *Hamza, 1989: 24*).

## 15. In the case of disasters:

15.1 For regionally significant disasters, develop methodologies that will appropriate to urban and peri-urban communities at risk an understanding of causes, agents and responsibilities, available techniques for natural hazard, vulnerability and risk assessment, constraints and opportunities for curbing high-risk situations. (In Latin America, a data collection effort is especially required for micro-zoning flood and landslide hazards in metro areas.)

### 15.2 Specifically:

- a. devise and apply interdisciplinary approach for enabling communities to become aware of and assess their vulnerability to disasters;
- b. enable communities to formulate and document risk generation and to identify contributing processes and causal agents (with or without water and waste mismanagement);
- c. enable communities to document the range and interaction of sectoral adjustment strategies for preventing and mitigating specific hazards and disasters, to assess distribution of returns, to characterise responsibility and accountability for losses, and devise attractive solutions for vulnerability reduction;
- d. encourage the active participation of the more vulnerable communities to the full research process on problems and solutions;
- e. facilitate formulation, documentation, dissemination and review of methodologies through networking national and regional research efforts;
- f. support the national policy-advisory role of lead research centres for introducing and promoting structural and behavioral changes, which are justifiable on environmental, social and economic grounds, to reduce generation of and communities' vulnerability to disasters;

- g. monitor and evaluate over the long term the impact of research, training, information, and policy interventions derived from funded projects and programs.

**16. In the case of waste:**

- 16.1 This component has been relatively less researched in LDCs. The GPI should promote waste management as a community-based resource-generating activity which also enables local people to take control of and improve their living environment (*WGB, 1992: 12*).
- 16.2 A series on recent LDC experience (*Environnement Africain, 1990*) points to neglected issues in the management cycle. These should be explored in connection with the other components of the URB GPI:
  - a. Development of mid-range transportation and combination with modern collection, to reach less truck-accessible areas and reduce uncontrolled dumping and increase recovery (IDRC project in Dominican Republic).
  - b. Solid waste elimination and treatment should consider import reduction, job creation, savings on transportation and waste as a potential community economic resource (IDRC project in Ecuador).
  - c. Fuller official encouragement of complementarity between informal and formal sector reclamation and recycling.
  - d. Arrangements for informal collectors to reclaim valuable waste at pre-collection in better-off urban districts, often officially repressed despite potential savings (Peruvian experience).
  - e. Risk assessment of disposal siting and appropriate rehabilitation for conditional reuse.
  - f. Composting of organic offers many opportunities: technology adaptation for plant-scale composting, better land use planning for close-to-source siting and reuse by urban agriculture to reduce transportation cost; water and sewerage-saving composting of excrements in arid/semiarid regions; biogas production using animal wastes or water treatment sludge to energise peri-urban social facilities with effluent as crop fertilizers.

- g. Solid waste reuse on industrial scale should explore links with informal sector to limit investment levels and market risks and decentralise sorting stations.

**17. In the case of urban agriculture:**

17.1 The goal of research is to overcome some of the main social, economic, cultural and environmental obstacles to the expansion and improvement of food production in urban areas. The actual and potential relations between water, hazard, waste management and urban agriculture also need to be explored.

17.2 Specifically, the proposed program should focus on:

- a. **food production-nutrition interface:** optimise food selection and production technology under different site and area constraints; devise multi-food production systems; optimise up and downstream impacts of full-cycle system (from growing to processing and marketing) to improve the nutrition of the urban poor.
- b. **economic, legal and policy aspects;** the need to develop a better accounting system for analyzing the cost/benefit ratio of using urban land for agriculture which integrates environmental, social and health benefits.
- c. **waste re-use and health risks:** Dispersed small-scale urban farming can benefit from, and increase returns on community/neighborhood-scaled and labour-intensive -- as opposed to current large-scale and capital-intensive -- waste management systems (e.g. modern biological waste water treatment or IDRC-funded research on the Grupo de Tecnologia Alternativa's (GTA) integrated organic recycling system in Merida, Mexico, *van der Blik, 1992: 15*). Urban and peri-urban irrigation with untreated wastewater is a problem; research must address the adaptation of low-capital-intensive pathogen and vector elimination processes, assess crop susceptibility to contamination (water, solid and air), and guide selection of crops accordingly (food versus non-food, human food versus feed or crop input, leaf versus non-leaf, etc.), also accounting for cultural constraints. Alternative systems can best serve city sectors with poor or no sewage network. Solid waste is already used in a variety of ways in urban agriculture, but the practice should be further encouraged. Currently, centralised management systems may hinder solid waste re-use for urban farming: solids are collected over large areas and dumped at few, major, often distant sites with restricted access. Composting is often inefficient and large-scale ventures have failed in many instances. Management systems usually do not sort organic from non-organic, non-toxic

from toxic waste; a lot also is being disposed of through sewage and is less recoverable. There may also be legal obstacles to retention and reuse of solid wastes for near-source urban farming.

- d. **access to land, crop security and credit:** lack of access to land is more a problem than lack of land. Urban farming often takes place on land or water in transitional use or of marginal quality, where crop security and usufruct rights are at issue. There is a need to support local authorities, NGOs and community groups to devise creative and flexible solutions for improving access to land (e.g.: multi- or flexi-zoning, agro-residential planning, land leasing and banking). Agricultural credit is almost universally unavailable to urban farmers and current credit programs to housing and small-enterprise development could be re-oriented.
- e. **equity aspects:** an analysis of who will benefit from the expansion and improvement of urban agriculture, with special attention to gender and ethnic inequities, is required.

### **Short/midterm achievements**

18. In two years:

A number of projects are coming to term of which selected results relevant to this GPI will be published and disseminated. New training and research modules will be established under new phases of current networks and in new projects. New partnerships will be encouraged and developed between research centres.

19. In five years:

Evaluation of policy uptake for more advanced projects, creation of new networks in other regions, GPI publication and dissemination of progress on specific objectives of the various components.

### **IDRC's comparative strengths**

20. On freshwater and disasters, IDRC's advantages in relation to other institutions stem from its long-term and gradually more comprehensive support to research by LDC institutions aimed at problems of worse-off social groups. This has been achieved thanks to the involvement of a growing number of Divisions and Programs, a strong Canada-based cooperating capacity and a wide geographic coverage of situations.

- 20.1. In the field of water, IDRC is a recognised leader; the LAUHN effort is unique and there is a major opportunity, as in the case of disasters, to merge upstream with downstream issues of water resource management and to link technical knowledge with policy development. As in disasters and waste management, greater involvement of communities most affected will be sought in managing their water resources, which implies knowledge appropriation and new types of collaboration between these and other sectors.
- 20.2. In the case of disasters, IDRC has decisively introduced a social science perspective in disaster research in Central America, valued by geo-technical circles (CEPRENAC) and consulted by international assistance agencies (RCRC); IDRC was approached recently by OAS to co-fund a related project in South America. Another, CIDA-cofunded, cooperative project is under review. The GPI approach will be well served by the past evolution IDRC's support on substance, from mainly technical mitigation provisions, health relief, hazard forecasting and warning systems (on which much of international assistance now concentrates), and towards risk assessment and zoning for preventive facility design and siting, evaluation of economic losses, opportunity-costing of deficient policy responses, effectiveness of local population coping strategies, and exogenous adversities on customary risk management.
- 20.3. As regards urban agriculture, consultations have taken place with research groups, Regional Roundtables and donors on IDRC proposed initiative as our follow-up to recent UNDP meeting on Urban Agriculture (June 1992). At this meeting, UNDP acknowledged IDRC leadership in supporting urban environmental research and welcomed such an IDRC initiative based on research networks and entry point at the local level. There is a major opportunity for examining the relevance of Asian technical experience and Latin-American organisational experience at the local level, to the needs of Africa. If appropriate, this could be formalised through an IDRC supported South-South research network, which could facilitate the transfer and evaluation of ideas and technology to African cities. Other donors potentially interested include IFPRI, FORD, UNDP and the World Bank.

### **Previous IDRC involvement**

21. On water: IDRC has supported a substantial volume of research on ground-water research (28 projects) which evaluated existing water resources and many active projects are linked through the LAUHN (e.g.: mathematical modelling of aquifer flow). Research efforts have been largely successful and a bulk of valuable information has been generated; however there is growing awareness of the need to address new issues for greater impact on the current water management.

22. On disasters: IDRC's closed and ongoing research (34 projects) on hazards and disasters, their causes, effects and policy responses, reveals a growing funding commitment between 1972 and 1990, with nearly one third approved since 1988. Mean grant size is relatively large by IDRC standards and grew recently. There is clearly a growth also in the number of sponsoring Divisions and in inter-divisional cooperation, a broad-based and growing involvement of Canadian aid professionals over time, and an expanding regional coverage from Africa initially to Asia and Latin America recently (see *Mougeot, 1992* for more details).
23. On waste: One project in the Dominican Republic is studying public and private collection fee structures and technologies, greater participation of informal collectors, options for a better system and conditions for a recycling programme (*Mougeot, 1991: 6*). A number of institutions in Latin America have been studying the management cycle (CIUDAD), promoting know-how transfer from large to intermediate centres (CIUDAD, IDRC-funded Fundacion Natura), and municipal agreements with small-enterprise coops (CIRES). A South American network is evaluating municipal provision of garbage collection in intermediate cities (SUR).
24. On urban agriculture: IDRC currently has about \$1 million CAD in active projects, of which about half are concerned with agricultural production and half are on urban nutrition. Research supported has also explored the links between waste treatment and recycling and farming activities (both crops and animals), surveys of urban food circulation systems focusing on the informal marketing sector and some of the production issues. Technical studies have assessed the feasibility of using organic wastes and wastewater for agriculture in order to increase the economic viability of the proposed waste treatment scheme, while other research in Africa and elsewhere has focused on local-level urban organisations and access to urban land as part of urban research projects.

### **GPI complementarity with other IDRC divisions and GPI strategies of ENR**

25. The new ENR Division rescues those units of the former Centre structure which have been more involved with the components so far. A comprehensive approach could only be managed via core teamwork of divisional program officers with urban environmental engineering and social expertise; this core team should continue to closely cooperate with Information Sciences, Health Sciences, and Social Sciences divisions, and particularly with regional offices for defining the region-specific players and emphases of this initiative.

26. There are clear linkages with the following GPIs:
- a. threatened ecosystems (TECO): the mismanagement of land, water and wastes contributes to the depletion and pollution of rural-based resources and ecological services, which in turn magnify urban-based environmental degradation and hazards; With regard to inland waters and aquatic resources (AQUA) and value of natural resources (VAL), the overextraction and contamination of near and more distant water bodies (even in Latin America, IIED-AL, 1991: 10), which serve as supply sources and disposal sinks for urban and rural uses, are life-threatening processes requiring major behavioral (educational) and structural (policy) responses;
  - b. development of environmental institutions (INST): major project proponents, including NGOs, will be based in cities and proper policy response to urban degradation and disasters usually requires the creation or strengthening of committed institutions, in community, public or private sectors;
  - c. small-enterprise development (SED): many solutions to problems in (a) will have to be economically attractive and will require decentralised, community-based implementation; in particular on low-input sustainable agriculture (LISA) because urban waste management solutions could benefit urban and peri-urban agriculture and husbandry with organic compost and irrigation water;
  - d. global economics and local resource sustainability (GELS) component of INST: in the long term urban environmental management can be adversely affected by demands of international markets on which large urban economies increasingly depend;
  - e. food security without resource degradation (FOOD): it will explore ways in which urban/metropolitan policy-making can encourage and manage urban farming activities so as to enhance the food security and environmental sustainability of cities. In this respect the URB GPI connects with the proposed IDRC-wide Agenda 21 theme of Food Systems Under Stress (ENR/IDRC, 1992: 3);

### **GPI implementation strategy and timetable**

27. We think that the four-component structure of the URB GPI is justified because we have only one GPI to address a potentially wide range of urban environmental

problems, while rural areas are currently served exclusively or largely by at least eight of our eleven GPIs. This situation is not peculiar to IDRC. We recognise that this does not dampen the challenge for URB, since these components often are interrelated in real-life situations. Common GPI approach and objectives will be applied to all components. Strategically, the GPI is to shift its resource allocation over time away from water, disaster and Latin America towards waste and urban agriculture in other regions, with former networks being encouraged to absorb teams from these regions and to resort to complementary funding.

28. Regarding water and disasters, we will strengthen existing networks in Latin America, while identifying and funding smaller activities in other regions with a view to associate these with current networks. The waste and urban agriculture components are less developed, with some ongoing projects and a growing number of proposals; we should try to develop more projects in other regions and promote exchanges with a view to network.

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Keynote address:

## **SOCIAL COMMITMENT AND COLLABORATIVE RESEARCH: CONFRONTING SOME CHALLENGES**

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### **INTEGRATING FRAMEWORKS**

The IDRC team for the Urban Environment Management Program, together with the experts invited to this meeting, have stated two main goals for this Program: it should lead to strategies to reduce the vulnerability of the urban poor to environmental degradation and hazards; and it should strengthen the capacity of research centres in the selected countries to conduct scientifically rigorous studies to aid urban policy-making. These objectives are reinforced in the discussion of the envisaged research approach, where the importance of working with needy communities, supporting their habitual survival techniques (e.g. the skills apparent in informal activities), while promoting behavioral change and ensuring participation in the decisions about research and its implementation are given priority over research methods as such. Further, the research is to be collaborative, the researchers representing both different disciplines and social interests. In terms of the subject areas selected for investigation —risk management, urban agriculture, wastes and water— the emphasis is upon understanding the linkages among them in the context of the urban environment as a system.

This emphasis on linkages produced interesting points in the background papers, and prompted me to reflect on connections I have observed between natural disasters in cities and solid waste management.

Some years ago I was in Calcutta when a cyclone that was pounding Bangladesh sideswiped the city. Many trees came down and much building debris was strewn around. By 8 o'clock the next morning, there was hardly a piece of useable debris to be seen. Before one's eyes, in a matter of a few hours, a whole social structure for the recovery and recycling of disaster debris had materialized; individuals and groups had carried off the resources released by the storm. I saw the same thing in Bangalore a couple of years ago when a cyclonic storm that was pounding Madras sideswiped that city: a man took possession of a tree and without moving from it, organized a team of workers to cut it up and carry it off for firewood. The old proverb "It's an ill wind that blows no one some good" suggests that we are alert to the ironies of linkages in our interactions with nature.

Linkages, whether they are derived from simple observation or more sophisticated information processing, are the warp of **analytical frameworks** that guide research. The need for better

frameworks and models for understanding urban environments in developing countries has been repeatedly noted in the papers. As a preliminary, several of you commented on the difficulties of even having an overview of urban characteristics and trends to give the context for understanding our specific topics.

We are fortunate that several recent projects and meetings on urban research are helpful to us in this regard. The "Sustainable Cities" Program of the UNDP and UNCHS is undertaking detailed case studies of selected cities within a comparative framework that emphasizes interconnections (Eigen 1992). The recently completed first phase of the Ford Foundation project on "Urban Research in Developing Countries," coordinated by the Centre for Urban and Community Studies at the University of Toronto, has highlighted major research findings and needs (Stren & McCarney 1992). Two meetings held at the University of Wales in 1991 and 1992, the more recent being on "Planning for Sustainable Urban Development —Cities and Natural Resource Systems in Developing Countries," have brought together much information relevant to both urban systems and planning. And there are other initiatives; indeed, digesting the information that will become available in the next few years will itself soon be a problem, which is all the more reason for developing analytic frameworks.

## ACHIEVING COLLABORATION

Our first challenge here is to achieve the kind of collaboration needed to fulfil the project mission statement.

What seems called for is not simply research teams, but **research coalitions or alliances**. That is, the priorities and directions of the work should be determined not just by academic researchers but by community representatives, members of NGOs, agency researchers, and the results sought should be directly applicable to urgent local and regional problems.

It will be a major challenge to assemble the right mix of people, especially as scholars tend not to have relationships with nongovernmental and community-based organizations (NGOs and CBOs). The IDRC will need to reach beyond the institutions that have been research partners in the past.

One cannot expect the members of these coalitions to feel comfortable at first. This may be a good thing because if researchers are all of like mind, the result might be less creative, narrower work. We need to disagree with one another, to feel confused and frustrated before unifying frameworks and methods will emerge. Doubtless the confusion and frustration will begin at this meeting.

The ultimate dedication has to be to understanding reality and this comes from a genuine curiosity and desire to know what is really happening "out there." It may be social idealism, availability of funds, even political correctness, that bring people together initially but it is the spark of scientific curiosity, of wanting to find out what is really going on, together with the mutual respect that develops with good collaboration, that binds a research group together.

## WHAT DO WE DO ABOUT RESEARCH?

In terms of practicalities I see a major challenge in integrating the perspective of local communities into the decision-making about this project. It is not clear to me how representatives of poor people will have an input into the process being initiated here —have we started in too top-down a way? Do we know enough about the processes of **participatory/action research**? We can draw upon the experience of other IDRC projects, especially in community health. In particular, IDRC has just published a report on a workshop on "Community Participation in Research" that was co-sponsored by the Unit of Applied Nutrition of University of Nairobi (Baldwin & Cervinkas, 1993).

Participatory/action research while strong in local understanding and detail is often handicapped by weak comparability or generalization. There are important roles for nonlocals here because we must find ways in which specific local experiences can be shared so that others in similar circumstances can "cut some corners" on the road to sustainability.

Regional research teams will need to evolve priorities and methods in the field, and in communication from desktop to field. There is a limit to what can be set down in black and white in project proposals.

Good action research, like all research, also depends upon honest, and to an extent detached or disinterested evaluation of the work. In this case, one needs both participatory evaluation (ongoing critical monitoring) and an independent view of the results. And, as Victoria Rialp says, one needs to be able to assess just how far behaviour has been modified as a result of the understanding achieved by the research.

I would like to briefly mention communication as a project goal. Usually we find "dissemination" is put at the end of project proposals but it is only part of the more general requirement for effective information sharing and communication which must operate from the very beginning. We are all familiar with empty "networks" through which very little is communicated unless a face-to-face meeting is pending. There are special skills needed for research collaboration at a distance: people may need training in how to really communicate ideas by letter and e-mail. I mean the ability to truly discuss ideas, to criticize, to elaborate, to compare. The ability to generate further understanding through informal written communication is not well developed anywhere. It cannot be

taken for granted to occur.

## WHAT DO WE DO RESEARCH ABOUT?

There is a wealth of suggestions on research topics in the papers. Somehow topics have to be transformed into operational research. But at this stage, the topics are less important than the generic nature of the research.

Here I will mention some of the difficulties of interdisciplinary, intersectoral work.

The different fields chosen are at different levels of development in terms of interdisciplinary balance and methodological sophistication. Disaster relief has had much technical and even natural science work, but hardly any social science; water, as a result of the International Water and Sanitation Decade has much more all- round work; waste has been largely technical and lacks both natural science and social science, while urban agriculture has mainly had social science research. If we are to make the linkages called for among these fields, we will have to work hard at establishing a basis of discourse.

A first step is **defining our terms and concepts**. A great deal of poor research and confused discussion, not to speak of inapplicable policy recommendations, is going on because we have not taken time to define basic terms or decide which terms will be used consistently.

In my own field, this is so with regard to terms such as "recycling," and "recyclers." The latter is loosely used to refer to people who recover waste materials, or trade them as well as to those who reuse and transform the materials into new products; if the people who are recovering wastes but have perhaps nothing to do with recycling processes are called recyclers we can hardly have clear analysis in waste management.

A large amount of disagreement has emerged with the use of the concept "informal sector." Scholars like Lisa Peattie have argued that the term is "fatally flawed" as a tool of analysis, and yet it has done a great deal to further understanding of urban life (Peattie, 1992).

At a more fundamental level, there are disagreements about the very definition of an environmental problem: some problems are more political ones than environmental ones. For example, the access of poor residents to clean water may be more due to failure to price water equitably, or to excessive leakage, than to pollution as such.

A major source of tension, expressed in the recent Ford Foundation Project *Urban Research in the Developing World* is the apparent conflict between what have been called "green" and "brown"

issues: the priorities of international scholars for examining macro issues such as ozone depletion and loss of biological diversity, and those of scholars and action groups in developing countries who argue that the local environmental problems of waste or lack of access to amenities are getting short shrift (Stren & McCarney, 1993).

One way to resolve this tension is to include projects that clearly integrate local concerns and global environmental issues. At least we need to seek the linkages between global and local environments.

## COMMON GROUND

But nevertheless there will be continuing tensions arising from the social goals of local groups and NGOs and even city managers, and the more comparative, generalizing goals of funding agencies and nonlocal academics. Even within the local communities there are distinct interests arising from difference in gender, age, social status, a point that is noted in one or two papers.

In the field of waste recovery and recycling, again, CBOs who are aiding the poorest categories of workers, waste pickers, may look at waste traders as the exploiters or competitors and may not feel sympathetic to research geared to understanding the role of these other categories of workers and entrepreneurs in the total system of recycling. Yet, ultimately, the waste pickers cannot be assisted if that total system is not understood.

So, there are a series of gaps to be bridged, as mentioned by Robertson Work and others: local-global, research-interventional, cultural-technical, interest group-governmental. To use another metaphor, we have to find common ground. This will be essential to an evolving process of research articulation, prioritizing and collaboration.

In conclusion, as we launch this global initiative for understanding the environment of developing cities, I think it is not the topics of research that are important, so much as the processes of research collaboration, the reconciliation of scientific and participatory/action research, the shaping of analytic frameworks, and the development of a dedication to multidisciplinary work that will provide the common ground between many rough patches on the way ahead.

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**Keynote address:**

**CANADIAN URBAN WATER MANAGEMENT  
ISSUES, POLICIES AND PROGRAMS**

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**SUMMARY**

This paper discusses two major programs of the Federal Government of Canada - the Water Conservation Program which is just beginning, and the Flood Damage Reduction Program which is nearing maturity. Under the Water Conservation Program, the Federal Government is stimulating provincial and municipal governments to introduce full cost pricing policies for municipal water supply and waste water treatment as a means of ensuring the sustainable development of water systems. Under the Flood Damage Reduction Program, the Federal Government has largely ceased to participate in the construction of flood control works such as dykes and dams, has assisted the provinces to map flood plains that are in urban areas, and to develop and promulgate policies intended to reduce or limit development in the plains as a means of reducing flood damages and of ensuring sustainable development of the plains.

**INTRODUCTION**

Water resources and their management under the Canadian constitution are largely provincial in nature. The Federal interest is limited to water resources of a transboundary nature or which traverse Federal lands. The Federal Government is also partially responsible for water resources used by or essential to Federal facilities.

The Canadian water paradox is that while we have within our borders approximately 9% of the world's fresh water supply, we have areas that are virtually deserts (both in the southern areas of the three Prairie Provinces of Alberta, Saskatchewan and Manitoba and in the Arctic) as well as areas (on the northern Pacific coast) where rainfall is amongst the highest in the world.

Canada has less than 1% of the world's population and we have generally considered our water supplies to be limitless. Our use of these resources has been less than ideal in an

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environmental sense, and the resources are generally undervalued, overused and polluted. Canadians are the second highest per capita consumers of water in domestic and industrial applications, in the world.

## **WATER CONSERVATION**

### **The Water Industry**

The Water Industry in Canada - those that extract, treat and supply water to domestic and industrial users, and also treat the waste waters before they are returned to the environment - is one of the largest public sector industries (behind health and education services) in the country with gross revenues on a national scale exceeding \$3 billions. It largely goes unnoticed by Canadians because it is very reliable (operating 24 hours a day with few strikes), almost always meets consumer demands (with the exception of mid-summer lawn sprinkling restrictions) and is very cheap (providing all the water we want for less than the average cost of a newspaper). It is considered to be like fresh air - an entitlement. The Water Industry is essential to the 21 million Canadians (of a total population of 28 million) who are hooked up to it.

In 1989, the Canadian Water Industry pumped a total of 13.9 billion m<sup>3</sup> of water and lost approximately 18% of it through leakage in the network (individual municipalities reported between 3% and 35% losses). Although it earned approximately \$3 billions in revenues in 1989, it is estimated that between \$6 and \$18 billions of new investment are needed over the next 10 years to reduce losses in the distribution networks and to bring the waste water treatment infrastructure up to a level that municipal effluents would be safe environmentally.

The following table provides some indications of the populations served by the water industry in 1983 and 1989:

These figures indicate that we are making progress in that an increasing proportion of our population have water and waste water collection services, and that we are making significant progress in installing waste water treatment systems.

By far the greatest proportion of our urban water supply comes from surface waters (12.6 billion m<sup>3</sup> out of a total of 13.9 billion m<sup>3</sup> overall or 90.9%) with only 1.3 billion m<sup>3</sup> (or 9.1%) coming from groundwater sources. However, where groundwater is used, it is often a significant source of water for a large geographic area and there are concerns for excessive uses and contamination of the aquifers in these areas.

On average, there is 680 m<sup>3</sup> of water pumped per Canadian but only 520 m<sup>3</sup> of waste flow per Canadian indicating that only 73.9% of the total pumpage is collected following use as

waste water. Not all of the difference is lost through leakage, although a substantial portion may be - industrial processes consume water in significant amounts.

### Populations Served 1989

Population Characteristic	Population (millions)	Percentage	Percent change (Since 1983)
Total population of Canada	26.2	100.0	6.0
Total urban population of Canada	20.2	77.1	7.0
Population with water services	20.4	77.9	8.6
Population with waste water collection	19.5	74.4	6.9
Population with waste water treatment	15.7	59.9	20.5

Of the total water pumped in 1989, 48% of it went to domestic use, 17% went to each of commercial or institutional and to industrial uses, and 18% was lost in the system. It is significant to note that we lose more water in the system than our industrial sector receives, but what is worse is that trend analysis also shows that water efficiency in our industrial sector has been diminishing over time - i.e. the quantity of water used per unit of production has been diminishing. For example, it takes about 15 litres of water to produce 1 litre of beer, 220 000 litres of water to produce an automobile, and between 50 and 150 tonnes of water to produce 1 tonne of newspaper.

### Water Pricing

The major contributing factor in over use and misuse of water (and the lack of revenues by the industry for infrastructure renewal) is the water pricing policy followed. The following table indicates the various types of water rates in use in Canada and the percentages of the municipal water Works that are applying them to the residential and commercial markets. It is significant to note that very few municipalities have a water rate type that results in higher costs for higher consumption, and thus there is little incentive on the user to invest in water conservation technology or to adjust behaviourally their water practices.

The following table indicates the levels of and the changes in the mean monthly prices

charged for different water deliveries in 1986 and in 1989. It shows that even though the prices charged for water have increased generally between the two years, there remains very significantly lower costs per cubic metre of water used as the total amount consumed increases.

### 1989 Canadian Water Rate Types

Water Rate Type	Residential		Commercial	
	Number	Percentage	Number	Percentage
Flat Rate	387	52.9	187	26.1
Constant Unit Charge	159	21.8	246	34.2
Declining Block Rate	167	22.8	255	35.5
Increasing Block Rate	15	2.0	17	2.4
Complex Rate Structure	4	0.5	12	1.8
Total <sup>2</sup>	732	100.0	717	100.0

### Water Prices/Month 1986 and 1989

Monthly quantity	1986 Price - \$Σ	1986 \$ m <sup>3</sup>	1989 Price - \$Σ	1989 \$ m <sup>3</sup>	Percent Change 1986-89
10 m <sup>3</sup>	10.90	1.09	14.40	1.44	32.1
25 m <sup>3</sup>	13.68	0.55	18.15	0.73	32.7
35 m <sup>3</sup>	16.08	0.46	20.88	0.60	29.9

It is interesting to note the varying costs per cubic metre of different liquids. In 1989, Canadians paid on a comparative basis the following prices:

<sup>2</sup> Not all municipalities are regularly surveyed - the approximate split is 100% of the large municipalities and 50% of the smaller ones.

**Comparative Prices of Liquids  
1989**

Liquid Type	Price \$ m <sup>3</sup>
Tap water	0.6
Bottled water	500.0
Colas	790.0
Milk	950.0
Beer	3,000.0
Wine	8,000.0
Liquor	24,300.0

The undervaluing of municipal water supplies is partly the consequence of an incomplete metering of water use (less than 50% of Canadian urban water users have metered delivery) and the subsidized delivery of water through low water rates and rates that do not reflect the true cost or value of the service. The consequence is excessive use and waste.

As a result, sewers are seen as a means of disposing of wastes which is resulting in a rapidly increasing cost of water treatment prior to its return to the natural environment as well as for treatment on its removal (the subsequent time) from the environment for delivery through a municipal water system. This is summed up in one significant point - municipal water treatment agencies have neither the revenue bases nor the mechanisms for generating the revenues necessary to maintain or improve their capital infrastructure.

### **Water Conservation Policies and Programs**

Water resources, constitutionally, fall under the responsibility of the provincial governments, and water supply to the Canadian population is largely the responsibility of the municipalities. Pollution control (including that from municipal waste water effluents) is largely provincial although there are some aspects of it that make it Federal - for example, fish and fish habitat protection.

At the Federal level, there has been a serious attempt to encourage two things to occur: first to attempt to get municipal water agencies to shift from supply management to demand management, and second, to get all agencies concerned to integrate water quantity functions

with water quality functions. Most people do not realize that it is cheaper to remove concentrated effluents rather than diluted ones. In Canada, the overall difficulty arises that the quantity functions lie at the municipal level, and the quality functions lie at the provincial level - integrating these functions across a jurisdictional boundary is extremely difficult.

In 1987, the Federal Government established a Federal Water Policy that set out two clear messages:

- in the immediate term, the Federal Government would no longer financially support the construction of municipal infrastructure, and
- in the longer term, the Federal Government would encourage improved water pricing practices (full cost pricing and metering) and would encourage water conservation practices.

A number of publications have been produced on Metering, Municipal Pricing Guidelines, and conservation matters. In the latter area, the Federal Government has conducted a Federal Water Audit, has produced a Federal Water Conservation Plan, and hosted with the provinces and private industry, the First National Conference and Trade Show on Water Conservation.

At the National Water Conservation Conference and Trade Show, it was clearly demonstrated to the delegates that savings in water consumption of 30% to 90% are clearly achievable in a variety of consumption areas, that closed loop water systems in industry are a significant and effective means of reducing water demand and in preventing pollutant discharges into the environment, and that the rate of economic return on the investments in these systems can range from 20% to 600% - resulting in payback periods (for the investment) which vary from 2 months to 5 years. The Federal Government released at the Conference, its own Federal Water Conservation Plan, under which the Federal Government intends to get "its own house in order". The Federal Government is a significant property owner using municipally provided water, and at the same time has many facilities and institutions that are self-reliant (i.e. directly provide and treat their own water supplies). The Federal Water Conservation Plan outlines the steps and procedures to follow for water conservation within federal facilities.

Many problems remain to be resolved. Cases of contamination in both surface and ground waters used for municipal water supply is increasing both in numbers and in levels of contamination. Most municipalities have effluent discharges that are considered deleterious substances under the Fisheries Act of Canada, and there is no capital available for the construction of infrastructure renewals. In the current economic circumstances of all levels of government, it is not possible to find the \$6 to \$18 billions estimated to be required for infrastructure renewal over the next 10 years.

While the Federal Government is encouraging municipal water treatment agencies to reduce water consumption patterns and simultaneously raise additional revenues by installing metres and introducing full cost pricing policies, the Federal Government is also exploring the varieties of economic instruments that might be used, including the concept of privatization of water treatment services as a means of achieving full cost pricing.

It is also encouraging the adoption of pollution prevention strategies on a broad scale. Pollution prevention may mean the elimination of pollution sources or the reduction in pollutant levels - in either case all options are being advocated including changes in production processes and the materials used. Known hazardous waste dump sites are being de-contaminated where this is feasible, and all programs are being focused to conform to different regional needs and problems. Finally, the Federal Government is actively supporting technology and process research and development.

Finally in the area of water conservation, the Federal Government has embarked on a major Environmental Citizenship campaign to raise the general awareness of Canadians to the public issues involved, to provide them with information of the simple technology or behavioural changes they can use or make to conserve water use or to prevent the discharge of hazardous and other chemicals into the sewer systems.

## **FLOOD DAMAGE REDUCTION**

Prior to 1972, the Federal Government had embarked on a long program of flood zone protection through the construction of control works and infrastructure. In the initial 15 years of the program, some \$400 millions were spent in federal-provincial programs for the construction of dams and dykes. This program was limited to the initial construction of the facilities, and was not intended to cover their maintenance over time.

In 1975, it was realized that the populations living in the flood plains, even though protected by the flood control works, were still in danger. Maintenance of the facility could not be ensured, and in any case, there was always the risk of the facility being over-topped even if it was not breached, with consequent flooding occurring.

It was decided then to remove federal participation from flood protection construction and shift the funds to flood risk mapping and flood forecasting. Once flood plains had been accurately mapped, it was argued that existing facilities within the plain should be flood-proofed, and further development in the plain limited to developments that were not particularly prone to flood damage. Such developments would be largely of a recreational or agricultural type, some light commercial or industrial, but rarely public residential or school or hospital institutions. Furthermore, awareness campaigns would be undertaken to inform the public of the presence of a flood risk and the means to defend against it.

As a result of this program, 600 communities have been mapped in which some 7.2 million Canadians live. The total area accurately mapped to 0.5 metre flood lines is 188 000 hectares. Flood proofing guidelines have been published to enable those already in the flood plain to reduce the flood risk for their homes and offices, and the National Building Code is being amended to bring further strength to the flood damage reduction program. A key factor in the federal policy is that federal funds will not be used to support development in the flood plain, and that no disaster assistance payments will be made to anyone suffering flood damage to a development that took place after the flood risk mapping and designation was made. Efforts to have the land registry process link flood risk mapping to the registry of land deeds has not been successful.

For the future, there will be program for the joint maintenance of the flood risk maps, but not major expansions. The Federal Government's interest is largely satisfied by the maturity of the program. Maintenance will include re-mapping as needed to note developments and changes, the conversion of the maps to electronic form, the maintenance of the policies and the awareness programs.

Some future research directions have been also identified for flood risk reduction. First, many of the dams and dykes are now relatively old, and safety standards have been modified since the dams were originally constructed (e.g. spillway capacities). The question to be asked is what is the impact of the change in standard on the acceptability of the existing structure. Secondly, the developments and uses of GIS and digital mapping techniques has significantly increased the analytical powers that can be applied to any subject. We are also looking strongly at the concepts of integrated resource management and the need for real-time flood predictions and simulations. The federal effort will be directed towards the development and application of methodologies in these areas.

## CONCLUSION

Although the Federal Government has a limited directed responsibility for water management under the Canadian constitution, it has and does play a significant role in a number of areas, most significant of which in the past has been the reduction of flood risk and damage. In the future, the Federal Government will be playing a significant role in ensuring the sustainability of our precious water resources through the interaction with the other two levels of government in water conservation policies and programs.

Various publications on these subjects are available free of charge, by contacting the Economics and Conservation Branch by mail at ESED/C&P, Environment Canada, Ottawa, Ontario, K1A 0H3, Canada, or by fax at (819) 994-0237.

## URBAN AGRICULTURE: EASTERN AND CENTRAL AFRICA

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Many city people dream about living off the land in some gentle rural haven where urban noise, and pressures are far away. But for everyone who actually makes the move toward such a self-sufficient life style, hundreds more remain town-tied ... Sadly, only a few urbanites use the resources for growing their own food that are at their disposal (Wickers, 1977:1).

### **INTRODUCTION**

Urban agriculture (UA) —the cultivation of food crops and keeping of small livestock in open spaces in and around cities— in Eastern and Central Africa and in other third-world regions convey a diametrically different message from the quote above on Western city living. As the world becomes increasingly urbanized, the pressures of rapid urbanization are undermining rural resource bases. Although global rural population may stabilize between 2020 and 2025 (UNDP, 1991:9, 19), still the majority of the world's poor will be living in the cities.

Several problems intensify as a result. Feeding these people and maintaining livable environments is a challenge of immense proportions to governments, researchers, planners, decision makers and funding agents the world over. However, recent research shows that UA is being perceived as a potential partial solution to this problem. This review of UA research in Eastern and Central Africa attests to this.

#### **General perception of urban agriculture**

Attitudes towards UA are mixed. Although UA is emerging, in both industrialized and developing countries, as an important economic activity within the urban informal sector, few planners and decision makers assume that UA in and of itself is a worthwhile legitimate activity (Sawio, 1993 forthcoming). To mainstream urban economists and planners, urban agricultural activities in cities are a contradiction of the common image of the city. Thus, to the traditional urban planner, the architect, the politician and other decision makers, UA detracts from the images of the "ideal, planned and modern western city." As a result many people perceive UA negatively. To many it is a remnant of an outmoded, transitory activity typical of rural living where people handle dirt.

Yet UA studies are showing that UA is becoming almost a permanent feature (Sanyal, 1984, 1986; Smit and Nasr, 1992) in the Third World as well as in developed countries.<sup>1</sup> It is

a concrete reality in that it occurs in cities and surrounding bio-regions about which more must be known because it is potentially a socioeconomic survival and livelihood-enhancing strategy for the urban poor. It is an innovative response of urban dwellers to the deteriorating national political economy and it has been fostered by the availability of unused open space<sup>2</sup> (Mosha, 1991; Maxwell and Zziwa, 1992) and it makes use of resources in urban ecosystems which would otherwise go to waste (Sawio, 1993).

### **Focus of the paper**

This paper has three parts. In Part 1, I describe the record of UA research in Eastern and Central Africa. (Countries included here are: Zaire, Congo, Cameroon, Zambia, Zimbabwe, Mozambique, Kenya, Uganda and Tanzania). Also, I outline the strengths and weaknesses of these researches, list their relevance to science and technology, briefly relate these to water, wastes and disasters in view of the URB Program's specific objectives and I list areas of further research. In Part 2, I present a list of possible research institutions and persons in the region likely to carry out the suggested research areas. In Part 3, I sketch out two possible UA research projects in Eastern and Central Africa in the foreseeable future.

## **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

Field studies of UA are relatively few in number, yet available studies in East and Central Africa give us a picture of its widespread practice. Current research shows that urban farming in the eastern and central African region is not new; it began many years ago (Winters, 1983; O'Connor, 1983; Sanyal, 1984, 1986; Rakodi, 1987; Freeman, 1991; Maxwell and Zziwa, 1992).

### **1.1. Strengths**

In view of the URB Program's aspects and specific objectives, before I describe some of the UA research experiences, I outline what I think are the best researched aspects of UA in the region so far. These include: (a) Identification of the major impediments or constraints of UA. Emphasis is placed on access to land for the urban poor, crop security and availability of credit; (b) there is ample documentation of the various foods farmers grow and the animals they rear where they live in the urban and peri-urban areas. Emphasis in these studies has been given to the contribution to household food and incomes; (c) there is good documentation of the social and economic benefits of UA which include reuniting migrant families, fostering recreation, creating employment, and reducing hunger and malnutrition.

## 1.2. Weak areas

It appears, however, that little research has been done to: (a) Develop small scale appropriate technologies suited to the non-commercial farmer to select the best crops for the types of sites farmed (for example, what crops are suited to roadside farms as opposed to open public spaces or factories or schools? Which crops are suited for flood plain agriculture, roadside farming, container growing, etc.); (b) examine multi-food production systems in intra-urban and peri-urban areas; (c) Legal and policy aspects to make UA an acceptable reality in cities are still ambivalent. Most activities are tolerated and much UA could be banned at will; (d) study thoroughly and design organic recycling systems to reuse waste —solid and liquid; (e) find solutions to health hazards/risks connected with UA. Although some of these aspects are reflected in some form in UA studies in the region, more research is needed.

## 1.3. Examples of urban agriculture studies

### CENTRAL AFRICA

A number of UA studies have been carried in this area since the late 1960s and early 1970s. For example, Streiffeler (1987:8-13, 1991:267-273, writing on "*Improving Food Security through Urban Agriculture in Africa: A Social Perspective*" cites several studies of UA. She cites Lassere (1958) who reports that in Libreville (Congo) in 1957, 80 percent of the women who were interviewed cultivated a field. Skinner (1962) found that 36 percent of those questioned in Ouagadougou called themselves cultivators. Adrien-Rongier (1980), Streiffeler reports, showed in a study during the dictatorship of Bokassa in Bangui, that many prisoners and residents in the city survived on the gardening efforts of local women. Land in Brazzaville was put under agriculture (Vennetier, 1963) with emphasis on the growing of vegetables and condiments.

In 1986, Streiffeler conducted a survey of 426 households in Kisangani, Zaire as a project to improve UA. It is not known whether the sample was drawn randomly or not. The method of choosing each respondent is not described either. She reported from the findings that "urban agriculture has favourably influenced the urban ecosystem through use of such factors as waste, the maintenance of water tables through high absorption levels ... and the beneficial effects on the micro-climate and the saving of fuel" (p.268). In this Kisangani survey, 32.6 percent of the respondents practice UA for own consumption, 0.3 percent for sale, and 63.4 percent for both personal consumption and sale. She also showed that urban farming is a reaction to price increases which did not match with rise in income.

Mbuyi (1989) writing on the management problems of Kinshasa, observed that with the expanded population of the city, provision of food has been critical and peri-urban agriculture has increased as a possible solution. He notes that the use of land for building has encroached

on agricultural land (1989).

In Cameroon, Ngwa Nebasina (1987) studied Buea Town Gardeners and argues that "urban dwellers, including civil servants and their dependents have discovered the small-scale agricultural potentials that urban lands provide" (p.77). In a sample comprising 115 household heads, and using an open-ended questionnaire instrument and field observations, Ngwa Nebasina identified two types of opposing land ownership: (a) land used by full-time farmers, and (b) that used by part-time farmers. His field observations showed that Buea town and a heterogeneous population carried out urban farming and because of availability of continuous out-of-office hours planned farm activities could be realized. His analysis showed that people did urban farming: (a) because of the desire to increase family urban food supply, and (b) as a recreational, out-of-routine activity with no serious commercial motivation (Ngwa Nebasina, 1987:80). The choice of crops was based on personal decision. Farmers used chemical fertilizers, but also composted waste and animal dung. Pesticides were also used in leisure time.

In Zambia, studies by Sanyal (1984) and Rakodi (1987, 1988) on UA have shown that the practice is officially recognized but attempts to ban it surface from time to time. Available data indicate that community food production in the city and especially by squatter dwellers is very extensive. In a survey of 250 low-income households in Lusaka, Zambia, Sanyal (1984, 1987:198) found that 45 percent of the low-income households cultivated food in their backyards or front yards or in the urban periphery. An additional 15 percent cultivated both.

Rakodi (1988) reported from several surveys she carried out in squatter settlements of Lusaka in 1970s and 1980s that urban gardening was widespread and even encouraged among Africans in the colonial period. In the households she surveyed, over 50 percent of the residents cultivated home and distant gardens and the majority of urban food producers were women.

Drakakis-Smith (1991) writing on urban food distribution systems in the Third World with reference to Zimbabwe includes subsistence production —urban farming. He observes that household members who engage in urban food production undertake several other roles in relation both to production and reproduction. In showing the nature of urban food production, Drakakis-Smith (1990:104-105) presented results of his study of three areas in Harare, Glen View (a government service site), Mabelreigh (mixed-middle class) and Epworth (squatter settlement) where about 80 percent of those interviewed grew crops in their gardens, and nearly all food was consumed by the growers.

## EASTERN AFRICA

Several UA studies have been done in eastern Africa, mostly in the late 1980s. Outstanding studies have taken place in Kenya, Uganda and Tanzania.

**Kenya:** A major study in Kenya was undertaken in 1985 in six towns selected from a list of ten towns by an NGO, the Mazingira Institute. This research sampled 1576 randomly chosen households. In great detail it documented a variety of urban agricultural activities which included crop growing, livestock keeping and fuelwood production. The study employed a household questionnaire which was tested several times and comprised 295 questions. A random procedure was used to select sublocations to include in the sample. Randomly selected households were visited by a team of interviewers and leaders who had extensive experience in field surveys. The results show (Lee-Smith et al., 1987:xv) that 62 percent of the households surveyed grew part of their food, 29 percent grew it in the urban areas where they lived, and 17 percent kept livestock within the city. 63 percent of the households carried out agriculture outside the cities.

The Mazingira study documented that the majority of operators were women (56 percent). Only 31 percent of farmers had legal access to urban land and about 29 percent grew crops on land which was not theirs. Generally (Lee-Smith, et al., 1987:86), the poorer households used land they never owned, which they farmed as squatters. Most of the food crops and livestock was consumed in the households. The researchers estimated that the crops produced amounted to about 25.2 million Kg, valued at US \$ 4 million (Stren, 1992:545). The Mazingira study suggested that municipalities should promote UA rather than harass the operators.

A follow up study to the Mazingira project is Freeman's 1987 study (Freeman, 1991) based on a sample of 618 urban cultivators in the open spaces in Nairobi. Instead of using households, Freeman used randomly selected areas and interviewed farmers on their farms. Freeman observed that urban agricultural activities in Nairobi were prevalent (Freeman, 1991:54). His findings show that 64 percent of the farmers are women, the majority of whom are migrants into the city and had lived there for over 20 years. Of the 618 urban farmers, 28 percent had primary education, and 6 percent secondary education. The bulk of the produce is used for subsistence. Freeman considers that urban farming in Nairobi reunites families, provides employment, helps to keep food costs down and generates income. Because the advantages of urban farming outweigh perceived disadvantages, Freeman advocates promotion of UA (pp.121-122).

Interestingly, Freeman developed a useful typology of urban farmers based on the type of land use and the location of plots (Table 1, in appendix): (1) backyard farmers who use private residential land, (2) riverside farmers who use land on river flood plains, (3) roadside farmers, and (4) squatter farmers who use public land e.g. railway and park land. This is important because it gives us an idea of where some of the idle resources in the city may be located. It also helps to see how through UA these resources can be put into "use values" (Sachs, 1986).

According to Freeman, the main constraints facing urban farmers in Nairobi are environmental, i.e. natural disasters such as: drought, land degradation (particularly soil erosion) and flooding, as well as crop loss due to pests.

Another UA study in Kenya is by Obara (1988) with reference to Nairobi. Obara, applying a von Thunen model, describes UA around Nairobi. He summarizes the experience thus:

"Agricultural production in Nairobi City and its environs consists of subsistence and cash crop cultivation and livestock raising to provide milk, meat, pork, etc. In the Central Business District (CBD) there is haphazard gardens of vegetables belonging to institutions, such as schools. From the CBD to a distance of about 10 kilometers, institutions and individual residents in different estates own gardens and grazing land. Although some of these gardens may be illegal, they produce food for the residents. Within the radius of about 10 kilometers from the CBD, there is diversification of agriculture which includes vegetables, fruits, grains (maize), bananas, flowers, poultry, goats, cattle, etc. Beyond this zone and in the suburbs, commercial ranging is carried out for the production of milk, meat, pork, etc. to be consumed by the City residents. The zone also specializes in cash crop production (e.g. coffee). However, subsistence crops including horticultural crops are grown under intensive agriculture. These crops are sold in the city to be consumed by the residents. Nairobi District recently produced 1200 metric tones of maize under 700 hectares. There is no doubt that given the proper planning, encouragement and extension services, Nairobi City is capable of becoming self-sufficient and self-reliant in food production." (Obara, 1998:863-864).

Obara's account is very optimistic that UA can contribute substantially to food security in cities. No doubt UA is here defined broadly to include all types of peri-urban activities. It is possible that Obara overstated the fact that a city like Nairobi could become self-sufficient and self-reliant in producing all the food it needs from within its boundaries.

Uganda: On UA practice in Uganda, Maxwell and Zziwa (1992) reported on their survey of 150 producer households in Kampala that nearly two thirds of urban farmer respondents (71.3 percent), were women (Maxwell and Zziwa, 1992:27). Other findings based on observations of household factors such as nutritional status of children, possession of certain household amenities, as well as income showed that only about 3 percent of those doing UA were high-income earners, 27 percent middle-income and the bulk of them (about 73 percent) were low-income people. Their study reveals also that urban farming in Kampala tends to be a livelihood strategy of the urban poor to supplement their inadequate incomes by producing food on any

available land (op. cit., p.28). Maxwell and Zziwa also cited references to reports that mention UA in their studies of the informal sector in Kampala, Mwesigwa (1987) and Oloya (1988). While Mwesigwa includes urban farming as one of four urban informal sector activities in his discussions, analysis of the sector is lacking; but Oloya, according to Maxwell and Zziwa (op. cit., p.15) attributes participation in UA in Kampala to cultural and economic causes and to the lack of enforcement of zoning regulations and municipal by-laws. The researchers observed that there was little use of urban waste, which was still a major problem.

**Tanzania:** A number of studies have mentioned UA in Tanzania, especially Dar es Salaam. Tripp (1990:65) cited a 1950 Survey of African laborers in Dar es Salaam which noted that 14 percent of households in the sample had farms on the outskirts of the city growing mainly rice. Several others have shown fluctuations in the practice of UA. In the 1980s it appears that a number of workers left formal employment to involve themselves in secondary income generating activities including agriculture. Tripp's (1989:11-24; 1990:67-73) survey, mainly in Buguruni and Manzese Wards, shows that about 40 percent of those who left formal employment went into urban farming. In her samples, almost half of all workers farmed and 59 percent of all residents had farms in 1987/88. According to Tripp, women (72 percent) are more likely than men (44 percent) to be involved in urban farming.

While there are several other studies which mention UA, In Tanzania, three major UA studies are on record to date. The first major UA study was conducted by three researchers at the Sokoine University of Agriculture (SUA), Morogoro, and it covered six cities like the Mazingira study. A Draft report has been submitted to IDRC entitled: *Urban Agriculture in Tanzania: A Study of Six Towns*. The study sampled 1800 farmers by using a disproportional stratified sampling. How each farmer was picked for inclusion in the sample is not described. The results show that UA constitutes economic enterprises with lucrative returns. These activities provide for more than subsistence needs. The SUA study showed that the wealthier urban dwellers were benefitting more than the poor. While crop growing is done by nearly all, livestock keeping is a preserve of the elites. The SUA researchers observed that UA as practiced is not sustainable, especially livestock raising which seems to conflict with several other land uses especially housing and is threatening to spread health hazards because of the accumulated wastes. However, the general conclusion is that UA should be encouraged and planned for.

The second is my own study entitled: *Feeding the Urban Masses?: Towards an Understanding of the Dynamics of Urban Agriculture and Land Use Change in Dar es Salaam, Tanzania*. My study's focus echoes that of Freeman in the open spaces in Nairobi. It is also complementary to the SUA study but slightly different. The results of my study are contained in a report soon to be submitted to IDRC, and has also produced a Ph.D Dissertation which I am submitting to the Graduate School of Geography at Clark University. I did not draw a completely random sample, Mine is a nonrandom sample of 260 urban farmers from three urban

wards in Kinondoni district. Though not random the sample is nonetheless representative of the range of urban farmers I intended to interview. I used, in part, a progressive contextual approach to analyze the historical contexts underlying UA practice in Dar es Salaam. I also used aerial photo interpretation to explain land use changes in three contiguous wards.

The overall results of the study show that UA is not a marginal social activity because it is practiced by people from all social classes. Economically UA makes contribution to the social well-being of many urban dwellers, produces appreciable amounts of food for household use and generates employment and supplementary incomes. The analysis of the constraints was placed within a possible typology of impediments (Appendix 1) and I believe that the major challenge to UA and its future in Dar es Salaam as a viable, efficient long-term source of food and wealth is the problem of land tenure which is uncertain in unplanned areas and inhibited by city regulations. I concluded noting that for UA to prosper and for urbanites to enjoy the acclaimed benefits, the city government and planners need to demonstrate the will to include UA as an integral part of the built-up environment.

The third study on UA in Tanzania was carried out by Mr. Davis Mwamfupe, an assistant lecturer in the Department of Geography at the University of Dar es Salaam. The title of his study is *Land use in the Peri-urban Zone of an African City: A Case Study of Dar es Salaam and Mbeya, Tanzania*. Mr. Mwamfupe notes that there has been little research undertaken on the peri-urban zones of African cities as suppliers of food. Underscoring the fact that land in the peri-urban zones around Tanzania's cities must be studied in the context of changes in the country's political economy, Mr. Mwamfupe observes that the sudden upsurge of peri-urban agriculture raises important questions about its effects on land use. So he sets out to explore —among other objectives— the way people adapt to urban pressures and the extent to which the farmers in the peri-urban zones have taken the opportunities of expanded urban market and the changing political economy. This study will also map land use changes in the peri-urban zones of Dar es Salaam and Mbeya and will also culminate into a Ph.D Dissertation at the University of Glasgow. The results are yet to be known.

Segal (1988) has observed that one important feature of urban squatting in Dar es Salaam is "squatter farming" or UA which occurs on unoccupied land (p.164). Unoccupied means that there is no inhabited building on the site. Segal argues that this "squatter farming" has a 'hit-or-miss' quality. That is, if the land is open, someone will clear and use it. Often, however, in the planned areas, the particular piece of land is formally designated as a house site. When a person comes to build that house, someone else's non-market source of food is destroyed. However, Segal (1988) argues that:

"the pervasiveness of agricultural squatting suggests that areas will probably be perceived as more livable if they contain vacant land. Unoccupied land in both

planned and unplanned areas has additional uses. Some is used as a source of raw materials for basketry or for firewood. Some is used for grazing a few goats or raising a few chickens" (Segal, 1988:164).

Maputo: UA is taking place in the peri-urban areas of Maputo, Mozambique. The government has recognized its social and economic value, therefore, it is supporting it. Graham, et al., (1991) conducted a baseline survey of 330 households consisting of 2,675 respondents in peri-urban Maputo, which was designed to investigate characteristics of labor, land and financial markets serving those households, with one of the views being food security (p.i). The area of focus was Districts II to VIII in the Greater Maputo area including Matola Gare but excluding the central city area and other peri-urban areas.

The results show that 37 percent of their sample households engaged in urban food production. Many households grew multiple crops, the most popular being yellow corn. Other crops included "manteiga" beans, vegetables, —lettuce, onions and cabbages. The findings also show that livestock was raised in 29 percent of the sample households. Ducks and chickens are the most common animals reared. Results of this survey also show that important agricultural land use occurred "in the more outlying areas in all the districts where use rights were less expensive and more easily secured," and a permanent source of water in two districts explains the "intensive cultivation of high value vegetable crops" in Districts V and VI (p. vii). Since under Mozambique law all land belongs to the state, one finding from the survey results is that about half of the households' occupancy was associated with concessions or rentals from various government authorities. Only about 10 percent did not know their user rights. Of the remaining 40 percent, 25 percent got use rights and occupancy through inheritance; 15 percent from purchase and 5 percent from private individuals (Ibid. p. vii).

#### **1.4. The contributions of these studies for science, technology and policy making**

The general contributions of these studies so far may be summarized as follows. First, most UA studies have shown that social scientists are beginning to realize that urban farming is a potential research topic. That UA is prevalent challenges the application of existing science of urban planning and management. It is becoming increasingly clear that there are considerable underutilized resources —physical and human— in cities and these must be put to efficient and rational use.

Relevant for science and technology is Ngwa Nebasina's observation that urban space, as a natural resource, when made to operate with other elements as time, leisure or daily food requirements, could generate quite other series of utility values. For Nebasina, what matters is not the physical expanse by itself, but the requisite inputs and technology invested on that urban small-size land that transforms everything economically and adds more to its value. The demand

and rational use of urban space for short cycle cropping, market gardening or intensive small livestock development may transform the outlook of some African towns (Ngwa Nebasina, 1987). The question is, should small-scale intensive agriculture which uses land that cannot be built on be promoted or not?

Second, it is becoming increasingly more acceptable that the informal sector is vital for the survival of rapidly urbanizing countries. In this context, UA should not be perceived as a socially marginal economic activity as operators cut across broad social groups. There is need therefore for urban planners and local authorities to recognize it and to legislate that it becomes an integral part of the urban economy and physical landscape.

Third, it is the duty of educators, curriculum developers and urban designers to promote the awareness that UA is a potential economic activity that can make cities efficient, self-reliant and sustainable. Along with this must be developed small-scale intensive technologies to: (a) utilize arable open spaces, (b) recycle household garbage and other biodegradable wastes to make compost as an alternative resource to chemical fertilizers, (c) make efficient use of water and create means of recycling used water, (d) design simple technologies to process food and to preserve it (e.g. canning and bottling).

Fourth, there is need to develop community networks, e.g. community urban farming or urban market gardening on a cooperative basis. This will help to realize economies of scale. Community networks will facilitate the sharing of knowledge, promote participatory problem solving, and may help to diminish neighborhood conflicts.

Fifth, UA may result in health hazards, especially when food is grown in contaminated soils and polluted water is used for irrigation and washing of vegetables. Failure to remove wastes in time and efficiently may render UA unsustainable. Techniques should be developed to address potential health problems, control sanitation and maintain working sewerage systems; and removal of unwanted noisy and socially or religiously unwelcome animals. Where necessary, some quiet animals such as rabbits could be promoted more than others if communities agree to do so.

### **1.5. Areas where more research is needed**

As it can be observed from the foregoing in virtually all studies of UA in Eastern and Central Africa, broad areas have been covered, but still the following areas need more research:

- Intensive use of waste in UA. Composting is done on a small scale and there are no demonstration projects on-site or on-farm to show farmers how this can be done at low cost. Techniques must be developed to enable farmers to do this by themselves.

- Urban governments have concentrated on landfill as the major means of waste disposal. It is time city governments recycle waste by composting and integrating this with UA. More research is needed to design programs which will help citizens to safely separate waste into compostable and noncompostable materials. Studies must be carried out to find out how to design simple systems for home use to help household members separate toxic from nontoxic waste so that it is easy to compost the nonpolluted ones.
- The use of wastewater for irrigation in urban and peri-urban areas is virtually untouched in East and Central Africa. Most urban farmers use the same treated water for domestic and industrial use. Use of waste water for agriculture is done in Latin America and elsewhere. In East Africa and Central Africa we are yet to learn how to do this economically and safely.
- Methods of selecting crops and livestock to suit particular urban environments need to be developed. Animals are kept haphazardly. It is possible to legislate such that certain animals or crops may be grown in certain areas depending on soil characteristics as well as local agreements. Along with these are techniques of safe marketing, processing perishable foods and handling dairy products.
- In the peri-urban areas where more agriculture is expected to occur in the future, research is needed to design appropriate infrastructure: water distribution, well digging and maintenance, road construction as well as mini-shopping centers to enable farmers preserve and market their products in clean environments.

#### **1.6. Interrelation with water, waste and disaster**

The interrelations are implied in the foregoing discussion. Freeman, as well as Maxwell and Zziwa have referred to this. Major obstacles involve conflicts in water usage, scarcity and pollution. Waste is equally an important input in UA but methods of handling it are lacking. As far as disaster is concerned, many urban farmers farm in flood plains which are prone to flooding. This entails loss of crops and energy should whole crops disappear with flooding. Disasters may also be connected with food contamination. Crops grown on dumps and along roadside may be polluted. Other disasters that may affect UA include: droughts and land degradation as well as crop pests. As for pests, it is possible to promote integrated pest management techniques and this is yet another area of research to be considered.

## **2. APPRAISAL OF RESEARCH CAPACITY**

### **2.1. Institutions potentially interested**

On the regional basis the following institutions are potential research centers which may develop networks to share and collaborate in UA studies:

#### **KENYA**

In Kenya, the Geography Department at Moi University is a potential partner.<sup>3</sup> The reason for mentioning Moi University is because in the department of Geography is Dr. Cleophas Lado who has interest in UA and is perhaps a potential researcher.

The Department of Geography, University of Nairobi is another potential research institution that might collaborate. In this department is Dr. Dustan Obara who has done some studies on UA.

An important research center is the Mazingira Institute whose motto is to support low-income groups and has experience in field research. More connections with the Mazingira Institute are needed and perhaps plans may be made to help in publishing since this NGO is well established and has personnel. Another NGO organization is ACTS Press, which published Maxwell and Zziwa's monograph. This is a resourceful institution with the capacity to assess research, evaluate manuscripts and publish at low cost.

#### **TANZANIA**

In Tanzania, a number of institutions are possible candidates for research in UA. One is the Department of Geography at the University of Dar es Salaam. In the Geography Department, there will be two Ph.D holders with interests in UA: Davis Mwamfupe and myself. Also interested is Mr. Cosmas H. Sokoni, a lecturer in geography with research interests in the informal sector.

The Geography Department has full-time cartographers and conducts field work each year with second and third-year students and this is a opportunity to involve some projects with UA. In addition, adjacent to the Geography Department is the Institute of Resource Assessment (IRA) with considerable experience in resource evaluation. The institute has vehicles for fieldwork, cartographic laboratory, remote sensing equipment and other mapping facilities which are useful in conducting certain technical assessments of soils, forest, water and the like. Besides, IRA has wide international readership of research monographs and this is a plus regarding dissemination of research findings. Also, the Director, Dr. Idris Kikula, is the Chairman of the National

Environmental Council (an NGO) who undoubtedly would welcome research agendas which deal with the urban environment such as UA.

The Departments of Sociology and Economics may also be interested because UA research has economic and social elements which interest researchers in these fields. Apart from the University of Dar es Salaam, there is the Sokoine University of Agriculture where a major UA project was conducted. Since SUA specializes in agricultural sciences, there is no doubt that expertise will be forthcoming when networking in research facilities and personnel is called for. Two more institutions of interest are the Ardhi Institute in Dar es Salaam which specializes in urban planning in all aspects, and the Tengeru Agricultural Center in Arusha which has a long history of research in crops, yields, diseases and numerous other avenues.

## UGANDA

In Uganda, clearly the University of Makerere and the Makerere Institute of Social Research (MISR) are the two institutions that come to mind. The MISR has indicated that UA research should be taken seriously because of its potential to offer alternative, often invisible contributions to development.

### 2.2. Expertise potentially available

The list is not given in any order of priority. More information is needed to outline the research interests better:

- Dr. Cleophas Lado, Senior Lecturer, Geography Department, Moi University, P. O. 3900, Eldoret, Kenya.
- Dr. Ruth Onian'go, Urban Center for Research, P. O. Box 74165, Nairobi, Kenya.
- Professor Dunstan O. Obara, Dept. of Geography, University of Nairobi, P.O. Box 30197, Nairobi, Kenya.
- Dr. I. J. Lupanga, Senior Lecturer, Dept. of Agricultural Education and Extension, Sokoine University of Agriculture (SUA) Morogoro, Tanzania.
- Dr. Z. K. S. Mvena, Senior Lecturer, Dept. of Agricultural Education and Extension, Sokoine University of Agriculture.
- Mr. R. R. Mlozi, Lecturer, Dept. of Agricultural Education and Extension, SUA.
- Dr. Camillus J. Sawio, Lecturer, Dept. of Geography, University of Dar es Salaam, P.O. Box 35049, Dar es Salaam, Tanzania.
- Mr. Davis Mwamfupe, Lecturer, Dept. of Geography, University of Dar es Salaam, P.O. Box 35049, Dar es Salaam, Tanzania.
- Mr. Cosmas H. Sokoni, Lecturer, Dept. of Geography, University of Dar es Salaam.
- Dr. Hussain Sosovele, Researcher, IRA, University of Dar es Salaam.

- Dr. Samuel Zziwa, Lecturer, Dept. of Agricultural Economics, Makerere, University.
- Mr. Daniel G. Maxwell, Ph.D Candidate, Development Studies Program, Land Tenure Center, University of Madison, Madison, Wisconsin, USA.
- Mr. Asaf Anyamba (from Kenya), doctoral student at the Graduate School of Geography, Clark University. Mr. Asaf has considerable knowledge in GIS analysis and applications. He is a potential tutor in GIS and urban systems as well as a researcher in UA and urban management systems at the regional level.

### **3. FUTURE RESEARCH OPPORTUNITIES**

I suggest two research initiatives/projects that could be planned for a period of two to three years and to be carried out collaboratively among two or three institutions. I am only listing the potential aspects of the research projects I envisage, and hopeful more focused research proposal will be prepared:

#### **3.1. Title: Integrating waste and urban agriculture through on-site composting**

##### **Research problem:**

To date little has been done to link UA and waste management. In cities of Eastern and Central Africa, for example Dar es Salaam, the garbage collection facilities of the city council are congested but citizens have not been awakened to recycle domestic waste, market waste, farm waste by composting on the farm for own use or even for sale.

##### **Perceived benefits:**

- On-site composting will save time in trucking waste to landfills, will relieve the pressure on communal landfills, and will create incentives to sort garbage.
- Composted materials can be collected from lawns, hedge clippings from homes, from farms and market squares. This contributes to city cleanliness.
- Compost applied to farms saves money that would have bought chemical fertilizers.

##### **Project aspects/planning:**

- Institutions will urge farmers and urban communities to form several cooperatives interested in on-site composting.
- Educate people of the value and use of compost. This was done once in Tanzania, but it was never seriously implemented.
- Researchers will prepare booklets or seminars to inform users on the uses of compost (a)

- on individual farms (b) on communal farms if any, or (c) for sale to other farmers and to public for horticultural purposes.
- In cities care will be taken to choose suitable sites away from houses to avoid odor and complaints.
- Design composting equipment and strategies: bins, rotating drums, boxes on farm, use of tanks or other means as research will direct —techniques must be easy to manage and use by low-income farmers.
- Researchers must indicate the sources of inputs and methods of turning them into compost to link with waste reduction in the city.
- Estimate costs of composting per farm/individual/cooperative unit.
- Trucks and loading equipment for small-scale composting on-site.
- Dissemination of information from research centers and to farmers —design of newsletters, posters and other means of communication to help farmers benefit from the findings.
- Assess the benefits to the principal beneficiaries (the urban farmers) of on-site composting.
- Replicability of techniques (evaluation of technology transfer and planning issues).

### **3.2. Title: Evaluating types of urban agricultural systems.**

#### **Research problem:**

Within the emerging sector of UA, several farming systems can be identified, including: residential house farming in backyard or front yards also referred to as plot gardening; market gardening; peri-urban farming; roadside farming; flood plain or river valley farming; power rights-of-way farming; basement gardening, aquaculture; horticulture; livestock keeping - poultry farming, dairy farming, pig farming; container farming; hydroponic and so on. These systems, within the urban ecosystem approach have not been evaluated.

#### **Research approach:**

Because of lack of any evaluation criteria vis-a-vis these systems research will be designed to assess (a) the potential productivity level of each; (b) the appropriate location of such activities within the urban environment; (c) impacts of such systems on overall social, economic and livability of the urban habitat; and (d) how to support and integrate these systems in urban planning and management policies.

#### **Objectives:**

- (a) list and document for specific cities/towns the urban farming system in practice;

(b) assess the connection between these systems and environmental problems, nutritional improvement, and location of other land uses in the city;

(c) document the direct beneficiaries of the systems;

(d) monitor production capacities of each systems per unit of land used or costs involved, including time spent in farming;

(e) assess social and economic aspects of the system: e.g. what is the relative importance of container gardening to roadside farming? Or how good is backyard farming compared with valley farming or peri-urban farming?

NB. I hope somewhere it is possible to design research projects to evaluate these systems collectively and learn from what citizens do, much of which is undocumented and goes unnoticed.

## NOTES

1. In developed countries see for example: Lockeretz, 1987, 1988; Bryant, 1986; Furuseth and Pierce, 1982; Lawrence, 1988; Deelstra, 1987. In the developing countries, examples abound: Thaman, 1977; Sanyal, 1984; Wade, 1986, 1987; Lee-Smith et al., 1987; O'Connor, 1983; Yeung, 1987; Rakodi, 1988; Mazambani, 1982; Drakakis-Smith, 1990; Briggs, 1991; Ngwa Nebasina, 1987; Mosha, 1991; Mvena et al., 1991; Freeman, 1991; Maxwell and Zziwa, 1992 to mention a few.
2. Often it is believed that there is not enough land in cities to carry out urban farming. But available data indicates that many cities in the world—in both advanced and developing countries—have large amounts of vacant and underutilized land. Some of the evidence is as follows: Greater Bombay has some 200 Km<sup>2</sup> of vacant land (McAustin, 1985); Bangkok, Thailand has 338Km<sup>2</sup> of vacant land (Tanphiphat, 1981); Metro Manila has an estimated 203 Km<sup>2</sup> of vacant urban land (Mendiola, 1981); in Sao Paulo, Brazil vacant land has been recorded at 600Km<sup>2</sup> (Sachs, 1984); in Karachi, it was reported that in the Development Plan for the period 1974-85 "over [sic] 12,000 acres of land (about 4.850 ha) sufficient to accommodate 1.2 million people at the current residential density of 100 persons per acre (around 250 persons per ha) lie unutilized at the heart of the city and in other parts of the built-up area, with public utilities and roads still being extended expensively into outlying areas in response to pressures that are primarily speculative" (Van de Linden Jan "Squatting by organized invasion — a new reply to failing housing policy" *Third World Planning Review*, No. 4, Nov. 1982, cited by J. E. Hardoy and D. Satterthwaite, 1989, *Squatter Citizen*, p. 101.
3. Address: Moi University, P. O. 3900, Eldoret, Kenya

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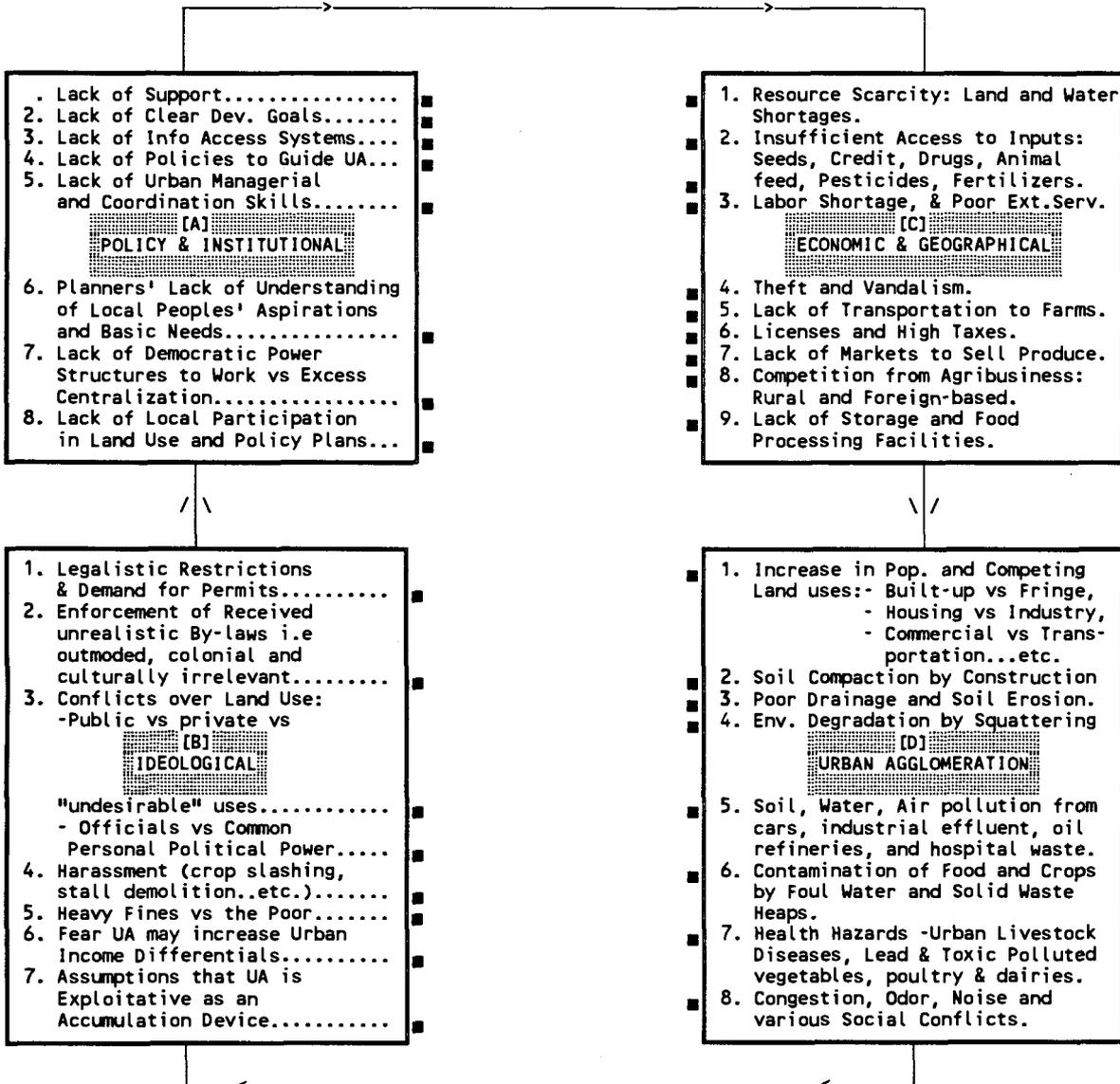
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**Appendix I Location Types of sampled Plots**

	No. Interviewed	Per Centage (%)
Roadside	176	28.5
Riverside	100	16.2
Park	8	1.3
Other public land	90	14.6
Private residential	195	31.6
Industrial	9	1.5
Railside	20	3.2
Other	20	3.2

Source: Freeman, 1991:132, Table 8.

### Appendix II A TYPOLOGY OF UA IMPEDIMENTS



## URBAN AGRICULTURE: EASTERN AFRICA

**Davinder Lamba**

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### **INTRODUCTION**

This background paper on Urban Agricultural Research in Eastern Africa Region has been prepared for IDRC to facilitate the specifying of the general agenda of its Urban Environment Management Program (URB) in the region. The paper is intended to serve as a reference for implementing the research agenda after the review workshop in Ottawa this May (1993).

The paper has been laid down in conformity with a standard format for all the papers commissioned by IDRC on the various elements of URB Program, for ease of review and cross-referencing. It thus consists of three sections: regional research record on urban agriculture; appraisal of research capacity, and future research opportunities.

The section on regional research record on urban agriculture looks at the aspects that have been best researched on; contributions underlying results for science, technology and policy making; the aspects and specific objectives that deserve further research; and the interrelations between urban agriculture, water, waste and disaster in cities.

The appraisal of research capacity section deals with research institutions which could be interested in studying the issues addressed. It includes the available expertise, record and facilities of the institutions and their institutional partners.

The section on future research opportunities suggests research ideas that could be supported in the region by IDRC itself or in conjunction with other donors.

Until recently, research on urban agriculture and reference to it in the literature on African urbanization and development has been sparse; farming activities were considered unworthy of serious study. They were assumed to be economically unimportant and detrimental to urban and economic growth by researchers to an extent that they were usually considered illegal and scarcely deserving mention, notably in studies of informal sector in African cities, even though farming activities share most of the characteristics of the informal sector (Memon and Lee-Smith, 1992).

This paper is a cursory overview and has been prepared using contributions from researchers in the region: Dr. Axumite G/Egziabher, Urban Planner (Ethiopia); Ms. E.J.

Chagu, Ardhi Institute (Tanzania); Mr. Daniel Maxwell, Makerere Institute of Social Research-MISR (Uganda); and, researchers at Mazingira Institute (Kenya).

The study in Ethiopia (Addis Ababa) was conducted by Dr. G/Egziabher as part of her doctoral work. The researches in Kenya, Tanzania and Uganda were largely supported by IDRC. The Tanzania and Uganda explorations focused on the capital cities (Dar es Salaam and Kampala). The Kenyan study was countrywide; it covered six towns and is one of the most extensive urban agricultural research undertaken so far.

## **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

This section describes, by country, the aspects of urban agriculture that have been well researched, the contributions underlying the most outstanding results, the aspects that deserve further research, and the interrelations between urban agriculture, water, waste and disaster in cities.

### **1.1. Aspects which have been best researched**

#### **ETHIOPIA**

Food security: In Ethiopia, urban agriculture has been shown to be a final stage by households in their sequence of survival strategies. Households in the urban areas respond to the extreme threat of poverty and food insecurity by carrying out urban farming on any vacant space available. Urban agriculture is also practised because of shortage of income and unemployment in the urban centres.

Nutritional aspect: Urban agriculture has also been studied as a contributor to improved nutritional levels among the urban poor in Ethiopia. Vegetable production has been very important in most of the studies. Most of the urban population in Ethiopia consists of the poor who cannot afford to buy high-valued food stuffs.

Access to land: In Ethiopia, urban agriculture is carried out on land in transitional use where usufruct rights are at issue. This problem leads to low investment in urban agriculture and hence poor productivity.

#### **KENYA**

Access to land and crop security: In Kenya, it was found that urban farming takes place on land in transitional use or in marginal quarters where crop security and usufruct rights are at issue (Lee-Smith, D. et al., 1987). The study suggested the need to support

local authorities, NGOs and community organizations in devising creative and flexible solutions for improving access to land. In the same study, urban agriculture was seen to be a neglected area among the others in the informal sector. It does not receive support commensurate with its contribution because it is dominated by women and is considered economically marginal (Lee-Smith and Lamba, 1992).

Food production: Fresh vegetables have been shown to improve the diet in urban centres of Kenya. About 77 per cent of urban farmers in Kenya produce entirely for domestic consumption (Memon and Lee-Smith, 1992). Crop growing is more common than livestock keeping although nearly half of the livestock die because of lack of veterinary services and starvation.

## TANZANIA

Crop production and livestock keeping: In Tanzania, few people can live on a single source of income; most of them must seek additional income sources. As long as this prevails, crop production and livestock keeping will continue to provide additional sources of livelihood in the towns. It was shown in most of the studies that food production and livestock keeping are quite important in urban areas.

Supplementing the incomes of urban employees: Urban agriculture was shown to supplement incomes that otherwise could not support the urban population. Some of the produce in urban Tanzania is sold for cash in order to buy other commodities. This sustains the livelihood of those holding down-low paying jobs even in a situation of rapid inflation.

## UGANDA

Urban food production: In Uganda, Maxwell and Zziwa (1992) found that urban farming was practised to produce food and to diversify and strengthen the income sources of the households. The two researchers describe urban farming as a significant component of the survival strategy of middle and lower-income households developed during the past 20 years amid harsh economic circumstances. Jamal's study also concentrated on food production in Kampala. He estimated that Kampala is now twice as self-sufficient in calories as it was in 1972. Bigsten and Kayizz-Mugerwa (1992) count both food production and cash crop production as categories of income generation in Kampala. Most of the food was produced for domestic consumption. Selling surplus production was at a very low-level through local or neighborhood markets.

Access to land: This is another important aspect that has been studied in Uganda. It was shown by Maxwell and Zziwa (1992) that land is held in freehold with a title, but it can also be held in the form of *kibanja*, which entitles land use and inheritance rights as well as

ownership of improvements to the land but not the actual ownership of land itself. The use of public land for farming is illegal.

## 1.2. Contributions of those studies for science, technology and policy-making

### ETHIOPIA

- Urban development planning has tended to neglect urban agriculture over the years. This has led to lack of supportive services to the sector.
- Urban agriculture has helped improve production and food security for the urban poor in Ethiopia.
- Urban agricultural practices are underdeveloped. They have not been developed to suit the changing demands for better technology.
- Urban agriculture has not been encouraged and given its rightful place in the economy. For example, there are no extension services available to the urban farmers.
- Presently there is no stated policy regarding urban agriculture in Ethiopia.

### KENYA

- Agricultural practices are very basic and dependent on hand labor with only a few simple and inexpensive tools (pangas, jembes or hoe). It should be noted that there is extensive use of organic inputs and even informal trade in these inputs in Nairobi.
- There is need to build on present practices to increase recycling urban biological wastes through methods which can be maintained with low investment and operational costs. Other organic waste such as sewage sludge can also be treated for purposes of aquaculture.
- The majority of urban households in Kenya are unable to feed themselves adequately due to their meagre earnings. Those who are able to do so, cultivate land in backyard spaces, on roadside verges, or on other publicly owned vacant land. These farmers are not represented by any organizations even though they constitute a substantial group amongst the urban population.
- Urban farming in Kenya is not planned for and is often prevented or harassed.
- Technical advice and/or agricultural extension services are lacking in Kenya's urban farming environment.

- The urban poor are the most disadvantaged of all the groups with serious nutritional deficiencies. Yet there are no specific programmes targeted to improve the nutrition of the urban poor in Kenya (Memon and Lee-Smith, 1992). Even famine relief efforts ignore them.

## TANZANIA

- Urban agriculture assists a big proportion of the unemployed and under-employed urban dwellers. For instance, in Songea a secondary town, about 59 per cent of the residents have farms; the climate in the region is favourable for farming. The crops grown both for food and income generation include: maize, cassava, beans, rice, sweet-potatoes, finger-millet, peas and coffee. The livestock kept include goats, sheep, pigs, poultry and dairy cattle (Songea Master Plan, 1990).
- Urban farmers experience low level of agricultural technology; exhaustion of the natural fertility of soils; inadequacy of authoritative guidance on the appropriate uses of river valleys which transverse the towns; and, inappropriate regimes of rains.
- Labor is abundant in urban areas and the built-up area is not extensive, so for the time being, there is the potential to use vacant areas for agricultural activities.
- About 23 per cent of the land in Dar es Salaam is used for agricultural production with 11 per cent of the population engaged in farming. Crops grown are for consumption and income.

## UGANDA

- Urban agriculture in Uganda revealed reliance on indigenous practices; low-cost inputs and limited ownership of tools (Maxwell and Zziwa, 1992).
- Although urban farming is technically illegal, its contribution to food production is recognized by urban authorities. Researchers have shown that urban agriculture has the potential to supply the city of Kampala with certain vegetables and milk.
- The major constraint to urban farming was found to be lack of access to capital and land. Theft of crops was also quite high in Kampala. Other constraints included harassment, nonavailability of tools, high production costs, and marketing bottlenecks.
- Urban agricultural producers in Kampala span a wide spectrum of socioeconomic groups. While urban farming is a commercial activity to a few, it is a significant component of the survival strategy of middle and lower-income households; it provides a stable source

of food and is seen as a preferable allocation of both financial and human resources provided there is some access to land.

- Urban agriculture has flourished in Kampala due to both cultural and economic causes and the lack of enforcement of zoning regulations and other municipal by-laws. The study by Oloya (1988) concludes that all three are causal factors.
- Urban agriculture was also seen as an activity that could easily make a greater contribution to public health if certain incentives were offered to recycle urban wastes.

### 1.3. Aspects and specific objectives deserving further research

#### ETHIOPIA

Equity aspect: In Ethiopia, no study has been carried out to consider equity. There is need to carry out an analysis of who will benefit from the expansion and improvement of urban agriculture especially with regard to gender and ethnic inequities.

Health risks: This is another very important area that has not been considered. The aspect of health risk is important from both the food production and air quality point of view. Most of the food is produced in urban areas without taking into account the effect of contaminants especially in the industrial sites.

Economic, legal and policy aspect: There is need to develop some accounting system for analyzing the cost-benefit ratio of using urban land for agriculture to include social and health benefits. It is inadequate to consider economic benefits only; the costs of low nutritional levels may be worse than low levels of income.

Measures to assist women: There is need to carry out research so that women can have greater economic status through urban agricultural activities. This will ensure that women are involved in the management and decision making of the overall production and distribution process.

Improvement of agricultural techniques: There is need for research to be carried out on government support in the provision of extension workers, agricultural inputs and credit facilities. This will improve productivity of urban farms.

## KENYA

Equity aspects: In most urban centres, the majority of the urban farmers are women and yet this is a sector that is ignored in terms of research and supportive services. No specific attention to gender and ethnic inequities has been addressed by researchers in Kenya. There is need to focus on gender and ethnic inequities under urban agriculture for the benefit of women and the poor.

Credit: So far, the most commonly mentioned problem facing urban cultivators across all income levels is access to capital. There is need to assess the possibility of giving credit to urban farmers. Credit is an area which is under-researched in the urban areas. It appears as if the credit needs of urban farmers has not been given the emphasis it deserves.

Health risks: The question of people feeding on food grown largely on untreated sewage is under-researched. Even air quality has not been considered when growing food crops. This is, however, an important research area as feeding on food crops grown on untreated sewage can be a health hazard.

Planning: This can be a productive tool to aid the harmonious integration of urban farming with the rest of the informal economy. Urban farming is a complementary and competing form of urban land use which needs to be well planned for. In particular, management and regulation of all forms of urban land use as well as the provision of facilities in the parts of the city where the informal sector operates is a matter of concern.

Food production: This is a complex area which needs a specific study if appropriate policy response are to be formulated. A particularly important aspect is the extent to which urban agriculture is dominated by women. This has important ramifications for gender relations regarding the composition of household labor and income. A distinction needs to be made between food produced for domestic consumption and food produced for sale. The destruction of commercial crops means only loss of income but destruction of subsistence food can mean malnutrition at best and starvation at worst.

Farming for income and food security: The least researched aspect of urban agriculture is the fungibility benefit it provides farming households by freeing income for non-food essentials (such as health care, education, clothing, housing, fuel and transportation) that would otherwise be spent on food. Within a large proportion of Kenyan towns, more than 50 per cent of the total family expenditure is on food. Further research is needed on whether protein from livestock and livestock products is more crucial to human nutrition than crop production.

## TANZANIA

Animal husbandry: This needs to be studied so that animal products can supplement the incomes of the urban employees and improve their nutritional intake. Also employment will be generated in the urban centres. The study should also consider ways in which animal refuse can be used to improve crop production. Despite its informal status, the activity should not be ignored; many people stand to benefit from it.

Urban gardening: This should be studied as it is practised within the built-up areas and on plots and farms in the fringe areas. This type of farming can help generate income and employment to the urban poor. It also stands to improve the nutritional standards. However, urban gardening may cause pressure on urban water supply network. Besides, there is need to sort out the conflict on land use —between this type of agriculture and other forms of land uses.

Crop production in salt and fresh water: This can be a health hazard to the consumers but can generate income and employment to the poor section of the urban community if proper technology is utilized.

Mixed farming: This is mostly practised in urban fringe areas and is likely to be a better way of utilizing land and urban wastes (which can act as manure for the crops). Moreover, several agricultural products will be made available and more income and employment opportunities will be generated.

## UGANDA

Economic, legal and policy aspects: As in most places, urban agriculture is technically illegal in Kampala. It would be pointless therefore to research on how to improve upon urban agriculture as long as this situation prevails. Having access to land for cultivation may improve food security and nutritional status. Although a better accounting system for analyzing the cost-benefit ratio of using urban land for agriculture is necessary, the nutritional evidence ought to be apparent.

Health risks: No researcher has so far looked at the health risks which may arise from both the food production and water quality perspective. People in urban areas may be feeding on food grown largely on untreated sewage.

Equity Aspect: Most studies on urban agriculture in Uganda have not come out clearly on who would benefit if it was improved. Except for Maxwell and Zziwa who mention the middle and lower-income groups as the majority, no mention of gender and ethnic inequities is made by any study.

#### **1.4. Interrelations between urban agriculture, water, waste and disaster in cities**

##### **ETHIOPIA**

The problems of waste disposal in the major towns of Ethiopia may be reduced by encouraging urban agriculture; wastes can be used as manure and consequently increase agricultural productivity. Urban agriculture can also improve the health of the people through the reduction of wastes and an increase in the nutritional status. On the other hand, if wastes are left unused, they become a health hazard especially in the slums.

##### **KENYA**

Urban agriculture can help reduce water, waste and hazard problems in the large towns of Kenya. Proper urban farming can increase returns on water bodies. With cultivation on home plots, there is a possibility to reuse domestic water (the "grey" water from homes). Also, by recycling urban wastes into production inputs, it can reduce urban demand for resources and minimize pollution.

Extensive open water degradation by urban organic wastes affect fisheries, public health and employment.

A growing share of Kenya's urban population lives or works in degraded and hazardous environments. If urban farming can be practised in those areas, the environment can improve a great deal. Water and waste management are worsening exposure of people, facilities and activities to disasters. Most of the urban populations have no access to adequate sanitation and very few are connected to sewerage systems. However, urban farming that uses some of the wastes can improve both the productivity of the urban areas and the health of the people.

##### **TANZANIA**

Pollution from industrial firms will affect the quality of agricultural products if not properly addressed. However, urban agriculture and waste can still be integrated to make the urban system sustainable. Dirty water from other domestic uses can be used to grow crops after treatment. What is needed is improved technology so that urban agriculture, water and waste can help to increase food production and the income of urban dwellers. Water and wastes from industries and households can be disastrous if not put to some use after treatment.

## UGANDA

In Uganda, urban agriculture can help reduce the problems of waste disposal in major towns. Urban agriculture would also help reduce environmental hazards and water shortages. To carry out this form of agriculture new farming techniques that take into account the health of the people and the resource constraints are required.

## 2. APPRAISAL OF RESEARCH CAPACITY

There are very few institutions in the Eastern Africa region with any record of urban agricultural research. Further work is needed to identify institutions that could be interested in this field; and their institutional partners in the country or the region whether governmental, nongovernmental or private, in terms of relevant expertise, record and facilities. This task is beyond the scope of this paper.

Urban agricultural research is a multidisciplinary area. It is wide in scope and presents an opportunity to researchers in several fields: agriculture, social sciences, environmental and urban planning and so on. Therefore, the range of institutions that could be interested in urban agricultural research is fairly large. Criteria needs to be agreed in order to make a judicious selection for further work in this area.

## ETHIOPIA

In Ethiopia, the major study on urban agriculture was conducted by an individual researcher (A. G/Egziabher, 1992). The academic institutions and specialized research institutes particularly in the field of agriculture have not shown any interest in urban agriculture. They have the capacity, expertise, record and facilities for research.

## KENYA

Mazingira Institute has a track record on urban agricultural research and can make further contributions in this field, in the country and the region —using its networking operations in the urban field.

So far, hardly any research on urban agriculture has emerged from the academic institutions' or specialized research institutes, particularly in the field of agriculture. There is the needed capacity, expertise, record and facilities in these institutions.

## TANZANIA

In Tanzania, researchers at the University of Dar es Salaam and Sokoine University have been involved in urban agricultural research. Ardhi Institute has also indicated an interest in this issue. The contact person at Sokoine, which is an agricultural university, is Mr. Camilius Sawio and at Ardhi Institute, Dr. Jossy Materu. These institutions have the capacity, expertise, record and facilities for research.

## UGANDA

In Uganda, Makerere Institute of Social Research (MISR) has interest in urban agricultural research. Mr. Daniel Maxwell who is currently conducting a study is affiliated to MISR. Interested institutions in Uganda may require additional support for strengthening capacity and facilities as the country is undergoing a phase of reconstruction.

### 3. FUTURE RESEARCH OPPORTUNITIES

In Eastern Africa, urban agriculture is prevented or harassed and has not been given any consideration in the urban development plans. In the whole region, there is no specific policy to encourage urban agriculture despite its contributions to food and income levels of the poor urban households. So far, the governments have not seen urban agriculture as a policy issue.

Urban farmers do not enjoy the same support from the governments as do their rural counterparts. There are no urban extension services for crop production and livestock keeping; such services are needed to prevent loss of livestock and improve productivity and farming methods and minimize any associated health risks. Also, credit facilities for urban farming, including other inputs, are not yet available hence the investments in urban agriculture remain low.

Equity is another important issue. Who will benefit from improvements in urban agriculture? Poor urban farmers produce food entirely for their own consumption. The important question is whether such subsistence activities, carried out mainly by women, should be dismissed as irrelevant and economically unimportant. It is important to note that recent interest in the issue of urban agriculture has been "spurred by the UN declaration of International Women's Year and the attention this focused on the activities of women, especially as regards food production, in the Third World" (Freeman, 1991).

The following are some research ideas that could be supported in the region in the near future:

### **3.1. Topic: Legality, official attitudes and access to land**

The urban poor, particularly women engage in urban agriculture for survival. In most countries informal urban agriculture is seen as an illegal activity, and the urban planners, managers and health officials have little time for it. Improving access to land for cultivation may improve food security and nutrition. However, reactions of governments to urban farming and livestock keeping have been proscriptive and uninformed. The issue of legitimisation of urban agriculture needs to be addressed.

### **3.2. Topic: Technical constraints related to urban agriculture**

Urban agricultural practices need improvements through inexpensive approaches like: waste recycling, intercropping, better animal health and husbandry management and so on. Research on removal of such constraints would help to improve productivity of urban agriculture both for subsistence and income generation purposes. Where already higher productivity of urban agriculture exists, it should be enhanced by building upon the good practices of urban farming such as intensive use of organic inputs including waste recycling.

### **3.3. Topic: Credit and extension services for urban agriculture**

Access to credit and extension services are essential for promotion of urban agriculture. Extension services are needed to improve productivity, prevent loss of livestock—which happens in many situations and minimize health risks. High animal death might also be alleviated through less harassment, allowing the livestock themselves to get better nourishment.

Such interventions are very suited to action-research (learning by doing), particularly by nongovernmental organizations. It also provides an important opportunity for governmental agricultural institutions to transfer the rich experiences they have accumulated from the rural areas to the urban areas.

### NOTE

1. This paper has been prepared by Davinder Lamba, Executive Director, Mazingira Institute, with the assistance of Dr. Edward Nyongesa and researchers from the region: Dr. Axumite G/Egziabher (Ethiopia), Mr. Daniel Maxwell (Uganda) and Ms. E. J. Chagu (Tanzania). Their contributions are gratefully acknowledged.

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## URBAN AGRICULTURE: EASTERN AND SOUTHERN AFRICA

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### **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

#### **1.1. Urban agriculture in Eastern and Southern Africa.**

In Eastern and Southern Africa, urban agriculture is a relatively new topic for research. The 'Pioneer' study<sup>1</sup> was done by the Mazingira Institute in 1985, and it highlighted urban food production and cooking fuel situation in urban Kenya. Subsequent studies in Zambia, Uganda and Zimbabwe have been less extensive, but follow the same themes. On the whole, research has focused on describing the phenomenon of urban agriculture and its importance for urban food production.

In many countries, the starting point has been that urban agriculture is an illegal activity. Therefore researchers have aimed to demonstrate its economic importance, particularly for the urban poor. The official views have emphasized the environmental/health risks of urban agriculture, the violation of town planning zoning and the encroaching on public health.

Most researchers have therefore aimed to inform policy makers of the positive features of agriculture, giving accurate figures on productivity and improved self-sufficiency of households. They have highlighted the importance of urban agriculture as a survival strategy of the poor. In terms of the URB Program's aspects and specific objectives, the following have been best researched:

- General food production and nutrition systems (Mazingira, 1985; Little 1992; Berg van den (ed) 1982; Sanyal, 1985, 1986,; Rakodi, 1988; Mascarenhas, 1986; Baker, 1990; Mbiba, 1992, 1993).
- Economic and policy aspects (same as above).

In our opinion, little scientific work has been done on health risks, access to land, crop security, credit, and equity aspects. There is some ongoing work on gender issues, but most outputs have been on access to shelter and land (Schlyter, in Zambia, Botswana and Zimbabwe).

In general, there are no outstanding results for science, technology and policy making for urban agriculture. Most research findings are of a baseline nature, telling us of the

incidence of and actions in urban agriculture. For policy makers an important result is that urban agriculture cannot be dismissed as an illegal activity —it has become an integral part of the urban economy for the poor. Urban agriculture in African cities is widespread but in most cases it is subsistence agriculture with limited capital inputs and legitimacy to facilitate for more intensive operations. Usually the scale is significant where the operators have legal access to land and therefore access to credit. In most African cities, urban agriculture is a transfer of rural subsistence agriculture to urban areas, particularly as whole families migrate and settle in urban areas.

Whereas the starting point for most researchers has been to inform policy makers of the existence and extent of urban agriculture, there is a need to contextualize the phenomenon within the overall context of urban economy. Firstly, is urban agriculture a spontaneous activity? Should it be a planned activity, incorporated in the urban areas? Secondly, what are the consequences of making agriculture a major land use for the African city? Is it not better to make more "efficient" use of the land by building more housing, industry or commerce? Thirdly, is urban agriculture an activity for the poor? Should it not be promoted and elevated in terms of self-sufficiency in food for urban centres (cf. Chinese cities)? What would be the implications of all this for the urban poor and urban economy in terms of employment and local authority finance ?

In Southern and Eastern Africa, urbanization is a major process which will transform the economies by the turn of the century. Most urban centres were planned for much smaller population and they lack adequate formal sector employment for the growing workforce. As a result most urban environments are characterized by informal sector activities, of which urban agriculture is increasingly an important feature.

In our opinion, the issues which deserve future research in the region are:

- (a) Rural-urban relationships and how they influence urban economic activity, including agriculture. The rural-urban migration trends and in particular the increasing urbanization of families have to be properly contextualized. Most studies are very superficial and lack the framework in which urban agriculture is occurring. Understanding the rural-urban dynamics will help in the understanding of access to land, crop, crop security and credit. Is urban agriculture simply a survival strategy or a response to economic opportunities?
- (b) In countries where policy frameworks have been positive about urban agriculture (Mozambique, Malawi, Lesotho etc.), what have been the underlying policy and political reasons? How much is it a factor of prevailing land tenure and zoning systems. We have to ask again, should urban agriculture be a key urban activity? That it is found in all urban centres does not mean it should be promoted —we have to ask the reasons much more systematically.

(c) It is important to research urban agriculture not just from the perspective of the urban poor, but to examine a whole range of activities including capital-intensive horticulture and dairying. There is a need for a typology or typologies which are inclusive of the phenomena as a whole. For too often, researchers focus on the peripheral/marginal urban agricultural activities simply to demonstrate that the poor are included. In Kenya, Zimbabwe and Tanzania, evidence suggests that high and middle-income households constitute a significant proportion of urban agriculturalists.

The interrelations between agriculture, water, waste and disaster in the cities of the region are many and varied. With respect to urban agriculture's use of water, it is noted that in most cities of the region, urban agriculture is a seasonal activity following the annual cropping patterns. This also determines the types of crops and levels of intensity of cropping. For most urban cultivators utilizing 'vacant' pieces of land in the city, there is no investment in water supply.

The middle and upper-income groups operating on authorized land usually invest in boreholes or even small dams for certain sizes of landholding. In Harare, Zimbabwe and Nairobi, Kenya there are areas in the city which are zoned for small agriculture (horticulture, chicken production) where the original developers created boreholes and wells. In most cases the areas do not have reticulated water systems and therefore have to be sufficient in terms of waste supply.

The use of wastewater tends to be restricted in most centres although increasingly the breakdown of sewers and water mains provide an opportunity for residents to tap on the supplies. In Zimbabwe the municipalities have the monopoly use of wastewater and treated sewage for 'municipal farms'. Evidence from the other cities does not suggest that urban residents have much access to the city's wastes. It is also likely that most of the urban poor live in unserviced areas and therefore the disposal of wastes is not formally organized.

With respect to agriculture and waste, the interrelationships are not as clear-cut in African cities as is the case in Asian cities. This is probably a legacy of peasant agriculture which tends to rely on animal and other organic manure but does not utilize human wastes. Urban agriculture has therefore tended to follow the same established patterns. The production-nutrition systems tend to be influenced by the lack of both capital and crop intensity.

On urban agriculture and disaster, except for conservation and related problems (soil erosion, siltation, deforestation), there is no direct association with disaster. There also have been public health consequences documented but nothing of a disaster magnitude.

## 1.2. Urban agriculture in Zimbabwe: Harare vs other African cities

How prevalent and significant is the issue of urban agriculture in Southern Africa? Is the issue of urban agriculture unique to specific countries and towns? In a pioneering study in Zimbabwe, Mazamabani (1982) looked at the activity of urban agriculture, wood fuel collection and energy in the city of Harare. These were seen to create rural landscapes within the urban environment; sometimes described as ruralization of urban areas. Coverages of African cities in that study unfortunately cited West African experiences. Although the activity is also very prevalent there, these cities have a different historical development and different morphological outlook compared to Harare and cities of Southern Africa in general. This point has merit when one attempts to distil a theory of urban agriculture which is circumscribed by a general theory of urban development.

In Kenya (the Mazingira study). it is reported that 29% of urban households grow crops in town, 17% keep livestock in and that US\$17 million worth of livestock were kept in Kenyan towns in 1985 (Diana-Lee Smith, 1991:3) In Lilongwe, Malawi, goats are a prevalent feature in towns. The growing of trees is promoted and the trees are latter used for fuel by urban residents (Mbiba B., personal observations and discussions with officials, October 1991).

Freeman (1992), also working on Nairobi utilized and extended the Mazingira studies. The focus was on the spatial distribution, the practices, the motives of cultivators and the problems they faced in urban Nairobi. The value of urban agriculture products for low-income households was again emphatically documented.

Rakodi (1987) reported similar occurrences for cities in Zambia and drew parallels with Indian cities where cows are prevalent in the cities. In a more detailed study, Sanyal (1987) highlights the financial and economical value of urban agriculture to the urban poor in Zambia, dismissing both the Modernization and Neo-Classical theories propagated against urban agriculture. Also from Zambia in an earlier period were studies of a medical nature (Watts et al., 1987) focusing on the link between mosquito breeding (and hence malaria) and flora typologies in the city. It was scientifically observed that mosquito breeding on maize plants or any other crops is not significantly different from that of other plants growing naturally.

Work has also been done in Tanzania in the 1980s<sup>2</sup> whose major objectives were to investigate the nature and origin of food production activities within the urban centres and their peripheries. Six towns were surveyed: Dar es Salaam, Morogoro, Dodoma, Mbeya, Kilosa and Makumbako. In these centres, local authorities were reported to have 'initiated' some form of structures to accommodate urban agriculture. The poor were identified as

needing a more positive environment to engage in urban agriculture; including such resources as more access to land and credit.

The town of Maseru, capital of Lesotho, is even more diverse in its urban agriculture. Dairy cows, maize cultivation, sheep and pig rearing, vegetable and fruit production are dominant and conspicuous activities (personal observations, 2-6 Dec., 1991).

In view of the above observations, a few salient features need comment vis-à-vis the situation in the region:

#### Alienation of urban agriculture

In addition to being considered illegal those involved in off-plot urban agriculture are subject to sporadic harassment by urban local authorities (Kenya and Zimbabwe). Maseru is unique in that it takes an enabling approach where urban agriculture is accommodated and supported. The town provides special veterinary services through the Ministry of Agriculture's Livestock Division (Maseru ..., 1987:27).

#### Urban agriculture and the urban poor

In all cases, it is noted that urban agriculture is an important sector in the urban economies particularly for the urban low-income families, women and children. In Maseru, the estimates available indicate a value of urban agricultural production to be Maloti 6,705,000.00 maloti at 1990 (one maloti = one rand) (Maseru..., 1987).

#### Urban vs rural agriculture

Studies in Kenya and Lesotho point to higher yields per unit area for urban agriculture when compared to rural rain-fed grain production which may have existed before urbanization of the areas. The implication is that "urbanisation does not necessarily mean the end of agricultural production" (ibid.) African cities in the precolonial era are seen to have taken urban agriculture as part of the urban way of life. Rakodi (1987) underlines this point and indicates that at a later stage, some colonial governments did promote the activity.

In summary therefore, the issue of urban agriculture is common in most cities in Africa. The differences seen in the different countries are in magnitude, typologies and, more important, the institutional responses. Responses can be either prohibitive or accommodative/enabling. That of Zimbabwe seems to fall in the prohibitive category. Urban agriculture, particularly 'off-plot peripheral' is fundamentally part of the urban system

and has formed the basis of long-standing European land use theory, particularly that of Von Thunen (1926).

Current and on-going work: B. Mbiba (University of Zimbabwe)

Since late 1991, B. Mbiba has rejuvenated research on urban agriculture. The research has so far confirmed the role of urban agriculture for household food supplies, employment of women and children and use of otherwise underutilized land. For the first time, evidence has been provided to show that urban agriculture does not benefit the poorest of the poor; indeed these have no access to the land as a result of both formal and informal gate-keeping processes in the city.

Mbiba's work is also very significant in that it attempts to place urban agriculture within the context of urban economy, urban management and urban development. This is necessary if we have to provide planners with a more usable strategy. A number of papers have been produced focusing on:

- urban agriculture and the poor;
- the gender dimension in urban agriculture;
- institutional responses to urban agriculture;
- images of urban agriculture;
- urban agriculture as a counterproductive activity.

The gender dimension, the institutional concerns and the quest to link urban agriculture to broader issues of housing supply and the fiscal base of local authorities are a significant new contribution of this work.

## **2. APPRAISAL OF RESEARCH CAPACITY: The RUPSEA<sup>3</sup> Framework**

### University of Zimbabwe

- Department of Rural & Urban Planning: Mr. B. Mbiba
- Department of Geography: Dr. D. S. Tevera
- Department of Land Management: Dr. M. Rukuni
- Department of Agriculture Economics: Mr. G. Mudimu and Solomon Chigume

### University of Botswana

- Department of Environmental Sciences: Dr. Mosha

- Department of Town and Country Planning, Ministry of Local Government: Mr. R. Segodi

University of Malawi

- Department of Geography: Dr. B. Kaluwa
- Lilongwe City Council: Mr. A.J.C. Kawonga

University of Zambia

- Institute of African Studies: Mr. Mulenga
- Lusaka City Council: Mr. Peter Lubambo

University of Swaziland

- Department of Geography: Dr. Kalapula

Makerere University

- Institute of Social and Economic Research: Mr. Wahire Jossy Bibambanga; Samuel Zziwa and Daniel Maxwell.

Nairobi University

- Department of Urban and Regional Planning: Dr. Ndengwa
- Department of Land Economy: Dr. Joyce Malombe
- Mazingira Institute: D. Lamba, D. Lee-Smith

Dar-es-Salaam University, ARDHI Institute, Sokoine University of Agriculture

- Mr. Kironde, Dr. Materu, Mr. S. Mlozi, S. K. Mvena

Lesotho Ministry of Lands and Local Government. Physical, Land Use Planning Division and Institute of Land Use Planning

- Ms. Aaa Sekhesa, Ms. M. Jjabane, Matseliso Morapale-Mphale, Khaliso Matsepe

We have identified some of the key members of RUPSEA Network of which I am the Executive Secretary. There are many other institutions which we associate with in the region

and we think it would be possible to organize a regional research network on urban agriculture.

In the institutions identified, there is relevant expertise and research capacity. As a network, we have produced several texts and there is a journal which has been operational since 1990. We could provide a full profile of the members of the network in due course.

Within the different countries, there are varying capacities depending on the size of the country, the institutions of higher learning and levels of urbanization. Within the region as a whole, nongovernmental organizations have a longer track record in rural development rather than urban development. Except for Kenya, there are very few indigenous nongovernmental agencies on the urban scene. Those which operate on the urban scene tend to be biased towards the provision of shelter and services.

### **3. FUTURE RESEARCH OPPORTUNITIES**

In general, the Centre should support more long-term and primary research as opposed to short-term, consultancy-type research. This would benefit the researchers, most of whom are young and require time to develop their capacities. The Centre should facilitate cooperation between institutions through workshops and seminars held regularly on specific topics and subjects.

#### **3.1. Topic: Urban food production - nutrition systems within the context of rural-urban relations and dynamics.**

Most urban centres have a recent colonial origin and have been influenced by political/economic changes which took place at independence. Of significance was the removal of restrictions of the colonial city on rural-urban migration. The postcolonial cities are being shaped by new forces, which raises a whole range of questions on their planning and nature of activities. Urban agriculture, although not new in itself, is an important activity which has grown significantly with high urban growth. It is also part of the reshaping of the postcolonial city whose values are likely to be different from a typical colonial city. There is need for rigorous research on dynamics rather than simply documenting phenomena. Most research on urban agriculture tends to be superficial and is unable to instruct us on new trends or features of African urban development and planning. If cities prospered, would urban agriculture be an issue? If the countryside produced adequate surpluses, would urban agriculture be an issue? Is urban agriculture a response to conjunctural poverty?

We want to suggest that through the RUPSEA Network, a budget be provided by the Centre. There would be a planning workshop at which key researchers in the region would be invited to discuss and elaborate the proposed topic. Researchers would be invited to put forward proposals which reflect priority issues in their specific countries, which would then be considered by the coordinators before funding. A major outcome would be a workshop and a book to disseminate their findings. RUPSEA would provide the Secretariat.

### **3.2. Topic: City - specific studies on access to land, crop security and credit.**

This would also address the economic, legal and policy aspects. The case studies are proposed for the following cities: Nairobi (upgrading Mazingira data), Harare, Gaborone, Maseru, Windhoek, Dar es Salaam, Kampala. For each, there is a need for up-to-date aerial photographs of equivalent data, plus detailed questionnaires. The cases will provide not only contrasting urban agriculture experiences but also different town planning legacies. The research format would be more or less similar to the first proposal (3.1.).

## NOTES

1. In Zimbabwe there were other studies before this; the Mazambani D. (1982) study in particular. Incidentally it focused on the issues of peri-urban cultivation, wood fuel collection and energy in Harare; same themes in the Mazingira studies (1985).
2. IDRC sponsored Research (1983) on Urban Agriculture Research in Tanzania.
3. Association of Rural and Urban Planners in Southern and Eastern Africa.

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- (b) 29th December, 1991, p. 1 "Uproar Over Maize Slashing".
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## URBAN AGRICULTURE: SOUTHERN AND EASTERN AFRICAN REGION

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### INTRODUCTION

Urban Agriculture, just like other informal sector activities, has been conceptualized as a contrarian industry which grows against a cyclorama of deteriorating national economics. In the case of Southern Africa, this feature is an outcome of the current rates of urbanization in the region (see Table 1).

Table 1.

#### Urbanisation Rates in Southern Africa

COUNTRY	Urban Population (as a % of total population)			Average annual Growth rate (%)			Percentage of Urban Population					
							in largest city		in cities over 50,000		No. of cities of over 500,000	
	1965	1980	1987	1965	1980	1987	1960	1980	1960	1980	1960	1980
Malawi	5	10	13	6.6	7.9	8.6	-	19	0	0	0	0
Mozambique	5	13	23	8.5	11.5	10.7	75	83	0	83	0	1
Tanzania	5	17	29	9.1	13.4	11.3	34	50	0	50	0	1
Zambia	23	43	53	7.6	6.6	6.6	-	35	0	35	0	1
Lesotho	6	14	19	8.7	7.3	7.2	-	-	0	0	0	0
Zimbabwe	14	22	26	6.7	5.5	6.3	40	50	0	50	0	1
Swaziland	7	14	30	5.1	13.3	13.9	-	-	-	-	-	-
Botswana	4	19	21	18.4	10.3	8.1	-	-	-	-	-	-
Angola	13	21	26	5.6	7.0	5.8	44	64	0	64	0	1

Source: Osman (1990) p.5

It is quite clear that the region is experiencing fairly high rates of urban growth leading to problems of unemployment, poverty and homelessness. As economies have failed, urban agriculture has become an alternative. Thus its rise to prominence has been enhanced by the economic austerity measures being implemented by most African Governments. The economic structural adjustment programmes have stretched urban household economy to the limit. The urban low-income households have been affected the most and have sought to

supplement incomes and improve family nutrition through urban agricultural indulgence. While the concept and practice of urban agriculture is not new to Eastern and Southern African cities (Ledogar, 1978), there is a paucity in empirical studies to characterize this field. A review of some of the studies done to date ascertains some of the strengths and weaknesses of the research record. The premise here is that like other conceptual issues, Urban Agriculture is epistemologically determined within the larger or wider framework of agricultural activities in society.

## 1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES

Most of the studies have been carried within the context of three broad paradigms. The first group of studies falls within what we would term the planning paradigm. The epistemological significance of this is that the studies are preoccupied with landuse arrangements within the city and therefore relate to urban agriculture as a deviation from formally recognized or expected landuse arrangements within the city. Most of the earlier urban agriculture studies held under this paradigm dominated by planners and geographers are baseline descriptive studies of the location of agricultural activities in space. This bias towards spatial distribution seems to be a factor induced by the training in the planning and geographical distribution. Studies by Mazambani (1982), Lado (1991) and Bowa et al.(1979) are examples of studies answering the what and where questions in the city.

The second research paradigm to urban agriculture relates to the socioeconomic *cum* industrial geography of the city. These look at urban agriculture within the context of urban informal sector studies. We will not look at the epistemic foundations of urban informal economy here, suffice to say it has often been wrongly conceptualized as subservient to the formal economy. We look at the urban economy as a "whole" that has several parts complementing each other. Urban agriculture while not being entirely conceptualized as a preserve of the urban poor is seen as a survival strategy. The majority of studies done to date look at urban agriculture in this fashion. These studies conceptualize urban agriculture as a contrarian industry thriving as the economy takes a plunge and are mostly concerned with the why and how aspects of urban agriculture. Most of the studies by Rakodi (1985, 1987, 1988), Jaeger (1982), Lado (1990), Mazingira Institute (1985) and the study by Maxwell and Zziwa (1990) fall under this paradigm. Most of these studies, while being baseline, assume analytical overviews of urban agriculture practitioners.

The third research paradigm is essentially a hybrid of the two and perhaps forms the most comprehensive paradigm. These studies assume a holistic approach to urban agriculture. They look at locational and functional or operational dimensions of urban agriculture both as a land use and within context of the urban economy. The studies by Mosha (1991), Smit and Nasr (1992), ERI (1992) which look at the spatial attributes of urban agriculture as well as

the economic, ecological and social context of this indulgence fall in this category. It must be said, however, that the studies by Smit and Nasr (1992) and WRI (1992) do not specifically refer to the regional experience of Southern and Eastern Africa although in general they contribute valuable starting points.

From this classification, it can be said that a lot of baseline studies have been done under the informal sector studies banner. The paradigmatic significance of these studies is that they establish the baseline for Urban Agricultural Research in the region. Looking at their content, most of the published studies are on Zambian experiences although Kenya and Tanzania have had their experiences reviewed. Scant attention has been paid to urban agriculture in Zimbabwe, Botswana, Mozambique, Malawi, South Africa and Uganda. There is paucity of published information in these six countries.

### 1.1. Aspects and specific objectives best researched:

Most aspects of the URB Program's objectives have received scant attention. Significant contributions have appeared in the informal sector conceptualization of urban agriculture. These contributions are largely production oriented and look more at labor dynamics role of urban agriculture to the urban household. Most of these studies look at the location of urban agriculture activities and postulate reasons for the observed spatial patterns in urban agriculture. The studies largely concentrate on cultivation agriculture. The following conclusions can be derived from these contributions.

a) From the Eastern and Southern Africa Region experience, urban agriculture is an economic activity which in the majority of cases is not supported by most local government authorities except for tacit tolerance in Zambia, Tanzania and Kenya. In Zambia, Rakodi (1988) has shown that the modicum of interest shown to date falls short of requirements, while in Tanzania and Malawi urban agriculture is only tolerated in new cities which take cognizance of this activity in city planning (RCD, 1992; Mosha, 1992). The South African case is blurred by political forces although urban agriculture is prevalent in Black townships.

In Zimbabwe, the implementation of the city landuse plans with crusading overzealousness has suppressed this activity but not with success (Mazambani, 1982). It is not clear whether the paucity of urban agriculture practices in Botswana is a result of urban policy. In Mozambique, tolerance seems to have been a *de facto* gesture to allow food production to ease shortages caused by the war in the countryside.

b) It is apparent that potential for input supply abounds if officials change their attitudes with regards to urban agriculture. Major inputs are readily available and transport constraints are largely absent although the case input constraints still exist (RCD, 1992; Rakodi, 1985).

What is needed are credit facilities. This issue is complicated by the absence of security of tenure. Not much can be invested in a venture whose future is uncertain (Rakodi, 1988).

- c) There is barely any extension activity among urban agriculture practitioners. This is largely because as a land use, it has never been formalized and can therefore not expect official support services. Given these and other inputs, there is scope for intensification of production.
- d) Studies indicate that there are limitations in this venture. These range from theft, harassment by local authorities to shortage of water. With improvements in the water supply, there is scope for intensification of urban cultivation activities.
- e) While local authorities may be more tolerant to urban agricultural activities, legal paraphernalia inherited from the colonial era need to be changed as they are still hostile to urban agriculture (Mosha, 1991; Mazambani, 1982). RCD Consultants (1992) have shown that Zambia's Lusaka, and Tanzania's Dodoma are exceptional cases brought about by external aid considerations.  
  
It is only when it appears as an informal activity on vacant land (becomes a spontaneous activity) that it is deemed illegal. In its legal forms, urban agriculture is practised in backyard gardens, in peri-urban locations (as horticulture on land in transition).
- f) Cultivation activity in urban agriculture is an activity dominated by women whose motive for production range from income generation to supplementing family diet (Bay, 1982 and Rakodi, 1988). This factor has implications for future extension work and technology choice. RCD (1992) and Smit and Nasr (1992) also show that this activity also includes more youths and men than in rural areas.
- g) Most of the people involved in urban agriculture are from the low-income bracket (urban poor) who are therefore resource poor. With a modicum of inputs, however, they manage to make ends meet. RCD Consultants (1992) have, however, shown that middle and high-income groups also practise this for different reasons other than basic survival.
- h) Urban agriculture is mostly concentrated around homes and in vacant or infill areas (Mazambani, 1982; RCD, 1992; Mosha, 1991 and Rakodi 1985). Where rain-fed urban agriculture is practised on land unsuitable for building, this land is usually marginal and the likely impact of cultivation on some of these lands is not known. It is necessary to look further at the ecological impact of urban cultivation activities.
- i) Urban cultivation/agriculture is not only the preserve of the informal sector. Aspects of livestock production are also practised by some local authorities as secondary purification

of recycled water. Recycled water is used to water pastures for livestock production in peri-urban locations (Mwiraria et al., 1991). Horticultural activities in peri-urban locations where planning permission has been granted also exist in the urban-rural fringe zone.

j) Urban land use planning has tended to ignore urban agriculture and the needs of the urban poor. The design of urban housing for low-income groups ironically gives little space around homes for urban agriculture. Ways of providing land for urban agriculture will have to be found. The major constraint is that the cost of servicing of stands increases with the size of stands so provision of more land around homes would increase the cost of low-income housing. If security for crops is improved, making use of infill areas is an alternative solution. There is, however, need for participation of local communities in designing housing needs of the low-income groups. The case of Lusaka's squatter upgrading and Tanzania's new city Dodoma are perhaps cases in which local authorities have inculcated felt needs of the urban agricultural practitioners into city plans.

## **1.2. Aspects requiring further research**

A number of contributions to the urban agriculture discourse raise questions for further research. The first issue relates to the major input which is also a limiting factor to production: land. Perhaps the questions raised by Rakodi (1988) are pertinent to this issue since subsequent studies have not addressed these crucial questions.

It is necessary to ascertain how landuse zoning systems can accommodate urban agriculture. The approaches in question relate to whether this need for land should be satiated by increasing house stands for low-income groups or should land be set aside adjacent to these residential zones. This issue is also related to the development of a methodological framework which includes popular participation in plan preparation while providing scope for estimation of land for urban agriculture.

Very little is known about the actual production levels in urban agriculture. It is imperative that these be ascertained with a view to having them improved. Ascertaining production level within context of household needs provides scope for production constraints diagnosis and hence enables informed solution formulation. Particular attention may have to be paid to issues relating to extension and credit needs of urban agriculture with a view to having them addressed through a support system. This aspect is vital since an understanding of needs precedes any establishment of urban farmer support system.

In view of the paucity in studies on urban management and its impact on urban agriculture, it may be necessary for more studies to focus on styles of urban management and how they affect urban agriculture. Particular attention may have to be paid to pieces of legislation inimical to urban agriculture with a view to reconciling these with urban

agricultural practices when they are amended. It may also be necessary to look at enabling legislation that will be required to provide scope for support of agricultural activities in urban areas.

To avoid duplication of effort among existing institutions, it may be necessary to explore the effect of extending the mandate of farmer support systems to urban areas.

Fewer studies have attempted to look at ecological or environmental effects of urban agriculture although it is quite apparent that peri-urban cultivation takes place on land deemed unsuitable for building activities. The ecological impact of urban agriculture needs to be explored particularly its impact on water quality and general land degradation. This is important as it points to sustainability of urban agriculture over time. Related to this are explorations of the linkages between urban agriculture and fresh water withdrawal to see if it is sustainable. This can be broadened to look at possible contributions from wastewater utilization and soil management practices that make use of solid waste from urban zones.

An urban agriculture market study may be necessary to establish existing output disposal systems with a view to strengthening them and making them more reliable. Particular attention needs to be paid to market decision environment, competition and possible accessibility to official marketing channels through quasi-state bodies.

### **1.3. Interrelations between urban agriculture, water, waste and disaster:**

Adopting a systems approach to the study of urban geography often conceptualizes cities as open systems drawing resources from their surrounding zones (Smit & Nasr, 1992). Conceptualizing them as Islands of privilege, they receive resource inputs, process them and discharge residue as effluent waste. Urban agriculture provides scope for transforming urban settlements into self-sufficient entities moving towards a closed system. Instead of churning out effluent, it provides opportunities for recycling water and reclaiming land thus becoming an effective and productive way of waste management in cities. Since water and land are limiting factors to urban agriculture in cities of the region (Rakodi, 1988; Mazambani, 1982; Mocha, 1991), wastewater management and wasteland reclamation could ease these problems. Making use of water from secondary purification sources can enhance urban agriculture while at the same time reducing water consumption in the city. Reclamation of wasteland for use in urban agriculture improves the city scape. Added to this are nutritional gains resulting from improved food supply.

Let us take a closer look at some of the issues raised so far. It has been mentioned that wastewater can easily be utilized in urban agriculture, thus, easing the pressure on water in urban areas, since fresh water withdrawals for urban agricultural practices are unsustainable because the water is required for domestic purposes. This is particularly

pertinent in view of the fact that most cities in the Region suffer from inadequate water supply.

Zulu (1990) has shown that while the city of Dar es Salaam needs 80 million gallons of water a day, it has a 25% shortfall and the National Urban Water Authority (NUWA) has nightmares trying to meet this shortfall. Gumede (1990) has also shown in the case of Mozambique how the overstretched urban services have virtually broken down as economic woes brought about by the civil war and austerity measures take their toll on support services. A similar scenario exists in Angola, Uganda and Namibia. Zimbabwe, Zambia, Malawi and Kenya's cities are also bursting at the seams as drought and economic hardships force more people onto the streets. Recycling of waste offers opportunities for income generation among the urban poor while the use of wastewater reduces the strain on water supply in addition to purification cost reduction.

Wastewater in different stages of purification can be utilized in several ways as Smit and Nasr (1992) have shown. Most Third World cities already use wastewater to irrigate pastures for council agricultural ventures in the peri-urban vicinity. For example, in Zimbabwe, Harare and Bulawayo city councils own farms within the cities for this purpose. Instead of discharging wastewater directly into rivers it could be made more useful in this way. The councils generate income from these farms thus reducing the cost of purifying water. Problems have been noted, however, with the use of wastewater in urban agriculture, the most critical being the existence of pathogens and vectors which pose serious health hazards if not carefully handled.

Solid waste also forms a valuable input into some urban agriculture ventures. Contributions of organic solid waste to soil fertility need not be underscored within the urban areas where industries and residential areas churn out a lot of organic solid waste. Inorganic solid wastes are also useful in different ways. For example, some chemical residue are essential additives to the soil nutrient components. With proper waste management, urban wastes could be turned into valuable resource inputs for urban agriculture. This becomes particularly pertinent when we consider the volume of solid and liquid waste generated, e.g. Bulawayo generates 410 tons per day of solid waste (Mwirai et al., 1991:53). So far, we have only looked at how solid waste and wastewater relate to urban agricultural ventures as valuable inputs. Let us also take a cursory look at the likely impact of urban agriculture ventures on environmental quality. We concern ourselves here with water and aquatic life within urban areas.

According to the World Resources Institute (1992) existing evidence indicates that runoff of fertilizers, herbicides and pesticides into urban rivers or streams is a significant source of water pollution. RCD Consultants (1992) and Rakodi (1988) have indicated the widespread utilization of herbicides, insecticides, fungicides and fertilizers to enhance

production. In view of the enhanced runoff in urban areas due to tarmac surfaces and artificial roofs, there are high chances of increased water pollution in urban areas as a result of increased urban agriculture activities. Perhaps, there is a case here for alternative agriculture, in particular low-input agricultural systems which promote reduced use of chemical fertilizers and other chemicals. The use of a lot of chemicals in urban agriculture production has also been linked to the bioaccumulation of heavy metals and synthetic organic compounds in aquatic life, particularly fish. The WRI (1992) pinpoints agriculture as the leading nonpoint source of water pollutants like sediments, pesticides and nutrients especially nitrogen and phosphorous. It has been observed that regular consumption of fish and other aquatic products from contaminated sources is injurious to fetus development and has side effects on young children. Table 2 characterizes some of the ecological implications of aspects of urban agriculture.

Table 2.

## Sources and Impacts of Selected Pollutants

Pollutant	Source	Impact on Aquatic Organism	Impact on Human Health and Welfare
Sediment	Agricultural fields Pasture livestock feedlots, logged hills degraded streambanks road construction.	Reduced plant growth & diversity and reduced prey for predators; clogging of gills & filters; reduced survival of eggs and young smothering of habitats	Increased water treatment costs; transport of toxins and nutrients; reduced availability of fish, shortened lifespan of lakes, streams & artificial reservoirs and harbours.
Nutrients	Agricultural fields, Pastures, landscaped urban areas; raw & treated sewage discharges and industrial discharges	Algal blooms resulting in depressed oxygen levels & reduced diversity and growth of large plants; release of toxins from sediments, reduced diversity in vertebrate and invertebrate communities; fish kills.	Increased water treatment cost; risk of reduced oxygen-carrying capacity in infant blood; possible generation of carcinogenic nitrosamines; reduced availability of fish, shellfish & associated species impalement of recreational uses.
Toxic Chemicals	Agricultural runoff Municipal and industrial discharges Leachates from landfills	Reduced growth and survivability of fish eggs and young; fish diseases.	Increased costs of water treatment; increased availability and healthfulness of fish, shellfish and associated species.

After WRI (1992) p.162

It is apparent from Table 2 that if not carefully designed, urban agriculture can lead to an urban ecological disaster. The gains obtained through the fungible use of self-produced food (RCD Consultants, 1992:21) could be lost due to the increased water treatment costs being passed on to the consumers.

Mosha (1991) has also shown that uncontrolled livestock keeping practices within urban areas have resulted in several negative externalities in urban life quality. Dumping of animal dung in house compounds along roads and other vacant land is common place. The result is that flies and other bacteria thrive (particularly the tetanus bacteria), compromising the city health. Besides this, urban livestock in Dar es Salaam has exposed people to zoonotic diseases like tuberculosis, leptospirosis, anthrax, salmonellosis and brucellosis. If not carefully controlled, urban livestock production can turn out to be a health hazard with disastrous effects. Before calling for radical transformation in attitudes towards urban agriculture, it is imperative that detailed research be carried out to clearly understand the ecological implications of this venture which, while being economically sound in the short term, may end up being a classic case of ecological disaster in the long term. Such statements emanate from the realization that the urban environment is an artificial one and ecological systems there have already been changed and may be in a state of flux.

## 2. APPRAISAL OF RESEARCH CAPACITY

From the modicum of contributions to urban agriculture research, it is possible to identify several research organizations and institutions. Perhaps as a starting point one could look at the Association of Rural and Urban Planners in Southern and Eastern Africa. Affiliate organizations and individual scholars have made significant contributions to urban management studies. The Association of Rural and Urban Planners in Southern and Eastern Africa runs regional workshops and disseminates information through its publication, the *Review of Rural and Urban Planning in Southern and Eastern Africa*. Affiliate institutions and scholars working under its auspices include:

Prof. A. R. Mosha  
University of Dar es Salaam  
ARDHI Institute  
Tanzania

D. M. Kiamba  
Department of Land Development  
University of Nairobi, Kenya

Mazingira Institute, Kenya

Dr. R. M. K. Silitshena  
Department of Environmental Sciences  
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Prof. P. S. Maro  
University of Swaziland

Dr. E. S. Kalapula

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Makerere Institute of Social Research  
Makerere University  
Uganda

Chancellor College  
Malawi.

Eduardo Mondhlane University  
Mozambique.

Most of the institutions and contact persons listed above have either published some literature on urban agriculture or have done some research in urban management. It must be mentioned, however, that most of these institutions have only paid scant attention to urban agriculture. Perhaps the most notable effort is the case of Kenya where NGO initiatives through the Mazingira Institute characterization study of urban agriculture. The University of Dar es Salaam's ARDHI Institute has now taken interest in the urban agriculture practice. If recent contributions by Mosha (1991) are indications of growing interest, the case of Zambia is however more interesting. Rakodi has been able to do a series of surveys in Lusaka through ODI funding. Students from University of Zambia have also done several projects on gardening activities. Substantial contributions have also come from the Institute for African Studies' Urban Community Research Unit at the University of Zambia. One student has actually written a Ph.D dissertation on "Urban agriculture: A Strategy for Survival in Zambia", University of California in Los Angeles (Sanyal B., 1984). Notable contributions have come from Makerere University's Institute of Social Research. In the case of Zimbabwe, the only notable contribution has come from D. Mazambani (1982) who wrote an M Phil dissertation on peri-urban cultivation, submitted in the Department of Geography at

the University of Zimbabwe. The department of works of the Harare City Council has however carried out snap surveys although these are poorly documented. Drakakis-Smith (1991) has done quite some work on food supply in Harare but scant attention is paid to urban agriculture. There is however extensive coverage of this activity in newspaper reports. The reports concern themselves with urban management responses to this practice.

The cases for South Africa, Malawi, Namibia, Angola and Botswana are largely void of published studies on urban agriculture. Perhaps, as a starting point, state-of-the-art papers are a necessity. Correspondence with contacts in South Africa indicates that the University of Natal's Centre for Social and Development Studies has done some work within the framework of urbanization and informal sector studies.

There are no courses on urban agriculture offered at most institutions in the region and a look at agriculture, economics, planning, geography and sociology courses outline and content shows that no attention is ever paid to urban agriculture. Scant attention is only paid to it in informal sector studies. In view of the contribution of urban agriculture to the urban economy there is perhaps a case for support to more research initiatives in this area. As a starting point, what is perhaps required is institutional support to research organizations and institutions to fund the research initiatives.

In our view, there should be support for both fundamental and applied research in all the institutions. What is required in the subregion as a start is fundamental research that leads to comprehension and explanations of observed agricultural practices from a theoretical point of view. Theory research could concentrate on location/spatial and socioeconomic aspects of the practice. This is perhaps what is required for long-term social and policy orientation. On the other hand, armchair theoretics or ivory-tower dwelling that does not look at the practical relevance hampers progress. Operationalization of some of the fundamental research contributions should match this effort on the ground. We argue here for a balance in fundamental and applied research. We seek evaluative theories that integrate social processes with spatial form. Perhaps the concept of phenomenology provides scope for this envisaged integrative theoretical framework.

### **3. FUTURE RESEARCH OPPORTUNITIES**

#### **3.1. State-of-the-art papers**

Since relatively few studies have been done concerning urban agriculture in the region, as a starting point what is perhaps required are state-of-the-art surveys by country. These surveys (which can exclude Kenya, Tanzania and Zambia, because these seem to be known cases already) should address themselves to the following questions.

- What types of urban agriculture exist in the cities and what is the motive for production?
- Who practices urban agriculture? Are there class differences? If any, define and characterize these.
- Where does urban agriculture occur in the cities and what is the type of response from local authorities?
- Are there any institutions which support urban agricultural activities (input supply and output marketing)?
- Appraise the management and legal paraphernalia with regards to "enabling" or "curtailing" urban agricultural activities.

These state-of-the-art papers could then be presented at a regional workshop. Using existing literature, there are several issues raised which could be pursued further in the region.

**3.2. Title: Decolonising urban management practices in Zimbabwe. Institutional *cum* legislative paraphernalia and urban agriculture: Towards a convergence and symbiosis in an urban economy.**

**Research problem:**

Tenants of colonial urban administration and management which are embedded in the Regional Town and Country Planning Act (1976) are generally hostile to urban informal sector activities and in particular landuse economic activities deviating from rigid plans. This hostility occurs against a background of a declining national economy and an increasing or thriving informal sector. This study seeks to work towards an enabling environment for the informal landuse activities, particularly urban agriculture.

**Research questions:**

- How important is urban agriculture to urban economies in Zimbabwe (to whom is it important and in what ways)?
- What constraints are faced by the practitioners?
- What responses has it elicited from local authorities?
- What institutional and legislative support exists for such practices (input supply and output marketing)?
- How can an enabling environment be created?

**Objectives:**

- a) to determine the economics of urban agriculture in major Zimbabwean cities;
- b) to identify institutional and legislative constraints to urban agriculture; and
- c) to determine how best to enhance urban agriculture in Zimbabwean cities.

A participatory approach will be used to execute the research process. This will entail working closely with the urban farmers to be able to fully conceptualize their activity environment. This approach has been successfully utilized among rural communities elsewhere in Zimbabwe in surveys done by ENDA-Zimbabwe. A multi-method research methodology will be utilized to capture the required information.

**Expected results:**

- Policy recommendations on how best to create an enabling environment to make cities produce their own food.
- Better understanding of urban agricultural practices constraints and prospects for improved performance.
- Theoretical contributions — characterization of urban agricultural practices.

**3.3. Title: Use of agrochemicals in urban agriculture and its possible ecological effects.****Research problem:**

Urban agriculture practitioners are thought to use more chemical inputs to enhance production on the limited amount of land available. It has been observed that because they have easy access to these chemical inputs urban agriculture practitioners use more inorganic chemical inputs than their rural peers. The efficiency of use of these is not known since no production studies have ever been done. Similarly, the possible ecological effects of those inorganic chemicals have never been determined in cities of the subregion. This study aims to determine the use and use patterns of the inorganic chemicals in urban agriculture. It is also hoped to determine if there are significant differentials in production levels among the various practitioners of urban agriculture.

**Research questions:**

- Which urban agriculture indulgences require chemicals most?

- How do the practitioners obtain chemicals and who teaches them on use? What are the use patterns?
- Are there significant differences in production levels between the families which use chemical inputs and those which do not?
- What are the likely impacts of the use of these on the urban ecology?

**Objectives:**

a) to determine the nature of use and use patterns of chemicals inputs in urban agriculture;

b) to determine production variances among user and non-user groups; and

c) to establish the possible ecological backlashes of increased use of chemicals with a view to coming up with policy recommendations on the use of these within urban environs.

**Expected results:**

- Policy recommendations on the forms of urban agriculture harmonious with urban ecological concerns.
- Policy information on ecological/environmental monitoring of urban agricultural practices.

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# **URBAN AGRICULTURE: WEST AFRICA\***

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## **INTRODUCTION**

Urban Agriculture (UA) in West Africa has been the subject of several publications, more or less closely linked to systematic research programs. However, they contain very few definitions of the many concepts used to define the areas and activities involved.

With regard to the areas, some authors only consider urban strips and inner courtyard plots, while others also include larger peripheral urban areas, i.e. border locations. Clearly, the separation between town and country is not always clear in the peripheral sections of the town.

The scale of activities also varies, from family kitchen gardens and classical market gardens to agricultural activities like those generally performed in rural areas during the normal rainy seasons (basic grains such as millet, corn, etc.) and animal husbandry. Contrary to Central or South-Western Africa, there are few studies dealing with animal husbandry in West Africa.

These differences in defining the subject are often the result of the specificity and, above all, the scale in which the problems are perceived and posed at the national level. This diversified perception always appears in the form of a duality, mainly in the context of formal/informal, legal/illegal economic activities, stressing aspects of employment/unemployment, survival strategy/rural-urban poverty, etc..

Approaches to the problems are many and varied, but in-depth and comparative research on all the aspects is rare, and the social perspective remains dominant.

## **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

### **1.1. Aspects and objectives best researched**

Generally, most research attempts to establish correlations (by intuition in some cases) between several aspects in the history of the country's economic development, urbanization trends and the appearance of UA. In fact, this type of reasoning is applicable to all the

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Editor's note: this document was translated from French.

survival strategies noted during the postcolonial period in developing countries, particularly in Africa: rural exodus, the appearance of shanty towns, extensive growth of the informal sector in different areas of activity, etc.. This removes any specificity in the analysis of UA.

- a) Links between the increasing impoverishment of the country, rapid urbanization, rural exodus, and urban agriculture:

Various reasons are, for many authors, the more or less immediate source of the appearance of UA. These reasons include the international macroeconomic environment which, for several years, has been unfavorable to developing countries, particularly through the price fall of agricultural export products in essentially agrarian economies, as well as climatic factors. Urbanization and rural exodus constitute two sides of the same coin in this chain of poverty. UA is therefore a survival system for social groups threatened by economic conditions (low income level in urban areas; seasonal migration of rural inhabitants progressively turning into permanent migrants).

The objective aimed for in using the above aspects is very often found in a social perspective: improvement in the assimilation and survival of these social groups in the urban environment, a better understanding of the role they play or could be made to play in the larger framework of urban management.

- b) Links between the decline in local food production, changes in urban lifestyle, unemployment and urban agriculture.

In addition to the above-mentioned survival strategy, some authors emphasize the adaptation of UA to certain characteristics of urban life in transition: a break between rural production and urban consumption, marked by the need to supply less expensive European-type market products (green beans, green peppers, tomatoes, etc.). Thus Bamako, capital of Mali, would be self-sufficient in vegetables because of urban market gardeners [7]. The same applies to essential provisions for the city of Lome, where competition of other origins exists: neighboring villages, importation of specific products from Burkina Faso, Niger, Mali, and Europe. UA would then be generating income and employment in an urban environment through a network of interdependent activities connected to it. These peripheral activities are found in the artisan production sector (blacksmiths, masons, carpenters, etc.), as well as in the services (transportation of fertilizers, phytosanitary products and seeds, repair of motor pumps, etc.) and marketing sectors [8].

This aspect of the problem makes it possible to approach an important objective for most research, namely to find the main actors in the area of production as well as their socioeconomic characteristics (origin, other activities, income and spending, sociological,

economic and cultural organization). In brief, the researcher must often reconstruct manpower training methods and the rationality behind its continuity.

c) Impact of urban agriculture on the quality of nutrition among marginal groups:

Implicitly, but also made obvious through research, marginal groups are predominant in UA. A possible positive aspect of this supposed implication would be the improvement of nutritional conditions in this environment. Even if this idea is attractive, however, it is not well supported by prior and subsequent data on the situation of the people involved. It should also be mentioned that the initial work on UA was done mainly by geographers and urban managers whose main interests differed from those of the nutritionists.

d) Status of areas and activities.

UA is developed in areas that, generally, have a precarious status and whose development or distribution in the town often depends on the unilateral ideas of municipal authorities or specific urban management institutions. Land under the authority of these legal institutions is used without formal authority but with a varying tolerance which is not always backed by rationality. Thus, the market gardens that have long been tolerated in Bamako, incited some people to grow grains (millet, corn, etc.) on interstitial strips in the towns with successful results. From 1989, the authorities prohibited this practice, since the high stalks created a bush which served as refuge to thieves [3]. The most often cited example in this context is Bafoussan in Cameroon, where the mayor arranged for the corn to be cut in order to clean up the town during the Seventies [2].

Land is very often free in the interstitial areas. However, often complex rental systems have been developed through the succession of occupants or the informal involvement of administrations in the activity. Leasing is also common between land owners and producers (Lome, Lagos) [1, 8]. In the latter case, the profitability of using this land for housing projects —not at all comparable to the profitability of UA— determines the risk of the activity.

The status of the activity varies, in contradiction to a premature classification in the informal sector which, nevertheless, remains the most current. In fact, in Zaire, the government has promoted it to an official project, supported by outside funding which has made it possible to subsidize water and drainage access for a certain period of time [16]. In Nigeria, the government has considered UA so important, that it has made all inputs tax-exempt (fertilizers, seedlings, etc.) [1]. For the majority, however, UA is simply an activity that is tolerated.

e) Water access and sanitary problems:

Water is essential for UA. For this activity, often considered on the borderline of profitability, access to low-cost quality water in the city raises enormous difficulties. The use of traditional wells is current practice in many towns located far from a river. Lacking a simple solution, some stopgap measures like using polluted water, expose the producer as well as the consumer to potential danger. One could mention, as an example, the use of wastewater to irrigate crops in Cambérène and Yoff (Dakar/Senegal) [10] as well as in some areas of Lome [8].

f) Competition and/or synergy of urban agriculture with other aspects of Urban Management:

Housing development, the cleanup and use of urban waste, the beautification of the city and many other aspects of urban management may be in conflict with or complementary to UA. Much research emphasizes the complementarity, particularly in the treatment of solid waste [4, 5, 10, 14, 15, 18].

## 1.2. Aspects deserving in-depth research:

a) Assessment and overview of urban agriculture:

Some systematic research has been conducted on UA to define several aspects simultaneously; for example, agronomic and socioeconomic aspects [8], the development of prices, markets and financial profitability [1, 21, 22]. However, such works are rare and fail to cover this aspect of the problem sufficiently.

Certain authors have discussed whether there is a need for the government to pay interest to the role of UA in a global agricultural policy, and to planning perspectives [23]. However, the studies generally pose the same problems as those of any other informal activity, and suggest the same policies to solve them. UA is, consequently, perceived as a perverted effect of bad development, and could not have a specific solution outside of macroeconomic considerations.

UA is also presented as a "glorification" of the ruralization of Third World towns, contrary to searching for a modernization of the countryside. The major contradiction here is easily seen: considering other alternatives (imperative) for developing rural areas, what are the real opportunity costs of a policy for increasing UA (presupposing the absence of physical constraints)?

This partly global debate clearly poses the question of the interest and limits of UA in the organization of urban areas. All the perspectives should take the following aspects into account:

**b) Environmental impact of urban agriculture:**

This topic remains to be explored. A few leads can be mentioned. In fact, small cultivated areas (generally less than 1 ha) could involve the very intensive use of fertilizers by a work force that has little or no qualifications or training. Underground and surface water could be affected. The same applies to products. UA can also carry positive environmental aspects. One could quote Zaire authorities who estimate "that it has contributed to preventing soil erosion and even landslides in Kinshasa" [20].

**c) Technology used:**

It should be noted that UA everywhere uses rudimentary technology, similar to that of subsistence agriculture. By this fact, it perpetuates the production methods which set a negative example for the areas where migrations towards the city originated. In addition, the precariousness of the status of the areas and of the institutional nature of the activity, as well as the results expected from such small areas are not conducive to investments in high-performance technology. This dilemma should also be the subject of thorough study.

**d) Lessons to be learnt from developed countries, and from Asian and Latin American countries:**

A study of the history of developed nations and of countries where the transition is at a more or less advanced stage in relation to Africa, is to be recommended. Research conducted on UA with comparative historical references could indicate some leads and avoid time loss with regard to methodology and content. Initiatives taken at certain points in the evolution of societies familiar with the phenomenon of UA before Africa must be analyzed in the context of current realities.

## **2. APPRAISAL OF RESEARCH CAPACITY**

Our documentation shows the existence of a major research capacity in West Africa. However, it is less certain that it can be summarily assessed without an update of the personnel currently available in several centres, some of whom may have experienced more or less significant changes.

We are, therefore, suggesting a preliminary list without giving any particular indications as regards the expertise. We are basing it on more or less recent experience and renown at a national or international level.

### **2.1. Agronomic research centres**

Although generally focusing on agriculture outside urban centres, agronomic research centres, linked to the departments of agriculture of various countries and often with major outside collaboration (notably with ORSTOM, a French agency), have a good reputation as experienced institutions. This is the case with ISRA in Senegal, the "Commission de la Recherche Agronomique" in Mali, INRA in Niger, and equivalent centres in Burkina Faso, Guinea, etc.. Intergovernmental agencies, such as the Centre AGRHIMET of Niamey, Niger, should be added to the list. We know less of their involvement with the URB Program's concerns. The participation of the Mali ministry of rural development in the study of the development of a market garden belt around the town of Bamako (December 1981) should, however, be emphasized. It is therefore likely that a similar study, i.e. an update of the situation in this area, could be of interest to them.

### **2.2. Market garden research centres**

Not all the countries in the subregion have this institution. It is probable, however, that such an agency would be very useful at a strictly national level. This is the case of the Cambérène research centre in Dakar, Senegal, whose role has been recognized in the quality improvement of simple market garden produce (short cycle) as well as of the orchards (long cycle) which increasingly supply the fruit consumed in the Senegalese capital. It would be advisable to investigate whether such agencies exist and which of their institutional strengths and weaknesses would be of interest to the proposed research.

### **2.3. Nongovernmental organizations (NGOs)**

There are many NGOs in the region whose primary concern is market gardening in rural areas. The opening of this activity in urban areas came before the proliferation of NGOs, and the approaches are completely opposed in their respective orientations. In urban areas, the activity is identified more as a small business while, in the rural zone, it is introduced and sustained at length among the population by the NGOs as a diversifying process of seasonal activities and nutritional improvement. However, the NGOs remain an excellent source of human skills for conducting research on the URB Program's theme. We would suggest that a list be established of NGO associations through a brief national survey.

ENDA Tiers Monde has long experience in urban management through several of its teams, and it could offer valuable contributions to this research program. The organization

also has several partners in the subregion, who could prove useful (Benin, Mali, Niger, Togo, Guinea, Ivory Coast, etc.).

The time available for this brief summary unfortunately does not allow for more recent data collection on these institutions, particularly their partners at the local, national or regional levels.

### **3. FUTURE RESEARCH OPPORTUNITIES**

The following two research ideas are mainly taken from the paragraph on topics to be the subject of thorough study.

#### **3.1. Assessment of urban agriculture in some countries of the subregion:**

Any proposal for a short-, medium- or long-term policy in the area of UA requires an explanation of the current function of this activity from the economic, social, cultural, etc. viewpoint, resorting to quantitative and qualitative data, actors, game rules (explicit or implicit). The capital of the country will be mostly affected by this research. The objective is to provide an informed opinion to the decision maker on the exact role that UA plays and could play in the economic and social policy of the country. The expected results must indicate when, how and where to encourage or discourage UA. Beneficiaries will be all the above-mentioned social categories involved in UA. Authorities will also benefit from explanations of the status of the land and the formalizing of relationships between producers and the government.

#### **3.2. Environmental impact of urban agriculture:**

Two phenomena will be increasingly combined in UA: the intensification of cultivation in small areas and, as a corollary, the use of various fertilizers, some of them chemical, and the difficulty of obtaining clean water for irrigation, particularly in urban strips. Environmental problems can then occur, and some research in this area would be useful. However, agriculture can provide opportunities for the urban environment: recycling of waste, undefined spaces developed and made green through this activity, etc.. At the same time, the results of this research will be applicable to urban public health, particularly of groups involved in UA, as well as to the decision makers for urban planning.

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## URBAN AGRICULTURE: EAST AND SOUTHEAST ASIA

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### **INTRODUCTION**

Urban agriculture is one of the most neglected dimensions of development in Asian cities, notwithstanding its obvious importance for the sustenance of the cities themselves and the quality of life of their inhabitants. To date, very little in terms of systematic research has been undertaken and what little research has been conducted has not elicited widespread attention from scholars, planners or policy makers. It is relevant to note the efforts of the Resource Systems Institute of the East-West Center in Honolulu in food and energy research in Asian Cities (Bardach, 1982, 1984), and a five-country project on the Effects of Rapid Urbanization and Population Change on Food and Fuel Requirements in Asia (Pernia, Ogawa and Wirosuhardjo, 1984). The latter project involved the participation of researchers from Indonesia, Japan, Korea, the Philippines and Thailand and was funded by the East-West Center. As far as could be perceived, the generative impact of these efforts for further studies by researchers has been weak, leaving aside the question of any direct influence on policy-making. Even the most laudable and almost messianic efforts of Isabel Wade of Urban Resource Systems in San Francisco have not led anywhere (Wade, 1981, 1984). In the belief that there was something the Urban Policy Program of the IDRC could contribute to this research gap, a project development meeting was organized in ASRO in 1983, but for various reasons a fundable project did not come about. In an effort to take stock of developments in the field and building on IDRC's limited involvement in 1983, Yeung (1985) completed a state-of-the-art review on the subject for Asia.

Three reasons may be proffered for the relative lack of interest from researchers willing to venture into this subject. First of all, urban agriculture does at first sight appear to be a contradiction in substance where, under usual circumstances, agriculture is practised in rural areas. There is indeed, on the surface, relatively little that can be done, let alone researched. It is unthinkable for many to believe that urban farming can be of any significance in crowded and land-scarce Asian cities, particularly in large cities such as Tokyo, Seoul, Hong Kong, Singapore and Taipei, and in the central urban areas. People living in these dense urban environments simply do not find land or time to engage in any sort of food-producing activities. Whatever free time they might find, they would pursue leisure or recreational activities. To researchers and policy makers alike, urban agriculture is not a subject high on their agenda for attention, action or funding. This attitude pervades in many Asian cities. The second reason for the relative lethargy to the subject is that urban agriculture is one that is concerned with the urban poor for the most part, as they can use homegrown food to supplement their income and household resources. Even if planners

wanted to help, there would be little they could really do since urban farming needs land, which should best be left to the devices of the poor to identify and access on their own. Thirdly, the scientific and technological aspects of food production within cities, such as improved methods of pig farming, new breeds of chicken for higher yields, and practical ways of helping fish farms to minimize loss from water pollution, appear to be well developed. These studies are focused primarily on production and efficiency and rarely venture into socioeconomic domains.

As far as the objectives of urban agriculture as identified in the URB Program document are concerned, it is not an exaggeration, based on the comments made in the previous paragraph, to say that none can be viewed as well researched. The program has correctly identified the removal of social, economic, cultural and environmental obstacles as the primary step in advancing urban agriculture in Asia, as Yeung (1985:39) has also argued. The actual and potential relations between water, hazard, waste management and urban agriculture should as well be explored, but in my view these should be considered as additional payoffs and widened perspectives in approaching the subject. They should not, however, be constraints or prerequisites in themselves in approaching studies in urban agriculture.

## **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

In respect of outstanding studies on urban agriculture, it should be prefaced by a clarification that although studies on urban agriculture as such are not plentiful, many studies bearing on food production and distribution of various kinds are found in many cities in Asia. James Jackson (1979) has studied daily food markets in Greater Kuala Lumpur and Cheng Lim Keak (1981) has examined fresh food supply in Singapore. Yeung (1978) has studied the night markets in Singapore, which have been phased out but at the time of their operation did play a role in food distribution. T.G. McGee and Y.M. Yeung (1977), moreover, documented the results of a six-city study on hawkers and vendors in Southeast Asia supported by IDRC, in which food distribution by the informal sector was shown to be not only important but to provide, as well, an avenue for productive employment for many people. The best study of an Asian city in terms of the relation between food and energy is one undertaken in painstaking details and over time by an Australian team on Hong Kong in the late 1970s, as reported in part by Newcome (1977). The study was scientifically and carefully conducted, with a great deal of documented results. Yet even such a study did not appear to have any lasting impact of note, on Hong Kong itself or the academic community. Looked at in a broader ecological setting, Chinese cities have attracted considerable research interest because of their ability to feed their populations within their urban regions, as studies by Hawkins (1981) and Skinner (1981) have shown. In the Pearl River Delta, an efficient ecological cycle of combining mulberry/pig/fish production through construction of dykes

and ponds has been perfected (Zhong, 1980), although recent rapid economic development consequent to the open policy has created changes to the age-old pattern. All these studies have relevant information that can be utilized for policy-making in respective cities and countries.

As to specific work on the science and technology of food production in urban settings in Asia, much has been achieved. This kind of work is primarily undertaken in universities or research centres. For example, S. T. Chang, of the Department of Biology at the Chinese University of Hong Kong, has pioneered in the production of mushrooms and has been recognized in his work by United Nations organizations and Chinese researchers. K.C. Lam and K.C. Chau, of the Department of Geography at the same university have been engaged in research to use organic waste to effect soil modification to improve vegetable growth. Similarly, Daniel K.O. Chan, of the Department of Zoology at the University of Hong Kong has achieved equal distinction in his research on the eel over several decades. The Primary Production Department in Hong Kong is always active in improving ways of rearing livestock, and of producing fish and vegetables. Recently a new way of treating piggery waste was experimented with success and has helped control water pollution in water catchment areas. These are several noteworthy attempts within Hong Kong and similar research has been ongoing in other cities in Asia.

Regarding scientific and technological work on agricultural production, the work of several research institutes in Taiwan warrants specific mention. These include the Agricultural Extension Centre of the Taichung District Agricultural Improvement Station, with outstanding work on hydroponics; the Chinese Society for Horticultural Science in Taipei; and the Asian Vegetable Research Development Centre in Shanhua. Research undertaken in these and other centres have accounted for Taiwan's continued progress in agricultural products for local consumption and export. Taiwan, for this reason, essentially monopolized the world market in dwarf corn and certain breeds of mushroom.

Following the realization of market potential in the wake of the open policy in China, many Chinese cities are also actively improving their agricultural products through research and exchange of information with outside scholars and bodies. The aspirations of the Chan Fong Lau Chee Experimental Farm in Dongguan, Guangdong to become the largest and the best lychee production centre in the world is a case in point. In 1992 more than 5,000 trees of lychee were planted in the farm but as lychee is a highly perishable fruit that has to meet the discriminating taste of the consumer in terms of water and sugar content, size of seed and texture, much research needs to be undertaken on improving quality, marketing and distribution. In China, scientific research on food crops, vegetables, trees and fish is facilitated by the existence of a network of agricultural universities that are found in many large cities. Many academic journals and popular magazines are published on a variety of agricultural topics.

The URB Program document outlines a list of potential subjects for research in urban agriculture. They are all important issues worthy of research support. However, one dimension that is not adequately addressed in the document is the need to promote attitudinal change among researchers and policy makers in their perception of the role of urban agriculture. As the URB Program document is conceptualized, the problem is intertwined with issues of the urban poor and disadvantaged population groups. In other words, the social and perceptual aspects of urban agriculture constitute a critical focus of urban agriculture if this component of urban development is ever to elevate itself in importance in policy-making circles. It is not an easily researchable dimension but it should not be neglected. This can also be built into any research design.

Lastly, regarding the possible interrelations existing between urban agriculture, water, waste and disaster in East and Southeast Asia. It is difficult to generalize, but depending on what aspects of urban agriculture is in question the links can be established. The Hong Kong nutrient study referred to earlier, for instance, showed the strong connection between use of organic waste and pig rearing (Newcome, 1977), and the most efficient ecological cycle developed in South China also referred to above harnesses organic wastes from fish and pigs to good effect and in the process, nothing is wasted (Zhong, 1980). Although the interface between urban agriculture and the other key elements is important, it should not, in my opinion, occupy the central position in our approach to urban agriculture issues.

## **2. APPRAISAL OF RESEARCH CAPACITY**

Although five research foci have been identified in the URB Program document in the proposed program for urban agriculture, it is considered more appropriate for this section to list relevant institutions and researchers by country, with some comments on their capacity and track record, so that when decisions are necessary for involving any of them, an assessment may be made of their appropriateness on this basis. It should be stated at the outset that the record of research on the scientific and technological aspects of food production in the region is much stronger than that on community participation and the urban poor in urban agriculture, as emphasized by the program. An incomplete listing of institutions and researchers in East and Southeast Asia may be found as follows:

### **CHINA**

China is a vast country with many talented and devoted researchers in many institutions having interests in researchable subjects of every description. I have not exhaustively searched for individuals who have interest in the subject but the several feelers that were sent out have turned in the following names, with a bias towards South China

because of geographical proximity to Hong Kong. It must be emphasized that many other potential researchers and institutions exist in China.

- Chi Juqing, Director and Associate Professor, Scientific Office, South China Agricultural University, Wu Shan, Guangzhou. He has extensive experience in general agricultural research.
- Li Naiqiang, Director of Guangzhou Fruit Research Institute, Vice-Chairman of the Guangzhou Society of Agricultural Science, Guangzhou. He is an agronomist by training and capable of researching on fruits.
- Zhang Shanwei, Professor, Fruit Tree Research Institute of Guangdong Academy of Agricultural Science, Guangzhou. He specializes in lychee research and development.
- Wu Shangshong, Professor who is trained in plant pathology, based in Guangzhou.
- Ning Yue-min, urban geographer who has written one of the first urban geography textbooks in China, has broad interest in the development of Shanghai. Based in the Department of Geography, East China Normal University, Shanghai. Young and dynamic, he should be a good person to involve in any urban agriculture study in China, particularly in Shanghai.

## S. KOREA

Several researchers from Korea have interest in urban agriculture and are described below:

- Ki-suk Lee, urban geographer and Associate Professor at Seoul National University, with a Ph.D. from the University of Minnesota. He has broad interests in urban and regional development of Korea and has published on the urban development of Seoul. A serious and able researcher who led the IDRC-supported study of export-processing zones project in Asia for Korea.
- Shin-Pyo Kang, American trained anthropologist who has broad interests in development. In a recent academic meeting in Beijing, I was impressed with his enthusiasm in field work and line of questioning while we visited a former commune, now called a village, specialized in vegetable growing. The village was called "Four Season Spring." He is from the Department of Anthropology, Hanyang University, Seoul.
- Kim Son-ung, American trained sociologist who previously worked for the Korea Development Institute when I met him. He was coordinator of the IDRC-supported study I

developed on factory workers in a new town near Seoul. He has since been with the Department of Sociology, Hanyang University, Seoul. He is a capable researcher, willing to explore new fields.

## PHILIPPINES

In recent years many NGOs or consultancy groups have sprung up which have conducted interesting research work. Thus in the Philippines one should look at usual researchers from universities as well as such sources.

- Alejandro Herrin. He was previously involved along with two researchers in a food and fuel project for the Philippines. He was based at the University of the Philippines and can be considered a researcher for potential involvement.
- Cayetano Paderanga, Jr., Professor of Economics at the University of the Philippines trained initially as a geographer. He worked previously at UNCRD, Nagoya and has valuable international collaborative experience. One of his latest interests is the extended metropolitan region of Manila, within which many urban agricultural activities take place.
- Nap Jamir, a researcher from an NGO who reported in 1983 on a most interesting case of a short-lived but innovative experiment of urban agriculture in Manila - in fact in a small district called Matalahib within Manila. It would be useful to find out if his group or himself have maintained an interest in the subject. Mr. Jamir was Founder and Technical Editor of Earthman Society, Manila.
- Jose Antonio League, of Urban Planning and Urban Management Consultants, is an able researcher who has worked on urban management issues in Manila. He would be a potential candidate for consideration of urban agriculture studies in Manila.

## HONG KONG

I would not repeat some of the names already mentioned above on the scientific research on different aspects of food production. However, I would mention the following having possible interests from the viewpoint of urban agriculture.

- Tang Wing-shing, geographer at the Chinese University of Hong Kong has done most of his research on Chinese cities. He was trained in Toronto and Cambridge and has youthful enthusiasm to do research. He should likely have an interest in urban agriculture in Hong Kong.

- Rebecca Chiu, urban geographer who obtained her Ph.D. from Australian National University now working as Lecturer in the Centre of Urban Planning and Environmental Management at the University of Hong Kong. She has worked largely on housing issues in Hong Kong and China, but her broad interests in urban issues could conceivably take her to a new field.

## THAILAND

I would mention three possibilities in this country where much scope exists for urban agriculture, two in Bangkok and one in Chiang Mai.

- Pawadee Tongudai, Economics Professor at Thammasat University in Bangkok. She was trained in the U.S. and has an excellent track record of research on Bangkok. She was previously involved in a multicountry study on urban food and fuel in Asia and should still be interested in doing more work.
- Watana Isarankura, Associate Professor of economics at the National Institute of Development Administration in Bangkok. She is a capable researcher with a respectable record of doing good work and delivering it. She has recently published useful articles on Bangkok.
- I am not up-to-date on the research situation in Chiang Mai, but I used to involve researchers from the Social Research Centre of Chiang Mai University in a Low-Cost Transport study. Urban agriculture is plausibly important in a secondary city like Chiang Mai and it is worthwhile to look.

## MALAYSIA

In 1983 I invited researchers of the Consumer Association of Penang (CAP) to report on a case study of land security affecting vegetable growers on the island. When I enquired if there was any recent work on the subject, I was told that there was more lobbying than research. However, the person who was an advisor to CAP and who participated in the 1983 ASRO meeting has moved to the University of Malaya in Kuala Lumpur. Interestingly, he has kept his interest in the subject and has written two recent papers on vegetable farming and livestock farmers in Malaysia. He is Professor Lim Tech Ghee, at the Institute for Advanced Studies, University of Malaya. He is certainly the best person to involve should there be any study involving Malaysia.

Another person who might be able to contribute is Gurgit Singh, a young and dynamic urban planner who participated ably in the World Bank Housing Indicators Survey. Educated in Cambridge University, he works for Sime Darby Plantations but should be a

useful contact person at least if he himself is unavailable in taking part in a collaborative research project.

## SINGAPORE

I have only one name from this city-state whose earlier work suggests that he might be interested in urban agriculture in this island country. He is Dr. Cheng Lim Keak, Senior Lecturer in geography at the National University of Singapore. He has recently published a volume on Singapore Chinese and is likely to Welcome an opportunity to work in a field he is familiar with.

## INDONESIA

This sprawling and still largely agrarian country holds much scope for urban agriculture, with traditional kampungs found in many Indonesian cities. I would mention three names from Jakarta and Bandung.

- Mohammed Soerjani, Director of Centre for Research on Human Resources and the Environment, University of Indonesia. This Centre has a strong research staff, including some medically qualified, with a reputation for research on the urban environment. This could include urban agriculture, should an opportunity presents itself. The Centre is well financed and equipped with very respectable facilities.
- Id Ayu Indira Murp, of the Institute of Urban and Regional Studies at the Institute of Technology in Bandung. She is trained as an urban planner, having demonstrated her ability to produce good work in recent professional meetings I have attended with her.
- Dr. Arunia Firdausy, Research Associate of the Centre for Economic and Development Studies, LIPI. He obtained his Ph.D. in Economics from the University of Queensland and has produced good research papers on urban issues in Indonesia.

Finally, on the question of institutional partners in support of urban agriculture research in the region, one might explore two logical places. One is the East-West Center whose Resource Systems Institute was very active in the field in the early 1980s. However, recent reorganization at the Center might have reassessed possibilities and involved personality changes. Nonetheless, in terms of past involvement, it is necessary to explore. The second place to look is UNDP and the World Bank, which jointly and recently commissioned a study on Urban Agriculture in Latin America, Africa and Asia by Jac Smit of Regional and Community Development Consultants. The contact person at UNDP is Frank Hartvelt and at the World Bank, Bruce Gross. The report by Jac Smit was recently available and an abbreviated version of it appeared in *Environment and Urbanization* (October 1992).

### **3. FUTURE RESEARCH OPPORTUNITIES**

Based on the URB Program document and the above review, it is possible to suggest at least three research topics for which Centre support can be considered.

#### **3.1. Urban poor and food sources**

This project attempts to focus on the food production-nutrition interface by a targeted investigation of how the urban poor in selected cities in the region supplement their food requirements by home production. It is hypothesized that those who have access to homegrown food will have better nutrition than those who have only the market to depend on for their food supply. The urban poor would therefore have to be sampled in two subsectors: those with homegrown food and those without. The former are likely those who live on the urban periphery or otherwise have access to food-growing land or other types of food. The study will help to establish the links between urban agriculture and the urban poor, and within the latter different disadvantaged groups by ethnic affiliation and other criteria may be used for differentiation.

Such a study can also investigate the economic, legal and policy constraints that impede food production by the urban poor. A comparative study across cities and countries in the region can yield information that will enable policy makers to take a more sympathetic and enlightened view of how the urban poor could be assisted in producing their own food. The study will also yield insights as to whether dependence on home-produced food will increase with the size of the city and the socioeconomic status of the family.

In order to carry out such a study, it is submitted that a comparison of three countries in Southeast Asia involving a large- and a medium-sized city in each would best capture the variation of the study problem. For consideration, the cities for inclusion might include Manila and Baguio in the Philippines, Jakarta and Yogyakarta in Indonesia, Bangkok and Chiang Mai in Thailand.

Researchers who might be considered for taking a lead role in this project include Cayetano Paderanga of the Faculty of Economics of the University of the Philippines, Dr. Mohammed Soerjani of the University of Indonesia, and Dr. Watana Isarankura of the National Institute of Development Administration in Thailand. Details of their professional background as well as their institutions have been provided in the previous section.

#### **3.2. Waste reuse and fish farming**

In Asian cities, organic wastes have traditionally been used efficiently to turn into food production in various ways. Food wastes, for example, have been used to feed pigs and

restaurants regularly dispose of their food wastes in this manner for useful recycling in Chinese communities in Asia. In a detailed study of nutrient flows in Hong Kong undertaken by an Australian team in the 1970s, one of their conclusions was to argue strongly in favor of keeping existent practices of food recycling, with very much in mind effective food wastes for pig feeding. For this reason, it was recommended that the people of Hong Kong should not turn to beef over pork, for the sake of maximizing use of organic wastes. Another example of an age-old practice of utilizing organic waste for food production is the application of plants and other organic wastes, such as droppings from silk worms, to feed fish. The ecological cycle is perfected by growing mulberry trees to feed silk worms, whose wastes are fed to fish in ponds, and this is connected to the raising of pigs. Hence the mulberry-dyke-pond cycle in the Pearl River Delta.

It is submitted that because of the onslaught of modernization and industrialization, the traditional organic waste recycling might have been adversely affected. This is particularly the case in the Pearl River Delta in Guangdong, which has witnessed exceptionally rapid economic development and environmental change over the past decade in the wake of the open policy adopted by China. In Hong Kong and Bangkok, where the demand for fish and seafood is always high, the pressure exerted on fish ponds to yield to other more intensive use has constantly been increasing. In the Yuen Long area of Hong Kong, the once scenic fish pond area is rapidly changing to a landscape of new residential homes and other uses. Fish farming has moved offshore to about 30 designated areas, which are subject to water pollution and occasional red tides. Similar changes are also occurring in Bangkok which also has to cope with a rapid pace of urban change.

A project aimed at establishing the relationship between waste-reuse, in particular organic waste recycling, is extremely useful in showing how traditional ways of utilizing organic wastes might have been reorganized and adjusted to new circumstances. Ideally, every means should be found to reuse waste to food production, and in this respect the Chinese experience, whether in China itself or Chinese communities in Southeast Asia, has everything to offer for other situations.

This project should be building on some known ways of waste recycling but from this known base, it may open up other possibilities and opportunities. The practical outcome of this project will assist operators and planners on how to treat and better use organic and other waste in the urban area. As a way of approaching the subject, it is suggested that fish farming would be a useful vehicle.

Potential researchers in this comparative study may include Professor Zhong Gongfu of the Institute of Geography in Guangzhou. He is a world-established authority on the mulberry-dyke-pond system and has published extensively on the subject. He retired recently but is still active in research. A sample of areas in the Pearl River Delta should update and

extend his previous studies. Hong Kong can usefully contribute to this study, with Dr. K.C. Chau, of the Department of Geography at the Chinese University of Hong Kong, as a likely researcher to study the Hong Kong situation. Bangkok with its large Chinese community and their tradition of recycling waste can also be included. Dr. Pawadee Tongudai of Thommasat University could be considered as a candidate to lead a project.

### **3.3. Vegetable supply and new technology**

In virtually every Asian city, an adequate supply of fresh vegetables ranks high as a basic need for its inhabitants. This is especially the case in Chinese cities in the south and in Southeast Asia. As vegetables are highly perishable, it is therefore vital for growing areas to be located within convenient transport distance from markets in the city. In Chinese cities, an effective system of near self-sufficiency has been developed for most large cities, with the city region spatially differentiated to meet the needs of urban dwellers. In other cities in the region, the supply routes might take longer, as it is known that certain vegetables in Singapore routinely come from the Cameron Highlands in West Malaysia, some 350 km to the north.

Traditionally methods of growing vegetables are efficient but in the face of new consumer tastes and demands, new technology has been utilized for producing certain types of vegetables for special needs. The use of hydroponics, for instance, is common in Singapore and other cities, where there is a lack of land space for growing and other reasons for using the new technology. Hydroponics normally is used for producing high-quality and high-priced vegetables for a more select market. There are also new breeds resulting from scientific research, but something comparable to the miracle rice or high-yielding varieties in rice and wheat has not apparently come to vegetables.

A project can thus examine the vegetable supply of selected Asian cities over at least two seasons by studying the spatial distribution of growing areas by broad categories of vegetables. The degree of self-sufficiency can be established and if vegetables need to be imported, from where, at what price, and over what distances? Is there any attempt to adopt new technology and growing methods by the farmers and authorities? Is the present system of supply and demand well articulated and efficient? Where are the bottlenecks and constraints? Is there any research done on improving vegetable types and their growing?

The answers to some of the questions posed above would provide some useful information for policy-making and ways of improving the present system of production and marketing. One of the problems identified in Hong Kong in its supply of vegetables from Shenzhen across the border is the use of banned insecticides, with the result that outbreaks of poisoned vegetables affecting the health of inhabitants recur. There is therefore an active campaign in Hong Kong for the lessened reliance on chemical fertilizers and insecticides, in

preference for organic methods of farming. This is one aspect of the green movement in Hong Kong. This is one dimension, for example, such a study might be able to help. However, Hong Kong is not suggested to be in this study.

The cities proposed for this network project are Shanghai, Kuala Lumpur and Seoul, providing different cultural and societal settings in which vegetable supply and new technology can be comparatively studied. For Shanghai, Ning Yue-min, of East China Normal University, can be considered to lead a project. Professor Lim Tech Ghee is the best qualified person for a Kuala Lumpur study. A study on Seoul can be undertaken by Professor Ki-suk Lee. Details of the professional background of these researchers have been provided in the previous section.

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## URBAN AGRICULTURE: LATIN AMERICA\*

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### **1. REGIONAL RESEARCH RECORD**

#### **1.1. Overall diagnosis**

A review of existing bibliography on UA experiences in Latin America shows that:

- (a) The most researched, tested with and widespread production system in Latin American cities is the family, school or community/group vegetable garden. Vegetable gardens can consist of greenhouses, microclimatic tunnels (organic beds) and open air plots (solar gardens).
- (b) Main produce grown are: vegetables (tomatoes, squash, broad beans, lettuce, onions, radishes, etc.); forest production (for reforestation and ornamental purposes) including flowers and medicinal plants; and some fruits<sup>1</sup>, although to a lesser degree.
- (c) The second fairly well developed activity is the breeding/raising of small livestock (pigs, chickens, hens, rabbits, etc.), fed with vegetal production residues and mainly carried out by family units.
- (d) Most family vegetable gardens are for self-consumption. Although output is not large, it affords diversification and a supplement to the basic diet. One aim is also to increase family income and create employment. Vacant urban lands are put to use, transportation costs are reduced, food quality are improved, and energy/caloric supply are increased.

Communal vegetable gardens are attempting to grow products for marketing and generate income for the organization and its family members. They are faced with a series of difficulties: high production costs, lack of resources to gain access to markets (transportation, storage, refrigeration, etc.); poor management, low productivity (due to soil exhaustion, lack of water and seed), scarce technical counselling. The main objective of the school vegetable gardens is to supplement the diet of school children, complemented by education and training in farming activities and practices.

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\* Editor's note: This document was translated from Spanish.

Most beneficiaries of urban agriculture are low-income families living in suburban or marginal city areas. As a rule, practitioners do not have permanent employment, nor agricultural ability or knowledge. Women are the main garden workers and beneficiaries followed by other family members (spouses, older daughters, grandmothers), school children (between 6 and 12 years old) and teachers. People practising this activity tend to be migrants from old urban settlements, as opposed to recent migrants from rural areas. The latter feel this is a typical agrarian activity, and they wish to adopt city ways and activities which supposedly improve their cultural status. Most vegetable gardens worked by low-income beneficiaries do not benefit from adequate technical guidance or orientation. There is no sewage treatment nor use of excreta as fertilizer. There is no production of biogas (from wastes) nor residual processing, or any type of efficient complement with other activities.

There is a scarce technological adaptation emanating from a few European NGOs; traditional technology is used in many of the vegetable gardens.

The situation for urban farmers with more resources and knowledge is somewhat different, as these have more resources; they work with improved seeds, drip irrigation, use fertilizers and pesticides, in addition to having more suitable lands and other advantages.

The support received by urban vegetable gardening systems in the majority of Latin American cities where it is practised can be summarized as follows:

- Nongovernmental organizations (NGOs) usually are the main promoters of these activities, they support the construction and spread of family and community vegetable gardens, implement technical and educational training workshops (in conjunction with other specialized government agencies), and support training in administration (although with many weaknesses) and accounting.
- NGOs also promote reforestation and vegetable production through the distribution of donated food (CARITAS - Adventist Churches, etc.) with little support for marketing, conservation and product distribution.
- International cooperation agencies (UNICEF - Technical Cooperation with Governments, PNUD, etc.) also finance NGOs' urban agricultural projects, although rarely offer the support of technical specialists in the field or promote research (use of organic wastes, water recycling, etc.). Some agencies finance urban and rural reforestation programs for erosion control.
- National governments offer very little support. In some countries, specialized organisms cooperate in agricultural technical training (Argentina), or in a better utilization of

water resources (Chile). In others, support is limited to health and education campaigns in supplementary nutrition, using products from the schools' vegetable gardens.

- Regional autonomous governments (such as municipalities or prefectures) collaborate the most in agricultural activities taking place within the informal economy. In general, they undertake campaigns for the collection of seeds and native seedlings used in forestation programmes of deserts urban areas and for public ornamental purposes (parks, squares, etc.). They also finance programmes for the purchase of forest trees, flowers, etc. although in a limited way.
- The rest of public and private institutions do not exert a major impact upon urban agriculture, although there are a few exceptions as in the case of Brazil's electricity utilities.

## **1.2. Some experiences contributing to urban agriculture**

There are a few experiences relating to urban agriculture which must be mentioned, both for their contribution towards improving agricultural systems and for the overall successes achieved. Some of the experiences occurring in the Latin American countries are being disseminated; these experiences refer to the relationship between urban agriculture and solid and liquid residues recycling, biogas production treatment, reclaiming of fertile lands and other facets.

- a) For instance, we have the case of the PROGRESAR Cooperative in Colombia which is implementing a garbage collection programme through a cleaning and garbage collection contract in urban developments in exchange for the exclusive rights to the waste, or the recollection of refuse in hospitals in exchange for free health services to pregnant women (members of the programme) and newly born children. PROGRESAR also has contracts with large companies which buy these materials (glass, cardboard, etc.) for recycling.
- b) A very important experience with hydroponics production in Colombia should be underscored, which at the present time is not well known throughout Latin America (although this is not the case in Central America). It is based on low capital input and is labour-intensive (contrary to what has been achieved in Europe, the U.S. and other countries where hydroponics is practised); it is also based on the reduction of production costs, minimal land requirement, and the absence of problems with contaminated water.
- c) In Peru, CIPUR (Research and Urban and Rural Projects Centre) has created solid waste domiciliary collection projects in those human settlements which are in a critical situation.

Many peripheral urban areas are affected by adverse geographical conditions (sand pits with high inclination gradient or slope and narrow streets) which render completely ineffective the use of conventional domestic solid waste collection methods. Therefore, a micro-enterprise system was created (groups of approximately twenty workers, associated as a legally constituted business enterprise with limited liability) offering services with wheelbarrows, brooms, rakes, sound devices, and proper attire. Two workers collect and transport the refuse to so-called *collection centres* from where it is subsequently carried to sanitary landfill sites.

Whereas the CIPUR is in charge of the promotion, selection, training and equipment of the micro-enterprise personnel, the municipality of the district is in charge of collecting payment for the services rendered. The success of the system rests on the management capabilities of the micro-enterprise workers and on the harmonious relationship with the population and the local government.

d) Another NGO, the ALTERNATIVA Social Research and Popular Education Centre, has also established refuse collection systems through regional cleaning cooperatives and it is preparing projects for compost production and sanitary manual micro-landfills.

The objective of the Compost Elaboration Plant is to offer to municipalities an alternative system of management and treatment of commercial organic waste, as well as to induce the creation of a micro-enterprise which would be in charge of the compost plant, thus bringing profit to the different local markets and, at the same time, treating approximately 7.5 tonnes of organic waste daily (from which 2.5 tonnes of compost, useful to fertilize and enrich soils, will be obtained).

The aim of the Manual Sanitary Micro-landfills Project is to give final treatment to the wastes of different neighbourhoods (separating inorganic elements suitable for industrial recycling, marketed to intermediaries) thus reducing transport costs, generating employment and saving time to broaden the services provided.

e) There are also some experiences in Brazil which should be underscored given their relationship with urban agriculture activities.

o In the city of Londrina, in Southern Brazil, the members of a small neighbourhood organization (called Democracia y Libertad [Democracy and Freedom]) started communal work on vegetable production not only due to the scantness of financial resources and the lack of permanent employment, but mainly due to the scarcity of available land belonging to them. They started the communal work on vegetable production after encountering many problems in order to obtain available space for the production intended.

- o The electricity utility (CESP) of Sao Paulo, Brazil, has been working, during the last few years, on the construction and testing of small digesters -for the improvement of organic fertilizers and the utilization, as well, of biogas and bio-fertilizers) which can be easily managed by rural and urban agriculturists, and thus contribute to ease agricultural work.
- f) There are also many experiences in Argentina, as is the case of the improvement of nonfertile soils through household wastes used as manure and fertilizer, carried out in Buenos Aires (Argentine) through an institution called the Club de Hornero which has succeeded in accounting for both technical and agronomic aspects.
- g) The last topic to be addressed refers to the interinstitutional degree of coordination and networking obtainable within the different facets of urban agriculture. Such is the case of the INTA (Instituto Nacional de Tecnología Agropecuaria or National Institute for Agricultural and Livestock Technology) in Argentina, where it was successfully obtained, for the production of vegetables, the cooperation and involvement of various specialized organizations (governmental and nongovernmental) such as universities, technical schools, Ministry of Agriculture, Ministry of Health, different municipalities and others, in the training and technical education of low-income families involved in vegetable production. At the present time, this work has benefited over 75,887 people, out of which there were 7,366 living in communities, 17,720 school children and 50,831 family members. Twenty per cent of the beneficiaries are employees, 34 % are self-employed, 8 % are small producers, 5 % are workmen, 20 % are journeymen, and the rest (9 %) are retired people and unemployed. There is a total of 10,414 family vegetable gardens, 673 school vegetable gardens and 180 communal ones distributed through 12 provinces in Argentina.

To conclude, there is scant or limited publication of experiences on urban work and there is almost nonexistent linkage and coordination between these works. In general, the scope of the work is limited to its region or vicinity without the experience reaching beyond. One of the reasons contributing to this problem is the lack of systematization of the results obtained and its dissemination through publications, workshops, etc.

### 1.3. Underscoring some aspects

From the analysis so far, we can say that:

- a) Urban agricultural systems implemented for the most part in Latin American countries, are usually activities undertaken by populations of scarce economic resources, characterized by not having permanent employment or agricultural training.
- b) These activities represent some support to family consumption/nutrition, and a relatively significant level of economic backing to the overall family income.

- c) Most of the cases studied involved specialized activities related to the production of small volumes of certain products (thus increasing production costs). They have not achieved sufficient product diversification, needed to compete in a marketplace characterized by a high supply-demand competition and free determination of prices.
- d) Problems are also encountered with the marketing of the agricultural products, because deliveries are not made at specified times, there are no refrigeration systems, and the transportation prices represent a very high cost in the overall selling prices.
- e) Also, there are also problems related to suitable agricultural lands, given that urban congestion, in some cases, and the incorrect use of available lands, preclude their use.
- f) There are problems with the availability of water suitable for irrigation purposes, due to their high contamination levels.
- g) There is no technological package suitable for each medium or region, which the beneficiaries could manage by themselves.
- h) As a general rule, the agricultural systems of the vegetable gardens accumulate an excessive number of beneficiaries with the corresponding dilution of the benefits obtained.
- i) The training provided to the beneficiaries, with some exceptions, is not comprehensive, as it does not touch upon subjects such as accounting, administration, marketing, etc. all of which impinge on the final results.
- j) The overall support provided to these activities is very limited, and, in general, it is provided by NGOs, with little participation by the state, and with practically no credit facilities, technological transfer, etc. For this reason, these activities ought to be handled not as isolated projects but as a broad and comprehensive programme, in which national and international organizations could participate.
- k) Experiences regarding work on waste recycling are almost nonexistent or very localized, the theory and practice behind this principle not having been widely disseminated.
- l) Several Latin American experiences could be extrapolated and suggested for the African situation, but two of them figure very prominently because of their greater applicability:

- 1) Firstly, to carry out work in **COORDINATION** with other institutions or organisms:
  - With government agencies, to technically support the use of fertilizers, seeds, amelioration of the water infrastructure, the mobilization of popular organizations and training campaigns for dissemination of information and financing of these activities.
  - With municipal governments, to logistically support the securing of resources, such as available land and water, to carry out experiments in the marketing of products, the legal defense of communal lands used in urban agriculture and the creation and implementation of an environmental defense code.
  - With international cooperation agencies, to obtain not only the necessary financing but also to have access to all other opportunities they create, A very clear example is the one referring to charitable organizations belonging to churches which have popular soup kitchens; these soup kitchens could buy urban agricultural products as they would from a regular supply source. Also, there should be coordination with those agencies which distribute donated food: through internal monetization programmes, the agencies buy nationally produced food to distribute it as donated victuals.
  - Lastly, with the various national and international NGO's, to avoid the repetition of experiences already carried out or avert committing the same mistakes; to exchange information, establish major contacts, transfer appropriate technologies, etc..
- 2) It is necessary to search for the greatest **DIVERSIFICATION** possible in the agricultural production carried out in urban agriculture works; the objective of this production would be to obtain the largest possible monetary earnings for the beneficiaries, but also the aim should be to **MINIMIZE** production **RISKS** and demand market price instability.
- 3) Production **QUALITY** must be emphasized because this will determine the market demand of urban agricultural products in the ensuing competition with the rural agricultural production.
- 4) Finally, Agricultural techniques which are **LABOUR-INTENSIVE** should be stressed, since African and Latin American countries are characterized by great unemployment and a work force with little training, as well as by scant

financial support; there is need for greater training-technification of the work force and lower financial costs since capital is the lesser available resource.

## 2. APPRAISAL OF RESEARCH CAPACITY

### 2.1. Institutions directly committed

The following is a short list of organizations and institutions carrying out activities related to urban agriculture in Latin America. Most probably, it is incomplete, although we believe it includes some of the more important entities.

#### ARGENTINA

- **CENTRO DE ESTUDIOS URBANOS Y REGIONALES (CEUR)**  
(Centre for Urban and Regional Studies)  
Av. Corrientes 2835 Cuerpo "A" 7° piso  
1193. Buenos Aires.

CEUR performs social analysis and research, issues publications and it has contacts with local and national authorities. **Contact:** Pablo Gutman

- **CLUB DEL HORNERO**  
(Baker Bird's Club)  
Av. Corrientes 2835 Cuerpo "A" 6° Piso  
1193 Buenos Aires

The Baker Bird's Club works on studies to improve infertile soils by means of household wastes. **Contact:** Jaime Nisnovich

- **VERDE ESPERANZA**  
(Green Hope)  
Virrey Arredondo 2652  
Capital Federal

Operates vegetable gardens worked on by youths and children.  
**Contact:** Ángela Alvarez

- **CIPES**  
Calle Zobaly N° 2677  
Buenos Aires

This organization works on biological food production and supplements it with popular education and technical assistance. **Contact:** Luis Rigal

- **INSTITUTO NACIONAL DE TECNOLOGIA AGROPECUARIA (INTA)**  
(National Institute for Agricultural and Livestock Technology)  
(PRO VEGETABLE GARDEN Integrated Project)  
Alsina 1407, 2° Piso, Of. 621  
1088 Buenos Aires

INTA works in vegetable production through community, school and family vegetable gardens, providing also technical training and counselling. It also works in coordination with several government and private institutions.

**Contact:** Daniel N. Diaz, P.Eng.

## BOLIVIA

- **ENDA - BOLIVIA**  
(Comprehensive Program - Youth of the Street)  
Casilla Correo 9772  
FAX (591) (2) (81.14.46)  
La Paz

ENDA Bolivia carries out organic wastes recycling work and also works through community vegetable gardens. **Contact:** Michel Gregoire, P. Eng.

- **SOLIDARIDAD LTDA. (Solidarity Ltd.)**  
(Agricultural and Marketing Cooperative)  
Calle Escalon Aguero 547 (Zona Villa Tejada)  
EL ALTO  
FAX (591) (2) (35.63.22)  
LA PAZ

Solidarity Ltd. works with greenhouses, microclimate tunnels and open air vegetable gardens with low-income families from the urban periphery.

**Contact:** Prof. Ernesto Valdes

- **"GREGORIA APAZA" Centre for the Promotion of Women**  
Calle Eulert 215 - Villa 16 de Julio  
Casilla 12571 - LA PAZ (El Alto)

The organization "Gregoria Apaza" basically works with women of the city's marginal areas. The community vegetable gardens are outstanding among the different activities carried out by this organization.

**Contact:** Lic. Diana Urioste (Director)

- **CENTRO DE INFORMACION Y DESARROLLO DE LA MUJER (CIDEM)**  
(Women Information and Development Centre)  
Calle Aspiazu 736  
Casilla Correo 14036  
FAX (591) (2) (37.42.61)  
LA PAZ

CIDEM basically works with women in different work areas, one of which is forestry production and vegetable gardens. **Contact:** Ximena Machicado

## CHILE

- **CORPORACION DE DESARROLLO SOLIDARIO (CODESOL)**  
(Corporation for Solidary Development)  
SANTIAGO - Chile

CODESOL works in support of the production of hydro-vegetable gardens in the poor districts of Santiago, providing technological support. It maintains links with the Catholic University, La Serena University and the Ministry of Agriculture.

- **CENTRO PARA LA GESTION TECNOLOGICA POPULAR (CETEP)**  
(Centre for Popular Technology Management)  
Venezuela (Barquisimeto)

CETEP supports popular organizations in the search for and application of simple and appropriate technologies as to improve the quality of life of poor families.

- **PROGRAMA DE ECONOMIA DEL TRABAJO (PET)**  
(Work Economics Program)  
Academia del Humanismo Cristiano  
Catedral 1063 - 6° Piso  
Santiago - Chile

PET works in socioeconomic research and also provides technical training to marginal and impoverished sectors. **Contact:** Mariana Schkilnik

## PERU

- CIUDAD (City)  
Bronsino 119- of 301, San Borja - Lima  
Telephone 37.65.25  
Fax 42.17.66

This is an NGO which works on projects dealing with urban vegetable gardens and wastes recycling. **Contact:** Jorge Burga

- ALTERNATIVA (Alternative)  
Emeterio Perez 348 Urb.Ingeniería  
San Martin de Porres - Lima  
Telephone 81.58.01  
Fax: 81.68.26

ALTERNATIVE works in the field of vegetable gardens and solid and liquid wastes recycling. **Contact:** Josefina Huamán (Director)

- CIPUR  
Baltazar La Torre 570 - Lima 27  
Telephone 40.91.61  
Fax: 40.79.82

CIPUR is another NGO working in the fields of urban agriculture and wastes recycling in Peru. **Contact:** Jorge Ruiz de Sommocurcio (Director)

- GUAMAN POMA  
Apartado 627 - Cuzco  
Telephone: 23.59.31  
Fax: 22.55.52

Guamán Poma is a NGO working in the Cuzco region in community vegetable gardens and in wastes recycling. **Contact:** José María Gómez G. (Director)

## MEXICO

- GRUPO DE ALTERNATIVAS TECNOLOGICAS (GAT)  
(Technological Alternatives Group)

GAT is an institution providing advisory services and technological training to families of scant economic means in the field of growing vegetables.

- **PROMOCION DEL DESARROLLO POPULAR A.C. (PDP)**  
(Promotion of Popular Development)  
Tlaloc 40 - 3  
11370 Mexico, D.F.

PDP supports the socioeconomic development of marginal population sectors, through productive and self-building projects. **Contact:** Luis Lopez Ll.

## COLOMBIA

- **ENDA - COLOMBIA**  
A.A. 091369 Bogotá

ENDA supports harvesting and energy generation in marginal neighbourhoods.  
**Contact:** Jean Jacques Guibert.

- **ASOCIACION DE PRODUCTORAS DE HIDROVERDURAS DE JERUSALEN**  
(APROHIJE) (Hydroponic Producers' Association of Jerusalem)

APROHIJE is the foremost Latin American institution devoted to the development of small-scale hydroponics based on commercial fertilizers and chemicals. It has carried out projects in close cooperation with the Municipality of Bogota and the Social Foundation of Colombia.

## BRAZIL

- **DEMOCRACIA Y LIBERTAD**  
(Democracy and Freedom)  
Zona de Cambé - Ciudad de Londrina  
(City located in Southern Brazil)

Democracy and Freedom is a neighbourhood organization, which at the beginning worked with one community vegetable garden; today, it has extended its activities to 14 additional vegetable gardens to grow produce. It also works on the recovery of municipal lands and in water use and recycling (sources and lagoons). This neighbourhood group receives support from the municipality and UNICEF.

## 2.2. Possible institutions/organizations linked to urban agriculture

### ARGENTINA

- CARITAS ARGENTINA (social assistance)
- MUNICIPALITIES Buenos Aires, Río Negro, Rosario) (logistical support)
- Ministry of Education (education)
- Ministry of Agriculture (technical training)
- Ministry of Health and Social Action (education)
- NGO - MADRE TIERRA (Mother Earth)
- RETURN TO THE LAND PROGRAMME (In Mendoza)
- Agronomic University of Buenos Aires (technical support)
- National Technical Education School (In San Juan) (technical support)

### BOLIVIA

- CARITAS BOLIVIA (social assistance)
- ADRA - OFASA (social assistance)
- Bolivian Centre for Information and Educational Action (CEBIAE) (technical support and training)
- Ministry of Health and Social Welfare (health support and nutrition)
- Ministry of Education and Culture (education)
- UNICEF (technical and financial support)
- Honorables Municipalities (forestral technical support)
- RICCERCA COOPERAZIONE (technical Assistance)
- Promotion and Education Experiences Association (AIPE) (nutritional institutions)
- Environmental Fund (technical support)

### CHILE

- University of Chile (technical support)
- Catholic University (technical support)
- PNUD (technical and financial support)
- Solidarity & Social Investment Fund (FOSIS) (financial support)
- La Serena University (technical research)
- Ministry of Agriculture and Irrigation Directorate

**PERU**

- CELADEC (NGO) (training support)
- International Potato Centre (technical support)

**COLOMBIA**

- Apprenticeship National Service (SENA) (training)
- Social Welfare Department of Bogota (nutritional health)

**3. FUTURE RESEARCH OPPORTUNITIES****Brief comments**

The Latin American experiences in popular hydroponics, solid waste recycling, water treatment, rural digester and biogas and bio-fertilizers utilization are widely scattered regionally, and have been supported, encouraged and sponsored by different institutions at various times.

Popular Hydroponics have been initially implemented in Bogota, Colombia, with the technical support of a PNUD (Regional Project for Surmounting Poverty). This project demonstrated the Popular Hydroponics possibilities in water, air and substrates as applied in those social sectors of low economic means. Popular Hydroponics were mainly administered by women (90 % of the total); hydroponic is a low investment economic activity with low input costs, which does not require large spaces, heavy nutrients or concentrated input, but which does necessitates continuous technical support.

Although this is an activity demanding individual responsibility, it unifies the family since parents and children participate equally in the production process. Hydroponic production has not only increased and diversified food consumption but has also generated income through the marketing of products.

Solid waste recycling has been vigorously experimented in the Lima, Peru, suburban areas, by the ALTERNATIVA and CIPUR institutions. This work has been described. It receives some modest support from a few national institutions (municipalities, universities, churches), plus some financial assistance from Dutch NGO's, such as CEBEMO, which back this type of work.

The Planta de Celulosa Forestal e Industrial de Santa Fé (the Santa Fe Forestal and Industrial Cellulose Plant) in Santiago de Chile, is one of the greatest success stories in water

treatment. The Bío-Bío river, from the river-head to its sea embouchure, runs over 300 km through human settlements, small mining buddles, industrial complexes and other areas which discharge all types of contaminants and refuse in ever increasing proportions. To make the cellulose plant located at the river watershed of the Bío-Bío compatible with the use of its waters, the Santa Fe Plan has entered into an agreement with the University of Concepción to baseline study the contamination, assess future impacts, monitor these and make appropriate recommendations.

The results of this study are forcing the company to carry out further studies in the design and construction of a water treatment system (effluent neutralization and subsequent fibre decantation in a clarifier) to guarantee the appropriate minimum quality conditions for water use.

There are very few studies and research on the impact of urban agriculture on urban families; this impact has been studied by some research centres, such as UNITAS en La Paz, Bolivia (see the studies carried out by Julio Prudencio), CEUR in Buenos Aires, Argentina (see particularly the work carried out by S. Finquievelich) and, to a lesser extent, the work of Luz Cereceda and Max Cifuentes in Chile (specially the paper: *What do the poor eat? Eating patterns, shopping strategies and survival mechanisms*). These studies were carried out from different viewpoints: type, survival strategies of poor families, women, energy and environment.

Sectors involved in the different processes mentioned (water recycling, hydroponic production, etc.) are different actors (researchers, NGO's, private enterprises, international organizations and even state-owned companies) and, support is provided by various organizations, such as the PNUD-NNUU, the Dutch government through Dutch NGO's, etc..

Any intervention on the different aspects of urban agriculture (organic waste recycling for fertilizer use, water treatment, hydroponic production, improvement of infertile soils, etc.) should seek the collaboration of sponsoring financial and technical institutions (PNUD, Dutch cooperation agencies, etc.), government organisms such as municipalities, prefectures and, if possible, ministries in the relevant technical expertise/jurisdiction.

From the analysis of experiences, situations and challenges of urban agriculture implemented by low-income populations of different Latin American countries, some points emerge which should be considered in future urban agricultural applied research.

### 3.1. Water recycling systems.

#### Research problem:

Many Latin American cities have, characteristically, a series of underground<sup>2</sup> and above ground creeks and rivers (for example, Lima, La Paz, Santiago) which crisscross the whole city carrying waters that are utilized for different purposes, whether to carry solid wastes, garbage or even dead animals; these waters are not only used in the urban production of vegetables and other products grown through urban agriculture, but for the self-construction of homes, to wash laundry (as an occupation in which housewives engage to obtain some economic revenue) and even for direct human consumption, or in preparing meals, or as drinking water for the different animals these low-income families raise.

This situation, common to several Latin American cities, is the causal agent of permanent cholera breakups, and confirms that most of the sewage waters carried by rivers passing through most of those cities are carriers of the *Vibrio colerae*.

Faced with this situation, governments have developed some courses of action to control these epidemics and eliminate contaminants, in view of the impact these have upon the nutritional health of the population, on the production of fresh produce and even upon their export trade.

In just a few days, many hectares of agricultural lands in several Latin American cities, which until then had been traditionally worked by urban farmers or by farmers exploiting their fields in the periphery of urban areas, and who had been irrigating with waters from contaminated rivers, have been either destroyed or taken out of production. Similarly, many people have died from cholera and hundreds of thousands are under intensive care, all of them contaminated by the consumption of agricultural produce.

Despite the ongoing programs to sensitize the population to the dangers of using these contaminated waters, nothing has been achieved until now because there has not been an alteration of the situation since no structural solutions are offered, and, above all, because the low-income population lack material resources which would enable them not to use or to stop using contaminated waters or to consume products irrigated with them.

#### Objective:

a) research, analyze and build water treatment systems to recycle water to make it fit for human consumption, for the preparation of meals, and for urban agricultural production;

b) subsequently, research, analyze and build monitoring systems for the conditions of rivers to satisfactorily ascertain water status.

### **Implementation:**

Several steps must be taken in order to implement the previously stated objective. Firstly, preliminary analysis must be undertaken on the actual contamination of rivers, not only in points where tributaries discharge their waters, but in areas of eventual dissemination of pollutants, as well as in the areas preceding the said discharges. This will enable to determine the basic level of pollutants carried by rivers and their impact upon wildlife so as to monitor and correct any critical situation. Also, basic contamination parameters and projections of their future impact should be developed. A water treatment plant system for subsequent fibre decantation in a classifier should be built.

The second step, following a monitoring period, will be useful for treatment according to the needs detected after relevant monitoring.

Urban agriculture can fulfil a significant role in the recycling of organic residues from the water, as these residues are good fertilizers once the pathogens are removed. However, research must be undertaken to define the level and type of solution which is admissible, bearing in mind the type of urban produce grown.

## **3.2. Popular hydroponics<sup>3</sup>**

### **Research problem:**

One of the main obstacles affecting urban agriculture as practised by low-income families in Latin American countries is water contamination; this problem has been explained in depth in the previous section. Other problems include: scarcity of land or spaces suitable for urban agriculture (due to increasing rural-urban migration, urban congestion and high demographic density), exhaustion or waste of current agricultural urban lands (due to overexploitation), or to the long distances where other suitable, not utilized, farming lands are located.

### **Objectives:**

a) to determine the social, economic, agronomic and marketing feasibility of producing vegetables, either as a group of products or individually, by popular hydroponic principles applied by low-income population in urban and semi-urban areas;

b) to formulate a Popular Regional/National Hydroponics Program able to articulate, support and promote over the long term the efforts and activities of the different institutions which are participating in the said programme.

### **Implementation:**

Hydroponics is a farming method based on aerated water or substrates saturated with nutrient solutions, requiring several steps for its correct implementation.

- Education and training in hydroponics techniques, together with reference material and measuring devices.
- Training in adapting the technology to the physical and climatic conditions of each city/region where the project would be installed, and to the characteristics of products consumed at each locality.
- To promote in each region a minimum basic knowledge to motivate the interest of urban farmers in the hydroponics technique to then be able to detect and formulate specific projects.
- Preparation of massive dissemination popular hydroponics programs (by establishing demonstration vegetable gardens at the institutional and group levels) basically leading to the alimentary self-sufficiency of low-income families.
- Support and follow-up experiences based on models adapted from other countries.
- Joint work among international institutions (PNUD), governments, NGOs and associations of producers to achieve better operational results.

In synthesis, it can be said that to become an efficient hydroponics producer requires knowledge on the part of the user, technical assistance enabling to identify optimum nutrients (inputs), to adapt traditional products to the hydroponics technique, and to identify solutions to physiological, environmental, health and other problems.

Similarly, hydroponics is an activity in which all members of low-income families can participate, without requiring large free spaces, and with definite nutritional and economic benefits for the household should some of the products be sold, with the added possibility of feeding (with food wastes) small domestic animals raised in the household. Water recycling and popular hydroponics constitute mere suggestions for applied research programs are closely interconnected with improving the environment and with achieving a real sustainable development.

### **3.3. Impact of urban agriculture upon the urban family**

To supplement the applied research on waste and water treatment and Popular Hydroponics, socioeconomic research is suggested on the impact of urban agriculture at the

micro family level. Although this activity has been broadly disseminated in the cities<sup>4</sup>, particularly among low-income families, there is a series of questions to which no answer has been forthcoming, namely:

- What urban agricultural system is the most advantageous for the families?
- When implementing urban agriculture, what are the main problems?
  - in marketing the products?
  - in organization/administration?
  - in production?
  - in availability of technology?
  - in training?
- What are the benefits of urban agriculture for the family?
  - in terms of consumption/nutrition?
  - in terms of contributing to the alimentary sufficiency of the family?
  - in terms of income-expenditures of the family?
  - in agronomic terms?
  - in social terms?
  - in terms of time invested?
- What productivity levels are achievable with urban agriculture?
- What recycling levels of solid and liquid wastes are achieved?
- What support is given to this activity in terms of credits, technical assistance, technological transfer, etc. from NGOs, state institutions and international institutions?

Socioeconomic research can be undertaken in several Latin American cities, considering different agricultural production systems used by low-income families, to accurately determine real impact upon the family in terms of consumption/nutrition, income and expenditures, use of family labour (especially the role played by women); supplies to urban food markets, and yields achieved in the cities.

The elaboration of common research protocol for a multiple-country study is recommended; this would ensure comparable results, and a method to specific areas requiring more support than others.

## NOTES

1. Although there are other more sophisticated products, such as mushrooms, broccoli, strawberries and others, these are produced by farmers with greater technical knowledge and economic means (water, land, etc.).
2. For example, the city of La Paz is crisscrossed North-South and East-West by more than 200 underground creeks and rivers.
3. Although hydroponics is known throughout the world, it is not generally known or practised in Latin America, with the exception of Colombia and some small regions in Central America where it is being promoted with excellent results.
4. There are several studies on this topic, although with different approaches and perspectives.

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# **URBAN WASTE MANAGEMENT: NORTH AFRICA AND THE MIDDLE EAST**

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## **INTRODUCTION**

The principal management activities of waste collection, transfer, processing and utilization, and the ultimate disposal of reject materials can be implemented in a number of different ways, depending on a variety of physical, social and economic conditions. These include the quantity and composition of waste generated, waste characteristics, climatic conditions, topography and hydrology, general layout of the area being serviced, population distribution and densities, as well as road conditions and circulation patterns. More importantly however, consonance with the cultural and human resource base of the city, the lifestyles and needs of local inhabitants, and their social values and structures are essential ingredients for optimizing the effectiveness of waste management systems and for directing these systems to servicing the real needs of urban settlements.

The purpose of this paper is to discuss prevailing waste management practices in the Middle East and North Africa (MENA) Region, focusing on the strengths and weaknesses of regional research on waste management, appraising current research capacity, and identifying future research opportunities. With the exception of Egypt and Jordan, there is a general lack of research and baseline information on waste management issues and practices in the region. There is no evidence of in-country or regional initiatives directed at sponsoring studies and research, or at developing appropriate waste collection and utilization systems. Policy formulation and operations continue to be guided by an excessive dependence on waste management system designs that are driven by a compulsion to procure expensive equipment, even in situations when financial resources are scarce. No clear strategies are being developed to benefit from the utilization of low-cost technologies or to maximize waste utilization potential in waste management operations. So far, very little has been done to develop mechanisms for information exchange and dissemination in the field of solid waste management.

## **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

### **1.1. Causes underlying the lack of regional research to date**

While there is no uniform pattern of information gathering and research in solid waste management in the region, there are definitely a number of interesting studies, pilot programs, and commercial-scale applications of waste management systems and technologies,

particularly in waste recycling and reuse. The principal causes limiting regional research to date stem from a lack of appreciation of the importance of research in policy formulation and in increasing the efficiency of operations, a general perception of solid waste management as a municipal operation rather than an important environmental and urban management issue, and a shortage of funds for environmental and urban research in general. Additional obstacles to research include the absence of a clearly articulated environmental action policy in most of the MENA sup-1 countries, which, by extension, has significantly undermined the development of a research agenda in the field of solid waste management.

## **1.2. Achievements to date**

The principal contributions to technology development, waste management system design, and policy transformation in the MENA Region have centered on selected innovative approaches to the collection and reuse of municipal waste in the informal sector, and on the application of appropriate technologies to solid waste composting. One such contribution includes the Zabbaleen Environmental Program in Cairo, which was primarily concerned with the life and work of some 30,000 garbage collectors operating informally in the waste management industry in Cairo. Detailed socioeconomic investigations of the Zabbaleen Community were conducted to serve as a basis for upgrading the area and the service delivery standards associated with its traditional trade. The Program resulted in the creation of 80 Zabbaleen-owned and operated waste management companies operating under formal franchise arrangements with the Cairo Governorate. The Program's emphasis on capitalizing on the Zabbaleen tradition of waste reuse has resulted in the proliferation of thousands of small-scale industries in the main Zabbaleen settlement in Cairo that are predominantly based on the use of waste as a source of raw material.

In Egypt, the recycling industry is currently considered to be one of the most significant components of waste management science, technology and policy making. In Cairo, for example, the private sector presently collects about 4,000 tons of waste per day and recycles about 80% of this. Moreover, the Government of Egypt has established five compost plants (three with a processing capacity of 160 tons per day and two, at 50 tons per day) in the governorates of Cairo, Giza, Alexandria and Damietta. Hundreds of thousands of people are currently employed in waste collection, transportation, sorting, processing, recycling and disposal, as well as in the marketing and selling of final or semi-final products manufactured from waste. Private recyclers are currently engaged in the recycling of various materials mainly from assorted household waste (Appendix I).

Other achievements in the region include the introduction —with varying degrees of success— of a wide range of composting technologies in Sudan, Jordan, Saudi Arabia and the Arab Emirates. The state of development of composting technology in all of these countries has gone beyond the pilot stage to commercial operations. The compost products are widely

distributed and have found a range of uses, from the landscaping of public areas to the reclamation of land in arid zones. The flow diagram (Appendix I) shows the different possibilities for recycling organic matter to produce compost. The region's experience in low-cost composting technology, as is the case in Egypt, is transferrable to many other developing countries. The successful implementation of advanced technology systems in the Gulf States is indicative of the adoption of a sound waste management policy that is based on resource conservation and reuse.

### 1.3. Future research needs

The underlying principle in waste management finance and budgeting should be low-cost technology and cost-effective projects. The initiation of waste recycling as an approach to waste management reduces the costs of waste collection and transportation, and keep service charges at a minimum, as recyclers compete to reap the utmost benefit from waste. The enhancement of the recycling industry will encourage individuals CDA's, PVO's and companies to collect waste using their own facilities thus relieving the municipality's burden. Those working on waste recycling collection would select the most appropriate vehicles and equipment in terms of cost-effective technology.

The importance of simple technology cannot be overemphasized. In Egypt, for example, an assessment of waste management alternatives suggests that building on the existing traditional system operated by informal service providers, "the Zabbaleen", is more attractive than municipally operated, advanced technology options. Not only is traditional garbage collection more productive and cost-effective, but it is also more socially sound because it capitalizes on maintaining a large low-income population productively employed in a vital urban service. Furthermore, the recycling of waste material, which is an integral part of the traditional system, provides a cheap source of raw material to tens of thousands of small workshops across the country. Therefore, research should attempt to identify low-cost sanitation systems and technologies which are simple to operate and maintain, and which have a high replicability potential.

Research in the Middle East and North Africa Region should address the local development or design of mid-range transportation methods, tailored to suit the specific needs of the local environment. Special attention should also be paid to designing collection and transportation fleets appropriate to the locally existing human resources and skills, maintenance and repair capacities, rates and composition of waste, traffic systems and waste disposal technologies. The main objective underlying such efforts should be to reach the majority of people and to reduce the costs associated with waste collection and transportation, thereby reducing uncontrolled disposal of waste. Another objective would be to develop formal, organized structures within municipalities to administer waste management systems with high reliability, to allow for high accuracy in planning based on realistic figures

and facts, and to achieve higher efficiency in coordinating with public and private institutions promoting waste reclamation and recycling. These institutions would assume the responsibility of facilitating solid waste elimination and treatment to boost the recycling industry. Consequently imports and transportation costs would be reduced, jobs would be created, and waste would become a potential and beneficial economic resource.

#### **1.4. Interrelationship between urban agriculture, water, waste and disaster**

A final point to be raised pertains to the interrelationship between urban agriculture, water, waste and disaster in the cities of the region. Generally speaking, the environmental condition of one area, city or village is a balanced system. Air, water and solid waste pollution negatively affects human beings, flora and fauna, thereby disrupting this balance. Thus, the free disposal of waste in open areas or in water canals and seas pollutes either underground water or surface water, which is used for drinking and irrigation purposes. Polluted water used for irrigation will in turn pollute and contaminate plants, thus causing health hazards and disasters.

## **2. APPRAISAL OF RESEARCH CAPACITY**

Out of a large number of governmental and nongovernmental organizations in the Middle East and North Africa Region, there are only few organizations dealing with waste management as one of their main activities. As a matter of fact, only very few of them have solid field experience in this domain, while their experience is restricted to waste management and the exchange of theoretical reports with universities and other organizations, either nationally and internationally. The following are names and addresses of a number of institutions in the MENA Region that have been identified as operating in this field:

- a) Institut National d'Aménagement et D'Urbanisme (INAU)  
Address: B.P. 6215, Rabat, Morocco  
Contact person: Fauwi Zniber

The National Institute for Town Planning and Urbanism, founded in 1981, is part of the Moroccan Ministry of Interior. It is divided into two main sections: a training and education section, responsible for the preparation of graduate students and officials to solve practical urban problems; and the Center of Studies and Research for Town Planning and Urbanism (CERAU). In addition to its academic activities, INAU administers the following research projects and activities: urban waste projects in Rabat; the urbanization and integration of the countryside; urban and habitat models; safe town planning; and the regulation and formation of underground settlements.

- b) Arab Urban Development Institute (AUDI)  
Address: P.O. Box 6892, Riyadh 11452, Saudi Arabia  
Contact person: M. A. Al Hammad

The Arab Urban Development Institute is a technical, scientific and consultative nonprofit organization affiliated with the Arab Towns Organization (ATO). The overall objective of AUDI's activities is to improve the image of Arab cities and municipalities by developing the skills of municipal officials. It is concerned with developing and raising the standard of municipal services and utilities in Arab towns, and the preservation of their Islamic character and heritage.

AUDI organizes conferences, seminars, symposia and urban-oriented short-term courses on specific topics such as: waste management; urban renewal; management of medium-sized cities; the Arab city, its character and Islamic cultural heritage; administrative methods and organization in the service of the Arab city; town planning and engineering design in Arab towns; and architectural landscape in Arab cities.

AUDI undertakes research projects either alone or in cooperation with regional and international institutions. High priority is placed upon problem-oriented research. The institute also provides consultancy services to improve basic infrastructure, municipal services, and the cultural and socioeconomic conditions of Arab citizens. In addition to its documentation and library services, AUDI has established for its members an information center on Arab cities, which provides selected information on specialized topics.

- c) Institut Tunisien de Technologies Appropriées (ITTA)  
Address: 88 Avenue Habib Bourgiba, Carthage Hanibal, Tunisia  
Contact person: Cherif Zaouche

The Tunisian Institute of Appropriate Technologies was founded in 1980 by a group of intellectuals following the ideas of the Egyptian architect Hassan Fathy. ITTA, in collaboration with UNESCO, has launched the Skhira Project, whose objective is to engage in irrigation projects, and to determine those building methods most suited to the existing irrigation systems. ITTA has attempted to restore traditional building techniques, and to stimulate the use of local building materials. However, so far Skhira is a very marginal site, and it is hoped that this project — named by the UNESCO: "Culture for Development Project" — will support the reevaluation of local civilization and thus boost local and self-reliant development.

- d) Dar Al-Handasah Consultants  
Address: Verdun Street, Dar Al-Handasah Bldg., P.O. Box 7159, Lebanon

Contact person: Kamal A. Shair

Dar Al-Handasah was established in 1956 to undertake assignments in all the key sectors of economic growth and development. The Resources and Environment Department of Dar El-Handasah was established in 1966 in response to the growing demand for specialized consultancy services related to the development of water and land resources, and to the design of environment-oriented systems. Since then the department had grown to about 130 engineers, specialists and supporting staff. It has successfully handled over 180 projects in the Middle East and Africa. These projects fall into the following fields: water resources, irrigation and drainage; agricultural development studies; storage and diversion dams; sewerage, sewage treatment and pollution control; solid waste collection and disposal; water supply; stormwater drainage; river training, inland waterways and land reclamation.

Dar El-Handasah has undertaken the study and design of solid waste collection and disposal systems as an integral part of Master Plans developed for various towns and as part of the essential infrastructure for several university complexes. The design covers refuse collection, storage and disposal. The character of the waste is assessed to determine its combustible qualities and the level of support fuels needed for sustaining ignition in furnace disposal, if this method is selected. Legislation on the pollution of air and water sources is taken into account in the study and recommendation of alternative disposal systems as, also, are national and international conventions regarding radioactive waste.

- e) Environmental Quality International (EQI)  
Address: 3B, Bahgat Ali Street, Zamalek, Cairo, Egypt  
Contact person: Dr. Mounir Neamatalla

Environmental Quality International was founded in 1981 to provide environmental and management consulting services to government and private sector institutions. The firm has been an active participant in Egyptian government programs to upgrade and expand basic urban services, particularly in the area of solid waste management. EQI has conducted over twenty studies for numerous governorates in Egypt, assessing the technical and economic merits of alternative collection and disposal methods, with a view to designing low-cost waste management systems that use intermediate technology and that are appropriately tailored to environmental and socioeconomic conditions. In addition, the studies analyzed the technical and financial potential of composting as a method of resource recovery and commercial and household waste disposal. Moreover, EQI designed ten, and oversaw the construction of four 160-ton-per-day composting plants and was responsible for testing and evaluating their performance during both the start-up period and the year of guarantee. EQI has also initiated programs designed to maximize material recovery from municipal solid waste by introducing mechanization into the reprocessing of textiles, plastics and ferrous metals, and has

participated as a technical advisor in similar program implementation in other MENA countries.

- f) The National Research Center  
Address: Tahrir St., Dokki, Cairo, Egypt  
Contact person: Dr. Mahmoud Nassralla

The National Research Center was established in 1939 to engage in the field of basic and applied research in industry, agriculture, and public health. It is divided into 15 specialized research divisions, one of which is the Environment Research Division. This division is comprised of the following laboratories:

- Water Pollution Laboratory, responsible for potable water and domestic and industrial waste treatment, water microbiology, water chemistry, water recycling, renewable energy sources (biogas), and water polluted with organic and inorganic substances;
  - Air Pollution Laboratory, responsible for diagnosing different cases of air pollution in various industries and in the atmosphere of towns and cities, and for studying pollution sources. It is further responsible for environmental and urban planning and industrial zoning.
  - Occupational Health Laboratory: responsible for conducting research studies on occupational diseases and on the employees exposed to these, for periodically analyzing industrial workers, and for carrying out laboratory research on animals.
- g) Academy of Scientific Research and Technology  
Address: 101, Kasr El Aini St., Cairo, Egypt  
Contact person: Dr. M. Mokhtar El Halwagi

The Academy was established in 1971, to operate as the central body responsible for supporting scientific research and the application of modern technology in all fields of socioeconomic development. It is also responsible for formulating policies linking all scientific research and technology institutions on the national level to the basic directives of scientific and technological research designed to meet the requirements of general development plans. The Academy embodies eleven specialized Research Councils and four Inter-council Committees. These are:

- Specialized Research Councils: food and agriculture; industry; petroleum, energy and mineral resources; medical research; environment; transport and communication; housing and construction; new settlements; management and economics; social sciences and demography; and basic sciences.

- Inter-council Committees: rural development; water and sewage; food industries and nutrition; and Sinai development.

### **3. FUTURE RESEARCH OPPORTUNITIES**

The practical and theoretical involvement of both the people and officials could be achieved through the creation of new institutions serving as coordinating bodies and consolidating the operations of human settlements. To be effective, these institutions must have explicit authority that cuts across line ministries; must have sufficient funding; and must have sustainable sources of revenue generation. Generally, they would be entrusted with the following:

- field work, to initiate as many positive effects as possible on the country's national economy (import/export, employment, industry), and generally on the environment;
- the promotion of public awareness and education, as well as the conduct of studies and research.

#### **3.1. The establishment of the Waste Management and Recycling Research Center**

This center would be engaged in recycling household waste —basically on a commercial basis— as well as in research. It would, for example, receive from 50 to 100 tons/day of household waste, which would then be assorted into its main components, such as organic matter, metals, plastic and bones. Each component would be moved to a specialized branch in the same plant for recycling. The branch manager would be responsible for the recycling of the material, its profitable sale, the purchase of new equipment, the maintenance of existing equipment, and, if possible, innovations in recycling methods (Appendix II).

In addition, students from other scientific centers, universities and institutions would be able to visit the Center, to research the following: methods for recycling waste materials; composting technologies; time/motion analysis; change in waste composition due to changes in consumption patterns in urban areas; health and hygienic methods of waste sorting and recycling; risk assessment of waste disposal; and the appropriate rehabilitation of conditional disposal, among others. The Center would be established with the following objectives:

- to provide a real-life example of waste recycling as a profitable and environmentally sound industry;
- to study, on-site, the problems, solutions and alternatives of waste disposal and/or recycling; and

- to assist in conducting research as well as in increasing public awareness.

The idea underlying the establishment of this Center stems from the notion that people as well as decision makers do not have sufficient background in problems associated with waste management, and knowledge of how recycling can positively affect the national economy. Thus, the Center would, for example, counter the common belief that the recycling of waste is not beneficial in terms of employment generation.

The Center would target all those using waste materials and their products or byproducts, such as the plastic industry, the metalwork industry, the glassware industry, land reclamation specialists, and cultivators.

The basic layout of the Center would include the following (Appendix III):

- an administration building, including a materials laboratory, a library, a showroom, as well as administrative offices for the general manager, directors and staff;
- a yard for waste reception and aerobic fermentation of organic matter, for the production of compost;
- six workshops for recycling secondary materials such as plastic, rubber and leather, metals, glass, paper, bones, and rags; and
- all the necessary equipment for processing and recycling waste components, and disposing of the rejects.

The estimated size of the Center is 10,000 m<sup>2</sup> and the estimated cost US \$ 2 million.

### **3.2. The establishment of the High Commission for Waste Management Studies**

The aim of this Commission would be to examine waste-related issues and problems in designated countries, and to develop environmental education and training programs directed at students, the general public, and professionals. The Commission would encourage environmental literacy, which will make people feel included in the development process and will facilitate the implementation of environmental and health programs. Generally, responsibilities would include the following tasks:

- obtaining measurements of prevailing environmental and health conditions. Baseline information and statistics typically collected include demographic and socioeconomic data; vital statistics; measurements on environmental conditions; community needs and priorities; availability and condition of infrastructure and facilities; transportation

- modes and networks; existing land use; and profiles of the human and financial resource base at national, local and community levels;
- conducting systematic audits of facilities —industrial, commercial, and others— to determine the characteristics of waste materials.
  - drawing up a nationwide map illustrating the types and quantities of waste generated in the country;
  - identifying the various methods of waste disposal (e.g. recycling, open disposal, controlled disposal, hazardous disposal, etc.) and their impact on the environment;
  - identifying alternative methods of waste management, and specifying the most suited method for each specific type of waste;
  - coordinating the efforts of governmental and nongovernmental bodies, to solve problems related to waste generation and disposal;
  - organizing and recommending educational courses of various levels, to familiarize students with the problems associated with waste generation and disposal;
  - organizing public awareness campaigns through the media, such as television, radio, movies, newspapers and advertisements;
  - coordinating, nationwide, between various research centers and universities active in the field of waste management and disposal;
  - establishing the link between studies on waste management and on issues such as urbanization, housing, urban agriculture, water and disaster; and
  - linking national efforts and studies on waste management and disposal with international ones. Special attention should be paid to studies conducted in neighboring countries, to exchange experiences and identify alternative solutions.

The High Commission should include administrators, representatives from concerned ministries and institutions, technical researchers, professionals from the fields of education and mass media, socioeconomic researchers, and data collection and analysis specialists (Appendix II).

Potential target groups of such a commission would include decision makers, students, researchers, as well as concerned and interested individuals or groups. In most developing

countries, these target groups have little or no access to information related to the above mentioned issues. Governments allocate insufficient funds, if any, to waste management. Moreover, institutions do not give this issue its due importance, and their efforts, if any, are not coordinated. Therefore, the socioeconomic outcomes resulting from the formation of such a commission are expected to be high, given that one organized body would be responsible for addressing all issues related to waste generation, management, and disposal.

It is recommended that two commissions entrusted with the above mentioned objectives be established in two neighboring countries, to coordinate efforts, exchange experiences and compare results. The first commission could be established in Egypt, to build on existing capacities, while the second could be established in Libya, Sudan, Jordan, Syria, Lebanon, or Tunisia, given their proximity to Egypt, and their comparable environments. The budget for one commission is expected to range from US \$ 3 to 5 million for the first phase (2-3 years). The commissions could initially start with addressing problems associated with solid waste, and subsequently deal with other forms of waste such as wastewater, waste gases, agricultural waste, industrial waste, and hazardous waste.

### **3.3. The development of a regional environmental data base**

An environmental resource profile should be developed for the MENA region, with the objective of assisting governments in formulating clear policies, enforcing the necessary controls, and facilitating the efficient design and implementation of environmental conservation programs. The establishment of the data base will involve data collection and gathering, and data interpretation and classification. This could be done through the combined efforts of PVOs, NGOs, universities and research centers in the MENA region. Interested organizations could be nominated as satellites entrusted with the investigation of environmental problems and the identification of potential resources. These satellites would serve as correspondents to a central data base for the MENA region. Possible areas of research may include the following:

- developing industrial waste management programs addressing both on- and off-site control measures, related institutional issues and financing requirements;
- examining the relationship between environmental and health conditions in both urban and rural settings;
- conducting systematic audits to determine the characteristics of waste materials produced by various industrial and commercial facilities; and
- drawing up a nationwide map illustrating the types and quantities of waste generated.

A team of researchers and field investigators would be involved in the information gathering process, while the satellites would be assigned the responsibility of interpreting and classifying the information. They will, in turn, feed the obtained information into the central data base, to be used in waste management, health-related, as well as in environmental and socioeconomic impact studies. Moreover, this information would provide an overall view of environmental problems and hazards in the region, thereby facilitating the decision-making process. Based on the collected information, policies could be formulated and environmental conservation programs designed.

To secure the success of the three above-mentioned plans, a systematic approach to instill civic consciousness, raise awareness, and attain scholarship in environmental sciences needs to be adopted to achieve measurable improvements in environmental and health conditions in urban settlements. Environmental concerns should also be integrated into the basic educational system. Communication networks should work on raising consciousness and converting the general public into environmental advocates. Governments and businesses should begin training their staff to account for the environment in their respective professional disciplines. This is necessary to introduce and sustain the concept of sound environmental management at all levels. Special emphasis would be placed on the media and on government officials working in the environmental sector. When formulating the media approach, planners should determine the appropriate medium for information dissemination and should take into account the high illiteracy rate in developing countries. Nongovernmental voluntary organizations should be encouraged to expand their membership and activities, given that such organizations are often best suited to raising awareness about environmental issues, soliciting community participation, and advocating the required reform.

The greater the community's involvement in a project, the better are its chances of success. In addition, public involvement can help compensate for any lack of financial and labor resources. Therefore, special effort should be devoted to developing appropriate models and raising awareness among the general public, to maximize their participation in sustaining the operation of environmental services. Decentralizing waste management activities to reach specific neighborhood is often the first step toward instituting pride in the community and raising civic consciousness, both of which are essential ingredients of community participation in the process of waste management.

Following are some ideas for research that could be handled at the levels of the recycling center and the high commission rather than the regional data base.

- a) At the recycling center level:
  - o Study the possibility of using waste material in the construction industry.

- Study the possibility of using paper, bones and other organic material for producing compost and animal fodder to enhance urban agriculture industries.
  - Design small equipment appropriate to small entrepreneurs to recycle other materials such as glass, paper, rags, etc..
- b) At the high commission level:
- Start with a diagnostic research in which all types of waste are identified as to quantity, composition, source and geographical location. This research will enable politicians and decision makers to make the right decisions concerning waste management. At the same time, it would help environmentalists and other researchers to initiate further complementary research.
  - Study the relationship between the socioeconomic levels, people and their preferences regarding waste collection and disposal service.
  - Study the relationship between the availability of waste collection and disposal service and, say, infant mortality, infant morbidity, epidemic infections, diseases, etc..
  - Study the hazard and risk involved in the recycling industry.

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## APPENDIX I

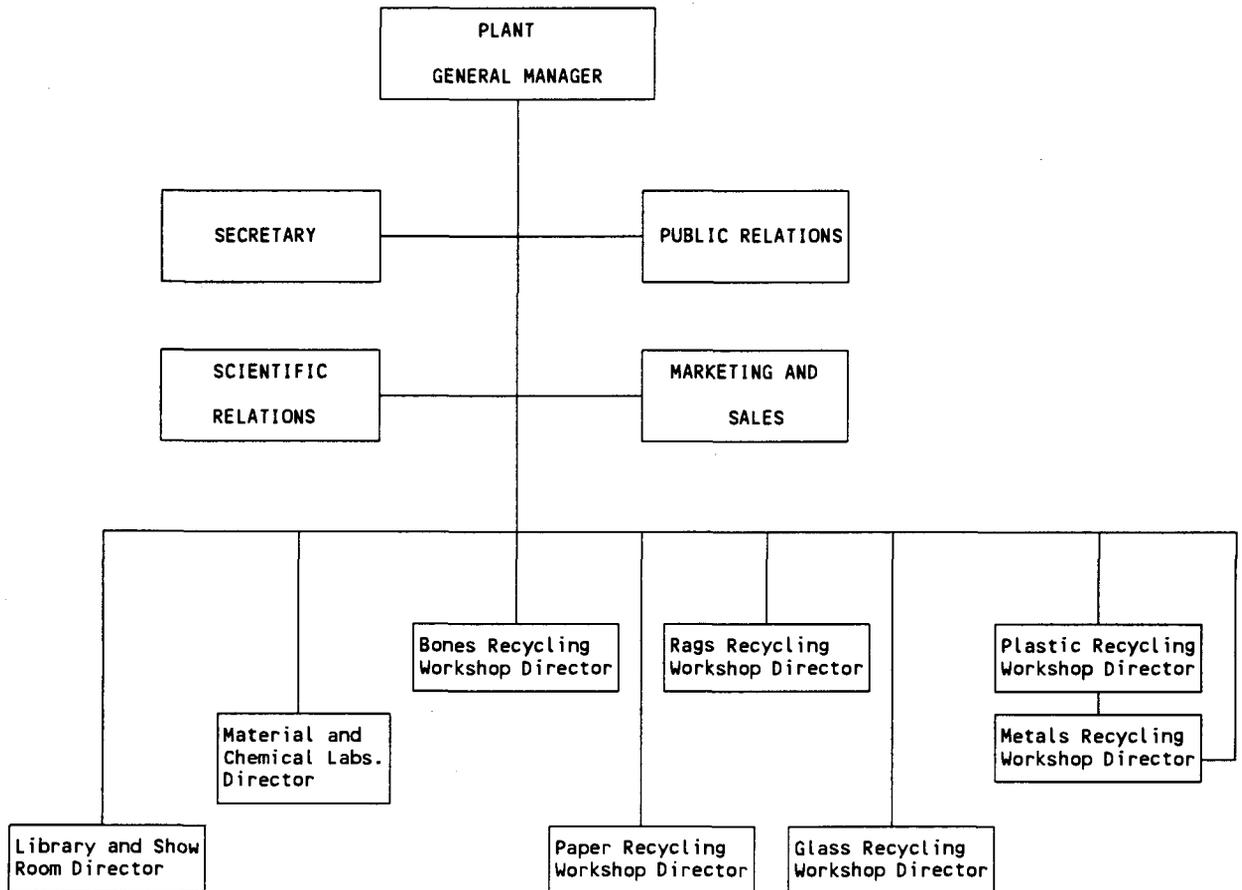
## Types and Uses of Waste

Type	Uses
Organic Matter	Rasing pigs Composting through aerobic and/or anaerobic processes
Plastic	Polymers Colors Plastic products
Paper	<u>Semi-final Products</u> Gray hardboard Craft Duplex cardboards <u>Final Products</u> Egg-trays Disposable dishes Boxes and containers
Bones	Extraction of fat, gelatine and pure calcium for use in industry
Glass	Glassware and glass products
Metals	Cans, semi- and final products
Rags	Upholstery of furniture and automotive seats

## APPENDIX II

### Diagram One

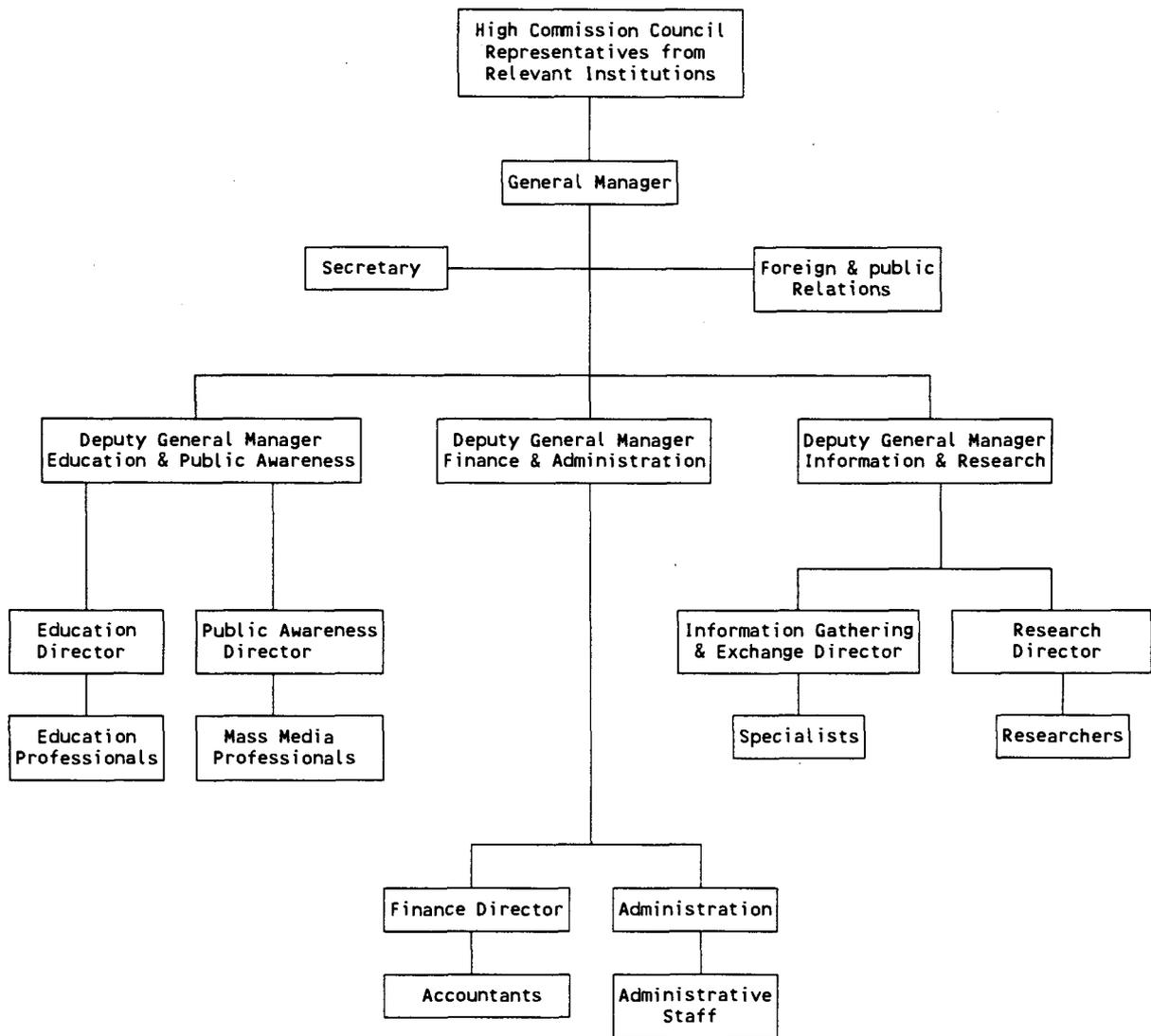
#### ORGANIZATION STRUCTURE OF THE RECYCLING AND RESEARCH CENTRE



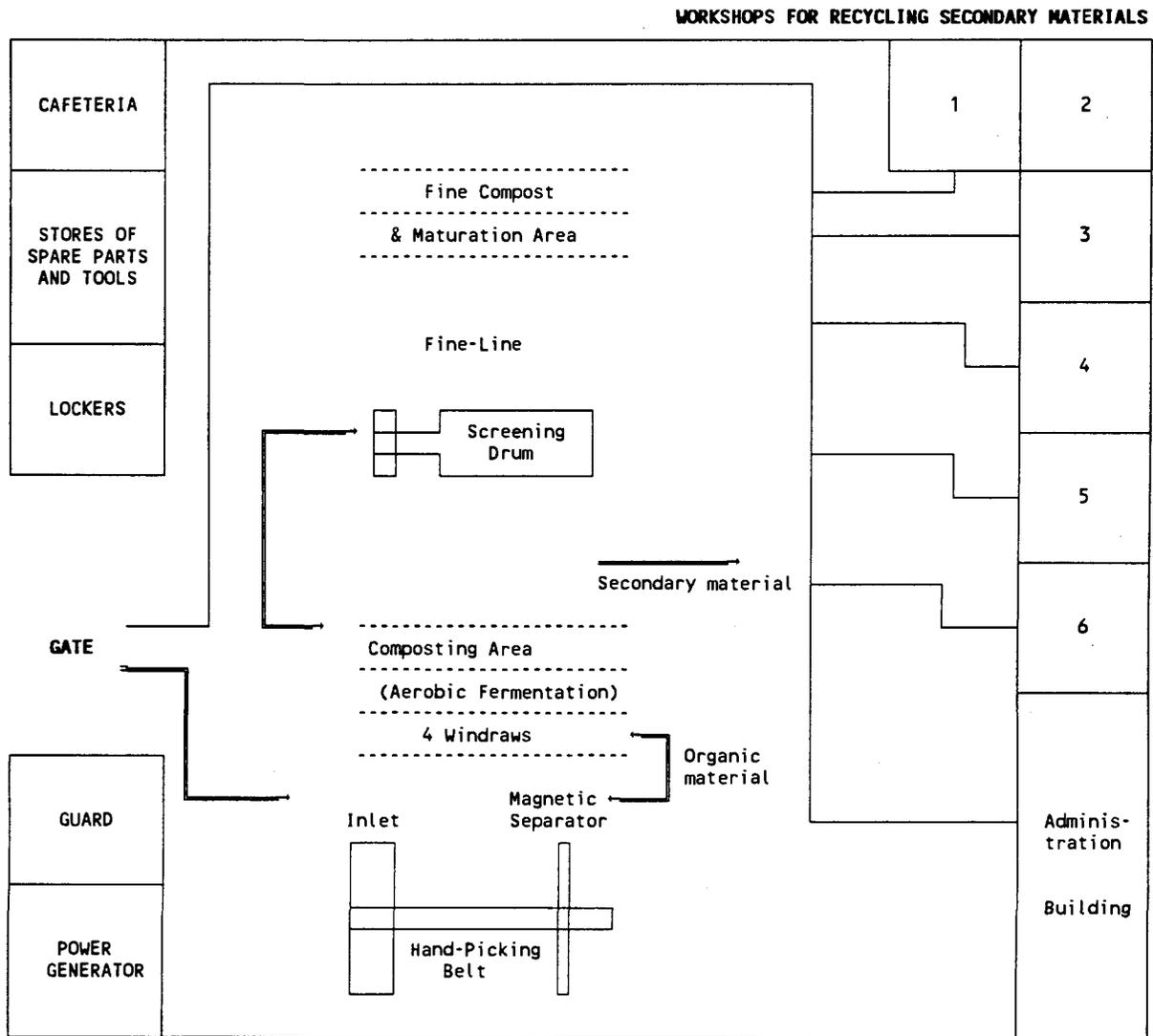
APPENDIX II

Diagram Two

ORGANIZATION STRUCTURE OF THE HIGH COMMISSION



**APPENDIX III**  
**THE WASTE MANAGEMENT & RECYCLING RESEARCH CENTRE**  
**PLAN AND FLOW OF MATERIAL**



# **URBAN WASTE MANAGEMENT: CENTRAL AND EASTERN AFRICA**

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## **INTRODUCTION**

The dawn of the last decade of the twentieth century finds the Central and Eastern African subregion at the verge of a massive transformation of its political and socioeconomic structures. Almost every country in the region is now involved in the process of effective systematic political and economic changes. At the same time, the aftermaths of an economic crisis which persisted throughout the previous decade are becoming more evident as they threaten the sustenance of social fabric. The standards of public services such as education, health, water, infrastructure etc. are falling below the levels enjoyed by the citizens in the 1970s (Stren, 1989).

Urban centres seem to be at the confluence of these dynamics. On the one hand, they have not yet recovered from the negative impact of economic crisis and administrative neglect of the previous decade and, on the other hand, they have now to accommodate the structural changes which are attaining their full momentum during the 1990s. The consequences of these changes tend to weigh heavily on the cities and towns of the subregion. The pressure exerted by these forces is of such magnitude that if it is not contained immediately it may undermine the total capacity of the subregion to cope with the broader challenges of the 21st century. The above predicament elevates the subject of urbanisation together with related issues of providing infrastructure and services to become a top priority issue in the development of the subregion. One such important issue is waste management in the urban areas. It becomes necessary for scholars and practitioners in the field to reexamine the content and evaluate the existing knowledge of urban phenomenon in the subregion. This involves taking stock of how much is known, identifying prevailing gaps and lacunae, and charting out a new direction for future inquiry and solution proposals to avert the crisis.

### **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

The cleanup of our environment is increasingly becoming an important issue on the national and international scenes. In addressing the problem of environmental degradation, governments will inevitably find other problem areas that would benefit from solutions for implementing prevention of environmental damage. One field of work, in particular solid waste collection and recycling, could achieve the combined improvement of the environment and unemployment rates. Solid waste collection and recycling of that waste not only serve to

reduce the amount of waste, the land area used for storage, and pollution, but also serve to generate employment in the areas of waste collection, sorting, transportation, processing, recycling, and the selling of waste components and its by-products.

The increasing quantity of waste is creating a serious environmental problem in the urban areas in the developing countries. The status of waste management in our major cities are unhygienic and unsatisfactory. In Tanzania, Kulaba (1988) observed that on average, all urban authorities could only collect 24 percent of the estimated refuse produced everyday in the urban areas. In Dar-es-Salaam the level of collection is only 16 percent of the garbage (Mabuba, 1991). In Kenya, Syagga (1992) pointed out that less than 50 percent of the refuse generated in Nairobi is collected while the rest remains scattered and rotten in open spaces, open drains and roadsides. Similarly, in Kinshasa, Zaire, Mbuyi (1989) pointed out that collection of household waste and cleaning are not carried out in a coherent way. In most parts of the city household waste is put on the road, in illegal dumps, in storm water drains or buried in plots. Similar cases of hopelessness in solid waste collection have been observed in Kampala (Bushra, 1992) and Kigali (Bertolini, 1992). A maximum of 15 percent of total household waste generated in Kampala is collected by the City Council, and residents have to bribe council workers so as to get garbage collected. The situation continues to grow worse as the population increases, and governments continue to lay emphasis on self-financing of municipal services.

Most of the available research in the region has concentrated on municipal waste collection and disposal of waste at dump sites. Very little attention has been paid to privatisation of waste management and the industrial or economic significance of waste recycling. Studies in Kenya (Mbugua, 1979 and Wachira, 1980) considered the need for appropriate housing estate design to facilitate solid waste collection by Nairobi City Council in terms of where to locate collection points or transfer stations within the buildings and the estates. The role of households, community, private sector and institutions was not considered an important issue in the management of the solid waste. Besides making recommendations such as the use of plastic bags to avoid rusting of the present metal dustbins, and the need to use compressing machines for any refuse from offices to compress the refuse into bales so as to reduce the volume of refuse collected, both studies assumed that tipping is the only disposal method for solid waste. In this regard both studies recognized that Nairobi would soon run out of sites for tipping since the City Council did not deliberately plan for such sites. Where the tipping is being done now in Nairobi was once a stone quarry site which may become filled soon, particularly if all waste generated daily was sufficiently collected. There is therefore an urgent need to consider alternative methods of not only reducing the amount of waste to be disposed but also the need to look into alternative disposal methods including composting, incineration and resource recovery. Yhdego (1992) in Dar-es-Salaam identified poor design and lack of a well-organized waste storage, collection and disposal systems in the city markets. Proposals for improved design

of storage and collection facilities were described. However, the basic assumption was that waste management remained the responsibility of Dar-es-Salaam City Council. Mabuba, (1991) equally supports the notion that the municipal government should still retain broad responsibility for waste management, providing operational and technical support.

Research on waste management in the region also makes no reference to possible benefits of waste to agriculture, possibly due to the prevailing practice in the region where urban agriculture is illegal. There is need to link waste management with urban agriculture. Furedy (1990a) pointed out that in India, Calcutta's main dumping site established in 1865, is now being leased by the Municipal Corporation for vegetable farming. Fresh refuse is also highly priced by farmers who make arrangements with drivers to obtain consignments before the trucks reach dump sites. In the Central and Eastern African region the link between waste management and agriculture would be particularly valuable. In Kigali, for instance, Bertolini (1992) draws attention to the preponderance of natural as opposed to synthetic or industrial matter in domestic garbage. The study shows that organic and inert matter makes up 92 to 96 percent in weight of total household garbage. This leads to the need to consider the possibility of making compost as a means of valorising the domestic garbage. Yhdego (1992) also points out that two-thirds of the waste from Kariokor market in Dar-es-Salaam consists of vegetable matter, while in Kampala 75 percent of waste generated is composed of organic matter or vegetables (ILO/UNDP, 1991). Given the nature of the eating habits of most of the inhabitants in the region it can be concluded that most of the household waste consists of organic matter. This gives rise to use of the waste either in composting or in feeds to animals such as pigs, etc.. Each of these activities would form a solid base for demand for urban agriculture. While many Asian countries have allowed for intensive urban and urban fringe agriculture, planning regulations in Central and Eastern African countries prohibit farming within urban areas. This is despite the fact that 60 percent or more of the urban population in these countries practice some form of agriculture illegally (Lee-Smith et al., 1987; Mosha, 1991). Those growing food in towns include middle and high-income groups who grow their food in their back gardens. The low-income groups tend to farm on road and railway reserves, river valleys and other vacant land such as open spaces in residential estates, open fields and forested land. The policies of "allotment" used in some countries should be studied by African countries to see how best urban agriculture can be promoted as a productive industry. It will also be necessary within the region to make detailed analysis of the composition of the waste for purposes of making compost. The waste may contain some inert matter such as sand or pebbles which are nonbiodegradable and thus reduce the extent of "compostability". Such materials will have to be separated from what is to be put in the compost heaps.

Other studies in the region (Khadaka, 1988; Ruto, 1988; Kulaba, 1989; Mbuyi, 1989; Mwaura, 1991; Syagga, 1992) have made references to the failure of the urban authorities to collect and dispose of waste adequately largely on account of insufficient equipment. Kulaba

observes that all local authorities have insufficient vehicles which are either in poor mechanical condition or are not working at all. Syagga pointed out that Nairobi City operates with only 25 percent of the daily requirements of refuse vehicles of different types. In the peripheral neighborhoods of Kinshasa, the squatter settlements of Nairobi or the unplanned settlements of Dar-es-Salaam and Lusaka, the lack of viable access roads handicaps the collection of household waste. Thus the use of modern equipment in collecting waste in this region would appear inappropriate not only because the vehicles are expensive to acquire and maintain, but equally rendered unusable in the unplanned settlements where the majority of urban residents in the region live. Despite this phenomenon, studies commissioned on waste management problems in Nairobi (Brown, 1985; Farid, 1985 and Sulo, 1988), continued to recommend the use of western-based high technology without due regard to the viability in terms of affordability by the urban residents. These reports are also prepared without due regard to the need to involve the households and the community in the management of waste in their areas. The Kampala study (ILO/UNDP, 1991) found that residents were willing to participate in solid waste collection and recycling programmes rather than wait for the irregular services from Kampala City Council. The need to establish a waste collection service managed by NGOs with the participation of local communities was emphasized as an alternative to the Kampala City Council services. It was also thought feasible to encourage small-scale businesses to carry out waste collection to be paid for by residents. These issues need to be studied in other towns in the region. Where found feasible a wide range of collection vehicles recommended by UNCHS/HABITAT (1986) would be deployed. The use of nonmotorized equipment such as hand carts and animal drawn carts should be considered in the region. Waste collection system in Cairo, for instance, is entirely in private hands, and the transport system is based on donkey carts which take waste from all neighborhoods, including narrow streets where modern trucks cannot enter (UNCHS, 1989).

Further south, work on solid waste management has been undertaken by Tevera (1991) in Zimbabwe and Botswana. The problems identified for poor services included institutional arrangements, finance and lack of motorable streets in the upgraded squatter settlements

The benefits of waste recycling is so far not clearly understood by the urban authorities and their residents in the region. The importance of a recycling approach to the management of solid cannot be overstated. The recycling of waste is an employment and income-generating activity which represents a viable and environmentally sound solution to waste management problems. It is also a cost-effective activity in terms of waste collection, transportation and disposal, and is energy saving at both the micro and macro levels. There is thus need to carry out household economy studies to estimate the importance of wastes in meeting basic needs, especially under conditions of increasing unemployment or scarcity of basic necessities. However, the uses to which the waste is put depends on the form in which

the materials are recovered, and available technology. There is thus urgent need for detailed study in the region to determine the cause of the reluctance to resource recovery in many cities, and to consider privatising solid waste management.

It may be summarized that the following objectives in urban environmental management with focus on waste management deserve further research in the region:

- a) Research is necessary to determine the economics of waste recycling and hence the need to create demand for it in the urban areas in the region. It has been reported that in Egypt, waste collectors have found markets for practically all waste materials and discard only 15 percent of the original waste volume at their dump sites. Recycling of refuse is a very labour-intensive activity and will contribute substantially to employment generation. Appropriate technologies should be promoted in recycling waste so as to provide a variety of options for reuse of waste materials.
- b) Research is necessary to determine the most appropriate waste collection methods, which promote the use of community resources utilizing informal sector and appropriate technologies. The use of human and animal-drawn equipment in solid waste collection deserves a closer look. The community approach is based on the principle that the responsibility for collection and removal of solid waste should lie with the generators of waste. Each generator of waste, households, businesses, institutions, industries, etc. should be required to draw from their own resources to ensure that waste is removed in accordance with guidelines set by the respective urban authority. The municipal authority should retain responsibility for maintenance of municipal dumps, establishing a system of guidelines and standards, monitoring compliance with guidelines, and spearheading campaigns for public participation.
- c) Research is necessary to determine the gender issues in waste management, especially under conditions of increasing unemployment or scarcity of basic necessities for the vulnerable groups. What is the attitude of women to solid wastes? What general concerns do women have about access to wastes, neighborhood cleanliness, and how do they view their role in solid waste management as a business? This research is important because many urban authorities employ women in cleaning, and therefore women's experience as both household managers and public cleaners could be drawn upon to provide insight into attitudes towards waste and waste management behavior in the community. A commitment by women to improve their earnings and work, would be a major entry to community-based solid waste management.
- d) Research is necessary to promote urban agriculture and hence create demand for organic waste both as feeds to animals and for compost manure. Urban agriculture will also utilize the water and sewerage effluents for fish farming.

e) Research is necessary to determine the environmental and health significance of solid waste management. Leachate from dumps affects soil, groundwater underneath and surface water around the site. Generation of gas in the sites augments the fire risk and combustion of hazardous wastes produces priority pollutants. Smell and litter affect the surroundings of the site and methane emissions from the dumps contribute to the greenhouse effect. None of these issues have been studied in the region to determine appropriate disposal sites as well as rehabilitation for conditions of reuse. Similarly, no studies have been carried out on the effects of waste handling on the waste workers such as scavengers, transporters and recyclers. Results from these studies could provide for improvements in waste handling so as to reduce the potential health hazards in the region.

## 2. APPRAISAL OF RESEARCH CAPACITY

Most of the research in the region has been carried out either by academic institutions (e.g. students' theses, staff papers, etc.) and consultants hired by international agencies. Many of the academic institutions in the region have research institutes or engineering faculties that are capable of carrying out research on waste management. Such institutes and faculties exist in most of the countries in the region and may be found in such documents as the Register of Development Projects in Africa (OECD, 1992a), the Directory of Development Research and Training Institutes in Africa (OECD, 1992b), and the Directory of African Experts (UN, 1990). The research institutes and faculties are in many cases equipped for purposes of carrying out research on environmental engineering as well as socioeconomic surveys. While considerable amount of work may have been carried out on the management of airborne and waterborne residuals, solid waste management has been scarcely studied. One consequence of this has been to adopt engineering approaches to problems inappropriately. The quality of policy analysis and recommendations, and the welfare of the society, are clearly dependent on the quality and character of thought that goes into both identification of the problems and supporting analysis. The levels of planning and management literacy among both public officials and consultants have in general been insufficient to deal with many of the problems of solid waste management. It will therefore be necessary to sensitize these institutions and use the capacities that exist in them to increase the general level of problem identification with respect to waste management.

Most of the institutions in the region are publicly funded and therefore have strong links and collaboration with the government as well as other institutions. Many of them have links with other institutions in the developed countries for purposes of collaborative research and staff exchanges. This has helped them to acquire both the equipment and research experience.

A few NGOs, both local and international are also now active in research in the region, although their research capacity may be limited to socioeconomic surveys rather than laboratory research.

Some of the institutions which are considered capable of carrying out research on waste management are listed below, including the names of possible contact persons. They are deemed to have adequate personnel and equipment, and from the records (OECD, 1992a) they are actively involved in research.

**Burundi:** Institut des Sciences Agronomiques du Burundi. **Address:** BP 795, Bujumbura. **Contact person:** E. Niyongabo

**Congo:** Direction Générale de la Recherche Scientifique et Technique, Brazzaville. **Address:** BP 2499, Brazzaville. **Contact person:** J. Diamonangana

**Kenya:** 1. Department of Civil Engineering, University of Nairobi. **Address:** P.O. Box 30197, Nairobi. **Contact person:** O. Mbeche.  
2. Housing Research and Development Unit, University of Nairobi. **Contact person:** P.O. Ondiege. 3. Department of Land Development, University of Nairobi. **Contact person:** P.M. Syagga

**Ethiopia:** Faculty of Technology, Addis Ababa University. **Address:** P.O. Box 30367, Addis Ababa. **Contact person:** Z. Berhane

**Malawi:** Department of Civil Engineering, University of Malawi, The Polytechnic. **Address:** Private Bag 303, Chichiri, Blantyre 3. **Contact person:** R.J. Young

**Sudan:** Faculty of Engineering & Architecture. **Contact person:** A.K.A. Wahab

**Tanzania:** 1. Institute of Resource Assessment, University of Dar-es-Salaam. **Address:** P.O. Box 35097, Dar-es-Salaam. **Contact person:** A.S. Kauzeni. 2. Water Institute, MWC & M, Dar-es-Salaam. **Contact person:** P.B. Mabuba

**Uganda:** Department of Civil Engineering, Makerere University. **Address:** P.O. Box 7062, Kampala. **Contact person:** C. Mukunya

**Rwanda:** Faculté des Sciences Appliquées, Butare Universitiet Nationale du Rwanda. **Contact person:** D. Munyangawizi

**Zaire:** Centre d'Etude et d'Experimentation des Technologies Appropriées (CEETA). **Address:** BP 2849, Bukavu. **Contact person:** Z.O. Lunanga

**Zambia:** Technology Development & Advisory Unit, University of Zambia. **Address:** P.O. Box 32379, Lusaka. **Contact person:** F. Yamba

### **3. FUTURE RESEARCH OPPORTUNITIES**

Research on environmental management strategies is needed to provide sound guidance in the region in the process of establishing new policies and programmes and selecting policy instruments aimed at waste management. The research should include in-depth studies on the following:

#### **3.1. Institutional resources**

There are no clear institutional arrangements and regulations in most countries in the region regarding waste management. Effective enforcement mechanisms and institutions are crucial to improve environmental quality and management of wastes. There are no regulatory instruments specifying the purpose of waste management, standards to be achieved, recovery charges and remedies for default.

Waste management requires the intervention of many actors, including: the municipal administration, the resident populations, community-based organisations and small-scale enterprises. It is important to define the scope of intervention of each actor. At the level of the municipality, it may be necessary to revise the current procedures for waste management that would allow for decentralisation and execution by other actors. It is therefore necessary to identify methods of sensitizing the urban authorities to appreciate the role of the community as partners in development. Waste management policies should be flexible enough to make use of local resources as much as possible. Such an approach would enable the municipality to get works executed more efficiently; share the burden with the population that takes a direct interest on waste management, and carry out better controls.

There is therefore an urgent need for research that would assist municipalities in acquiring a solid legal framework to support implementation of local environmental policies. The research should end in the production of a sample manual on policy, and appropriate regulatory instruments for monitoring and enforcement capabilities.

#### **3.2. Human resource development**

The starting point for understanding the social dimensions of waste management is the recognition of the centrality of waste in the lives of the people. There are many people involved in waste management including those who generate waste, those who collect and transport waste, and those who reuse waste. Thus waste management requires much more

than good engineering or good management. There has to be a combination of both with an understanding of the people and their way of life. It is also important to note that waste management is one of the essential services that any healthy community must have. Although dangers of waste management mainly concern toxic industrial waste, household waste may be a cause of biological hazard through proliferation of rodents, vermin and environment nuisances. A preventive strategy should diminish the risks involved in working with waste, including information, sensitizing and education of all actors, particularly the community.

Providing for the needs of the urban poor is a tremendous challenge in the region. The use of wastes by poor households to meet their basic needs is hardly recognized and has not been studied in the region. Similarly, scavengers who are the poorest group of the underprivileged community are extensively exploited in the waste management process, but no studies have been carried out in the region to improve their working conditions both in terms of increased incomes, and reduction of health hazards arising from waste collection to which they are exposed. Women as the main actors in the household, are very much concerned about questions of waste management. As such they should be among the main beneficiaries and actors in waste management, provided there are appropriate incentives and enabling environment.

A really successful environmental initiative is where local communities solve their own problems with the municipality as a facilitator, providing information and basic resources to empower them to act on their own behalf. The community and local organizations must be involved both in determining what is to be done and in actually doing it. Lack of public cooperation is a significant obstacle to effective waste management.

A number of ideas arise for research from the above perspectives which can help increase waste management efficiency, employment generation and better working conditions:

(a) **Mobilising community participation in waste management.** This will involve identifying methods of public awareness campaigns, education programmes, provision of incentives and creation of appropriate community-based institutions (CBOs) whether in the form of cooperatives or small-scale enterprises to protect those most disadvantaged from exploitation.

(b) **The role of women in waste management.** Through their household roles and informal and municipal work, women acquire distinct insights into attitudes to wastes and waste behaviors that until now have not been used for environmental improvement. Efforts should be made to strengthen women's role in CBOs and for the creation of independent women's grassroots organisations, enabling them to voice their needs. Methods of education and awareness creation among women should be identified that encourage their participation

in CBO activities formed for the purpose of waste management. Appropriate technologies developed for waste management should consider the role of women as principal actors.

### **3.3. Technical aspects of waste recycling**

A major part of the battle to overcome solid waste management crisis must be to reduce the amount of waste through reuse and recycling. However, policies of the municipal authorities in the region do not integrate recycling dimension of waste disposal. For instance, the beneficial service provided by waste pickers in recovering some materials should be incorporated in the waste management system rather than being looked down upon. The municipal authorities should instead run campaigns to create public awareness of the need for citizens to help recover materials through recycling. There is need for detailed study in each town in the region to determine the quantity and quality of waste generated, possible market demand for the products and various possible methods of recycling.

(a) Given the possible composition of waste in the region, studies should focus on recycling of organic waste, paper products, plastics, textiles, rubber, glass and metals. In each case the investigation should include environmental impact assessment, health and working conditions, economic impact and technologies. The research should lead to pilot projects adopting low-cost appropriate technologies, appropriate arrangements for technical training, and instruments for motivating the private sector and the population interested in waste recycling. Waste management and hence the potential market for recycling is specific to every town. The size of the town and level of consumption will determine the priorities for recycling.

(b) To ensure the availability of recyclable materials, attention should also be paid to means and methods of collection, sorting and transportation. Further work is required in each town to determine appropriate collection and transportation equipment as well as collection points.

(c) Disposal methods should be studied to determine appropriate sites. There is thus need for geological and hydrological investigations for disposal sites to avoid groundwater pollution, and investigations on air pollution arising from methane gas and other pollutants. These investigations will help local authorities plan for sites that will have least effect on human health and environmental degradation.

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## **URBAN WASTE MANAGEMENT: EASTERN AND SOUTHERN AFRICA**

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### **INTRODUCTION**

This regional paper on waste management in the Eastern and Southern Africa Region was commissioned by the International Development Research Centre (IDRC) and its aim is to serve as a reference for implementing the research agenda of the Urban Environment Management Program (URB Program). For the purpose of this paper the Eastern and Southern Africa Region is defined as the Southern African Development Community (SADC) countries plus Kenya and Uganda.

The main sources of information were literature review and other sources such as university calendars and research abstracts. After identifying individuals, university departments, and institutes in the Region with research interests in waste management contacts were made where it was possible.

The paper is divided into four parts. The first part examines the strengths and weaknesses of the research conducted on waste management in the Eastern and Southern Africa Region. The second part of the report provides an appraisal of research capacity in the Region. The third part proposes three research ideas that the IDRC might want to consider for funding. Finally, the fourth part summarizes the main points and recommendations raised in the paper.

#### **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

##### **1.1. The URB Program document's best researched aspects and objectives**

There are few researchers currently involved in research on waste management in the Eastern and Southern Africa Region. Research publications and conference papers show that only a handful of researchers in the Region have an active interest in this field. Most of these researchers are based in Botswana, Kenya, Tanzania and Zimbabwe.

Not surprisingly, URB Program's aspects and specific objectives hardly have been researched in the Region. Of the research done so far, studies focusing on the link between improper waste disposal and environmental pollution and those analyzing informal sector resource-recycling activities have been the most significant largely because they fit into the research agenda of the URB Program. However, a weakness of many of the studies is that

they tend to be too general and have not attempted to involve the communities most affected by the urban environmental problems that emanate from poor waste management practices.

## 1.2. Summary of research done in the Region

This section of the paper reviews research on waste management that has been conducted in the Eastern and Southern Africa Region. The existing research can be grouped into four broad categories covering the following themes: solid waste collection and disposal; waste management and environmental pollution; formal and informal sector resource recovery and recycling activities; and general waste management studies focusing on technological and institutional issues. However, the research has been quite fragmented so far and most studies have focused on a single urban area as the unit of analysis. Regional studies addressing a broad range of issues such as waste collection and disposal, waste management and the environment, and resource-recycling activities have been limited to a few fairly isolated cases (e.g. Tevera, 1991c; UNDP/World Bank, 1991). A study conducted by Tevera (1991c) examined urban solid waste management in selected Sub-Saharan countries with respect to environmental, financial and economic issues.

The waste management and environmental pollution studies have focused on air and water pollution problems resulting from inadequate collection and disposal of wastes (Mashauri and Mayo, 1989; Jonnalagadda, 1989; Chogumaira, 1990; Mkuula, 1990; Misana, 1991; Tevera, 1991a; 1991c; Segosebe and Van Der Post, 1991; Segosebe, 1992; Mpotokwane, 1992). Chogumaira (1990) focused on Harare, the capital of Zimbabwe, to examine a broad range of urban environmental problems and their management. Jonnalagadda et al. (1989) and Mashauri and Mayo (1989) conducted scientific studies that measured pollution resulting from urban waste discharges in Kenya and Tanzania respectively.

Research on solid waste collection and its disposal has concentrated on the collection of data on the amount and composition of waste generated by urban areas, and the waste management technologies used (Morris, 1983; NZA, 1985; Yhdego, 1988; Kulaba, 1989; UNCHS, 1989; Environmental Resources Ltd, 1990; Tevera, 1991c; Dohrman et al., 1991; UNDP/World Bank, 1991; Khupe, 1992). Waste collection and disposal is the responsibility of municipal authorities throughout the Region (Tevera, 1991) although efforts are now being made by some municipal authorities to partially privatize the collection or disposal of solid waste, as is the case in Gaborone (Dohrman, 1991) and Nairobi (Regional Housing and Urban Development Office, 1991).

A UNDP/World Bank (1991) study did a systematic performance assessment of the solid waste collection service in Zimbabwe and Uganda. The study noted that the productivity of the waste collection vehicles was low and that although the informal sector is

actively involved in recycling waste, only a small percentage of the waste resources is recovered. The study recommended that the sector could be stimulated through government interventions such as environmental taxes, licenses, raw material restrictions and so forth. Yhdego's (1985) study showed that in Tanzania lack of reliable information on the volume and composition of the wastes generated hindered the development of an efficient and economic national urban solid waste management system. According to Kulaba (1989) the services and practices of municipal solid waste management in Tanzania are insufficient and inefficient and as a result collection levels in most of the major urban areas were below 25%. Yhdego (1985) also noted that the most neglected areas were the squatter settlements where about 60-70% of the urban population were living. Most of the studies that have been conducted in Tanzania and Eastern Africa in general relate to the effects of waste discharges on rivers and lakes (e.g. Jonnalagadda, et. al., 1989; Mashauri and Mayo, 1989; Misana, 1991). Misana (1991) observed that despite the outcries by residents of the area about air pollution from the Tabata waste dump site in Dar es Salaam the municipal authorities have made no effort to determine the effects of the dump on the local community and the environment. In Botswana a study on waste management and pollution conducted by Segosebe and Van Der Post (1991) found out that poor and crude methods of waste disposal were in common use throughout the country.

A report by the Regional Housing and Urban Development Office (1991) on privatization and disposal of solid waste collection in Nairobi found that the Nairobi City Commission Cleansing Department was underfinanced and financial management was weak; the routing of the vehicles and performance standards of the crews were not systematically monitored; and there was a mismatch between the containers and the vehicles. A consultancy report recommended that there was a need to privatize the disposal of solid waste while the collection service remained with the Nairobi City Commission. The consultancy report also recommended that if a charge was levied for each load of waste dumped at the landfill it would be profitable to manage the landfill to much higher environmental standards while still operating at a reasonable profit level.

According to the Environmental Resources Limited (1990) in several of the major Ugandan cities the solid waste management service provided is deteriorating. For example, in Kampala the responsibility for waste removal is fragmented and there is no office with responsibility for overall development, planning and coordination of the various cleansing activities. The other constraint is lack of funds for investments and daily operations, for example, the supervisors have no means of transportation and the workshops are without equipment or spares. In Jinja there is no formally organized municipal solid waste treatment and resource recovery besides the composting of slaughterhouse waste (Environmental Resources Limited, 1990). However, the same study noted that there existed a rather active waste separation and resource recovery system involving the informal sector.

Formal and informal sector resource recovery and recycling studies have been undertaken in Botswana, Tanzania and Zimbabwe (Yhdego, 1988; Kulaba, 1989; Tevera, 1989; 1991b; 1993b; Dohrman et al., 1991; Gould, 1992). The studies show that waste-pickers operating at the lower rungs of the waste recycling industry are very poor and live in deprived conditions (Tevera, 1989; 1991b). A study of waste recycling as a livelihood in Harare noted that about 500 people earned a living picking waste at two dumps; that the working conditions of these waste-pickers were appalling; and that the municipal authorities were not keen to improve the situation (Tevera, 1989; 1991b). The study further observed that uncontrolled disposal of industrial and domestic waste (some of which hazardous) at the dumps was likely to pose a health risk to waste pickers who obtain their livelihood from sorting the refuse. According to Tevera (1993b) waste recycling activities in Botswana should be justified on both economic and environmental grounds.

General waste management studies focusing on technological and institutional issues have also been undertaken (Hayuma, 1983; Yhdego, 1985; UNCHS, 1989; Dohrman et al., 1991; Tevera, 1991c; UNDP/World Bank, 1991). Tevera (1993c) has argued that progress in improving solid waste management in Zimbabwe requires policy and regulatory reform and institutional development. Lack of finance is one of the institutional problems facing Municipal solid waste management in the Region (Tevera 1991c). The urban structure has been found to pose a constraint on solid waste management. Tevera (1993a) observed that the lack of motorable streets in the upgraded squatter settlements of Old Naledi and Botshabelo in Gaborone and Selebi-Pikwe respectively has hampered waste collection by municipal authorities in Botswana. Segosebe and Van Der Post (1991) noted the following: that a well-coordinated institutional framework for the control of environmental pollution was nonexistent; that there was poor legislative provision and lack of specific regulations governing the handling and disposal of wastes; that there was limited recycling of waste; and that there was inadequate enforcement of the bylaws. Bylaws setting standards and guidelines on environmental sanitation have either been lacking or have not been enforced (Tevera, 1993a). Dohrman et al. (1991) argued that Gaborone would have a much better waste management service if the Gaborone City Council privatized waste collection and disposal activities on an incremental basis.

### **1.3. Areas requiring further research**

Most of the waste management studies that have been conducted in the Region are quite preliminary and have not attempted to analyze the intertwined links between land, water and waste management. There is obviously need for regional universities and research institutes to undertake detailed investigations that explore these links. The impact of waste mismanagement on the urban environment and the resource base also requires to be investigated. In addition, the involvement of the poor in resource recovery activities needs to be examined. The following are some of the priority research areas:

- investigation of waste mismanagement on poor communities who live in unserviced or inadequately serviced areas;
- investigation of inappropriate waste disposal on surface and groundwater pollution, air pollution, open drainage systems, urban floods and disasters;
- investigation of urban-based informal resource recovery and waste-recycling activities;
- a study that develops simple and cheap methods of identifying, monitoring and checking pollution at waste dump sites;
- a feasibility study and pilot project on community-based waste collection;
- research on on-site composting and use of organic waste for animal fodder;
- an evaluation of existing waste management technologies currently employed in the Region and the dissemination of the results through a series of published reports; and
- a feasibility study on establishing national or regional Waste Exchange Centres in Eastern and in Southern Africa respectively whose terms of reference would be to provide information to municipal councils and individuals about the type of waste required for recycling in the Region, where it is required, and who requires it.

#### **1.4. Interactions between urban agriculture, water, waste and disaster**

Urban population in the Eastern and Southern Africa Region is growing faster than the rate at which infrastructure and services are expanding and as a result there has been a congestion of the urban systems. Such congestion is evident in the low-income residential areas where substandard housing and lack of water and sanitation services create health problems. The densification of residential areas, through infilling or plot subdivisions, also results in excessive demand on the existing water supply, and sewerage, solid wastes and transportation infrastructure. Only a few cities provide environmentally acceptable disposal of the wastes that are collected, and cities end up being the major polluters of the environment. In many African cities the traditional problems of human wastes have not been solved and faecal contamination of the environment is still a major concern. The challenge is to expand basic sanitation, sewerage and solid waste collection services, especially for the urban poor, based on affordable approaches.

The excessive urban demand on the natural resource base of both the urban area and the surrounding region is manifested through many forms of environmental degradation. Rivers and lakes, which are common sources of potable water, are often polluted from

industrial wastes, community discharges, oil slicks and chemical detergents. However, not much is known about the effects of air pollution emanating from industries, mines, waste dump sites on water resources.

The externalities of inadequate waste disposal and pollution are well known. The waste load on air, water and land far exceeds the assimilative capacity of these ecological resources. Untreated wastewater discharges pollute surface water resources, making them unsafe or expensive for other uses such as drinking water or irrigation supplies. Infiltration of leachate from uncontrolled solid waste dump sites contaminate groundwater.

Urban wastes are injurious to human health and to the environment. The urban poor, especially the slum dwellers and squatter settlers, who currently constitute 35-45% of the urban population in the Region, are a high-risk group because many live close to waste dumps and lack potable water and basic sanitation. Hence, they rely on open canals and holes in the ground as regular means of waste disposal. Consequently, there is a high incidence of sanitation-related diseases among the urban poor, especially the squatters because they are exposed to epidemics such as cholera, typhoid and dysentery (Bartone, 1988).

## **2. APPRAISAL OF RESEARCH CAPACITY**

### **2.1. Relevant research institutions**

The following research institutions in the Eastern and Southern Africa Region have in the past conducted research in urban environmental issues and are, therefore likely to be interested in studying the issues identified in 1.3 and 1.4 within the general approach and goal of the URB Program.

#### **BOTSWANA**

- Department of Environmental Science, University of Botswana, P. Bag 0022, Gaborone, BOTSWANA.

The leading researchers on waste management in the Department of Environmental Science at the University of Botswana are Mr. Segosebe (Lecturer; currently away on study-leave), Mr. Cornelius Van Der Post (Senior Lecturer), Mr. John Gould (Lecturer), and Dr. A. Mosha (Senior Lecturer).

**KENYA**

- Department of Geography, Kenyatta University, P.O. Box 43844, Nairobi, KENYA.
- Institute of Development Studies, University of Nairobi, P.O. Box 30197, Nairobi, KENYA.

Professor H. Thairu, who is the Dean of Science at Kenyatta University, has an interest in environmental pollution. Also at Kenyatta University, there is a lecturer in the Department of Geography, Dr. Asenath Omwega, who recently expressed an interest in researching on waste recycling activities in Nairobi.

**LESOTHO**

- Institute of Southern African Studies, National University of Lesotho, P.O. Roma 180, LESOTHO  
Tel: 266 340247, Fax: 266 340000
- Department of Geography, National University of Lesotho, P.O. Roma 180, LESOTHO  
Tel: 266 340601, Fax: 266 340000

The Institute of Southern African Studies has in the past undertaken research on environmental issues and is therefore likely to be interested in participating in research on waste management and urban pollution. The Director of the Institute is Dr. Gwen Malahleha.

Mr. Clement Leduka, who is a lecturer in the Department of Geography at the National University of Lesotho, teaches urban geography courses on Lesotho and should have good knowledge of the local urban environmental problems.

**TANZANIA**

- ARDHI Institute, P.O. Box 35176, Dar es Salaam, TANZANIA Tel: 71263/4
- Department of Geography, University of Dar es Salaam, Dar es Salaam, TANZANIA
- Faculty of Science, University of Dar es Salaam, Dar es Salaam, TANZANIA

The Department of Urban and Rural Planning at the ARDHI Institute, has among other things, a research interest in waste management in Tanzania. The Head of the Department is a leading researcher whose name is Mr. George Mbyopyo. At the University of Dar es Salaam, Dr. S. Misana (Lecturer, Department of Geography) and Dr. Mashauri and Mayo (Faculty of Science) have all done some research on water pollution and have several local publications on the subject.

#### UGANDA

- Institute of Environmental Science, Makerere University, P.O. Box 7062, Kampala, UGANDA

The leading researcher at the Institute of Environmental Science is Dr. Takahirwa who is the Director of the Institute. Dr. Takahirwa has good knowledge of the waste management problems in Kampala.

#### ZAMBIA

- Department of Geography, University of Zambia, Box 32379, Lusaka, ZAMBIA  
Tel: 260 1 254406, Fax: 260 1 253952

Dr. Raban Chanda (Lecturer; currently away on sabbatical leave) and Mr. Mufalo Mbinji (Lecturer) are the lead persons.

#### ZIMBABWE

- Department of Geography, University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, ZIMBABWE  
Tel: 263-4 303211, Fax: 263-4 732828
- Zimbabwe Energy Research Organisation (ZERO)  
P.O. Box 5338, Harare, ZIMBABWE  
Tel: 263-4 791333, Fax: 263-4 732858 (manual)

Dr. Daniel Tevera (Chairman; Department of Geography), Mr. Charles Kunaka (Lecturer; Department of Geography) and Mr. Kaseke (Researcher; Water and Sanitation Training Centre).

Mr. Sam Moyo, who Heads the Research Unit at the Zimbabwe Energy Research Organisation (ZERO), has keen interest in environmental issues.

## **2.2. Appraisal of expertise, research record and facilities**

### **BOTSWANA**

The Department of Environmental Science is based in the Faculty of Science at the University of Botswana and has a teaching staff that is international and very active in research and publication. Four of the staff members have in the past five years either published papers or presented conference papers on the environment and waste management. The department has excellent research facilities in the form of laboratories, computers, photocopiers and vehicles.

### **KENYA**

Several researchers at the Department of Geography (Kenyatta University) and the Institute of Development Studies (University of Nairobi) have an interest in waste management issues. However, very little research on the topic has been done and only a few publications have emanated from these institutions. Lack of research funds and serious staff turnover during the past 10 years are the main reasons for the relatively low research output. However, both the Department of Geography (Kenyatta University) and the Institute of Development Studies (Nairobi University) have excellent research facilities in the form of computers, photocopiers and vehicles.

### **LESOTHO**

Both the Institute of Southern African Studies and the Department of Geography (National University of Lesotho) have suitable research facilities in the form of computers, photocopiers and vehicles. The Department of Geography has a small teaching staff and many of whom are relatively junior. This largely explains the department's low research output. With respect to waste management virtually no research has been done by the Department of Geography and the Institute of Southern African Studies primarily because in the past it has not been an area of interest.

### **TANZANIA**

The Faculty of Science as a whole and the Department of Geography in particular have considerable research experience in waste management and several publications have already been produced on the subject. Both, the Faculty of Science and the Department of Geography have adequate research facilities and qualified staff to conduct detailed work on waste management and environmental pollution. The research facilities include soil-testing laboratories, computers, photocopiers and vehicles.

The Department of Urban and Rural Planning at ARDHI Institute is also well equipped with good research facilities. However, in the past little research has been conducted in the area of waste management.

## UGANDA

The Institute of Environmental Science has a keen research interest in environmental pollution and degradation. The Institute has good research facilities such as vehicles, computers and photocopiers. However, lack of research funds and staff turnover during the past years have been responsible for the low research output. The Institute has the expertise to conduct detailed scientific research on waste management in the country.

## ZAMBIA

The Department of Geography is still to recover from the adverse effects of staff turnover during the past decade. No research on waste management has been conducted yet by members of staff. However, the Department has already supervised a couple of undergraduate dissertations on urban pollution. Dr. Raban Chanda (Lecturer) has previously been involved in several projects on the provision of services and the urban environment.

## ZIMBABWE

The Department of Geography has a teaching staff that is very active in research and publication. The Department has excellent research facilities in the form of well-equipped laboratories, computers, photocopiers and vehicles. A number of lecturers have been researching on urban environmental pollution and waste management for several years now. The Department, in collaboration with the Water and Sanitation Centre and ZERO, has sufficient expertise to conduct research in any aspect of waste management.

### **2.3. Regional and national institutional partners**

In the Eastern and Southern Africa Region there is little collaboration in waste management research between institutions both at the national and regional levels. The tendency is for each institute to use its own meagre resources to conduct research and as a result there is considerable duplication of low-key research. To remedy the situation there is need for central governments, donor agencies, nongovernmental organisations to encourage institutional cooperation by funding projects that involve researchers from a number of institutions.

In Botswana, the Department of Environmental Science has institutional links with the National Institute of Development Research Documentation (NIR), which administratively is

also part of the University of Botswana. In addition, the Department of Environmental Science has strong links with a Gaborone-based environmental organisation, Somarelang Tikologo (Environmental Watch Botswana).

The Department of Geography at the University of Zimbabwe has informal, but strong, ties with the Water and Sanitation Training Centre, housed in the Faculty of Engineering at the University of Zimbabwe. Unofficial links also exist between the Department of Geography and the Zimbabwe Energy Research Organisation (ZERO). ZERO is a locally based NGO which is mainly involved in environmental research. Since 1992 an informal research network has emerged between the Department of Geography and ZERO involving several researchers with common interest in urban environmental pollution and waste management.

It is most probable that other informal research links also exist elsewhere in the Region. However, it would require a separate study to identify the existing regional and national institutional research networks.

### **3. FUTURE RESEARCH OPPORTUNITIES**

Three broad research ideas have been suggested in this paper and they all involve several research institutions based in a number of countries in the Region.

#### **3.1. Title: Resource recycling in the Eastern and Southern Africa Region: Case studies from Zimbabwe, Botswana and Zambia.**

##### **Objectives:**

- a) to identify and evaluate the main formal and informal recycling networks currently existing in the urban areas of Zimbabwe, Zambia, Lesotho and Botswana;
- b) to highlight the poor conditions under which informal-sector recoverers work with the goal of persuading central government and municipal authorities to improve the conditions;
- c) to formulate policy options for promoting resource recovery and recycling activities in the three study countries; and
- d) to establish a regional databank that provides information on the type of waste available, where it is located, recycling activities and recycling companies in the Region.

**Results:**

It is hoped that at the end of the project the following would be achieved:

- increased public awareness of the difficult working conditions of the vulnerable groups engaged in resource recovery activities;
- institutional research networks in the Region would have been strengthened; and
- increased information about type of waste available and where it is located and the recycling activities in the study countries is likely to promote the growth of the waste recycling industry (and creation of more employment opportunities for the urban poor) and this might ultimately result in increased waste management efficiency.

**Potential recipients:**

On the basis of identified current research interests the following university departments are being recommended for consideration as potential recipients of research projects and grants by the International Development Research Centre:

- Department of Geography (University of Zimbabwe);
- Department of Environmental Science (University of Botswana);
- Department of Geography (University of Zambia).
- Department of Geography (National University of Lesotho).

**3.2. Title: Feasibility studies and pilot projects on community-based waste collection: The experiences of Kenya, Tanzania and Uganda.****Objectives:**

- a) to undertake feasibility studies on community-based waste collection services in selected low-income housing areas and upgraded (former) squatter settlements;
- b) to provide waste collection services in the poor (and often partially serviced) areas through the establishment of community-based waste collection pilot projects; and
- c) to assess the effectiveness of community-based waste collection projects.

**Results:**

It is hoped that at the end of the project the following would be achieved:

- involvement of low-income communities (currently not receiving an adequate waste collection service) in the planning and implementation of environmental sanitation programmes (such as the provision of efficient waste collection services);
- development of capacity in community organisations; and
- improved environmental sanitation in areas previously suffering from various effects of inadequate waste management.

**Potential recipients:**

The following institutes are being recommended for consideration as potential recipients of research projects and grants from the IDRC:

- Institute of Development Studies (University of Nairobi, Kenya);
- ARDHI Institute (Dar es Salaam, Tanzania);
- Institute of Environmental Science (Makerere University, Uganda).

**3.3. Title: Environmental impact of improper municipal waste disposal on air, water and land in the Eastern and Southern Africa Region.****Objectives:**

- a) to measure pollution on air, water and land resulting from improper municipal waste disposal in the Region;
- b) to make available to municipal authorities and central governments data on municipal and national pollution levels; and
- c) to recommend ways in which local authorities and their citizens can all play roles that help achieve efficient waste management.

**Results:**

It is hoped that at the end of the project the following would be achieved:

- air, water and land pollution levels resulting from contamination by municipal waste will be known and the information will be distributed to authorities and other interested parties; and
- increased awareness of the danger of environmental pollution is likely to result in improved municipal waste management as communities will most likely begin to demand regular collection services and will most likely be willing to pay for the services.

**Potential recipients:**

The following nongovernmental organisations, research institutes and university departments are being recommended for consideration as potential recipients of research projects and grants from the IDRC:

- Faculty of Science (University of Dar es Salaam, Tanzania);
- Institute of Southern African Studies (National University of Lesotho)
- Zimbabwe Energy Research Organisation (ZERO)

**CONCLUSION**

The urban population in the Eastern and Southern Africa Region is growing faster than the rate at which infrastructure and services are expanding and consequently there has been a congestion of the urban systems. Such congestion is evident in the low income residential areas where substandard housing and lack of water and sanitation services create health problems.

Only a few researchers are currently involved in research on waste management in the Eastern and Southern Africa Region. The regional research that has been done so far can be grouped into the following categories: solid waste collection and disposal; waste management and environmental pollution; formal and informal sector resource recovery and recycling activities; and studies that focus on technological and institutional issues.

However, most of the studies have been very preliminary and have not attempted to analyze the intertwined links between land, water and waste management. The studies tended to focus on a single urban area as the unit of analysis and there has not been any

comparative regional studies. There is need for regional universities and research institutes to carry more detailed investigations that explore these links. The impact of waste mismanagement on the urban environment and the resource base also requires to be investigated. In addition, the involvement of the poor in resource recovery activities needs to be examined.

Most of the research done in the Region has been in Zimbabwe, Botswana, Tanzania and Kenya. Elsewhere in the Region there have only been sporadic efforts. It is hoped that the IDRC's current research programme, URB Program, will initiate a systematic research effort in waste management in the Region and will promote collaborative research efforts.

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## APPENDIX

### RESEARCH INSTITUTES WITH SOME INTEREST IN WASTE MANAGEMENT

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#### ANGOLA

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#### BOTSWANA

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#### KENYA

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#### LESOTHO

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#### MALAWI

Bunda College of Agriculture, University of Malawi P.O. Box 219, Lilongwe, MALAWI, Tel: 277 222, Fax: 277 364

## **MOZAMBIQUE**

Department of Surveying and Cartography, Universidade Eduardo Mondlane, C.P. 2102, Maputo, MOZAMBIQUE,

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## **SWAZILAND**

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- c) Zimbabwe Energy Research Organisation (ZERO)  
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## URBAN WASTE MANAGEMENT: WEST AFRICA<sup>\*1</sup>

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### **1. REGIONAL RESEARCH RECORD: STRENGTHS AND WEAKNESSES**

#### **1.1. Specific URB Program issues and objectives best researched**

Almost all research program documentation includes the issues and objectives listed in the URB Program document: community participation; improvement of living conditions in poor urban peripheral areas; creation and support of research, exchange, distribution and training networks; upgrading, utilization and improvement of local "know-how"; advance involvement of the formal and informal private sector.

Unfortunately, research activities often apply to pilot projects that are limited in time and space. Although the results may be relevant, they do not permit an overall assessment. In addition, research results are poorly disseminated, and exchanges between researchers are still rare.

In the specific field of waste management, the following are among the areas of importance: wastewater; excreta; solid waste; hazardous waste.

Significant results have been obtained in the areas of managing: wastewater (small diameter sewerage system, lagooning, phyto-treatment, etc.); excreta (VIP latrines, waterproof tanks, etc.).

On the other hand, solid and harmful waste management has not been the subject of much research. A few pilot projects have mainly focused on the non-conventional collection of garbage in inaccessible urban peripheral areas (Dakar, Rufisque, Kaolack in Senegal, Abidjan in the Ivory Coast, Douala in Cameroon, Bamako in Mali). These projects are generally initiated by development agencies which are not often concerned with methodological issues and very rarely conduct external assessments of their activities.

The African Institute for Urban Management, therefore, proposes to make a comparative assessment of the different projects by analyzing the following issues:

- project design;
- community participation;

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\* Editor's note: This document was translated from French.

- cost recovery;
- garbage collection technology;
- system performance;
- institutional setting;
- regulatory mechanism;
- etc., etc.

It should also be noted that most capital cities have master plans for solid waste management. These plans, prepared by research consultants, unfortunately propose conventional solutions that are too costly and never become implemented for lack of sufficient resources. Even if they are used, they quickly become obsolete from lack of maintenance and operating resources, because of the low cost recovery rate.

The collection techniques and systems are not subject to any optimization rule, and the mathematical models are also difficult to apply because of the highly contrasting urban fabric and the widely varying and poorly controlled socioeconomic conditions.

Some surveys of waste recycling by the formal or informal sector (Dakar in Senegal, Ouagadougou in Burkina Faso and Conakry in Guinea) have been conducted. These surveys clearly show the potential of solid waste recycling, but also the general presence of certain problems:

- persons working in this sector, particularly in garbage dumps, are exposed to safety and hygiene problems;
- the return on informal recycling is relatively low because of the rudimentary methods used by collectors;
- the low level of market value materials contained in garbage is not conducive to industrial scale recycling (metals, iron, plastics, etc.).

As regards kitchen garbage disposal, the garbage dump is still the common solution in most urban areas. The selection of dump sites, as well as the conditions for their use, does not comply with standards of public health and environmental protection: two recent studies on the Mbeubeusse dump in Dakar (Senegal) and the mining dump in Conakry (Guinea) constitute proof to this effect (pollution of water tables, various harmful substances, etc.).

Some experiments in slow composting (Porto-Novo in Benin and Bamako in Mali) are being conducted. These are empirical pilot projects.

Finally, harmful waste is posing serious problems in West African towns: used oil poured into gutters and on empty lots, used paints and solvents put in dumps, pesticides and insecticides infiltrating the groundwater tables, industrial wastewater for cooling facilities

containing micro-pollutants and hydrocarbon dumped in the natural environment, etc.. Studies on these subjects are rare, since their analysis requires specialized laboratories and costly measures. African governments often have environmental laws regulating most of these questions; standards are not applied, however, for lack of regulatory methods.

It should be mentioned that the African Institute for Urban Management, with the financial support of IDRC, has been implementing a program of Applied Research on Urban Management in the African Environment (RAGUMA) since October 1992, with a network of 10 researchers, 8 of whom are working on waste management (wastewater, excreta, solid waste).

### **1.2. Applicable results**

The most significant results obviously involve wastewater management. In fact, with the International Drinking Water Supply and Sanitation Decade (DIEPA), convincing results and successful projects have been achieved. Relatively low cost models of latrines, notably the VIP, have been developed and introduced. Training manuals and audiovisual support on drinking water and sanitation have been produced and distributed (see UNDP-World Bank Program). The International Training Network has been introduced. Finally, GREAs (Regional Groups for Drinking Water and Sanitation - UNDP-World Bank Program) have initiated a number of projects, one of which achieved the following significant results (KUMASI in Ghana):

- participatory management;
- assessment of willingness to pay;
- introduction of latrines adapted to socioeconomic context and conditions;
- etc., etc.

In addition, CREPA<sup>2</sup> has conducted research on the cost reduction of individual sanitation facilities.

Unfortunately, at the level of research, as well as that of human resource development through training, results have not yet produced viable solutions to the sanitation problems because of the enormity of the problems involved. In addition, kitchen garbage, sewage sludge and harmful waste management has not been a major priority in the programs.

### **1.3. Issues and objectives of the document**

Sanitation backwardness and needs are so tremendous that all issues and objectives in the document are of importance. However, priorities must be set and projects be carried out in sufficient quality and quantity to achieve sustainable solutions. Solid waste management

and sewage sludge treatment require an ambitious program in order to:

- develop overall strategies;
- devise institutional frameworks to improve and increase formal and informal private sector involvement;
- develop precollection, collection, transportation, and transfer technology;
- initiate disposal systems that increase and improve waste recycling, recovery and reclamation;
- cause central and local public authorities to assume their controlling and regulatory roles in order to improve environmental and public health protection;
- establish financial and cost recovery mechanisms with greater popular involvement;
- develop human resources in order to increase local abilities;
- produce management, planning, operating, maintenance, and regulatory tools in order to assist political, financial, technological, legislative, organizational and institutional decision making and options.

#### **1.4. Relationship between urban agriculture and environment**

Urban agriculture is developing particularly in large urban centres. In fact, the formal sector is no longer able to offer enough employment, and there is an extensive demand for agricultural products in the cities, particularly fruits and vegetables.

The relations between urban agriculture and environment are various and complex:

- urban agriculture generally uses groundwater table wells which are often polluted because of the lack of sanitation systems; some products (lettuce, tomatoes, etc.) may be contaminated and hazardous to public health;
- urban agriculture also uses pesticides and insecticides which may infiltrate and pollute groundwater tables;
- urban agriculture sometimes uses drinking water, while some inhabitants in the city lack access to fresh water;
- urban agriculture occasionally fills its land parcels with sewage sludge without taking sanitary and environmental precautions;
- urban agriculture sometimes produces kitchen waste compost to improve its plots.

## **2. APPRAISAL OF RESEARCH CAPACITY**

### **2.1. List of research institutions**

Each country in the subregion has national (vocational schools) and/or regional

(university, technical schools) professional education and/or research institutions. Specialized research centres also exist in particular fields, i.e. agriculture, energy, etc.. Finally, regional or international research and exchange programs can be added (CREA, CREPA, PGU<sup>3</sup>, etc.). These institutions and programs are often very specialized: administrative management, master's degree in technical engineering, financial management.

Within the general approach and objectives of the URB Program, it would be difficult to find an institution which by itself could conduct a research project of such interdisciplinary dimensions. There may be outstanding institutions (schools of engineering, administrative and management schools, university faculties, specialized centres) capable of handling a research project, but not without resorting to outside experts in the field in order to deal with all the research issues. Therefore, the creation of networks based at host institutions for guidance and scientific and technical leadership appears to be more advisable.

A nonexhaustive list of reference centres can be suggested:

- At the technical and technological level:
  - Ecole Africaine et Mauricienne d'Architecture et d'Urbanisme, Lome, Togo;
  - Ecole Polytechnique de Thiès, Senegal;
  - Ecole Nationale de Yamoussoukro, Ivory Coast;
  - Ecole Inter-Etat d'Ingénieurs de l'Équipement Rural, Ouagadougou, Burkina Faso;
  - Ecole Nationale Supérieure de Technologie, Yaoundé, Cameroon;
  - Institut Sénégalais de Recherches Agricoles, Dakar, Senegal
  - Ecole Nationale d'Ingénieurs, Bamako, Mali.
- At the administrative and financial level:
  - Centre d'Études Supérieures Africaines de Gestion, Dakar, Senegal;
  - Ecole Nationale d'Administration, Cotonou, Benin;
  - Institut Africain de Développement Économique et de Planification, Dakar, Senegal.
- At the socio-sanitary level:
  - Institut de Médecine Tropicale, Dakar, Senegal;
  - Institut de Santé et Développement, Dakar, Senegal;
  - Institut d'Hygiène, Abidjan, Ivory Coast;
  - Ecole Supérieure des Sciences de la Santé, Ouagadougou, Burkina Faso.

## **2.2. Resources and expertise of research institutions**

The above-mentioned institutions generally have the material resources and basic

logistical means to design, conduct and implement research work. They also have quality expertise and highly experienced professionals. As already mentioned, this selective expertise is highly specialized: economists, financial analysts, water geologists, sanitary engineers, civil engineers, mechanical engineers, computer programmers, geographers, urban planners, sociologists, legal experts; it is difficult, however, to find interdisciplinary teams experienced in research practices on environmental issues.

### **2.3. Partnership between researchers, decision makers and professionals**

Research in the subregion still suffers from a lack of relations between researchers, decision-makers and experts or professionals. Although the institutions and research centres or programs often receive support from public authorities, the results of the work are seldom applied. Research needs are identified without a clear statement of the demand by the decision-makers, based on the requirements of the population. Researchers are generally isolated in their laboratories and centres. NGOs occasionally work at the grassroots level without taking into account the public political options adopted. This basic issue of partnership between decision makers, researchers and experts highlights the problem of the implementation process of a research program:

- identification of priority fields of research;
- identification of specific research problems;
- development of research plans and proposals;
- financing of research work;
- research framework, including quality/performance assessment and control mechanisms;
- dissemination of research results;
- application of research results;
- replicability of applications and structured training through adaptation and exchanges.

### **3. FUTURE RESEARCH OPPORTUNITIES**

Research proposals are based on the following principles:

- competition between researchers;
- development of local expertise;
- political and administrative sponsorship by public authorities and scientists from host institutions.

### **3.1. Title: Methodology of strategic and integrated urban solid waste management.**

#### **Research problem:**

Urban solid waste management is generally deficient in most African countries. This issue has not been subject to much attention. Recommended solutions are still very conventional and only short term. In general, the urban fabric is very differentiated and contrasting, while the solutions are centralized.

In addition, the solutions lack sufficient social dimension to mobilize the population and all local resources. In the field of drinking water supply and wastewater and excreta sanitation, strategic management approaches have been applied with significant results. The proposed research consists of an adaptation and application of this approach to the study of solid waste.

#### **Objectives and expected results:**

- a) adapt the SSA (Strategic Sanitation Approach) to the urban solid waste problem;
- b) apply the methodology;
- c) assess the results;
- d) develop a decision-making support tool.

**SSA:** The basic principles of the SSA are as follows:

- study all proposals for collection, transportation and disposal services of solid waste in a given area;
- assess the demand (i.e. analyze what the population wants and is willing to pay for);
- compare offer and demand;
- propose financially and institutionally acceptable solutions.

The SSA is based on a division of the territory into homogeneous areas, based on criteria which influence the production, evacuation and elimination of solid waste. The proposed solutions are based on physio-chemical parameters (waste characteristics), urban and socioeconomic parameters (accessibility, dwelling typology, activity index, average income, etc.). The inhabitants are interconnected and formulate their demands; each option consists of a chain of potential actions including one or several activities (precollection, collection, transportation, disposal including reclamation, recycling, etc.). Each management

system analyses financial, sociopolitical and legislative aspects.

**Organizational methods:**

- calls for research tenders, defining the research framework, the objectives, the SSA methodology to be adapted and applied, etc.;
- preselection and selection of researchers on the basis of preestablished criteria: spatial analysis, formulation and generation of surveys among the population (demands), comparison and assessment of management systems (assessment criteria), etc.;
- scientific leadership of research networks.

**Recipients:**

Interdisciplinary teams of researchers sponsored by public authorities and based in host institutions.

**3.2. Title: Composting of urban solid waste.**

**Research problem:**

In most African countries, urban solid waste contains an average of more than 60% organic material. Even if the anaerobic processing of these components is not often recommended, a slow aerobic processing still deserves to be explored. In fact, experiments are rare. This proposal consists of conducting a comparative study of the process and conditions of composting urban solid waste on various sites.

**Objectives and expected results:**

- a) assessment of the composting process under African conditions (composition of garbage, limiting factors: ventilation, water content, carbon/nitrogen supply, etc.);
- b) assessment of the impact of composting on the solid waste management system (reduction in quantities of waste to be transported and/or eliminated, etc.);
- c) assessment of the quality of compost produced from solid waste (agro-pedological, granulometric quality, etc.);
- d) market value of compost (market study, marketing strategy, etc.);
- e) development of a composting guide.

**Methodology:**

Slow composting technology will be applied. The units will be decentralized and the producer/consumer principle will be favored, i.e. the researchers must include in their proposals a training plan for potential users and a dissemination plan of the most efficient technology. The sampling plan must be developed for analyses, measures and surveys relating to relevant factors and parameters. A market study proposal must include an analysis of constraints and the development of measures for their mitigation or solution.

**Organizational methods:**

- call for research tenders;
- preselection and selection;
- network leadership.

**Recipients:**

Interdisciplinary research teams sponsored by public authorities and based in host institutions.

**3.3. Title: Social communication and sanitary and environmental education.****Research problem:**

Environmental and public health training concerns mainly the formal level. However, in matters of the environment and public health, prevention should be promoted. This is achieved through proper information, i.e. a message with a simple and comprehensible text, transmission support, a target group and an assessment of the impact. This proposal concerns action research to educate the population in waste-related sanitary prevention and protection of the environment. Two target groups will be favored: women and children. The researchers must carry out sanitary and environmental education plans: concept, development, application, assessment. This is a structured learning process: testing the plans, assessing and modifying them, restarting the process to develop techniques, methods, and processes adapted to local conditions and characteristics.

**Objectives and results:**

- a) develop sanitary and environmental education tools;
- b) apply these tools;

- c) develop and apply a dissemination plan;
- d) assess behaviour changes following the application of education plans.

**Methodology:**

Research teams propose a strategic plan for sanitary and environmental education: tools, pedagogical support, institutional framework, resources, dissemination, impacts, participatory training methodology, target groups, etc.

**Organizational methods:**

- o call for research tenders;
- o preselection and selection;
- o network leadership.

**Recipients:**

Interdisciplinary teams of researchers sponsored by public authorities and based in host institutions.



### NOTES

1. Contribution to the preparation of the URB Program workshop (IDRC, Ottawa, Canada, 4-6 May 1993).
2. CREPA: Regional Centre for Low-Cost Drinking water and Sanitation - OUAGADOUGOU, Burkina Faso
3. PGU - Urban Management Program (UNDP-HABITAT-World Bank), Lome, Togo.