AUFS

American Universities Field Staff

1981/No. 2
Africa

Reports

BILHARZIA CONTROL IN SWAZILAND — THE DILEMMA OF DEVELOPMENT

by J. Gus Liebenow

Ironically, the debilitating disease bilharzia has been spread by the very irrigation and hydroelectric power schemes designed to help farmers in tropical Africa. While medical researchers intensify their search for a cure, a water source protection project launched in Swaziland may prove an effective, if expensive, method of impeding the disease and improving the Swazi quality of life.

[JGL-1-'81]

ISSN 0161-0724

American Universities Field Staff

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For every dollar we spend on agricultural and other forms of development, we ought to spend an additional amount to insure that the people involved are made more efficient and productive and that they can enjoy an improved quality of life. Ironically, it is often the very dollar that we spend on development that guarantees the spread of debilitating diseases, such as bilharzia.

--a senior UNEP official, Nairobi

This statement by the United Nations Environment Program official in Nairobi may be an overly dramatic presentation of a case; nevertheless it does emphasize the dilemma of development in Africa. All too frequently, the solution of one problem of development leads to the creation or aggravation of several far more serious situations. This has been especially true of the struggle against bilharzia, or schistosomiasis, which ranks second only to malaria as the major health hazard of the tropics. It is estimated that more than 200 million residents of Africa, Asia, and Latin America are afflicted with this dread disease. Its incidence, moreover, is on the rise, as dam construction, irrigation schemes, and other development projects create ideal conditions for the spread of bilharzia.[1] While seldom the single cause of death, bilharzia's damaging impact on the liver, kidneys, large intestines, and other vital organs is a key contributing factor in the death of many Africans—particularly the very young and the elderly. Not only does bilharzia cause great pain and discomfort among those afflicted, but it accounts as well for a significant portion of the absenteeism from work and school and for the general fall-off in productivity among people in all walks of life.

Despite bilharzia's broad incidence, it was not until 1951 that Theodor Bilharz of the Faculty of Medicine in Egypt provided the first clinical description of this complex disease which bears his name. Papyrus scrolls dating back to the XIIth Egyptian Dynasty (c. 1550 B.C.) indicate, however, that practitioners of medicine have long been at least crudely aware of the affliction and have suggested various treatments and cures.[2] Yet even now there is no means of vaccinating or inoculating human beings against bilharzia. Current chemotherapy treatment of the disease, moreover, is expensive and produces dangerous side effects. This treatment may soon be superseded by use of a new drug still in the testing stage.[3]

Although the disease is associated largely with the tropics, with hot and humid climates, and with rural poverty, the effects of bilharzia are far more widespread. It does exist in temperate zone areas, in regions with both high and low rainfall, in hot and cold seasons, and in urban areas. The disease, moreover, has apparently been no respecter of rank and wealth, for ova of bilharzia have been found in the renal cortex of royal Egyptian mummies. Bilharzia, nevertheless, has today been identified largely as a disease of the rural poor. It is this sociological group which cannot afford the comparative luxury of having pure water piped directly into the home for drinking and cooking purposes, for bathing, and for washing clothing. It is the members of this group, too, who are often compelled to make their livelihoods by wading in waters infested by the trematode flatworms called schistosomes— *S. haematobium*, which attacks the urinary tract and *S. mansoni*, the more severe form, which causes intestinal bilharzia. Not all African rivers and lakes are sources of bilharzia; the disease occurs only in relatively warm and placid freshwater bodies lined with the grasses or reeds that provide a breeding ground for the particular species of snail which serves as the intermediate host for the schistosome larvae. The species of snail vary around the globe. It is the *Bulinus africanus* and *Biomphalaria pfeiffori* species that are common in Swaziland, the focus of this study.

The transmission cycle of bilharzia is complex. Schistosomes have both male and female forms, and both must be present in the human liver for sexual reproduction to take place. After conception, eggs are laid by the male schistosome in the wall of the bladder or the large intestines. Eventually the eggs are ejected from the human body in the urine or feces. At that point, the presence of slow-moving or stagnant water becomes crucial, for the eggs must have fresh water in order to hatch into the free-swimming larvae, or *miracidiae*, which then must locate the appropriate snail host roughly within 24 hours. Once inside the snail, each male or female miracidia larva goes through an asexual form of reproduction which may produce several thousand larvae of a new form called *cercariae*. It is this second form of free-swimming larvae which then seeks out a human host. Although an open sore or the delicate areas beneath the toenails and fingernails facilitate entry, the extended

exposure of a human to infested water permits entry through any part of the skin. Inside the human body the male and female cercaria larvae migrate through the heart, lungs, liver, and eventually to the bladder and large intestines. The onset of the disease bilharzia occurs as the mature schistosomes begin producing eggs that interfere with the flow of blood through the various organs, thereby destroying the sensitive tissues. The cycle begins once more as the schistosome eggs are discharged through human waste into fresh water.[4]

Even without human intervention, the host snail or the larvae are transferred from one body of fresh water to the next on the feet of birds or in the excreta of cows, sheep, goats, or baboons, which can be infected by some varieties of schistosomes. Human labor migration, of course, has accelerated the spread of bilharzia. This has come partly as a consequence of human ignorance of the life cycle of the bilharzia parasite. It has also arisen because of carelessness in improperly disposing of human waste materials, in allowing stagnant pools to accumulate where clothes have been washed, or in failing to cover stored water. Spread of bilharzia, however, has also come, as was suggested in the introduction, as a direct consequence of human efforts to improve the environment.[5] Lake Kariba, which lies between Zambia and Zimbabwe, is a classic example of this point. The energy of the mighty Zambezi River was harnessed by development planners in the 1960s at the point where the river flowed through the Kariba Gorge. Although the construction of the Kariba Dam accomplished its initial goals of providing hydroelectric power to light and heat homes and help run the industrial machines—as well as providing a fresh water supply for nearby towns and recreational opportunities for those who traveled to the new lake—it also created an excellent breeding ground for the snails that host the schistosome larvae. Curiously, Lake Kariba, which is heavily infested by bilharzia schistosomes, is fed by the Zambezi River, which is relatively free of the disease. As new sources of food are sought in Africa through the introduction of dams and irrigation schemes, and the creation of wetland rice projects, the incidence of bilharzia seems destined to experience a parallel rise.[6]

Control Measures of Bilharzia

As several analysts have noted, the variety of ecological conditions under which bilharzia is transmitted requires that control measures be almost site-specific in order to be effective. No method that is recommended for one species of snail will necessarily be effective in dealing with another. Similarly, the control measures must be adapted to the climate, the abundance of water in that area, the living patterns of the local residents, and other environmental factors.[7]

It must be recognized that bilharzia control measures are of comparatively recent origin. Governments of independent states in Latin America and elsewhere in the tropics lacked, until recently, both the resources and the inclination to do much about bilharzia. Most of the affected areas in Africa and Asia, moreover, were under colonial control until midcentury, and the focus of medical attention, in colonial Africa at least, was upon curing or alleviating the illness among that portion of the population which was most relevant to European economic, missionizing, or other interests. Thus, the needs of the more stable rural majority, who did not become migratory laborers, were left largely unattended. Furthermore, since the incidence of bilharzia is normally endemic, rather than epidemic in nature, there was no particular urgency to do something about a disease that seldom threatened the European minority directly.

Some preventive measures were undertaken as early as the 1920s, mainly the use of molluscicides to eradicate the host snails. This approach was pursued with more determination after the Second World War, when chemicals such as DDT were thought to be the panacea in ridding the world of all pest forms. Only gradually was it appreciated that this was another instance of misapplied technology causing more problems than it eliminated. In addition to what we have yet to discover about the carcinogenic risk posed to humans by the use of molluscicides, the latter control strategy indirectly diminished human well-being by killing the fish, crayfish, and other organisms upon which many people depended for their nutritional and employment needs. As one official of the United States Agency for International Development (USAID) in Swaziland put it: "The U.S. Food and Drug Administration and environmentalists would have us up against the wall if we even hinted that molluscicides might help solve the problem of bilharzia in this part of Africa." Similarly, efforts to employ biological means to eradicate the snails, or the reeds upon which the snails breed, run many risks. The introduction of "alien" species of fish, trematodes, insects, or snails, for example, has been considered in terms of directing prey to the bilharzia snail, of creating competitors for food, or of providing a decoy snail which would interrupt the schistosome larvae breeding cycle. Each suggestion, however, involves the prospect of upsetting the delicate local balance of nature and creating a new pest which must then be subjected to still further control measures.

There are other complications, as noted by Mr. Gene Morris of USAID-Swaziland: "Engineering control devices which may have proved effective in dealing with bilharzia in one part of the globe might be climatically and culturally inappropriate in another." Mr. Morris pointed to the syphon spillway control technique developed in Puerto Rico. Under this method the water level of the lake behind a dam which is threatened with bilharzia snail infestation can be reduced whenever the reed growth around the margins of the lake creates ideal conditions for the multiplication of the snail population. Since the snails can survive only about two or three feet from the shoreline, the rapid reduction of the water level exposes the snails to the drying effect of the sun, and they are soon killed. "This is fine for small dams," Mr. Morris stated, "but it would be too costly for large dams or reservoirs." Moreover, the areas where storage dams have been constructed are not normally those that have a year-round source of water. "It would," Mr. Morris continued, "be regarded as the height of folly in Swaziland if we recommended that large quantities of water be wasted by opening

the sluice gates when scarce water would not be replaced until the next rainy season."[8]

It was obvious, too, as we shall see in the Swaziland case, that many other proposed methods for control of bilharzia would encounter resistance of a social, cultural, religious, or even political nature. Thus, one who would approach the problem of bilharzia control or eradication from purely a medical or an engineering point of view would be bound to fail in bringing about an enduring transformation in the habits and attitudes of the individuals affected.

Two complementary efforts that approach the problem of bilharzia control in a broad, interdisciplinary fashion are taking place today in the Kingdom of Swaziland in southeastern Africa. One of the efforts is funded by the United Nations and involves personnel of three of its international agencies. The second program, which potentially covers the entire half million inhabitants of Swaziland, is funded over a five-year period by USAID. Each effort attempts to avoid the pitfalls of the chemical, biological, and mechanical schemes described above. Each project also attempts to avoid high capital costs in an effort to provide a program which can be duplicated elsewhere in the developing world at relatively low cost.

The United Nations Effort in Swaziland

The United Nations' assault on bilharzia in Swaziland ties in with a more general goal set by the United Nations Environmental Program (UNEP) at Mar del Plata, Argentina, in March 1977. During this meeting on water, health, and ecology, UNEP's governing council designated the 1980s as the "Decade for Clean Water." The established goal was to have all people of the globe provided by 1990 with access to an adequate supply of safe water as well as the sanitary facilities to protect that source of water. To achieve the goal, UNEP seeks "to promote the rational and environmentally sound management of water resources around the globe." Setting this goal is an explicit acknowledgment of the fact that waterborne and water-related diseases constitute some of the most significant impediments to the full utilization of human talent and energy in overcoming poverty. Also implicitly recognized is that—for Africa at least—it is normally the rural majority that most acutely lack the clean water and the sanitation facilities taken for granted by the urban minority.

To achieve the 1990 goal, UNEP decided to utilize the period prior to 1982 in amassing knowledge on the best way to achieve that goal. This knowledge could be acquired through creating pilot demonstration projects under United Nations' auspices in various parts of the globe. Rather than using exclusively UN efforts, however, UNEP hoped to promote cooperative and coordinated efforts by governments, private donor agencies, and others which would enhance our knowledge regarding better ways of achieving rational and environmentally sound management of water resources.

It was with these objectives in mind that UNEP in November 1977 launched in Swaziland the first of a series of pilot projects to provide clean water to rural inhabitants. The actual site selected was the Shiselweni District of southern Swaziland, centering on the government headquarters in Nhlangano. Dr. Letitia Obeng explained to me in an interview at UNEP's international headquarters in Nairobi in June 1980 that Shiselweni was important as a pilot project in several respects. "In the first place," Dr. Obeng commented, "Shiselweni District has a far higher incidence of bilharzia than the estimated Swazi national average of 30 percent." She suggested that it might even range as high as 75 percent. "Secondly," Dr. Obeng continued, "by piping water directly into homesteads, we have the most advantageous conditions for measuring what should be a dramatic fall in the incidence of this waterborne disease."By making it unnecessary for people to drink from, or to bathe or launder their clothes in polluted water from lakes and streams, UNEP hoped, as Dr. Obeng stated, "to considerably reduce the direct exposure of people to the sites where the bilharzia snail breeds."[9]

Dr. Obeng, who had just been promoted to the position of Regional Representative and Director of the Regional Office for Africa within UNEP, considered the Swaziland project "her baby." It was during her administration as Chairperson of the UNEP Soil and Water Task Force that the Swaziland project was launched. She personally was involved in the decision of November 1976 to focus on Shiselweni District as the first pilot project. "Frankly," Dr. Obeng commented, "we did not look upon Shiselweni as simply a health project; if that had been the case, we would have left it to the World Health Organization (WHO)!" What UNEP hoped to achieve was a broad scale social assault on a vital problem of development. Unless the project had involved the community in helping itself, Dr. Obeng pointed out, "we would have been making the same mistake that so many other donor agencies commit—that is, considering development as something you do *to* or *for* people rather than something you do *with* people."

Dr. Obeng was quite candid in acknowledging that she had an even broader social purpose in mind than community involvement in her pressing of the Shiselweni project. "By bringing water directly into the Swazi homestead," she asserted, "we had hoped to liberate yet another group of rural women from the burdensome chore of spending many of their waking hours and much of their energies in hauling water." Reflecting on her own childhood in rural Ghana, Dr. Obeng recalled that during the dry season her mother and other women of the village had to walk several miles to the dried-out riverbeds to dig deep into the sand for water. "Walking back from the river with 25-pound earthenware pots of water on their heads," she remarked, "made the women of rural Ghana old before their prime, with spinal and other problems."

"Can you imagine what it would be like if all the women of America, Great Britain, France, and West Germany combined were suddenly obliged to carry water on their heads several times each week?" she asked. "If you can, then you can appreciate the magnitude of the problem faced today by rural women in Africa."

In addition to its health and social aspects, the Shiselweni project also

had value as an exercise in bureaucratic cooperation.[10] It involved several agencies of the Swazi government, such as the ministries of Health, Water and Sewerage, Community Development, and Public Works, that had not previously been compelled to cooperate in attacking a total situation. The interministerial committee created for the purpose of coordinating the effort was chaired by a dynamic Swazi woman medical officer, Dr. F. Friedman, who has since retired. The committee began a very productive experiment in interministerial cooperation which seems destined to have long-term consequences for the Swazi bureaucracy. It considerably broadened the horizons of both technical persons and administrators who had previously experienced "tunnel vision" with regard to seeing the implications of their respective works for the programs and activities of other ministries. The exercise also compelled administrators to take a more concerted stance on one of the more neglected aspects of governmental services in Swaziland, namely rural hygiene and health education. Much of the burden of serving the majority of the Swazi had previously been borne by foreign companies, missionaries, and other private groups.

The Shiselweni project has also been instructive with respect to another form of bureaucratic coordination—namely, the cooperation of officials from the United Nations Environmental Program with representatives of other UN agencies. Although UNEP provided the inspiration for the clean water project in Swaziland and has provided most of the funding for the pilot experiment, the terms of its charter prevent it from engaging in action programs. Most of its goals are accomplished by involving other UN bodies or private groups in the actual operational program. The involvement of officials from the World Health Organization (WHO) was perhaps obvious, inasmuch as one of the end products was further knowledge about control of bilharzia. WHO representatives were conducting a base-line study of bilharzia in the district before the water taps were turned on so they would have a standard for evaluating the effectiveness of the pilot project at the end of the three-year period. They were also engaged in doing a general vector study of snails, mosquitoes, and other hosts for the many waterborne diseases endemic in Swaziland. The key to the success of the UNEP project, however, has been the involvement of personnel from the United Nations International Children's Emergency Fund (UNICEF). The participation of this specialized agency was justified on the grounds that the principal beneficiaries of the clean water experiment would be the Swazi children. Swaziland has an abnormally high infant mortality rate, estimated by one medical researcher in 1978 to be 156 deaths per 1,000 live births and rising.[11] A high percentage of the infant deaths was attributed to bilharzia and other water-related illnesses. Especially significant were the dehydrating effects of diarrhea, caused in many instances by the absence of clean water.

The selection of Shiselweni District as a pilot project has had both its supporters and its critics.[12] Among the plus factors in the selection process was the fact that Shiselweni is an area with a stable population of relatively high density which had a reportedly severe incidence of bilharzia, particularly among the very young. The area was served by an all-weather road, which cut the costs of laying the pipe for the water scheme and facilitated supervision of the project and its subsequent evaluation. A further consideration was the fact that the district had been designated in 1977 by the Swazi government as a Rural Development Area. This meant that the new energies which might be liberated by the reduction in disease level could be put to positive effect in improving commercial agriculture, building community schools, consolidating landholdings, and in other developmental efforts. Indeed, at the time of the decision on the pilot project, the people of the area had already demonstrated a commitment to community organization for self-help in providing governmental services. This would be crucial to the success of the pilot project. Finally, the government had demonstrated its prior commitment to the district by establishing a health center for the area and by launching a water source protection scheme at two schools in the district.

The selection of Swaziland for the demonstration project met the necessary requirements of rural poverty and national commitment which could produce the measurable and dramatic change that UNEP sought in launching its Clean Water Decade. The country's rural character is beyond dispute since close to 95 percent of the population live in dispersed homesteads. The nature of Swaziland's poverty, however, is deceptive. The Swazi case demonstrates in an impressive way the danger of using gross data in determining poverty. If, for example, one employed only Gross National Product figures, Swaziland's $550 GNP figure would appear to place that country in the category of "lower middle income" states. What the gross data figures conceal, however, is that Swaziland is a typical example of the dual economy model.[13] A small fraction of the population—constituting less than one percent of the total and consisting primarily of Europeans from South Africa and Western Europe—enjoy a relatively high standard of living based upon the export of products from extractive industries. The foreign enclave economy consists of roughly 800 freehold or leasehold enterprises devoted to the production of grains, minerals, cattle, or forest products. The last named source of income has become increasingly important as Swaziland has launched one of the most impressive reforestation programs of any country in the world. The European-owned or -leased land constitutes 40-44 percent of the land area of the country, an ironic commentary on neocolonialism in this part of Africa. By way of contrast, the overwhelming majority of Swazi either live close to the poverty line on the 56 percent of the land area designated as Swazi National Land or they are absent from the country, engaged in wage-labor employment in the mines of South Africa.

Although many Swazi—particularly those in politically prominent roles—have acquired large personal wealth, most Swazi citizens cultivate land or graze cattle on Swazi National Land. Land for cultivation and for homesteads is assigned on the basis of usufructory right of occupancy. Grazing land, which constitutes close to 90 percent of the National Land, is theoretically enjoyed in

common. Lately, however, there have been an increasing number of cases of de jure ownership of grazing land as well as de facto individual freehold. The latter arises as a consequence of rights acquired through the drilling of boreholes for underground water. Cultivation of crops such as maize, groundnuts, sorghum, beans, potatoes, and fruit takes place largely within the subsistence economy. Cattle production for most Swazi, on the other hand, fits into the prestige economy. One measures a man's importance by the size of his herd. This means that the exchange of cattle does not contribute substantially either to real cash income or to meeting the nutritional needs of rural Swazi.[14] In addition, the absence of restrictions on the size of herds and the reluctance to sell cattle for the market sector mean that overgrazing has substantially reduced the fertility of the soil. Finally the reluctance to fence the herds means there is the ever-present threat of cattle polluting water sources, thereby adding to the spread of bilharzia.

The net effect of the preceding commentary is that Swaziland is a poor country indeed. The life expectancy of residents of countries designated as "lower middle income" is 61 years; life expectancy in Swaziland, however, is only 44 years—several points lower even than the average for residents of countries designated as "lower income." Out of all the factors that contribute to Swaziland's generally low rating on the Overseas Development Council's Physical Quality of Life Index (PQLI), poor health and health care seem to be the most significant single factors that place Swaziland well below the PQLI rating for the "lowest income countries."[15] Thus, Swaziland seemed to be a logical candidate for UN assistance to the rural poor under the Decade for Clean Water program.

The selection of the Swaziland site for the UNEP clean water project has not been without its limitations, as well as its critics. It has been argued by officials in some funding agencies that the nature of human settlement in Swaziland limits the transferability of the results of the experiment to other areas. A host government generally has only limited revenues, and donor agencies are interested in getting a larger spread effect with their development funds. This criticism arises from the fact that Swaziland differs from many areas of Africa where the rural population is clustered in villages—as is the case in the Mulanje area of Malawi (described by this author in a subsequent *AUFS Report* on southern African water problems). The Swazi, by contrast, live in scattered homesteads. As Hilda Kuper has described it,

In control of the homestead is the patriarchal headman (umnumzana), *whose prestige is enhanced by the size of his family and the number of other dependents. A conservative homestead may include the headman, his wives, his unmarried brothers and sisters, married sons with their wives and children, and unmarried sons and daughters, as well as more distant relatives....*

The homestead is built according to a definite plan that reflects the main interests of the occupants and their status relationship. In the center is a heavily palisaded, unroofed cattle pen, and...dug into the cattle byre are deep flask-shaped pits for storing the best grain from the fields. Informants state that the pits were devised in the days of tribal warfare to hide food from the enemy, and the fenced cattle byre served also as a stockade against attack....

Grouped round the western end of the byre are the living quarters [*of the wives*]. *The only fixed point is the main enclosure with the "great hut"* (indlunkulu) *under the charge of the mother of the headman, or, if she is dead, of a sister co-wife, or, in special cases, a wife who is then raised to the status of "mother." The "great hut"...is used as the family shrine: in the rear, the headman offers libations of beer and meat....*

Distinct from the huts of the "mother" are the quarters of the wives. In ordinary large homesteads, after a period of service to her mother-in-law each wife is given her separate sleeping, cooking, and store huts, which are shut off from the public by a high reed fence. Within her enclosure...she leads a certain private existence with her own children, who, although legally bound to the patri-kin and an integral part of the wider homestead, are emotionally most closely identified with their own mother.... She is allotted her own fields, and, if possible, cattle for her use, so that her "hut" is a semi-independent social and economic unit.... A headman may establish a smaller homestead for one or more wives, especially if they have grown sons, in order to obtain a wider choice of garden land, or to prevent friction between the women or...to extend political influence....[16]

It is estimated that 80 percent of the 520,000 Swazi residents in the country live in these dispersed homesteads. The number of homesteads is reckoned to be approximately 50,000, with the typical homestead being occupied by 10 persons. The poverty line data accumulated by Professor Fion DeVletter in 1977 estimated that in the northern Swazi area his team surveyed, 92 percent of the homesteads lacked piped water. The situation in the Shiselweni district was thought to be comparable. Each homestead—and this in most cases meant the women of the homestead—had the task of securing water for domestic purposes from wells, springs, rivers, or rainwater catchment systems.[17]

The conditions of dispersed settlement prevail in the district selected for the UNEP demonstration project. There are roughly 1,050 to 1,200 homesteads, containing an estimated 15,000 inhabitants settled in an area of 85 square kilometers. Although the population to be served could possibly reach close to 20,000 in a few years, due to the influx of new residents who were attracted by the development, it was obviously a smaller population than would be served by the less costly Mulanje project in Malawi, where over a quarter of a million residents would be served by village taps. In the Shiselweni scheme each of the homesteads by 1981 would be directly served by a tap unit sufficient to meet the family needs for drinking, cooking, bathing, laundering, and other domestic activities. Although there was no absolute prohibition, tap water in the Swazi project was not to be used for watering gardens or for livestock

purposes. While Dr. Obeng and other officials at UNEP recognized that the per capita cost of the clean water project in Swaziland might severely limit the possibility of replication in other areas of the globe, it was regarded as beneficial, nonetheless. "It will give us," Dr. Obeng argued, "some idea of the cost of clean water on the maximal side of the situation and provide us with an ideal case study for measuring the health, social, and other benefits of the scheme."

A further factor seized upon by critics was the escalation in costs of the Swazi project beyond the initial UNEP-UNICEF budget figure of $2,162,380 (which included a contribution by the Swazi government of $626,520). A critical element in this miscalculation was the initial weight given to gravity flow as a possible means for reducing the overall costs of the project.[18] In the case of the Mulanje water scheme in Malawi, the gravity factor has been a significant element in making the project financially feasible, since all of the water comes from streams high up the slopes of Mount Mulanje. Given the rainfall data on Swaziland, the initial optimism may have been justified, although the uncertainty at this point again demonstrates the pitfalls of relying on gross data in making specific development calculations. Swaziland, it is true, is one of the best watered countries in southern Africa. Its four major rivers—the Komati, the Usutu, the Mbuluzi, and the Ngwavuma—carry water to the Indian Ocean on a year-round basis. Moreover, Swaziland's annual rainfall of 130 cm. in the highveld, 90 cm. for the middleveld, 70 cm. for the lowveld, and 60 cm. for the Lubombo Plateau is relatively high for southern and central Africa. Unfortunately, the absence of area-specific data conceals the fact that there are some locations where water is in short supply during the height of the dry season, and Shiselweni District happens to be one of them! Only one of the seven project phases was capable of being served by the low-cost gravity flow system. One additional phase is to be served by the year-found flow from a spring, but the remaining five are to be served by water pumped from boreholes.Thus there are the additional costs of maintenance, energy to run the borehole pumps, and equipment replacement. Given that the total capacity of the 7 systems is to be roughly 60 liters per person per day, this could be a considerable additional operational cost during the dry season. Since there is a reluctance to impose rates for individual homestead use, this means that the Swazi government will have to find the additional revenue to operate the schemes. The water meters which are being installed are to be used for monitoring purposes only—in order to ascertain whether there has been abuse of the system, such as using the clean water for agricultural or animal husbandry purposes.

Despite the limitations in terms of replication, those UNEP and UNICEF officials most closely connected with the clean water project in Swaziland were convinced of its overall value. Abraha Berhane, the energetic Ethiopian manager of Shiselweni who has been with the scheme since 1977, was convinced that community enthusiasm was one of its more positive features. He attributed this only in part to the bonds of loyalty which have characterized the traditional Swazi political system. It is one of the few areas in Africa where chiefs who base their legitimacy upon the ascriptive criteria of birth, age, and ethnicity are able to organize people effectively for the purposes of communal labor. Under King Sobhuz II, who celebrated his eighty-second birthday in 1980, Swaziland had a brief flirtation with modern political parties and elections before reverting to the type of feudal political system that existed prior to the independence movement. Central to that feudal system is the relationship between the king and the chiefs, who are financially and in other ways dependent upon the king. The chiefs in turn exercise control over the common people through their key role in the allocation of land. Not only does the allocation entitle the chief to an initial payment of a cow or a 10 Rand gift, but there are also continuing obligations on the part of the people to provide free labor, a portion of the harvest (such as a 200-pound bag of maize or sorghum), and other gifts at special occasions.[19] While the influences of modernization such as cash cropping, migration, urbanization, and education are undermining the feudal system, the coercion inherent in the system is still a significant factor in the achievement of developmental goals.

Abraha Berhane, on the other hand, felt there were more significant elements than coercion in sustaining the community enthusiasm for the UNEP/UNICEF project. One positive incentive has been the fact that the plumbing fixtures were already being installed in the homesteads, thus providing some indication of what people could expect to have once the water started flowing. Each plumbing unit, which has been constructed locally, contains a tap for drinking water, a showerhead for bathing purposes, and a spigot and concrete slab to be used in laundering clothes. Not all homesteads, Mr. Berhane pointed out, contain the full unit. For the purposes of comparative evaluation of the impact of the scheme upon health of the community, some homesteads were provided only with communal wash sheds, and a few "control" homesteads were left without a direct supply of clean water.

An unanticipated benefit of the UNEP project is that it has brought new skills into the district. "Finding it difficult to attract trained manpower away from the private sector, where the salaries and perquisites are relatively high," Mr. Berhane commented, "we were compelled to engage in on-the-job training for the personnel we required." The project needed manpower in the laying of pipes, in constructing the water units, and in building the sheds for the pit latrines, which are a complementary phase of the clean water project. Although the clean water plumbing units have been provided free of charge, there has been a levy (equivalent to US$6.00) for the construction of the pit latrines. The revenue thereby secured has gone into a revolving fund for the future maintenance of the water system.

The fruits of the United Nations joint effort will only begin to become apparent in 1981, after the various phases of the water system are hooked up to water sources. Both Mr. Abraha Berhane and Ted Murphy—the Mbabane representative of UNICEF, who hails from Evansville, Indiana—were optimistic that the Shiselweni experiment

would soon be attracting the attention of visitors from other African areas as well as other Third-World countries. They also felt that many of the circumstances of the project could be emulated elsewhere. Even if that latter objective did not materialize, they felt that at least the 15,000 to 20,000 Swazi residents of the district stood a far better chance of being liberated from the scourge of bilharzia. Moreover, they echoed Dr. Letitia Obeng's comments to me in Nairobi that "even if it might be beyond the means of many African states or donor agencies to provide clean water directly to each household, it ought to at least be the ultimate goal of every society that its women should be freed in this generation from the inhumane task of toting water for many miles during the dry season."

USAID Program on Bilharzia in Swaziland

The efforts of the United States government regarding bilharzia control in Swaziland are to complement those of the United Nations in that country. The AID program, however, will not actually commence until late in 1980 or early 1981, and it will run for a five-year period. Its geographic scope will be much more comprehensive than the UN program, since it will cover the country as a whole. Its objective will be to improve the health condition of the rural poor in Swaziland by focusing on the twin problems of safe water control and alteration in sanitation habits. In keeping with the current USAID policy of avoiding major capital construction projects, the program will concentrate on education as the device for limiting exposure of Swazi to sites contaminated by bilharzia and other waterborne diseases. As Dr. Connie Collins, senior health official for USAID in southern Africa, explained: "By education, we refer to the sensitizing of people at all levels of society regarding the problems of waterborne diseases." The AID program, for example, includes convincing the technical staff in the ministries of agriculture, public works, and other areas regarding the environmental consequences of launching new rice cultivation programs or constructing new dams. "We are not opposed to development," Dr. Collins commented. "What we hope is that they will build environmental concerns into their cost analyses of development projects."

Also covered by the category of education in the broader sense was better understanding by the bureaucrats in the Ministry of Health regarding the actual incidence of bilharzia and other water-related diseases in Swaziland. "The epidemiological surveys to date," the AID official commented, "are all somewhat suspect since they rely largely on children in school; and this tells us little about the adult population or the home environment of the schoolchildren." The bilharzia tests have also been inadequate since they tested only for urinary infection and avoided sampling the stools. Hence, the attaching of an epidemiologist to the USAID project is regarded as crucial in conducting the national health survey which will tell not only Swazi officials, but also donor agencies, where they ought to concentrate their efforts in terms of mass education, introducing pit latrines, and the like. "We felt, too," Dr. Collins commented, "that a water technologist could be helpful in telling us more about the life cycle of the bilharzia larva in its Swazi setting, since the virulence of the disease and the habits of the schistosomes vary from place to place around the globe." Another AID official, Dr. Gene Morris, referred to the known fact that schistosomiasis larvae appear to peak in activity between 11 A.M. and 2:30 P.M. "While we do not know the full implications of this," Dr. Morris added, "it may prove useful in terms of restricting people from bilharzia exposure during those critical hours." Such information could be valuable, for example, in managing the extensive wetland rice cultivation schemes that the Taiwan government has been introducing in Swaziland.

Further, in the category of education at the bureaucratic level, the USAID effort would lead to an upgrading of the clinical laboratories and the training of laboratory technicians for better diagnoses of waterborne diseases. Finally, as a means of improving bureaucratic understanding of the problem, the AID program will include the services of a rural sociologist, who will do both a baseline study of people's current knowledge of the nature of waterborne diseases and treatment of illness, as well as a follow-up study over the next three years to measure the effectiveness of the AID educational campaign. One payoff of this greater awareness of the consequences of bilharzia and other diseases is that the donor community and the Swazi government officials might achieve better coordination of their efforts. As one expatriate put it: "It's nothing short of scandalous to see the way government officials, private donors, and representatives of the UN and foreign governments seem to be oblivious of what the other is doing." The official noted several examples of duplication of effort as well as wide gaps in coverage of essential services. "In a country of this size," the expatriate continued, "such an example of 'tunnel vision' is absolutely appalling."

While bureaucratic education was an integral element in the AID program, the primary focus of the five-year effort was to be the rural Swazi resident. The educational approach to control of waterborne diseases is crucial. Most diseases in that category—with the exception of typhoid (as well as cholera, which is not found in Swaziland)—are not yet controllable by inoculation or other indirect means of attacking the diseases. Waterborne disease control requires a high degree of direct human involvement. Informed participation in Swaziland is thwarted by the fact that no more than 30 percent of the Swazi population is literate. As one writer put it:

Like most people in rural Africa, the Swazis have little awareness of the dangers lurking in sluggish river water, or from stagnant pools left after the rains. Shortage of water has never been a problem in this well-endowed country and most Swazis have rivers or streams close to their homes and fetch water from these natural sources whenever they need it. [20]

Lack of awareness and lethargy are not the only impediments to changing the habits of Swazi with respect to reducing the incidence of diseases like bilharzia. As noted previously, there are many political, social, religious, magico-religious, and other factors that can inhibit change and counter the efforts of

USAID officials and others seeking to provide a more scientific explanation of the relationship between the environment and disease. Trying to educate Swazi farmers with respect to the benefits of fencing off human water sources against pollution by cattle and other livestock, for example, runs into a complex of factors involving sex roles, economic and social status, and other issues. By way of illustration, Swazi women bear the primary responsibility of securing the water needed by the family for domestic purposes. Men, on the other hand, dominate the activities relating to the grazing of cattle. To a cattle owner who is interested in enhancing his prestige through the accumulation of a large herd of cattle, that factor may be a more important consideration than the health and well-being of his family. Since males also monopolize political power, getting agreement on legislation protecting water sources may be well-nigh impossible. Taking another example, cultural and religious attitudes underlie some very basic health habits, such as toilet training. Getting people to accept the notion of using pit latrines in common with neighbors and even relatives—or in providing the urine and stool specimen needed to make a proper medical diagnosis—may fly in the face of cultural and religious taboos. Beyond these impediments, there is, of course, the simple resistance to changing the habits of a lifetime, which may make it particularly difficult for the older generation to respond to modern instruction in hygiene.

One of the greatest educational impediments among the Swazi, however, may be the continued belief in the efficacy of traditional medicine. It must be acknowledged, of course, that Western medicine has been learning much from traditional African medicine in recent years—particularly in the use of herbs. Thus, it is easy to adopt a romantic attitude about the role of traditional healers. A great number of the herbs, purges, inhalations, and charms used by the healers, however, are without any redeeming qualities. It is also dangerous to assume that the services of the traditional healer can automatically be "harnessed" in advancing modern medical knowledge and techniques as a supplement to traditional medical practices. "Many of the traditional healers," commented an expatriate with years of experience in African medical problems, "have never been exposed to any systematic type of training, and they would probably resist being retooled as paramedics." One of the problems, this official noted, "is that it is difficult to identify the healers—they don't exactly hang out shingles, you know." Moreover, the "healer is in the field for the money," he insisted, "and the earnings are considerable." Many of the traditional explanations of the causes of illness fall into the category of witchcraft accusations. Some of the recommended treatments, moreover, are absolutely counterproductive, if not destructive to the patient. One of the standard "treatments" for diarrhea, for example, is to prescribe an herb which induces vomiting. Instead of curing the patient, which most often is a young child, the so-called "treatment" further contributes to serious dehydration. One of the dilemmas, as Dr. L. P. Makhubu, a Swazi medical researcher, pointed out, is that resorting to traditional healers or combining traditional cures with Western medicine sometimes cancels out the effect of the latter. She estimated that 80 percent of the Swazi consult traditional healers—sometimes as a form of extra insurance after having received treatment at a Western-type medical clinic.[21]

There are two further aspects of the five-year educational program of USAID in Swaziland which should be singled out for attention. The first is the sanitation phase of the project. Recognizing that a great part of the problem of water resource management is keeping the water source free of human contamination, AID officials felt that educating Swazi with respect to the value of using pit latrines had to be a central element in interrupting the cycle of bilharzia and the other water-related diseases. Consequently, AID will provide the concrete, venting, and other materials needed for the construction of 2,000 demonstration pit latrines. The selection of key homesteads in this experiment will, obviously, be of critical importance in terms both of the actual use of the facilities and the dissemination of information regarding the impact of latrine use in improving the health conditions of members of the selected homesteads.

The second aspect that deserves attention is the key role of women in the program of improving the health information delivery capabilities of the Swazi Ministry of Health. The overall USAID program, of course, will involve formal training of male and female staff officials at various levels in the Ministry of Health. But central to the training would be the augmented instruction given to the over 200 women who serve as Rural Health Visitors (RHV). It is the female RHV who constitutes the direct link with the rural homesteads. The value of the RHV program, which was launched several years ago, is that it vests responsibility for health and hygiene matters in women who are selected by their own community and thus enjoy the confidence and respect required to be effective change agents. The limited funding of the RHV program in the past, however, and the absence of systematic administrative supervision have hampered the program. Since the RHV did not receive a fixed salary for her work, the range of choice available in electing RHVs was restricted to the more politically influential and affluent members of the community.

Under the expanded AID program, efforts would be made to provide more effective supervision of the work of the RHV and to provide a course of training which would enable her to handle a more comprehensive range of duties. Included in the latter would be the responsibility for organizing informal community discussions on health and hygiene relevant to water-related diseases; responding to individual inquiries on health matters; and visiting homesteads to give advice on such matters as the value of pit latrines, the dangers of letting stagnant pools of water accumulate in laundry and bathing areas, the proper method of storing drinking water, and the need to avoid areas which potentially are infested with bilharzia snails. The RHV would work closely with the Ministry of Agriculture's domestic science assistants in giving advice on nutrition, on the value of cultivating backyard gardens, and on family

planning. The last named subject, of course, is a highly sensitive one in a society where the head of state, King Sobhuza II, has fathered over 180 children. Nevertheless, given the 3.4 percent growth rate in Swaziland, it is an issue which must soon be addressed.

"It is ironic," as one expatriate put it, "that the female Rural Health Visitor should be so crucial to the success of health education, in a society which is so male dominated." This stems from the fact that the prime target of health education in Swaziland is the adult female head of household. As noted previously, it is the Swazi mother who has the main duties in the rearing and disciplining of children, providing toilet training for the young, securing the water needed for household needs, and creating family cohesion. As one Swazi elder said: "Men tend the cattle; women tend to children." The centrality of the female role in the domestic setting today is even more significant than it was in the past. Given the high incidence of male labor migration to South Africa in search of employment in the mines, Swaziland (and the same is true of many neighboring countries) has experienced a severe sexual imbalance. For the country as a whole, the ratio is 1.13 females to one male. When one takes into account the internal migration of males to the cities or European estates within Swaziland, the ratio of females to males in rural Swaziland is roughly 1.55 to one. The Fion deVletter survey data on rural poverty in northern Swaziland collected in 1977 revealed that "up to one-third of the homesteads do not have an adult male present, and about one-fifth of the homesteads are headed by women."[22] Such circumstances virtually mandate that the Rural Health Visitors have been women. It was felt that only women—and preferably older, more respected neighbors—could properly serve as agents in charge of demonstrating to rural mothers the recommended health and sanitation techniques needed to combat bilharzia and other waterborne diseases.

The United Nations project in Shiselweni has the benefit for rural females of liberating them from the onerous daily search for water during the dry season, but also has special significance in their overall lifestyle. The USAID educational effort should go far in reducing the emotional concerns of the Swazi mother as well as reducing the family expenditures devoted to medicine, transportation to clinics, and paying traditional healers. Depending upon the interests of the rural female, the educational program would give her more time to spend on the rearing of her children, to supplement the diet by planting a backyard garden, or to pursue wage employment or even a professional career.

Although the rural Swazi mother would be the prime beneficiary of both the United Nations and the USAID program, all Swazi affected by the two programs would experience considerable improvement in the quality of their lives. With the increased time, physical energy, and financial resources available for local investment, the two programs could actually lead to a reversal of the migratory labor patterns. The habits of community cooperation which have been encouraged in the solution of health problems, moreover, could be translated into other developmental efforts in rural Swaziland. Above all, the lessons learned in Swaziland might be of great benefit to the other 200 million persons around the globe who suffer from the ravages of bilharzia.

(September 1980)

NOTES

1. Cf. *Uniterra* (UNEP), Vol. 4, No. 7 (September 1979), p. 5; and Patricia L. Rosenfield, *The Management of Schistosomiasis* (Washington, D.C.: Resources for the Future, 1979), pp. 1-4.

2. Khalid El-Hadidy, "Effects of Industrialization on the Infestation with Bilharziasis in Egypt," *Proceedings of the First National Symposium on Bilharziasis* (Cairo: Ministry of Scientific Research, 1964), pp. 1ff. For general reference, cf. Zea Zimmerman, *Bilharzia in Africa South of the Sahara, 1958-1966* (Johannesburg: University of Witwatersrand, Bibliography, 1967).

3. The drug, amoscanate, had originally been developed by Swiss scientists to treat hookworm. Modifications in the drug by Dr. Ernest Bueding, a veteran biochemist-pharmacologist at Johns Hopkins University, have now readied the drug for testing on humans suffering from any of the various forms of bilharzia. Experimental usage in China has already yielded positive results. When given in conjunction with the antibiotic erythromycin, the drug has almost no side effects and is both inexpensive to produce as well as easy to administer in oral form. *The Sun* (Baltimore: August 17, 1980).

4. See "The life cycle of schistosomiasis" in John Homans, *A Textbook of Surgery*, 6th ed. (Springfield, Ill.: Charles C. Thomas Publishers, 1945), p. 7; also reproduced in Patricia L. Rosenfield, *The Management of Schistosomiasis* (Washington, D.C.: Resources for the Future, 1979), p. 2.

5. Cf. Charles C. Hughes and John M. Hunter, "The Role of Technological Development in Promoting Disease in Africa," in M. Taghi Farvar and John P. Milton, eds. *The Careless Technology: Ecology and International Development* (Garden City, N.Y.: The Natural History Press, 1972), pp. 69-101.

6. Letita E. Obeng, "Starvation or Bilharzia?" in Carl G. Widstrand, ed., *Water and Society; Pt. 1: The Social and Ecological Effects of Water Exploitation in Developing Countries* (Oxford & New York: Pergamon, 1978).

7. Rosenfield, op. cit., p. 7.

8. Cf. also USAID document, prepared for the Sahel Epidemiological and Environmental Assessment for Development of Clean Rural Water Supply Program—the Kingdom of Swaziland," AID/Afr-C-1253 (August 1977), pp. 59-62.

9. Bilharzia, of course, is not the only water-related disease problem in Swaziland. Fasciolopsiasis (giant liver fluke) has intermediate hosts living in or near water. Water-related diseases having an insect vector, such as malaria and

dengue fever, are also found in Swaziland. Indeed, the incidence of malaria has risen dramatically during the past two decades as new rice schemes, dams, and other development projects are undertaken. There are also diseases such as trachoma, typhus, and relapsing fever and infectious skin diseases which would be reduced by having a sufficient quantity of safe water available. Finally there are a number of diseases spread by drinking water or eating food contaminated with fecal material which could contain worms, virus, or protozoa. Amoebic dysentery, diarrhea, hepatitis, typhoid, paratyphoid, etc. could be substantially reduced if greater attention were paid to sanitary facilities and improved toilet habits. One test of schoolchildren in Swaziland showed 85 percent of them have parasites in their stools. USAID, "Swaziland Rural Waterborne Disease Control Project Paper," No. 645-0087 (August 23, 1979), pp. 5ff.

10. Berhane Abraha, "Annual Report, 1978/79 of the UNEP/WHO/UNICEF Assisted Water Supply and Sanitation Pilot Government Project in Swaziland (Control of Bilharziasis, Project No. 03-025/1)."

11. Estimated by Dr. Harriet Sibisi, quoted in USAID, "Rural Water-Born Disease Control Project, Swaziland," Project 645-0087 (August 23, 1979), Appendix E.

12. In addition to interviews with various officials of the Swazi government, UNICEF, and USAID, I appreciated the cooperation of Mr. Ted Murphy and Berhane Abraha in making available the original feasibility study conducted by Mr. C. K. Stapleton of UNICEF and C.R. Jones of WHO, as well as the annual reports for 1978/79 and 1979/80 prepared by Mr. Berhane Abraha. Cf. "Annual Reports of the UNEP/WHO/UNICEF Assisted Water Supply and Sanitation Pilot Government Project in Swaziland (Control of Bilharziasis), "Project No. 03-025/1. Also helpful in the preparation of this report was the AID report prepared in August 1977 for the Sahel Epidemiological and Environmental Assessment Project: "Environmental Assessment for Development of Clean Rural Water Supply Program—the Kingdom of Swaziland," AID/Afr-C-1253.

13. USAID Project, No. 645-0087, op. cit.

14. Hilda Kuper, *The Swazi: A South African Kingdom* (New York: Holt, Rinehart & Winston, 1963), pp. 43-45.

15. Swaziland's rating is 36 out of 100 on the PQLI; the average rating for "lowest income countries" is 49. Cf. USAID Project, No. 645-0087, loc. cit.

16. *The Swazi: A South African Kingdom* (New York: Holt, Rinehart and Winston, 1963), pp. 18ff.

17. Cited in USAID, "Swaziland Rural Water-borne Disease Control Project," op. cit., Appendix E, pp. 15-16.

18. Report of C. K. Stapleton and C. R. Jones to UNEP/WHO/UNICEF (September 30, 1977), mimeographed report.

19. Absolom Vilakazi, "Swaziland: From Tradition to Modernity," in Gwendolen M. Carter and Patrick O'Mear, eds. *Southern Africa: The Continuing Crisis* (Bloomington, Ind.: Indiana University Press, 1979), pp. 273-277.

20. Alastair Matheson, "Stubborn Snails Snare Swazi School Children," *Uniterra* (UNEP), Vol. 4, No. 7 (September 1979), p. 5.

21. Cf. her interesting book *The Traditional Healer* (Mbabane, Swaziland: University of Swaziland and Botswana, 1978).

22. Cited in USAID, "Swaziland Rural Water-borne Disease Control Project," op. cit., p. 42 and Appendix E, pp. 15-16.