27. Swaminathan, M S. 1983, Science and the Conquest of Hunger Concept, Delhi, p113

28. Shah, C H. (ed) Agricultural Development of India, Orient Longman, Delhi 1979, p xxxii

29. Richaria, R H. 1986, Paper presented at Seminar on Crisis in Modern Science, Penang

30. Yegna Iyengar, op cit, p30

31. Wright Angus, 1984, Innocents Abroad: American Agricultural Research in Mexico, in Jackson, W. et al (ed) *Meeting the Expectations of the Land*, North Point Press, San Francisco, 1984

32. Schlich, op cit

33. Caufield, op cit p177

34. UNESCO 1985, Tropical Forest Ecosystems, Paris

35. Caufield, op cit, p178

36. FAO, 1986, Tropical Forest Management, Rome

37. Fahser, L. 1986, The Ecological Orientation of the Forest Economy, lecture given at Faculty of Forestry Science, University of Freiburg im Breisgan

38. Shiva, V. and Bandyopadhyay, J. 1985, Ecological Audit of Eucalyptus Cultivation, Research Foundation, Dehra Dun

39. Shiva, V. 1989, The Violence of the Green Revolution, Research Foundation of Science and Ecology, Dehra Dun

2 Biodiversity: A Third World Perspective

The Crisis of Diversity

DIVERSITY IS THE CHARACTERISTIC of nature and the basis of ecological stability. Diverse ecosystems give rise to diverse life forms, and to diverse cultures. The co-evolution of cultures, life forms and habitats has conserved the biological diversity on this planet. Cultural diversity and biological diversity go hand in hand.

Communities everywhere in the world have developed knowledge and found ways to derive livelihoods from the bounties of nature's diversity, in wild and domesticated forms. Hunting and gathering communities use thousands of plants and animals for food, medicine and shelter. Pastoral, peasant and fishing communities have also evolved knowledge and skills to derive sustainable livelihoods from the living diversity on the land and in rivers, lakes and seas. The deep and sophisticated ecological knowledge of biodiversity has given rise to cultural rules for conservation reflected in notions of sacredness and taboos.

Today, however, the diversity of ecosystems, life forms and ways of life of different communities is under threat of extinction. Habitats have been enclosed or destroyed, diversity has been eroded and livelihoods deriving from biodiversity are threatened.

Tropical moist forests cover only 7% of the earth's land surface but contain at least half of the earth's species. Deforestation in

these regions is continuing at a rapid pace, with very conservative estimates suggesting rates as high as 6.5% in Cote d'Ivoire and averaging about 0.6% per year (about 7.3 million ha) for all tropical countries. At this rate, which is a net figure, and incorporating reforestation and natural growth, all closed tropical forests would be cleared within 177 years (FAO, 1981). Raven (1988) estimates that about 48% of the world's plant species occur in or around forest areas where over more than 90% of their area will be destroyed during the next 20 years, leading to about a quarter of those species being lost. Wilson (1988) has estimated that the current extinction rate is 1000 species a year. By the 1990s, the figure is expected to rise to ten thousand species a year (one species an hour). During the next 30 years, one million species could be erased.

Biological diversity in marine ecosystems is also remarkable, and coral reefs are sometimes compared with tropical forests in terms of diversity (Connell, 1978). Marine habitats and marine life are under severe threat; with the destruction of diversity, the fisheries base in most coastal regions of the world is on the verge of collapse.

The erosion of diversity is also very severe in agricultural ecosystems. Crop varieties have disappeared, and cultivation during the 'Green Revolution' phase shifted from hundreds and thousands of crops to wheat and rice derived from a very narrow genetic base. The wheat seeds that spread worldwide from the International Centre for Maize and Wheat Improvement (CIMMYT) through Norman Borlaug and his 'wheat apostles' were the result of nine years of experimenting with Japanese 'Norin' wheat. 'Norin', released in Japan in 1935, was a cross between Japanese dwarf wheat called 'Daruma' and American wheat called 'Faltz' which the Japanese government had imported from the US in 1887. The 'Norin' wheat was brought to the US in 1946 by Dr D C Salmon, an agriculturist acting as a US military

adviser in Japan, and further crossed with American seeds of the variety called 'Bevor' by US Department of Agriculture scientist Dr Orville Vogel. Vogel in turn sent it to Mexico in the 1950s where it was used by Borlaug, who was on the Rockefeller Foundation staff, to develop his well-known Mexican varieties. Of the thousands of dwarf seeds created by Borlaug, only three were used to create the 'Green Revolution' wheat plants which were spread worldwide. On this narrow and alien genetic base, are the food supplies of millions precariously perched.[1]

Over the last half century, India has probably grown over 30,000 different indigenous varieties or land races of rice. The situation has altered drastically in the past 15 years, however, and Dr H K Jain, Director of the Indian Agricultural Research Institute in New Delhi predicts that in another 15 years this enormous rice diversity will be reduced to no more than 50 varieties, with the top ten accounting for over three-quarters of the subcontinent's rice acreage.[2]

Livestock populations are also being homogenised and their diversity is being irreversibly lost. The carefully evolved pure breeds of cattle in India are on their way to extinction. The Sahiwal, Red Sindhi, Rathi, Tharparkar, Hariana, Ongole, Kankreji, Gir are cattle breeds developed for the different eco-niches where they had to survive and support the needs of local communities. Today they are being systematically substituted by cross breeds of Jersey and Holstein Cows.

With animals disappearing as an essential component of farming systems, and their contribution of organic fertility being substituted by chemical fertilisers, soil, fauna and flora have also gone extinct. The locally specific nitrogen-fixing bacteria, fungi that facilitate nutrient intake through mycorrhizal association, predators of pests, pollinators and seed dispersers, and other species that co-evolved over centuries to provide environmental

services to traditional agrosystems have become extinct, or have had their genetic base dramatically narrowed. Deprived of the flora with which they co-evolved, soil microbes also disappear (Norgaard, 1988).

Biodiversity erosion starts a chain reaction. The disappearance of a species is related to the extinction of innumerable other species with which it is inter-related through food webs and food chains, and about which humanity is totally ignorant. The crisis of biodiversity is not just a crisis of the disappearance of species which have the potential of spinning dollars for corporate enterprises by serving as industrial raw material. It is, more basically, a crisis that threatens the life-support systems and livelihoods of millions of people in Third World countries.

Primary Threats to Biodiversity

(i) *Primary causes*

There are two primary causes for the large scale destruction of biodiversity:-

The first is habitat destruction due to internationally financed mega-projects such as the building of dams and highways, and mining operations in forested regions rich in biological diversity.

The second primary cause for the destruction of biodiversity in areas under cultivation is the technological and economic push to replace diversity with homogeneity in forestry, agriculture, fisheries and animal husbandry. The Green Revolution in agriculture, the White Revolution in dairying and the Blue Revolution in fisheries are revolutions based on the deliberate replacement of biological diversity with biological uniformity and monocultures.

a) *Biodiversity destruction due to development projects in forest areas*

The Narmada dams will submerge large areas of forests in the Narmada Valley in India. The Sardar Sarovar project will submerge 11,000 ha and the Narmada Sagar will submerge nearly 40,000 ha of forest land. Besides direct destruction of biodiversity in these forests, the submergence will irreversibly destroy the survival base of tribals in the region.

In Thailand, the Nam Choan Dam would have flooded the valley land of the Tung Yai and Huai Kha Khaeng wildlife sanctuaries, which together comprise the largest intact block of forested land set aside for wildlife conservation in Thailand. The dam thus threatened to destroy the habitat of the largest remaining populations of elephant and bantcug, as well as a variety of other threatened or endangered species such as tiger, gaur, and tapir, and birds like the green pea fowl. (Tuntawiroon and Samotsa-Korn 1984).

In Brazil, the Grande Carajas Programme involving the Tucurui dams, iron ore and bauxite mining and processing industry threatens biodiversity and cultural diversity in the Amazon. Amazonia harbours more wildlife than any other place on Earth, both per unit area and as a subcontinental region. There are estimated to be 'over 50,000 species of higher plants, at least an equal number of fungi, a fifth of all the birds on our planet, at least 3,000 species of fish, amounting to ten times the number of fish in all the rivers of Europe, and insect species numbering in the uncounted millions' in the Amazonia.

The great age and size of the forests, their favourable climate (hot and moist), the fact that they have remained undisturbed for millenia, and the presence of very high concentrations of species in particular areas (known as *Peistocene refugia)* have all contrib-

uted to the region's unparalleled diversity. For instance, a typical hectare of Amazonian forest contains between 200-300 different varieties of trees alone.[3]

During the filling of the Tucurui reservoir which flooded at least 2,150 square kilometres of rainforest over many months, an attempt was made to rescue drowning animals. In one ten-day period, 4,037 mammals, 4,848 reptiles, 6,293 insects such as giant scorpions and spiders, 717 birds and 30 amphibians were captured by men in boats – some 15,925 creatures from one part of the lagoon. Brazilian ecologists estimated that this total was a tiny fraction of the actual number held by the forest.

The 10% of the world's species that occur in Amazonia are not uniformly spread, but cluster throughout the river basin. Most are endemic or have limited distributions. Inevitably, high diversity means that there are relatively few individuals of any one species. The more development intensifies, the greater the likelihood of extinctions. In regions like Carajas, where single projects involve the clearance of thousands of square kilometres of forests, not just individual species but whole habitats are rapidly disappearing.[4]

(b) *Displacement of biodiversity by monocultures*

According to the dominant paradigm of production, diversity goes against productivity, which creates an imperative for uniformity and monocultures. This has generated the paradoxical situation in which plant improvement has been based on the destruction of the biodiversity which it uses as raw material. The irony of plant and animal breeding is that it destroys the very building blocks on which the technology depends. Forestry development schemes introduce monocultures of industrial species like eucalyptus and push into extinction the diversity of local species which fulfil local needs. Agricultural modernization schemes introduce new and uniform crops into farmers' fields and

destroy the diversity of local varieties. In the words of Professor Garrison Wilkes of the University of Massachusetts, this is analogous to taking stones from a building's foundation to repair the roof. This strategy of basing productivity increase on the destruction of diversity is dangerous and unnecessary.

Not until diversity is made the logic of production can diversity be conserved. 'Improvement' from the corporate viewpoint, or from the viewpoint of western agricultural or forestry research, is often a loss for the Third World, especially the poor in the Third World. There is therefore no inevitability that production should act against diversity. Uniformity as a pattern of production becomes inevitable only in a context of control and profitability.

The spread of monocultures of 'fast-growing' species in forestry and 'high-yielding varieties' in agriculture has been justified on grounds of increased productivity. All technological transformation of biodiversity is justified in the name of 'improvement' and increased 'economic value'. However, 'improvement' and 'value' are not neutral terms. They are contextual and value-laden. Improvement of tree species means one thing for a paper corporation which needs pulping wood and an entirely different thing for a peasant who needs fodder and green manure. Improvement of crop species means one thing for a food processing industry and something totally different for a self-provisioning farmer.

The categories of 'yield', 'productivity' and 'improvement' which have emerged from the corporate viewpoint have, however, been treated as universal and value-neutral. Thus, all tree planting programmes financed by international institutions in recent years and encouraged by the Tropical Forestry Action Plan (TFAP) have spread fast-growing eucalyptus monocultures across Asia, Africa and Latin America. The only fast growth to which eucalyptus contributes is pulp wood – it is not fast growing in

terms of yield of wood for other purposes, and in terms of yields of non-woody biomass for fodder it has zero yields since its leaves are not eaten by cattle. Given that the industrial sector does not benefit from the diversity of species and uses of trees, forestry programmes deliberately destroy diversity in order to increase yields of industrial raw material.

Viewing diversity as weeds leads to the extinction of that diversity which has high ecological and social value even when it does not profit industry. The pattern of destruction of diversity has been the same in both forestry and agriculture.

Plant improvement in agriculture has been based on the enhancement of the yield of a desired product at the expense of unwanted plant parts. The 'desired' product is however not the same for agri-business and a Third World peasant. Which parts of a farming system will be treated as 'unwanted' depends on one's class and gender. What is unwanted for agribusiness may be wanted by the poor, and when it squeezes out those aspects of biodiversity, agriculture 'development' fosters poverty and ecological decline.

In India, the 'high-yielding' strategy of the Green Revolution squeezed out pulses and oilseeds which were essential for nutrition and soil fertility. The monocultures of the dwarf varieties of wheat and rice also squeezed out the straw which was essential for fodder and fertilizing the soil. The yields were 'high' for the purposes of centralised control of the food-grain trade, but not in the context of diversity of species and products at the level of the farm and the farmer. Productivity therefore differs depending on whether it is measured in a framework of diversity or uniformity.

(ii) *Secondary Causes of Biodiversity Erosion*

The dominant view ignores the primary causes of biodiversity

destruction and instead focuses on secondary causes such as population pressure. However, stable communities, in harmony with their ecosystem, always protect biodiversity. It is only when populations are displaced by dams, mines, factories, and commercial agriculture that their relationship to biodiversity becomes antagonistic rather than co-operative. The displacement of people and displacement of diversity goes hand in hand, and displaced people further destroying biodiversity is a second order effect of the primary causes of destruction identified above.

Effects of Biodiversity Erosion

The erosion of biodiversity has serious ecological and social consequences since diversity is the basis of ecological and social stability. Social and material systems devoid of diversity are vulnerable to collapse and breakdown.

i) *Ecological vulnerability of monocultures of 'improved varieties'*

Case A: In 1970-71, America's vast cornbelt was attacked by a mysterious disease, later identified as 'race T' of the fungus *Helminisporium maydis* which caused the Southern Corn Leaf Blight as the epidemic was called. It left ravaged corn fields with withered plants, broken stalks and malformed or completely rotten cobs with a grayish powder. The strength and speed of the Blight was a result of the uniformity of hybrid corn, most of which had been derived from a single Texas male sterile line. The genetic make-up of the new hybrid corn which was responsible for its rapid and large scale breeding by seed companies was also responsible for its vulnerability to disease. At least 80% of the hybrid corn in America in 1970 contained the Texas male sterile cytoplasm. As a University of Iowa pathologist wrote, 'Such an extensive, homogeneous acreage is like a tinder-dry prairie waiting for a spark to ignite it.'

A National Academy of Sciences study *'Genetic Vulnerability of Major Crops'* stated: 'The corn crop fell victim to the epidemic because of a quirk in the technology that had redesigned the corn plants of America until in one sense, they had become as alike as identical twins. Whatever made one plant susceptible made them all susceptible.' (Doyle, 1988)

Case B: In 1966, the International Rice Research Institute released a 'miracle' rice variety – IR-8, which was quickly adopted for use through Asia. IR-8 was particularly susceptible to a wide range of disease and pests: in 1968 and 1969 it was hit hard by bacterial blight and in 1970 and 1971 it was ravaged by another tropical disease called tungro. In 1975, Indonesian farmers lost half a million acres of Green Revolution rice varieties to leaf hoppers. In 1977, IR-36 was developed to be resistant to 8 major diseases and pests including bacterial blight and tungro. However this was attacked by two new viruses called 'ragged stunt' and 'wilted stunt'.

The vulnerability of rice to new pests and disease due to monocropping and a narrow genetic base is very high. IR-8 is an advanced rice variety that came from a cross between an Indonesian variety called 'Pea' and another from Taiwan called 'Dee-Geo-Woo-Gen'. IR-8, Taichung Native 1 (TN1) and other varieties were brought to India and became the basis of the All India Co-ordinated Rice Improvement Project to evolve dwarf, photoinsensitive, short duration, high yielding varieties of rice suited to high fertility conditions. The large scale spread of exotic strains of rice with a narrow genetic base was known to carry the risk of the large-scale spread of disease and pests. As summarised in a publication titled 'Rice Research in India – An Overview' from CRRI,

The introduction of high yielding varieties has brought about a marked change in the status of insect pests like gall midge, brown planthopper, leaf folder, whore maggot etc. Most of the high yielding varieties released so far are susceptible to major pests with a crop loss of 30 to 100%... Most of the HYVs are the derivatives of TN1 or IR-8 and therefore, have the dwarfing gene of Dee-Geo-Woo-Gen. The narrow genetic base has created alarming uniformity, causing vulnerability to disease and pests. Most of the released varieties are not suitable for typical uplands and low-lands which together constitute about 75% of the total rice area of the country.[5]

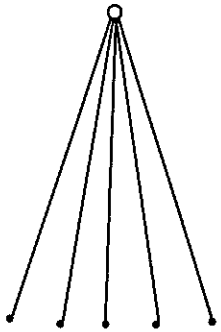
The 'miracle' varieties displaced the diversity of traditionally grown crops, and through the erosion of diversity, the new seeds became a mechanism for introducing and fostering pests. Indigenous varieties or land races are resistant to locally occuring pests and diseases. Even if certain diseases occur, some of the strains may be susceptible, while others will have the resistance to survive. Crop rotations also help in pest control. Since many pests are specific to particular plants, planting crops in different seasons and different years causes large reductions in pest populations. On the other hand, planting the same crop over large areas year after year encourages pest build ups. Cropping systems based on diversity thus have built-in protection.

ii) *Social vulnerability of homogeneous systems*

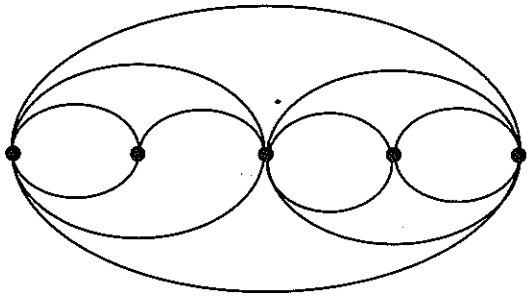
The two principles on which the production and maintenance of life is based are:

(a) the principle of diversity, and
(b) the principle of symbiosis and reciprocity, often also called the law of return.

The two principles are not independent but interrelated. Diversity gives rise to the ecological space for give and take, for mutuality and reciprocity. Destruction of diversity is linked to the creation of monocultures, and with creation of monocultures, the



Monocultures are associated with external inputs, centralised regulation and high vulnerability to ecological breakdown.



Systems based on diversity are associated with decentred self-regulation and high resilience.

self-regulated and decentralised organisation of diverse systems gives way to external inputs and external and centralised control. Schematically the transformation can be imaged figures as illustrated on page 76.

Sustainability and diversity are ecologically linked because diversity offers the multiplicity of interactions which can heal ecological disturbance to any part of the system. Nonsustainability and uniformity means that a disturbance to one part is translated into a disturbance to all other parts. Instead of being contained, ecological destabilisation tends to be amplified. Closely linked to the issue of diversity and uniformity is the issue of productivity. Higher yields and higher production have been the main push for the introduction of uniformity and the logic of the assembly line. The imperative of growth generates the imperative for monocultures. Yet this growth is, in large measure, a socially-constructed, value-laden category. It exists as a 'fact' by excluding and erasing the facts of diversity and production through diversity.

Diverse systems have multiple outputs and yields, and much of these outputs flow back within the system to allow for 'low-external-input' production, so that production is possible without access to purchasing power, credits and capital. Livestock and crops help maintain each other's productivity symbiotically and sustainably. Different crop varieties also maintain each other eg. corn and beans, millets and pulses, where the legume provides nitrogen for the main cereal crop through nitrogen fixation.

In addition to providing ecological stability, diversity also ensures diverse livelihoods and provides for multiple needs through reciprocal arrangements.

Homogeneous and one dimensional production systems break up community structure, displace people from diverse occupa-

tions, and make production dependent on external inputs and external markets. This generates political and economic vulnerability and instability because the production base is ecologically unstable and commodity markets are economically unstable.

Negros in the Philippines is an economic disaster because its entire economy depended on sugarcane, and when sugar substitutes were derived from corn, there was no longer a market for sugarcane. The vulnerability of Africa is extremely high because colonialism introduced exclusive dependence on monocultures of cash crops for exports and displacement of biodiversity for local food needs. Many African countries rely on single crops for export earnings.

With the emergence of the new biotechnologies and the industrial production of substitutes for the biological products from plantation crops, severe dislocation of the economy and society in these countries can be expected.

First World Bio-imperialism and North-South Conflicts

The wealth of Europe in the colonial era was to a large extent, based on the transfer of biological resources from the colonies to the centres of imperial power, and the displacement of local biodiversity in the colonies by monocultures of raw material for European industry.

A W Crosby has called the biological transfer of wealth from the Americas to Europe the 'Columbian exchange', because with Columbus' arrival in America started the mass transfer of maize, potatoes, squash, tomatoes, peanuts, common beans, sunflowers and other crops across the Atlantic.

Various spices, sugar, bananas, coffee, tea, rubber, indigo,

cotton and other industrial crops began to make their move to new production sites under the control of newly emerging colonial powers and their state backed trading companies.

Violence and control were an intrinsic part of this process by which the North accumulated capital and wealth by gaining control over the biological resources of the South. Destroying the biodiversity it could use or control was the other less visible side of this process of colonisation.

In 1876 the British smuggled rubber out of Brazil and introduced it in its colonies in Sri Lanka and Malaya. The Brazilian rubber industry collapsed and famine replaced the rubber business.

The Dutch cut down 75% of the clove and nutmeg stands in the Moluccas and concentrated production on three heavily guarded islands.

Physical violence might no longer be the main instrument of control, but control of the Third World's biodiversity for profits is still the primary logic of North-South relationships on biodiversity. The large scale introduction of monocultures in the Third World through the Green Revolution was spearheaded by the International Centre for Wheat and Maize Improvement (CIMMYT) in Mexico and International Rice Research Institute (IRRI) in the Philippines, controlled by the Consultative Group on International Agricultural Research (CGIAR), which was launched by the World Bank in 1970.

In the Philippines, IRRI seeds acquired the name 'seeds of imperialism'. Robert Onate, President of the Philippines Agricultural Economics and Development Association observed that IRRI practices had created a new dependence on agrochemicals, seeds and debt. 'This is the Green Revolution Connection,'he

remarked, 'New seeds from the CGIAR global crop seed systems which will depend on the fertilizers, agrichemicals and machineries produced by conglomerates of the Transnational Corporations.'

The International Bureau for Plant Genetic Resources (IBPGR) which is run by the CGIAR system was specifically created for the collection and conservation of genetic resources. However, it has emerged as an instrument for the transfer of resources from the South to the North. While most genetic diversity lies in the South, of the 127 base collections of IBPGR, 81 are in the industrialised countries, and 29 are in the CGIAR system which is controlled by the governments and corporations of the industrialised countries in the North. Only 17 are in the national collections of Third World countries. Of the 81 base collections in the North, 10 are in the hands of the countries that fund IBPGR.

The US has accused countries of the Third World as engaging in 'unfair trading practice' if they fail to adopt US patent laws which allow monopoly rights in life forms. Yet it is the US which has engaged in unfair practices related to the use of Third World genetic resources. It has freely taken the biological diversity of the Third World to spin millions of dollars of profits, none of which have been shared with Third World countries, the original owners of the germ plasm.

According to Prescott-Allen, wild varieties contributed US$340 million per year between 1976 and 1980 to the US farm economy. The total contribution of wild germ plasm to the American economy has been US$66 billion, which is more than the total international debt of Mexico and the Philippines combined. This wild material is 'owned' by sovereign states and by local people.

A wild tomato variety (*Lycopresicon chomrelewskii*) taken from Peru in 1962 has contributed US$8 million a year to the American tomato processing industry by increasing the content of soluble

solids. Yet none of these profits or benefits have been shared with Peru, the original source of the genetic material.

(i) *Drug firms rob Third World's medicinal plants*

The pharmaceutical industry of the North has similarly benefited from free collection of tropical biodiversity. The value of the South's germplasm for pharmaceutical industry ranges from an estimated US$4.7 billion now to US$47 billion by the year 2000.

As drug companies realise that nature holds rich sources of profit they begin to covet the potential wealth of tropical moist forests as a source for medicines. For instance, the periwinkle plant from Madagascar is the source of at least 60 alkaloids which can treat childhood leukaemia and Hodgkin's Disease. Drugs derived from this plant bring in about US$160 million worth of sales each year. Yet another plant, *Rauwolfa serpentina*, from India is the base for drugs which sell up to US$260 million a year in the US alone.

Unfortunately, it has been estimated that with the present rate of destruction of tropical forests, 20-25% of the world's plant species will be lost by the year 2000. Consequently, major pharmaceutical companies are now screening and collecting natural plants through contracted third parties. For instance, a British company, Biotics, is a commercial broker known for supplying exotic plants for pharmaceutical screening by inadequately compensating the Third World countries of origin. The company's officials have actually admitted that many drug companies prefer 'sneaking plants' out of the Third World than going through legitimate negotiating channels.

Screening and collection cover plants, bacteria, algae, fungi, protozoa and a wide range of marine organisms including corals, sponges and anemones.

Another method is that of the US National Cancer Institute which has sponsored the single largest tropical plant collecting efforts by recruiting the assistance of ethno-botanists, who in turn siphon off the traditional knowledge of indigenous peoples without any compensation.

(ii) *First World bio-imperialism*

In spite of the immeasurable contribution that Third World biodiversity has made to the wealth of industrialised countries, corporations, governments and aid agencies of the North continue to create legal and political frameworks to make the Third World pay for what it originally gave. The emerging trends in global trade and technology work inherently against justice and ecological sustainability. They threaten to create a new era of bio-imperialism, built on the biological impoverishment of the Third World and the biosphere.

The intensity of this assault against Third World genetic resources can be seen from the pressure exerted by major drug and agricultural input companies and their home governments on international institutions such as the General Agreement on Tariffs and Trade (GATT) and the FAO to recognise such resources as a 'universal heritage' in order to guarantee them free access to the raw materials. International patent and licensing agreements will increasingly be used to secure a monopoly over valuable genetic materials which can be developed into drugs, food, and energy sources.

Limitations of the Dominant Approaches to Biodiversity Conservation

The dominant approaches to biodiversity conservation suffer from the limitations of a northern bias, and a blindness to the role

of the North in the destruction of biodiversity in the South.

'Conserving the World's Biological Diversity' (a study released by the World Bank, the World Resources Institute, the International Union for the Conservation of Nature Resources and the World wide Fund for Nature) has undoubtedly emerged from the North. However, even this report suffers from a biased analysis and biased prescriptions.

(i) *Neglect of primary causes of destruction*

In this report, while the crisis of erosion is focused on as an exclusively tropical, and Third World phenomenon, the thinking and planning of biodiversity conservation is projected as a monopoly of institutes and agencies based in and controlled by the industrial North. It is as if the mind and the solutions are in the North, while the matter and the problems are in the South. This polarity and dualism underlies the basic shortcomings of the book, which could more honestly have been titled 'The North Conserving the South's Biological Diversity'.

It is of course true that the tropics are the cradle of the planet's biological diversity, with an incomparable multiplicity and variability of ecosystems and species. However, not only is erosion of diversity as great a crisis in the North, it is also in the North that the roots of the South's crisis of diversity lie. These aspects of the destruction of diversity are not addressed in the book.

Closely related to the book's neglect of forces and factors in the North as part of the problem is its neglect of the crisis of diversity in what are viewed as 'production' spheres – forestry, livestock and agriculture. Among the causes identified as leading to the loss of biological resources are forest clearing and burning, overharvesting of plants and animals, and indiscriminate use of pesticides. In the past 20-30 years, however, in addition to these

factors, there has been a deliberate substitution of diversity by uniformity of crops, trees and livestock – through development projects financed by aid from international agencies.

The report thus ignores the two primary causes of biodiversity destruction which are global in character,and focuses on secondary and minor causes which are often local in character. It therefore blames the victims of biodiversity destruction for the destruction, and places responsibility for conservation in the hands of the sources of destruction.

(ii) *Disease offered as cure*

The World Bank, which continues to introduce biodiversity action plans, has for the past 10 years been financing the destruction of genetic diversity in the Third World. It financed the Green Revolution which replaced genetically diverse indigenous cropping systems in the Third World with vulnerable, genetically uniform monocultures. It contributed to genetic erosion through the encouragement of centralised research institutions controlled by the Consultative Group on International Agriculture Research (CGIAR), which it launched in 1970.

The Tropical Forest Action Plan (TFAP) which is cited as an example of a strategy for conserving habitats has been responsible for the destruction of biodiversity in both natural forests and agricultural ecosystems. Large scale introduction of monocultures of eucalyptus and other industrial species has been accelerated under the TFAP, displacing indigenous tree, crop and animal species. In effect the TFAP has become an instrument for giving public subsidies to multinational corporations such as Shell and Jaako Poyry in Asia and Latin America.

(iii) *Who produces, who consumes biodiversity?*

The northern bias of the World Bank/IUCN/WRI/WWF report is also evident in its analysis of the value of biodiversity. In the self provisioning economies of the Third World, producers are simultaneously consumers and conservers. In fact, it is recognised that 'the total genetic change achieved by farmers over the millenia was far greater than that achieved by the hundred or two years of more systematic science based efforts'. (Kloppenberg, 1988).

If this contribution to knowledge and development of biodiversity is recognised, farmers and tribals are the original producers, and corporate and public sector scientists consume their finished products as raw material for commodities. The dominant approach puts this relationship of producer and consumer on its head.

Probably the authors' treatment of Northern agencies as part of the solution rather than part of the problem is related to their economistic approach. In the chapter on 'Values of biological diversity', it is recognised that biological resources have social, ethical, cultural and economic values. 'But', the authors proceed to say:

...in order to compete for the attention of government decision makers in today's world, policies regarding biological diversity first need to demonstrate in economic terms the value of biological resources to a country's social and economic development.

The economic values of biological resources are then divided into the following categories:

- 'consumptive value' – value of products consumed directly without passing through a market, such as firewood, fodder and game meat;

- 'productive use value' – value of products commercially exploited; and
- 'non-consumptive use value' – indirect value of ecosystem functions, such as watershed protection, photo-synthesis, regulation of climate and production of soil.

An interesting value framework has thus been constructed which predetermines analysis and options. If the Third World poor, who derive their livelihoods directly from nature, only 'consume', and the trading and commercial interests are the only 'producers', it follows quite naturally that the Third World is responsible for the destruction of its biological wealth, and the North alone has the capacity to conserve it. This ideologically constructed divide between consumption, production and conservation hides the political economy of the processes which underlie the destruction of biological diversity.

Defining production as consumption and consumption as production also matches the demand for intellectual property rights of the North, and denies the intellectual contributions of those in the South who are the primary producers of value.

(iv) *Commercialised conservation*

The economistic bias narrows down conservation options to a commercialised approach in which both the means and ends of conservation are financial values on the market.

Commercialised conservation is linked to the emergence of new biotechnologies which have transformed the genetic resources of this planet into the raw material for industrial production of food, pharmaceuticals, fibres, energy, etc. Commercialised conservation measures and justifies the value of conservation in terms of its present or future use for profits. It does not take into account that this will wipe out genetic diversity. Biodiversity

conservation here is seen only in terms of setting aside reserves in undisturbed ecosystems for the purpose of conservation. This schizophrenic approach to biodiversity, which adopts a policy of destruction of diversity in production processes and a policy of preservation in 'set-asides', cannot be effective in the conservation of species diversity. Biodiversity cannot be conserved unless production itself is based on a policy of preserving diversity.

Exclusive dependence on economic value as the reason for conservation is the wrong place to initiate a conservation programme. As Ehrenfeld has noted: 'By assigning value to diversity we merely legitimise the process that is wiping it out, the process that says, "The first thing that matters in any important decision is the tangible magnitude of the dollar costs and benefits...." If conservation is to succeed, the public must come to understand the inherent wrongness of the destruction of biological diversity.' (Ehrenfeld, 1988).

(v) *The reductionist approach*

The dominant approach to biodiversity is inadequate for conservation both because it values biodiversity only as a commodity, but also because it perceives biodiversity in a fragmented and atomised form. It views biodiversity merely as an arithmetic, numerical, additive category. Thus 'conserving the world's biological diversity' uses biodiversity as an 'umbrella term for the degree of nature's variety, including both the number and frequency of ecosystems, species or genes in a given assemblage' (McNeely et.al., 1990). This leads to a reductionist approach to conservation, which serves commercial objectives well, but fails to fulfil ecological criteria.

Ex situ conservation in high-tech gene banks is the dominant response to conservation of biodiversity. This approach is both static and centralised. It is an efficient means of conservation of

raw material in the form of germ plasm collection. However, it has its limitations both because it removes control over biodiversity from local communities from whose custody the germ plasm has been taken away, and it removes biodiversity from the habitats where the diversity would evolve and adapt under changing environmental conditions.

From Bio-imperialism to Bio-democracy

Conserving Biodiversity on the basis of ecology and equity

(i) *Ecology, equity and efficiency*

An ecologically sustainable and just approach to biodiversity conservation needs to begin by halting and reversing the primary threats to biodiversity. This involves stopping aid and incentives for the large scale destruction of habitats where biodiversity thrives, and stopping subsidies and public support for displacement of diversity by centralised and homogeneous systems of production in forestry, agriculture, fisheries and animal husbandry. Since the drive for this destruction comes from international aid and financing, the beginning for stopping biodiversity destruction and for starting conservation has to be made at that level. In parallel, support needs to be given to ways of life and systems of production that are based on the conservation of diversity, and which have been marginalised by the dominant pattern of development.

Ecologically, this shift involves recognition of the value of diversity in itself. As Ehrenfeld has stated: 'Value is an intrinsic part of diversity.' All life forms have an inherent right to life, and that should be the overriding reason for not allowing species extinction to take place.

At the social level, the values of biodiversity in different cultural contexts need to be recognised. Sacred groves, sacred seeds, sacred species have been cultural means for treating biodiversity as inviolable, and present us with the best examples of conservation. In addition, we need to recognise that market value and dollar value is only a limited value which is often perverse for biodiversity. There are other values of biodiversity, such as those of providing meaning and sustenance, and these values need not be treated as subservient and secondary to market values.

The recognition of community rights to biodiversity, and farmers' and tribals' contributions to the evolution and protection of biodiversity also need to be recognised – by treating their knowledge systems as futuristic, not as primitive.

At the economic level, if biodiversity conservation is to be aimed at conserving life, rather than profits, then the incentives given to biodiversity destruction and the penalties that have become associated with biodiversity conservation need to be removed. If a biodiversity framework guides economic thinking rather than the other way around, it becomes evident that the so-called high production of homogeneous and uniform systems is an artificial measure, which is artificially maintained through public subsidies. If half a calorie of energy produces one calorie of food in non-industrial biodiversity based systems, and 10 calories of energy produce one calorie of food in a homogeneous industrial system, it is clearly not efficiency and productivity that pushes the displacement of the former by the latter. Productivity and efficiency need to be redefined, reflecting the multiple input, multiple output and internal input systems characterised by biodiversity.

In addition, the perverse logic of financing biodiversity conservation by a small percentage of profits generated by biodiversity destruction amounts to giving licence to destruction, and reduces

conservation into an exhibit, not a basis of living and producing. The disadvantages for conserving systems arise from privileges given to destroying systems, and conservation cannot be achieved by extending those privileges and deepening the disadvantages. Third World governments need to remember that one cannot protect one's house against theft by begging the thief to give back a small share of the loot. Protection comes from not allowing theft to take place in the first place.

Ecology, equity and efficiency meet in biodiversity, while they are in opposition with each other in monocultures and homogeneous systems. Diversity ensures ecological stability. Diversity ensures multiple livelihoods and social justice. Diversity also ensures efficiency in a multidimensional context. On the other hand, uniformity creates:

(a) ecological instability;
(b) external control, which leads to displacement of livelihoods;
(c) efficiency in a one dimensional framework, but undermines it at the systems level.

(ii) *Who controls biodiversity?*

Neither ecological sustainability nor livelihood sustainability can be ensured without a just resolution of the issue of who controls biodiversity.

Until recent times, it was local communities who have used, developed and conserved biological diversity, who have been custodians of the biological wealth of this planet. It is their control, their knowledge and their rights that need to be strengthened if the foundations of biodiversity conservation are to be strong and deep. This strengthening has to be done through local action, national action and global action.

After centuries of the gene-rich South having contributed biological resources freely to the North, Third World governments are no longer willing to have biological wealth taken for free and sold back at exorbitant prices to the Third World as 'improved' seeds and packaged drugs. From the Third World viewpoint, it is considered highly unjust that the South's biodiversity be treated as the 'common heritage of mankind', and the return flow of biological commodities be patented, priced and treated as private property of northern corporations.

This new inequality and injustice is being forced on the Third World through the patent system and intellectual property rights by GATT, the World Bank and the US Trade Act. The new North-South asymmetries it will generate make for an unstable world and are of course an issue of major concern. Equally serious is the undermining of the sovereignty of the Third World.

But much more serious is the total erosion of sovereignty of local communities, the original custodians of biodiversity, and the sovereignty of the diversity of life-forms which are our partners in co-evolution, not merely mines of genes to be exploited at will for profits and control.

Putting value on the gene through patents makes biology stand on its head. Complex organisms which have evolved over millenia in nature, and through the contributions of Third World peasants, tribals and healers are reduced to their parts, and treated as mere inputs into genetic engineering. Patenting of genes thus leads to a devaluation of life-forms by reducing them to their constituents and allowing them to be repeatedly owned as private property. This reductionism and fragmentation might be convenient for commercial concerns, but it violates the integrity of life as well as the common property rights of Third World peoples. On these false notions of genetic resources and their ownership through

intellectual property rights are based the 'bio-battles' at FAO and the trade wars at GATT.

To redress the North-South imbalance and to recognise the contributions of local communities to the development of biodiversity, it is imperative that the regime based on bio-imperialism be replaced by structures based on biodemocracy. Gandhi has shown us that absolute power based on unethical and undemocratic foundations can only be challenged by a resurgence of the ethical and democratic.

Biodemocracy involves the recognition of the intrinsic value of all life forms and their inherent right to exit. It also involves the recognition of original contributions and rights of communities which have co-evolved with local biodiversity.

Biodemocracy entails that nation states protect these prior rights from erosion by corporate claims to private property in life forms through patents and intellectual property rights.

The deeper the devolution and decentralisation of rights to biodiversity, the smaller are the chances for the monopolising tendencies to take hold.

Governments of the South can only be strengthened by standing behind their peoples and their biodiversity and supporting and protecting the democratic rights of diverse species to exist, and diverse communities to co-exist with them. If states in the South join the move to deny rights and to take away control over biodiversity from local communities, they too will be weakened and will lose their sovereign rights to and control over biodiversity to economic powers in the North whose global empires in the biotechnology era will be built on the destruction and colonisation of the South's biodiversity.

References

1. Shiva, V. 1989, *The Violence of the Green Revolution: Ecological Degradation and Political Conflict in Punjab*, p54
2. Mooney, P. R. 'The Law of the Seed: Another Development and Plant Genetic Resources', *Development Dialogue* 1983:1-2, p14
3. Treece, D. *Bound in Misery and Iron*, Survival International, p61
4. Ibid, p62
5. Jack Doyle, 1985, *Altered Harvest*, Viking, New York, p205
6. FAO, 1981, *Tropical Forest Resources*, FAO Forestry Paper 30, Rome
7. Raven, P. 1988, 'Our Diminishing Tropical Forests' in Wilson, E. O. (ed) *Biodiversity*, National Academy Press, Washington
8. Wilson, E. O. 1988 'The Current State of Biological Diversity' in Wilson, E. O. (ed) *Biodiversity*, National Academy Press, Washington