

Informal Irrigation in Peri-Urban Areas

Institutional Aspects and Options for Improvement

**KAR project R7132
October 2002**

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Summary

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This report presents findings arising from the Knowledge and Research Contract R7132, Improved Irrigation in Peri-Urban Areas, carried out by HR Wallingford for the British Government's Department for International Development. The work was done in Ghana and Kenya in collaboration with the Kwame Nkrumah University of Science and Technology, Ghana and the Smallholder Irrigation Scheme Development Organisation in Kenya. The purpose of the research was to improve understanding and knowledge of the productivity and hazards of peri-urban irrigated agriculture, with the aim of identifying measures to improve output whilst minimising risks to health and the environment. This report provides an overview of the institutional aspects of the study and is an additional output requested by DFID. Other key findings from the study are presented in OD 144 'A summary of findings and recommendations'.

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1. INTRODUCTORY REMARKS

Many cities, large and small, face the challenge of rapid urban growth and are ill-equipped to cope. Weak overall capacity, unclear mandates and a lack of transparency and accountability are familiar issues. Such problems are exacerbated in the peri-urban areas owing to unclear responsibilities and a lack of integrated planning between the rural and city institutions. Many different government and non-government entities operate in the peri-urban zone but do not take account of its unique characteristics.

Agriculture is a familiar economic activity in many urban and peri-urban zones although it is not often officially recognised. There are several studies on peri-urban agriculture but few have examined the role of informal irrigation. This study looks at informal irrigation of peri-urban agriculture in Nairobi in Kenya, and Kumasi in Ghana. It draws together quantitative information that can contribute to raising policy makers and government departments' awareness of informal irrigation and points them towards areas for practical action.

Informal irrigation is only one activity amongst many that are together described as Urban and Peri-urban Agriculture (UPA). However, it has particular importance owing to the increasing competition for water, potential health hazards and opportunities for poverty alleviation. Although peri-urban agriculture is receiving considerable attention from UN agencies, NGOs and the research community, it still has to vie with the demands of other sectors when seeking the attention and resources of officials and decision-makers.

The extent and importance of informal, irrigated peri-urban agriculture appears to be generally underestimated in government statistics. Data from both cities show that informal irrigation is widely practised by individuals generally acting without support from government or NGOs, and is the primary source of cash income for over 80% of households involved. In the 40km radius around Kumasi there are estimated to be 12,700 households irrigating at least 11,900 ha. To put this in perspective, the total formally irrigated area reported by the Government of Ghana is just 6,400 ha. In the smaller study area around Nairobi, which is one quarter the size of the Kumasi study area, at least 3,700 households irrigate 2,200 ha, compared with approximately 66,600 ha in the country as a whole (FAO, 1995).

Informal, small-scale irrigation is an important part of urban and peri-urban agriculture, producing a large proportion of the fresh vegetables consumed in cities and providing the major source of cash income for thousands of households. However, because many of the water sources used are heavily polluted, both growers and consumers are at risk from bacterial and helminth infections. This combination of significant benefit and risk should motivate policy makers and government departments to actively review the actions that could be taken to enhance the benefits and reduce the associated health risks. However, to a large extent UPA operates outside the formal institutional framework, so it is not provided with meaningful support and regulation. Policy makers and government departments will only formulate supportive policies and release resources for interventions when they recognise the scale and importance of UPA. This requires them to have reliable information on both the benefits that it brings – contributions to the urban food supply and household income generation – and the health risks associated with the use of polluted water for irrigation.

This report summarises some of the findings from a research study in Kumasi and Nairobi funded by DFID. It outlines the institutional issues and sets out some options for improvement. The report builds on a series of publications (listed in Annex 1) that have arisen from this study and also a workshop organised by UNCHS (United Nations Centre for Human Settlements) in Nairobi.

2. INSTITUTIONAL CONTEXT

The study outputs focused on technical and socio-economic constraints and measures to alleviate them. Some assessment was also undertaken of the institutional context within which peri-urban agriculture is set. This is a complex issue and full analysis would require studies that are beyond the scope of the present research work. A key element of the institutional framework is the spatial definition of the peri-urban area. This is undefined and official administrative responsibilities are thus unclear. It is not easy to make any definition of the peri-urban area that is acceptable to administrators, politicians and law makers owing to its arbitrary nature, coupled with constant changes to urban development and land use, transitory economic activity and varied impacts of environmental issues such as river flows and pollution. It was identified that institutional issues pose a risk for any viable policies aiming to develop peri-urban agriculture.

In both Nairobi and Kumasi, urban and peri-urban agriculture does not come under the exclusive agenda of any central ministry or government department. The Ministry of Agriculture does not assume responsibility and does not offer extension services to most peri-urban farmers. Responsibility for health matters, environmental issues and regulation are not clear. More studies are needed in order to design better institutional arrangements that benefit both the farmers and consumers. In particular, skills must be developed within a specified agency to manage the use of wastewater for irrigated agriculture.

Unlike other forms of urban and peri-urban agriculture, which are often valued for their direct contribution to family food security, access to irrigated production on a more commercial basis generates a cash income. However, as yields are often low and the areas cultivated small, returns remain low. Average profit generated from informal irrigated agriculture in Kumasi, where irrigation occurs over approximately 5 months (December – April), was \$US 153, with the best performers achieving almost \$US 360. In Nairobi, where irrigated production continues through the whole year, average annual profit generated from informal irrigated agriculture was \$US 279.

2.1 The Kumasi Peri-Urban Area

Institutional aspects are complicated by the differences between the formal government institutions and traditional governance structures. The formal government and traditional structures are described more fully in Holland *et al.* (1996). The informal structures, community and NGO-based, add another layer of complexity. This section draws on work carried out under the DFID Natural Resources research project (Brook and Davila, 2000).

The Kumasi urban and peri-urban area (KPA) straddles a geographical area covered by the Kumasi City Council and surrounding villages within about 10 km of the city centre. This area forms part of the Ashanti Region as defined by the Local Government Administration Act of 1971. The KPA can be described as lying within the Greater Kumasi City Region although the latter is not a formally recognised administrative entity. In the future it may become necessary to formally create such an entity to better co-ordinate development across the numerous administrative boundaries.

The KPA is affected by the policies, laws and economic activities of the Ashanti Region as a whole and Kumasi city itself. Owing to its indistinct boundaries there is little documented information or data related to the KPA. Preparing an institutional and economic profile of the area would require considerable analysis beyond the scope of this study. The surrounding villages in the KPA lie within the jurisdiction of four District Assemblies. There has been a policy of decentralisation in Ghana for some time and the District Assemblies are important in promoting development, although in practice central government still retains considerable power. The District Assemblies are responsible for formulating plans and budgets and implementing policies and programmes under the auspices of the National Development Planning Commission. Under the Local Government Act (1993) they have legislative and executive functions and are theoretically the highest political administrative and planning authority in the peri-urban areas outside Kumasi City boundaries. It would appear that none of the District Assemblies have plans that would capitalise on the region's agricultural potential and its proximity to Kumasi.

In the urban area of Kumasi the equivalent institution is the Kumasi Metropolitan Assembly, which is a key player in the economic development of the city. However, according to Korboe (1998, cited in Brook and Davila, 2000), KMA is structurally weak and poorly managed with shortfalls in revenue collection constraining development of services. The KMA are mainly responsible for the acquisition of lands for development, for disaster management and for providing business credit, basic health and education services and public latrines. Although they do not have specific responsibilities for any agricultural activity within the city area, they would appear to have a responsibility for regulating it from the health perspective.

All District and Metropolitan Assemblies assign functions to committees and sub-committees for specific tasks and central government agencies can attend meetings. There are no specific sub-committees for agriculture. The lowest tier of administration is the Unit Committee at the village level. There are just over 400 Unit committees within the KMA area. The Unit committees have development planning functions, including self-help projects, at the village level.

Land ownership and land use planning is an important aspect of agriculture in the KPA. Land is described as either family land, stool land (controlled by the traditional chief), individual land or government land. The Lands Commission is responsible for the management of government land and recognises the role of the traditional authorities. More information on land is provided in the DFID funded research on natural resources systems in the Kumasi area (Brook and Davila, 2000).

There are no strategic plans that cover agriculture in the urban or peri-urban areas and little recognition of the special characteristics of the peri-urban area. In Kumasi the value and importance of peri-urban agriculture to the poor and their role in providing services to the city dwellers are not specifically recognised and the activity has no official status, although it does not appear to contravene any laws. The farmers thus operate in the informal sector and do not benefit from any government advice or support. The farmers' livelihoods are very precarious and, in the present institutional framework, are more likely to be adversely affected by any planning changes, particularly related to land. Many stool chiefs sell land for housing leading to increased homelessness, which raises particular problems for women. There is also unauthorised building by middle-class urban dwellers on community land belonging to the poor.

An analysis of the impact of different government policies on peri-urban agriculture is needed, taking account of their impact on poor farmers. This should examine how financial resources, both central government and district, are allocated for services in the peri-urban area. The role of agricultural activities within the KPA should be covered in planning activities and support and advisory services provided for it.

Any future development activities in the peri-urban area should be based on integrated policies that take account of the special character of this area and should not simply rely on either rural or urban policies and plans. However the prevailing institutional structure and lack of recognition of the activity make it difficult to prepare integrated policies for the KPA. The District Assemblies should have a more pro-active role in agricultural activities in the peri-urban zone as their responsibilities include the welfare of poor farmers. Whilst it may not be the responsibility of the KMA to promote or support farmers within its administrative boundaries, it should work closely with the District Assemblies to provide an enabling environment for services such as credit and marketing in the city as well as a regulatory framework to reduce health risks. This study could only examine the broader institutional framework and it is recommended that further institutional studies are undertaken to better understand the roles of various actors and the need for proper policies and planning to support and regulate small-scale peri-urban agriculture.

2.2 Nairobi peri-urban area

There is a lack of policies addressing urban agriculture and this poses difficulties for both practitioners and administrators. Nairobi City Council (NCC) does not have a specific policy on urban agriculture although the World Bank has proposed to assist NCC in setting out policies in this area.

The study looked at an area within a 20 km radius of the city centre. Half of the farmers practising peri-urban agriculture are squatters on government land while the remainder either own or rent the land. UPA is an important source of income for the urban poor, particularly women, and some NGOs promote urban agriculture as a means to alleviate urban poverty. Farmers are at the mercy of city planners and rely on the inability of the authorities to properly police the urban areas. They survive through forcing their way through weak points in the bureaucratic system and lately have become more aggressive in their struggle for survival (Kariuki and Gathuru, 2001).

In Nairobi, the shortage of water has led to farmers using untreated sewage water for irrigation. During the study, some discussions were held with Nairobi City Council regarding the major health risks posed by the use of untreated sewerage, which is more of a problem in Nairobi than in Kumasi. This has been a very sensitive issue that extends beyond urban agriculture alone and NCC were reluctant to discuss it. Attempts to involve the DFID office in Nairobi did not produce any results.

Agricultural activities and practices are forbidden by city bylaws established in colonial times (City of Nairobi, General Nuisance bylaws of 1961) essentially for public health reasons. However, the bylaws set out conditions for cultivation and livestock and indicate that they can be carried out in controlled areas. The Local Government Act prohibits cultivation and keeping livestock but also gives NCC powers to allot its own land for temporary cultivation or for keeping livestock (Kariuki and Gathuru, 2001). The Public Health Act specifies the type of livestock that can be kept and which are a nuisance or a health hazard. The Public Health Act (CAP 242) can override the local bylaws if the activity is deemed to be a health hazard. The laws can thus permit UPA but they also allow for controlling the use of raw sewage in agriculture where it is a health hazard. In Maili Saba the local authorities are positive about the benefits of urban agriculture since the community are able to feed themselves, whereas in Embakasi and Kasarani there is greater concern about the use of raw sewage water for cultivation.

The Environmental Management and Co-ordination Act of 1999 establishes a specific link between environmental protection and the right of citizens to a clean, healthy environment. There is an urgent need to clean up the rivers in the Nairobi area and this should perhaps be given more emphasis than restricting urban agriculture, as it would have much greater benefits. UNEP are presently working with the Nairobi City authorities to improve the quality of the Nairobi rivers and have established a monitoring system.

The waters that pass through Nairobi are heavily polluted and, although the link between diseases and the use of untreated waters for cultivation has not been established, there is a health risk and this has been reported in local newspapers. However, it is important to distinguish between agriculture using raw sewage and agriculture using less polluted water. The study determined that about 36% of farmers use raw sewage. There is a danger that the use of sewage water could lead to the whole practice of informal irrigation being prohibited altogether. NCC should recognise that urban farming exists and can be beneficial in the right conditions. NCC should also formulate a clear policy and regulatory framework to cover peri-urban agriculture including a means to reduce the health hazard from the use of very poor quality water for growing vegetables. A means to control excessive pollution from agricultural inputs is also needed.

The Ministry of Agriculture and Rural Development and the Ministry of Health (Food Quality and Safety) are key players in peri-urban agriculture as well in NCC. The Poverty Eradication Commission and many NGOs are also actively involved. There is no consensus on the practice of informal irrigation. Generally, government and municipal authorities are concerned with the health hazards and thus oppose the practice, whilst NGOs provide support as they recognise that it is an important measure in reducing poverty. Several NGOs, both local and international, are actively involved in supporting the farmers to improve their production.

Farmers, many jobless and landless, fear that the authorities will prevent them from farming and thus do not co-operate with the authorities. Apart from the health risks from the food produced, the NCC are also

concerned about the costs and hazards arising from the damage to sewage systems. Whilst there is a risk to consumers and farmers from the present activity and regulation is essential, the present conflict does not help in finding a solution.

The DFID study, and the HABITAT Workshop in May 2002, clearly raised the issue higher up the agenda. Since completing this work, the Nairobi Informal Settlement Co-ordinating Committee (NISCC), a stakeholder forum involving government and NGOs and chaired by the Nairobi City Council Planning Department, have established a Task Force to look into the issue. They have prepared a proposal for a study to examine the availability and quality of food in Nairobi. Their main aim is to analyse the public health risks associated with raw sewage farming in Nairobi, although an underlying theme is to create public pressure to stop the practice. The study will establish levels of micro-organisms and heavy metals in sewage produce. This will therefore verify the nutritional and health implications, identify whether previous epidemics of typhoid and other diseases are attributable to sewage farming and identify safe and sustainable options to manage the situation. The study is welcomed and is a step in the right direction. However, it would be better to have a more open approach to improving the situation rather than pre-empting the findings and commissioning TV and radio programmes to raise public pressure against urban agriculture. Any attempts to stop the practice altogether could have severe consequences for the poor and in particular women, who make up 66% of all farmers.

Throughout the world there are many projects promoting UPA, including projects in Nairobi. By 2020 about one third of the population of Kenya will be living in Nairobi and urban food production is likely to remain a key survival strategy for the urban poor. Several NGOs, including the Undugu Society, Action Aid, Help Self Help Centre (HSHC) and others, are implementing projects as they are considered critical in providing livelihoods for the poorest people. An example is the Urban Farming Programme in Maili Saba, one of the poorest squatter slums some 15 km from Nairobi centre (Kariuki and Gathuru, 2001). Under the Green Towns Project, NGOs and training institutes have been working together to look into environmental governance in urban areas and to empower communities to lobby for action. There have been workshops with the Ministry of Local Government and the Ministry of Lands and Settlements. These have provided a platform for future co-operation in the search to find a UPA that is acceptable to the state and local communities.

2.3 Common institutional constraints

The available resources and economic and physical environments of the two cities, Nairobi and Kumasi, are quite different and for that reason their approach to the management of informal, irrigated urban and peri-urban production will differ. Nonetheless, the following institutional issues are common to both cities:

- Many different government agencies and CBOs have responsibility for issues relevant to informal irrigation but no single agency takes a controlling role to support and regulate the practice.
- The special characteristics of the peri-urban zone – the interface between urban and rural policy domains – are not adequately recognised in the formulation of urban policy.
- Where agencies are aware of urban and peri-urban irrigation practices the focus is understandably on potential health risks and issues of nuisance. Environmental, economic and food security benefits that may accrue from some types of well managed peri-urban irrigation may go unrecognised.

These constraints cannot be simply or quickly removed. This project has brought more quantitative information to the attention of policy makers and institutions but the institutions themselves, possibly with longer term support from donors, must agree priorities and allocate resources to meet the needs for support and regulation that peri-urban irrigation requires.

Finally, it must be stressed that there are several different types of informal urban and peri-urban irrigation, using water of greatly differing quality to irrigate different crop types. The use of raw sewage will carry much greater risk to growers and consumers than irrigation with polluted river water. Further research may still be required before these levels of risk can be adequately quantified and used to guide policy

decisions. Equally, irrigated crop production is only one component of UPA. Institutions must be prepared to distinguish for example, between the nuisance impact of a dairy livestock unit in a residential area and irrigated cultivation of a vacant building plot. A single policy on “urban agriculture” will be too blunt an instrument to manage this sensitive policy area.

3. ESTABLISHING FARMER ASSOCIATIONS

The formation of formal or informal farmer associations is a mechanism by which official support could be channelled and through which farmers could improve their access to credit, extension advice and improved market opportunities. Despite the apparent benefits arising from group formation and action, there were almost no effective formal or informal farmer groups identified by the studies in either Kumasi or Nairobi. In workshop discussion groups, farmers from around Kumasi accepted the suggestion that group actions could bring benefits, but proposals to form groups were always given a low priority when farmers ranked their “preferred” interventions. In Ghana the forming of groups or co-operatives has come to be strongly associated with politics and party control within the community, which is given as one reason for the unpopularity of such groups.

Effective group formation is not a spontaneous event. There appears to be considerable potential for intervention by a neutral agency such as an NGO that can provide training and support to farmers to overcome their misgivings and form effective group structures. Defining group objectives should be in the hands of the group members and not imposed from outside. There is a wide range of activities where group co-operation could be effective, including:

1. The certification of a water source as being safe for unrestricted irrigation and labelling of crops grown with clean water. This would be administratively difficult unless the water source was used by an organised group of farmers who were responsible to the certifying agency. Thus a major component of this approach depends on farmers sourcing their water and marketing their crops as organised groups.
2. The construction of physical works, small storage ponds or reedbeds to treat polluted surface water before irrigation, or the construction of small earth dams for water storage. A farmer group would need to agree to carry out, or assist with, construction and then maintain the asset. Group co-operation is also needed for effective management and allocation of the treated or stored water.
3. To seek the support of extension services. Individual irrigating farmers are often widely scattered and cultivate only small plots, so it is impractical for extension staff to visit or support single farmers. By forming a group and petitioning the extension service for support then the needs of this farmer group are more likely to be recognised. If necessary, this could include the group paying the travel costs of the agent, where these are not excessive.
4. To facilitate the use of extension techniques such as farmer field schools, which are regularly shown to have a better impact than traditional one-to-one training methods. Developing and promoting good extension materials and establishing farmer groups to receive and evaluate extension advice is probably one of the most effective short-term interventions, with the objective of increasing productivity and improving farmer income from informal irrigation.
5. To purchase equipment, e.g. a treadle pump, pipes and sprinklers. Care is needed in such arrangements to ensure that there is explicit agreement amongst all the participants over how the resource will be shared, how routine maintenance costs will be met and how any accidental damage will be paid for.
6. To plan production schedules to coincide with periods of price peaks and to regularly obtain and compare price information from several market centres. Where farmers can avoid being “locked in” to selling into a single market, access to such market information, provided it can be coupled with access to traders from alternative markets, could enable farmer groups to exploit regional variations in the supply and demand of fresh produce.

4. PROVIDING BETTER CREDIT SERVICES AND MARKETING

The issue of credit in Kumasi is described more fully by Cornish *et al.* (2001). Existing formal micro-credit provision through the Poverty Alleviation Fund is widely discredited as being too politicised. An alternative mechanism would be to extend credit to formally registered farmer groups. Such groups do exist for the production of other crops in the rural areas, such as rice, but there is no evidence to date of credit provision being made for vegetable irrigators in the peri-urban areas.

The study in Kumasi revealed that many farmers are tied into informal, pre-financing arrangements with market traders, thereby linking these two aspects of production. Kumasi farmers identified these two issues of credit and marketing as their top two concerns. By contrast, Kenyan farmers ranked these issues lowest when asked to identify practical constraints to production and income.

There may be scope for the provision of credit where it is tied to the introduction of a particular technology such as a treadle pump, sprinklers or low-cost drip irrigation. Where farmers are making a capital investment an initial down payment can be made, a repayment schedule agreed and, if repayment is not made on time, the capital item can be repossessed. However, the provision of credit to meet expenditure on seasonal start-up costs – seed, pesticides, labour, etc. – is more problematic.

Because farmers in Kumasi are frequently bound into what they perceive to be disadvantageous marketing arrangements when they secure informal credit from traders, they highlight this as an issue requiring the attention of outside agencies. This study has identified this as a complex issue and any intervention must be carried out with great caution. There do not appear to be many immediately promising options to pursue in this area and as long as the farmers remain within the informal sector they are likely to remain at the mercy of the traders.

Kumasi farmers reporting of marketing problems and their desire to see intervention in that field reflect a number of complex issues, not least of which is the control of the Kumasi central market by the market queens and traders, with farmers being forced to pay a number of commissions and levies. Bypassing these existing market systems on a large scale through the provision of parallel market systems would require major political and policy level interventions. A more feasible and smaller-scale intervention would be to gain greater understanding of how some farmers make contact with travelling buyers from other urban centres, who appear to pay better prices than the traders selling into Kumasi.

The most immediately practical intervention may be to study medium- and short-term price fluctuations for key irrigated products and to provide information to assist farmers in planning production to coincide with price peaks. This requires specific inputs and support to farmers from the Ministry of Agriculture through the extension or advisory service.

5. POLICY AND WATER QUALITY

The linking of water quality interventions with policy reflects the scale of intervention required to bring about change and safer production for both producers and consumers. Use of water with levels of microbiological pollution well above WHO guidelines for irrigation is commonplace. However, bringing about improvements in current practices is not straightforward, given the nature of informal irrigation where thousands of farmers work independently of one another, drawing their water from many unregulated sources.

Any programme aimed at reducing the health risks associated with irrigation in UPA must be broad-based, combining several of the interventions listed in Table 1. Such a programme must provide an incentive for producers and consumers to change current practices and make change possible, without those groups incurring high additional costs. The technical and institutional resources needed to eliminate the use of polluted water for crop irrigation by informal irrigators should not be underestimated. Westcot (1997) describes the characteristics of such a programme, based on successful interventions in Chile and Beernaerts (2001) describes how elements of the same approach might be applied in Accra.

Raising the awareness of producers and consumers of the health risks associated with the use of polluted water for vegetable irrigation can provide an incentive for change amongst consumers, traders and growers. Where consumers are made aware of the potential link between consumption of produce irrigated with polluted water and the incidence of diarrhoeal disease within their households, they can pursue one of several options:

- Accept the situation, making no change to their buying or food preparation practices.
- Buy the same produce but take precautions in its preparation – i.e. thorough washing or cooking.
- Reduce their consumption of those food items which pose the greatest health risk, e.g. salad produce.
- Demand alternative produce, which is certified to be safe. Some consumers may be willing to pay a premium for this improved quality.

Studies of irrigated vegetables grown in Accra (Maxwell and Armar-Klemesu, 1998) have shown that greater bacterial contamination occurs through poor hygiene during crop marketing and distribution than during production in the field. In view of this, campaigns to raise public awareness may be better focused on consumer food hygiene rather than on irrigation water quality.

Traders may be encouraged to maintain improved levels of hygiene in the storage, washing and presentation of produce – for example avoiding the use of dirty water to freshen produce. To achieve this, market traders must have easy access to clean water supplies. The traders may also pass on the demand of consumers to growers, seeking only to buy produce from farmers using clean water.

Where farmers are pressed by traders to supply “clean” produce or where premium prices are paid for “safe” produce, they have an incentive to use clean water sources. However, alternative, cleaner water sources must be available to them and, if premium prices are to be paid, consumers need some form of assurance, through a policed system of certification, that produce has been grown using clean water.

The provision of alternative, clean water sources is a major challenge in many locations. Water drawn from shallow wells or dugouts might be expected to be less polluted than that in rivers draining urban centres. However, water quality studies in both Kumasi and Nairobi (Cornish *et al.*, 1999; Hide *et al.*, 2001) showed the mean faecal coliform count in all monitored wells to exceed the WHO guideline of 1000 FC/100ml for unrestricted irrigation. The source of pollution in these wells is not known but there is a need for field research to determine whether simple protection measures, combined with awareness raising amongst farmers, can raise the water quality from these wells to a level that consistently lies within, or at least closer to, the WHO guidelines.

Where farmers are using motorised pumps to lift water from polluted rivers or other open water bodies, shallow dug-outs do not provide a viable alternative unless the sustainable yield of the well matches the pumping rate, which is seldom the case. Good quality water may be available from specifically constructed well points, but such wells are expensive and would tie a farmer, or, more realistically, a group of farmers, to one site.

In the long term, improving the microbiological quality of rivers and other water bodies is the best solution but in many urban and peri-urban locations this remains an unrealistic goal in the short to medium term.

In some situations, it might be more appropriate to promote the controlled reuse of treated effluent. Where sewage treatment infrastructure already exists adjacent to potentially cultivatable land, it may be practical to encourage farmers to relocate from sites where they are using unsafe water to a new site where they have access to treated effluent. To be successful, such an intervention requires that:

1. There is sufficient treated effluent to satisfy predicted irrigation demands.
2. The quality of the effluent is regularly monitored by an appointed authority and the treatment process consistently delivers water that is “safe” for irrigation. Resources are required to maintain the

treatment infrastructure and regularly monitor effluent quality. (This point again identifies the possible role of a water and crop certification programme.)

3. Suitable land is available and farmers are willing to relocate. This carries major implications regarding housing, access to other services, access to markets, etc.
4. Consumers are confident that produce irrigated with treated effluent is safer than existing produce.
5. Clear policy decisions are made and institutional frameworks established to ensure that these needs are met.

Westcot (1997) discusses certification programmes and their attendant policy issues in detail. Certification that a water source is safe for irrigation is most easily applied where many farmers draw water from a common source. Such a situation occurs on a formal irrigation scheme where water samples at the scheme intake can be monitored. It might also apply where the effluent from an existing treatment plant is to be used. Routine certification of water quality is much more difficult where many small-scale farmers draw their water from numerous streams and shallow wells. To overcome this, there would need to be clear market incentives and appropriate technical interventions to motivate small, independent farmers to come together in groups or associations. The groups would require the provision of a safe and monitored water source.

For a formal labelling and crop certification programme, farmers would need to work together in organisations that would bear responsibility for securing and maintaining certification of their water sources. It is clear that an intervention of this type – water certification and crop labelling – requires sustained activity by an independent agency in which consumers and producers have confidence. The District Authorities and Health Authorities would need to work with each other and with the farmers to set up a viable and sustainable system.

Restricting production to only selected crops, such as fodder or grain crops or produce that will be processed and cooked before consumption, is likely to be unworkable under present conditions. For crop restriction to be effective, Westcot (1997) suggests that all of the following conditions must apply:

1. Irrigation using wastewater occurs only in well-defined sites (formal irrigation schemes) which have strong central management.
2. Strong mechanisms to enforce the restriction regulations are in place and are respected.
3. There is adequate demand and good prices for the crops permitted under the restrictions.
4. There is little market demand for excluded crops.

None of these conditions prevail and mandatory crop restriction is not a sensible option to pursue when attempting to improve the health of producers and consumers of produce from peri-urban agriculture.

With the exception of evaluating / piloting the use of protected wells as a source of clean water, all of the foregoing interventions require policy decisions and actions to be taken on a large scale. Policy makers and government departments are therefore the focus of these interventions, which would require a co-ordinated approach to be successful. Before such policies can even be discussed, institutional responsibilities would need to be agreed among various government and local government agencies.

Modern technologies, such as better irrigation systems, pumping methods and community-based technologies for domestic wastewater treatment could all help to alleviate the hazards posed by low quality water. However, the investment required is relatively high and this would only become viable if production was increased, tenure was more secure and extension services were made available. To achieve effective uptake, wider issues such as local manufacture, effective marketing, farmer training/support and possibly credit provision also need to be addressed.

6. IMPROVING IRRIGATED AGRICULTURAL TECHNOLOGY

In Kumasi, a majority of farmers considered that physical effort or the cost of paying labour limited the amount of water applied to crops, whereas in Nairobi, few farmers thought this constrained their production. There appears to be considerable potential, particularly in Kumasi, for demonstrating and evaluating the acceptability to farmers of modern technology including low-cost water lifting devices such as treadle pumps. These pumps can reduce the drudgery and effort required of those carrying water and considerably improve the productivity of irrigation labour. Unlike motorised pumps, they can be used in combination with shallow dugouts – one of the most common sources of water. More work is needed on assessing demand and determining the potential for small- or medium-scale enterprises to market such technologies.

Construction of small dams to retain water for dry season irrigation could provide more reliable water delivery. This would require adequate technical supervision on site selection and dam design and construction, but these skills exist within public sector agencies – ministries of irrigation and public works departments – and in NGOs and private sector engineering companies. There is presently no evidence in either Nairobi or Kumasi of small dams being constructed by communities or farmer groups. However, it should be possible to use these agencies to implement such an intervention to improve the availability of water for informal irrigated agriculture. Such small dams would probably be owned and managed by local irrigating communities following the model successfully adopted by NGOs in rural communities. Special attention would need to be given to ensure that irrigators would welcome such a form of intervention and to develop the arrangements needed for maintaining the dam and sharing the water. While the number of technically appropriate sites will be limited in some localities, the introduction of small dams is an intervention worthy of further evaluation by both government departments and NGOs.

Knowledge of good agronomic practices, from the preparation and care of nursery beds, planting densities, weed and disease control, and water management through to the maintenance or improvement of soil fertility by use of manures, compost and inorganic fertilisers, is generally poor amongst informal urban and peri-urban irrigators. Peri-urban irrigators farm very small plots and work as individuals and at present they do not benefit from the extension services of the Ministry of Agriculture. The ministry should actively engage with these small irrigators to offer support and advice and disseminate information to improve agronomic and water management practices. Apart from increasing production and improving livelihoods, this could also help to address some of the risks of using low quality water. Farmers need to establish groups to facilitate communication and the extension services need better information and training in order to support the farmers. Such training is particularly needed where extension workers have traditionally only focused on rainfed food production and traditional cash crops.

7. A SUMMARY OF OPTIONS

Informal urban and peri-urban irrigation is widely practised, providing an important source of cash income to thousands of poor households in the urban and peri-urban zones of Nairobi and Kumasi. Agronomic practices, including land preparation, crop husbandry and water management are often poor and farmers have little access to good information or demonstrations of good practice. Water sources used for irrigation are often highly polluted, posing a threat to the health of producers and consumers. Water scarcity or the lack of appropriate means to convey water from source to crop is often a critical factor that limits farmers' production.

The institutional framework is weak and farmers operate informally with no support from government and little from NGOs. The level of interest in irrigated farming in the urban and peri-urban areas is high amongst donors and researchers but largely overlooked by the national administration at central and local level because:

- The area irrigated at a single location is minimal and individual plots are small so it falls outside the remit of government irrigation departments.
- The proximity to urban centres, combined with the focus on non-traditional crops, result in the sector being overlooked by over-stretched agricultural extension services that focus on traditional food and cash-cropping systems in the rural areas.
- City administrations are ill-equipped to address the needs of the sector and may ignore it or act against it when bylaws relating to land use are infringed, infrastructure is damaged, or concerns over consumer health are raised.
- The peri-urban area is ill-defined spatially and does not coincide with administrative boundaries. Moreover, the activity is covered inadequately by the mandates of local and municipal authorities.
- Farmers operate as individuals and, as the plots are scattered, they have not formed groups or associations thus making it difficult for authorities to provide

In the light of these findings, a range of potential actions or interventions can be identified. They have different objectives, are targeted at different end-users, but can be grouped under the main issues, as summarised in Table 1. Many of the interventions are relevant to several issues and may be targeted at more than one user group or audience. Column 4 in the table indicates whether the intervention focuses on the formulation of policy, immediate action to bring about change or where further research is needed to verify benefits. For several of the interventions, particularly those bearing on water quality, actions need to be taken in parallel, as part of a larger programme. For example, a crop certification programme cannot be launched without parallel actions to provide clean water for irrigation support.

Table 1 Interventions to sustain and enhance the productivity of IUPIA

Intervention	Issue					Actors				Possible Actions			Primary Objective
	Water quality	Water availability	Agronomic practices	Credit	Marketing	Policy makers	Government departments	NGOs	Farmers	Change gov/municipal authority policies	Test Pilot Interventions	Research to verify impact	
Acknowledge existence and extent of IUPIA	✓	✓				✓	✓			✓			Safer, increased production
Raise public awareness of water quality issues	✓					✓	✓	✓	✓	✓	✓		Safer production
Improve river water quality	✓	✓				✓	✓			✓	✓		Safer production
Crop restriction	✓					✓	✓		✓	✓	✓		Safer production
Controlled reuse of effluent	✓	✓				✓	✓	✓	✓	✓	✓		Safer production
Water and crop certification	✓				✓	✓	✓		✓	✓	✓		Safer production
Use of protected wells	✓	✓					✓	✓	✓			✓	Safer production
Alternative irrigation methods	✓	✓		✓			✓	✓	✓		✓	✓	Safer, increased production
Small-scale local water treatment	✓					✓	✓	✓			✓	✓	Safer production
Targeted agronomic/irrigation extension			✓			✓	✓	✓	✓	✓	✓		Increased production
Improved water lifting technology		✓		✓			✓	✓	✓		✓		Increased production
Small dams for water storage		✓				✓	✓	✓	✓		✓		Increased production
Provision of alternative credit mechanisms				✓				✓			✓		Improved incomes
Better market knowledge					✓		✓	✓	✓		✓		Improved incomes
Alternative marketing arrangements					✓			✓	✓		✓	✓	Improved incomes
Form farmer groups	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	Improved incomes

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Annex 1 –List of publications from the Peri-urban research study

Report No	Referenced as	Title
OD/TN 95 Sept 1999	Cornish <i>et al.</i> , (1999)	Water quality and peri-urban irrigation: An assessment of surface water quality used for irrigation and its implications for human health in the peri-urban zone of Kumasi
OD/TN 97 March 2000	Cornish and Aidoo, (2000)	Informal irrigation in the peri-urban zone of Kumasi: Findings from an initial questionnaire survey
OD/TN 98 March 2000	Hide and Kimani (2000)	Informal irrigation in the peri-urban zone of Nairobi, Kenya: Findings from an initial questionnaire survey
OD/TN 103 February 2001	Cornish <i>et al.</i> , (2001)	Informal irrigation in the peri-urban zone of Kumasi: An analysis of farmer activity and productivity
OD/TN 104 April 2001	Hide, Kimani and Kimani, (2001).	Informal irrigation in the peri-urban zone of Nairobi, Kenya: An analysis of farmer activity and productivity
OD/TN 105 April 2001	Hide, Hide and Kimani, (2001)	Informal irrigation in the peri-urban zone of Nairobi, Kenya: An assessment of surface water quality used for irrigation
April 2001	HR Wallingford, (2001)	Informal peri-urban irrigated agriculture: Opportunities and Constraints. Proceedings of a workshop held at KNUST, Ghana, 7 – 9 March 2001
OD 144 November 2001	Cornish and Lawrence (2001)	Informal irrigation in the peri-urban areas. A summary of findings and recommendations.