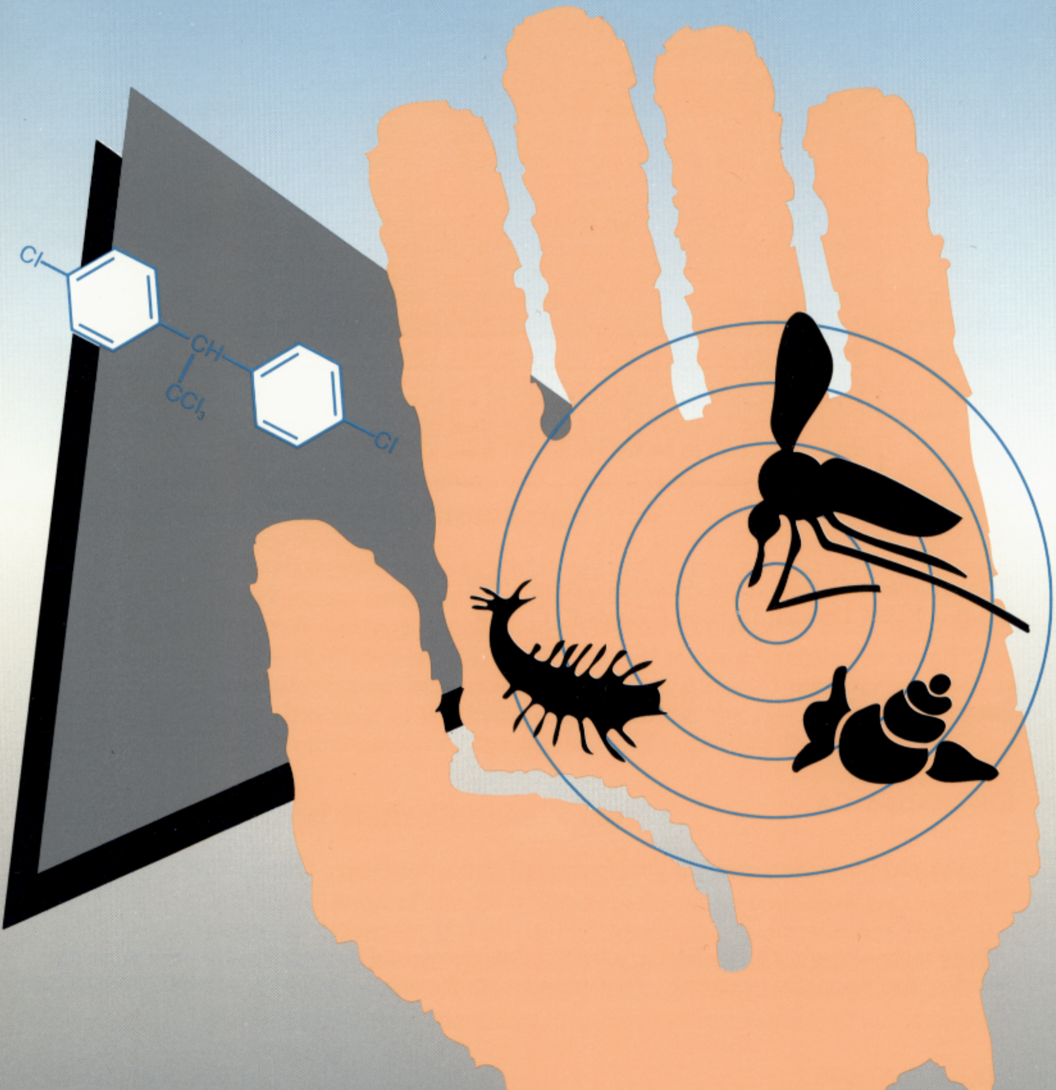
# Health and the Environment

## *A People-Centred Research Strategy*




IDRC

CANADA

## IDRC

Through support for research, Canada's International Development Research Centre (IDRC) assists developing countries in creating their own long-term solutions to pressing development problems. Support is given directly to Third World institutions whose research focuses primarily on meeting the basic needs of the population and overcoming the problems of poverty. Research is undertaken by Third World recipients independently or, occasionally, in collaboration with Canadian partners.

The principles guiding IDRC-supported research are that projects must be targeted to benefit the poor. Support is usually provided to applied rather than basic research. Projects are designed to maximize the use of local materials and to strengthen human and institutional capacity.

IDRC is funded by the Canadian government, but it is autonomous in its policies and activities. Its Board of Governors is international and reflects the nonpartisan, multicultural nature of the organization.

This publication is a slightly modified version of a paper submitted by IDRC to the United Nations Conference on Environment and Development (UNCED) to be held in Rio in June 1992.


PO Box 8500, Ottawa, Ontario, Canada K1G 3H9

Forget, G.

IDRC, Ottawa CA

Health and the environment : a people-centred research strategy. Ottawa, Ont., IDRC, 1992. 36 p.

/New technology/ , /public health/, /risk/ , /environmental degradation/, /environmental effects/, /participatory research/ , /organization of research/ , /poverty/ , /technology transfer/.

UDC: 614.87:005.1 ISBN: 0-88936-600-4

A microfiche edition is available.

*Il existe également une édition française de cette publication.*

# Health and the Environment
## *A People-Centred Research Strategy*

*Gilles Forget*

## *Contents*

# *New Technologies, the Environment, and Health*

## *A new environment: new diseases*

The introduction of new technologies often leads to major transformations of the local environment. New technologies are frequently associated with large-scale development initiatives (for example, hydroelectric dams and agroindustrial activities) that lead to major environmental transformation such as deforestation, water pollution, and air pollution. Such effects often expand or create new health risks for local populations.

For example, a proliferation of water bodies increases the number of breeding sites for disease vectors such as mosquitoes (which transmit malaria, yellow fever, and dengue) and aquatic snails (which are the intermediate hosts for human schistosomiasis). Also, deforestation and soil erosion expand the habitat of sand flies, which transmit leishmaniasis.

Industrial development also brings with it the risk of chemical contamination of the living environment. It may provide a new source of income for local people in the short term; however, the longer term health effects of the associated environmental contamination are seldom considered in the planning process for such activities.

Industrial development is not alone, however. The evolution of agricultural production has also introduced new technologies that represent serious environmental risks. For example, the large-scale use of pesticides may have revolutionized food production, but these chemicals are responsible for more than 2 million human poisonings every year, with a resultant 20 000 deaths (WHO 1986). In many cases of accidental poisoning, the major cause is a lack of knowledge on the part of the user, both on the dangers of these compounds and on how to use them properly (for a discussion of pesticide poisoning in the developing world, see Forget 1991).

In their quest for self-sufficiency, developing countries often face the same health problems that industrialized countries are only now effectively beginning to solve. Clearly, developing countries must continue to consider interventions such as those outlined above if they are to become self-sufficient. These interventions are usually for the greater good of all citizens of the country. Regretfully, they may also have negative effects on health, especially on people living close by. How then can local populations protect themselves from new health risks that are brought about by unwanted environmental change?

## *Any benefits for the poor?*

The direct links between poverty and environmental degradation in both developing and developed countries is well documented. However, there is a predicament that is not stated so clearly in relation to poverty: *poor people can rarely cope with environmental health risks.*

To date, the emphasis has been on resolving global challenges such as the depletion of the ozone layer and global warming. Consideration of these global issues may lead us to pay less attention to human development and how it relates to environmental degradation.

There is a concern that any agreement reached on these critical issues in June 1992 at UNCED (the United Nations Conference on the Environment and Development) in Rio de Janeiro will filter down to the developing-country poor at a pace that may not be commensurate with the environmental health risks they face every day: lack of clean water, endemic diseases, and a shortage of wood for cooking. Of course, the environmental problems that face the poor of the developing world can be a partial result of global problems. In turn, global problems are exacerbated by the reaction of people trying to cope with the local degradation of their environment. It is increasingly recognized that poverty in the developing world contributes to environmental damage (Leonard et al. 1989; OECD 1990; The South Commission 1990). This situation was well summarized by Ramphal (1990):

> Poor people often destroy their own environment — not because they are ignorant, but to survive. They overexploit thin soils, overgraze fragile grasslands, and cut down dwindling forest stocks for firewood. In the context of short-term needs of survival, each decision is rational; in the longer term and wider context the effects are disastrous.... Poverty is both a cause and an effect of environmental degradation.

## *Coping with environmental health risks*

One step toward helping people cope would be an alternative, more equitable development model predicated on the principle of investing in people. This model would identify intersectorial options for action to reverse the downward spiral of poverty, ill health, and environmental degradation.

This model need not be one that reduces the pace of development. In 1968, Gunnar Myrdal, the then future Nobel laureate, argued convincingly for the need to strike a new balance between investment in people (in particular, health and education) and economic growth. He not only proposed that health and education were basic human needs, but also that healthier and more educated populations produced more resilient and skilled workers, better equipped to compete in national and international economies.

In the past 2 years, several public policy reports prepared by international agencies have reinforced a more people-centred and participatory model of development (OECD 1990; UNDP 1990; World Bank 1990). People of the developing world must be allowed to identify the environmental health risks that plague them. Furthermore, the relationship between these risks and development efforts must be recognized. More importantly, sustainable, affordable solutions for countering the health risks represented by environmental changes must be found and tested. This is why research is a vital tool for development in the context of health and the environment. The corollary is that this research cannot find sustainable solutions unless populations at risk are allowed to participate.

## *Empowerment Through Knowledge*

## *What kind of research and why?*

Research can be a powerful tool in assisting the world's poorest peoples to develop solutions for coping with environmental health risks. It is of prime importance to focus on both the physical dimensions of environment and on the human dimensions of development. Health, population, poverty, and environmental degradation are highly interdependent and tightly linked.

There are three general reasons for research. First, research will allow the production of new knowledge vis à vis changing environmental conditions and the new health risks they may represent. Second, research is essential if solutions to these new environmental health risks are to be found and tested. Third, the impact of these solutions on the health of affected populations must be evaluated before expansion and replication is even considered. In this, the greater participation of those most at risk will be the key to success. Too many miracle devices that worked wonders in laboratory or limited field trials have failed miserably in their application.

The current emphasis on global environmental problems is timely. How humanity responds to this challenge may well decide the future of our planet. Regrettably, concern for a similar micro approach to health in relation to the environment is not so clearly articulated. We must openly recognize that the poor of the developing world must cope on a daily basis with environments that threaten their well-being as well as that of their children. Moreover, our recognition must translate into action.

The conventional approach to resolving environmental health risks tends to be grounded largely in biomedicine and engineering. It often relies on a vertical problem-solving approach. Many of the solutions developed through this conventional approach are applications of products already developed in industrialized countries. The problem with such an approach is that it ignores the developing-country context in which the situation exists, often making the intervention irrelevant to the circumstances at hand.

Another shortcoming of this conventional approach is that it presupposes that the poor of the developing world are incapable of dealing with environmental health risks or have no interest in doing so. Yet, the contribution that the poor can make to solving these problems must not be overlooked. Individuals and communities already live and cope under formidable circumstances, attesting to their knowledge of environmental problems and their skill to survive.

The research challenge will be to identify, develop, and implement effective, sustainable, and practical technologies that are simple, serve the needs of the poor, and are within the range of their capabilities and capacity.

## More consensus, more action needed

There is an emerging consensus in the world community that greater participation by beneficiaries is key to successful development efforts (UNDP 1990). At the same time, a new challenge is recognized: How can these new concepts be translated into action?

One way to address this challenge is to identify "success stories" and learn from them. These examples could then be gradually replicated and expanded. Such an approach would enable us to build on past success and further experiment with a diversity of projects aimed at improving human development.

To succeed in the field of development, however, research will have to go beyond the familiar format of hypothesis formulation and testing. Research must include action. As pointed out by Chen (1991), "setting of the research agenda" should go beyond the rather naive and simplistic format of "academics being supported by donors to produce research for use by policy-makers." People-centred research strategies can make important contributions to development; improving health in the context of environmental risks is one area where this is especially true.

Some key principles in the development and planning of such a research strategy are:

- Active participation of the beneficiaries in the identification, planning, execution, and monitoring of research and action strategies.
- Identifying priority needs for research and assessing the capacity of the beneficiaries to participate.
- Transferring appropriate technology and strengthening local technical capabilities.
- Sustainability, replicability (via networking), and empowerment of beneficiaries to address their own problems.

The importance of the first point (active participation of beneficiaries at all stages of the research) cannot be overstated. It should be seen as the starting point in identifying appropriate strategies to counter environmental health risks.

The ultimate test of the sustainability of a development project is whether it can be successfully maintained once external funding is no longer available. Furthermore, the solution discovered must be applicable (albeit in a modified form) to similar environmental problems elsewhere in the developing world. As noted by Annis (1987), "small is beautiful but it may also be insignificant." In this respect, a multilevel networking strategy (linking local, national, and global beneficiary communities, including development workers, scientists, and policymakers) will maximize the prospects of replication.

Such a research strategy allows people to take control of their own environmental circumstances and promotes self-reliant development. Only by empowering beneficiaries to cope with environmental health risks will sustainable solutions be found and implemented.

Technologies can be developed, adapted, and applied to reduce, if not eliminate, environmental risks to the health of people in developing countries. The projects outlined here focus on people, their health problems in relation to the environment, and the quest for practical, community-based solutions. All of the projects were supported financially by the Health Sciences Division of the International Development Research Centre (IDRC) of Canada. IDRC's ultimate objective is that of the developing countries: to create an indigenous capability to use science and technology for the benefit of society. The Health and Environment Program of IDRC's Health Sciences Division focuses on research that identifies, develops, applies, and evaluates technologies and approaches to help people cope with environmental health risks.

## *Building better homes to prevent Chagas disease*

Humans shield themselves from the environment in various types of shelters. These afford protection from wind, rain, and extremes of temperature. They also provide a modicum of privacy as well as safer storage space for personal possessions. What is often not realized is that humans can guard themselves from environmental health risks with a properly constructed shelter. Poorly constructed quarters may present favourable conditions for disease vectors and, in fact, increase the risk of acquiring disease.

A case in point is the infestation of wall cracks and roofing by blood-feeding bugs that transmit Chagas' disease. The insects vectors of Chagas' disease are endemic to nearby fields and forests and naturally infest dwellings constructed of conventional mud wattle, substandard cement, and thatch roofs. Furthermore, traditional construction methods foster a lack of natural interior light and poor ventilation, factors that maintain the dark and humid conditions that are favourable to these insects. Conventionally, houses are periodically sprayed with insecticides. This is an expensive intervention, using imported chemicals, which are costly, often a health risk, and usually cannot be sustained or replicated in developing countries. The endemic nature of the insects ensures that reinfestation will occur as soon as the pesticide has lost its effectiveness (usually over the course of a year).

Building better homes could be an effective way to control the incidence of Chagas' disease. This was the hypothesis that researchers in Paraguay decided to explore.

In Paraguay, scientists from two institutions (the Appropriate Technology Centre at the Universidad Catolica Nuestra Señora de la Asunción and the Health Sciences Research Institute at the Universidad Nacional de Asunción) developed a multidisciplinary project. The team analyzed construction techniques and building materials. It also carefully considered the popular knowledge both of the disease and of shelter fabrication. The project demonstrated that the transmission of Chagas' disease could be interrupted by simple interventions preventing the infestation of homes by the triatomid vector. The project produced an improvement in the living environment of the home, proved that the interventions were sustainable, and showed that the community was motivated to participate. Thus empowered by new knowledge, communities can take control of their own health.

A similar IDRC project took place in Brazil entitled Evaluation of Chagas' Disease Control. Taken together, the Brazil and Paraguay studies show that community-based approaches and simple technologies can empower rural communities to control a serious environmental health risk. Following both studies, the ministries of housing and health of both Brazil and Paraguay have indicated their interest in incorporating these results into their respective primary health care strategies.

## *What Is Chagas' Disease?*

Chagas' disease is an American variant of the African sleeping sickness. It is one of the most serious tropical diseases found in Latin America, both in terms of occurrence and in impact on human health and productivity. About 15–20 million people are infected, and another 65 million are exposed to the risk of acquiring the disease. It can kill after 10 years or more of debilitating illness. There is no satisfactory cure for the chronic phase of Chagas' disease, which is rarely diagnosed during the early, acute phase.

Chagas' disease is a serious environmental health risk. It is transmitted by blood-sucking insects (triatomid bugs) from the forest and savanna that continuously invade human dwellings. There, they breed and feed, transmitting the disease.

## A Chagas-Free Home

**THE ENVIRONMENTAL HEALTH RISK:** Triatomid bugs capable of transmitting Chagas' disease invade human dwellings from the sylvatic habitat.

**EXACERBATING CONDITIONS:** Increasing population pressures lead to migrations to new settlement sites in areas endemic for the insect vector, thereby promoting increased disease transmission.

**THE CONVENTIONAL SOLUTION:** Periodic spraying of dwellings with imported pesticides to kill the resident bugs.

**ITS DRAWBACKS:**

- High cost of imported pesticides makes this vertical intervention difficult to maintain in the long term.
- It is not usually under the control of the people most at risk.
- When the pesticide loses its effectiveness, the unmodified living quarters are rapidly reinfested.
- Pesticides may pose a health risk to livestock and children.

**THE RESEARCH HYPOTHESIS:** Improving traditional construction methods and designing and testing affordable (but superior) building materials to repair existing (or construct new) dwellings can control Chagas' disease by preventing the infestation of homes by the triatomid bug.

**THE RESEARCH TEAM:** A multidisciplinary group of biologists, sociologists, architects, and communicators working in the laboratory and local inhabitants from three rural communities.

### THE ACHIEVEMENTS

**NEW KNOWLEDGE:**

- The prevalence of Chagas' disease in rural Paraguay is high; however, rural inhabitants have little or no knowledge of Chagas' disease or its mode of transmission.
- People are aware of the infestation of their homes by bugs and would welcome their eradication (the bugs inflict painful bites during the night). They would welcome home renovation to achieve this.

**NEW SUSTAINABLE TECHNOLOGIES:**

- After extensive testing and design, new building materials based on traditional substances were identified. These substances are more durable and resistant to environmental degradation, promoting a bug-free habitat.
- New building techniques were devised. They provide better, stronger, brighter, and easier to clean dwellings, while remaining relatively affordable.
- Popular education interventions on Chagas' disease and its control by improved housing were designed and implemented. These measurably increased community awareness and participation in the renovation and upkeep of Chagas-free homes.

**PROJECT FINDINGS:** Chagas' disease **can be controlled** in rural Paraguay by a combination of three **sustainable, community controlled, and environmentally friendly** interventions: 1) Popular education (Chagas' disease and triatomid bugs/improved construction and home maintenance). 2) A **single**, initial fumigation of existing homes to kill all resident triatomids. 3) Dwelling renovation in a way to make the living quarters inhospitable for triatomid bugs, followed by a home-maintenance program.

**THE FUTURE:** Is the intervention sustainable over the long term? What will be the impact on the occurrence of Chagas' disease? What is needed to maintain active community awareness and participation? How can these interventions be integrated as a national strategy for disease control?

## *Fighting malaria with recycled materials*

Houses may also protect humans from other insect-borne diseases, such as malaria. Malaria is an environmental problem that is exacerbated when humans modify the environment to fit their immediate and long-term development plans. Malaria is conventionally controlled by spraying with insecticides to reduce the mosquito population. This technique is exacting a toll on the environment, as insecticides are also toxic to organisms other than mosquitoes, such as humans and livestock. Although this strategy is becoming less and less efficient with the appearance of pesticide resistance, it is still a standard response.

For night-biting mosquitoes, breeding opportunities are better around human settlements, taking advantage of environmental modifications. Of course, this also places these blood-sucking insects in an ideal feeding habitat (close to sleeping humans).

Bed netting is a conventional, yet costly, response to night-biting insects. In recent years, bed nets have been treated with insecticides to either repel or kill mosquitoes on contact. It appears that bed nets treated with insecticides are actually reducing mosquito numbers. The effect on malaria incidence, however, is much harder to measure. Some studies report a considerable reduction in childhood malaria mortality. However, unless the technology can be made affordable, it is unlikely to have any profound impact on global malaria.

Researchers at the National Institute of Medical Research in Muheza, Tanzania, are exploring an affordable alternative. If successful, it would empower communities to control this environmental health risk. The study explores the use of old sacking material to fabricate bed curtains that can be treated with the same insecticide used on the bed nets. It is known that treated bed nets with holes in them perform as well as intact nets; therefore, these curtains will likely be effective. The key issue in this study is that of empowerment: empowering people to protect themselves and their families against a grave environmental health risk. This approach integrates villagers in the process of controlling malaria with local resources. Furthermore, the approach is sound in the context of environmental management. It is an elegant, practical, and innovative use of material that would otherwise be disposed of.

### *What Is Malaria?*

Malaria remains the most important of all tropical diseases, with the highest prevalence and most debilitating effects. Nearly half the world's population, more than 2.5 billion people, live at risk of the disease, and about 250–300 million new cases occur every year, mostly among children. Africa is the worst affected region, with between 1 and 2 million deaths annually. Malaria is caused by a blood parasite transmitted by many species of mosquito.

Ecological and environmental changes, including the proliferation of water resources (breeding grounds for mosquitoes), have exacerbated the problem of global malaria.

## *Curtains for Malaria*

**THE ENVIRONMENTAL HEALTH RISK:** Several species of mosquitoes enter homes at night and bite humans resulting in a high probability of transmitting malaria.

**EXACERBATING CONDITIONS:** Water resource development projects provide ideal conditions for the proliferation of mosquitoes through widespread increase of breeding sites and prolongation of the breeding period. Human habits related to solid waste disposal around the home have also intensified this problem.

**THE CONVENTIONAL SOLUTIONS:** Insecticide spraying for mosquito control; antimalarial drugs as a prophylactic or curative intervention; bed nets.

**THEIR DRAWBACKS:**

- Insecticides and antimalarial drugs are expensive and foreign currency is required for importation.
- Insecticide spraying can cause serious environmental contamination with effects on nontarget organisms, including humans.
- Resistance by mosquitoes to insecticides and by the parasite to antimalarial drugs is becoming widespread.
- Bed nets are often too costly.

**THE RESEARCH HYPOTHESIS:** Sustainable malaria prevention can be achieved through community participation by fashioning bed curtains from the plastic recovered from locally available sacking material made for agricultural products, and then treating these curtains with pyrethroid insecticides.

**THE RESEARCH TEAM:** Scientists from the National Institute of Medical Research (at the Amani Medical Research Centre) in Muteza,Tanzania.

**SIGNIFICANCE OF THE RESEARCH**: There is a growing body of evidence indicating that bed nets treated with insecticide have a dramatic effect in reducing the mosquito population. However, the effect on malaria incidence is much harder to measure. Some studies are reporting considerable reduction in childhood malaria mortality associated with the use of treated bed nets.

This new project will test the following hypotheses:

- The incidence of malaria is reduced by the use of insecticide-treated bed nets.
- Bed curtains made of polypropylene fibres obtained from old sacking material and treated with pesticides are as effective in reducing the incidence of malaria.
- The cost and simplicity of the technology make it sustainable at the community level.

**THE FUTURE:** The project is still in its infancy; therefore, results are not yet available. The project epitomizes the type of simple, environmentally friendly technology that is likely to become a sustained, community-driven intervention with great potential to alleviate a very serious environmental health risk.

## *Health risks from the environment*

There are many factors in the living environment that present a risk to our health. Global environmental considerations affect both North and South. More often than not, however, it is the day-to-day, local environmental health risks that have an immediate impact on the poor of the developing world.

In both rural and urban communities, polluted sources of water for domestic use, as well as poor drainage of excess water and wastewater, create environmental conditions that favour disease transmission. As noted earlier, stagnant ponds are excellent breeding sites for insect disease vectors. The expansion of endemic areas for malaria and schistosomiasis in relation to irrigation schemes and hydroelectric dams is well documented. If the consequences of such water-related development schemes could be addressed by the people most at risk, it would empower them to protect their health at the micro level, notwithstanding macro schemes that are outside their control. The next two studies illustrate how research can provide communities with the technology to do just that.

## *Coconut milk for malaria control*

For countries like Peru, the economic costs, the resources, and the logistics required for mass spraying campaigns against malaria are very limited. There would be a clear advantage for any program that relied on self-directed community action.

Can people modify environmental parameters to reduce health risks? This was the question posed by scientists at the Alexander von Humboldt Tropical Medicine Institute in Lima, Peru. There has been increasing interest on the part of public health officials for using bacterial insecticide to control malaria. It is environmentally safe and deadly only to target organisms such as mosquito and black fly larvae. However, there are logistical problems with its distribution, mainly because of its biological nature (storage, production, shelf life, etc). How could this novel technology be transferred effectively to people in communities in a way that would empower them to reduce the environmental health risk posed by malaria?

The research team developed an innovative and low cost approach to making *Bacillus thuringiensis* var. *israelensis* (Bti) available cheaply in communities where malaria is endemic. The technology focused on using locally available coconuts to grow the biological insecticide. Research demonstrated that coconut water was a good culture medium for Bti. The research team demonstrated that whole coconuts could be inoculated directly with Bti and that laboratory conditions were not necessary. This opened the door to implementing the strategy in the field. Research has shown that two or three inoculated coconuts produce enough Bti to maintain a small, shallow pond free of mosquito larvae for 45 days. A prototype kit for inoculating coconuts was devised.

## *Milking the Coconut*

**THE ENVIRONMENTAL HEALTH RISK:** Mosquitoes breed in ponds surrounding human dwellings and their proliferation seriously increases the risk of contracting malaria.

**EXACERBATING CONDITIONS:** Human activity multiplies mosquito breeding sites, notably in the vicinity of human dwellings.

**THE CONVENTIONAL SOLUTION:** Spraying with pesticides to kill mosquitoes and their larvae.

**ITS DRAWBACKS:**

- High cost of imported pesticides makes regular application impossible.
- It is not usually under the control of the population most at risk.
- Pesticides pose a continuous threat to the environment, more specifically to nontarget species including humans.
- Mosquito resistance to pesticides is reducing the effectiveness of this strategy.

**THE RESEARCH HYPOTHESES:**

- A bacterial insecticide (*Bacillus thuringiensis* var. *israelensis*) can be produced in whole coconuts and used to destroy mosquito larvae.
- The technology can be transferred to communities, which can be taught to produce the insecticide and to use it to control malaria.
- The strategy is effective for controlling malaria in humans.

**THE RESEARCH TEAM:** Scientists from the Alexander von Humboldt Tropical Medicine Institute in Lima, Peru.

### THE ACHIEVEMENTS

**NEW KNOWLEDGE:**

- *Bacillus thuringiensis* var. *israelensis* can be grown in whole coconuts where they survive for at least 18 days in sufficient quantity for use in mosquito larvae control.
- When the inoculated coconut milk is added to pond water, virtually all mosquito larvae are killed; further larval growth was stopped for up to 45 days.

**NEW SUSTAINABLE TECHNOLOGY:** A low-cost prototype kit that villagers can use to inoculate coconuts with only minimal instructions.

**PROJECT FINDINGS:**

- *Bacillus thuringiensis* var. *israelensis*, which is deadly to mosquito and black fly larvae, **but harmless to humans and livestock**, can be grown in whole coconuts and represents a simple, low-cost, and effective means of malaria control through an environmentally friendly intervention.
- The technology is simple and affordable enough to make it accessible to people with no scientific training and very modest means.

**THE FUTURE:** How can the technique be disseminated to other malarial regions? Will the use of the strategy bring down the actual incidence of malaria in other ecological settings?

The second phase of the project will concentrate on the economic, social, and technical constraints that define the practicality, potential impact, and sustainability of the method. Researchers will attempt to gain an understanding of the community and its perceptions of malaria. The purpose being to design a health education program for malaria control.

The success of this project has raised the interest of Peru's Ministry of Health. The Ministry is looking at using this technology within the national primary health care system.

Again, the emphasis of this project was on integrating the community into the problem-solving process. The technology uses locally available material that may otherwise have been wasted. Thus, expensive resources do not have to be deployed from outside the village, thereby improving the potential sustainability of the technique.

## *A snail-killing berry*

Water is essential to all life, and access to clean water is a daily concern in the developing world. Water is also a ubiquitous component of the environment and is often tied to severe environmental health risks for people. This was already alluded to in the previous discussion on malaria, as an indirect influence. It can have a more direct effect, however.

In rural tropical areas, people come in daily contact with water for a variety of reasons: drinking, bathing, washing clothes, and crossing by foot. Such frequent contact with water can lead to infection by water-borne parasites, such as those that cause schistosomiasis. Although the disease is clearly environmental in nature, the health risk is increased by human activity.

### *What Is Schistosomiasis?*

Schistosomiasis is a serious parasitic disease affecting some 350 million people, with a further 600 million at risk. Four species of *Schistosoma* are pathogenic for humans. The infection is acquired through contact with water inhabited by aquatic snails, who are the intermediate hosts. The infective larvae penetrates the skin and develop into worms that inhabit the blood vessels, the intestines, or the urinary bladder.

Schistosomiasis is a chronic disease that seriously impedes child growth and human productivity. In its more severe forms, it can cause paralysis and death.

Schistosomiasis is an environmental health risk, and is exacerbated by any human activity that increases the habitat for aquatic snails, such as irrigation and damming projects.

## *Slowing the Snail's Pace*

**THE ENVIRONMENTAL HEALTH RISK:** Fresh water harbours the snails that are the intermediate host of human schistosomiasis. Simple contact with water (drinking, bathing, washing clothes, or crossing by foot) is sufficient for infection by the schistosome parasite.

**EXACERBATING CONDITIONS:** Expansion of the snail's habitat (irrigation schemes, hydroelectric dams, etc.) and unsanitary human practices favouring the contamination of the environment with the parasite's eggs.

**CONVENTIONAL SOLUTIONS:** Massive spraying of water bodies with chemical molluscicide. Massive chemotherapeutic treatment of affected populations.

**THEIR DRAWBACKS:** The molluscicides of choice are persistent and toxic to many aquatic organisms, and their use poses a serious environmental hazard. Chemotherapy alone does not eliminate the environmental risk of contracting the disease. The cost of combined massive molluscicidal and chemotherapeutic interventions make them impractical to sustain in developing countries.

**THE RESEARCH HYPOTHESES:**

- The saponin contained in the fruit of a naturally occurring bush is a safe, efficient molluscicide.
- It is a practical alternative to existing molluscicides for preventing schistosomiasis.
- The berry can be grown and used by communities for effective, sustainable schistosomiasis prevention.

**THE RESEARCH TEAM:**

- Scientists from the Institute of Pathobiology of Addis Ababa, Ethiopia.
- Scientists from a number of laboratories for toxicity testing in Canada, the United States, the Netherlands, and Ethiopia.
- Scientists from the Blair Research Institute, Ministry of Health, Zimbabwe.

### THE ACHIEVEMENTS

**NEW KNOWLEDGE:**

- Soapberry (*Phytolacca dodecandra*) produces a saponin, Endod, that efficiently and quickly kills the intermediate snail host of the schistosome parasite.
- Endod passed all the toxicity tests in accordance with OECD Minimal Data Requirements for premarket chemicals with a rating of either nontoxic or slightly toxic (except for eye irritation) and is nonmutagenic.
- Ecotoxicity tests indicate that Endod is no more toxic than currently recommended synthetic molluscicides.

**NEW SUSTAINABLE TECHNOLOGY:** High-yielding cultivars of soapberry were identified and propagated.

**THE FUTURE:** Can traditional practices, such as the use of soapberry for laundering, be modified slightly and strategically to have sustainable effects on the occurrence of schistosomiasis? The first comprehensive community-based trials of Endod are now underway in Zimbabwe and include environmental impact studies.

Currently, the conventional environmental fix is to spray bodies of water with a chemical molluscicide to kill the intermediate snail host. The major drawbacks of this intervention are that it is difficult to sustain (because of its cost) and that it seriously contaminates the environment. The recommended molluscicide is toxic to many aquatic organisms, and is persistent in the environment, thus amplifying its toxic effects on nontarget organisms.

In the early 1960s, a group of researchers in Ethiopia discovered that when tiny amounts of a dried soapberry (*Phytolacca dodecandra*) were crushed and mixed with water, the resulting solution killed freshwater snails, the intermediate host for the schistosome parasite. The active ingredient in this solution was Endod, a saponin produced by the soapberry plant. Because the soapberry plant was endemic to the region, scientists thought that this plant could replace the conventional synthetic molluscicide. Soapberry was already used by local populations to wash clothes; thus, its acceptance for schistosomiasis control would be relatively easy. Scientists at the Institute of Pathobiology of Addis Ababa selected some high-yielding cultivars of the plant and studied their life history.

However, the use of this natural molluscicide could not be promoted until it was proven safe. A series of international workshops and consultations was initiated, culminating in a full battery of toxicity testing in accordance with OECD Minimal Data Requirements for premarket chemicals. It was established that Endod is either nontoxic or only slightly toxic to mammals and is nonmutagenic. Ecotoxicity testing has indicated that Endod is no more toxic than the recommended synthetic molluscicides. Indeed, after application, Endod does not remain or build up in the environment.

A team of researchers at the Blair Research Laboratories in Zimbabwe have now started studying the effectiveness of Endod application for schistosomiasis control, looking at the actual decrease of infection rates, the community acceptance of the scheme and the cost efficiency of the intervention. The control of schistosomiasis through the application of this botanical molluscicide can only become a reality if the people at risk find it practical and affordable.

The use of Endod as a botanical molluscicide would offer many advantages. It is both biodegradable and locally available. It can be grown on marginal land by rural people, with the added advantage of stabilizing soils and preventing erosion. Its acceptance as a method for the control of schistosomiasis may also increase its value as a cash crop. Furthermore, it would put the means of controlling a severe environmental health hazard in the hands of the people most at risk, increasing the sustainability of the solution.

Already networking of scientists in the South with those in the North has enabled a discovery from Ethiopia to be further investigated in the laboratories of North America and Europe. Its practical advantages are now being analyzed in Zimbabwe.

## *Transferring technology to people*

As rural and urban populations increase, people live closer to each other and to their own wastes. The pollution of water sources and the living environment with faeces is a serious environmental health hazard. Faecal contamination of drinking water and food is the major cause of acute diarrhea in the developing world. The World Health Organization (WHO) predicts that 3.2 million children under 5 years of age will die from diarrhea in 1991 (WHO 1991).

These projects illustrate how the use of simple, locally produced, community-based technologies can have a more prolonged, substantial impact on human health relative to conventional strategies that focus on breaking the cycle of disease. The people who are the beneficiaries are directly and actively involved in the intervention and, therefore, have a stake in its outcome. The aim of this approach is to assist people to resolve local environmental conditions through the use of methods that are perceived by people as practical, easy to use, and immediately and visibly beneficial.

## *Safeguarding health through the practical use of knowledge*

Ticari and La Chaves are two young rural communities in the District of Rio Frio on the Atlantic coastal plain of Costa Rica. The standard of living in this region is low. People lack many basic services including electricity, public transportation, potable water, and sanitation. Visits by health workers and doctors are irregular.

In 1988, a Costa Rican nongovernmental organization (NGO), Fundatec (based at the Instituto Tecnologico de Costa Rica), began to study the transfer process of low-cost handpumps from Asia through an IDRC-supported project entitled "Participatory Strategies in Water Supply."

The project evolved and, eventually, the NGO was conducting applied research to improve community health by controlling factors in the physical, biological, and social environments that affect the transmission of water- and excreta-related diseases.

The project did not begin as planned. The handpumps imported from Asia took over 6 months to arrive. During this time, the researchers regularly visited the communities, keeping them informed of the whereabouts of the hardware and the expected arrival date. They used the opportunity to become acquainted with the problems of the communities, their needs, and their expectations. For their part, the people of the communities were struck by the candid and forthcoming attitude of the "outsiders," their preoccupation for keeping them informed, their punctuality, and their commitment to keeping their word, a trait they had not previously seen in external experts.

This people-to-people interaction, based on mutual respect and trust, helped maintain the interest of the communities in the project. Researchers and communities became interested in learning from each other. Project activities became a learning process in which people were invited to help shape, change, and criticize the implementation.

The fact that the project investigators took the time to understand community perceptions proved to be very helpful in overcoming the apathy of the communities to improve the hygienic conditions of water sources and latrines. From their discussions about hygiene, with both young and old, the researchers realized that the people of the communities had no understanding of the microscopic world. Any talk about improving hygiene practices was, therefore, meaningless.

To overcome this problem, the team organized a meeting with the community leaders and water committees. A flea with whiskers was drawn on a blackboard and a microscope was set up. The researchers then asked the puzzled audience if they had ever seen the whiskers of a flea, and invited them to see for themselves. The discovery of the microscopic world was a fascinating experience.

The people discovered things they had not previously imagined before, but were now normal facts. With the help of the researchers, community leaders organized a "health week" to talk to their communities about the role of hygiene and the transmission of disease. The microscope and the flea's whiskers were one of the main features of the event. Through this exercise, the communities became aware of the microbial world and the links between health, hygiene, and their living environment.

As the project progressed, a number of technologies were developed or adapted (including handpumps, ferrocement wells, and training workshops on sanitation, hygiene, organization, and management). Community members were also trained as instructors in these technologies. The community instructors successfully replicated the project in a neighbouring community, with the research team acting as technical advisors.

In this project, the aim of the "outside experts" was not to introduce technology, but to add their knowledge to that of the community and work jointly with the communities to solve immediate problems. From this people-to-people interaction and sharing of knowledge, a new form of consciousness emerged. People began to understand how the problems they were trying to solve were part of a larger picture. Today, self-help and self-organization are very much in the minds and actions of the communities of Rio Frio.

## *Transforming faecal contamination*

After the 1976 earthquake in Guatemala, several governmental agencies and NGOs began latrine construction and health-improvement programs in rural areas. Simple pit latrines were introduced with limited success, even though the latrine slabs were donated to the users. The digging of pits was difficult in the rocky ground. People living on small plots did not view the pit latrine as useful or practical because of the lack of space to relocate the latrine once the pit was full. In areas with high groundwater, the pit contents became wet, odorous, and attracted flies.

In 1978, the Centro Mesoamericano de Estudios sobre Tecnologia Apropiada (CEMAT) began to evaluate the technical performance and social acceptability of various improved latrine designs for rural areas. CEMAT was searching for an economical answer that could both fight disease and provide fertilizer. It was very aware that subsistence farmers in Guatemala, many of whom must cultivate land with poor soil, could not afford the ever-increasing cost of chemical fertilizer. The possible use of composted excreta could decrease the dependence on imported, expensive chemical fertilizers and, at the same time, diminish the health risks associated with the lack of proper sanitation facilities.

A modified version of the Vietnamese double-vault latrine was developed in close collaboration with community users. It was named the Letrina Abonera Seca Familiar (the Dry Alkaline Fertilizer Family (DAFF) latrine). This latrine does not have a pit (it is built above ground) and produces fertilizer. It offers several advantages: no digging is required, it can be built in densely populated areas or on small plots, it does not pollute the groundwater, and it reduces the farmer's need for chemical fertilizer while helping rebuild the organic content of the soil.

Between 1981 and 1986, CEMAT promoted the diffusion of this technology through training workshops for rural microenterprises, national and international NGOs, and public institutions working in the sanitation and health sectors. By 1986, more than 3,600 DAFF latrines had been constructed throughout the country.

Since then, CEMAT has conducted many surveys to assess the levels of use, status, and acceptance of the DAFF latrines. They found that more than 60% of the latrines installed by the various organizations had either been abandoned or had never been completed. Through the experience of these evaluation projects, CEMAT discovered that it was not enough simply to develop a sound technology.

Widespread acceptance and effective use depends on the proper organization and execution of replication programs. Complications can easily arise when different organizations, with different levels of expertise and approaches to replication, become involved in the transfer of the technology from one location to another. Promising new technologies can easily fall into disrepute if the quality (of both the

## *Composting Faecal Material*

**THE ENVIRONMENTAL HEALTH RISK:** Indiscriminate defecation practices contaminate drinking water and the peridomiciliary environment with pathogenic organisms causing diarrhoea.
**EXACERBATING CONDITIONS:** The migration of rural populations to the periurban habitat, with concomitant crowding in areas devoid of services and sanitation, has intensified the environmental contamination from faecal wastes.
**THE CONVENTIONAL SOLUTION:** Building pit latrines.
**ITS DRAWBACKS:**

- Digging the pits can be arduous in rocky ground or impractical in sandy soil.
- On small plots, general lack of space is a disincentive for latrine construction.
- If the water table is high, contamination of the aquifer is a risk and the pit content becomes wet and odorous, attracting flies.

**THE RESEARCH HYPOTHESIS:** Human faeces can be managed simply and safely while providing fertilizer for food production.
**THE RESEARCH TEAM:** Scientists from the Centro Mesoamericano de Estudios sobre Tecnologia Apropriada (CEMAT) of Guatemala.

### THE ACHIEVEMENT

**NEW TECHNOLOGY:** A modified version of the Vietnamese double-vault latrine. It is built above ground and produces fertilizer. When one vault is full, the second is used, the contents of the first vault are naturally composted to fertilizer.
**NEW KNOWLEDGE:**

- All pathogenic organisms are destroyed by the composting process, producing a safe fertilizer.
- The composted faecal material is an excellent fertilizer, improving agricultural yield.

**SUSTAINABILITY PROBLEMS:** By 1986, 3,600 latrines had been constructed in the country. Since then, surveys conducted by CEMAT have indicated that more than 60% of the latrines had either been abandoned or had never been completed. It was not enough simply to develop a sound technology. CEMAT has been very active in the last 4 years developing networking mechanisms between communities and macrolevel development agents to promote the exchange of information and collaboration.
**LESSONS LEARNED:** Community-based actions can only be replicated or expanded to the extent that microlevel activities are organized in networks that support and facilitate the exchange of information. Links must be established between the action groups and regional/national organizations.

technology and the introduction process) suffers and the intended benefits fail to materialize. Mechanisms are, therefore, necessary to link local, regional, and national organizations into a supportive multilevel network to ensure proper transfer while remaining sensitive to user needs.

CEMAT has been very active during the last 4 years developing networking mechanisms between communities and macro-level development agents to promote the exchange of information and collaboration. They have also instituted a number of remedial actions, including standardization of essential design features and monitoring tools, training and technical support through technology-transfer workshops for communities and interested organizations, and providing follow-up support to communities on rehabilitation and proper use of the latrines, as well as on fertilizer use.

## *Technology from the South in Canada's North*

It is often assumed that developing countries have little interest and little to contribute to developing of technologies that protect the environment, decrease environmental risks to health, or help to monitor changes in the environment. Yet, the people of the developing world are very aware of environmental concerns and development needs. The following case study is a good illustration on how simple, low-cost technology from the South can be used to help solve intractable problems in Canada's North.

The community of Split Lake is located on a peninsula on the north shore of Split Lake in Northern Manitoba, Canada. It has a population of about 1,600, all of whom are members of the Cree Nation. This community is one of five Indian reserves affected by the Churchill–Nelson hydroelectric project. One of the effects of the hydro project is fluctuating water levels in the lake because of hydro demands. The changes in lake levels affect, in turn, the quality of the community's drinking water.

Water-quality monitoring in the whole region is difficult. The required laboratory facilities are located hundreds of kilometres to the south. Current monitoring procedures, administered by Health and Welfare Canada, involve a community health representative collecting samples at predetermined sites. Samples are collected, packaged, and delivered over land or by air to a provincial laboratory.

The South–North transfer in water-testing technology began in response to concerns expressed by the local Cree health representative. He complained that when a water sample was sent into the provincial system, results were received 4–6 weeks later. By this time, not only were the results useless but, and even worse, Band Council members were never told about the health implications of the test results.

## *South–North Technology Transfer*

**THE ENVIRONMENTAL HEALTH RISK:** Faecal contamination of drinking water transmits diarrheal diseases to humans with a high risk of child mortality.

**THE CONVENTIONAL SOLUTION:** Vertical government programs for inspection and testing of drinking water sources.

**ITS DRAWBACKS:**

- Although there are methods to test the safety of drinking water, these usually require a central laboratory facility, and results of the analysis often do not reach high risk populations in time for remedial action.
- The prospect of carrying out regular inspection of all national water sources is daunting, and logistics are rarely adequate.

**THE RESEARCH HYPOTHESIS:** A battery of simple, cheap, and rapid tests could be used, with modest training, to test water quality on-site, with as much sensitivity and reliability as tests used in a central laboratory facility.

**THE RESEARCH TEAM:** A network of scientists and laboratories in Brazil, Chile, Egypt, Malaysia, Morocco, Peru, and Singapore with the collaboration of scientists from Canada's National Water Research Institute.

### THE ACHIEVEMENTS

**NEW TECHNOLOGIES:** Three simple and rapid methods for testing water quality were improved and adapted for field use; a fourth method, measuring the presence of a virus as an indicator for faecal bacteria, was developed, tested, and packaged in a prototype kit.

**NEW KNOWLEDGE:** Water quality can be tested rapidly, affordably, and reliably in the field using simple methods. The broad spectrum of available techniques makes possible reliable testing in varied ecological and geographical regions of the developing world. Community members can be easily trained to use these methods.

**THE FUTURE:** Can the methods be disseminated as easily to other cultural groups? How can the concept be scaled up in a national/regional plan of water-quality control based in communities? Are there technical questions that still need to be answered?

The inability of governments to provide adequate water-quality monitoring and feedback to isolated communities is a very common problem in the developing world because of the cost of conventional methods. In fact, since 1983, a network of researchers in Brazil, Chile, Egypt, Malaysia, Morocco, Peru, Singapore, and Thailand have been experimenting with simpler and cheaper tests. With the assistance of the National Water Research Institute (NWRI), part of Canada's Ministry of the Environment, researchers in these various countries have been developing and testing a number of simple, reliable, and inexpensive water-quality tests that can be performed in the field.

Based on the involvement of NWRI with the developing-country network on water quality, personnel from Environment Canada proposed a collaborative project with the community Band Council. The objective of the project was to assess the feasibility of introducing simple microbiological water-quality tests for routine use by members of the Band Council. The first phase of the study confirmed the potential usefulness of the tests. No difficulties were encountered with their routine use. When contamination of samples was detected, household heads were informed of the results and remedial measures were promptly applied. The project helped improve the community's understanding of potential sources of contamination, the frequency and types of contamination of both drinking and recreational waters, and the available options for solving the problems.

A second phase is now under way to evaluate the feasibility and sustainability of a locally operated water-quality monitoring system. It will also continue to build the technical capability of the Cree Band Council. The eventual goal is to establish a basic microbiological laboratory, operated by members of the Cree Nation, to service other Indian Bands within boat or car access of Split Lake. The Assembly of First Nations of Canada and the Department of National Health and Welfare, the agency responsible for the supervision of environmental health in the North, are fully supportive of the objectives of these projects.

## *Health and the working environment*

Most human adults spend more of their waking time in a work setting than they do in their domestic environment. In developing countries, this is sadly often true of children as well.

The working environment frequently holds special health risks. These risks are often exacerbated by foreign technology for which developing-country labourers are often ill prepared either socioculturally or intellectually. Mechanization and processes using toxic chemicals are examples of such technology.

The very nature of the work can also produce environmental health risks. Herders, loggers, and oil-prospecting crews, for example, have a higher risk of contracting leishmaniasis.

## *Leishmaniasis as an occupational disease*

In Peru, Andean leishmaniasis affects agricultural populations of the slopes and valleys of the Western Andes. Treatment of lesions with drugs is a difficult, lengthy, and expensive process, often requiring hospitalization. Drastic and painful practices causing disfiguration are commonplace as local therapeutic measures are used.

In 1986, a collaborative project supported by IDRC between the Universidad Peruana Cayetano Heredia, the Alexander Von Humbolt Tropical Medicine Institute, both located in Peru, and the University of British Columbia (Canada) was carried out to define the epidemiological pattern of Andean cutaneous leishmaniasis. The project not only attracted overwhelming support from the Peruvian Ministry of Health, but also stimulated, for the first time, greater awareness and concerted action by the Andean communities to control this debilitating disease. Although the research team focused initially on the control of a specific disease, it is their environment-focused and community-based strategy that is worthy of note. By actively involving communities in the control strategy, these communities built a local health centre and organized volunteer health committees to facilitate active and passive case detection and treatment of leishmaniasis, as well as other health problems.

The project revealed that the transmission of the disease was related to the working habits of the population. Farmers and their families travel to their fields and remain there for varying periods of time (ranging from several days to several weeks) using provisional shelters. As these shelters are open, people are exposed to sandfly bites. Peak rates of transmission occur while people are in the crop fields. The project revealed that disease transmission was intensely focused near ravines scattered throughout agricultural land and grazing fields. These ravines, conspicuous for being rocky and having sparse vegetation and few trees, are resting places for sandflies. There is also evidence that indicates a marked decrease in sandfly population after the planting of eucalyptus trees.

The same research team is carrying out a second project, to develop an appropriate control strategy for Andean leishmaniasis with the participation of the valley communities. It will investigate the effect of controlling the vector population (sandflies) around community working environments. This will be done through reforestation of the sandflies' common resting places. Community participation will focus on reforestation activities. The people in the project communities have experience in this activity; they own and manage a small eucalyptus

## *What Is Leishmaniasis?*

With an estimated 12 million cases worldwide, leishmaniasis has been identified by WHO as the least studied and least understood of the major parasitic diseases of the world.

The disease is associated with considerable morbidity, debility, and mortality. At least 350 million people are at risk. The parasite circulates naturally in animal reservoirs and is transmitted to people through the bite of sandflies. Sandflies are active during the day and are an occupational health risk to agricultural workers. Other high risk groups include workers in development projects (oil drilling, mining, road construction, and agriculture). Clearly, environmental changes brought about through human activity have exacerbated the public health risk of leishmaniasis.

## *Sandflies in the Works*

**THE ENVIRONMENTAL HEALTH RISK:** Sandflies, which inhabit deforested zones, transmit leishmaniasis to humans from infected domestic and wild animals through bites.

**EXACERBATING CONDITIONS:** Ecological changes associated with development and industrial projects, such as deforestation, road construction, mining, oil drilling, and mega-agricultural activities, as well as occupationally related migration, place populations at greater risk of transmission.

**CONVENTIONAL SOLUTIONS:**

- Limited scale insecticidal spraying for sandfly control.
- Animal reservoir destruction campaigns.
- Antileishmaniasis drugs.

**THEIR DRAWBACKS:**

- Insecticide spraying is ineffective and prohibitive (sandfly breeding and activity are widespread) and can generate widespread contamination of the environment.
- Destruction of domestic animals is often unacceptable to the local population.
- Drugs are very expensive and cause side effects that often require careful follow-up.

**THE RESEARCH HYPOTHESIS:** People can be trained to reduce leishmaniasis by simple early diagnosis methods and environmental control of sandfly breeding through appropriate forestation practices.

**THE RESEARCH TEAM**: A multidisciplinary field research team from the University Peruana Cayetano Heredia and the Alexander von Humboldt Tropical Medicine Institute in collaboration with scientists of the University of British Columbia (Canada) are working closely with the national health authorities.

### THE ACHIEVEMENTS

**NEW KNOWLEDGE:**

- Transmission of leishmaniasis is related to working habits and conditions of the Andean population.
- There are specific intense transmission foci (ravines scattered throughout agricultural land and grazing fields).
- There is a marked decrease of sandfly infestation in areas planted with eucalyptus trees.

**NEW TECHNOLOGY:**

- A new sensitive diagnostic test (ELISA) was developed and validated for leishmaniasis.
- A local health centre has been established to move beyond leishmaniasis into general health and to facilitate education, early diagnosis, and simplified treatment strategies, with only minimal assistance from the traditional health authorities.

**THE FUTURE**: The establishment of cost-effective, replicable procedures for widespread application in all endemic foci of the country and, hopefully, in the entire region.

forest, which provides wood for construction, carpentry, and other needs. This strategy will also improve the local environment, increasing the availability of fuelwood and building materials, helping to stabilize the soil, thereby preventing soil erosion and landslides and regenerating the local natural ecology.

The comparative advantage of the strategy used in this project is its use of local knowledge and practices to resolve an environment risk to human health. The simplicity of the solution and its compatibility with the day-to-day activities of the beneficiaries serve to reinforce sustainability and success.

## *Participatory research and the steel workers of Mexico*

Industrial development in many developing countries is occurring within a context of scarce resources and ineffective structures to address issues of health and safety within the workplace. Poor countries are being squeezed between scarce financial resources, more competitive global markets, and an imperiled environment. In the developing world, it is not uncommon to find a concentration of heavy industries in particular locations, designated by governments as "export-processing zones" or "development poles." But the rapid introduction of technologically complex and potentially hazardous processes into a social context ill prepared to control the associated risks can result in serious consequences to the environment and the health of people.

Short-term maximization of profits often means minimizing costs. A consequence of this is that the occupational health risks to workers are assigned very low priority. Many industries operate sophisticated production processes with obsolete or unsafe machinery. Skilled and experienced personnel to service and maintain equipment is often lacking. Spare parts are difficult to obtain. In many countries, the process for establishing standards and regulations to govern occupational health and safety in the workplace is either very recent or outmoded. Governments often lack adequate resources and technical capability to develop, implement, and sustain institutional and regulatory mechanisms to protect the well-being and health of workers.

Within these constraints, the challenge is to plan and implement compatible policies for industrial development and occupational health and safety. One means of evolving toward sound policies may be through the active participation of the people most directly affected by an unhealthy workplace: the workers. Opportunities for change can be created through participatory research mechanisms that build on the knowledge of workers and generate action around health issues.

The experience of a research project supported by IDRC in the steel industry of Mexico demonstrates how workers can make a valid contribution toward improving their working environment. Through a worker-participation approach, a university-based research team worked with the union and the workers to identify and assess health risks in the workplace. They then used this information to plan practical solutions to redress safety and health issues.

The labour force, young men of rural origin, had little previous experience in industrial work. The technical personnel lacked the knowledge to plan and implement the necessary protective measures in the workplace. A paradoxical social situation occurred: the workers had, on the one hand, comparatively favourable wage and social security conditions, but, on the other hand, they were exposed to very dangerous working conditions. Because of the workers' lack of experience, it took them several years to recognize the health risks associated with their working environment. It was only after health problems started to appear that worker concern began to grow and actions to reduce the health risks were initiated.

The first step was taken in 1986, when researchers from the Universidad Autonoma Metropolitana-Xochimilco, at the request of the union, began to work together with the workers to raise their awareness of occupational health issues. A research project was initiated to develop simple participatory tools to identify and evaluate occupational risks in the workplace. The results were to be used by the workers to generate proposals on remedial and preventive actions. The underlying assumption of this methodology is that the day-to-day experience of a group of workers sharing the same working conditions is a rich source of knowledge that can be used in the formulation of proposals for intervention.

A subsequent study supported by IDRC was carried out to validate this methodology and was called "Occupational Health in the Metal Industry (Mexico)." Its purpose was to analyze the reliability and possible biases in the information collected by the workers. The study confirmed that the approach and the data were particularly useful in changing working and health conditions and establishing preventive measures. Application of the method by the workers serves two purposes: it produces organized knowledge about risks and health issues related to the workplace and it serves as an educational process, allowing the workers to analyze and become aware of the specific problems involved in their work. The combination of these two aspects empowers the workers to formulate and carry out valid actions for change.

A similar project is being conducted by the Zimbabwe Congress of Trade Unions (ZCTU). The difference between the Mexican and Zimbabwean experiences rests with the nature of the research team. In the Mexican case, a university-based research team assisted the union in planning and implementing the research project. In Zimbabwe, the research team is the union. This illustrates that research is not the exclusive domain of academics. The demystification of applied research and the use of participatory research are two of the principles of a people-oriented approach.

# *Learning From and With People*

## *Lessons learned*

The continuing degradation of the environment increases the risks to the health and well-being of populations everywhere. This reality demands urgent and immediate remedial action. Even though earnest dialogue at the international level heightens public and political awareness about this issue, direct benefits to disadvantaged populations are often slow to follow. The time required to adopt national policies, develop strategies and programs, allocate resources, implement programs, and develop national standards and measures can often be very long.

Under these circumstances, it may be too much to expect that international dialogue could significantly and immediately benefit the poor of the developing world who face serious environmental health risks on a continuing and daily basis. Moreover, new international policies and conventions are unlikely to address the major environmental risks they are already facing and increasingly likely to be facing tomorrow.

Using concrete examples, this publication illustrates that applied research can go a long way in helping people to solve their immediate and medium-term health problems. The chances of a sustainable solution are enhanced with the active participation of beneficiaries and a sharing of knowledge about the environment and its associated health risks. With funding from IDRC, these projects have confirmed that it is possible to link laboratory-based research to the realities and conditions of the field. Such technology transfers are only possible, however, if their initial development considered the real needs and existing capabilities of the intended beneficiaries.

The technologies described share the following characteristics:

- They are environmentally sound.
- They empower the users to cope with health risks.
- They are sustainable within the context of prevailing local resources.
- They are people-oriented rather than disease oriented.

There are also many operational factors in the development of a project that may positively affect its outcome. In most instances, project protocols were refined through active consultation between the developing-country scientists and IDRC scientists. In this way, the recipient institution benefited from the broader context of similar studies supported elsewhere in the world. At IDRC, grants are only considered for submissions from *developing-country institutions*. Submissions are scrutinized for their relevance to the priorities of target communities as well as for their scientific validity. The practicality of the technologies and the short- to medium-term potential benefits to people are always stressed during project development. The suitability of the technology and its relevance to people are always assessed through field trials. If such trials are not part of the first phase of the project, they are included in follow-up phases. Participatory research projects are only funded if evidence is provided that the participating communities are already fully integrated into the process of research design and utilization.

As is the case with all research, even the most promising or innovative technologies can fail. An example is the series of projects on the development of composting latrines in Guatemala (DAFF). The first phases of the project demonstrated that the concept was sound and that fertilizer of high quality (field proven) can be produced. The potential for income generation as well as faecal hygiene was real. Why then, have the DAFFs not become the standard latrine in the Guatemalan countryside? The initial development work was undertaken in isolation from the potential users. User preference was not given sufficient precedence, and the result was that a technology was proposed to communities that may not have felt that it fulfilled their own needs and priorities. The lesson from these projects is that it is not enough to work *for* people; unless research teams work *with* people in designing and testing the interventions, demonstration projects are unlikely to succeed at the community level. Furthermore, these demonstration projects can serve an important purpose if they are the opportunity for:

- "Marketing" and getting feedback on the technology demonstrated; and
- Setting in place supportive networks of local, regional, and national organizations that will ensure the sustainability of the intervention and gauge evolving user needs and perceptions.

Other projects that build on an extensive participation of the community can sometimes achieve the research objectives but fail to bring about sustainable development if the external environment is unfavourable to change. Such was the fate of the project on workers' participation in the steel mills of Mexico. The study conclusively proved the research hypothesis: *Workers are perfectly able to identify occupational risks and hazards in the workplace.* However, the deteriorating economic situation and lack of favour from the steel mill management led to the disbanding of the shop-floor research teams and, in some cases, the discharge of workers. This prevented any practical follow-up of the project recommendations, which could have led to a bipartite monitoring of occupational health and safety involving the workers and the management of the steel mill.

The results were, nevertheless, important; although they may not have benefited the participating community directly in any tangible way, they led the way for other similar projects that sit in a more viable socioeconomic environment. The lesson is that the sustainability of results must often be judged on a series of projects (sometimes including different geographical, political, and cultural settings) rather than on the basis of a single case.

However, donor agencies must carefully examine projects to determine if they are likely to present unacceptable risks for recipient communities. The ethical aspects associated with funding such projects cannot be overemphasized! If risks are foreseen, they should be assessed with recipient communities and only after careful joint consideration should the project go forward.

It is possible for people to organize and act to identify problems, find solutions, and assist other people facing the same or similar environmental health risks. People are the strength of a people-centred strategy, a strategy for research in which IDRC believes.

We must strive to resolve the environmental health risks that face humanity all over the globe in a more permanent and sustainable manner. To do this in an equitable fashion, the people of the developing world must be allowed to identify and solve their own problems. To achieve this, industrialized countries must continue to fund applied research, must strengthen the research capacity of developing-country scientists and institutions, and must increase their investment in people.

# *References*


Annis, S. 1987. Can small-scale development be a large-scale policy? The case of Latin America. World Development, 15(Suppl.): 129–134.

Chen, L. 1991. Summary of the Health Transition Workshop at Harvard University. Health Transition Review, 1(1): 115–122. Health Transition Centre, Canberra, Australia.

Forget, G. 1991. Pesticides and the Third World. Journal of Toxicology and Environmental Health, 32: 11–31

Leonard, J., Yudelman, M., Stryker, J.D., Browder, J.O., De Boer, A.J., Campbell, T., Jolly, A. 1989. Environment and the poor: development strategies for a common agenda. Overseas Development Council, Transaction Books, Washington, DC, USA. 222 pp.

Myrdal, G. 1968. Asian drama: an inquiry into the poverty of nations. Pantheon, New York, NY, USA. 2284 pp.

OECD (Organisation for Economic Cooperation and Development). 1990. Towards a green development strategy. In 1990 Report on Efforts and Policies of the Members of the Development Assistance Committee. OECD, Paris, France. pp. 29–43.

Ramphal, S.S. 1990. Third World grievances. EPA Journal, 16(4): 39–43.

The South Commission. 1990. The challenge to the South — the report of the South Commission. Oxford University Press, Oxford, UK. 325 pp.

UNCED (United Nations Conference on Environment and Development) Secretariat Documents:

A/CONF.151/PC/16 Secretariat: "Progress Report on Environment and Development"

A/CONF.151/PC/45 Secretariat: "Poverty and Environmental Degradation"

A/CONF.151/PC/46 Secretariat: "The relationship between demographic trends, economic growth, unsustainable consumption patterns and environmental degradation"

A/CONF.151/PC/54 Secretariat: "Environmental health aspects of development"

A/CONF.151/PC/CRP.14 Secretariat: "Chairman's summary of discussions on poverty, education and health"

A/CONF.151/PC/L.40 Secretariat: "Decision on women in environment and development"

A/CONF.151/PC/L.48 Secretariat: "Decision on indigenous peoples and local communities"

A/CONF.151/PC/L.51 Secretariat: "Decision on cross-sectoral issues (poverty, sustainability, health and education)"

UNDP (United Nations Development Programme). 1990. Human development report, 1990. Oxford University Press, New York, NY, USA. 189 pp.

WHO (World Health Organization). 1991. World Health Commission on Health and Environment: draft report. WHO, Geneva, Switzerland.

WHO (World Health Organization). 1986. Informal consultation on planning strategy for the prevention of pesticide poisoning. WHO, Geneva, Switzerland. WHO/VBC/86.926.

World Bank. 1990. World Bank development report, 1990. Oxford University Press, New York, NY, USA.

# In the Same Series

## *The Global Research Agenda A South–North Perspective*

It is useless for scientists from the North to set up ultra- modern laboratories and concentrate on the pure sciences — the solution to world problems cannot be solved in one hemisphere. Without the immense resources of the South, without access to the knowledge and discoveries of those who are making inroads in the South, few technologies will make a noticeable difference to world problems.

## *A Patent on Life Ownership of Plant and Animal Research*

*by Brian Belcher and Geoffrey Hawtin*

Patent legislation was not designed for living organisms. The limits are being set by the courts using laws written before the invention of genetic engineering techniques. The resulting decisions are inconsistent, and the implications of patents on living things are not known. It is clear, however, that there are serious technical and ethical issues that need to be addressed. The repercussions for developing countries may be even more serious than for the developed countries.

# The author

**Gilles Forget** is currently the Associate Director for Health and the Environment at IDRC. He has also held the positions of Associate Director and Senior Program Officer of Occupational Health and Environmental Toxicology. He holds a DSc in Pharmacology and Toxicology and an MSc in Pharmacology.

He serves on the Scientific Committee on Pesticides and on the Scientific Committee on Occupational Health in Developing Countries of the International Commission on Occupational Health. He has authored and coauthored numerous publications on related issues and has served as a Lecturer and Research Fellow at the University of Sherbrooke and as a Canadian Technical Expert and Professor at the College Polytechnique Universitaire d'Abomey-Calavi, Benin, West Africa.

The ***Searching Series*** is intended for an informed public concerned with the broad questions of international development. The opinions expressed are meant to inform and encourage interest in the issues related to research and development. In an effort to understand our developing world better, *Searching* examines the common challenges that face both North and South.

## IDRC

Through support for research, Canada's International Development Research Centre (IDRC) assists developing countries in creating their own long-term solutions to pressing development problems. Support is given directly to Third World institutions whose research focuses primarily on meeting the basic needs of the population and overcoming the problems of poverty. Research is undertaken by Third World recipients independently or, occasionally, in collaboration with Canadian partners.

The principles guiding IDRC-supported research are that projects must be targeted to benefit the poor. Support is usually provided to applied rather than basic research. Projects are designed to maximize the use of local materials and to strengthen human and institutional capacity.

IDRC is funded by the Canadian government, but it is autonomous in its policies and activities. Its Board of Governors is international and reflects the nonpartisan, multicultural nature of the organization.

This publication is a slightly modified version of a paper submitted by IDRC to the United Nations Conference on Environment and Development (UNCED) to be held in Rio in June 1992.


PO Box 8500, Ottawa, Ontario, Canada K1G 3H9

Forget, G.

IDRC, Ottawa CA

Health and the environment : a people-centred research strategy. Ottawa, Ont., IDRC, 1992. 36 p.

/New technology/ , /public health/, /risk/ , /environmental degradation/, /environmental effects/, /participatory research/ , /organization of research/ , /poverty/ , /technology transfer/.

UDC: 614.87:005.1 ISBN: 0-88936-600-4

A microfiche edition is available.

*Il existe également une édition française de cette publication.*

20 YEARS OF DEVELOPMENT THROUGH RESEARCH

IDRC CANADA

**Searching Series 3**