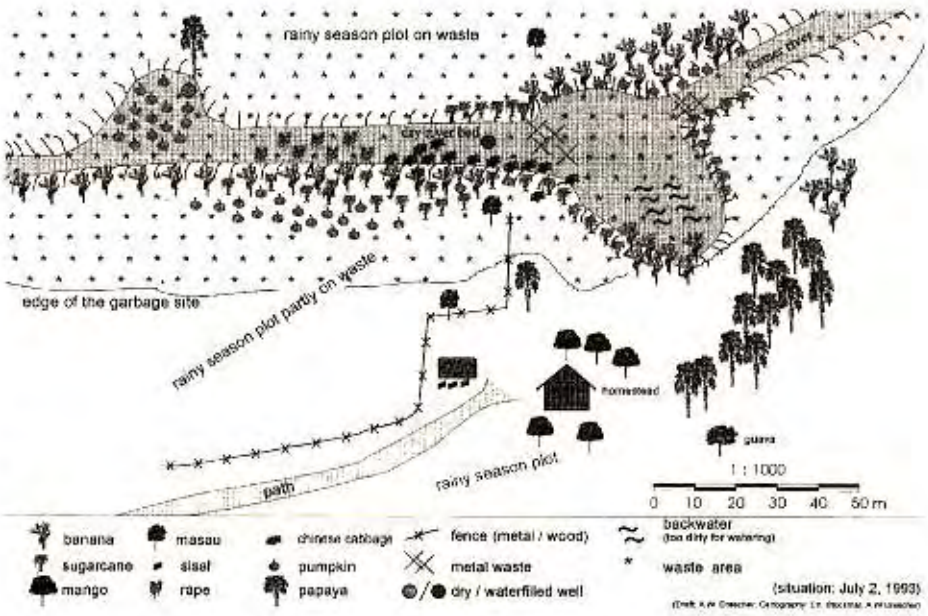
Gardening on garbage: opportunity or threat?

Gardening on waste disposal sites is common practice in many developing countries. Such sites offer fertile land not used for other purposes, but toxic wastes and heavy metal pollution may threaten human health. Axel Drescher presents a case study of such a periurban garden in Zambia.

Axel Drescher



About 15 km north of Zambia's capital, Lusaka, a riverbed and its edges were used as a waste disposal site from 1967 to 1992. The wastes included toxic substances from hospitals and industry. The area is now intensively used by vegetable gardeners from December to July, when water is available. In August the wells in the riverbed dry up; the stagnant pools formed where the wastes block the river are too dirty to be used to water gardens. One example of the hundreds of people who grow crops along this riverbed is a family who has been living there for more than 20 years, with the garbage site at its doorstep.

According to our survey, about 25% of the people living in Lusaka town do dry-season gardening and almost half the women and a third of the men grow staple foods like maize in the wet season. Farming is done by about 75% of the people living in the periurban area, but more market-oriented than in town. Most commercial periurban gardening is men's work, but this semi-commercial case-study garden of about 1400 m² is managed by a woman aged 54. She grows vegetables for her family (76-year-old husband, adult daughter, brother-in-law and 2 grandchildren) and for the market. No family member is formally employed; their sole source of continuous income is the garden.

Banana is their main crop (250 plants). Selling bananas brings an income almost year-round, while vegetables can be grown only at certain periods. The woman says she earns 160,000 Kwachas per year from sales. This means a monthly income of US$ 20-25, about as much as a night-guard earns in town. The part of the harvest eaten by the family lowers their food expenses by over US $100 per year.

Valuable variety of crops

The garden contains numerous fruit trees: 26 papaya, 14 mango, 2 masau (*Ziziphus mauritiana*) and 1 guava. Masau is traditionally grown in the valleys and produces small, sweet fruits, richer than oranges in protein, vitamin C and some minerals (FAO 1988). Papaya helps generate some income in August, thus buffering shortages in vegetable supply. Sugarcane is also grown but is not sold, as prices are too low. No fertilisers and few pesticides are used in the garden.

Livestock-keeping is not integrated, as the family no longer has any animals. The son, now in jail, sold all the goats and chickens when in urgent need of money. The cattle died of disease.

Table: Heavy metals in soil samples from the disposal site

Sample No.	*Pb(ppm)*	*Cd(ppm)*	*Zn(ppm)*	*Cu(ppm)*
1	*5*	*nd*	*6.6*	*4.25*
2	*4*	*6*	*112.5*	*2.50*
3	*4*	*nd*	*54.0*	*8.50*
4	*10*	*nd*	*6.6*	*4.25*
5	*200*	*6*	*525.0*	*25.00*
6	*4*	*8*	*135.0*	*2.25*
7	*5*	*15*	*27.0*	*900.00*
EU thresholds 1986	***50 - 300***	***1 - 3***	***150 - 300***	***50 - 140***

ppm = parts per million; nd = not detected.

Sources: Data from Zebdo (1993), European thresholds from Förstner (1993).

Continuous harvest

The management conditions and other factors, such as shortage of family labour, result in low yields. The estimated banana yield was 8-10 kg per plant, compared to yields of 20 kg or more in high-input systems (Moran 1992). In July 1993 Chinese cabbage (*Brassica chinensis*), rape (*Brassica sp.*) and pumpkin (*Curcubita sp.*) were growing in the garden. Chinese cabbage predominated with 790 plants, followed by pumpkin (515) and rape (306). Earlier in the rainy season, the pumpkin was intercropped with maize, sweet potatoes and other crops.

The vegetables are not grown to gain a high yield at the end of the season, but rather for continuous harvest. Pumpkins are a good example: the main products are the leaves, used as relish, and not the fruit. Spacing in this garden, like the others in the area, was therefore less than recommended. Depending on their aims, the gardeners find their own systems of planting

and spacing. In general, the garden plants are not in best condition because of lack of water, continuous harvesting and competition caused by high plant density.

Heavy metal pollution

The soils have a relatively high organic matter content (5.7%) and a moderate pH value (7.7). Heavy metals are widely distributed over the disposal site, but concentrations differed greatly between samples (see table). International thresholds for vegetable-growing sites were exceeded in some samples in the case of lead, zinc and cadmium. The sewage sludge, sold as fertiliser to commercial gardeners, contained levels of cadmium and copper exceeding any European threshold.

Nevertheless, no uptake of cadmium was detected in the vegetables, while copper concentrations of 1-3 ppm were found in maize. Cucumbers accumulated zinc at a rate of 45 ppm, while the wild plants *Bidens steppia* and *Tithonia diversifolia* had zinc accumulations of 102-106 ppm and cadmium of 10 ppm. These plants are widespread on the disposal site, which is grazed by goats and cows. It is not known whether people also harvest these plants as wild vegetables.

In the case of this garden, the high pH value and the relatively high content of organic matter appeared to help demobilise heavy metals. This reduces the uptake by crops.

Advice urgently needed

By providing income and food for the family, gardening increases household food security. However, heavy metal pollution and toxic wastes are likely to be found on many waste disposal sites, and threaten the health of people who consume products from gardens established there. The behaviour of the heavy metals in soils and plants depends greatly on soil characteristics. Neutral pH values and a high content of clay and organic matter can minimise the uptake of metals by crops.

There is urgent need for advisory services for gardeners on disposal sites, supported by research, and for effective control of the use of these sites so as to protect producers and consumers from contaminated vegetables.

■

References

- FAO. 1988. **Traditional food plants**. Food and Nutrition Paper 42. Rome: FAO.
- Förstner U. 1993. **Umweltschutz Technik: eine Einführung**. Berlin: Springer.
- Moran FT. 1992. **Success in vegetable and fruit production**. Harare: Longmann.
- Zebedo MC. 1993. **Accumulation of heavy metals in disposal sites.** University of Zambia (unpublished).

Axel W Drescher, Inst for Physical Geography, Werderring 4, D-79098 Freiburg, Germany.