Sanitation Options in Rural and Urban Areas: Best Practices

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Abstract
Suitable low-cost sanitation systems for use in poor rural and urban areas are described. For dispersed rural areas Arborloos generally represent the 'best' choice. As the density increases other options may be used, including alternating twin-pit or twin-vault systems providing they can be desludged by the users. In poor urban areas the choice is normally between simplified sewerage, low-cost combined sewerage and community-managed sanitation blocks.

Keywords
Arborloos; biogas toilets; simplified sewerage; low-cost combined sewerage; community-managed sanitation blocks

INTRODUCTION

In 2004 there were around 2.6 billion people without improved sanitation and, to meet the Millennium Development Goals sanitation target, some 1.6 billion people will have to be provided with improved sanitation by the end of 2015. How is this going to be achieved? This is a hugely important question for these 1.6 billion people. Part of the answer is the correct selection of sanitation technologies. Fortunately there are not many options, but they need to be fully understood by local sanitation engineers and planners so that they and the intended beneficiaries can make informed choices about which system may be the most appropriate in any given situation.

SANITATION OPTIONS IN RURAL AREAS

Low-density dispersed areas

In low-density rural areas individual-household on-site sanitation systems, including some simple means of greywater management, are commonly viable options. Such systems include:

1) single-pit ventilated improved pit latrines (Morgan and Mara, 1982; Mara, 1985a),
2) urine-diverting alternating twin-vault ventilated improved vault latrines (WIN-SA, 2006),
3) single-pit pour-flush toilets (Roy et al., 1984; Mara, 1985b),
4) biogas toilets (Mara, 2007), and
5) Arborloos (Morgan, 2007a,b; Simpson-Hébert, 2007).

Of these five options probably the one that is most likely to be the most appropriate in many, if not all, dispersed rural areas is the Arborloo as it provides not only sanitation but also agroforestry benefits and so actively helps to alleviate rural poverty (IFAD, 2008).

All the above options have to be complemented with a simple greywater-management system such as disposal in a stone-filled soakaway or used for irrigation of a "greywater garden" or the fruit or medicinal trees planted in full Arborloo pits (Ridderstolpe, 2004; Morel and Diener, 2006).

Higher-density nucleated areas

As the density increases (e.g., in large villages), options 2, 4 and 5 above are still viable. although, as the density increases and the availability of space for sanitation facilities thus decreases, there would be a limit on the number of 'Arborloo trees' that could be grown. Options 1 and 3 would be better changed to alternating twin-pit VIP latrines, and alternating twin-pit pour-flush toilets, respectively (van Nostrand and Wilson, 1983; Mara, 1985a,b). Greywater management options would now also include modified stormwater drains (Kalbermatten et al., 1982b).

There is also a further option which has been successfully used in villages in the state of Ceará in northeast Brazil (Sarmento, 2001): simplified sewerage (see below).

SANITATION OPTIONS IN URBAN AREAS

In high-density low-income urban areas, often termed 'periurban' areas, the most relevant sanitation systems are (i) simplified (also called 'condominial') sewerage (Sinnatamby, 1986; Mara et al., 2001; Melo, 2005), similar to 'slum networking' in India (Diacon, 1997; Parikh et al., 2002), (ii) low-cost combined sewerage (Guimarães and de Souza, 2004; Beauséjour and Nguyen, 2007; Beauséjour, 2008), and (iii) in periurban slums community-managed sanitation blocks (Burra et al., 2003).

In areas with existing septic tanks (i.e., mainly non-poor areas) which are malfunctioning due to the inability of the local soil to absorb the tank effluent, options are the installation of in-house water-saving plumbing fixtures (to reduce the quantity of wastewater generated to the level that the soil is again able to absorb the septic tank effluent) (Mara, 1989), and/or settled sewerage (also called 'solids-free' sewerage) (Otis and Mara, 1985).

There are two sanitation options that are *not* applicable in poor urban areas: these are conventional sewerage which is excluded on grounds of excessively high costs (Kalbermatten et al., 1982a), and ecological sanitation, especially its multi-sewer variant, which is also excluded for reasons of very high costs (SEI, 2005; Oldenburg et al., 2007), but also because it is not yet sufficiently well developed for large-scale application in urban areas (Otterpohl, 2008).

SELECTION CRITERIA

In any one location the most appropriate sanitation option has to be chosen from those mentioned above, with 'appropriate' being understood to refer to social acceptability, financial affordability, institutional acceptance and physical feasibility. As almost all those to be provided with improved sanitation facilities by 2015 and beyond are the poor and the very poor, cost is generally the most important selection criterion. Thus in dispersed rural areas Arborloos 'win' because not only are they very cheap to build (costing around USD 10−20, Simpson-Hébert, 2007), but they also generate an income for very many years. Similarly in

high-density periurban areas simplified sewerage generally wins as the monthly charge is very low (Mara, 2008).

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