

Impact of Urban Agriculture Research in Zimbabwe¹

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Abstract

The paper presents an overview of the importance of urban cultivation and government response to this trend. It summarizes research findings from a project, implemented in two phases, that delved into issues identified by practitioners and politicians: the socio-economic, nutritional, health and environmental benefits and problems of urban agriculture in Harare and Gweru, Zimbabwe.

The area used for food production nearly doubled in 4 years in response to a difficult economic environment. Cultivation in public areas has led to clashes between practitioners and local authorities. Interviews and aerial mapping revealed the following: On-plot farming is practiced by 91 percent of households in Gweru, and 65 percent in Harare. The study confirmed that the main vegetable and crop, rape and maize contributed positively to nutritional and income levels. Environmental aspects studied determined the risk of agro-chemical use and the role UA might play in soil quality, water pollution and erosion.

The project developed a model to assess its impacts, called "effect-influence-output-impact network." Human resource development was significant, as many on the team received technical and managerial training. The NGO performing the study gained recognition as leader in its field. Its empirical findings were presented on several occasions to government authorities and have led to greater understanding of the phenomenon of UA. Local partnerships were created within the university and city council struck a new UA committee. The scientific contribution of project related

to the analysis of heavy metals in crops. The added value of the multi-disciplinary approach is discussed in detail in the paper, as is the results utilization by non-research entities for policy intervention. In particular, details on the institutional and legal framework at the central local government level are discussed. Finally, the paper recommends that the many actors should cooperate to develop a formal policy framework for support and regulation of urban agriculture.

Introduction

Urban agriculture in Zimbabwe is characterized largely by a harsh economic environment and a prohibitive policy framework. The structural adjustment program (SAP) that began in 1991 led to a high cost of living for urban households. In order to lessen the effects associated with economic hardships, most urban households pursued alternative coping strategies -- among which urban agriculture is the most common. Studies conducted by ENDA-Zimbabwe showed that between 1990 and 1994, land under open space cultivation in Harare increased by 92.6 percent. Thus, a total of 9288 ha were under open space crop cultivation.

Research studies have shown that the practice of urban agriculture cuts across all income groups. Both the poor and the rich are involved in the activity. The main difference is expressed in terms of access to resources and the driving force behind the activity. Most urban farmers point out the importance of urban agriculture in meeting household food requirements as well as the income generation and savings derived from consumption of self-produced food. A household socio-economic monitoring survey conducted by ENDA for the 1996-97 season confirms the nutritional significance and economic benefits of urban agriculture. Farming households are better off in most respects than non-farming households. Even after subtracting direct input costs, the farmers have a positive net benefit, although it is a marginal one.

Despite the importance of urban agriculture to household food security, the activity is viewed by local authorities as detrimental to the urban environment. Common arguments against urban cultivation mainly relate to high rates of soil erosion and chemical pollution of soil and water owing to chemical and pesticide use in crop and vegetable production. However, most of these criticisms are simply presumptions with no basis in empirical data. Recent research showed that pollution of urban rivers is caused mainly by industrial effluent and sewage disposal rather than by urban cultivation. The contribution of agrochemicals to water pollution is minimal.

The absence of clear policies and statutory documents relating to urban agriculture has been associated with multiple conflicts between UA practitioners and urban managers. Apart from conflicts arising among practitioners (for instance, relating to acquisition of cultivable land), conflicts also arise among urban managers themselves, especially with respect to implementing by-laws that restrict open space urban cultivation. In some cases, local authorities have cut down immature crops as a way to curb the spread of cultivation. But this does not deter practitioners since the harsh economic environment leaves households with no option.

Background: Urban Agriculture in Zimbabwe

Cities are viewed as essential engines of economic and social development. With the advent of economic structural adjustment programs in developing countries over the last decade, pressure on urban scarce resources has been rising uncontrollably. In Harare, like most other developing cities, this trend has been exacerbated by increasing rates of rural to urban migration (by job-

seekers) and incessant droughts since 1982. The rate of urbanization in Harare is currently estimated at 4.5 percent per annum.

Under structural adjustment, some firms have either been liquidated or have engaged in massive retrenchment programs. Consequently, many employees have lost jobs that were their livelihoods. Since January 1997, seven firms in the textile industry have been liquidated and 60 others are experiencing serious problems (Herald, 4 August 1997). These developments and the general rise in the cost of living have led most urban households to engage in informal activities to meet basic household requirements. Urban agriculture (UA) is one such informal activity.

The rise of UA in Zimbabwe is attributed largely to economic hardships (ENDA-Zimbabwe, 1994). It is viewed as a coping strategy by urban households to sustain their livelihoods (ENDA-Zimbabwe 1996; Matshalaga 1997; Mudimu 1996) and is considered a spontaneous, haphazard activity that is unplanned for and hence not supported. The practice is widely viewed as illegal since it is not backed up by any statutory instrument.

UA takes place on home fronts or back yards (on-plot) and on open public spaces around the city's built environment (off-plot). Marketing of agricultural produce is usually carried out on street corners and at some council-designated stalls. On-plot farming is mainly confined to vegetable production of which the *brassica* species of green leaf vegetables is the most common. Rearing small livestock, mainly poultry, is an on-plot activity practiced mostly by middle-income households (ENDA- Zimbabwe 1996). Open space cultivation (off-plot) is devoted largely to production of cereal crops such as maize and sweet sorghum or to root tubers such as sweet potatoes. Crop cultivation occurs usually on undeveloped land, land not suitable for building, infrastructural servitudes, and idle public land.

Off-plot crop cultivation is the main form of UA that leads to clashes between practitioners and local authorities over the management of urban environments. While orthodox planning principles view such open spaces as green wedges or the 'ecological lungs' of the city, the urban farmer views such land as an 'idle' resource that should be put to productive use. The typical response by city authorities has been to destroy semi-mature crops as a deterrent measure. Most practitioners view such responses as a manifestation of colonial-era policies that were designed to serve a minority. Consequently, the practitioners have not yielded, but continue their activity. Eventually, local authorities are obliged to exercise a certain degree of leniency.

Rees (1997) attempted to explain why urban farming is not seriously considered as a legitimate urban land use. He argues that the industrial approach of short-term economic efficiency that takes pre-eminence over most public and private life values has resulted in urban farming being undervalued in some cities. With the emphasis on the open market economy, potential urban farmland has been viewed as a tradable commodity that should compete with other land uses. Agricultural uses represent the lowest land values in an urban area and, therefore, are considered uneconomic.

Most urban managers and planners take little regard of the idea of cities producing their own food instead of relying on external sources. Urban farming is viewed largely as a transitory activity that will soon disappear from the city environment. This attitude shows that the importance of urban agricultural activities to household food security is poorly understood.

Recent studies and workshops confirm that UA will remain a recurrent feature of the urban environment. Therefore, strategies on how to integrate this activity with existing urban land-use systems should be considered seriously (ENDA-Zimbabwe June 1996; April 1996; Mbiba 1995). For poor households, UA is a survival strategy. For better-off households, UA is mainly recreational and a source of fresh vegetables. This trend can also be demonstrated by the dramatic increase of land under cultivation in Harare between 1990 and 1994. ENDA's aerial studies (1994) showed that the area under cultivation nearly doubled within the space of four years to 9288 ha (a figure that excludes on-plot crop cultivation).

The first phase of UA activity brought several issues to the fore that needed further investigation. Agro-chemical use was widespread in off-plot cultivation -- a practice that posed risks to human health and to soil and water conservation. Off-plot UA was practiced largely on poor soils, which explains why 88.4 percent of producers invested in chemical fertilizers despite tenure insecurities (ENDA-Zimbabwe 1995).

The dangers of chemical use are many: high rates of chemical runoff may encourage eutrophication, affect the health of consumers of water and food, and increase plant toxicity and soil acidity beyond plant tolerance. The quality of raw water has been deteriorating over the years. The first signs of eutrophication were noticed in Lake Chivero (then Lake McIlwaine) in 1963. Although water is a scarce commodity, pollution has been on the increase. Recent large-scale fish deaths and the invasive spread of the water hyacinth suggest that the ecosystem is stressed by high levels of pollution in the lake's catchment area. For purposes of comparison, the smaller city of Gweru was monitored.

Eutrophication occurs when an excessive supply of plant nutrients disrupts ecological processes in water bodies or soil. Eutrophication was measured from water and soil samples collected from the project sites. Nearly one-third of the off-plot fields were located near streams, swamps, or vleis, situations that can lead to pollution through runoff and leaching. The study sought to establish whether the problems of algal blooms, poor sedimentation, filter clogging, dirty colour, and smell and taste disorders could be attributed to UA activities. Like most other cities, Gweru and Harare recycle their water, which has implications for water quality and the cost of treatment.

Two acts specifically ban cultivation in environmentally sensitive areas: the Streambank Protection Regulation (Natural Resources Act, 1975) forbids cultivation within 30 metres of a stream; the Water Act (1974) forbids cultivation to prevent downstream dry season river flows, and reduce erosion along with siltation. However, these bylaws are apparently not stringently enforced, leading to them being blatantly ignored. Based on the findings of phase one, ENDA

embarked on phase two of the UA project.

The overall objective of the first phase of research was to document and analyze socio-economic, nutritional, and environmental benefits and problems of UA. The more specific objectives included:

- To determine the extent, spatial distribution and crop types of on-plot and off-plot cultivation in the mid-sized city of Gweru and to update data for Harare.
- To determine the economic impact of UA on urban households.
- To assess the agro-ecological use effects on water and soil quality, and of UA product safety for human consumption.
- To assess the overall nutritional impact of UA products on urban households.
- To survey the environmental awareness of UA practitioners and explain the reasons for the degrading practices, constraints and requirements for curbing such practices.
- To assist policy makers in introducing policy changes for environmental protection and a fairer distribution of socio-economic benefits of UA to practitioners and consumers.

The household monitoring carried out in the second phase of the research set out to address in more detail the following objectives:

- To determine the economic impact of UA on urban households (farming versus non-farming).
- To assess the overall nutritional impact of UA products on urban households (farming versus non-farming) and health implications of the UA products.
- To identify crop types of on- and off-plot urban cultivation and activities during the cropping season.

The environmental research centred on assessing the general impact of agriculture on the urban environment. This research sought to verify whether UA was contributing to the problems associated with the cities' soil and water quality. The more specific objectives were to:

- Assess the ecological impact of UA on soil and water quality,
- Identify the impact of urban farming activities on vegetation, including deforestation and afforestation,
- Discriminate and contrast soil and water pollution caused by UA and that caused by other sources, and
- Estimate the annual average rate of soil loss from a range of cultivated plots.

Major research findings

Socio-economic aspects of UA

The research showed that gardening and cropping are the main agricultural activities carried out by urban farmers throughout the year. On-plot gardening is the most common activity, being practiced by about 91 percent of households in Gweru and 65 percent in Harare. However, this gardening must compete for land resources with cropping once the cropping season arrives. The single most common *vegetable* grown is rape. Maize is the most common *crop* in terms of hectareage sown and contribution to household food requirements.

Nutrition

With regard to urban farming's impact on household nutrition, the study looked at both farmers and non-farmers earning below Z\$850 per month and between Z\$850 and Z\$3000 per month, had three meals per day. The proportion of farmers having three meals was, however larger. For Harare, most farmers had two meals a day while non-farmers had three. This difference was attributed to the fact that most farmers worked in fields far from home. Therefore, it was not possible to return home every lunch time to consume a meal.

The impact of UA was also assessed by examining the quality of food consumed by households. The research showed that for Gweru, the lowest-income farming households have more opportunities per month to consume protein-rich foodstuffs than non-farming households. This may be the result of income savings derived from the consumption of self-produced vegetables and crops. In Harare, there were no clear patterns, but farming families generally fared better in months when the household economy was heavily burdened. Discrepancies between farming and non-farming families became less pronounced as household income increased. Analysis of children below the age of five showed that children of urban farmers have greater growth rates for height and weight than children from non-farming households.

Household Income

The practice of urban farming is widely viewed by many farming households as contributing significantly to household income generation and savings. The monitoring exercise actually showed that farming households with incomes below Z\$840 per month spend more money on food purchases than non-farming households. This was owing to farmers having high purchasing power derived from the sale of their produce. Such income is spent on other foodstuffs such as beef. The consumption of one's own produce also contributes to household income through savings on vegetables.

Gardening, marketing, and livestock production were shown to accrue positive benefits, while cropping had a negative cost, largely due to labour expenses, climatic risks, and lack of appropriate farming techniques. UA also fosters social ties in civil society since households share

resources, especially cropping inputs and other materials during land preparation activities.

Environmental Health

Most metals occurred in levels higher than the maximum daily intake recommended by WHO/FAO standards. These varied from 11 percent to more than 8000 percent higher than the recommended levels. Levels of heavy metals were highest in rape and lowest in maize. Generally, metal levels were higher in Gweru samples than in Harare, perhaps because Gweru is traditionally a mining area. For Gweru, levels of heavy metals were higher in vendor samples than in on-plot ones, whereas for Harare, the reverse was true. These findings point toward atmospheric pollution as the major culprit in the contamination of UA produce.

Soil Erosion

The results for soil loss estimation carried out before the agricultural season (Tables 1 and 2) show that four of the six study sites recorded soil losses greater than the recommended target levels. For Harare, all sites had unacceptable levels. The losses recorded for Highfield (Mangwende Drive) were 64 percent higher than the tolerable levels, while those for Highfield (Simon Mazorodze Road) were a staggering 266 percent higher than recommended. For Meyrick Park (Harare Drive) and Mabelreign (Sherwood Drive), the losses recorded were 17 percent and 11 percent higher, respectively. In Mkoba and Senga, the losses were within safe limits.

Comparing data for October 1996 against that of July 1997, results for the two plots of Highfield and Meyrick Park (Sherwood Drive) were unchanged. This finding suggests that in these areas the crop cover resulting from the crops being grown during the agricultural season was negligible. Generally, rates of soil loss decreased at the end of the agricultural season. This was as expected because in October the fields had been cleared and bare, allowing erosion to occur unchecked. During the growing season, the vegetation provided some crop cover, resulting in reduced soil erosion. At the end of the season when soil loss was estimated, considerable crop residue remained in the field, providing cover for the soils. In July, three out of the six plots had erosion rates above the target levels. In Senga, erosion decreased by 25 percent, in Mkoba by 17 percent, and in Meyrick Park by 72 percent.

Table 1. Rates of soil loss from cultivated land in Harare and Gweru in October 1996

Site and area type	Crop Type	Soil Conservation Method Used	Plot length and slope	Fm	K	X	I	C	Z (t/ha)	Zt (t/ha)
Senga 5G (Fersiallitic granite)	Maize	None	540m 3%	6	10	2	36	0.12	2.4	5-9
Mkoba 4G (Siallitic granite)	Maize	None	480m 1%	4	4.5	1.15	36	0.12	0.62 1	5-9
Highfield: Mangwende Drive 5G (Fersiallitic granite)	Maize	None	120m 1.8%	5	235	0.9	45	0.07	14.8	5-9
Highfield: Simon Mazorodze Road 5G (Fersiallitic granite)	Maize	None	180m 4%	5	235	2	45	0.07	32.9	5-9
Meyrick Park: Harare Drive 5E (Fersiallitic basic rocks)	Maize	None	360m 1.3%	7	100	1	45	0.07	7	4-6
Meyrick Park: Sherwood Drive 5E (Fersiallitic basic rocks)	Maize	None	300m 1%	7	100	0.95	45	0.07	6.65	4-6

Key:

Fm = soil erodibility

K = predicted rate of soil erosion from a standard bare plot

X = factor which combines slope steepness and length

I = vegetation factor

C = crop factor

Z = estimated soil loss

Zt = tolerable (target) soils loss

Table 2. Rates of soil loss from cultivated land in Harare and Gweru in July 1997

Site and area type	Crop Type	Soil Conservation Method Used	Plot length and slope	Fm	K	X	I	C	Z (t/ha)	Zt (t/ha)
Senga 5G (Fersiallitic granite)	Maize	None	540m 3%	6	10	1.6	36	0.12	1.92	5-9
Mkoba 4G (Siallitic granite)	Maize	None	480m 1%	4	4.5	0.975	36	0.12	0.53	5-9
Highfield: Mangwende Drive 5G (Fersiallitic granite)	Maize	None	120m 1.8%	5	235	0.9	45	0.07	14.8	5-9
Highfield: Simon Mazorodze Road 5G (Fersiallitic granite)	Maize	None	180m 4%	5	235	2	45	0.07	32.9	5-9
Meyrick Park: Harare Drive 5E (Fersiallitic basic rocks)	Maize	None	360m 1%	7	100	1	45	0.07	7	4-6
Meyrick Park: Sherwood Drive 5E (Fersiallitic basic rocks)	Maize	None	300m 1%	7	100	0.55	45	0.07	3.85	4-6

From this data, comparisons were made of the relative effects of variables (such as soil type, geology, slope steepness, cultivation, plot length, and crop type) on the amount of erosion caused by the cultivation. The results clearly showed that steeper slopes were more prone to higher rates of erosion because of the faster speed at which surface runoff moves and its consequently greater erosive quality. It was established that most fields of urban farmers are on sloping land. By their very nature, these slopes are unsuitable for urban development and, therefore, had been left vacant. The current economic climate has forced people to exploit any vacant pieces of land for farming.

Since all the sites were predominantly cropped with maize, the results could not attribute any differences in the amount of erosion to crop type. What they do show is that all the sites in Harare have unacceptable levels of erosion. This finding was probably owing to Harare having higher rainfall than Gweru as well as having a higher population pressure. This last factor will continue to increase pressure on the environment as people open new land for cultivation.

The results of the vegetation similarity analysis were from vegetation counts conducted in two plots (A and B) in Mabvuku measuring 200 x 40 square metres each. Plot A was on an old field with 100 percent cultivation while plot B comprised new fields with uncultivated sections. It was observed that in plot A, *Uapaca kirkiana* was the dominant species and *Julbernardia globiflora* made up the bulk of tree stumps. In plot B, *J. globiflora* was dominant and made up the bulk of the tree stumps. The situation in B was to be expected under normal circumstances in miombo woodlands. Plot A consisted only of the major miombo species while B had others. This situation might have been owing to the loss of the less-adapted species in Plot A as a result of recurrent cutting. The other species in plot A had undergone cutting over a long period and *U. kirkiana* was likely dominant because it had been spared deliberately for its fruit. By contrast, in plot B, *J. globiflora* was dominant since clearing was still occurring in an area dominated by miombo vegetation.

Table 3. Comparing similarity between plots A and B over the monitoring period

Similarity analysis	April 1996	October 1996	December 1996	February 1997
Overall similarity (percentage)	90.22	41.87	31.51	21.73
Similarity without stumps (percentage)	57.44	19.44	24.63	27.27
Similarity in deforestation levels (percentage)	97.36	47.2	34.19	0.0

There was no similarity in deforestation levels at the end of February, because the fields in plot A were now well established and deforestation could be considered complete. Deforestation still occurred in plot B, but at a rate much lower than in October and December 1996.

Areas of impact relevant to the project

The approach taken in this survey followed closely the "effect-influence-output-impact network" (EIOIN) developed and adapted by ENDA-Zimbabwe to articulate the impacts attributed to the IDRC-funded program. The EIOIN sought to highlight the effects and influences of each activity on the other activities, including the output and external factors, and how these built up to create the ultimate impact. Figure 1 shows a model that is a checklist of the stages where impact could be expected. In writing this paper, staff found the checklist useful, but found the models' diagrammatic representation rather confusing. The major components of the EIOIN are shown below. The EIOIN attempts to identify impacts and influences at every stage of the project cycle

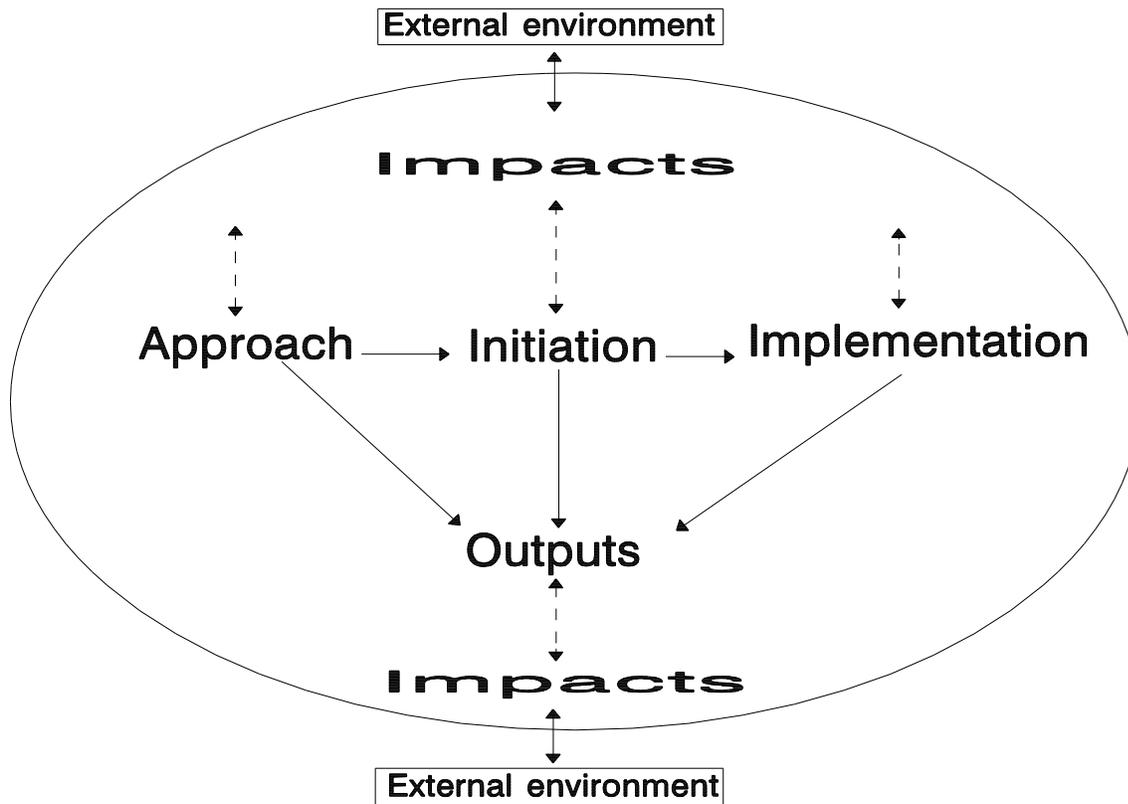
while bearing in mind that each stage interacts with the subsequent stage of the cycle. The model assumes that each activity yields an output that could lead -- potentially -- to an impact. Therefore, the model requires gathering as much detail as possible about the implementation process.

Components of the effect-influence-output-impact network

1. Impact of methodologies used when approaching the urban cultivators,
2. Impact of methodologies used during project initiation,
3. Impact of methodologies used during the research survey,
4. Influence of external factors on the methodologies used,
5. Influence of external factors on the project process,
6. Influence of external factors on intended effects/influences (project interventions),
7. Influence of project interventions on the project process, and
8. Influence of the project process on the output.

Following considerable debate after the research survey, the EIOIN was refined and is presented graphically in Figure 1. The principles remained the same: at each stage of the project, there is interaction with the external environment (effects) of the activities being undertaken (input) and the results (outputs).

Figure 1. The effect-influence-output-impact network



Human resources development

Four staff members (three men and one woman) were trained in the use and application of geographic information systems (GIS). ArcInfo GIS software was used to measure urban land under cultivation. This knowledge was used to map UA in Gweru. However, two of the staff trained in GIS have since left the institution, one to private industry and the other to further studies at the University of Zimbabwe. The latter individual used the work done on UA by ENDA-Zimbabwe as the basis for his proposal to enter the Masters' Program in the Department of Rural and Urban Planning.

The project also sponsored an ENDA-Zimbabwe employee to study for a Masters' in

environmental policy and planning. The thesis, entitled "An investigation into the potential role of cultivators in the reform of open-space cultivation in Harare," was based on a study of the impact of urban governance on UA. Within ENDA-Zimbabwe, the UA team developed further skills in data management and in the use of the statistical package for social scientists (SPSS) to analyze and interpret data from the household socio-economic survey. The masses of data generated from this survey required exceptional proficiency with a statistical package. Hence, the need to undertake two weeks of training for the UA team in SPSS. The project co-ordinator was able to develop management skills, which eventually led to his appointment as acting manager of the research, development, and consultancies division by the end of the project's second year.

Staff also benefited from training in the use of survey equipment, namely in the use of the 'dumpy' level -- a surveyor's level with a short telescope rigidly fixed and rotating only in a horizontal plane. This knowledge has also been transferred to staff of other agricultural projects such as the co-ordinators of the community drought mitigation project and the community management of wetlands project. The survey equipment was used to estimate the levels of soil loss from the UA plots. Seven research assistants were recruited for the duration of the study to help administer the household questionnaires and collect soil and water samples. The intensive training centred on the project background, objectives, questionnaire techniques, interview approaches, and pre-testing and review of the questionnaire.

Impacts in HRD are sometimes difficult to measure, largely because most staff who attained skills through the project then used these skills to pursue more lucrative positions elsewhere. However, in most cases the skills and knowledge they left behind were sufficient for remaining staff to continue implementing the project. One need not look at staff departures as *lost* training. Rather, this training was creating a pool of experts in the field of UA, both inside the institution and in the country at large. Hence, human resources development was not limited to ENDA-Zimbabwe.

The project allowed the staff to gain multiple skills. By conducting analyses of pollution in urban water sources, staff who had previously commanded only rudimentary knowledge of chemistry became familiar with industrial standards for raw effluent and wastewater. They became conversant with the chemical elements of the periodic table, especially the heavy metals. They acquired knowledge about plant nutrients, toxicity and deficiency levels, and their symptoms.

Institutional capacity strengthening

A computer, digitizer, colour plotter, and printer were purchased to carry out data entry of research findings, produce project documents, and draw maps showing the extent of UA. Other projects have also made use of the colour plotter, which has enhanced mapping presentations throughout the institution. Other uses of the computer and colour printer have included the production of quality certificates for internal programs. By producing these certificates in-house, it is estimated that ENDA-ZW has saved more than US\$300 over two years. Project documents from the first and the second phases have been widely distributed to other institutions and NGOs.

ENDA-ZW's work on UA has helped put it on the map of Zimbabwean NGOs and made it widely recognized as one of the leading organizations in its field in the country.

When the project began attitudes toward UA were generally negative. Some city council members suspected ENDA-ZW's intentions and were wary about a relationship with it and other NGOs. But the fact that ENDA-ZW engaged in debate with the council using empirical findings about UA has put the topic in a better light. It has also reduced some misconceptions about the work of NGOs.

The three workshops held on UA and the release of four reports on the subject have created a core group within urban councils interested in the legalisation of UA. Even central government has shown interest, as demonstrated by the active participation of local authorities (councillors) and the Department of Physical Planning at the UA workshops held by ENDA-Zimbabwe. In a workshop organized by ETC International and ENDA-Zimbabwe in 1996, 10 of 27 participants came from the urban councils. This level of participation indicates significant interest in the subject.

Effectiveness of local partnerships

Partnerships were established with the University of Zimbabwe's department of food sciences, which assisted in designing the research component for determining levels of heavy metals in UA products. Two former employees also managed to use some of the research findings on UA as a basis for postgraduate studies.

Some success was also met in partnering with local government. In 1997, the Harare city council set up a UA committee comprising various stakeholders. These stakeholders included NGOs such as ENDA-ZW and Environment 2000, which is an environmental pressure group. The Wildlife Society of Zimbabwe, ratepayers and residents associations, Department of Agricultural, Technical and Extension Services (AGRITEX) as well as municipal and district officers are represented on the UA committee. Its mandate is to keep city council up to date about UA activities on municipal open spaces. The committee meets monthly or whenever there is an urgent need. Among the issues debated are illegal streambank and natural vleis cultivation, enforcement of bylaws related to illegal cultivation, and the control and management of urban farming areas.

Added value of multi-disciplinary approach

A multi-disciplinary approach was adopted in order to go beyond the conventional characterization of the extent of UA. This multi-faceted approach was used to assess the socio-economic and ecological impacts of UA. The research looked at household nutrition, socio-economic costs and benefits, and environmental impacts. This holistic approach meant that the different aspects of UA were treated collectively as the team addressed the objectives specified in the project proposal. The methodologies employed were aerial photography, a household

questionnaire, transects, soil and water analyses, erosion determination, crop descriptions, and analysis of UA products and vegetation.

In addition, the team was comprised of experts in various disciplines. An urban planner, a biologist, a socio-economist, an environmentalist, and a cartographer were all involved in various aspects of the study.

Aerial Photography

Air Survey Company conducted an aerial survey of Gweru. The photographs were digitized using the ArcInfo GIS software. This enabled measurement of the actual area under crop cultivation. These maps showing the actual extent of UA were a much needed resource. Although some maps had been produced for Harare in the early eighties, they needed to be upgraded, a task completed in 1994. The maps produced for Gweru in 1996 were the first of their kind. In Gweru, the area under cultivation was found to comprise 2257 ha, or 8.8 percent of the city's total land area. UA covered 9288 ha in Harare, 8.8 percent of its total land area and an increase in UA since 1990. This data shows that UA activities are continually expanding in Zimbabwean cities. Before the ENDA-Zimbabwe study, no other institution had attempted to determine the actual or potential rates of soil erosion attributable to UA.

Household Survey

Proceeding from the assumption that activities within the household are related to the environment in the cropping fields, it was thought that household monitoring should take place in areas where field environmental monitoring was being conducted. In August 1996, the preliminary survey was conducted across the suburbs to identify and select monitoring households. A street-by-street random number sampling procedure was used in the process.

Main areas of monitoring were:

Socio-economic changes within the household

This component addressed demographic, social, and economic changes within the household during the month. The actual household costs and benefits of UA were calculated each month.

Household Nutrition

Using a monthly questionnaire, changes in the diets of households were noted. The growth rates (height and weight) of children under five years in both farming and non-farming households were measured during the monitoring period.

Environmental Impact Assessment

Transects

The main method used for environmental monitoring was transects. Transects are based on general observations on a broad range of specific factors. This research placed special emphasis on soils, water, crops, and vegetation.

Soil Sampling

Soil samples were collected using an auger from the top 15 cm of soil. Where an auger could not be used, soil clods were collected in sealed plastic bags from the surface. Transects were walked along a catena and samples collected where change was noted on the surface in colour, texture, or degree of wetness. These samples were then sent for analysis based on agricultural and environmental criteria. Recommendations were then made to improve the productivity of the soil for crop production.

Water Sampling

Water samples were collected in plastic bottles at the sources in the transect sites. Wherever possible, water was collected at the beginning, the middle, and the end of rivers. The analysis used WHO standards for drinking water and the city council's wastewater and effluent standards. The main emphasis was to determine what contribution inappropriate farming practices make to pollution of water bodies.

Erosion Determination

Erosion determination was done using the soil loss estimation model for Southern Africa or SLEMSA (Elwell 1981). This model was developed using four different systems: crop, climate, soils, and topography. SLEMSA assigns values to variables gathered from field information and combines them to estimate actual sheet erosion from croplands. SLEMSA is based on modeling principles under which the complexities of the "real world" system are simplified to provide a means of providing soil loss in tons per hectare per year. The SLEMSA equation is:

$$Z = KCX \text{ (t/ha/per)}$$

Where C describes the protection of the soil through vegetation against the erosive forces of the rain, determined through seasonal rainfall energy (E) intercepted by the vegetation (I). K is a predicted rate of soil loss from a bare plot in tons per hectare from standardized plots. It depends upon seasonal rainfall energy (E) and the erodibility of the soil (F). The X factor adjusts the soil loss estimates for different slope steepness (S) and length (L) and the factor C for differences in vegetation cover. Soil loss from cropped lands (Z) is then calculated from the formula.

The research results indicating potential rates of soil erosion from UA plots were the first of their kind in the country.

Crop Descriptions

The crop descriptions, first carried out to allow the crop variable to be included in the SLEMSA equation, gives specific values for various crops since the type of ground cover influences erosion to a large extent. For example, since sweet potatoes provide more ground cover than maize, more erosion is expected in fields planted with maize than with sweet potatoes. The study also provided a general overview of the type of crop production favoured by urban farmers in the transect areas.

Vegetation Analysis

Vegetation analysis was carried out periodically by looking at the presence and absence of different plant species in the successive monitoring sessions in all sites except Mabvuku. In Mabvuku, two plots were compared in terms of woody species composition in order to assess the effect of opening up areas for cultivation and the implications of deforestation.

This study took an approach that was less demanding with regard to computational requirements. It used a coefficient of similarity to calculate the contribution of each species as weighted by a measure of its abundance. The Czekanowski coefficient of similarity is calculated as:

$$S = 2 \sum \min(x_i, y_i) / (\sum x_i + \sum y_i) \quad (\text{after Motyka } et \text{ al, 1950; Bray and Curtis, 1957}).$$

Where S is the similarity coefficient and (x_i, y_i) are relative amounts of species x and y. This is then expressed as a percentage by multiplying by 100.

Analysis of Heavy Metal Toxicities in UA Products

Vegetable samples (maize, rape, and tomatoes) were collected in Harare and Gweru from a total of seven suburbs. The samples came from on-plot gardens and from street vendors who had bought the vegetables from a non-urban market. This selection enabled a comparison between levels of heavy metals in urban and non-urban products. This research on heavy metal toxicities in UA products provided the first quantifiable results for the cities of Harare and Gweru.

Gender Sensitive Analysis

Although women comprise the majority of UA practitioners, their needs have often been neglected in planning research and urban settlements. This situation is not only found in Zimbabwean cities, but in most developing countries. Moser (1995), in an attempt to explain why most urban policy remains "essentially gender-blind," argues that policy makers are much more concerned with development control mechanisms than with empowerment of the urban women. The household monitoring carried out by ENDA-Zimbabwe was not gender-focussed; rather, it was gender-neutral. Nonetheless, the data from the household questionnaire was disaggregated by gender. Upon analysis, certain gender issues came to light as discussed below.

Gender implications in urban farming

The activity of UA can be viewed in terms of gender relations within a society. In Zimbabwe, as in most other African countries, crop and vegetable farming is culturally viewed as the domain of the women. Farming was historically practiced in the rural areas. As most of the men migrated into urban areas in search of off-farm formal employment, this meant that farming in the rural areas was left entirely in the hands of the women. This rural pattern also had significant impact on land use practices within urban environments. Agriculture was never seen as a viable land use for the open spaces in cities and towns.

Besides the fact that women's participation in UA may be viewed as a cultural norm, it is largely household food requirements that push women to violate urban planning by-laws. Matshalaga (1997) points out that women are the principal actors in issues of household food security. Their roles include actual food production, acquisition, preparation, and management of food stores. As food purchases became more expensive owing to removal of subsidies and declining real wages, women had to devise coping strategies to ensure food security within the household.

However, UA should not be solely viewed as a mechanism to ensure the availability of sufficient food to the household. Urban farming also amounts to saving on income that can be used on food purchases. Maxwell (1995) argues that urban farming can be a means of protecting other sources of women's income -- especially where allocations from husbands to meet household needs may be insufficient.

A study conducted by Mudimu (1996) pointed out that women are the main participants in UA since -- unlike men -- they are not formally employed. On average, women farmers spend five to six hours in the fields at peak periods of land preparation and weeding. Most women gain the support of their husbands whereas few men are found against the activity as they view agriculture as the image of poverty. Men also view UA as having marginal returns.

These findings underline the fact that urban planning and management should respond to emerging socio-economic challenges in order to ensure the sustainability of the urban environment. For example, planners should consider gender implications in the design of urban settlements. Most cultivation takes place within the homesteads and on open spaces adjacent to residential areas. As women are the main practitioners of UA, the issue of distance becomes important since women are also engaged in other household chores, including childcare.

Fund leverage

ENDA was also fortunate to receive non-IDRC funds to strengthen the original project. ETC International and the Dutch government sponsored the first national workshop on UA in June 1996. In addition, the Dutch embassy provided Z\$20,655 to supplement the budget for the computer and digitizer. However, even after this contribution a deficit had to be absorbed by ENDA. Without the additional contribution from the Dutch embassy, it would have been difficult

to purchase much-needed equipment. Acquiring this equipment was certainly worthwhile, although the indirect benefits were not immediately obvious. The equipment has also been used for ENDA projects in other divisions such as training and sustainable natural resources management.

Methodological and scientific advances

The issue of heavy metal toxicity in UA products is of particular importance because of their exposure to potential pollutants in soil, water, and air. Crops grown in urban areas are often an important pathway for heavy metals into the human body. Heavy metal toxicity is a function of several factors including existing levels of heavy metals in individuals, total dietary intake, absorptivity of the metal, interaction with other metals, body weight, sex, and age. This variety of factors made the research on heavy metal toxicity more complicated, but still very relevant. As shown below, the results of the nutritional analysis were rather alarming.

Table 3. Percentage by which metal levels in UA crops exceed maximum recommended intake (Harare)

Metal	Rape-Gardens	Rape-Vendor	Maize-Fields	Maize-Vendor
Zinc	29	-	-	-
Nickel	1648	1578	386	384
Copper	-	-	-	-
Cobalt	2502	2395	452	722
Manganese	5776	7098	271	1108
Cadmium	2572	2453	607	631

Table 4. Percentage by which metal levels in UA crops exceed maximum recommended intake (Gweru)

Metal	Rape (Gardens)	Rape (Vendor)	Tomato (Gardens)	Tomato (Vendor)
Lead	458	7560	-	-
Zinc	111	361	194	262
Nickel	1175	1678	677	879
Copper	41	214	81	58
Cobalt	2413	3238	806	672
Manganese	8746	6587	4873	3603
Cadmium	2206	3212	1135	1258

In all cases, the samples were unwashed and uncooked. The effects of washing and cooking have not yet been investigated, hence more work needs to be done. However, these research findings pose the following questions:

1. What are the actual sources of the heavy metals and what does each source contribute toward the levels found in UA crops?

The possible metal sources for vegetable samples from on-plots sites are gardens, rubbish pits close to gardens, corroding zinc structures such as chicken pens and fences, the soil on which they are grown, and the water used for irrigation. For samples taken from vendors, possible metal sources are exhaust fumes and stagnant water in metal containers used to wash vegetables or keep them cool.

2. Do pre-cooking preparations and the cooking process itself reduce the level of heavy metals to the point that when these crops are consumed the total intake is within recommended levels?

In the developed world, metal pollution into the environment has been showing a downward trend. By contrast, in the developing world it has been on the increase. The main reasons for this are:

- ▶ Inadequate financial resources force countries to rely on technologies that are often obsolete and pollution prone.
- ▶ Environmental regulations are either lax or ineffectual.
- ▶ Industrial operations that cannot meet the strict environmental regulations in the developed countries tend to relocate to the developing countries.

The situation calls for more stringent measures to combat pollution and further research on the risks and possible impacts of heavy metal toxicity in UA products.

Result utilization by non-research entities for policy interventions

Before ENDA had carried out research on UA, the views of Harare's city planners on open space cultivation were generally negative. The most widespread belief was that open space cultivation causes land degradation and interferes with the city's planned development programs. Planners were not aware of the results of the studies carried out by ENDA-Zimbabwe that showed the extent and magnitude of this degradation.

The view that open space cultivation interferes with planned urban development of housing, commercial, and industrial sectors seems to be based on the traditional definition of urban areas as those where agricultural activities are absent, while rural areas are defined by agriculture as the major activity. It became clear that the city of Harare subscribes to this traditional school. The department of housing and community services insists that Harare has no land for agriculture. While the department acknowledges there are open spaces within city borders, it argues that land should not be allocated to agriculture.

However, planners in the council's health department (town planning and co-operatives sections) now see that open space cultivation provides food, incomes, and informal employment to the cultivators. This shift in attitude was achieved after various consultative meetings with officials from the departments of engineering and works, town planning, city health, city valuations, co-

operatives, and housing and community services.

Council officials often appear cooperative during discussions, but then fail to implement recommendations or commit themselves in writing. The attitude of the local authorities has somewhat hampered progress toward policy shifts that would accept UA as a viable urban land use. Nonetheless, some headway with local authorities has set in motion a process that will likely see UA acknowledged as a legitimate use of urban open space.

Within central government in Zimbabwe, natural resources planning and management related to agriculture is largely the domain of the Ministries of Agriculture, Local Government, Regional and Urban Development, and Environment and Tourism. Discussions with planners in the responsible departments within these ministries reveal that they have no mandates for natural resource planning, use, and management in Harare.

Discussions have shown that central government is not entirely opposed to open space urban cultivation in Harare and Gweru. The general view of the central government departments noted above is that city councils should state their preferred position to the central government for recommendation and approval. In line with this central government position, the environment and education committee passed a resolution in 1992 to allow open space urban cultivation in Harare. Council was then asked to develop implementation mechanisms for this activity in consultation with other government departments. However, this recommendation was neither gazetted nor publicly debated in parliament and city council. Furthermore, the basis for this policy shift in favour of urban cultivation seems to have been the sympathy felt by members of the environment and education committee toward cultivators. In any event, policies enunciated to date are merely rhetorical since people essentially ignore policies and cultivate off-plot areas in any way they see fit.

ENDA's research showed that the following elements were present in UA products in quantities too high for human consumption, irrigation, or to support aquatic life: manganese, potassium, iron, and sodium. They are potentially harmful to human health. Through ENDA's efforts to disseminate its research results, it was reported that the City of Harare is seeking a "speedy promulgation of stringent anti-pollution bylaws, an imposition of hefty fines against polluters to protect the city's sewers, sewage treatment works and water" (The Herald, August 16, 1997).

Overall evaluation of determinants

Institutional and legal framework

UA in Zimbabwe subsists in a plethora of fragmented and uncoordinated legislation dealing with environmental issues. At the time this research was carried out, 18 pieces of legislation administered by at least eight different ministries had a bearing on environmental management. This context hampers implementation of comprehensive urban environmental planning and

management systems. Most current environmental legislation originated in the colonial era and is not suited to contemporary and emerging socio-economic and environmental problems in urban centres.

Central Government Level

The Ministry of Mines, Environment, and Tourism is responsible for all issues relating to the management of natural resources. The Department of Natural Resources within the Ministry is central to natural resource management countrywide. This department derives its statutory mandate from the Natural Resources Act, Chapter 150. The department offers secretarial services to the natural resources board (NRB). The board is supposed to exercise general supervision over natural resources. The Natural Resources Act gives the board powers to order any occupier, owner, or user of land to implement any conservation measures it deems necessary.

The Department of Natural Resources also has a mandate to influence other government departments and agencies to work with provincial authorities and the public to conserve and enhance environmental quality. The research and technical branch within the department is concerned with environmental monitoring and research. The extension branch promotes environmental awareness. The inspectorate oversees compliance with environmental regulations under the Natural Resources Act. The streambank protection regulation under this Act stipulates that no cultivation should take place within 30 m of a streambank.

However, the department's activities have been largely concentrated in the communal areas and have been ineffective in urban environments. This shortcoming could be owing to the multiplicity of players involved in urban environmental management and planning.

Ministry of Local Government, Housing and Public Construction

This ministry oversees and regulates all council activities, in both rural and urban areas. These councils are responsible for projects or activities carried out in their areas of jurisdiction. The department of physical planning within the ministry derives its mandate from the Regional, Town and Country Planning Act (RTCPA), 1976. The jurisdiction of the department as stipulated in the Act is to oversee and take charge in:

"The co-ordination of the planning of regions, districts, and local authorities with the object of conserving and improving the physical environment and in particular promoting health, safety, order, amenity, convenience and general welfare as well as efficiency and economy in the process of development and improvement of communication". (Preamble; Regional, Town and Country Planning Act, 1976).

Enshrined within its mandate is the protection of public interests and powers for local authorities to issue development permits and prepare master and local plans. The department gives advice to local authorities, approves, and monitors their plans. It also recommends change of use for any

state land where there is a demonstrable need. However, in its definition of urban development (section 22, subsection (b), paragraph (iii)), the RTCP Act states that use of urban land for agricultural purposes does not constitute land development (Government of Rhodesia, 1976). The Urban Councils Act (section 235 (1)(j)) gives the Minister of Local Government the authority to make regulations prohibiting or regulating cultivation in local government areas (Government of Zimbabwe, 1995).

Although these acts do not explicitly prohibit urban cultivation, they paint a negative picture of the activity.

Local Authorities

Local authorities are partly the creation of the central government through the Ministry of Local Government, Housing and Public Construction. Through this Ministry, central government imposes controls, monitors, and interferes with operations of local government on matters of urban land, housing, and finance.

Urban council activities in Zimbabwe are also governed by the Urban Councils Act (1995). Urban councils are supposed to provide certain services to areas under their jurisdiction ranging from the provision of utilities to ensuring some types of economic activities. These functions can be described as the regulation and development of land and the provision of public infrastructural services.

Local authorities play a crucial role in safeguarding the environment of areas under their authority. They articulate government policy and implement government regulations and standards relating to certain aspects of the environment. The Urban Councils Act (1995) empowers local authorities to formulate their own by-laws. However, these by-laws should not contravene the enabling legislation. Thus, powers of local authorities to enact regulations governing the urban environment are still curtailed by higher statutory and ministerial powers.

From time to time the Harare city council, for instance, sets up a committee, such as the environmental management committee, to deal with a particular environmental issue. However, most of the committees established to date have been efforts to curb 'illegal' urban cultivation rather than seek ways to promote and improve the activity. For example, in December 1997 Harare city council struck a UA committee whose main recommendation at its first meeting was to slash all maize crops within the stipulated 30 m from streams. Such recommendations are yet to be executed.

Apart from the Regional, Town and Country Planning Act, the Urban Councils Act and the Natural Resources Act, other acts directly impinging on UA include the Water Act and the Public Health Act. With regard to other ministries, the Ministry of Agriculture has a significant role to play in UA, especially through AGRITEX.

Non-governmental organisations (NGOs)

Several NGOs play an important role in environmental management. Leading NGOs in this field include ENDA-Zimbabwe (UA research and advocacy for policy change), Environment 2000 (waste management and environmental education for urban communities, among other projects), and ZERO (research into various environmental problems). However, it is unfortunate to note that no NGO, government institution or local authority is working with the urban micro-farmers to improve farming practices. This type of activity could ensure that conservation mechanisms are put in place and productivity is boosted. In cities such as Mutare and Gweru, the Ministry of Agriculture's department of Agricultural and Technical Extension Services (AGRITEX), and the Zimbabwe Farmers Union (ZFU) have worked with urban farmers to improve farming practices. However, such efforts were not sustainable without explicit legal backing.

Politics of urban cultivation

The practice of urban cultivation cannot be divorced from central and local authority politics. The activity is closely linked with the economic hardships associated with structural adjustment. In this context, politicians and urban managers are faced with the dilemma of whether or not to implement the regulation measures already found in existing statutory instruments and by-laws. The discourse revolves around humanitarian ethics versus urban legal requirements.

The history of crop slashing as a regulatory measure dates as far back as the early 1980s. But municipal councils have not been consistent in this regard -- they shift between accommodation of UA activity and repression. Urban councils have generally tolerated UA in periods of drought and economic hardship. However, most councils have not reached consensus on the issue.

Some city councillors and Members of Parliament in Harare, particularly those in high-density, low-income areas, have encouraged UA in their constituencies. Yet they have not dared advocate for policy change. Politicians appear double faced: in their constituencies they sympathize with the plight of the urban farmer. But in council chambers or parliament they are silent or supportive of regulations prohibiting open space cultivation.

At a workshop bringing together urban managers, politicians, and micro-farmers a vital question was posed: "Are political statements policies?" The question referred to an incident where a Member of Parliament had given a green light to urban farmers to cultivate. But the farmers' maize was later cut down by council officials.

Toward an enabling environment

Various attempts to rationalize UA have often failed owing to conflicting positions within city departments, governing statutes, and relevant government ministries. The absence of a clear policy framework has certainly hindered the development of UA. In 1992, a resolution to allow open space cultivation was passed by Harare's environmental and education committee, whose

members came from the city council's department of housing and community services, NRB, and the central government departments of natural resources, physical planning and AGRITEX. Harare city council was tasked to develop specific implementation mechanisms for urban cultivation in consultation with the aforementioned departments. The department of natural resources was tasked with identification of land suitable for cultivation. AGRITEX was responsible for developing conservation measures and the city council for allocating land to cultivators. Unfortunately, this proposition never succeeded. There was alleged political interference by local politicians in land allocations and in the treatment of offending cultivators (Masoka 1997).

Urban cultivation co-operatives

These co-operatives are regarded as semi-legal cultivators since permission to cultivate was granted by Harare city council. The city council initiated these 'co-operatives' in 1986 as a move to try to control and organize cultivation. This initiative was consistent with the country's socialist ideology, which favoured the co-operative model. But the structures that emerged were not co-operatives per se; rather, they were groupings of cultivators whose sole purpose was to gain access to land. Land was apportioned free of charge on a short-term lease. Co-op members were supposed to renew these leases annually. Compliance with this obligation was not complete. In subsequent years, some cultivators continued their operations without consulting city council.

Some unfortunate incidents followed. For instance, in February 1989, council workers slashed about 12 hectares of maize that was near maturity. This included the crop of a local co-operative that had obtained permission from the ward councillor (Herald, February 20, 1989). The council was obliged to compensate the co-op members for the destroyed maize.

The Simon Pitt Incident

This case involved a Harare city councillor representing a low density, high-income suburban ward. In April 1997, acting on the advice of a local environmental conservation group, the councillor sanctioned and funded the destruction of three ha of maize along a stream in his ward. Most of the maize belonged to locally employed domestic workers. The executive mayor of Harare was not pleased with the councillor's action and ordered him to compensate the maize growers. But the councillor insisted he had acted according to existing regulations. The matter had to be brought before a disciplinary hearing.

In recent years, the mayor of Harare has sympathized with the plight of the cultivators. For instance, the mayor acquired 6000 tonnes of maize seed for some councillors to distribute in their constituencies (Financial Gazette, December 5, 1996). However, both the mayor and city council's environment and development committee argue that UA needs to be organized and management structures need to be set up if the activity is to be sustained. Cultivators also require training in appropriate methods of agricultural production and conservation of the natural

environment.

Conclusion

The very nature of the research carried out on UA was pertinent to the quality and relevance of the results obtained. The policy arena was not favourable to the promotion of UA since the activity was deemed illegal. As detailed in the legal and institutional framework, the study was launched against a background of social, political, and institutional disharmony between practitioners and both local and central government authorities. Institutional linkages were established through continuous dialogue in feedback workshops and through the UA committee of Harare city council. The institutions included: the ministries of local government, rural and urban planning; agriculture; environment and tourism; and health as well as the municipality of Harare's department of health and the University of Zimbabwe. This dialogue increased the diversity of ideas available for developing feasible policy recommendations and further avenues of research. The way forward for ENDA lies in developing and implementing a practical model for UA. This goal can be achieved in partnership with other stakeholders such as city council, AGRITEX, and the natural resources board. The model can be tested in pilot cities before being replicated elsewhere. ENDA also intends to pursue the issue of heavy metal toxicity in urban products. The research design could analyze unwashed and washed samples, and compare vendor, garden, and supermarket samples.

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