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Udo E. Simonis*

Poverty, Environment and Development

The United Nations Committee for Development Planning (CDP) in its annual report 1992 will address the relationships between poverty, environment and development, as a kind of input to the discussion that led to and will ensue from the United Nations Conference on Environment and Development (UNCED). We have asked Professor Udo E. Simonis, a member of the CDP and chairman of a respective working group, to summarize the main findings and recommendations of that report.¹

Sustainable development is a concept that so far has eluded a simple and precise definition. The concept arose as a reaction to negative experiences. Both in the developed and the developing countries past patterns of economic growth have been accompanied by various antinomies. Most importantly, the natural capital stock on which all development ultimately depends has suffered considerable degradation and depletion. Perpetuating past patterns of economic growth would result in ecological collapse.

In an ecological sense, sustainable development would call for development patterns that maintain the natural capital stock and overall ecological integrity. Strictly speaking this would imply that development be based only on renewable resources, used at a rate at which they regenerate.

A more pragmatic view places the emphasis on development first and on ecological integrity to the extent that it is important for sustained development. In this view, key ingredients for sustainable development are seen to be

- ☐ eradication of poverty so as to prevent the poor from causing resource depletion, which calls for changes in socio-political structures;
- ☐ clean or cleaner technologies to mitigate environmental degradation, which would call for R & D investment and environmental impact assessment;
- ☐ slowing-down population growth, so as to relieve the pressure on natural resources;
- ☐ internalization of environmental costs, so as to reduce

discharge of harmful emissions and disposal of hazardous wastes, etc.

Such principles and respective measures, it is believed, would mitigate the negative effects of current patterns of economic growth, prevent further degradation of the natural resources base, and at the same time contribute to the alleviation of poverty. How valuable are such considerations vis-à-vis rural and urban poverty in the developing countries?

Extent and Causes of Land Degradation

In the rural areas of the developing world, poverty defined as severe deprivation of basic needs is, first of all, linked to landlessness. According to recent estimates, 73% of all rural households in the developing countries are either landless or near-landless. Assuming an average household size of 5 to 6 people that translates to 935 million rural people who have too little land to meet the minimum subsistence requirements of food and fuel. (This estimate excludes China which could add 200 million absolute poor.) To this must be added another 1,000 million people who are living on the borderline of absolute poverty. Land scarcity on account of population pressure and skewed distribution of land are the prime causes of landlessness.

A second characteristic of the rural poor is that the majority of them have become clustered on low-potential land. Pushed into marginal areas, the poor have no choice but to overexploit resources available to them in order to survive. Survival thus takes precedence over concern for the future viability of the land. Some 60% of the developing

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¹ The full report, including the data references, should be available by the end of 1992 as a United Nations publication.

world's poorest people live in highly vulnerable areas – arid and semi-arid lands, steep slopes and poorly serviced urban lands. The “retreat” of the poor to fragile lands with low agricultural potential is the result of a combination of factors: industrial development and urban sprawl, commercialization of previously common land, modernization of agriculture with reduced labour inputs, and population pressure in previously sparsely populated areas.

Desertification

Land degradation is reflected in a decline of land productivity due to depletion of the vegetative cover, exposure of the soil to wind and water erosion, reduction of the soil's organic and nutrient content, and deterioration of the soil structure and its capacity to retain water. This process is referred to as desertification. It may be the result of natural phenomena, like frequent and prolonged droughts. In recent times, however, desertification has been aggravated by the action of man. Large-scale deforestation, slash and burn agriculture, overgrazing and overcultivation of marginal lands are among the main causes.

By the early 1980s, some 1,987 million hectares of productive dryland had been desertified. Of this, 1,536 million hectares were to be found in the developing world. At the regional level, Africa is the most affected, accounting for 37% of the area desertified worldwide, followed by Asia, accounting for 29%.

What should be of great concern is that the rate of desertification continues to accelerate in parts of Sahelo-Saharan Africa, the Near East, Iran, Pakistan, and North East India. The semi-arid area of northeastern Brazil and parts of Argentina are subject to similar conditions. Morocco, Tunisia and Libya are losing some 100,000 hectares of rangeland and cropland each year through desertification. Worldwide it is estimated that desertification is claiming 6 million hectares of land each year.

Deforestation

Desertification is likely to be exacerbated if the process proceeds unchecked, particularly if cleared land is put to unsustainable use. Deforested land is subject to soil erosion which is slowly undermining about one-third of the world's cropland. According to FAO, soil erosion could reduce agricultural production in Africa by one-fourth by the year 2000.

Deforestation affects agriculture in other ways. It alters the local hydrological cycles by increasing run-off and affecting rainfall inland. The former effect is starkly evident

in the Indian subcontinent where deforestation of the Himalayan watersheds has raised rainfall run-off, causing increasingly severe flooding; the area affected has more than tripled since 1980, from some 19 million to 59 million hectares.

Another effect of deforestation is increasing scarcity of energy for the poor. Fuelwood and charcoal supply over 75% of the total energy use in several developing countries, such as Bangladesh and Ethiopia, and even oil producing Nigeria. In terms of people involved, over 2,000 million use wood for domestic heating and cooking. Projections for the year 2000 suggest that without remedial action, 2,400 million people will be unable to obtain their basic energy requirements. While there may be room for increasing efficiency of use, the problem is obviously daunting. Sources of cheap fuel for the poor, such as dung and biomass, are not in plentiful supply either, and their use may have the effect of depriving agricultural land of vital nutrients. Other alternative sources, such as solar and wind energy, so far are too expensive and will not come within the reach of the rural poor unless vigorous initiatives are taken, both nationally and internationally, to promote and disseminate them.

The causes of deforestation vary from region to region, with the expansion of agricultural production being the most important single factor, followed by ranching (mainly in tropical America), colonization programmes (mostly in tropical Asia), and overexploitation for fuelwood (particularly in the dry zones of Africa).

The absolute number of people living in tropical forest areas has been on the rise. Estimates put the current number at 200 million. A high proportion of these people are recent poor immigrants who have been forced into forest areas due to increasing land scarcity in the existing agricultural areas. Tropical forest areas thus have become “safety valves” for countries facing a rising tide of landlessness because of population pressure on high potential land, for instance in Indonesia; limited urban absorption of people displaced by agricultural modernization, for instance in Brazil; or grossly inequitable distribution of agricultural land, for instance in Central America.

In the face of population growth, massive poverty and landlessness in many developing countries, it is not easy to imagine how deforestation can be stopped and reversed. The problem has, however, received great international attention in recent years, mainly in connection with the loss of biodiversity and reductions of the size of carbon sinks. This attention could be channelled towards new solutions of international support, like compensation schemes for instance.

Water Scarcity

Water scarcity is increasing rapidly in most of the developing countries. Asia and Africa are facing the greatest problems. In Asia, water supply per capita is less than half the global average. In Africa, the situation is mainly one of underdevelopment of water resources, and uneven distribution.

Over the years, the limits set to freshwater availability by nature have been exacerbated by man. Expansion of irrigation and industrial use of water have led to increased water withdrawal. On account of leaks in the distribution systems, a high proportion of water is lost. More groundwater has been withdrawn from aquifers than is recharged naturally, with possibly disastrous long-term consequences for agriculture in the arid and semi-arid areas of the developing world. Altogether some 53 developing countries could face severe water scarcity by the year 2025, and 19 are already in that situation. In most of these countries, industrial and household demand for water strongly compete with the agricultural sector for the limited water supply, making food self-sufficiency probably an elusive goal.

Concern about water relates not only to its quantity but even more to its quality. Problems of water pollution must be seen in the context of rural and urban health problems.

Environmental Degradation and Rural Health

The rural poor mainly suffer from ill health on account of undernutrition and/or malnutrition. Their health is further affected by various forms of pollution and agricultural hazards, most importantly by water pollution, indoor air pollution and exposure to pesticides and herbicides.

High proportions of the rural poor depend for drinking water on water bodies that are heavily polluted. Storm water run-offs carry herbicides, pesticides and chemical fertilizers as well as human and animal wastes into the water bodies. Rivers flowing through urban areas to rural areas are contaminated with industrial pollutants and sewage directly discharged into the rivers. Diseases caused by microbial pollution of water and related to inadequate sanitation are widespread.

According to WHO, up to 2,000 million people are at risk from diarrheal diseases, 800 million from diseases affecting skin and eyes, 500 to 600 million from bilharzia, over 100 million from Guinea-worm, 50 million from sleeping sickness, 900 million from Filariasis, 2,100 million from Malaria, 85 to 90 million from river blindness, most of them in the rural areas of the developing countries.

In spite of some progress made during the International Drinking Water and Sanitation Decade in the 1980s, large

numbers of the rural as well as urban poor are still without safe drinking water and adequate sanitation facilities. In Africa, for instance, safe drinking water is inadequate for about 50% of the rural population, or about 240 million people.

While air pollution is a growing problem in urban areas, the rural poor also suffer from it because they rely heavily on biomass fuels. Instead of turning biomass into gas, the fuels are usually burnt in primitive cook stoves. The combination of inefficient stoves, absence of chimneys and poor ventilation leads to indoor air pollution which has severe effects on health, particularly on women and children. Data on exposure is limited. According to WHO, an estimated 700 million women worldwide are affected by indoor air pollution arising from biomass fuel. This constitutes the largest single health problem for women in the world.

The problem of direct poisoning of agricultural workers by pesticides is serious in the developing world, but is not continuously assessed. Evidence that mortality and illness from pesticides is common is provided by a recent study in the Philippines.

Slowing Down Population Growth

In the face of persistent degradation and depletion of natural resources upon which development depends, no strategy is likely to succeed unless the day to day pressure of poverty that forces the poor to overuse the resource base is removed. To achieve poverty alleviation without adverse impacts on the environment, any effective rural development strategy needs to be supplemented by policies to slow down population growth.

In the 1980s, the population of the developing countries grew by 770 million, and according to the UN medium variant projections will increase by an additional 900 million in the 1990s. Assuming an annual rate of growth of 2.5%, the population of the developing world would actually double in 25 to 30 years. This implies a further increase of pressure on the natural resource base, especially in the rural areas.

The dominating policy stance of most developing countries on population growth is shown in a recent survey by the United Nations: more than 50% of the 74 developing countries surveyed consider their rate of fertility to be too high. But, out of the total of 131 developing countries, 10 have policies in place to raise fertility, 12 intervene to maintain the rate, 64 have policies to lower the rate, while 45 do not intervene.

In countries that have policies in place to lower the fertility rate, implementation is hampered by cultural, financial and administrative constraints. These constraints are the most severe in the poorest countries,

obviously on account of the lack of resources to launch and staff the institutional arrangements required.

Slowing down population growth because of ecological reasons thus is not going to be easy, but efforts are needed so as to relieve the pressure on land. The promotion of rural infrastructure, industries and services would provide alternatives to eking out a living on marginal land. Rural off-farm employment focused on small towns and villages can have the benefits of urbanization people are generally looking for, without putting undue stress on the large cities. Improvement of productivity and equity through land reform in economically viable units would have a direct effect on the alleviation of poverty. High potential land could be allocated to the landless and near-landless through reform of property rights.

To be sustainable, rural development should be based on land use planning and environmental impact assessment. The fragile land, where the bulk of the rural poor is concentrated, needs to be protected, and environmental impact assessments are necessary to prevent individual projects having negative effects on the environment. It is a matter of some urgency that legislation and regulatory mechanisms in respect to land and natural resources be enacted to ensure sustainable development.

Sustainable Development of Land

Both to improve agricultural productivity and to take the pressure off marginal land, greater attention needs to be paid to the high potential areas. Under optimal conditions these areas alone could produce enough food to meet the demand of growing populations. High potential areas can generally sustain intensive crop production, as long as exploitation does not exceed the regenerative capacity of the soil. Substantial increase in production is still possible in such areas as the central plains of India, the fertile plains and Savannah belt of Africa, and the high Savannah and Pacific lowland plains of Central and South America, through intensive cultivation. The ecological challenge in those areas is to implement land and water management that will ensure that increased agricultural productivity does not cause land degradation in the long term.

Some 250 million of the very poor people of the world live in areas of high potential land and could benefit from increasing agricultural productivity. To enable them to do so, it must be ensured that agricultural modernization does not result in the eviction of the poor from these areas, either through land consolidation, privatization of common land, or as a result of mechanization. This may sound politically difficult but it can be done, and would amount to immediate relief of poverty.

While growth of agricultural production will have to rely

on the intensification of work on high potential land, investment in low potential land is also necessary, both to alleviate rural poverty and prevent further degradation of land. Low potential lands are generally dry lands, often subject to drought and desertification, mountain ecosystems and saline lands. Hundreds of millions of poor people live on those lands, and much could be done in their favour through a change in the mode of farming.

Land degradation in marginal areas has occurred primarily because the poor have not been provided with the infrastructure necessary to move beyond subsistence farming and herding, which deplete soil fertility. It is well known that the type of farming that is economically and ecologically sustainable on marginal land consists of intensive cultivation of non-food crops: perennial bush and tree crops such as coffee, nuts, cocoa, rubber, fruits, vines, etc. and not field crops such as rice, beans, squash, maize, tubers and other traditional crops. Poor farmers should therefore be enabled to switch from subsistence field crop farming to sustainable commercial farming. This type of farming will call for better transportation, for marketing, and for more capital inputs at least initially, but holds out the promise of raising the incomes of the poor *and* providing plant cover to the land, preventing further degradation.

Some amount of traditional food crops can still be grown on marginal lands through new techniques. For instance, the combination of rows of leguminous plants alternated with rows of annual crops provide organic nutrients that prolong productivity of acid, infertile soils. Examples of these modes of farming exist in many parts of the developing world, but only on a small scale. The main challenge is multiplying the successful small-scale initiatives.

Rehabilitation of Degraded Land

In view of the constraints on increasing cropland in most developing countries, the prevention of further degradation needs to be supplemented by measures to rehabilitate the already degraded land, both in high-potential and low-potential areas. Although not much has been accomplished by way of rehabilitation so far, efforts are underway in a number of developing countries to restore the productivity of degraded land. A few examples of successful measures might serve to illustrate what is possible.

In China, rehabilitation of saline soil by natural and artificial drainage, land levelling, and adding clay to the soil has been tried with good results. Soil structure and fertility have been improved by harvesting flood water and cultivating green manure such as sweet clover and alfalfa. Terracing has made possible cropping with nominal

erosion, while cash crops such as apple and leguminous shrubs have been planted to stabilize sloping land.

Land has been restored in the Yatenga Province in Burkina Faso by building stone bunds, digging deep planting holes to collect and concentrate run-off water, and placing manure or compost in each hole. The combination of contour stone bunding and deep planting have proved highly beneficial to farmers. Even in dry years these techniques ensure moderate yields.

A very successful example of rangeland restoration is the revival of the ancient "Hema" system of cooperative management in Syria, in which each cooperative has the sole grazing right to a demarcated area of rangeland, and each family member of a cooperative is granted a licence to graze a certain number of sheep within that area. By reducing overgrazing, the system has enabled the revegetation of some 7 million hectares of rangeland.

Conservation needs to involve local communities in the planning and maintenance of those projects designed to benefit local people. If local communities see no short-term advantage, conservation projects are likely to be abandoned.

Reforestation and Afforestation

Since most of the deforestation is occurring for purposes of agricultural production, the most effective approach to arresting and reversing the process lies in increasing agricultural productivity, as discussed above. Intensification of agricultural production in the high potential areas will make it unnecessary to clear more forests and will free marginal land from agriculture, which then can be reforested. Switching from field crops to tree and bush crops in the marginal areas would at the same time amount to reforestation and afforestation.

In many countries deforestation has been and still is encouraged through direct or indirect subsidies, such as agricultural and pasture incentives, logging concessions and unnecessary road construction. The identification and removal of such incentives is indispensable to prevent further deforestation.

Estimates of the rates of reforestation needed are staggering. A World Bank estimate suggests, for instance, that the rate of tree planting in Africa would have to increase 15 fold by the year 2000 if demand for fuelwood were to be met.

Reforestation in many parts of the developing world is also necessary for the restoration of degraded watersheds so as to increase water supply for agriculture and other uses, and has the additional advantage of preventing floods by slowing down run-off. Such reforestation

obviously has not only environmentally positive effects but also economic benefits.

In view of the growing scarcity of wood resources, afforestation in the form of plantation forestry is a financially viable option. Such afforestation would instantly provide gainful employment to the poor and in the medium term would increase the supply of fuel wood. Plantation forestry has been established in several countries, notably Southern Brazil and Southern Chile on land degraded by past agricultural activities, with good results.

Whenever afforestation and reforestation are undertaken by the private sector on a commercial basis, it would help to have appropriate incentive policies to make the venture profitable. Secure land tenure would help, through the creation of vested interests, to maintain forest cover. In other cases, such as reforestation for watershed restoration and climate protection, the government may have to undertake the task itself, hopefully in the future with the help of an *International Forest Fund*.

Environmental Stress and the Urban Poor

In 1975, the rural poor outnumbered the urban poor by three to one; this relationship could be reversed by the turn of the century. Why could this happen?

Urbanization is the most dramatic social and material transformation that has taken place in the developing world since the mid-century. The urban population rose by 450 million between 1975 and 1985, and demographers expect that by the year 2010, some 52% of the population of developing countries will live in urban agglomerations as compared to 37% in 1990. By the turn of the century, the developing world might have 37 cities with a population of over five million.

Urbanization was initially propelled by rural-urban migration. Although this is still important, migration has ceased to be the driving force behind urban growth. The urban poor are increasingly born in the urban areas, and urbanization has been accompanied by an increase in the number of the urban poor. Over 130 million of the developing world's poorest poor now live in urban areas.

Manufacturing industries, services and commercial centres are located at the core of many big cities in the developing countries. Large numbers of the urban poor cluster in slums and squatter settlements around such centres or at the urban periphery, be it due to absolute shortage of land or to the high rents on serviced lands. These areas are prone to hazardous natural and man-made environmental conditions, such as flood plains, slopes, or land adjacent to dangerous industries.

Most of the urban poor thus live and work in hazardous

exposure situations, shunned by the more affluent. An estimated 600 million urban dwellers in the developing world live in what might be termed life and health threatening circumstances.

The urban poor are affected by water pollution, inadequate sanitation facilities, insufficient collection and disposal of solid and toxic wastes, indoor and outdoor air pollution. A WHO estimate for 1988 suggests that 170 million urban inhabitants lack access to safe and adequate water supply, and 330 million lack adequate sanitation. The urban poor depend on water from inland water bodies that are contaminated by human excreta, and industrial toxic wastes. Most urban agglomerations in the developing countries have no sewerage at all.

Large numbers of the urban poor depend for subsistence on urban waste, i. e., gathering materials from dumps and the streets. In so doing, they are exposed to a variety of hazards – bacteria, diseases and, most importantly, toxic wastes from industries, hospitals, and utilities.

While by and large the quality of urban cooking fuels is better than that used in rural households, not everybody in the urban areas can afford clean fuels. Poor households still depend on traditional biomass fuels which they burn in unventilated shacks. In the large urban agglomerations increasing numbers of people (both poor and non-poor) are being exposed to outdoor air pollution caused by industrial and automotive emissions.

The problem of hazardous wastes in developing countries has been exacerbated by the transfer of products and technologies from developed countries. In many cases it is cheaper to relocate such industries to the developing countries than to meet the increasingly stringent environmental standards and regulations at home. Officially, "codes of conduct" on environmentally sound management have been signed, but in actual life such agreements on the national and international level all too often do not reach local decision-making.

Sustainable Urban Development

Urbanization in developing countries has put considerable stress on the natural environment and the health of the urban poor. To stop or reverse the process may well be impossible. What is needed, however, and what should be possible, is to find ways of providing cost-effective infrastructure and services, to prevent a further decline in the sanitary conditions, and to contain existing environmental hazards. Given that international mass migration is impossible, these are the only ways to relieve the pressure on the environment, to ensure income growth and to alleviate poverty.

The spatial concentration of production in urban areas can bring many cost advantages. Urbanization in developing countries, however, has proceeded in a haphazard manner in the absence of appropriate institutional and legal structures, turning economies of scale into diseconomies of scale. What is needed, therefore, is a new paradigm for urban development – "urban ecology" –, appropriate institutions and a legal framework conducive to environmental city planning.

Assuming an effective city governance, highest priority should be given to the urban poor who are directly affected by the negative side effects of urban dynamics. The urban poor have benefited little if at all from the industrial and commercial activities that degrade the environment, but bear the full consequences of their adverse effects. They are the primary victims of municipal sewage discharged in water bodies, of solid and toxic waste dumps.

First and foremost, the urban poor need to be protected from the immediate threats to life posed by unhealthy sanitation facilities, water supplies and cooking facilities. A full-scale attack on urban problems using conventional capital-intensive technology would, however, require large increases in investments. For example, to meet the WHO targets for water and sanitation in Latin America by the year 2000, a threefold increase in the levels of annual investment (some \$ 50 billion) would be needed. Moreover, conventional technologies require large amounts of freshwater, often as much as 40% of the average daily water consumption. At such costs the crying need of urban sanitation cannot be met. There exist, however, a wide range of alternative technologies that are much cheaper but equally efficient, and use locally manufactured hardware-plumbing, concrete caps, etc. Labour for such activities could be provided by the beneficiaries in the form of "sweat" equity.

Both the social and the technical factors of such basic sanitation facilities have been tested in Africa, Asia and Latin America. The modified systems cost as little as a quarter of conventional sewerage. What is needed, however, is wider diffusion of these low-cost alternatives.

As far as safe drinking water supply is concerned, cities can encourage water conservation in water intensive industries as well as in the services and residential sectors, by ensuring that water consumers pay realistic prices for water, and by better maintenance of existing distribution systems to prevent leakage. A survey of 14 large Latin American cities found that unaccounted for water ranged from 39 to 67%. These measures alone may suffice to provide safe drinking water to most of the still unserved urban poor.

Solutions to indoor air pollution are more difficult to find,

but several possibilities exist. For instance, charcoal or biomass when fermented to produce wood alcohol provide more energy per unit of fuel than raw biomass, and reduce air pollution at the same time. The same goes for improved cooking stove design that concentrates the heat. Another possibility is the use of solar stoves. Until now, however, such alternatives have largely failed to meet affordability criteria. While technologies to use energy more efficiently and to mitigate adverse health effects are available, their use requires financial resources that the poor often do not have. The ultimate solution thus lies in measures to quickly raise the income of the poor, or to drastically reduce the cost of alternative technologies.

To deal effectively with the growing waste problems, emphasis needs to be placed on waste prevention, minimization and re-use. There is not only need for more stringent environmental laws, there is room also for economic instruments and, of course, many forms of local actions.

Hazardous toxic materials may have to be banned outright. Solid waste minimization can be achieved through modification of industrial processes and through change in the design and use of products. Already many options are available to reduce waste through raw material substitution. Additional recycling, such as the recirculation of cooling water through a closed loop, is also possible to a substantial amount. Durable packaging instead of single-use packaging can be made mandatory. Establishing strict criteria for discharging industrial waste water into the sewer networks and enforcement of these criteria would drastically cut the cost of sewage treatment by municipal authorities.

The foremost instrument to reduce waste is the application of user charges. To be effective in changing behaviour, however, charges need to be sufficiently high. Various mechanisms, such as "pay-per-bag" or "charge-per-can", have been successful in reducing solid waste. The "deposit-refund system" for certain kinds of packaging is quite common in many developing countries. Concessional loan and tax incentives can encourage the application of waste minimization technologies, etc.

Generally, the environmental costs are not or not fully integrated in the price of a product. As a result, market signals do not provide sufficient incentives for waste minimization. Therefore, efforts need to be made for the full internalization of environmental costs, also in order to promote new technology.

With regard to municipal sewage treatment plants that ensure the elimination of pathogens, technology is well developed. Cost-effectiveness and affordability, however, remain critical to the choice of technology. The most

effective waste water technology suited to the climatic conditions of many developing countries is the stabilization pond system. Unfortunately, this system requires a large space that is not always available.

Solid waste management which includes storage, collection, transport and disposal poses different problems. The collection technologies imported from industrial countries are often not appropriate, and the large standardized vehicles cannot reach the slum and squatter settlements on account of narrow roads. UNCHS (Habitat) therefore promotes the use of appropriate equipment in solid waste management.

In order to mitigate the effects of outdoor air pollution, there is urgent need for regulations on industrial and automotive emissions. New industrial plants and automobiles should be required to be fitted with state-of-the-art pollution control devices and allowed to operate only if they meet strict pollution standards. Leaded gasoline should be banned; at least price differentiation favouring cleaner gasoline could be introduced. In most developing countries, however, the price of gasoline is already rather high. Still, a moderate gasoline tax would be useful for raising revenue which could be spent for financing public transport. In countries where gasoline is subsidized, such subsidies should be removed instantly. Vehicle tax and licence fees need to be redesigned to discourage the ownership of energy-intensive and polluting vehicles. Compulsory inspection and regular maintenance of vehicles in most developing countries are still unknown but could, if introduced, cut automotive pollution substantially.

National Environmental Policy

Traditionally, regulations have constituted the centrepiece of national environmental policy. Regulatory instruments aim at directly influencing the behaviour of polluters by imposing norms or standards on products, technologies and discharge of pollutants into the environment. Their use is likely to persist, particularly as regards hazardous and toxic substances. Increasingly, economic instruments are being introduced, but in most countries they are used only in conjunction with regulations.

A variety of economic instruments could be conceived for the developing countries, namely (a) charges, such as effluent charges, user charges, product charges, tax differentiation; (b) enforcement incentives, such as non-compliance fees and performance bonds; (c) subsidies; (d) deposit-refund systems.

The major problem in the application of economic instruments arises from the fact that pollution is a complex and multidimensional problem. Economic efficiency can

be achieved only if heavy polluters are charged more than low polluters, which calls for a scale of charges or instruments, based on detailed monitoring. The costs involved in calculating the charges and in enforcing such a system can be high, even in a developing country.

The discussion on economic instruments for pollution control in the literature is based on rather few experiences in developed market economies. A general conclusion from those experiences could be that economic instruments cannot be expected to do better in the developing countries. Developing countries, most probably, will have to rely mainly on regulatory instruments to achieve environmental policy goals. Still, some differentiated answers can be given with regard to the relationship between poverty, environment and development.

□ The application of *user charges* seems not very viable in situations of extreme poverty. The poor contribute to certain types of pollution, and they are the ones who suffer most from it. The provision of safe drinking water and sanitation facilities to the poor at low cost would be a useful social function since such services give rise to positive externalities in terms of health and productivity. Charges for household water and for discharge of sewage into municipal facilities probably should not be based on the amount of use or discharge but on the ability to pay (income).

□ Regarding solid-waste management, the *deposit-refund system*, as applied to bottles and other reusable containers, seems to be a viable mechanism. The system is already in widespread use in developing countries. *Tax differentiation* or *command and control measures* could be used to extend the deposit-refund system by inducing the production of reusable containers for as many products as feasible. Metallic waste re-use is not a big problem in most developing countries because it is remunerative and provides an income to the poor.

□ Elimination or reduction of *subsidies* for products brought directly into the environment, such as fertilizers and pesticides, would help in reducing their impact on water pollution, soil degradation, biodiversity, and on human health.

□ A major consideration as regards the application of *pollution charges* is the viability of industries. Even in developed market economies pollution charges are often kept low in order not to undermine the international competitiveness of industries. The main emphasis in developing countries, as far as industrial pollution is concerned, would have to be placed on the use and generation of *cleaner technologies*, particularly in new plants. While the provision of funds from the budget generally is not compatible with the "polluter pays principle", subsidies would be justifiable in cases where

environmental problems are severe, as for instance, water pollution treatment, restoration of hazardous waste sites, and emissions from fossil fuel combustion.

□ *Product charges* can be effective in controlling pollution if environmentally sounder products are available at prices that will induce polluters to switch to these substitutes, i. e., if the cross price elasticity of demand is high.

Global Warming

There are good reasons that global warming figures high on the international policy agenda, but the subject is mired in controversy. The dilemma is twofold: ecologically, global warming leads to irreversibilities; economically, delayed action will mean higher costs for future generations.

Global warming is due to the emission of so-called greenhouse gases, notably carbon dioxide (CO₂), chlorofluorocarbons (CFCs), methane (CH₄), and nitrous oxide (N₂O). The emission of CFCs leads to destruction of the stratospheric ozone layer, which is potentially harmful to plants, animals, and to human health. Global warming with the resulting climate change will alter rainfall patterns and increase the incidence of droughts and floods. It will lead to sea-level rise, affecting numerous small islands but also large countries, like Bangladesh. While the consequences of global warming would be felt worldwide, the poor in the developing countries could suffer most, as many of them live in fragile areas and along the coasts.

At present, global warming is basically caused by the industrial countries through burning of fossil fuels and extensive use of CFCs. In the 1980s, the industrial countries were responsible for some 75% of the CO₂ and more than 90% of the CFC emissions. Unless action is taken, however, the contribution of the developing countries to global warming will increase rapidly. So far, a high proportion of the CO₂ emissions in the developing countries are the result of deforestation and burning of biomass fuels; industrialization and motorization will take over in the future. Clearly, the industrial countries have a responsibility to lead the way, both through their national policies and through bilateral and multilateral assistance.

Biological Diversity and Carbon Sinks

Concern about deforestation has centred on two main issues, namely, loss of biological diversity and reduction of carbon sinks. The tropical rain forests contain a wealth of plant and animal species, including wild relatives of important varieties of crops. Benefits of preserving biodiversity are seen in its potential to respond to specific problems, such as new pests and plant diseases, and to the possible need to develop new plant varieties in the future. The preservation of biodiversity has assumed

increased attention also in the light of recent advances in biotechnology.

Forests also contribute to the slowing-down of the rate of climate change by absorbing atmospheric carbon, i. e., by serving as carbon sinks. Current international efforts at reforestation and afforestation centre mostly on this role of forests. Economically viable approaches to afforestation need to be accompanied by increased efforts at slowing down and finally halting the process of deforestation so as to achieve a net gain in forest cover. It must be borne in mind, however, that the major source of carbon dioxide remains the burning of fossil fuels. This means that unless the share of renewables in energy use is multiplied, the expansion of forests alone will not solve the problem of global warming. Natural gas, hydrogen, solar and wind energy are eminently clean sources of energy and deserve greater attention, at the national but particularly also at the international level.

Preventing or Slowing Global Warming

A number of mechanisms have been proposed to deal with global warming, among them a global carbon tax, tradeable emission permits, and international environmental off-set programmes.

The chief objective of a carbon tax is to stabilize and decrease greenhouse gas emissions, according to the "polluter pays principle". The tax is actually intended to alter the behaviour of polluters by making fossil fuels more expensive, encourage energy conservation, enhance efficiency and use of renewables. A global carbon tax could be part and parcel of the envisaged climate convention ("CO₂ protocol"). To be effective, the tax would have to be rather high, which obviously runs against apparent interests in low-income countries. Moreover, a high tax rate could lead to shifts from fossil fuels to charcoal, firewood and biomass scavenging, with implications for further deforestation and deprivation of nutrients to the soil. It is here that international arrangements must come in.

Perhaps, a feasible use of the mechanism would be to impose a moderate carbon tax in the developed countries (in Europe, for instance) to generate revenue which could be used for transfer of environmentally sound technology to the developing countries on a preferential basis. The intent of the mechanism would be to place the greater financial burden on the wealthier nations which is where lifestyle changes are most necessary if the threat of global warming is to be substantially reduced.

Another mechanism that has received much attention in the literature is emissions trading. This calls for emission permits to be issued (by an international agency) for transboundary pollutants based on current emissions, levels of income or population size. Under this

mechanism, permission to release stipulated safe levels, or critical loads of pollutants, would be made available for a fee. Those who do not fully utilize their quotas could sell or lease the balance to third parties anywhere in the world at a price to be determined by the market for emission permits. While experience with tradeable permits is limited, in principle the mechanism offers an efficient solution for reducing the levels of pollution. Regarding the complexities of setting targets, assessing emissions, etc., tradeable permits are unlikely to be introduced at the international level in the very near future. From the point of view of resource transfer from North to South, however, the mechanism has some merits.

A mechanism that could be viable in the short run is an international environmental offset programme (compensation principle). In such a case, an industrial country would invest in environmental protection in a developing country whose harmful technologies undermine global emission-reduction targets. Recently, the modernization of two nickel smelting plants in the former Soviet Union near Murmansk was funded by the governments of Finland, Norway and Sweden. This is a clear, though only regional case of concessional transfer of environmentally sound technology that benefits both the donor and the recipient – and the natural environment.

Mechanisms for Protecting Tropical Forests

As pointed out above, deforestation is partly due to massive poverty. Since tropical forests serve biodiversity and serve as CO₂ pollution sinks to the rest of the world, they could be taken to exemplify the compensation principle. To the extent that tropical forests are important for the state of the global environment, countries with or people in tropical forests would have to be compensated for preserving these forests by the international community. The modalities of preservation of tropical forests, through appropriate regulations and policies, seem to be of secondary importance and can be devised, once the commitment to preserve and the willingness to pay have been established internationally.

Other mechanisms, such as debt-for-nature swaps and international environmental offsets, have been used, but are limited in number and extent. Debt-for-nature swaps initiated by NGOs in developed countries have been successful on a small scale but are not viable on a large scale. The major problem is the unavailability of funds for swaps, but there are others. Countries that predominantly have public debt are reluctant to sell them on the secondary market at a discount for fear that this would undermine their credit rating with the international finance system. Moreover, the mechanism is often seen as a device to force developing countries to relinquish sovereignty over natural resources to foreign NGOs.

International environmental offsets so far have been limited. One example is the financing of afforestation in Latin America by the government of the Netherlands to offset CO₂ emissions at home. To the extent that more developed countries want to invest in reforestation and afforestation in the developing countries, this mechanism could become powerful. If, however, forestry measures in developing countries were financed only to offset the effects of *additional* polluting plants in the developed countries, this would be understood as fake.

Agreements on Air Pollution

Because of the transboundary impacts the emission of greenhouse gases can best be controlled through concerted international action. Some efforts have been made in this direction in the last fifteen years or so.

The "Convention on Long-Range Transboundary Air Pollution" which has been signed by 31 of the 34 member states of the UN Economic Commission for Europe, was concluded in 1979, and was followed by four protocols. One protocol signed in 1984 dealt with financial contributions to a European cooperative programme, one in 1985 established the targets for reducing SO₂ emissions by at least 30% ("30 Percent Club"), one in 1988 established the targets for NO_x emissions to 1987 levels by the end of 1994 at the latest, and another signed in 1991 established targets for the emission of volatile organic compounds.

The "Vienna Convention for the Protection of the Ozone Layer" was concluded in 1985, and supplemented by the "Montreal Protocol" signed by 53 countries in 1987. This protocol at first required a 50% reduction of CFCs by the end of the century. In recognition of the special situation of the developing countries, the protocol concedes a grace period to delay their compliance for up to ten years. The Montreal Protocol was strengthened by the "Helsinki and the London Declaration" in 1989 and 1990, respectively, signed by 80 countries and aiming at banning all CFC production by the year 2000. Individual countries, like Germany and the Netherlands, meanwhile have announced the phasing out of production by 1994.

Transboundary Movements of Wastes

The "Basle Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal" was approved by 116 countries in 1989, but only 36 signed it at that time. Its effectiveness is marred by the fact that it does not actually prohibit the transfer of hazardous wastes, but specifies the conditions under which such transfers may take place. Those conditions can be easily circumvented.

In 1991, African countries adopted the "Bamako Convention on the Ban of the Import into Africa and the

Control of Transboundary Movements of Hazardous Wastes within Africa". This convention imposes an outright ban on the import of all hazardous wastes. It also prohibits ships of non-signatory countries from dumping hazardous wastes in the seas, internal waters or waterways of the signatory nations and requires that all waste generation in Africa meets certain requirements.

Support for Sustainable Development

Putting sustainable development on the agenda without increasing commitment to global environmental policy would lead to serious disturbances of the international system. At the same time, there are no quick fixes to this endeavour. Feasible solutions are available or can be found, but the costs involved are high and the returns somewhat uncertain. No doubt, achieving a socially necessary rate of growth and alleviation of poverty in the developing countries while at the same maintaining the integrity of the environment will call for *additional* financial resources, but also for new thinking on international burden-sharing.

While parts of the additional financing will represent a cost to ensure sustainability by way of curing environmental degradation, parts of it will represent investments rather than costs. In many cases, such investments will simultaneously produce economic return and environmental relief. Also, the costs of timely (preventive) action will be less than the eventual costs of delayed (adaptive) action.

Estimating the additional financial resources needed to cope with the various environmental issues involved is beyond the scope of this report. Some estimates are available, however, which at least give an order of magnitude of the financial requirements. Currently attempts are being made in the preparatory meetings for the UNCED conference to provide comprehensive and consistent estimates of sectoral and overall financial needs.

As is well known, the net capital inflow required for development of the developing countries, in terms of efforts by donors, has been set at 0.7% of the GNP of industrial countries. This target, if met, would amount to US\$ 120 billion in 1990 prices, exchange rates and GNP levels. In terms of the needs of the developing countries to attain a socially necessary rate of growth of 5.5%, a WIDER study has estimated that an *additional* \$ 40 billion over the actual flows of \$ 55 billion would have been required in 1990, and that this would rise to \$ 60 billion in the year 2000. To achieve both the goals of the socially necessary rate of growth *and* environmental protection, *additional* flows over current levels would have to rise from \$ 60 billion in 1990 to \$ 140 billion in the year 2000. An

estimate of the Worldwatch Institute puts the financing needs of developing countries for environmental conservation at US\$ 20 to 50 billion per year during the 1990s. The World Resources Institute (WRI) has also arrived at about the same estimate. Maurice Strong, director of the forthcoming UNCED conference, in March 1992 came out with a figure on the necessary transfers for environment and development from North to South of US\$ 600 billion and more.

Estimates of capital requirements at the sectoral level have also been made, but cannot be presented here.

Current Efforts

Most multilateral agencies have started to integrate environmental concerns into the planning, budget allocation, implementation and assessment of their work. For instance, the World Bank now requires an environmental impact assessment for all new projects. UNDP in one year has increased its budget allocation for environmental activities by over 100%. Some 55% of IFAD's projects reflect concern about the environment. In addition, several multilateral programmes have been established with an explicit environmental thrust. The largest is the Global Environmental Facility (GEF) established in 1990 as a three-year pilot scheme of the World Bank, UNDP and UNEP, to provide grants and low interest loans to developing countries to help them carry out environmental programmes. Several sectoral efforts are also underway, for instance, the Tropical Forestry Action Plan (TFAP), the Metropolitan Improvement Programme (MEIP), and the Environment Programme for the Mediterranean (EPM).

The TFAP, initiated in 1985 to prepare national action plans in 80 countries, is under review. The MEIP, launched in 1990, aims at arresting and reversing environmental stress in five major Asian cities – Beijing, Bombay, Colombo, Jakarta, and Manila. The EPM, a long-term technical assistance plan, aims at improving environmental quality in the Mediterranean Basin.

Thus, the trend regarding environmental protection is positive and must be encouraged. The present efforts, however, do not constitute adequate responses given the magnitude and urgency of the problems.

Potential Sources of Additional Funding

In view of the very substantial amounts of additional financing required for sustainable development, there is a need for increasing the resources of the UN agencies. It does not seem realistic to rely primarily on voluntary contributions. Emphasis should be placed on additional long-term commitment. The potential for redeployment of funds within national budgets, through reduction in military

spending ("peace dividend"), elimination of subsidies for activities that are environmentally destructive, and for changes in taxation systems seems to be great. Also, a number of innovative approaches to funding environmental protection activities have been proposed. Examples are, notably, debt relief, charges, earth stamps, energy or carbon tax, tradeable permits.

Debt relief through debt-for-nature swaps has been tried on a small-scale basis. What is needed, however, is comprehensive debt relief. The WRI has proposed a "Multilateral Authority" which would purchase debt at a discount and then negotiate for phased forgiveness in return for the implementation of sustainable development programmes.

Charges for the use of the global commons – seabed resources, ocean fishing, use of the high seas by shipping, use of the atmosphere for air transport and other economic activities – could yield substantial financial resources. These charges could be levied and collected nationally or through an international taxing authority established under the United Nations (ITF – International Taxation Fund), and the revenues could be used for environmental protection measures.

Funds could also be raised by asking UN member states to permit their postal systems to sell "*earth stamps*" which would be added to regular postage. The funds could be used to finance the transfer of clean technologies to developing countries.

A *non-renewable energy* or *carbon tax* has been proposed and meanwhile is widely debated. The primary objective of such a tax is to alter the behaviour of polluters by raising the cost of highly polluting activities. Behaviour modification, however, would require the tax rate to be rather high, which again could make many current economic activities unprofitable. But the willingness to implement at least a moderate tax in many industrial countries is also high.

Tradeable emission permits offer the potential of effectuating substantial transfer of resources from one country to another. In recent plans by WMO, UNEP, and the German Enquête-Kommission it has been argued that in the case of greenhouse gases, industrial countries have the room to reduce emissions considerably (up to 80%), while many developing countries would need to maintain or even increase emissions to achieve legitimate development objectives. If the allocation of permits to developing countries were larger than needed in the short to medium term, they could sell or lease their permits to industrial countries giving them time to adjust to stipulated lower emission levels, and use the proceeds for developing clean technologies or for other sustainable economic activities.