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Session "Water Utilisation"

Public Health and Social Implications of Water-related Innovations

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Introduction

I am very pleased to have been given the honour to introduce the topic " water utilisation". While the subsequent presentations deal with specific issues of agricultural water utilisation, I will give an overview of some of the concerns from a Public Health point of view:

Public Health describes health as a public good and a human right, and, in the context of this paper, ecological, social, demographic and cultural determinants in relation to water and to the health of the community at large.

Water-related innovations are linked to disease prevention and control, domestic water supply, water for food production, urbanisation, mining, industrialisation and energy production –and their effects on health.

Water management, like food production, nutrition or concepts of health and disease, is deeply rooted in the socio-cultural heritage and lifestyle patter.

Water has been a major factor in the rise and fall of civilizations.

Each stage of evolution, from gatherer-hunter to domestication of plants and animals to modern times has always been and still is accompanied with relevant water

management issues. We know of pre-historic irrigation schemes in Egypt, Yemen, Mesopotamia, of urban water and waste management systems in Mohenjo-Daro (South Asia) or the Mississippi Culture (North America) - followed by urban water management systems in ancient Rome.

It is appreciated that efficient water management for agriculture and animal husbandry is of immediate interest for safeguarding human nutrition and survival, but it has also to be acknowledged that Man is competing for water for his immediate needs against plants and animals, or nowadays industry. Solving a water problem in one sector may lead to positive spin-offs or to a new water related problem in another sector (UNESCO, 2003a, 33). Water has many complex, direct and indirect implications on health.

Several areas of conflict will be discussed here:

Ecosystem Water and Health:

The burden of water-associated diseases in countries with low resources is still appallingly high. The source of infection is the Ecosystem Man in the interaction with the Ecosystem Water. This leads in poor countries to unsafe drinking water, polluted waste water, sub-standard sanitation and poor personal and environmental hygiene and to a disease burden which is 20 to 30 times higher than in richer countries (UNESCO, 2003b, 102 – 123).

About 30 infectious diseases are related to water: According to their ecological background they can be classified into water-borne, water-washed, water-based and water-related diseases, specifying how they are linked with water (Feachem et al., 1983). Plasmodia, the Malaria parasite and many other water-associated human parasites are still spread by human activities, in rural agriculture as well as in urban settings. Malaria kills over a million people every year, most of them children under the age of five, mainly in Africa, south of the Sahara. Worldwide, over 2 million people are infected with Schistosomiasis and soil-transmitted and water-related parasites and 300 million suffer serious illnesses as a result.

Both, Ecosystem Water and Ecosystem Man, need to be well understood in their interdependency if sustainable control measures against these diseases shall be found.

Local communities must be involved and their concern for health will provide a strong incentive for fighting the diseases.. The *Primary Environmental Care Concept* developed by the World Conservation Union (IUCN) in the early 90's has a famous predecessor , the *Primary Health Care- Concept* (PHC) developed by the health sector, WHO, UNICEF, and others, 25 years ago (UNESCO, 2003c, 138).

There are many examples where the control of disease and their vectors may lead to a conflicts of interests between public health specialists and the users of water.

It has been known for centuries that the draining of swamps has a positive effect both on land reclamation for agriculture and on mosquito control as a potent measure against malaria. In contrast, spraying insecticides against malaria vectors frequently was met with stiff resistance by the beneficiaries, for a number of reasons.

Irrigation systems with slowly flowing or stagnant water may provide new, hitherto non-existent breeding grounds for malaria vectors and thus trigger off malaria epidemics in a newly settled farmer population coming from non-malarious areas, while intermittent irrigation could prevent this.

Schistosomiasis, a disease which is typically associated with irrigation agriculture in tropical areas, is actually increasing, in spite of all control activities WHO, 1995,).

When fighting Onchocerciasis (River blindness) in West Africa by large scale chemical vector control much attention was given to highly specific, fast degrading insecticides so that the aquatic ecosystem did not suffer. In consequence, large fertile arable land areas have been reclaimed and could be re-settled by this huge international programme (Samba, 1994).

The Guinea Worm Control Programme in West Africa and Pakistan was effectively connected to the "International Water Decade" programmes in the 80's, aiming at the improvement of rural and small-town water supply (WHO, 1998).

Population Density, Water and Health

We all need 20 to 50 litres of safe water each and every day. However, the number of people who do not benefit from anywhere near this amount is staggeringly high. In

our society this is the amount of water we flush down in our toilets every day. This is just another example of our bizarre pattern of the distribution of wealth and water.

1.1 billion people lack access to improved water supply and 2.4 billion to improved sanitation. While in Latin America an estimated 66% of people have access to piped water and are connected to a sewer system, in Asia it is 49 % resp. 18% and in Africa it is only 24 resp. 13% of the population, which of course also reflects the degree of urbanisation (UNESCO, 2003d, 109).

Considerable improvements have been made since the 1980's, when the "International Water Decade" was declared, but due to the almost doubling of the populations in these areas since that time, the proportion of people without access to clean water has remained almost the same.

There is one principle from the Public Health point of view: The more water is used, the more waste water is produced, and this could mean that the health benefit caused by more water may be lost by the disadvantages of environmental pollution by waste water, if these two developments do not go hand in hand, which is rarely the case.

Increase in population size and density thus means more demand for water and more environmental pollution by waste water. It also means a changing pattern of water utilization with an ever rising consumption of water per head.

One extreme is the growth of mega-cities, the other extreme is the growing problem of refugee camps.

Food Production, Water and Health

Food production is by far the largest consumer of water, 100 times more than used for basic personal needs. A growing population will need more food and thus more water, not only for domestic purposes but even more for food production. 1 kg of wheat means 1 m³ water. Paddy rice needs 2 m³ and meat production 6 to 20 m³ , depending on the feed/meat conversion factor. In order to grow the amount of food which provides 2800 Kcal/person/day 1000 m³ of water are needed (UNESCO, 2003e, 203). Thus water resource development for food production, be it in agriculture, horticulture or animal husbandry, and for food processing has certainly a high priority over many others (UNESCO, 2003f, 215).

On the other hand, it has to be asked who benefits from this production process, those in need of food or those who are already overfed.?

There is basically no shortage of food or food production capacity, but it is “the market” and politics which fail to provide food for all, not the producer.

Innovations to support higher productivity, e. g. by small scale or large scale irrigation systems however, may lead to new ecological conditions which favour the introduction and spread of hitherto unknown or less prevalent diseases like malaria, dengue fever, Schistosomiasis or other vector-borne diseases.

Intensification of animal husbandry in semi-arid areas may lead to over-consumption of water and exhaustion of subsoil water reservoirs which have serious consequences not only for the ecosystem but also for the consumer (e.g. by overstocking of cattle in the Sahel in the 70’s).

Rural Water Supply and Health

The impact of improved rural water supply on children’s diarrhoea and other “water-washed diseases” has been studied extensively, but with rather diverging results at times. The problem is multi-facetted. General conclusions from specific studies in household settings are difficult to draw. It has been found that it is rather the quantity of water than the quality which matters for improving the level of personal and household hygiene (UNESCO, 2003g, 102 ff).

Various types of hand pumps or electric pumps have been tried out and installed. Where women formerly spent a good part of their time and energy on fetching water

from shallow wells or other surface sources far away, deep well pumps nearby have raised the quality and quantity of available water considerably and help to save women's precious time and energy.

Maintenance of the pumps however is a technical problem and therefore a task assigned to men who are never concerned about domestic water supply. A lot of input is necessary to arrive at a fruitful sharing of responsibilities.

The weak point in the system is the transport and the storage of water at home rather than the quality at the source. Patterns of personal hygiene do not depend on quality and quantity of water alone but rather on the degree of hygiene education, even when the environment is poor. The most striking results are found in the case of trachoma control by simply washing the face of children with as little water as is available. Another problem might be the taste and colour of the new deep well water which might be so different from the traditional shallow well water that even a generous supply of water and shorter distances are not enough to convince people to use it.

The cultural background in which water is deeply embedded, is rarely known or respected. Traditional rules and rituals connected with the drawing and distribution of water may not be carried over to the new system (Katzan, 2001; Al Azaria-Jahn, 1981.; White, Bradley and White, 1978).

Innovations in rural water supply must be accompanied by improved sanitation and waste disposal. The construction of whatever type of latrines, does not guarantee that they will be used and properly maintained.

Reducing one pathway of disease transmission, but permitting others to remain unchanged, is unlikely to lead to dramatic drops in morbidity.

As children are weaned from the breast they are at a risk of becoming infected by improper weaning food and unsafe drinking water. As they become more mobile and therefore are more exposed to a polluted household environment they are at an even greater risk to catch different types of intestinal infections against which they have yet to develop immunity. This is the time of the highest multi-factorial child morbidity and mortality.

Urbanisation, Water and Health

Cities are among the planet's most threatening environments. Cities are the centre of national economic, social and political activities. Today 42% of the world population (2002) live in urban areas. This will increase to over 60% by 2030. By 2015 75% of the world's population will live in developing countries (UNESCO, 2003h, 160 – 187).

Urban ecosystems are greatly determined by water demand and waste water management problems under constantly increasing population pressure and poverty. This is particularly true for urban slum areas. Chittagong with a population of 1.6 million provides individual household water connections for 400.000 people and street pumps for 200.000 only, while 1 million people have to rely on surface water of different type and quality. Over 50 % of the Nairobi and Dar es Salaam population live in areas of minimal or no water and sanitation infrastructure.

There is considerable loss of water through leakage and at the same time contamination of piped water from sewage drains. Cholera is a good indicator of an inadequate urban water supply.

Urban child mortality is 10 – 20 times higher in problem cities compared to good and fairly well served cities or when comparing low and high income areas. This has been known since the 19th century, when cholera and diarrhoeal diseases of children were rampant in European cities.

A new and increasing problem is urban malaria, in particular in South Asian cities, where drinking water storage tanks on roof tops are ideal breeding sites for *A. stephensi*, the classical urban malaria vector. (WHO, 1996) Aedes species are typical waste water breeders who transmit urban Dengue and Yellow fever, Culex species transmit urban Filariasis, not to speak of flies who transport Amoeba and other pathogens (WHO, 1995 op.cit.).

Dams for urban water supply may be used also for recreation and fishing. Vegetable production on the shores is very popular and a means of income and better nutrition for those who can afford to buy it. But these water bodies also provide good breeding grounds for Malaria and Schistosomiasis vectors.

The aim is to have piped water as close as possible by the household, but introduction of user fees for water may be too heavy a burden for the small household economy and people turn to the former unsafe water sources.

In areas not connected to public supply, people may depend on private retail vendors of water with questionable quality through inappropriate storage and supply techniques and at about 10 to 100 times the unit cost compared to public water supplies (UNESCO, 2003i, 339 - 342).

There is a high level of risk in suburban and urban residential areas by water related disasters. Floods, landslides, rainwater run-off mixed with waste water, in particular in slum and squatter areas cause havoc among residents. Between 1991 and 2000 665.000 people died in 2557 natural disasters of which 90% were water related events, 97% in developing countries (UNESCO, 2003j, 271 ff).

Mining, Industrialisation, Infrastructure Development, Water and Health

The development of the modern sector like mining, industry and infrastructure have a particular impact on water and water related health problems. World-wide many examples could be given, here, only a few from the past and the present will be cited.

The classical examples is India during the 19th and 20th century. During the development of the enormous railroad network dam constructions and earth work frequently cut through natural subsoil and surface water courses and led to enormous ecological irritations and led to massive malaria epidemics.

The development of the coal fields in the State of Bihar, India, with open cast and shaft mining led to large amounts of underground water being pumped indiscriminately onto the surface. The result were severe malaria and cholera epidemics in the first half of the 20th century to such an extent that coal mining almost collapsed (Diesfeld, 1982).

Development of steel and other heavy industries in the second half of the 20th century, with a lot of internal migration from remaining malarious areas led again to the re-introduction and serious outbreaks of malaria.

Wild open cast mineral and gold mining in many parts of Africa, where water is a major production factor, under appalling hygienic conditions, leads to severe outbreaks of many water-related diseases. The construction of the Transamazonia

Highway with the opening and destruction of dense forests for road construction and agricultural settlements with massive internal migration led to severe malaria epidemics particularly in the Rondonia Province of Brazil (WHO, 1996 op. cit., Diesfeld, 1997). Malaria to-day is more than ever a man-made disease.

Hydroelectric Energy and Health

Biomass accounts for 80% of all household fuel consumption in developing countries and most of it is used for cooking, which is done primarily by women.

In-door air pollution contributes considerably to chronic obstructive lung diseases, lung and naso-pharyngeal cancer. 60% of the global burden of acute and chronic respiratory diseases are associated with indoor-air pollution. In Africa this is 30 x higher, in South East Asia this is 15 x higher than in Europe (WHO, 2002, 186; 223).

Clean, e.g. hydroelectric, energy could contribute tremendously to health by saving time spent on women's daily chores, such as fetching water and fuel, by contributing to safer cooking, less accidents , less respiratory diseases, and by reducing emission of green house gases etc.(UNESCO, 2003k, 250 ff)

These advantages have to be balanced against the negative effects of dam construction for hydro-electric schemes and reservoirs which displace a large number of people who are inadequately compensated, flood arable land and create new breeding places for disease vectors. The pertinent question has to be asked again: Who will benefit most from this innovation such as hydroelectric energy?

Water and Sanitation, Key Links with Poverty Reduction and Health

The integral role of water in the development process has been recognised over the past two decades, with several international agreements specifying targets on water supply and sanitation, dating back to the UNICEF International Water Supply and Sanitation Decade, 1980 (IWSSD).

Poverty today is recognised to be a complex, multifaceted situation that involves both the material and immaterial conditions of life, deprivation of health, education, nutrition, safety and legal and political rights.

Improving access of the poor to water and sanitation is defined as the 7th Goal of the Millennium Development Goals (MDG 7), laid down by the UN in 2000, because it has the potential to make a major contribution towards poverty reduction (UNDP, 2003, 28).

Only recently, in 2003, the UNESCO published a joint report by 23 UN-agencies concerned with fresh water (UN-World Water Development Report, 2003,) in which all aspects of "Water for People and Life" have been addressed and the role of water for poverty reduction has been acknowledged (UNESCO,2003a op.cit.).

All these international declarations are laudable statements but rarely address conflicting technical problems, social inequalities or political interests, which in practice determine the outcome or acceptance of any actions taken to fulfil the stated goals

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