

ECOLOGICAL SANITATION

a sustainable approach to the future

Austrian

Development Cooperation

1. Background

“Water is a key to development in all its many dimensions. First and foremost, it is an essential element for human survival, and the combination of safe drinking water, adequate sanitation and hygiene is recognized as fundamental to human well-being.”¹

Ever since the Earth Summit in Rio de Janeiro 1992, all the world over people have been talking about environmental pollution, exploitation and the limitation of natural resources. Economic development, rapid urbanisation, fast population growth and migration to urban centres have all contributed to overloading the natural environment with harmful emissions – up to a very critical point. The effects are manifold, but those most affected are the poorest in society – especially women and children in developing countries. They suffer most from water related diseases and a damaged environment.

One of the main burdens of the poor population is the lack of sanitation facilities. Worldwide, every second person does not have access to sufficient and safe sanitation. The majority of people, who have to struggle with contaminated drinking water and accompanying illnesses, live in Asia and Africa.

“Water-related diseases are among the most common causes of illnesses and deaths, affecting mainly the poor in developing countries.”²

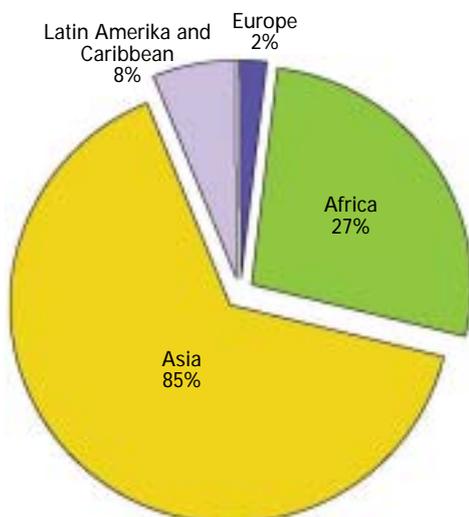


Figure 1 : Water supply distribution of unserved population.

Every year, millions of people die from preventable diseases, hundreds of millions more suffer from diarrhoea or parasitic worm infections. For all these reasons and with the UN Millennium Development Goals in mind, this brochure has been prepared to support the efforts of the Austrian Development Cooperation (ADC), NGOs and private companies working in the Water Supply and Sanitation (WS&S) sector. Its particular focus is on Ecological Sanitation and it aims to spread a holistic, closed-loop approach to project partners and all groups and individuals involved in WS&S projects.

“By 2015, reduce by half the proportion of people without access to safe drinking water.”³

“By 2015, half the proportion of people who do not have access to basic sanitation.”⁴

<http://www.un.org/millenniumgoals/>
<http://www.johannesburgsummit.org/>

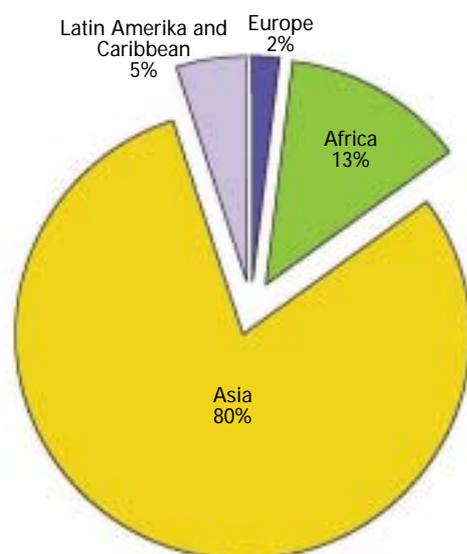


Figure 2: Sanitation distribution of unserved population.

(Proportionally the number of unserved people is highest in Africa due to the difference in population size between the two continents.) a)

2. Definition

An alternative and holistic approach to overcoming the lack of sanitation and negative impacts of conventional systems is called Ecological Sanitation (EcoSan). EcoSan marks a paradigm change from a linear to a circular flow of nutrients and to safe water resources. EcoSan is an approach which takes economic, ecologic and social parameters into account but not by promoting a single new technology but new sanitation principles and concepts. These principles are based on a (local) closed-loop system for the recovery of nutrients from human urine and faeces, greywater and organic waste to the benefit of agriculture.

*“EcoSan (ecological and economical sanitation) represents a holistic approach towards sound ecological and economic sanitation. The underlying aim of this approach is to further sustain development by closing nutrient and water cycles with as little loss of material (nutrients) and energy as possible. Strategically, promotion of EcoSan concepts will contribute towards the overall objective of closing material cycles.”*⁵

*“Ecological sanitation can improve social and economic conditions for all, but especially for impoverished communities. EcoSan offers empowerment and safety, particularly to women and girls in urban and peri-urban areas that are often without sanitation, by providing a private and dignified environment for urinating and defecation.”*⁶

In the “Lübeck Recommendations for Action from the 2nd International Symposium on Ecological Sanitation 2003”⁷ the main advantages of EcoSan are defined as follows:

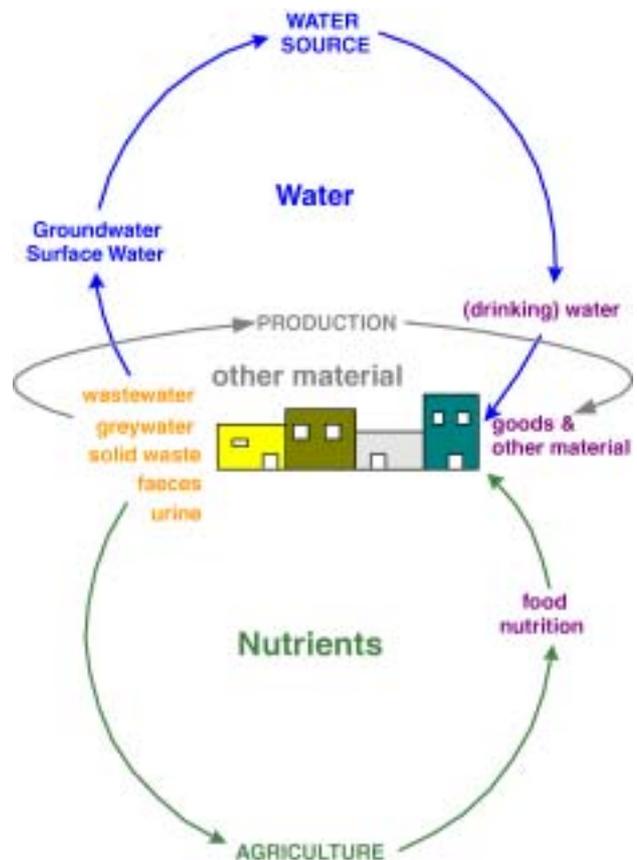


Figure 4: Circular flow of Ecological Sanitation.

- EcoSan reduces the health risks related to sanitation, contaminated water and waste.
- EcoSan prevents the pollution of surface and groundwater.
- EcoSan prevents the degradation of soil fertility.
- EcoSan optimises the management of nutrients and water resources.

<http://www.ecosanres.org>
<http://www.gtz.de/ecosan>
<http://www.ecosan.at>
<http://www.waste.nl>

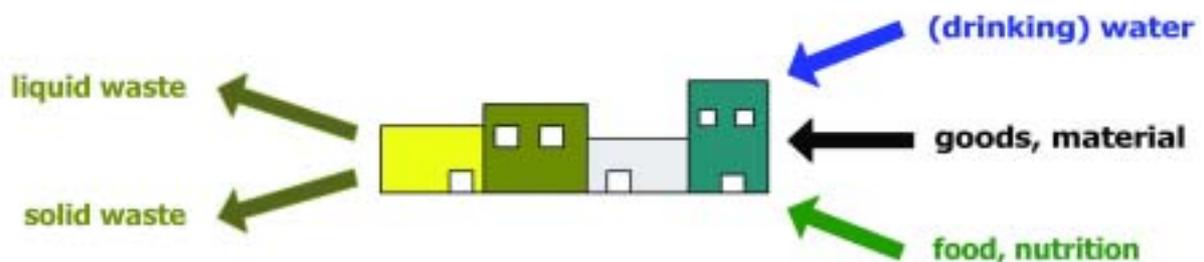


Figure 3: Linear flow of conventional systems.

3. EcoSan Systems

An EcoSan concept looks at the entire system, consisting of social and natural components in consideration of areal and temporal material flows. EcoSan systems themselves are based on the principle of recovering and recycling plant nutrients and organic matter as far as possible.

The technologies used have to be appropriate for local and the users' circumstances and should be flexible as well as affordable, manageable and adaptable. None of them is ecological per se but only in relation to the observed environment. They issue from the whole range of available conventional, modern and traditional technical options, from source control to treatment, combining them to EcoSan systems. The technologies range from simple, low-tech to complex, high-tech systems, which have to be appropriate for the following system components:

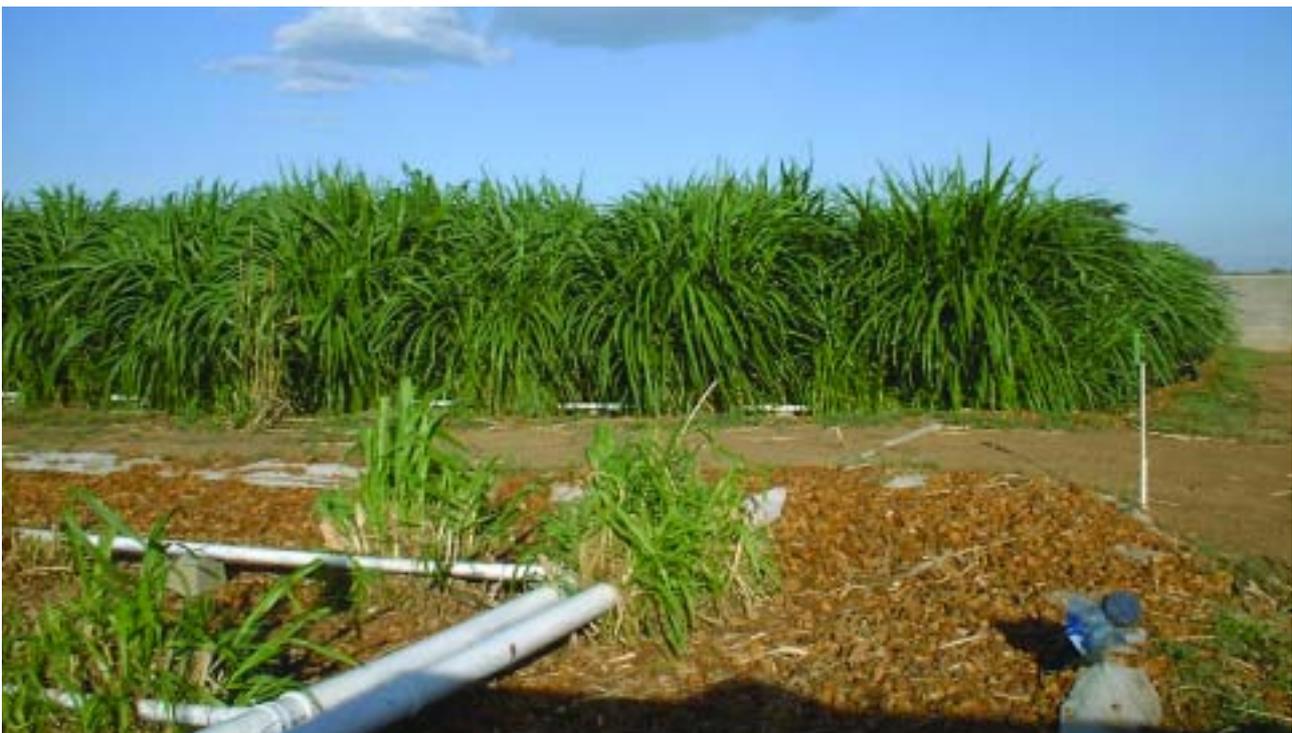
- Collection of human excreta, wastewater and solid waste
- Transport
- Treatment and
- Recycling

For each of these components, several technologies are applied, like composting or urine diverting (dehydration) toilets, low flush

toilets and water-free urinals, vacuum sewer systems, biogas units, constructed wetlands for wastewater treatment or greywater reuse systems.

However, EcoSan systems are more than just technical infrastructure. The users' acceptance for new sanitation technologies is ingrained within local cultural contexts and specifically affected by individual attitudes and behaviours. Socio-economic as well as natural components influence the decision for *"a specific sanitation option [and] vary from culture to culture, community to community and even family to family."*⁸

Planning and decision-making processes have to be participatory, by providing the users with information enabling an informed choice. It is generally agreed that heightened awareness brings better results, if people are more involved and participate actively in decision making.⁹ Rational arguments for EcoSan concepts are manifold and well understandable in the face of the drawbacks of conventional sanitation solutions. But rationality alone may not convince the users to opt for EcoSan concepts. Decisions are influenced by emotions, i.e. aiming to raise the personal standard of living by changing from one sanitation system to another.



Constructed wetland for waste water treatment (Matany Hospital/Uganda)

4. Human excreta management

From out of all what is meant by sanitation (management of human excreta, solid waste and wastewater) the focus of the ADCs activities, which concentrate on the rural areas, lies on human excreta management, being the aspect which needs to be addressed most urgently at present.

4.1 Reuse potential

Each person produces about 400-500 litres of urine and between 25-50 kg dry matter of faeces every year; this contains, together with the organic waste, nearly the same amount of nutrients as the food consumed. Out of the total wastewater produced (urine, faeces and greywater), in urine the three major plant nutrients can be found: 87% nitrogen (N), 50% phosphorus (P) and 54% potassium (K).¹⁰ Additionally, urine contains very low heavy metal concentrations and normally a very low amount of pathogenic organisms. In contrast to human urine, faeces contain only a small portion of plant nutrients (10% N, 40% P and 12% K), which are not immediately plant available. However, the major problems with reusing faeces as a fertilizer in agriculture are the pathogens, which are a significant health risk if not sanitised in a proper way.

"[...] compost improves soil and its fertility. It makes soil easier to cultivate, reduces the need for chemical fertilisers and pesticides, and adheres to the principle of EcoSan. Composting serves as a secondary level of processing of faeces, making it safe and preventing disease.



Field trials in Kisoro/Uganda: the maizfield in the back was fertilized with urine, the one in the front without

*Composting conserves water because it holds more water in soil for a longer period of time. And finally, composting recycles nutrients."*¹¹

4.2 Hygiene Aspects

Pathogens and parasites found in human excreta are widely responsible for a variety of illnesses in developing countries. The majority of pathogens can be found in human faeces. Therefore, the main risk lies in the contamination of the environment by faeces spread near places where people and animals live and next to or into drinking water sources.

The risk of transmission of infectious diseases via the abundance of pathogens can be reduced essentially by keeping the scope of the problem as small as possible – by preventing the mixing of the critical fraction – faeces – with other substances, e.g. urine or water.

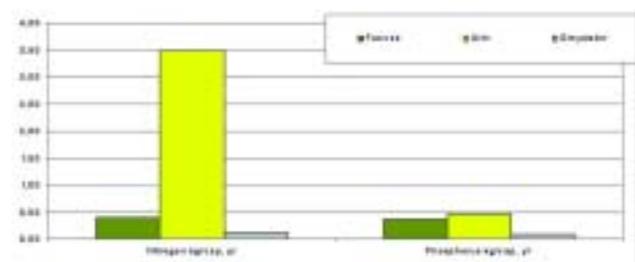


Figure 5: Nitrogen and phosphorus content in urine, faeces and greywater. b)



Tank with treated wastewater for irrigation (Matany Hospital/ Uganda)

However, contamination with pathogenic organisms as well as organic and inorganic pollutants cannot be excluded, although compared to conventional solutions the risk is much lower. This EcoSan approach cannot be seen as a zero-risk solution, but rather as a search for new possibilities. Prevention of waste production, diversion at the source, adequate treatment, awareness of the risks and consequently appropriate handling – all combined – assure the minimisation of health risks.

Recommendations on how to sanitise human excreta before using them as fertiliser under various different conditions, have been developed and are continuously extended and updated.

Obviously, safe drinking water supply and safe excreta disposal is not sufficient for an effective and long-term reduction of spreading diseases and preserving health. Infections are mainly spread by contaminated fingers, liquids, environment, flies and foods. These risks can be reduced or stopped by using barriers to prevent pathogens being transferred. A primary barrier (e.g. dry toilets) prevents contact with faeces and afterwards with liquids, foods and environment. Nevertheless, secondary barriers, like washing hands, adequate cooking of food, food hygiene or water disinfection are nearly as important.



Fruit trees irrigated with treated wastewater (Matany Hospital/ Uganda)

5. EcoSan Programmes of the Austrian Development Cooperation

5.1 Uganda

In 1996, the South Western Towns Water and Sanitation Programme (swTWS) was initiated by the Austrian Development Cooperation together with the Ugandan Directorate of Water Development (DWD). The project was designed to cover small towns and rural growth centres in the South-West of the country with the aim to provide safe water and improved sanitation facilities.



Solar pumping station for water supply system (Kisoro/Uganda)

The EcoSan Project in Kisoro

Kisoro Town was chosen as a case study community for an EcoSan pilot project due to the local conditions concerning the (hydro-)geological situation (Kisoro sits on the top of its only water source) and the poor sanitation coverage.

At the beginning of the project, a feasibility study was elaborated with a strong focus on local conditions as well as user participation. With a view to reaching the majority of the community members, the project emphasised the use of drama, rallies and meetings. Political leaders were contacted to gain commitment for supporting the project by way of an official implementation agreement.

Various options were discussed. The final decision was in favour of solutions based on EcoSan principles, which were adapted to the local circumstances in order to maximise the use of pumped potable water, to protect ground water from faecal contamination and reuse nutrients and organic substance for agricultural purposes. The different components are:

- Water-borne sanitation, sewer, treatment plant (constructed wetland) and reuse of the outflow (e.g. irrigation of fruit trees).
- Water-borne sanitation septic tanks, cesspool emptier and treatment plant.
- Pit latrines as basic sanitation.
- Composting and dehydration toilets on private and public level and reuse of compost, urine and/or faeces as manure in agriculture.

More than 250 units were built during 1999 and 2000. Dry toilets were built for both public households and high polluters such as primary



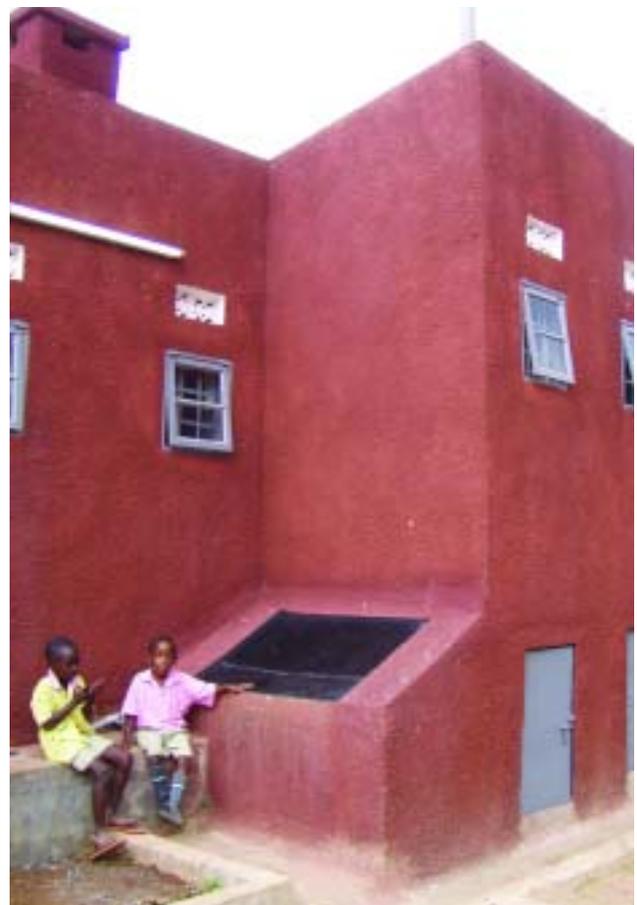
Private dry toilet in Kisoro/Uganda

schools, secondary schools, boarding schools, the prison, the old and the new market, the taxi park and other institutions.

Dry toilets were chosen because of the above-mentioned hydro-geological situation, soil occupancy, land shortage and difficulties of digging pits into the rocky ground.

In this project, two main aspects of developing and implementing EcoSan concepts were considered – the project approach on the regional level and the fact that decisions on sanitation solutions are not only based on rational processes but also and maybe even more on social/emotional aspects.

<http://iwga-sig.boku.ac.at/swtws/>



A dry toilet constructed inside a house (St. Franzis Naggalama Hospital/Uganda)

5.2 Mozambique

Within agreements on the bilateral co-operation between the Province Government of Sofala and Austria, one is the sub-sector program for Rural Water Supply and Sanitation (PAARSS). Based on the environmental and gender strategy of the program, training and capacity building on water supply and adequate sanitation (with a special focus on Ecological Sanitation) was initiated within the Province Government, District Administration and Municipal Administration down to the community level.

The emergency situation caused by floods of Búzi River in 2000 that displaced around 4,000 people in the district of Búzi, forced the PAARSS team to extend the EcoSan initiative to the Guara-Guara resettlement area, where pit latrines were considered as a hazard to public health.

Post-emergency challenges targeted to improve peoples' livelihood by providing adequate water and sanitation facilities. Hence, the project designed a diverting toilet model including a bathing compartment not only to provide basic sanitary infrastructures but also to introduce

people to domestic water resources protection and management.

Any sanitation alternative in this area of Mozambique is usually viewed with suspicion, a social practice against the odds, aiming at preventing culture conflicting sanitation concepts. So, local activists and constructors were trained on-the-job to facilitate the awareness campaign and hardware construction.

With community education in water supply and sanitation issues, discussions and decision making processes on various levels, from the Búzi District Authorities to the Guara-Guara Community, the project resulted in the construction of 200 family toilets and 10 public units.



Public dry toilet in Guara-Guara/Mozambique

6. Conclusions and Steps towards the Future

From 7th to 11th April 2003, the “2nd International Symposium on Ecological Sanitation” was held by the International Water Association (IWA) in Lübeck, Germany. One of the results of the symposium was the formulation of priority actions for the further promotion of EcoSan and to bring the approach to scale:

10 Recommendations for Action on Ecological Sanitation ⁷

1. Promote EcoSan systems as preferred solution in rural and peri-urban areas.
2. Accelerate large scale applications of EcoSan principles in urban areas.
3. Promote agricultural use.
4. Raise awareness and create demand.
5. Ensure participation of all stakeholders in the planning, design, implementation and monitoring processes.
6. Provide for decisions on an informed basis.
7. Promote education and training for EcoSan.
8. Adapt the regulatory framework where appropriate.
9. Finance EcoSan.
10. Apply EcoSan principles to international and national Action Plans and Guidelines.



Ponds for waste water treatment in Bangladesh

7. Sector Policy: Water Supply and Sanitation

The essential targets of the Austrian Development Cooperation's activities in the water sector concentrate on satisfying people's basic water supply and sanitation needs. Therefore, the Austrian Water Sector Policy ¹² deals with the long-term safeguarding of drinking water and sanitation (basic supply) as well as hygiene standards in rural districts and peri-urban areas.

Based on the structure and characteristic of the water supply and sanitation sector, the contradiction between Water supply – Water demand – Water use effects, the following mainstream objectives constitute the basis of all activities:

- Easily accessible water and sanitary provision in sufficient quantity and quality as basic care for all regional stakeholders.
- Management and protection of the water sources in the catchment area – quantitative and qualitative.
- Security of supplies in technical, organisational, legal and institutional respect.
- Financial and economic feasibility of investment and operation & maintenance.

Sustainable development of water resources and Water Supply and Sanitation demands application of a balanced strategy accounting for natural resources, social-cultural and social-economic as well as technical aspects. Hence, all goals need to be approached simultaneously, comprising all levels, from households to communities, from the region to the national authority and to include the political dialogue.

<http://www.mfa.at/adc>
<http://www.ada.gv.at>

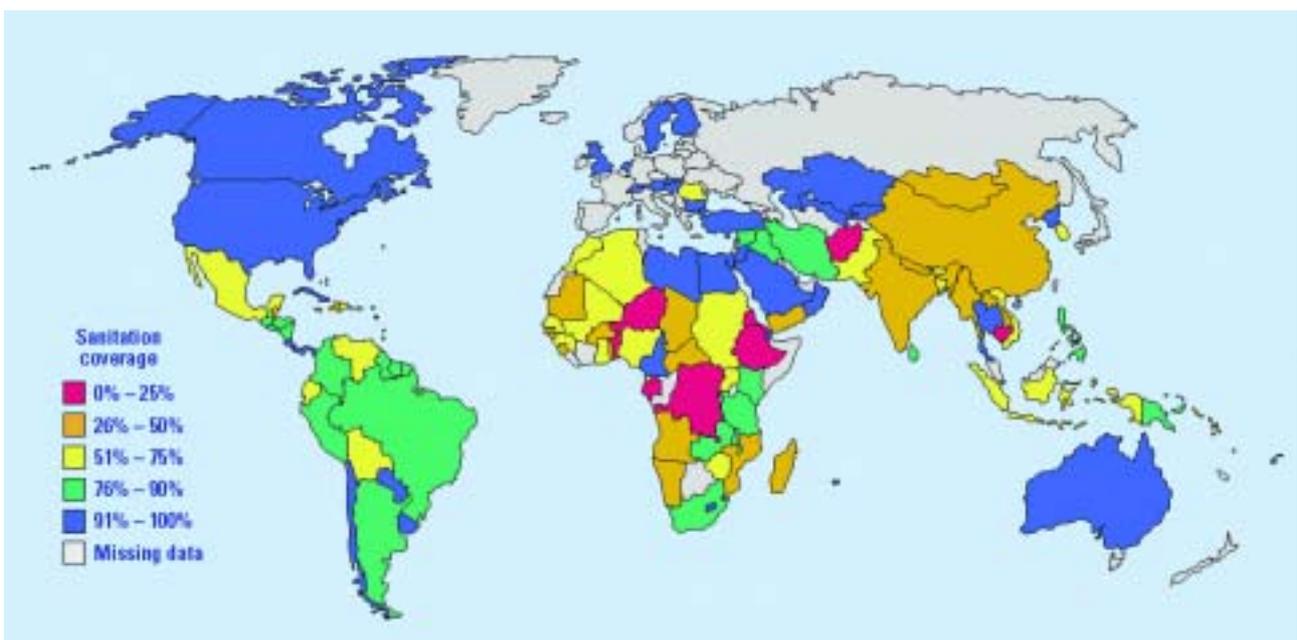


Figure 6: Sanitation data at global level. ^{a)}

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 - 2) The United Nations (2003). *Water for People. Water for Life. World Water Development Report*. UNESCO Publishing. Paris, France.
 - 3) The United Nations (2000). *UN Millennium Development Goals (MDG)*.
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 - b) *ATV-Handbuch der Abwassertechnik (1997). Biologische und weitergehende Abwasserreinigung, 4. Auflage, W. Ernst und Sohn. Hennef, Germany*.

Further Reading:

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Internet Links:

- EcoSan Club: <http://www.ecosan.at>
EcoSanRes: <http://www.ecosanres.org>
GTZ EcoSan: <http://www.gtz.de/ecosan>
WASTE: <http://www.waste.nl>

EcoSan concepts...

- ... are based on a closed-loop system – to close water and nutrient cycles in a controlled way in order to recover nutrients from human urine and faeces, greywater and organic wastes to the benefit of agriculture.
- ... look at the entire system, which consists of social and natural components, considering spatial and temporal material flows.
- ... are affordable, manageable and adaptable offering tailor-made solutions.
- ... centre on users priorities including all stakeholders in the process from planning to implementation.
- ... comply with legal frameworks (on communal, regional and national level) and adhere to international standards.
- ... use an interdisciplinary approach to comprise all affected disciplines (from agriculture to town planning) with a strong emphasise on education.
- ... are in accordance with gender equality and consider cultural aspects.
- ... are based on awareness creation and provision of information (the concept of social marketing) to enable stakeholders to make their informed choice.
- ... are monitored and evaluated continuously throughout the entire process to turn the process towards the objectives.