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SOLID WASTE REUSE AND URBAN AGRICULTURE--DILEMMAS IN DEVELOPING COUNTRIES: THE BAD NEWS AND THE GOOD NEWS

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INTRODUCTION

Today, two strongly promoted urban management strategies for the developing countries are urban agriculture and reduction/reuse of solid waste. These strategies, promoted both to conserve and increase resources and assist low-income groups, include some interdependent and complementary activities. Urban waste reduction and reuse involves, among other things, composting of urban organic wastes (especially in cities of developing countries where the organic fraction of municipal solid waste (MSW) is high) and the feeding of kitchen and food wastes to domestic animals and livestock. Discussions of urban agriculture (UA) frequently point out that city farming often absorbs urban solid waste, thus reducing the volume of waste and the need to collect and transport wastes to distant dumps. In practice, urban farmers in many cities acquire municipal wastes as resources. (Cf. UNDP 1996, p. 141; Lewcock 1994).

The combination of urban organic wastes (UOW) and urban agriculture (UA) creates particular issues in the modern urban setting. On the one hand, the interests of urban waste reduction mesh well with the promotion of UA, since urban and peri-urban farmers are in need of organic matter as soil conditioner/fertilizer and animal feed, and cities and towns wish to conserve disposal space and reduce the costs of municipal solid waste management (MSWM). At the same time, some tensions occur between public health officials (with their concerns about diseases affecting both humans and animals and accidents associated with the reuse of municipal solid wastes) on the one hand, and the proponents of urban agriculture (who emphasize job creation and increased food production, especially for the urban poor) on the other. The fundamental issue was pointed out by the Ad Hoc Panel of the Advisory Committee on Technology Innovation for the Board on Science and Technology for International Development of the National Research Council (USA) in 1981:

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> The strongest negative factor in the use of human and animal wastes for the production of food, feed or fertilizer is the possibility of disease transmission, which would negate the gains derived from the use of the waste. (p. 134)

Health risks are typically low priority in settlements where people lack basic needs. For instance, we tolerate squatters building shelters with flammable materials. But in the long run, if standards of living are to rise, the risks have to be faced and ameliorated in whatever ways are feasible. The boost being given to UA in the developing countries suggests that the time has come to detail the main health risks and promote discussion of how they can be countered. While the risks associated with the use of human excreta and wastewaters have been researched for many years (see Shuval et al. 1987, NRC 1981) there has been no parallel or integrated discussion of the similar (although less extensive) risks of solid waste reuse.

In this paper, I introduce the basic issues of public health arising from solid waste reuse in urban agriculture. I am not writing as a planner, so much as suggesting preliminary ways that development advisors and urban planners can understand these concerns and develop frameworks and criteria for reducing the public health risks of using of urban solid wastes in urban agriculture.

The scope of this discussion is confined to municipal solid wastes (household-commercial-institutional). It does not include separately managed special wastes or segregated human excreta and wastewater, e.g, septage and sewage sludges, and sludge cakes.

MAIN PRACTICES OF URBAN ORGANIC WASTE REUSE IN DEVELOPING COUNTRIES

The state of Karnataka in India has a simple proverb: "<u>waste is food</u>."[1] In traditional settlements in many parts of the world, the age-old habit of returning household wastes to the food chain persists. Kitchen peelings and food leftovers are fed to animals, selected organics are fed into fish ponds, and wastes are composted for home gardens. Where there is intensive farming in peri-urban areas, areas that typcially receive MSW, the farmers frequently exploit the products of MSW decomposition in various ways. In addition to old practices, others, such as community vermicomposting (composting through worm culture), are growing in the urban areas of some regions like South Asia and Andean countries.

The following table lists the main types of solid waste reuse in urban agriculture with comments on the practices.

TABLE I
MAIN PRACTICES OF URBAN ORGANIC WASTE REUSE IN DEVELOPING COUNTRIES

Types of solid waste, (or site)	Materials included	Practices	Comments
Kitchen, restaurant and canteen food wastes	Raw peelings and stems, rotten fresh fruits and vegetables and leftover cooked foods	Food waste may be fed to animals within the house or compound, or deposited on nearby dumps for animals to forage. Also sold for commercial use (by local farmers;or auctioned to large poultry or pig farms)	Direct feeding of household livestock is probably rather low-risk.
Regular mixed municipal	Full range of local domestic, instit'nl, commercial solid wastes, with small industrial wastes, biomedical wastes,human and animal excreta	In South-east and South Asia farmers buy MSW off garbage trucks and apply it to soil, immediately or after 5-14 days.	In China, farmers are told to compost the wastes before applying to the soil, but this may not be done long enough to kill pathogens and parasites
Kitchen and yard wastes	Kitchen wastes with some garden trimmings, grass cuttings	Backyard composting for home gardening,dom estic animals (poultry,pigs goats, cows)	Kitchen wastes composted over long periods may concentrate pesticide residues in plants grown in home gardens

Kitchen, yard wastes from community households and shops	Organic waste, but may contain other household waste as waste separation is often not done thoroughly	Cooperating household and institutions are asked to separate organic wastes for community compost heaps	Compost heaps are located on vacant land, parks, often where children play. Few projects have infrastructure to reduce hazards such as leachate. Rodents are attracted to compost piles, for food, warm nesting places in winter. Other vectors are flies, cockroaches, birds, etc.
Mixed municipal waste delivered to centralized composting plants	Mixed municipal waste which may contain problematic levels of plastic film, small industries' wastes, broken glass, batteries and fluorescent light starters, biomedical wastes, human excreta.	Compost is collected from centralized (municipal) plants by farmers, sold, or used in municipal parks, golf courses,etc.	Most centralized composting plants have either failed or are operating at low capacities. Products are hard to sell due to glass splinters and plastics. Where thorough testing has been done of compost from mixed wastes in large cities, plants have often been closed own due to heavy metal contamin'n. Pesticide levels of organics in market wastes have not been researched to any extent.

Kitchen and yard wastes delivered to vermicompos-ting (VC) projects	Same materials as for small scale community composting	Compost is sold or distributed from small vermiculture projects, often located in parks.	VC is growing in popularity, especially in India and Andean countries. Little known of health risks--pathogens,para. eggs, viruses may not be destroyed under the cool conditions of VC. VC bins and pits have to be protected by screens as rats eat worms.
Old garbage dumps	Most is well decomposed waste, often several years old. In areas of high recycling, extensive waste recovery, there may be relatively little synthetic materials in the natural compost.	The original use of "garbage farming" referred to the practice of converting old garbage dumps to farm plots. Garbage farming represents the most extensive use of MSW for food production in the world today.	Provided the dump did not receive much industrial waste, farming on old dumps may be low risk in terms of infection. Injuries from sharps are common. Respiratory problems from dust. Sometimes farmers cultivating old dump areas may "invade" the current dump to plant seedlings for transportation or they may illegally encroach at the edges of current dumps.

Removal from garbage dumps	Well decomposed mixed municipal wastes	Nearby farmers collect compost from old dumps or closed sections of current dumps.	A large garbage hill opposite the city produce market in Yangon is being gradually eliminated by the mining of compost, which is now being encouraged by the city authorities in order to achieve free levelling of the site. Dust inhalation is a potential health hazard for compost miners.
Cowdung	Cowdung	Cowdung is collected from pastures or roads, made into round patties or dried on sticks to be used for fuel. Cowdung is also used as fertilizer and as a binding ingredient in plaster made of mud.	The women and children who gather wet dung for drying do not have access to any washing facilties while doing this itinerant work.

Park and verge trimmings, swept leaves	Twigs, grass, leaves, branches, etc.	When gathered by poor people, these wastes are used as animal fodder or fuel.	In some cases, these wastes are taken by the municipal authority directly to a compost plant.Complete and efficient diversion deprives poor residents of fuel and fodder. Municipal trimmings may be contaminated with pesticides and vehicle pollution residues.
Agricultural wastes	Predominantly agricultural residues produced by farming, but municipal wastes may be used to a small extent.	Integrated organic waste recycling and acquaculture is mainly practised in South China in peri-urban sericulture-fish-vegetable-poultry-pig farms.	Usually contaminated with pesticides and herbicides. The effects of concentration in compost are not known.
Fruit seeds from garbage dumps	fruit seeds	Seeds are collected for horticulture and direct sale.	This was promoted as an urban agriculture activity in the Jati Dua project in Bandung in the 1980s, where mango seeds were the major kind retrieved. This is a varient of waste picking, with all the attendant risks of that activity.

This somewhat sketchy summary of waste reuse practices indicates many potential health issues, more diverse than the usual issues raised in discussions of urban agriculture.

PUBLIC HEALTH CONCERNS IN RELATION TO URBAN AGRICULTURE

In the development of human settlements, a primary motivation for regulating or even forbidding practices of food production has been concerns about human health, from infections to accidents. Some of the earliest known regulations in human settlements pertain to animal raising and consumption (cf. Jewish and Muslim prohibitions on consumption of pork; kosher and halal regulations).

But, on many occassions, what really constitutes a public health risk has been defined flexibly by local authorities. For instance, when Britain was under seige during the Second World War, regulations against raising animals in urban areas were relaxed to encourage local food production (Hough 1981). Europeans have been prepared, in emergencies, to adopt practices that they would condemn at other times. From about 1943, Germans were encouraged to use their excreta in backyard gardens; despite a long history of concern with hygiene and public cleanliness in Germany, the Nazi government was too preoccupied at the time to monitor these practices.

It is worth remembering this historical flexibility when judging the practices of poor citizens in cities of developing countries today.

It is also worth remembering how sketchy our understanding is of specific causal factors in the health status of particular low-income populations living in unsatisfactory conditions [cf. the currrent work of the Stockholm Environment Institute, comparing intra-urban differentials in health , environmental conditions and socio-economic status in Accra, Jakarta and Sao Paulo.(McGranahan and Songsore 1994, Songsore and McGranahan 1995)].

The focus of attention in healthrisks are humans. Urban agriculture, however, includes animal rearing, so that an additional concern is the ways in which animals' health may be affected by problematic practices which can result in infections <u>from</u> humans, injuries from sharps in garbage, and so on.

Box 1

HUMAN GROUPS AND ANIMALS AT RISK FROM REUSE OF MSW ORGANICS UNDER CONDITIONS OF POOR MANAGEMENT

- Waste workers: (i) waste collectors and dump operators; (ii) compost miners;(iii) waste pickers of wood, cinders, coconut husks, seeds
- Infants and children: accompanying waste workers (e.g. pickers); playing in wasteland; guarding animals, plants
- Farmers: (i) farming on old dump sites;(ii) applying MSW organics;(iii) applying low quality compost from MSW
- Residents: people living close to large composting plants/sites, esp. infants and the aged in such settlements
- Consumers: (i) of food produced from soil using low quality compost; (ii) of meat livestock fed unsterilized waste food, or foraging from solid waste containers, grazing on garbage dumps; (iii) of water contaminated by untreated leachates from compost plants and piles
- Food handlers: sellers of produce, cooks
- Livestock: fed unsterilized and/or contaminated waste food, or foraging from solid waste containers, grazing on garbage dumps

The following box lists the main factors that should be taken into account in attempts at risk assessment in municipal solid waste management.

Box 2

FACTORS IN TRANSMISSION OF INFECTIONS, INJURIES FROM SOLID WASTE REUSE

Waste materials
- composition and origin of organic waste materials; esp. whether source-separated or mixed; whether human excreta are present
- exposure of wastes to vectors; prevalence of disease among vectors (e.g. yersinia pestis in fleas on rats)

Biological factors
- survival time of prevalent pathogens (relevant to pathogens)

Cultivation techniques
- methods of application of waste/compost; composting time and methods
- type of crops grown on soils receiving wastes; mono or multicropping
- periods of crop growth

Animal characteristics and exposure
- types of animals fed organic wastes; their propensity to harbour parasites, etc.
- use of animals in plowing, transportation
- prevalent wild and stray animals (e.g. rabid dogs at dumps)

Human characteristics, exposure, hygienic habits
- type of exposure: primary handlers of waste; composters; field or pond workers; crop handlers; consumers
- immunity levels and hygiene practices of handlers, consumers
- health of animal keepers
- cooking, food preparation, habits of consumers

Site characteristics and physical infrastructure
- siting of acquifers, wells vulnerable to MSW leachates
- availability of sanitation for workers

TABLE II: WASTE-LINKED DISEASES AND CONDITIONS RELEVANT TO URBAN AGRICULTURE

Waste-Linked Disease	Most at Risk (refer to Box 1)	Contexts
Injuries, Chronic Disease		
-snake, scorpion bites	-waste workers, esp. pickers	-open dumps, garbage farms
-cuts from sharp wastes leading to infection	-waste generators -waste workers, esp. pickers, farmers	-primary collect'n points (poor storage) -open dumps; compost plants; farms using MSW
-burns from fires in waste piles	-waste workers	-open dumps; illegal dumps
-chemical burns or wounds	-waste workers	-unprotected handling of mixed MSW
-toxication and cancers from exposure to hazardous waste and gases	-waste workers -residents	-open dumps; contaminated aquifers & wells
-chronic respiratory and opthalamic diseases from exposure to dust and gases	-waste generators -waste workers -residents	-open dumps; poorly managed compost plants
-trauma or death from collapse of huge waste piles	-waste workers	-open dumps; compost mining sites

Bacterial, Viral or Parasitic Disease		
-bacterial (tetanus, staphylococcus, streptococcus) or viral(AIDS, hepatitis B)blood infections from injuries caused by sharp wastes	-waste workers -farmers	-open dumps, esp. those receiving unregulated biomedical wastes; compost plants processing mixed MSW
-eye (trachoma, conjunctivitis) and skin (mycosis, anthrax) infections from waste generated dust	-waste workers -residents	-dumps, landfills, compost plants
-respiratory infections (bacterial or viral pneumonia) from waste generated infected dust	-waste workers -residents	-dumps, landfills, compost plants
-viral (dengue, yellow fever) or parasitic (malaria, filariasis, schistosomiasis) diseases transmitted by vectors living or breeding in waste	-waste generators -waste workers -residents -livestock -waste workers -farmers -livestock	-dumps, esp. in wetlands; settlements without drainage infrastructure and garbage collection (squatter settlements)

-bacterial, viral or parasitic enteric diseases transmitted by:		
1) insects and rodents feeding on wastes	-waste generators -waste workers -farmers -livestock	-leachate ponds at garbage dumps; dumps; informal dumps; open storage containers; waste piles
2) accidental ingestion of waste food	-waste workers, esp. pickers -farmers -livestock, esp. foragers	-dumps; open storage containers; waste piles
3) drinking water contaminated by leachate	-waste workers -farmers -residents -livestock -consumers -food preparers	-squatter settlements, etc
4) food contaminated by leachate	-waste workers -consumers	-poor hygienic conditions for sale and preparation of food
-zoonosis carried by stray animals and rodents feeding on waste (rabies, plague, tick-borne fevers)	-waste workers, esp. pickers -farmers -residents -livestock	-dumps; squatter settlements, settlements adjacent to compost plants

Developed from "Summary of waste-linked diseases and conditions with their causes or pathway of transmission" in Girault, Christen and Brown (1996, in press).

The conclusion reached by a survey of the health effects of the use of wastewaters in agriculture sponsored by the World Bank in 1980s may well be largely applicable to the use of municipal solid wastes in UA, as currently practiced in some countries (notably China and India):

> Wastewaters cary the spectrum of fecally excreted human pathogens endemic in the community, including helminths, protozoans, bacteria, and viruses. Their concentrations and their persistence, even in generally unfavourable environments...are great enough to create the potential for human infections. (Shuval et al., 1986).

In other words, where mixed municipal wastes are applied directly to soils, where composting is done inefficiently, where source separation of organics for composting is not thorough, and organic wastes are contaminated by biomedical or toxic substances, we can expect that the typical pathogens will survive and may infect composters, farm workers, animals, and ultimately consumers. The additional hazards of urban organic wastes are injuries from sharps, respiratory and opthalmic problems from dust and further problems of accidents, fainting and even death from landfill gases and cave-ins.

POOR LIVING ENVIRONMENTS: THE GOOD NEWS?

Many factors govern the potential for infections to seriously affect large numbers of people. As suggested in Box 2, the actual risks for any category of people undertaking activities such as those included in UA will depend largely upon their general health status, what immunities they have acquired, hygiene habits and their general living conditions. It is ironic that the poorer the environmental conditions and the economic status of a community, the less the residents may be susceptible to some of the risks from waste reuse. This has been established in studies of wastewater reuse. Shuval et al (pp. 298-299), note:

> Some endemic pathogens, such as enteroviruses, are so infectious and so common in the household environment of the developing countries that most infants acquire lifelong immunity at an early age, with the result that additional extrenal environmental exposures do not lead to quantifiable excess disease, even under the most insanitary conditions. In many of these countries, multiple routes of concurrent infection by enteric pathogens from contaminated water and food and poor personal and domestic hygiene may be at such intense levels that additional exposure resulting from uncontrolled wastewater irrigation will be an insignificant cause of excess disease. However, when such routes become restricted or are blocked, exposure the the same level of pathogens ... may then lead to detectable levels of disease. This may be particularly true for countries at the higher socio-economic levels.

This may be regarded as the "good news" for the health aspects of UA. Most of the current practitioners in the LDCs are of low economic status; they frequently live in inadequate housing and in precarious locales. Hence, they are exposed to multiple sources of infection and, those that live to adulthood are less susceptible to infections (although not less susceptible to injuries) associated with reusing organic wastes for food production. This is not to deny that "an 'overdose' of toxins will poison even the most accommodating biological system." (Dalhammer and Mehlmann, p. 46)

This protection through immunity, however, gives little comfort to middle and upper class consumers of the products. And, as food production improves (directly or indirectly) the standard of living of poorer urbanites, it becomes more important to control risky practices in order to maintain the advances in public health.

COMMUNITY COMPOSTING AND GARBAGE FARMING---EXAMPLES OF CONCERNS RE: CURRENT PRACTICES

In order to illustrate some of the problems that may arise with particular practices of waste reuse, I comment here on small-scale composting and practices that have been dubbed "garbage farming." (I am leaving aside composting at centralized plants as this has been subject to more analysis than other forms of composting with organics from multiple sources.)

Community and small-scale composting

The safety of compost generated from multiple sources, and other risks associated with composting, mainly depends upon the following factors:

a) the thoroughness of separation of organics at the household and institutional level;
b) the care taken in the composting process;
c) the general health of the waste generators;
d) levels of immunity acquired by consumers of foods grown on the compost;
e) accumulation of pesticides in organic residues (little is known about the associated risks).

Comments on some of these aspects are contained in Table I. Some further comments are:

Source separation: Thorough source separation of organics for composting and vermicomposting is done in many developed countries today. To achieve the same levels of purity in cities of developing countries, considerable education and monitoring is necessary. Householders in cities of CLDCs are highly motivated to separate out those materials that can be sold to itinerant buyers, but such separation is not sufficient to ensure uncontaminated kitchen wastes. Frequently one finds in the kitchen waste turned over the community composting projects: household biomedical wastes (including sanitary

napkins), broken glass, syringes and razor blades. Since householders cannot usually sell their organics to community projects, there is no economic incentive for thorough separation; the waste generators have to learn the ecological motives for separating organics more carefully than they are used to doing.

Sharps in composted organics can injure all handlers and farm animals also. Even very fine sieving of compost does not eliminate fine fragments of glass and hyperdermic needles. In very poor peri-urban areas, farm workers are usually barefooted.

Research at the National Environmental Engineering Research Institute in India, on the agricultural use of municipal solid wastes, has highlighted the acidic pH values of leachate from MSW and its propensity to dissolve metals (Olaniya & Bhide 1995).

A growing concern is the accumulation of plastics in agricultural land. Even the farmers have noted the deterioration of soils, in Shanghai, Dar es Salaam, Eritrea, and Vietnam. (Furedy, field notes 1988; Midmore 1994, p. 71).

Health of waste generators: This factor has never been examined, but it seems obvious that if the community from which the wastes are taken has high levels of disease, the chances that the wastes taken for composting will contain pathogens is high, especially if feces are present. Regardless of the standard for the composting process, the handlers of these organics are exposed to some risk of infection.

Levels of immunity and tolerance: As suggested above, the specific level of risk with regard to viruses, protozoans, bacteria and helminths may be much lower for low-income groups than for populations that have been more "protected." It is worth noting that in some regions, community composting and vermicomposting are being carried out in middle-class neighbourhoods, with manual workers from poor groups (e.g. street dwellers). Hence the workers may well be less vulnerable to disease -- although still vulnerable to injuries -- than the consumers of food produced from the compost.

Pesticide accumulation in source-separated organic wastes: Since backyard and community composting in developing countries use a high proportion of fruit and vegetable peelings, with few tree and shrub clippings, the proportion of pesticide residues in the compost may be high compared to compost produced from more diverse organics. There is no research comparing the pesticide residues in compost from mostly fruit and vegetable peelings as against that from the more diverse organics.

Although composting of solid wastes is technically easy, yet, as the scenarios above suggest, there are many ways in which the safety of the end product may be compromised. The most successful small scale composting projects have been those done within institutions such as schools, religious institutions and work complexes such as are found in

Chinese cities. These may also produce the safest compost, since the composting process is well- supervised. These are not, however, strictly speaking, "community" composting projects in that the wastes do not come from multiple sources.

Garbage farming

The most risky use of MSW in food production are the direct application of mixed municipal wastes to soil,or inadequate composting of the wastes. Such direct application is routinely practised in some peri-urban areas in China and India, although it may be against city regulations. Truncated composting is a habit in many areas, although documentation of this is rare.

The writing about garbage farming in the former wetland areas east of Calcutta in the last few years has brought to light some information on farming practices with municipal solid wastes.

A member of the Institute for Wetland Management in Calcutta, Dr. Nitai Kundu, noted, in 1994, that the general practice of farmers who purchased or received wastes directly off the city garbage trucks was to leave the wastes for two weeks before digging the material into the soil.

In describing the "garbage farming procedure" of this area, Giri (1995), presenting a paper at the workshop on "Urban Agriculture and Sustainable Development" in Calcutta, wrote:

> The cultivators ask the (Calcutta Municipal) Corporation truck drivers to unload refuse at the cultivation sites against some small payments. Garbage is left there for five to seven days for fermenting. Subsequently the decomposed wastes are mixed with the soil and land is prepared for the sowing of seeds or the planting of saplings... Primarily, market garbage is used for cultivation purposes.

Five to seven days is not sufficient for complete decomposition and stabilization, nor, indeed is two weeks. Since no designed piling is used, it is quite likely that the temperatures of the waste piles do not reach a height sufficient to destroy helminth eggs. I suspect that many farmers dig the wastes directly into the soil. I know from observation that all farmers do not leave muncipal garbage piled at the edge of their fields--this would be very obvious to a visitor to the farms. There are two reasons why they would not wish to leave the wastes even for a week: that they have acquired city garbage off the Corporation's trucks is too obvious, but, more importantly, they are in a hurry for the organic material. No one has advised these farmers of any risks associated with immediate application and there is no monitoring service to enforce a rule against it.

Since the paper presenter from the University of Calcutta (Giri) did not comment on the truncated decomposition period, it would appear that

she was not aware of any health risk associated with it.

Chinese sanitation officers in cities that export MSW for use in urban fringe garbage farms are well aware that many farmers do not compost the wastes according to the specified standards; they frankly admit that they do not have the resources to enforce these standards (Furedy, field notes, Guangzhou, June 1998). The general policy of the Chinese government seems to be to encourage the shift to artificial fertilizers while seeking foreign assistance in constructing regular landfills to receive municipal wastes. (There are a few centralized compost plants but the total amount of compost produced in them is negligible). Furthermore, monitoring of the health of municipal and farm workers appears to be declining with the retraction of socialism, the end of communes, etc. (Yeung 1993, p. 8).

We do not know whether there are specific patterns of disease and vulnerability that can be attributed to poor practices in small scale composting and garbage farming, but truncated and casual composting is never recommended by proponents of composting (Rosenberg and Furedy 1996). These are the kind of monitoring issues that should be pursued in cases of garbage farming.

REGULATION RE HEALTH RISKS IN CITIES OF DEVELOPING COUNTRIES

It is very common for health considerations to be adduced as a reason for restricting UA. But, while public health officials undoubtedly recognize the main problems, the actual regulations designed to control or reduce these in cities of developing countries (particularly in sub-saharan Africa and south and south-east Asia) are haphazard. In many cases, regulations from colonial regimes remain on the books. Sometimes, the health risks mentioned in particular are not the most common or serious ones. Regulations are rarely enforced, except following health emergencies.

Some of the most stringent regulations relate to the keeping of animals, especially cattle and pigs. The concern about pig keeping and the difficulty of dealing with the resultant highly polluting wastes became so high in Singapore that the country banned pig raising altogether in the late 1980s. In most cases, however, the approach to urban regulation is not based on a comprehensive framework for understanding the health risks. For instance, as regards food produced from composted wastes, the focus is almost invariably on the consumers of the products only; there is virtually no attention to the producers and handlers.

Modern developments in pollutants are very rarely mentioned in typical regulations. Admittedly, it is extremely difficult to estimate any risks from new chemicals as very little is known about xenobiotic compounds, their environmental chemistry or the ability of biota to metabolize or degrade them (Dalhamman and Mehlmann, p. 49). Nevertheless, the possibility of the presence of such compounds as a result of organic waste contamination should be flagged (see Midmore,

p. 71).

If the regulations about health risks are often haphazard, the enforcement of regulations is even more so. With virtually no research on the etiology of disease specifically resulting from UA practices, the result is that health departments have little to guide them in assessing the actual risk of different practices. Vague generalities about public health characterize the rationales for whatever specific regulations or guidelines exist in cities of LDCs, with the exception, perhaps, of regulations pertaining to the use of excreta and wastewaters in some cities. Since most UA is informal, it is naturally difficult to advise, monitor, and regulate.[2]

ADVOCATES OF URBAN AGRICULTURE ON HEALTH RISKS

What have the advocates of UA had to say about health risks when they promote urban organic waste reuse?

Almost all discussions of UA express a genuine concern about the health aspects related to food production and animal raising; it would be surprising if they did not. What is striking, however, is how little is actually said on the subject. The most detailed recent discussion is in the recent UNPD book on urban agriculture (1996, pp. 197-204), where the main issues are set out. But this amounts to only a few pages and scattered references. Most of the discussion, understandably, concerns problems of human excreta reuse and wastewater irrigation. The reuse of municipal solid wastes, which is strongly advocated by the book, is addressed only vaguely from a health risk standpoint.

There appears to be a lack of systematic thinking about this issue in projects on UA. Evidence of this comes from the set of papers sponsored by the Internatinal Development Research Centre (IDRC) under the Cities Feeding People programme. In 1993, key researchers in developing countries were asked to prepare overviews on urban agriculture research in major regions (e.g. East and Central Africa, Latin America, East Asia, etc.) In contracting for these reviews, the Environment and Natural Resources Division specifically asked the writers to refer to health aspects. Almost all the reviewers dutifully did this, in rather vague terms. They noted the lack of research on the topic. A major aspect of this assignment was to suggest areas where research is needed, opportuntiies for research and even research topics. In spite of the emphasis earlier in the papers on the health aspect, not one of the reviewers suggested a research project on this aspect, or even mentioned it in the projects proposed. (Considering that the IDRC had a good department on health until fairly recently, it is disappointing to see the lack of guidance given by the Cities Feeding People project in this respect).

I think there are several reasons for this gap in the discussions of urban agriculture: one is simply that the work that could be applied to the health risks of UA is published in sources that are not readily

accessible to UA scholars and practitioners, especially those in developing countries. Another source of blockage may be that UA advocates are intent upon breaking down the traditional resistance of urban adminstrators (including health officers) to UA activities; to draw attention to potential risks (albeit usually of a different nature to those that old urban regulations aim to combat) may seem inadvisable. And, since research ideas are being evolved through networks of like-minded people, and the UA groups are not connected to the epidemiologists and veterinary and agricultural researchers with expertise on health risks, such discussion as takes place --and there is little enough of it--bypasses the UA advocates. There are simple solutions for such blockages, which are noted in the next section.

CONTROL MEASURES: DEVELOPING FRAMEWORKS AND EXPERTISE

The assumption of UA advocates that the marriage of urban agriculture and waste solid reduction/treatment will contribute to better health in the long run, through improved nutrition and incomes, is reasonable. Nevertheless, the summary information presented here shows that there are legitimate concerns that must be addressed in the management and facilitation of agricultural and waste management practices.

My preliminary suggestions are for the promoters of UA to draw upon the interdisciplinary expertise on human waste reuse in agriculture and acquaculture, to use the frameworks of environmental risk assessment to involve UA stakeholders in awareness of risks and ameliorative measures and, to link UA scholars and practitioners with public health and epidimiological experts for focussed research on key issues.

Scholars and practitioners of UA do not need to "reinvent the wheel" in devising measures to reduce health risks. At a general level, the procedures of environmental risk assessment and health risk assessment can be applied to workshops and working groups on urban agriculture. A useful discussion, with simple but instructive diagrams, that suggests how discussion and research can be organized to systematically examine public health (and ecological) issues, is contained in: Environmental Risk Assessment for Sustainable Cities, in the Environmental Technology series of UNEP's International Environmental Technology Centre (Kaputska et al., 1996). Such diagrams can be the basis for research and stakeholder workshops in UA.

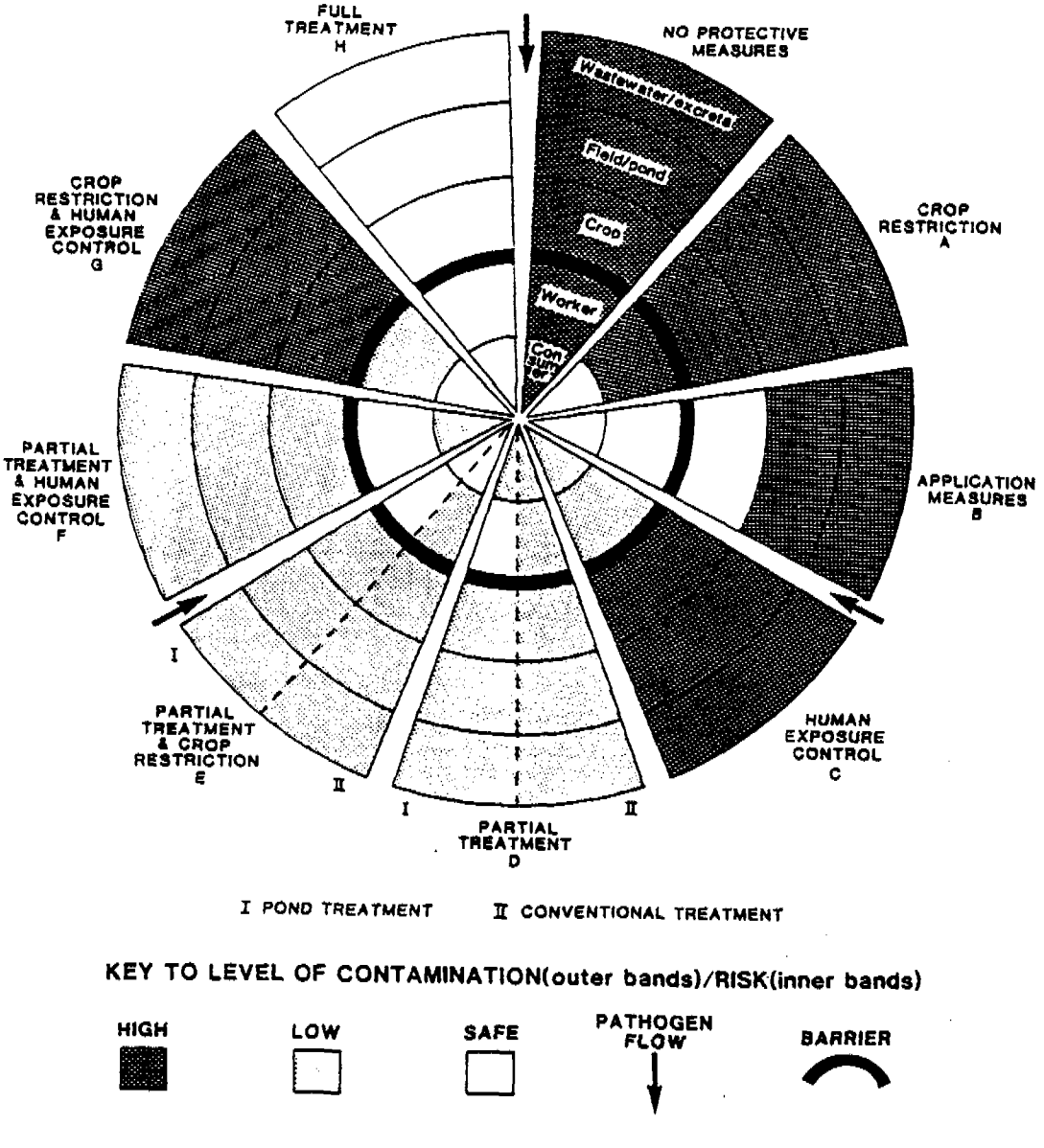
Examples of the diagrams used are given here:

More specifically, with regard to epidemiological concerns, the considerable work on the reuse of human excreta and sewage waters in agriculture can be the starting point for understanding the related health risks and ameliorative measures when solid wastes are used for growing crops and feeding animals.

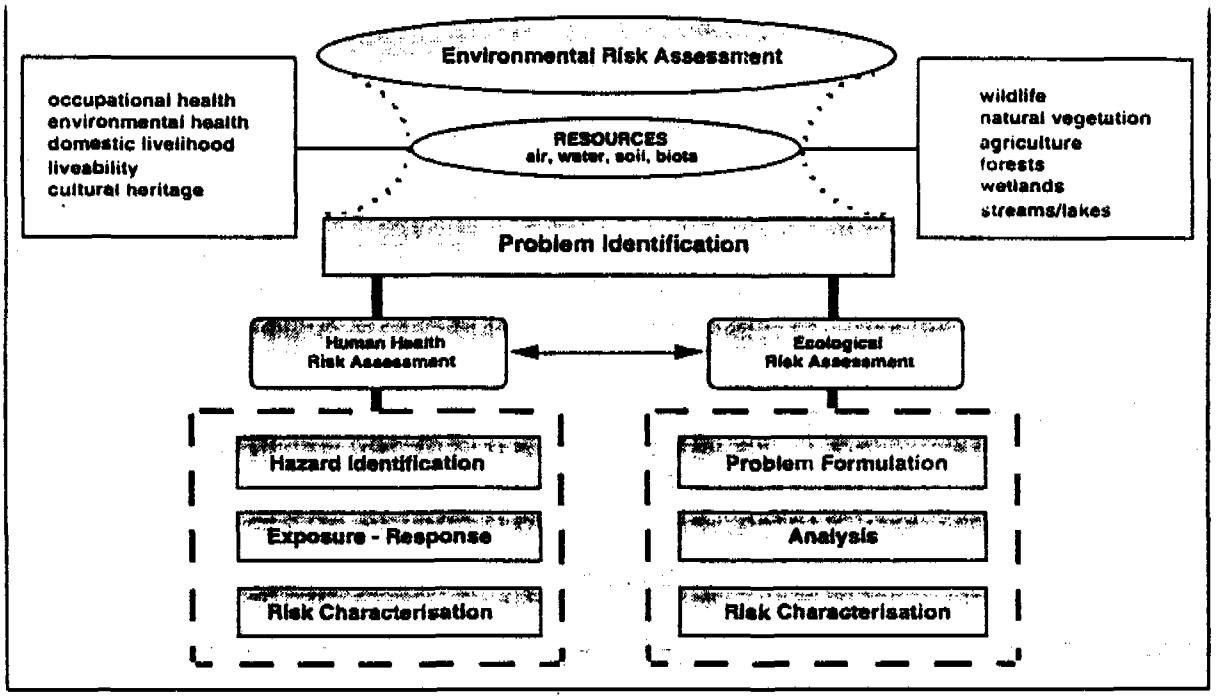
Ursula Blumenthal and Sandy Cairncross at the London School of Hygiene and Tropical Medicine have devised the following diagram to show the main relationships of contamination, risk and measures for the use of human wastes in agriculture.

Figure 1

Generalized model of the effect of different control measures in reducing health risks from waste



(Blumenthal et al. 1989.)



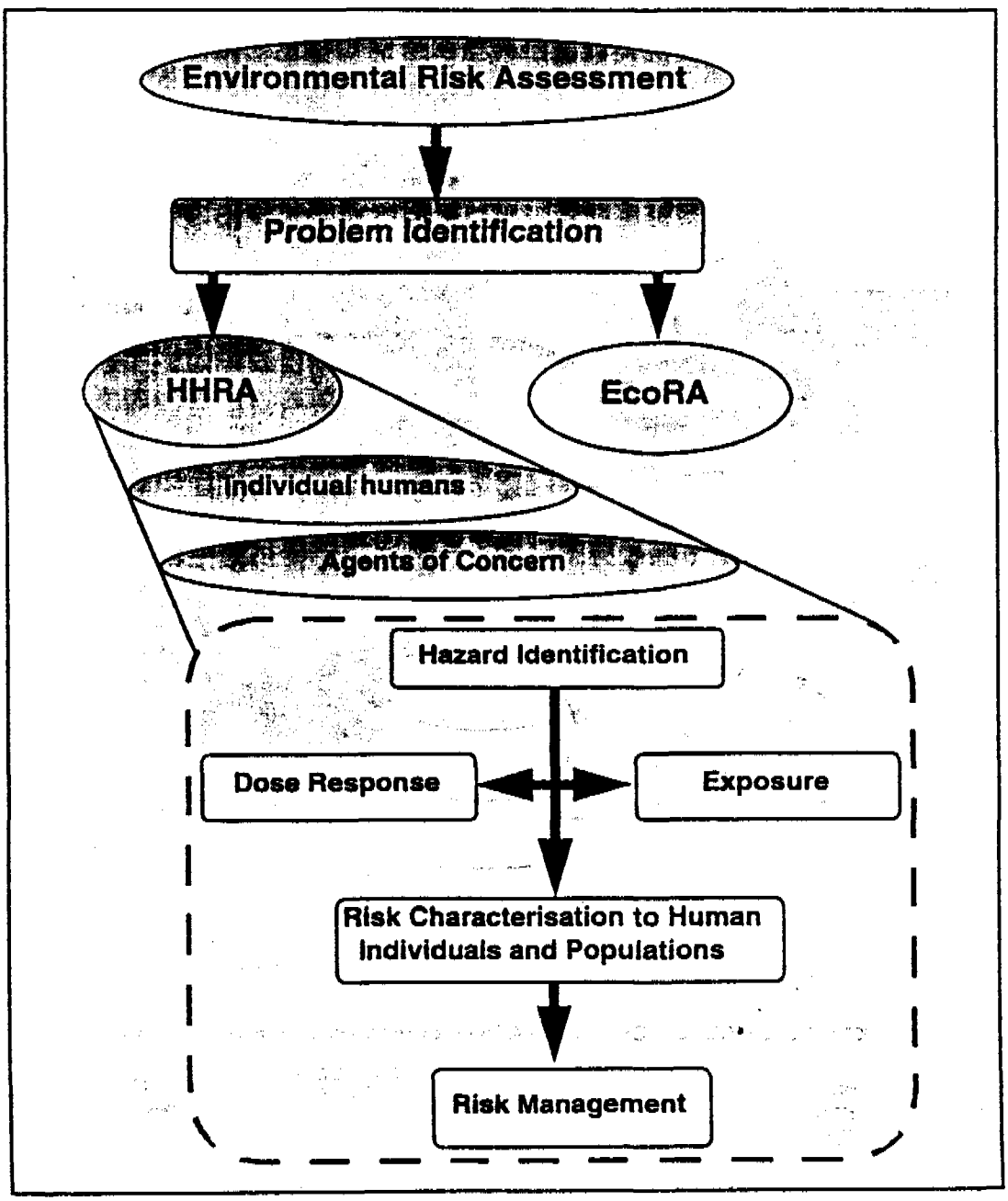


Figure 16. The Human Health Risk Assessment component of Environmental Risk Assessment.

Devising a similar matrix for risks levels and control measures associated with the reuse of solid wastes could assist more systematic discussion for amelioration of the problems.

If the recommendations of the World Health Organization, sound as these are, were to be followed, risk reduction seems an overwhelming task:

> The only rational way of dealing with the public health aspects [of MSWM] a comprehensive way is the put the health aspects into strategic planning context for the overall MSWM system....A comprehensive public health impact assessment should be made mandatory at the project design stage....The process should be repeated every five years to keep track of unforseen developments and to establish the information base for rational decision-making in the future. In the final analysis, public education and consciousness raising should be the cornerstone of any mitigation effort. (Girault, Christen and Brown 1996)

It is not likely that such an ideal vision will guide the reuse of urban solid wastes as an element of solid waste management, even in the most modern cities, in the immediate future.

The good news about control measures is that technically simple interventions, at a few points, might achieve considerable risk abatement. For instance, keeping organics pure at the main generation points in a city would eliminate risks from sharps, and contamination from chemicals, biomedical substances and synthetic materials. Crop selection could be as effective with organic waste-based agriculture as it has been with wastewater-fed aquaculture and agriculture. Site selection for composting could add another type of "barrier" to pollution. Improved occupational protection and home hygiene are ends to be desired in and for themselves.

The bad news, as ever, is that such changes in personal behaviour and occupational management are not easy to achieve when urban agriculture is practised informally by groups who are not "reached" by routine school or community education and are not assisted by regular urban management. I am not as sanguine as the UNDP that "most potential problems can be easiy averted" (UNDP 1996, p. 197).

The development of internet networks provide the opportunity to link experts in public health and solid waste management for the developing countries with those interested in urban agriculture. A model for productive internet discussion is the recent joint one organized by the Global Action Plan International andthe World Health Organization, with Swedish and UNCHS funding (Dalhammar and Mehlmann 1996). It would be useful if the facility established by the International Development Research Centre (SGUA) could take a lead in facilitating collaboration to address the public health aspects of organic waste reuse.

Box 3
Some Internet Contacts Relevant to Health Aspects of Waste Reuse

. Water and sanitation for developing countries:
[water-and-san-applied-research: mailbase-admin@mailbase.ac.uk]

. Hygiene behaviour:
Contact mailbase-admin@mailbase.ac.uk or D. L. Saywell@lut.ca.uk

. University of Loughborough's GARNET (for solid waste management:
Contact: D. L. Saywell@lut.ca.uk

. IDRC's Support Group on Urban Agriculture:
http://www.idrc.ca/listproc/sguaf-cl

. PROMED
promed-ahead@usa.healthnet.org

. UNICEF
Regional Water and Sanitation Network for Central America
Contact: tony.brand@unicef.un.hn

. Envirolink
recycle@envirolink.org

CONCLUSION

Although this paper has focussed on setting out numerous potential health concerns (the "bad news"), one can still say that municipal solid wastes can be safely used in urban agriculture if adequate control meassures are consistenty practised and workers and consumers adopted basic precautions and hygienic practices.

The "good news" is that there is little evidence at present to suggest that health risks from the reuse of urban organic wastes (excluding large amounts of human excreta) are such as to constitute a matter of great concern at present in UA.[3] Most of those who practise UA in developing countries are poor people living in unsanitary conditions: hence, those who have survived infanthood have acquired several important immunities. They are constantly exposed to sources of infection through impure water. Thus the risks (of infection) added by integrating improperly treated solid wastes into their animal raising and crop production may be insignificant and/or undetectable. The risks of injuries and accidents may be no greater than if the workers engaged in other agricultural work. It remains for research to establish just how risky are the activities noted in this paper.

Nevertheless, if the health risks are not better understood and control measures are not promoted, disease and accidents will increase as UA spreads and standards of living rise.

It is not difficult to initiate discussion on this topic and to examine ameliorative measures. Showing a willingness to confront potential risks and take action can only help the urban agriculture movement to gain acceptance among urban planners. This is, indeed, the general position taken by UA advocates in the UNDP volume on urban agriculture (UNDP 1996, p. 197).

1. I am grateful to Prof. Narayana Rao of Madras for this proverb.

2. It is ironic that, while centralized composting carries greater risks of a contaminated product, it is easier to monitor municipal plants. It will be very difficult to monitor and advise scattered community and backyard compost piles, but the inputs into these types of composting are likely to be relatively pure.

3. It is even difficult to estimate the risks and incidence of disease from the use of sewage waters. In 1986, World Bank judged that there were few credible epidemiological studies of health effects of wastewater reuse in agriculture. There have been hundreds of studies but few present evidence that can meet standards of modern epidemiological criteria (Shuval et al., p. 299).

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ENDNOTES

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