BIODIVERSITY, CONSUMPTION PATTERNS AND GLOBALISATION

by Dr.Vandana Shiva

1. Biodiversity as the basis of Sustainable Livelihoods of the Poor.

Biodiversity as the diverse species of life forms is not just a conservation issue. It is also related to the production and consumption patterns on which the poor depend directly. Biodiversity is the means of livelihood and the "means of production" of the poor who have no access to other means of production or assets. For food and medicine, for energy and fibre, for ceremony and craft, the poor depend on the wealth of biological resources and their knowledge and skills related to biodiversity. It is thus the basis of both the production and consumption patterns of the poor.

Biodiversity erosion therefore does not merely have ecological consequences. It also translates into destruction of livelihoods and lack of fulfilment of basic needs for the poorer two thirds of humanity which lives in a biodiversity based economy. The consumption patterns of the rich can undermine the consumption patterns of the poor by contributing to biodiversity erosion.

1.1 Agricultural biodiversity and rural livelihoods

Agricultural biodiversity in the form of plants and animals, is the basis of the livelihoods and consumption of the two-thirds people who live in rural areas in the Third World. The diversity of crop varieties and animal breeds have been evolved as a response to the diversity of different ecosystems. Rice varieties have been evolved to produce in flooded regions and in rainfed mountain slopes. Cattle breeds have been evolved to match the climate in deserts and in wet rainforest regions. Biodiversity is thus intimately linked with cultural diversity in consumption patterns, since cultures evolve in dynamic interaction with nature's endowment. It is also related to diverse production patterns and economic systems.

There exists a very intricate relationship between the local communities and the biological diversity. People are dependent upon the biodiversity for their survival and sustenance. Communities have developed knowledge and found wayd to derive their livelihood 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 living diversity on the land, in the rivers, lakes and seas. So, there exists a symbiotic relationship whereby people have lived off nature while helping to sustain it. The life of communities was enhanced spiritually, culturally and economically as the communities enriched earth's biodiversity.

The knowledge and practice relating to forestry and agriculture best illustrates this. The life support, food giving capacity of the forests have spawned the local knowledge system. This has led to the development of knowledge, practices and lifestyles designed to preserve the integrity and diversity of the forest and its sustainable use. Forests have been a major source of food, fodder, fuel, fibre, timber, medicine, oil and dyes etc.

For the tribes of central India, the forest represents the focal point of their survival. For example, the *mohwa (bassia latifolia)* tree is regarded as special for the tribals of Chattisgarh, Santhal parganas, Bastar and of the Satpuras. A large deciduous tree, usually with a short bole is one of the most important forest trees of India. The fleshy corollas of its flower are eaten raw or cooked, or dried, ground and mixed with flour for making cakes, or distilled into spirit. A thick white oil extracted from the sed is used by the triabls for cooking and burning. For the forest dwellers of central India, the mohwa is life. In Madhya Pradesh, although rice and millet form the staple diet of the tribals, almost all of them supplement it with seeds, grains, roots, rhizomes, leaves and fruits of numerous wild plants which abound the forests.

Grigson noted that famine has never been a problem in Bastar as the tribals were always been able to draw half of their food from the innumerable forest products.[1] Tiwari prepared a detailed list of wild plants species eaten by tribals in Madhya Pradesh. He has listed 165 trees, shrubs and climbers. Of these, the first category contains a list of 31 plants whose seeds are roasted and eaten. There were 19 plants whose roots and tubers are eaten after baking, boiling or processing; there were 17 plants whose juice is taken fresh or after fermenting; 25 plants whose leaves were eaten as vegetables and 10 plants whose petals were cooked as vegetables. There are 63 plants whose fruits are eaten raw, ripe or roasted or pickled, there are five secies of ficus which provide figs for the forest dwellers.

The tree kasorka *(strychnos muxuomica)* found in Malnad forests grows upto 60 inches to 90 inches in height. It bears a lot of foliage and the leaves are bitter in taste. The pesticidal property present in the seeds and leaves have been known to our farmers since time immemorial. Indian farmers value the properties of the phyllanthus emblica tree, using its leaves, barks and twigs for pesticidal purposes.[2]

The above two plant materials are boiled in ten to twelve litres of water for about two hours. To this solution is added cattle urine and this is prepared as a concentrate. For every one litre of this solution, 18 litres of water is added. For one acre of paddy, farmers in Western Ghats have used 180-225 litres to keep off pests. *Hibiscus cannabinus* seeds are sown in upland dry ice fields to control termite attacks. Similarly Nigris is grown in the borders of the crop fields, so that the pests are attracted to the Niger away from other crops.[3]

Indian farmers are dependent on biodiversity for green and organic manure for their field as well as fodder for their livestock. Soil is often described as consisting of solid particles, water, gaseous elements, humus and raw organic matter. Organic matter serves as a nutrient store from which the nutrients are slowly released into the soil and made available to the plants. Trees, shrubs, cover crops, grain, legumes, grasses, weeds, ferns and algae all provide green manure. Green manure crops contribute 30 to 60 kilograms nitrogen per hectare annually. The cumulative effects of continued use of green manure are important, not only in terms of nitrogen supply but also with regard to soil organic matter and micro-elements.[4]

Deep rooted green manure crops in a rotation can help recover nutrients leached to subsoil. Similarly, there is a balance maintained in the ecosystem between the animal population and fodder availability in the ecosystem. A wide range of fodder trees are grown all along the regions. Trees are grown in combination with agricultural crops useful for producing fodder for livestock, Bhimal *(grewia oppositifolia)*, a farm tree in Garhwal region is an important source of farm fodder supply especially in the dry season.[5]

Long before the introduction of chemicals fertilisers in Indian agriculture, the oil seed cakes particularly those of peanut *(arachis hypogaea)*, castor *(ricinus coimmunis)*, and mohua *(bassia latifolia)* were used as a source of plant nutrients. Scientists have reported on the value of seed, bark and leaf of Karanji *(pongamia glabtra)* as manure in the Deccan region. Other plants which contribute to the green manure are thangadi *(Cassia anriculosts)*, yekka *(calitropics gigantea)*, neem *(azadirachta indica)*, the creeper uganishambu *(pettsonia spp)*, and wild indigo *(tephrosia purpurea)*. Some of the other kind of green manure collected from the jungle are: portia *(thespesia populmuraa)*, four o' clock plant *(mirabiulis jalepe)*, all pilli persara *(phaseolus aconitifilius)*. Some of the crops that contribute to the green manure are pulses, for example greengram, horsegram, blackgram, glycricidia maculata, cowpeas and other legumes like sunhemp and diancha.[6]

As for fodder for the animals, the tree *prosopis cineraria* is a most useful plant in the dry parts of the country. There is a popular saying among the farmers that death will not visit a man even at the time of a famine if he has a prospis cineraria, a goat and a camel since the three together would sustain him even under most trying conditions. The trees are heavily lopped during the winter months when no other fodder was available.[7]

In wetland cultivation, it is observed that green manure directly enhances the soil conditions, whereas in dryland, the fodder through animal dung is source of manure. Local tall varieties of rice and millets are also an important source of fodder, which in turn return to the soil as farmyard manure.[8]

Thus, it is the farmers' traditional knowledge of our biodiversity use that helps in increasing yields and protecting the environment, by providing internal inputs as substitutes to economically expensive and environmentally destructive agro-chemical.

Approximately 80,000 edible plants have been used at one time or another since the beginning of agriculture, of which atleast 3,000 have been used consistently. However, only about 150 have been cultivated. Today, our food base is not just down to a few main crops, it is also severely reduced in diversity. Globally we now rely on just eight crops to provide 75 per cent of the world's food.

India which possesses a great diversity of animal livestock is renowned for its livestock wealth. Breeds of livestock have evolved to specifically adapt to their local environmental and climatic conditions, making them intricately involved and indispensable to the rural economies of their regions. Tragically many breeds of livestock are faced with extinction as their numbers have been declining dramatically over the last few decades. The importance of livestock to the rural economies of India, cannot be overstated. Indian livestock provide some of the following draught power and transportation, dung to be used as fertiliser and cooking fuel, dairy products (such as milk, ghee, dhai, buttermilk, butter, rabari, paneer), wool, meat and leather.

Within India, there are 26 breeds of cattle. The *Ongole* breed of cattle from Andhra Pradesh, are reputed to be very strong, appropriate for heavy ploughing as well as excellent for milching. The *Desi* from the same region, are known to be hardy and disease resistant. Quite like the famous *Vechur* breed of cows of Kerala -- which are nearly on the brink of extinction. There are very few Vechur cows remaining in India today, those of which are suriving in Kerala -- due to the conservation efforts of the Department of Animal Husbandry, Kerala Agricultural University. The Roslyn Institute of Britain associated with the cloning of the sheep "Dolly" has surreptitiously obtained embryos of the Vechur cows in order to facilitate their patentable transgenetic research. Just referring to the state of Rajasthan, for example the *Red Sindhi* bullocks are good for agricultural activities and are sound milk producers, while the *Nagauri* of the north are one of the most useful draught breeds of India. Meanwhile Rajasthan possess a multitude of other livestock species and breeds apart from cattle. Some of the breeds of camel include the *Bikaneri, Jaisalmeri, Sindhi, Kutchi* and the *Malwari*. Out of the eight breeds of sheep to be found in the state, six are from the desert areas. Some of breeds are referred to locally as the *Nali, Phugal, Chokia, Jaisalmeri, Malwari* and the *Nagra* -- which is the best wool producer. Sheep play a vital role in the rural economy and households in their provision of wool, milk and meat.[9]

Within India, one can find a broad range of fodder diversity, varying extensively from region to region, intricately linked to the range of indigenous animals present in the area. Over centuries, animals have adapted to the flora environment around them, evolving to a delicate equilibrium between the indigenous animals and the fodder disversity of the region. The communities and their livestock are heavily dependent on the diverse array of fodder, with the differing species of livestock not competing with each other for scarce fodder. Instead, the livestock consume different plants and trees so a balance is sustained.

In particular regions of India, communities have evolved over the centuries a comprehensive medicinal knowledge of local fodder used to cure livestock illnesses. For example, the Bishnoi community in Bikaner district use *saunf, jaggery, ajwain, dried ginger, kali mirch,* and *methi* to cure animals of diseases such as stomach, throat and worm ailments.[10] In the arid regions of Rajasthan, the nomadic people have a specific sustainable livestock fodder base, of which no adverse ecological effects are committed to the ecosystem. The cattle consume a variety of indigenous wild grasses that grow in the sandy soils, Some of these are; *sevan, dhaman, bekkar, bangri* (*gateel* or *dudell*), *chapri, shinabri, kataria, bhurt* and *murath*. Sevan and dhaman grass are particularly important for the health of cattle. Dhaman is known to produce better milk from cows. Goats and camels in the Bikaner district are encouraged to graze on the leaves of desert trees such as the *khejri*. However, the consumption of *kherji* leaves does not endanger the rejuvenation of the tree. It also does not compete with the community's use of the tree's branches and twigs for firewood. Livestock are rfed different species of fodder to avoid competition between the animals as well as over exploitation and depletion of fodder varieties. For instance, dry cows or those temporarily not milking are fed *bhuratt*, while milking cattle are fed guar in addition to the grasses: *sevan, gatia* and *baker*. Gatia is most preferable for sheep, *khejri* leaves ane *ber* for goats while *guar* and *moat* is almost suitable for camels.[11]

1.2 Biodiversity as the basis of health care

It has been estimated that three billion people - 60 per cent of the world's population -- depend upon traditional medicines for their principle source of cure for illness. In India and China, 80-90 per cent of traditional medicines are plant based, and Chinese herbal treatments alone employ 5,000 species. In Kenya, 40 per cent of herbal medicines come from the native forest trees. In Amazoniam an ethnobotanical team has catalogued more than 1,000 plants used by Indians, many of them as medicine.

India also has a rich and ancient heritage of medicinal knowledge based on its vast resources of medicinal plant biodiversity. These systems of knowledge and the sources from which they have evolved from have survived millennia because they are systems built on sustainability. Even today, over 70 per cent of the health care needs of India are met by these systems. According to an ethno-botanical survey, there are 7500 species of plants which have been used for medicinal purposes by the local indigenous communities. The ethnic utilisation of the biodiversity is absolutely tremendous for medicinal and veterinary use. Everywhere local people have made independent appraisals of their local resources. The plant ephedra vulgaris which is found in trans-Himalaya, possesses broncho-dilation properties and is only found in that ecosystem. It is commonly used by the local people as a herbal tea, which is drunk several times a day. A plant named tulse *ocimum sanctum L.*) has a very sacred place in Indian healing since the Vedic period because of its medicinal properties.

In Ayurveda and Siddha, the tulsi leaves and juices from its leaves, roots and seeds are used to cure various ailments, e.g. gas trouble, cough, intestinal worms, skin diseases, and kidney disorders. It also regulates the flow of urine, subdues inflammation and restores the body by cleansing the system of toxins, while strengthening and toning every organ. The Kani tribe of the Agastyar hills in the Southern Kerala have a habit of eating the raw leaves of a plant known as arogya pacha (*trichopus zeylnicus*) which they call `health drug'.

Unlike folk traditions, which are oral traditions, the specialised system is documented. In the Central Himalaya region, rice of the millet cooked in water is mixed with buttermilk and is used in the treatment of chickenpox. In fact, in Ayurveda there is an entire body of knowledge called dhravya guna shastra, which is the indigenous knowledge of pharmacology. It is a very effective holistic knowledge system of understanding the biological activities in plants.

In terms of numbers, India has something like 1400 plants documented in various Ayurvedic texts, approximately 342 in Unani, and close to 328 in the Siddha system.[12] This biodiversity based traditional medicinal system is still being kept alive by 360,740 Ayurveda practitioners, 29,701 Unani experts and 11.644 specialists of Siddha, not to mention millions of housewives and elders who prepare home made remedies for common ailments.

In South Africa, there are approximately 200,000 traditional healers. In total, about 3,000 species of higher plants are used for traditional medicines and of these about 300 are the most commonly used.[13]

Our dependence on plant biodiversity for medicine is indicated by the part of the 76 major pharmaceutical compounds obtained from flowering kplants, only seven can be commercially produced at comparative prices through synthesis. Reserpine, an alkaloid which is produced from the snake root (Rauwolfia Serpentina) and revolutionalised the treatment of nervous disorders is produced for 75 cents per gram from natural sources and for $1.25 per gram through synthesis.

This is just one example of dependence on biodiversity for health care. Besides the large, organised pharmaceutical provides, millions of traditional healers provide health care to the poor through plant based medicine.

In 1988, an international meeting of more than 50 pharmacologists, economists and conservation biologists met in Thailand to develop guidelines on how to conserve medicinal plants. The "Chiang Mai" Declaration called for greater effort to catalogue and conserve medicinal plants and launched a programme to "Save the Plants that Save Lives".

1.3 Marine diversity and livelihoods in fishing

It is estimated that 100 million of the world's poorest people depend on fishing for all or part of their livelihoods. According to an FAO estimate, there are million large scale boats and 2 million small scale boats. It is the large vessels that lead to the problem of overfishing. Most of the large fishing vessels are controlled by transnational corporations and incorporate fish detection, catching and processing, allowing them to become more efficient hunting machines. As the special issue of the Ecologist reports, completely automatic trawl nets that detect electronically the approach of a school of fish and automatically pay out or retrieve warp to place the net directly in the path of the oncoming shoal are now appearing on the market. The "Gloria" super trawl net, developed in Ireland, measures 110 by 170 metres at its mouth, large enough to swallow a dozen Boeing jumbo jets.

The reduction of all value to commercial value results in the development of technologies which are ecologically crude. Large catches are made possible by externalising the destruction of livelihoods, of diverse species and by externalising the destruction over time. Please see **figure 1**.

The misplaced efficiency of technologies created in response to maximising commercial catch has the social impact of destroying the livelihoods of traditional fish communities through the ecological impact of undermining the very basis of sustaining fisheries activities.

As a Malaysian community has said,

> The trawlers approved by the government 10 to 15 years ago are strongly opposed by the small inshore fishermen whose income is small and who use traditional nets. We shoudl be concerned with the government's policy of too mcuh dependence on modern science and technology... The root cause of the present scarcity of fish is trawler fishing. The trawler overturns the soil on the seabed and scoops up all the small fish and fry.

In India, eversince shrimp became an export commodity through export oreinted fisheries development, there is less catch and less to eat.

Until the end of the 1950s marine fish harvest increased at a rate of 5 per cent per annum. After "development" by mid 80s, the rate of growth of marine fish harvest dropped. Fish consumption declined in India from 19 kg/yr to 9 kg/yr. In South America the consumption went down by 7,.9% and in Africa by 2.9%. In the same period European fish consumption rose by 23%.

In India from the early 1970s onwards, the landings of nearly all the major bottom dwwelling fish began to decline sharply, largely because of excessive fishing (in the case of purse0seining) and destructive fishing (in the case of trawling which degraded the sea bed). Catches of sardines and mackerel, once the mainstay of the fisheries, plummeted from 250,000 tonnes in 1968 to 87,000 tonnes in 1990.

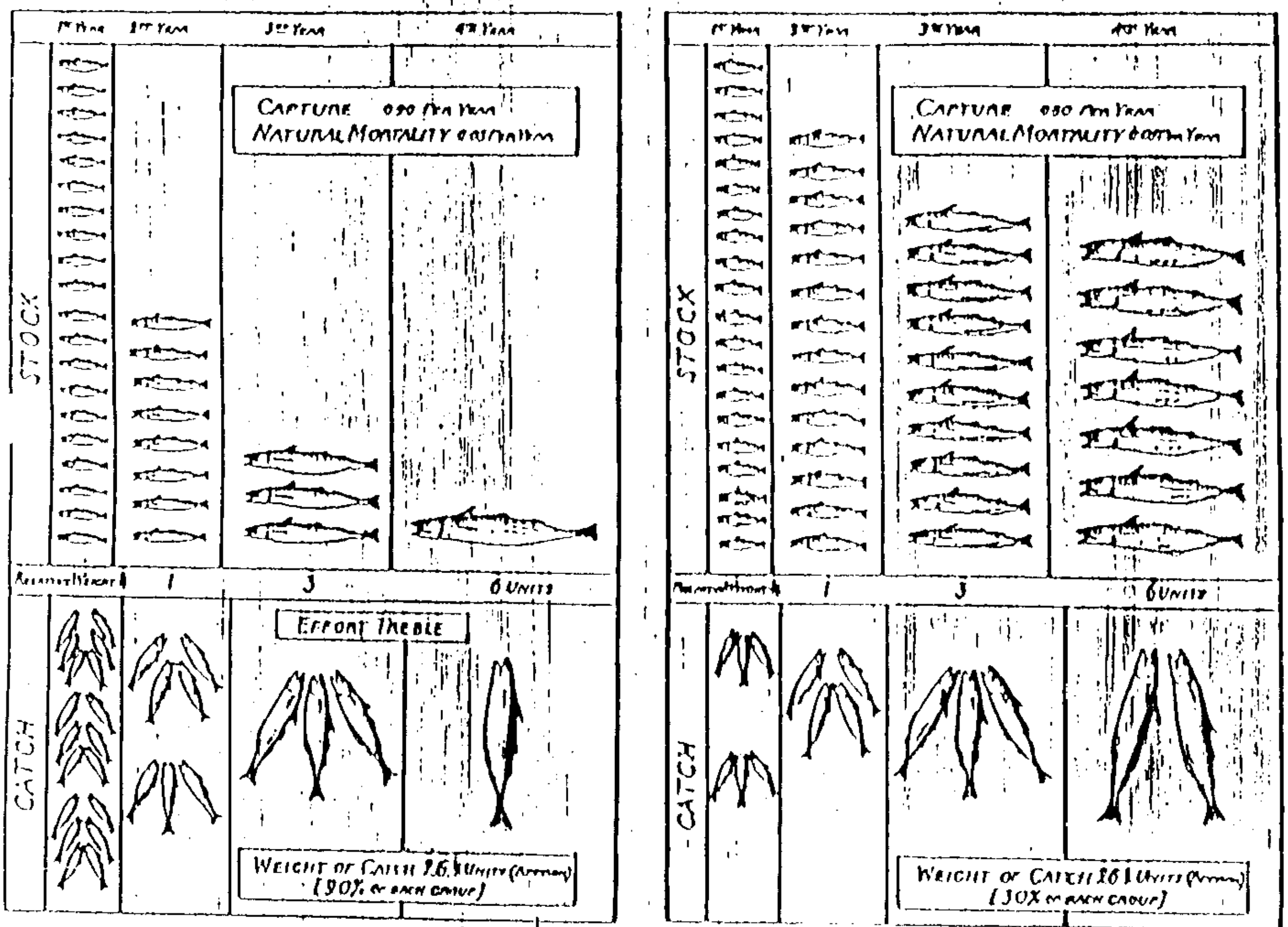
This is the reason that small fishermen world wide have organised to protest their right to fish.

On 23rd and 24th November 1994, one million fish workers from nine maritime states covering a coastline of over 7,500 km went on strike. They were protesting against Indian government policies giving international joint ventures free-access to fish in the country's Exclusive Economic Zone (EEZ). During the week of the National Strike, one joint-venture vessel called at the port in Cochin, Kerala. Its hold contained 2,000 tonnes of perch and snapper, equivalent to the amount caught in one year by1,000 hook and line fishermen in the region. The destructions of local livelihoods by large scale commercial

Figure 1

This is well illustrated by Michael Graham

Michael Graham was one of the first fisheries scientists to explain the problems caused by overcapitalization in fishing. His diagrams compare two hypothetical fisheries, one which catches 90 per cent of each year's class of fish (left-hand diagram) and one which catches just 30 per cent (right-hand diagram). The fishery putting in triple the effort initially has higher catches; in the third year of fishing, however, the catches of both fisheries are exactly the same, while thereafter, the catch of the more intensive fishery declines to less than that of the 30 per cent fishery. The extra fishing effort has been wasted while the spawning stock of the fish has been drastically reduced. Photo: Michael Graham



Ecologist Asia, Vol. 3, No. 4, July/August 1995 fishing fleets is the reason for protests against these boats. A narrow definition of "productivity" based on human labour input continues to relentlessly drive fishing technologies in the destruction of livelihood destruction of millions. However, when measured in terms of the sustainability and diversity of fish yields, these commercial technologies are very unproductive and wasteful.

2. Globalisation and the Destruction of Diversity

Globalisation is a process which creates global consumption and production patterns which are based on monocultures and uniformity. This in turn has an impact on the consumption patterns of the poor in the Third World who depend on local biodiversity for their survival.

The destruction of biodiversity is therefore the destruction of the sustainable livelihoods and sustainable consumption of the poor.

Globalisation is leading to a loss of biodiversity and hence a destruction of livelihoods in three ways.

Firstly, globally mobile investment and the demand for clean production in the North is leading to relocation of resource and pollution intensive industries to biodiversity rich areas in the South, thus destroying both biodiversity and livelihoods dependent on it. Secondly, global consumption patterns create the need for production based on uniformity and monocultures, which is the most important cause for biodiversity erosion as well as displacement of small producers.

Thirdly, globalisation is leading to intellectual property rights regimes, which restrict the rights and entitlements of the poor to continue to have access to the biological resources and knowledge which has been theirs.

Biodiversity erosion starts a chain reaction. The disappearance of a species is related to the extinction of innumerable other species with which it is interrelated 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 serve as industrial raw material and have the potential of spinning dollars for corporate enterprises. It is, more basically, a crisis that threatens the life-support systems ande livelihoods of millions of people in Third World countries.

Biodiversity is a people's resource. While the industrialised world and affluent societies turned their back on biodiversity, the poor in the Third World have continued to depend on biological resources for food and nutrition, for health care, for energy, for fibre, for housing.

2.1 Globalisation and biodiversity and livelihood erosion through habitat destruction: The case of "kewra" against steel.

Steel plants around the world are closing down due to excess capacity and global competition. Steel plants are then getting relocated in countries like India where ecological destruction and displacement are forced on people to provide the social and environmental subsidy to make steel production in India "globally competitive".

Tata Steel and Iron Com.Ltd. (TISCO) ar proposing a Rs. 7000 crore steel project for exports. The project also requires the construction of a dam across the Rushikulya to pump water to the plant. The project will affect the inhabitants of around 25 villages of the Chhatarpur-Berhampur tehsils and 12 villages at Pipalapanka Reserve Forest in Saroda block, of the Ganjam district, in Orissa. The plant would require about 4.4 million tonnes of iron ore per annum, for which a deposit having a potential of 400 million tonnes of iron ore reserves should be necessary. For this a mining lease for 38 sq.km area around Mankadnacha -- Baliapahar area in Keonjhar and Sundergarh districts in Orissa has been applied for, Nippon Steel Corporation of Japan has been appointed technology consultants, while serveral other foreign interests are vying for technical contracts associated with the project.

5000 acres of private land is being sought by TISCO, in addtiion to about 1500 acres for a township for its workforce and for rehabilitation colony. More than 25,000 people will be displaced from the plant site alone, in addition to displacement from the township and displacement colony site, as a sacrifice for exporting steel at a time when steel plants in the north are closing down.

The 5000 acres set in mind for the site is rich in biodiversity, containing lush green fields of *coconut groves, jack fruit, banana, mango, cashew nut, pineapple, date, black berry, guava, rose berry, papaya, tamarind, palang (Calophythum inophyllum), drumstick, casurina, lemon, achu.* Most important to the local people is the Kewra (*pandanus fascicularis*) -- endemic to the local region. Please see **Table 1**. This plant, known for its aromatic properties, has provided the mainstay for the local economy, providing the dominant source of livelihood for several generations of local people.

Financial assessments were carried out gauging the current approximate earnings for Gopalpur families. Two acres of orchard land through the sale of fruit alone, provides an annual income of Rs. 334,700, while the annual income from one acre of agricultural lands is Rs. 35,950.Please see **Tables 2 and 3**. From these figures, approximations have been made for 5000 acres of orchards and agricultural crops in the porposed plant site being approximately 50 crores (1 crore = 10 million rupees). This amount represents the potential lost income for 25,000 local people.

The people of Gopalpur are meantime blocking the establishment of the steel plant through direct action. They are refusing to leave their homes, their fields and their kewra

Table 1

Income from Kewra (Gopalpur Plant Site – 5000 acres inhabited by 25,000 people)	Income from 56 Distillation Units Under the Gopalpur Plant Site (Rs)
Kewra Flowers (approx. flowers production 2.80 crores, each flower cost Rs. 4.50)	126,000,000
Kewra Flower Distillation Charges (@ Rs. 600 per 1000 flowers)	16,800,000
Distillation Waste	168,000
OTAL	**142,968,000**

Table 2

Hortl. Crops	No. of trees/ Flowers	Each tree/ flower Income	Total Income
Kewra flowers	: 4,000 flowers	Rs. 4.50 each	Rs. 10,000
Coconut Tree	: 160	Rs. 1000	Rs. 1,60,000
Mango Tree	: 6	Rs. 1200	Rs. 7,200
Jackfruit Tree	: 8	Rs. 3500	Rs. 28,000
Cashew nut	: 20 Trees	Rs. 3000	Rs. 60,000
Pineapple	: 1500 plants	Rs. 5 each	Rs. 7,500
Banana	: 400	Rs. 120	Rs. 48,000
Drum sticks	: 6	Rs. 1000	Rs. 6,000
Sapeta Tree	: 2	Rs. 1000	Rs. 2,000
Sita Fruit	: 10	Rs. 300	Rs. 3,000
Palang Tree	: 5	Rs. 600	Rs. 3,000
Aachu Tree	: 4		
Aru Tree	: 4		
Gomarh Tree	: 5		
Forest Trees	: 10		
			Rs.3,34,700

Table 3

Agri. Crops in one Acre	Yield	Price per kg/ bag	Total
Paddy (Aug - Dec)	23 bags	Rs. 400.00 per bag	Rs. 9,200
Mung (kidney bean) (Feb-May)	250 kg	Rs. 17.00 per kg	Rs. 4,250
Vegetables a) Brinjal	2000 kg	Rs. 5.00 per kg	Rs. 10,000
b) Tomato	2500 kg	Rs. 5.00 per kg	Rs. 12,500
			Rs. 35,950

plantations. The proposed steel plant will devastage the livelihoods of the people of Gopalpur, who are dependent on the kewra plant and other biodiversity for their living.[14]

2.2. Globalisation, the Homogenisation of Consumption Patterns and Production of Uniformity

Globalisation of consumption patterns creates monocultures and leads to the destruction of diversity. The poor are affected by biodiversity erosion linked to globalisation -- first, they are pushed into deeper poverty by being forced to "compete" with globally powerful forces to access to these local biological resources. The Leipzig Global Plan of Action on Plant Genetic Resources for Food and Agriculture based on 158 country reports and 12 regional and sub-regional writings has stated that "the chief contemporary cause of the loss of genetic diversity has been the spread of modem, commercial agriculture. Please see **Figure 2**.

Secondly, their economic alternatives outside the global market are destroyed. **Table 4** gives the Genetic Uniformity of major U.S. crops.

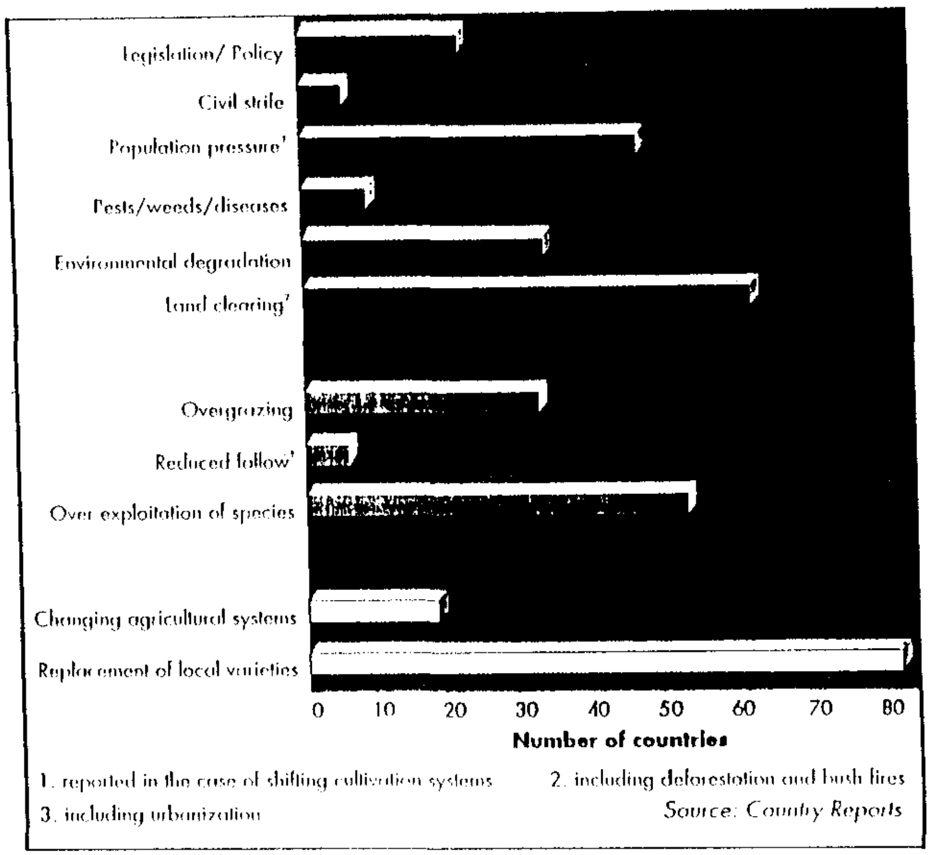
A U.S. Department of Agriculture list of recommended fruits published in 1897 included more than 275 different varieties of apples. Today by contrast, the apple varieties sold by producers are less than 1 dozen. Supermarkets around the world essenttially offer three types of apples: a red one (the Starking, from the U.S.), a Yellow one (the so called Golden Delicious, also from U.S.) and a green one (the Granny Smith or peppin, from Australia).[15] A survey done in France showed that a few years ago, the diet was rich with 250 plant species including vegetables, fruits and condiments. Today, barely 60 are cultivated in the region of which only 30 make up the bulk of local consumption.

The wheat diversity in Greece has declined by 95 per cent. As the food industry becomes more concentrated and integrated, uniformity is the result. In these globalised systems, only 15 per cent of the price of a loaf of bread goes to the farmer -- the rest goes to m;illing, baking, packaging, transport and marketing. Almost 90 per cent of the food consumed by Northern consumers is processed. Today, 75 per cent of the European Communities milk is produced by a quarter of the dairy farms, and 60 per cent of the cereals come from 6 per cent of the grain farms. 80 per cent of the pork output comes from 10 per cent of the pig producers. 90 per cent poultry comes from 10 per cent poultry farm. Each year, half a million farmers are displaced. It is therefore not just diversity which is eroded but livelihoods also. 80 per cent of all farmland in Europe is sown to just 4 crops.[16]

Table 5 gives the varietal uniformity in Netherlands and **Table 6** gives the varietal uniformity inEurope.

In the U.K. the national crop potato is dependent on just a few varieties. Three varieties cover 68 per cent of the area, and one variety covers 40 per cent of the area. Please see **Table 7** for Genetic Poverty on the farm in Europe.

Figure 2



The chief contemporary cause of the loss of genetic diversity has been the spread of modern, commercial agriculture. The largely unintended consequence of the introduction of new varieties of crops has been the replacement – and loss – of traditional, highly variable farmer varieties. This process was the cause of genetic erosion most frequently cited by countries in their Country Reports.

Source: "The Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture: The Global Plan of Action", The State of the World Report, FAO, Rome, 1996

Table 4

Genetic Uniformity of Major United States Crops
Extent on which Small Numbers and Varieites Dominate Crop Average

	Major Varieties	Average (%)
Bean, dry	2	60
Bean, snap	3	76
Cotton	3	53
Corn*	6	71
Millet	3	100
Peanut	9	95
Pea	2	96
Potato	4	72
Rice	4	65
Soybean	6	56
Sugar beer	2	42
Sweet potato	1	69
Wheat	9	50

* Corn includes seeds, forage and silage

Source: Cary Fowler and Pat Mooney, "Shattering Food, Politics and the loss of Genetic Diversity", The University of Arizona Press, 1990

Table 5 Varietal uniformity in the Netherlands (1989)
Percentage of acreage sown to lead cultivars

Crop	*Top variety* (%)	*Top two* (%)	*Top three* (%)
Winter wheat	61	73	79
Spring wheat	94	98	99
Spring barley	76	87	92
Winter barley	59	71	81
Oats	56	74	91
Rye	47	83	95
Forage peas	45	70	93
Fodder maize	21	37	53
Sugar beet	32	59	77
Potato	78	82	84

Source: Calculated by GRAIN from *Beschrijvende Rassenlijst voor Landbouwgewassen,* Wageningen, 1990.

Table 6 Varietal uniformity in France (1990)
Percentage of acreage sown to lead cultivars

Crop	*Top variety* (%)	*Top two* (%)	*Top three* (%)
Durum wheat	40.59	52.58	61.20
Bread wheat	21.90	32.27	39.38
Barley	27.05	42.75	47.75

Source: Draft ONIC statistics for 1990, provided by ONIC to GRAIN.

Table 7

Genetic poverty on the farm in Europe

Wheat	• More than 90 per cent of the French bread wheat varieties registered and sold to farmers over the past 30 years share at least one common parent in their pedigree; only 9 per cent are truly original types. • Nearly half of the German wheat varieties registered for sale in 1986 derived from the same parent, Caribo. Caribo itself is derived from the French variety Cappelle, one of the top three wheat progenitors used in France. (These top three are found in nearly half the bread wheat seed on the French market.) • The top four varieties cover about two-thirds of the crop's acreage in West Germany through the 1980s. • The top four varieties represent 71 per cent of Britain's winter wheat acreage.
Barley	• On 3 October 1990, the date of German 'reunification', East German farmers were prohibited from growing varietal mixtures of barley to produce a more uniform product for the West German brewing industry.
Maize	• In 1986, 60 per cent of the French maize harvest came from five varieties. Of these five, all but one were produced by one firm, France-Maïs, which is owned by the American company Pioneer Hi Bred. • Some 80 per cent of the maize seed produced in France in 1979 had either F7 or F2xF7 as a parent. Both F2 and F7 were created in the 1950s from the folk population Monts de Lacaune.
Rye	• In the 1980s, the single variety Halo accounted for half the acreage planted to rye in West Germany.
Sunflower	• In the mid 1980s, two varieties, Mirasol and Frankasol, both produced by Cargill, represented more than 50 per cent of France's sunflower production.
Potato	• All European potato cultivars derive from two plants brought in in the 15th century. Despite the introduction of wild materials, all cultivated potatoes in Europe carry genetic traces of their common ancestor, Rough Purple Chili. • One variety, Bintje, developed in the 1940s, covers nearly 80 per cent of the potato fields in the Netherlands.
Sugar beet	• All cultivated European varieties carry the same genotype for susceptibility to Beet Yellow Virus. • Widespread occurrence of powdery mildew in northwest Europe viewed as a 'timely warning' to broaden genetic variation in this crop. • All European sugar beet hybrids are based on the same source of cytoplasmic male sterility, isolated in the 1940s.
Fruits	• Three cultivars make up two thirds of the newly planted apple crop in Czechoslovakia, replacing most landraces over the past 20 years.
Vegetables	• In 1980, more than 1,500 distinctly named varieties were banned from the EC market under the pretext that they were 'synonyms'; independent researchers showed that fewer than 40 per cent were actually different names for the same variety, while more than 60 per cent were originals, simply denigrated by the private sector as not worth the bother to maintain.

Source: Compiled by GRAIN from a range of sources including *Broadening the Genetic Base of Crops* (Pudoc, 1978), P.B. Joly and M.A. Hermitte, *Biotechnologies et Brevets* (CNRA/INRA, 1991), M. Glachant, *La Diversité Biologique Végétale: Elements d'Economie* (CERNA 1991), *Biological Diversity: A Challenge to Science, the Economy and Society* (European Commission FAST Programme, 1987), and various issues of *Semences et Progrès*.

In the case of pigs, the entire pork economy of the world is based on 4 breeds -- Duroc, Yorkshire, Hampshire and Landrace. Hundreds of native pig breeds are thus being pushed to extinction.

In China 40-50 breeds were used, and there are being replaced by hybrid pigs bred from the 4 "Global" breeds.[17]

Behind these figures is hidden major destruction of livelihoods as the case of luxury consumption of shrimp brings out vividly.

2.3 Prawns and the price paid by the poor for the luxury consumption of the rich

Figure 3 shows the increasing trend in the consumption of prawns or shrimp in the rich industrialised communities. Most of this shrimp is produced in the countries of the South. Please see **figure 4**.

The boom in shrimp consumption and shrimp industry led to cultured shrimp production increasing from 10 per cent in 1985 to 30 per cent in 1992. During the last decade, shrimp aquaculture has become a major component of fish farming both in terms of area and of market value. Though pushed by both national and international organisations as an answer to world food scarcity, particularly that of proteins, in reality, it contributes little to the nutritional needs of the world's population, being a luxury item that is consumed mainly by the rich in the developed world.

Luxury consumption of shrimp for northern consumers is however very costly for local communities.

In country after country, where commercial shrimp farming has been tried, it has proved totally unsustainable. For a variety of reasons: such as degradation of the environment, pollution, and diseases. The degraded ponds can rarely be used for any kind of agriculture. For this reason, this industry is known as the 'rape and run' industry.

Shrimp aquaculture production varies widely from year to year and from place to place, as it is particularly sensitive to disease outbreaks. Till 1988, Taiwan was the world's largest producer. However, a major disease outbreak in 1988 led to the collapse of the industry there, and it has still not recovered. China then led world production till 1993, when its productivity dropped for similar reasons. Today, Thailand is the world's largest producer of shrimp. Shrimp farms in India were subject to a major virus attack in 1994 and early 1995, which led to the government's declaring a crop holiday for the industry.

While climate plays a role in the proliferation of the shrimp industry in tropical Asia, this is not the only reason. Taiwan, which does not lie in the tropical zone, also led world production at one time. A draft report prepared by the United Nations Research Institute for Social Development shows that while the U.S. contributes less than 0.5 per cent to the

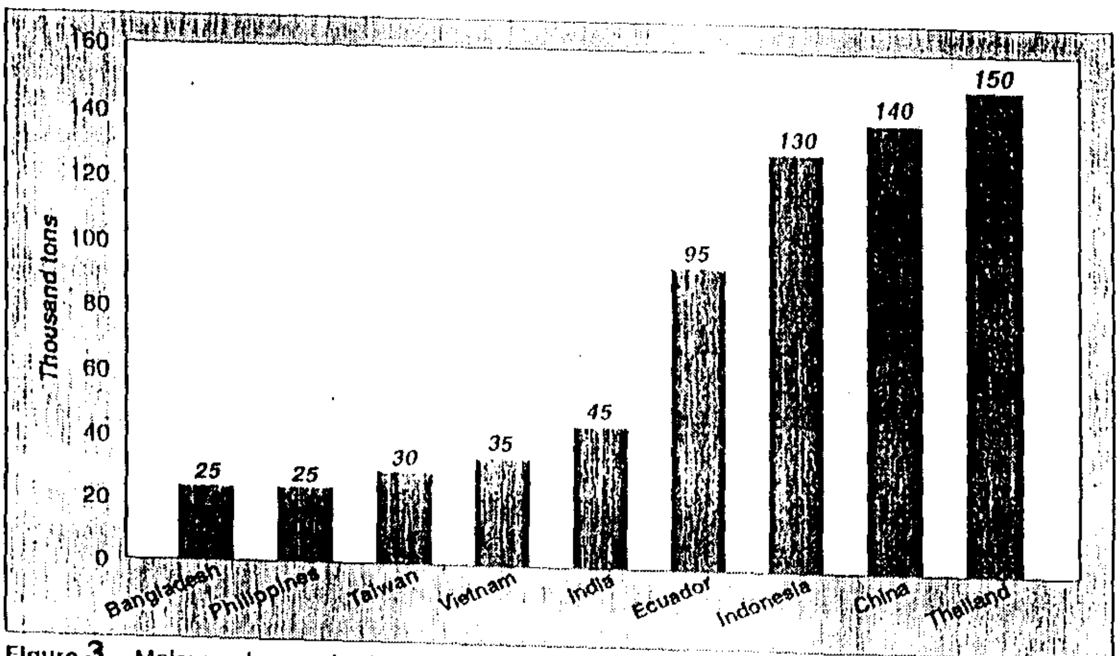


Figure 3 . Major producers of cultured shrimp in the world

(Source: Csavas 1994)

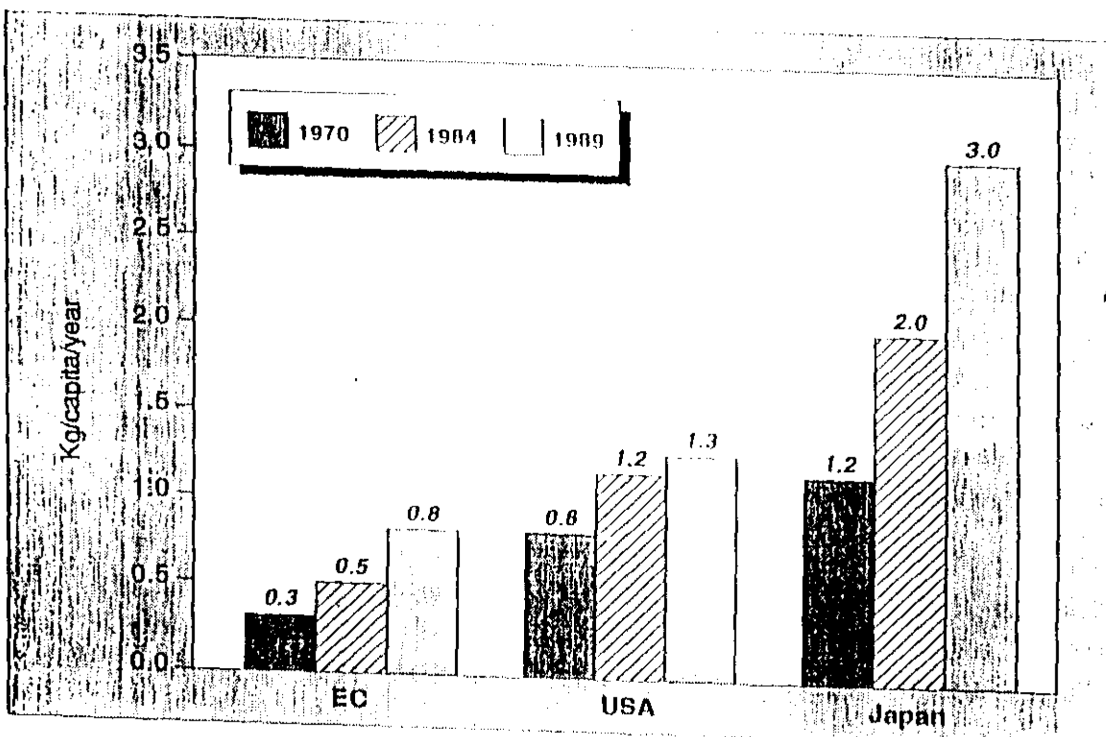


Figure 4 Per capita shrimp consumption in major export markets
(data from GLOBEFISH 1989; Ferdouse 1990)

world's shrimp production, it has shown high rates of return in comparison to other shrimp producing countries. In spite of such high productivity, and the profits that accrue to the industry, shrimp farming has not proliferated in the U.S. or in any other industrialised country. Instead U.S. investment and involvement in aquaculture has grown in countries like Mexico and Ecuador. In all, Western hemisphere accounts for less than 25 per cent of the world shrimp production.

This indicates that the environmental destruction caused by intensive shrimp farming is one of the major factors for its spread in Third World countries (TWCs), even though the main consumers of shrimp in the world are in affluent countries. Please see **figure 5.**

The non-sustainability of industrial shrimp farming is directly related to its intensiveness. Shrimp farming if of 5 kinds -- traditional, extensive, modified extensive, semi-intensive, and intensive. **Table 8** gives the characteristics of different prawn systems. **Figure 6** gives the non-sustainability dimensions.

The maintenance of high production levels of intensive shrimp farms, and to some extent semi-intensive and extensive farms, requires the use of artificial feeds, pesticides and antibiotics in large quantities.[18] These inputs, along with pond construction, not merely damage the local environment, but also directly and indirectly adversely affect mangrove forest ecology, resulting in salinisation and pollution of land and water, increase in diseases and as well loss in land and marine biodiversity.

Shrimp farming is leading to a major destruction of mangroves which have been called the nurseries of marine life. Mangroves play crucial ecological role in coastal ecosystems by protecting against tropical rain storms, anchoring the shifting mud and thus preventing erosion of coastal land, and providing shelter and habitat for fish and other marine life.[19]

Table 9 gives the loss of mangroves as a direct result of Shrimp Aquaculture.

Figure 7 gives relationship between mangroves and cultural shrimp in the Asia-Pacific region.

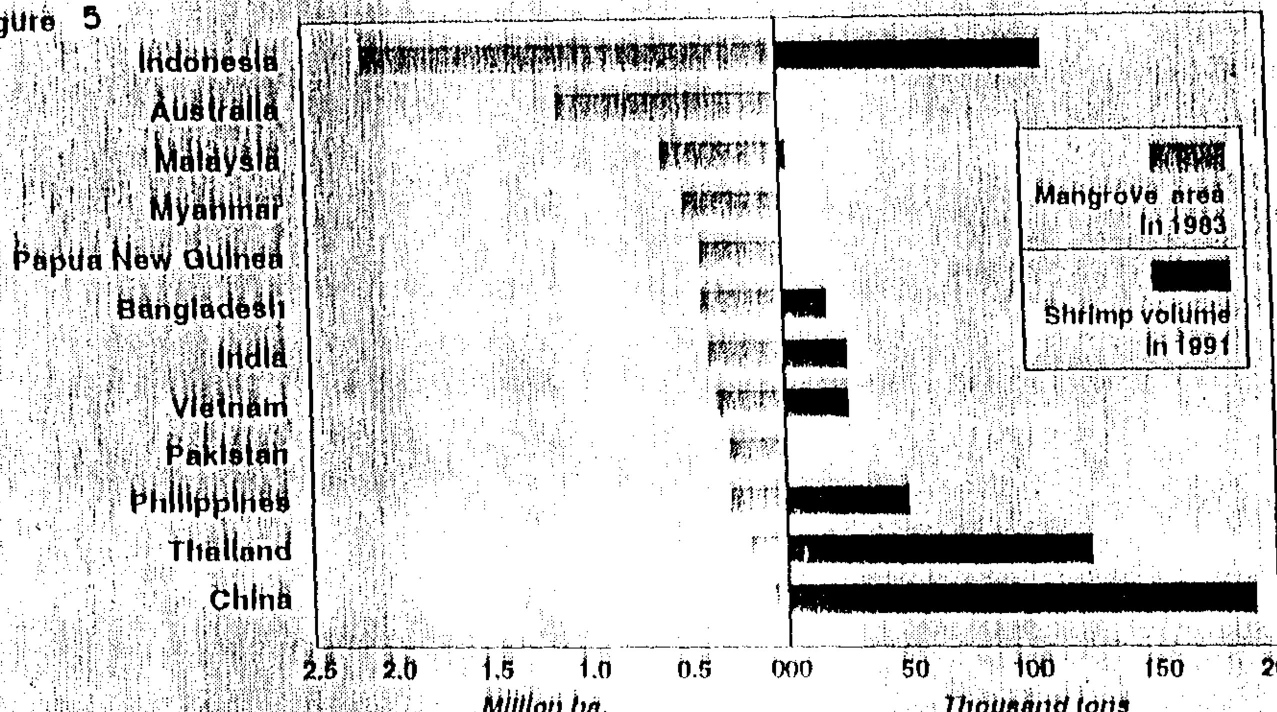
Mangrove destruction leads to depletion of marine resources, hence declining catches for small fishing communities.

In addition, marine fisheries is destroyed in three ways by industrial shrimp farms.

- Wild fry is the major source of seed in shrimp farms. For every single fry of commercially desirable P.Monodon caught. More than 1000 other species are wasted as "Fry by Catch" leading to species loss and extinction.

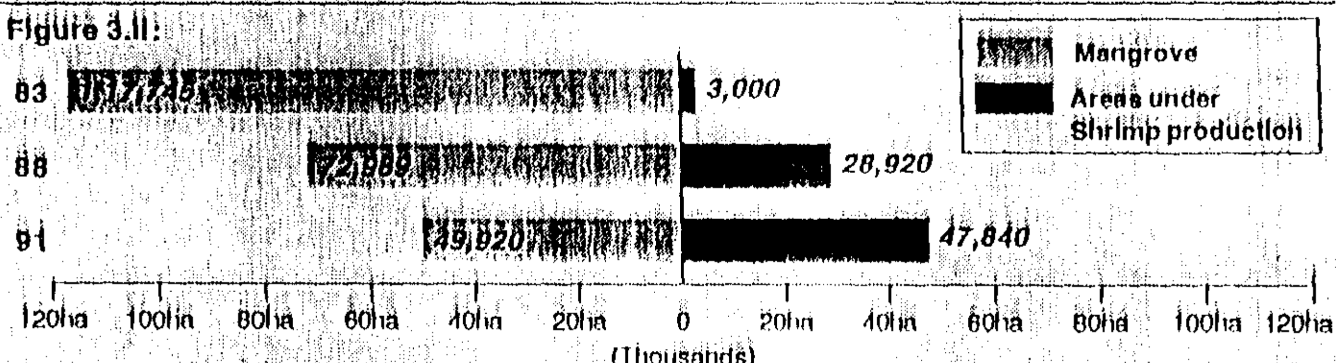
- Fish caught at sea is a major source of shrimp feed. Each ton of industrial shrimp requires 10 times its weight in marine fish for conversion to feed.

Figure 5



Relationship between mangrove resources and cultured shrimp production in Asia and the Pacific (data from Saenger, Hegerl and Davie 1983, FAO 1993).

Figure 3.II:



Relationship between mangrove resources and shrimp production in Minh Hai (data from Sembo & Kloth 1996).

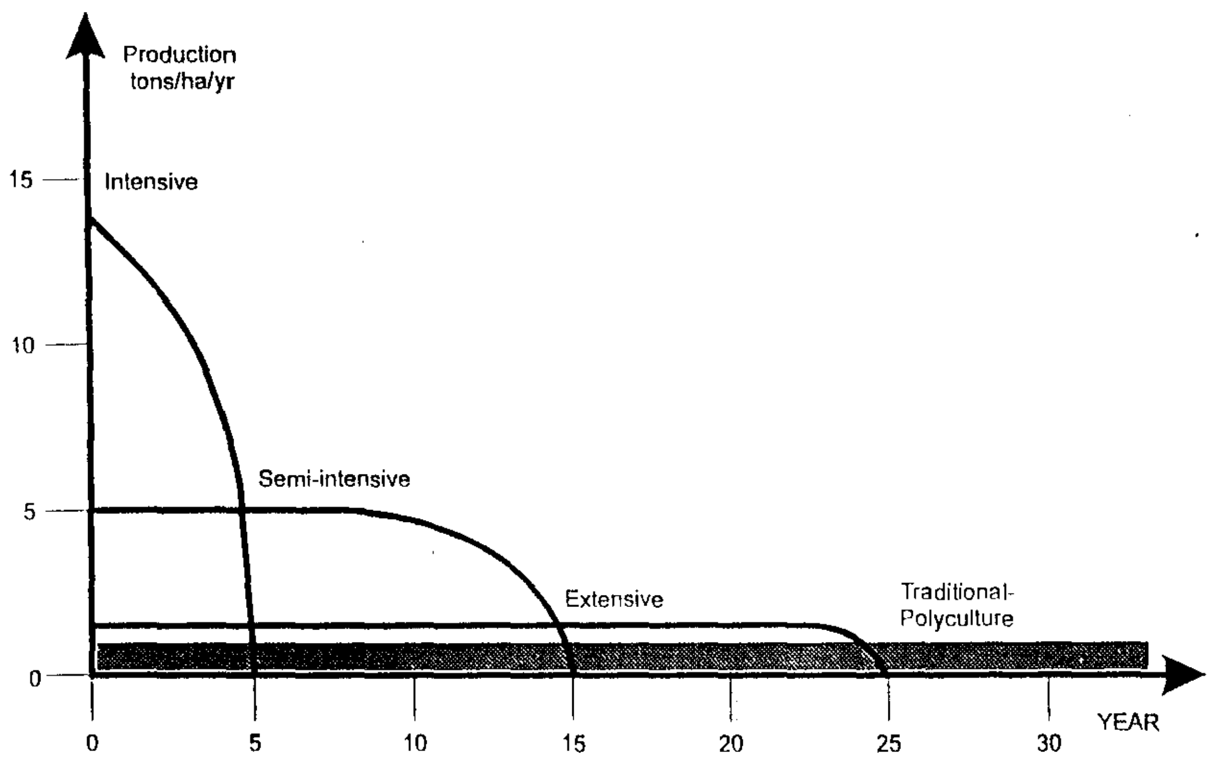
Table 8

Summary of Prawn Aquaculture Systems

CHARACTERISTICS	Traditional	Extensive	Modified Extensive	Semi-Intensive	Intensive
Pond Size	>5 ha	1 to 5ha	1 to 2ha	0.2 to 0.5	0.03 to 0.1
Stocking density	Natural, under 10,000/ha	Natural and Artificial 10,000	Majority artifical 10,000 to 18,000	Artificial 1 to 3 lakhs/ha	Artificial 5 to 20 lakhs/ha
Average Production annual	0.5 to 1 tonnes/ ha/year	1 to 1.5 tonnes/ ha/crop	1.5 to 2.0 tonnes/ ha/crop	Upto 5 tonnes/ ha/crop	10 to 20 tonnes/ ha/crop
Feed Source	Natural	Natural and Formulated	Formulated	Formulated	Formulated
Seed Source	Natural/wild	Hatchery/wild	Hatchery	Hatchery	Hatchery
Water Exchange	Tidal	Tidal and pumping	Pumping	Pumping	Pumping
Aeration and Water Exchange (%)	nil	2 to 4 times daily	4 to 6 times daily	6 to 10 times daily	> 10 times and oxygen injectors
Fertilisers	None	Organic and biodegradable	Organic and biodegradable	Organic and biodegradable	Organic and biodegradable
Diversity of crop	Polyculture	Occasionally Polyculture, majority monoculture	Monoculture	Monoculture	Monoculture
Disease and Viruses	Very rare to nil	Rare	Moderate	Moderate to Frequent	Frequent
Management	Minimal	Minimal with some skilled personnel	Skilled personnel	Skilled personnel	Highly skilled
Employment	No figure for employment, however 30-40% of operating budget is for labour	Up to 7 persons/ha 45 days per working cycle	Less than 7 persons/ha	1-3 persons/ ha employed for 26 days	1 person/ha, only 6% of the operating budget is for labour
Effluent treatment	Not required	Not required	Required	Required	Required
Environmental implications	*Self sustaining system *Yields 6 mths prawn/fish and 6 mths paddy in chemmeen system	*Self sustaining with inputs *Requires land to be cleared *Only produces prawn	*System relies on inputs *Requires land to be cleared *Only produces prawn	*System relies on inputs *Self polluting *Only produces prawn	*System relies on inputs *Pollutes environment *Only produces prawn
Social implications	*Provides employment *Source of food	*Provides employment *Source of food if product not exported	*Product export, *Little employment	*Product exported *Mechanised *Little employment	*Product exported *Mechanised *Little employment
Viability of system	Productivity of system is continuous, if uninterrupted	Productivity of system is 15 to 20 years	Productivity of system is 15 years	Productivity of system is less than 10 years	Productivity of system is 5-10 years

Source: MPEDA, Waterbase 1993, Lin 1995, Dunavera 1993, WWF/UNRISD 1996, Nijera Kori 1996

Figure 6



(Source : N. Kautsky, 1997)

Table 9 : Loss of Mangroves as a Direct Result of Shrimp Aquaculture

Country	Estimated Area (ha.)
Ecuador	1,20,000
Thailand	2,00,000
Bangladesh	9,250
Vietnam	67,000
India	35,000
Malaysia	20-25% of Malaysia's total mangrove forests

Source : Wilks 1995, FAO Report #47 1991, UNRISD/WWF 1996, Sernbo and Kloth 1996."

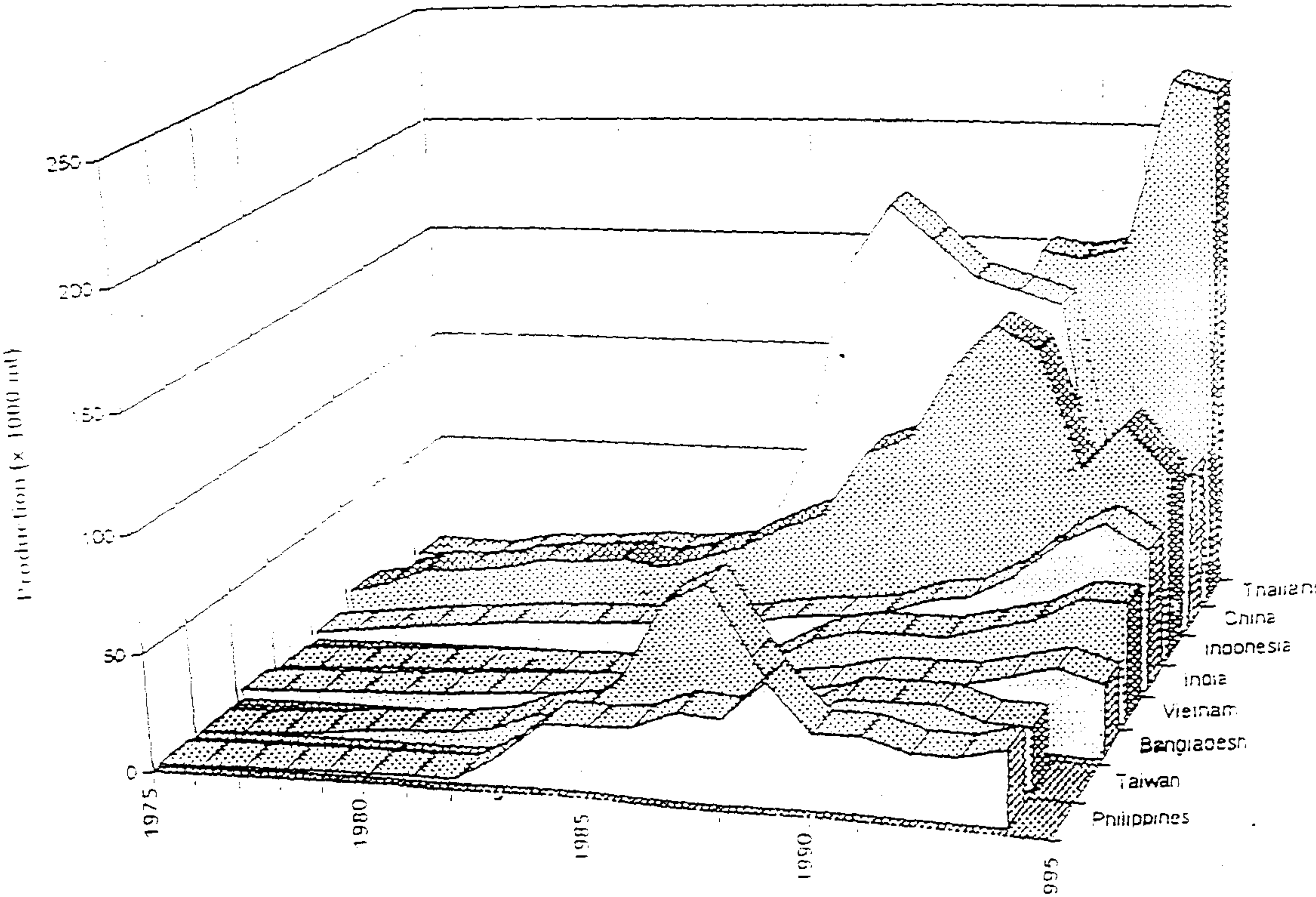


Fig. **7** Production of cultured shrimp in leading Asian countries (data from Rosenberry, 1989-1995; Ferdouse, 1996

- The pollution from shrimp farms also kills fish life and destroyes marine resources.[20]

As Mr. Chandran of Tarangamvadi district, Nagapattnam stated,

> In this district there are 28 fishing villages spread over 75 kms. Apart from the general issues of environment and drinking water being affected, an important issue is that of mother prawns and the seedlings. Because of the prawn farms, the seedlings are not making their way back to the high seas from the estuaries. This has led to a decline in our fish catch. Where earlier the catch used to be 25 tons of prawn every 6 months, now it is down to 5 tons every 6 months.
>
> While the prices of the raw material and the nets have increased, that of prawns have gone down. Every time we catch a kilo of prawns, we have to use up 1kg. of net, i.e. we use Rs. 500/- worth of net to catch Rs. 200/- worth of prawns.[21]

Livelihoods in agriculture are also destroyed because the salt water pumped from the sea causes salinisation. Agriculture and drinking water are both destroyed.

The large scale pumping of sea water into the shrimp farms is the most serious environmental impact of shrimp farming. The massive extraction of fresh water from underground aquifers for salinity control in the ponds poses a serious threat to the salinity control of the coastal ecosystems.

Prawn culture activity requires the pumping of sea water into ponds, since the majority are marine prawn species which require a salinity between 25-30 ppt.[22] The growing period for prawn is between 120-140 days, meaning seawater is also on the land for this period of time which is sufficient to allow salt water to seep into the neighbouring agricultural farm areas and as well into the water table.[23]

Destruction of mangrove forests also leads to increased salinity as there is an increase in flood area thereby allowing further intrusion of salt water onto land.

The massive extraction of fresh water from underground aquifers for salinity control in the ponds also intensifies the problem of salinity. Estimates show that roughly 6600m^3 of fresh water are needed to dilute full sea water in a one hectare pond at one metre water depth over a cropping period of four months. Emptied aquifers are subject to salt water intrusion. Seepage from the tanks also increases salinisation of ground water.

1 ha. industrial shrimp farm requires 120,000 cubic metres of sea water annually. This 12 metres of saline water over and above the water in coastal ecosystems creates serious problems of ground water salinisation.

Ground water salinisation is creating a major drinking water famine creating tremendous difficulties for women of coastal regions. Women are walking for 10 miles to collect water or paying Rs.5/- for a pot of water. Since people's livelihoods are being destroyed as a result of the destruction of coastal ecosystems, this additional burden is becoming economically unsustainable and families are migrating out of coastal regions.

As Chine Venkaiah of Nellore stated at the Public Hearing,

> My village has about 200 families, and is surrounded by 2000 acres of prawn farms. Two creeks are there around the village.
>
> Big bunds have been constructed all over the village and the creeks. Earlier, during yearly floods, the waters used to be max. 2-3 ft. high, and would flow for about 10 days, never affecting our agricultural activities. Now, because of the bunds, free flow of water is not possible and in the floods last year, about 9-10 ft. high waters were flowing over the agricultural fields. The entire land has turned saline. The five agricultural villages in this area would be in deep trouble because of the big bunds.[24]

Fisherfolk in Kuru village in Nellore district were supplied with extremely meagre quantities of freshwater in tankers only after the local women protested. The richest ground water source in the entire country, the coastal region, has therefore been struck by water famine. Each shrimp exported from the country thus amounts to an export of large scale aquifers if the costs of ground water destruction are internalised in shrimp production.

Shrimp farms flush their effluents and wastes directly into the sea and neighbouring mangrove and agricultural lands.

The water quality of prawn farms is maintained by the regular refilling of ponds with 'fresh' sea water. The outflowing pond water, cntaminated with heavy concentrations of pesticides and antibiotics, is discharged either back to the sea or to rivers and commercially produced food pellets instead of natural feed. The use of various chemicals in the feed, some 32 required ingredients,[25] accumulate at the surface bottom of the pond causing deposits of algae and bacteria which affect the oxygen balance of the water.

The Supreme Court of India appointed an expert committee to look into the social and ecological costs of aquaculture. **Table 10** gives the costs calculated.

These costs are not unique to India. They have been calculated in other parts of the world through the ecological footprint.

The ecological footprint of a productive system is the productive ecosystem required to supply inputs to the production and to assimilate waste outputs from the production cycle.

Every 1 M^2 of an industrial shrimp farm can require upto 200 M^2 of marine and coastal ecosystems for input supply of shrimp seed and water and for sinks for waste and pollution. Please see **figure 8**.

Table 10

Andhra Pradesh

Parameters	Costs, Rs. in Lakhs	
	Permanent Damage	*Annualised Damage*
Land	10,573.40	95.20
Equivalent wages for the farmer to be earned		38511.00
Equivalent cost of agricultural produce of rice and husk		1102.16
Loss due to cutting of casuarina trees in terms of loss of fuel		42750.00
Loss in terms of grazing grounds		23.80
Loss involving diseases		85.00
Loss due to cyclones due to cutting of casuarina trees		400.00
Loss due to desertification of land		40222.60
Loss in terms of potable water		924.40
Total loss due to mangrove destruction		42750.00
Loss in fishing income		60077.20
Loss due to damage to fishing nets		3081.00
Man days lost due to non-approachability to the sea coast		400514.00
Total Damage	10,573.40	63,05,36.96 (Rs. 6305 crores)
Earnings from the sale of coastal aquaculture produce	1,49,765.00 (Rs. 1498 crores)	

Tamil Nadu

Parameters	Costs, Rs. in Lakhs	
	Permanent Damage	*Annualised Damage*
Land	1,779.12	160.20
Equivalent wages for the farmer to be earned		7200.00
Equivalent cost of agricultural produce of rice and husk		207.16
Loss due to cutting of casuarina trees in terms of loss of fuel		7200.00
Loss in terms of grazing grounds		0.40
Loss involving diseases		16.00
Loss due to cyclones due to cutting of casuarina trees		80.00
Loss due to desertification of land		752.00
Loss in terms of potable water		172.80
Total loss due to mangrove destruction		7200.00
Loss in fishing income		11232.00
Loss due to damage to fishing nets		576.00
Man days lost due to non-approachability to the sea coast		7488.00
Total Damage	1,779.12	42,284.80 (Rs. 423 crores)
Earnings from the sale of coastal aquaculture produce	28,000.00 (Rs 280 crores)	

Figure 8

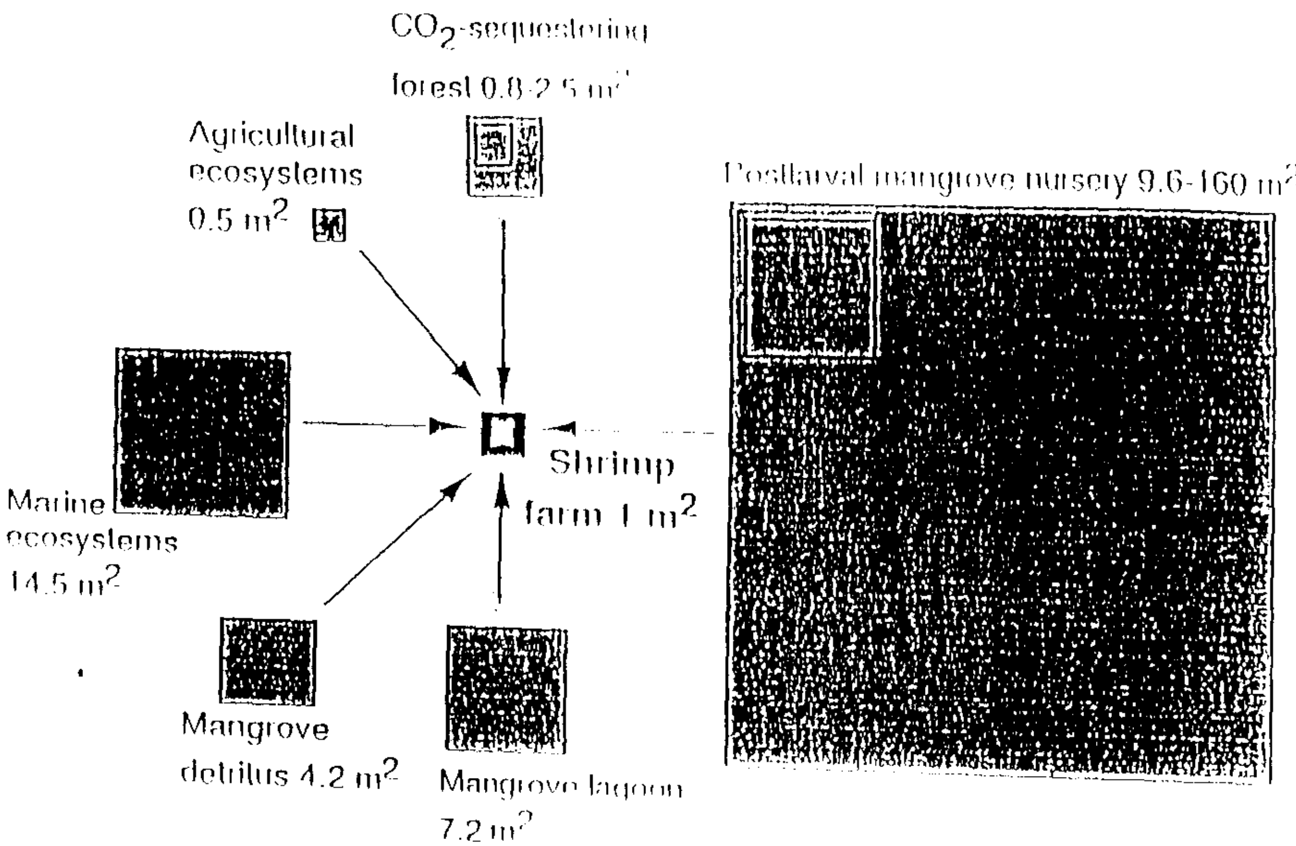


Figure 1 Ecosystem areas (m2/m2 cultured area) appropriated by a semi intensive shrimp farm in a coastal mangrove area, Bay of Barbacoas, Colombia (redrawn from Larsson et al 1994).

3. Policy Issues.

3.1 Biodiversity and technology policy

Conservation of biodiversity requires a shift in consumption patterns. This in turn requires a shift in technology policy. In the monoculture paradigm, technology policy has been guided by maxmising the one dimensional output of biological systems, even though this has resulted in massive destruction of diversity and with it the destruction of livelihoods.

Biological production is systematically propelled in directons which create monocultures and destroy diversity because commodities that feed the consumption patterns of the rich are given value, and products that feed the consumption patterns of the poor are devalued.

3.1 (a) The monoculture paradigm

A dominant myth of the industrial agriculture paradigm is that productivity requires the creation of monoculture and the destruction of diversity. 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 modern 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 such as eucalyptus, and push into extinction the diversity of local species which fulfills local needs. Agricultural modernisation 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 Massachusets, this is analogous to taking stones from the foundation of a building in order to repair the roof. This strategy of basing productivity increase on the destruction of diversity is dangerous and unnecessary.

An article in Scientific American has developed this approach further and has shown how the economic economic calculations of agricultural productivity of the dominant paradigm distort the real measure of productivity by leaving out the benefits of internal inputs derived from biodiversity as well as the additional financial and ecological costs generated by purchase of external inputs to substitute for internal inputs in monoculture systems.[26]

In a polyculture, 5 units of inputs produce a 100 units of output, while in monoculture, 300 units of input produce the same 100 units. Please see **Figures 9 and 10**.

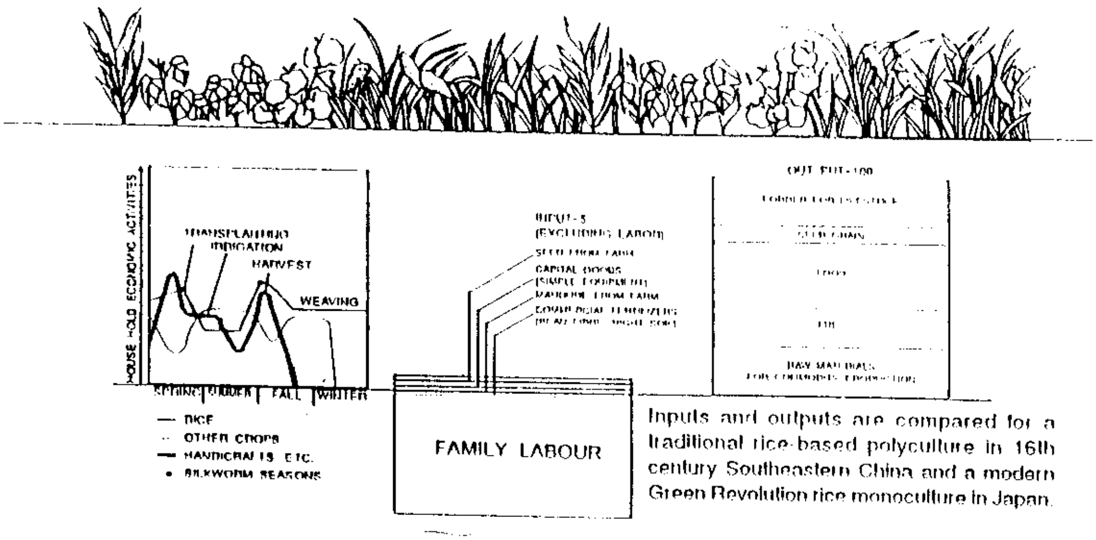
As I have argued in "Monocultures of Mind",[27] the perception that --

monocultures = high productivity

diversity = low productivity

Fig. 9

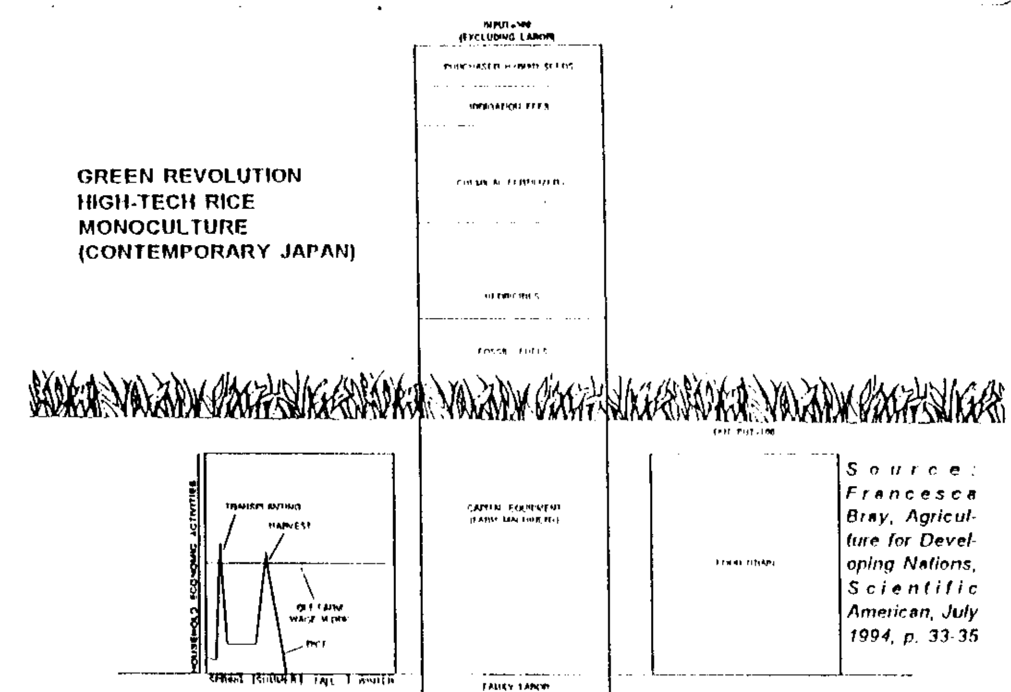
TRADITIONAL RICE-BASED
POLYCULTURE
(16-CENTURY S.E. CHINA)



Inputs and outputs are compared for a traditional rice-based polyculture in 16th century Southeastern China and a modern Green Revolution rice monoculture in Japan.

Figure 10

GREEN REVOLUTION
HIGH-TECH RICE
MONOCULTURE
(CONTEMPORARY JAPAN)



Source: Francesca Bray, *Agriculture for Developing Nations, Scientific American, July 1994*, p. 33-35

The height of the labeled bars reflects the relative amount of that input or output. The curves at the bottom left of each diagram indicate how the people of the farm household apportion their productive time. In the poly culture economy the women do little work in the fields but are heavily involved in handicrafts such as silk production. In the monoculture economy, women do more of the field work because many of the men have off-site jobs.

is based on monoculture thinking. It is linked to centralised control over food and agriculture system by interests external to it. Diversity is the view from the inside. Monocultures is the view from the outside.

The diversity paradigm The inside view	The monoculture paradigm The outside view
The view of poor peasants and women inhabiting agro-ecosystems is the diversity paradigm.	The view from the outside,held by agribusiness; agrichemical companies and external experts is the monoculture view.
The problem for them is "What is the use of a hectare which maximises basic needs satisfaction,while minimising external inputs and maintaining nature's capital?	The problem they pose is "What is the use of a hectare to maximise output of a single commodity of interest to them while also maximising sales of external inputs?"
The answer from the inside is "biodiversity intensification".	The answer from the outside is "Chemical Intensification"

Not till diversity is made the logic of production can diversity and livelihoods be conserved. If production continues to be based on the logic of uniformity and homogenisation, uniformity will continue to displace diversity and ecologically costly patterns of production will continue to displace people from work. 'Improvement' from the corporate viewpoint, or from the viewpoint of western agricultural or forestry research, is often a loss for the Third World, especially for 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.

Plant improvement and animal improvement in agriculture and fish improvement in aquaculture has been based on the 'enhancement' of the yield of desired product at the expense of unwanted plant parts. The 'desired' product is however not the same for agribusinesses and Third World peasants. Which parts of an ecosystem and production system will be treated as 'unwanted' depends on what class and gender one is. What is unwanted for agribusiness, the livestock industry or the fisheries industtry may be wanted by the poor, and by squeezing out those aspects of biodiversity, technological and '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 fertilising the soil. The yields were `high' from the viewpoint of centralised control of food-grain trade, but not in the context of diversity of species and products at the level of the farm and the farmer. The Blue Revolution is squeezing out diverse marine species, and the White Revolution has pushed many animal breeds into extinction

Overall productivity and sustainability is much higher in mixed systems of farming livestock and forestry which produce diverse outputs, even though dimensional yields are higher over a short period in a monoculture.

These high partial yields do not translate into high total (including diverse) yields.

Production is therefore different depending on whether it is measured in a framework of diversity or uniformity.

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

If all outputs and all inputs are taken into account, industrial agriculture and industrial aquaculture is very inefficient. These inefficiencies are hidden by major subsidies for water, energy, chemicals and transport, and by excluding the purchased chemical inputs from being included in inputs.

Monocultures need external inputs. External input agriculture and aquaculture is now recognised as being non-sustainable. Energy derived from fossil fuels for farm operations, such as ploughing and threshing is contributing to the build up of green-house gases and climate change. Chemicals for fertilisers and pesticides are leading to contamination of ecosystems and inputs unviable. **Table 11** gives the comparison of HYV and traditional varieties from the economic perspective of marginal farmers in marginal regions. **Tables 12 & 13** show that even in the context of yields, traditional varieties can yield more than HYV varieties.

In addition to the ecological costs of external inputs in agriculture, the economic costs are also becoming too high for most farmers. Fossil fuel and fertiliser prices have shot up with the removal of subsidies and are beyond the reach of small and marginal farmers.

Ecological and economic sustainability of agriculture demands that these costly and environmentally destructive external inputs be substituted by internal inputs which are locally available and are environmentally regenerative. Biodiversity conservation is an important means for rebuilding resources for internal inputs in agriculture.

Thus animals provide milk, meat, energy and fertilizer, however, since affluent consumers need more milk and meat, while poor producers need sustainable and renewable energy

Table 11

	HYV	(Paddy) Rs.400/Q	Traditional	
Yield	15-16 Q/A	Rs.6400	10 Q/A	Rs.4000
Straw	not used		12-14 Q/A	Rs.1000
(Paryat,Geetanjali, Swarna)				
Costs				
Seeds	10 Kg/A	Rs. 550		O
Fertilizer	50 Kg/A	Rs. 625		O
Grow more Urea	Kg/A	Rs. 350		O
Pesticide				
Themut	5 Kg/A	Rs. 250		O
Democrin		Rs. 100		O
Water		Rs. 700/acre		O
Labour		Rs.1800/acre		Rs.1000/acre
Return		Rs.2100		Rs.4000

Table 12

Comparison of Yield in Green Revolution Paddy varieties and indigenous varieties in Garhwal Himalaya

Rice variety	Yield 1992			Yield 1993		
	Grain	Straw	Total	Grain	Straw	Total
Indigenous varieties						
Thapachini	66	94	160	66	92	158
Hansraj	50	80	130	48	75	123
Rikhva	56	64	12	50	66	116
Jhumkia	72	104	176	66	90	156
Rekhalya	48	80	128	48	70	118
Ghiyasu	48	80	128	58	90	168
Basmati	50	80	130	42	75	117
Ramjawan	52	64	116	40	50	90
Green Revolution varieties						
Kasturi	40	56	96	40	54	94
Pant 6	52	40	92	50	40	90
Saket 4	48	36	84	68	64	132
Saket 4	-	-	48	36	84	
Dwarf (unknown)	33	36	68	48	40	88

Table 13

Comparison of productivity of native varieties and Borlaug (Green Revolution) varieties of wheat (2)

	Native variety	Borlaug variety
Yield kg/ha.	3291	4690
Water demand	53 cm	16 cm.
Fertiliser demand	47.3	88.5
Productivity with respect to water use (kg/ha/cm)	620.94	293.1
Productivity with respect to fertiliser use (kg/ha/kg)	69.5	52.99

2 Shiva, V. Violence of the Green Revolution, Third World Network, 1991, p. 196

and fertilisers, animal breeding has selected animals for maximum milk and meat yields, and the functions needed by the poor, such as drought power, have been bred out. This had led to extinction of breeds which provide sustainable energy alternatives.

3.1 (b) Racist attitude to crops and biodiversity destruction: Nutrition/acre Vs Kg/acre.

Sometimes the productivity consider measurements land as an input, but does not focus on the entire output from an acre of land. They only consider the output of the farm commodity of interest.

In Orissa farmers continue to use traditional varieties largely because of the contribution that the tall straw makes to thatch for housing and because lack of capital makes the purchase of external chemical impossible.

Further, even in the restricted definition the output considered is never of the nutrition per acre, but only of weight per acre.

This focus on quantity irrespective of quality has also been a major reason for displacement of agricultural biodiversity. Nutritious crops with low resource requirements have been called as "inferior", "coarse", "marginal" -- while crops low in nutrition have been promoted as the basis of food security, highly nutritious crops such as amaranth, buckwheat, finger millet, barnyard millet have been pushed to extinction. Please see **Tables 14 and 15**.

The treatment of `white' as superior and `dark' as inferior is a kind of racism extended from human societies to biodiversity. A distorted idea of productivity focussing on kilograms per ha.of so-called superior crops rather than nutrition per ha. is like eugenics in agriculture. Like racism among people, a racist attitude to crops is illegitimate and unjustified. Diversity of crops is diversity of cultures. The Leipzig Global Plan Action has recommended the developing of new markets for local varieties and diversity rich products derived from farmers varieties. Biodiversity conservation thus becomes the basis of market pluralism.

3.2 Biodiversity and Property Rights

Biodiversity has been the common property of the poor. They have saved, utilised, reproduced and exchanged seeds, plants and animals as part of the process of the continuity of life.

Even though references are increasingly made to `global biodiversity' and `global genetic resources', biodiversity is not a global commons in the ecological sense in which the atmosphere or oceans are. Biodiversity exists in specific countries and is used by specific communities.

FOOD VALUE OF AMARANTH AND CHENAPODS

TABLE 14

Composition of Cereal Grains and Amaranth Grain

	Iron	Calcium	Protein	Calories	Fibre (crude)	Total Dietary Fibre	Soluble Fibre
Amaranth	3-22	25-389	16-19%	366	4-14%	16-17%	11%
Corn	2	10	9-13%	352	2-3%		
Wheat	12	48	12-14%	343	1-2%	7%	
Oats	4	50	14-16%	384	2%	6-9%	4-5%
Rice	3	10	8%	353	1%	2-4%	
Barley	3	16-34	12%	353	2-3%	6%	

TABLE 15

Food Value Comparison of the Himalayan Grains Chenapods with other Crops

Parameter	Himalayan grain chenapods	Quinoa	Amaranth	Wheat	Barley	Rice	Maize	Finger millet
Protines, %	16.0	15.0	16.0	12.0	11.0	6.8	11.1	7.3
Carbohydrates, %	66.0	68.0	62.0	69.0	69.0	78.0	66.0	72.0
Lipids, %	7.0	5.0	8.0	1.7	1.3	0.5	3.6	1.3
Minerals, %	3.0	3.0	3.0	2.7	1.2	0.6	1.5	2.7
Energy, kcal/100g	395	391	376	341	336	345	328	328

Source: "Cultivating Diversity:Biodiversity Conservation and Politics of Seed", The Navdanya Team,New Delhi, 1993,p130

The `global' as related to biodiversity does not derive from its ecological status, but its emerging role as `raw material' for global corporations.

The emergence of new intellectual property regimes and new and accelerated potential for exploitation of biodiversity creates new conflicts over biodiversity -- between private and common ownership, between global and local use.

3.2 (a) Biodiversity: whose resource?

Biodiversity has always been a local common resource. A resource is common property when social systems exist to use it on the principles of justice and sustainability. This involves a combination of rights and responsibility among users, a combination of utilisation and conservation, a sense of co-production with nature and of gift giving among members of the community.

There are many levels at which resource ownership and the concept of knowledge and access to it differs in private property regimes and common property systems. Common property biodiversity systems recognise the intrinsic worth of biodiversity. Regimes governed by IPRs see value as created through commercial exploitation. Common property knowledge and resource systems recognise creativity in nature. As John Todd, a visionary biologist, has stated,biodiversity carries the intellgigence of 3 1/2 billion years of experimentation by lifeforms. They see human production as co-production and co-creativity with nature. They are also based on usurpation of the creativity emerging from indigenous knowledge and the intellectual commons. Further, since IPRs are more a protection of capital investment than a recognition of creativity *per se*, there is a tendency for ownership of knowledge and products and processes to move towards where the capital is most concentrated and away from poor people without capital. Knowledge and resources are therefore systematically alienated from the original custodians and donors and become the monopoly of the transnational corporate sector.

Through this trend biodiversity is converted from a local commons into an enclosed private property. The enclosure of the commons is the objective of IPRs in the area of lifeforms and biodiversity. This enclosure is being universalised through the TRIPs treaty of GATT and through certain interpretations of the Biodiversity Convention.

3.2 (b) W.T.O./TRIPs

IPRs are supposed to be property rights to products of the mind. If IPR regimes reflected the diversity of knowledge traditions that account for creativity and innovation in different societies, they would necessarily have to be plural, reflecting a triple plurality -- of intellectual modes, of property systems, and of systems of combinations. However, IPRs as being implemented nationally as a follow-up of the finalisation of Uruguay Round of GATT and the implementation of WTO rules, or as unilaterally imposed through Special 301 clause of the U.S. Trade Act, are a prescription for a monoculture knowledge. These instruments are being used to universalise the U.S. patent regime worldwide, which would inevitably lead to an intellectual and cultural impoverishment since it would displace other ways of knowing, other objectives for knowledge creation, and other modes of knowledge sharing.

The TRIPs treaty of WTO is based on a highly restricted concept of innovation. By definition, it is weighted in favour of transnational corporations, and weighted against citizens in general, and Third World peasants and forest dwellers in particular. People everywhere innovate and create. In fact, the poorest have to be most innovative, since they have to create survival while it is daily threatened.

However, IPRs as construed in the trade treaty and be will as enforced by the World Trade Organisation have been restricted and reduced at a number of levels.

The first restriction is the shift from common rights to private rights. As the preamble of the TRIPs agreement states, intellectual property rights are recognised only as private rights. This excludes all kinds of knowledge, ideas and innovations that take kplace in the "intellectual commons" -- in villages among farmers, in forests among tribals and even in universities among scientists. TRIPs is therefore a mechanism for the privatisation of the intellectual commons, and de-intellectualisation of civil society, so that the mind becomes a corporate monopoly.

The second restriction of intellectual property rights is that they are recognised only when knowledge and innovation generates profits, not when it meets social needs. Article 27.1 of TRIPs in GATT refers to the condition that to be recognised as an IPR, innovation has to be capable of industrial application. This immediately excludes all sectors that produce and innovate outside the industrial mode of organisation of production. Profits and capital accumulation are recognised as the only ends to which crativity is put. The social good is no longer recognised. Under corporate control a 'de-industrialisation' of production in the small scale and in the informal sectors of society takes place.

The most significant reduction of IPRs is achieved by the prefix "trade related". Since, most innovation in the public domain is for domestic, local and public use, not for international trade, and only multinational corporations (MNCs) innovate exclusively to increase their share in global markets and international trade, TRIPs in WTO will only be an enforcement of the rights of MNCs to monopolise all production, all distribution and all profits at, the cost of all citizens, and small producers worldwide, and Third World countries.

Article 27.5.3 (b) of the TRIPs text WTO refers to the patenting of life. The Article states

> Parties may exclude from patentability plants and animals other than micro-organisms, and essentially biological processes for productions of plants or animals other than non-biological and micro-biological processes. However, parties shall provide for the protection of plant varieties either by patents or by an effective *sui*

> *generis* system or by any combination thereof. This provision shall be reviewed four years after the entry into force of the Agreement.

The first part of the Aticle addresses the patenting of life. On first reading, it appears that the article is about the exclusion of plants and animals from patentability. However, the words `other than microorganisms' excludes the exclusion of microorganisms from patentability. It therefore makes patenting of microorganisms compulsory.

Since microorganisms are living organisms, making their patenting compulsory is the beginning of a journey down what has been called the slippery slope that leads to the patenting of all life.

The Trade Related Aspects of Intellectual Property Rights Agreement (TRIPs) as it is most often referred, falls under the purview of the World Trade Organisation (WTO).

In the preamble itselfm it recognises the...

> underlying public policy objectives of national systems for the protection of intellectual property, including developmental and technological objectives.

Under Article 1(1), it is stated that:

members shall give effect to the provisions of this Agreement. Members may but shall not be obliged to, implement in their law more extensive protection than is required by this agreement, provided that such protection does not contravene the provision of this agreement. Members shall be free to determine the appropriate method of implementing the provisions of this agreement within their own legal system and practice.

Articles 7 and 8 allow for evolving appropriate instruments in national legislation to protect public interest. Article 8 states:

> members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provision of this agreement.

Article 27, also known as `exclusion clause', provides protection to biodiversity without offending any of the other provisions of the TRIPs. It deals with `Patentable Subject Matter', stating under clause 2, that

> members may exclude from patentability inventions, the prevention within their territory of commercial exploitation of which is necessary to protect "Order Public" or morality, including to protect human, animal or plant or health or to

> avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law.

3.2 (c) The Convention on Biological Diversity

The 1992 Convention is an international treaty devised for the protection of biodiversity guaranteeing to individual states sovereign rights over biodiversity and the patterns of its utilisation. The state thus regulates access to their genetic resources and can deny it if it appears harmful to its national interests. In the preamble, it recognises that traditional knowledge, innovations and practices are of importance to the conservation of biological diversity and that indigenous and local communities have a close and traditional dependence on biological resources. Their livelihood and lifestyles often depend upon it and are shaped by it.

The preamble to the Convention commits countries to local community knowledge and practices, to take community consent before using such knowledge widely, and to share the resulting benefits with them on an equitable basis.

The preamble asserts:

> that states have a sovereign right over their own biological resources

and that

> they are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner.

Further it recognises the:

> close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components.

The Convention provides a comprehensive definition of the term `biological diversity; which it defines under Article 2 as,

> the variability among living organisms from all sources including interalia, terrestial, marine and other aquatic eco-systems and the ecological complexes of which they are a part; this include diversity within species, between species and ecosystems.

Under Article 3, it recognises the sovereign rights states have in accordance with the Charter of the United Nations...

> to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Article 8(j) recognises that:

> subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovation and practices.

The Convention acknowledges the role of local farmers and tribals in bio-conservation, and obliges states to provide avenues for the protection of farmers' and national rights to biodiversity, and indigenous knowledge. Furthermore, it exhorts states to protect and encourage customary use of biological resources in accordance with cultural and traditional practices that are compatible with conservation or sustainable use requirements.

Article 10(a) and 10(c) directs the contracting parties to:

> integrate consideration of the conservation and sustainable use of biological resources into national decision making and protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.

In accordance to Article 10 (c):

> contracting parties are obliged to protect and encourage customary use of biological resources in accordance with traditional cultural practices to conserve and sustainably use these resources.

Article 15(1) refers to access to genetic resources recognises the

> sovereign rights of states over their natural resources, the authority to determine access to genetic resources rests with the national government and is subject to national legislation.

It also states under 15(2) that:

> each contracting party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other contracting parties and not to impose restrictions that run counter to the objectives of this Convention.

Under Article 15(4) and (5), it directs that such access be granted on mutually agreed terms and subject to prior informed consent.

Significantly Article 18(4) of the Convention states that the contracting parties shall:

> encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation of sustainable use requirements.

and;

> develop methods of cooperation for the development and use of technologies including indigenous and traditional technologies in pursuance of the objectives of this Convention.

The Convention calls upon contracting parties to ensure that such IPRs are supportive of and do not run counter to its objectives. In view of recent trends through TRIPs in WTO to oblige developing countries to strengthen IPRs protection, the Convention may offer an opportunity to reject the establishment of a regime which will be incompatible with its objectives.

3.2 (d) Preventing Biopiracy

A major policy challenge is emerging in the form of "biopiracy" -- the piracy of the knowledge and resources of the poor by the rich. If biopiracy continues, and only the intellectual property rights of scientists and corporations are recognised, and the innovation of indigenous people and traditional societies is not recognised, the poor will keep getting poorer as their resources and knowledge keep getting appropriated and privatised. Protection of the rights of the poor to their biological resources therefore requires that international treaties and national laws evolve mechanisms to recognise and protect the innovation and community rights or indigenous users.

IPRS as an extension of the eurocentric concept of property to biodiversity and biodiversity related knowledge.

The culturally biased and narrow notions of rights and property that have shaped IPRs are inadequate and inappropriate for indigenous cultures and for the objective of conserving biodiversity and cultural diversity. Through IPRs and TRIPs, a particular eurocentric culture has been universalised and globalised. When applied to biodiversity, such narrow concepts of rights become mechanisms for denying the intrinsic worth of diverse species, and denying the prior rights and prior innovations of indigenous communities.

The reason that the collective and cumulative innovation of millions of people of thousands of years can be "pirated" and claimed as an "innovation" of western trained scientists or corporations is because of two reasons. The first reason is the colonial hangover of the idea that science is unique to the west, and indigenous knowledge systems cannot be treated as scientific.

The second reason is that countries like the US, where most pirated indigenous innovations are filed for patenting, do not recognise the existing knowledge of other countries as prior art. Thus, while patent regimes offer no protection to indigenous communities for their common innovation and their common resources, they allow the appropriation of their biodiversity and knowledge by scientists and commercial interests of other cultures, including members of the 'modern' scientific culture in their own societies.

Juridical innovation is, therefore, needed which would achieve three tasks simultaneously.

it would protect the biodiversity and cultural integrity of indigenous communities, and allow them to continue to use their resources and knowledge freely as they have done through times immemorial

it would prevent the piracy and privatisation of indigenous biodiversity and indigenous knowledge through IPRs, nationally and internationally.

it would carve out a public domain of commons in the area of biodiversity and knowledge.

To reflect the collective and community nature of the innovation and right related to indigenous biodiversity utilisation, we call these rights "community intellectual rights" (CIRs).

IPR system evolved in industrialised countries reflected in the TRIPs agreement only recognise western knowledge systems as scientific and formal and non-western knowledge systems are regarded as unscientific and informal. The creation of monopoly rights to biodiversity utilisation through its claim to the creation of 'novelty' can have serious implications for erosion of national and community rights to biodiversity and devaluation of indigenous knowledge. TRIPs give countries the option of formulating its own *sui generis* regime for plants as an alternative to patent protection. Collective rights can be a strong candidate for such *sui generis* systems for agricultural biodiversity and medicinal plant biodiversity. Therefore, it is crucial that community held and utilised biodiversity knowledge systems are accorded legal recognition as the "common property" owned by the communities concerned. Building such an alternative is essential to prevent biodiversity and knowledge monopolisation by an unbalanced mechanistic and non-innovative implementation of TRIPs or in response to Special 301 threats from the US.

Examination of existing national and international legal community rights' legislation reveals, that there are no binding legal instruments or standards that adequately grant rights to indigenous people's collective knowledge and innovations thereby protecting their knowledge from biopiracy. That is not to say there is no scope for such developments. To the contrary, trends and precedents set in the area of international indigenous rights legislation and case law signify a strong movement in this direction, with several significant judgements being passed in recent years.

Further, movements towards ethical and ecological consumption are also creating a new basis for consumption that does not cause ecological destruction or lead to economic deprivation of the poor.

3.2 (e) The three economies and ethically responsible consumption

a. Natural Resource Sustainability
b. Socio-economic Sustainability

Natural Resource Sustainability is based on the stability of the ecology of production ecosystems based on interactions between soil, water and biodiversity. This sustainability measures the wealth of 'nature's economy' and the foundation of all other economies. Nature's economy includes biodiversity, soil fertility and soil and water conservation that provides the ecological capital for all economic activity.

Socio-economic Sustainability relates to the social ecology of production and consumption, including the relationship of society to the environment, the relationship between different social groups engaged in agricultural production and the relationship between producers and consumers, which is invariably mediated by traders, government agencies and corporations. Socio-economic sustainability measures the health of 'people's economy' or the economy of sustenance, in which human needs of livelihoods and nutrition are met. People's economy includes the diverse costs and benefits both material and financial, that farming communities derive from agriculture.

Both environmental and social sustainability have been undermined by globalisation because 'nature's economy and 'people's economy' have been neglected and hence eroded by the dominant paradigm of economic development which only recognises the global market economy, only measures growth in the global market economy, even though this growth is often associated with destruction and shrinkage of nature's economy and people's economy. The ecological base of production is thus been destroyed and farmers, fisherfolk, pastoralists are faced by large scale displacement and uprooting.

Sustainability in nature involves the regeneration of nature's processes and a subservience to nature's laws of return. Sustainability of agricultural communities involves the regeneration and revitalisation of the culture and local economy of agricultural production. Sustainability in the market place involves ensuring the supplies of raw material, the flow of commodities, the accumulation of capital, and returns on investment. It cannot provide the sustenance that we are losing by impairing nature's capacities to support life. The growth of global markets also hides the destruction of the local economy of domestic production and consumption.

The transition to sustainable production and consumption requires that the two neglected economies of nature and people should be made visible in the assessment of productivity and cost-benefit analysis in economics. Sustainability criteria can be internalised in economics only when nature's economy reflects the health of nature's ecological processes and people's economy reflects the real health of people's socio-economic and nutritional status. **Figure 11** illustrates how the growth of the market economy that takes place at the cost of nature's economy and people's economy and people's economy creates both environmental and social non-sustainability.

Development, economic growth and consumerism are perceived exclusively in terms of processes of capital accumulation. However, the growth of financial resources at the level of the market economy often taken place by diverting natural resources from people's survival economy, and nature's economy. On the one hand, this generates conflicts over natural resources; on the other hand it creates an ecologically unstable constellation of nature, people and capital.

In addition market growth and consumption patterns that undermines the growth in nature's economy and people's economy usually benefits agribusiness, chemical companies, seed companies, not the small peasant.

These market unpredictabilities which turn bumper harvest into an economic collapse for farmers are bound to increase with globalisation of agriculture. A dramatic example of such a market growth not translating into economic benefits for farmers is the case of tomato cultivation in Karnataka. The price of tomato seed has increased to Rs.15,000/kg, but the price of tomato crashed to Rs.1 forcing the farmers to destroy their crop since they could not even recover transport costs.

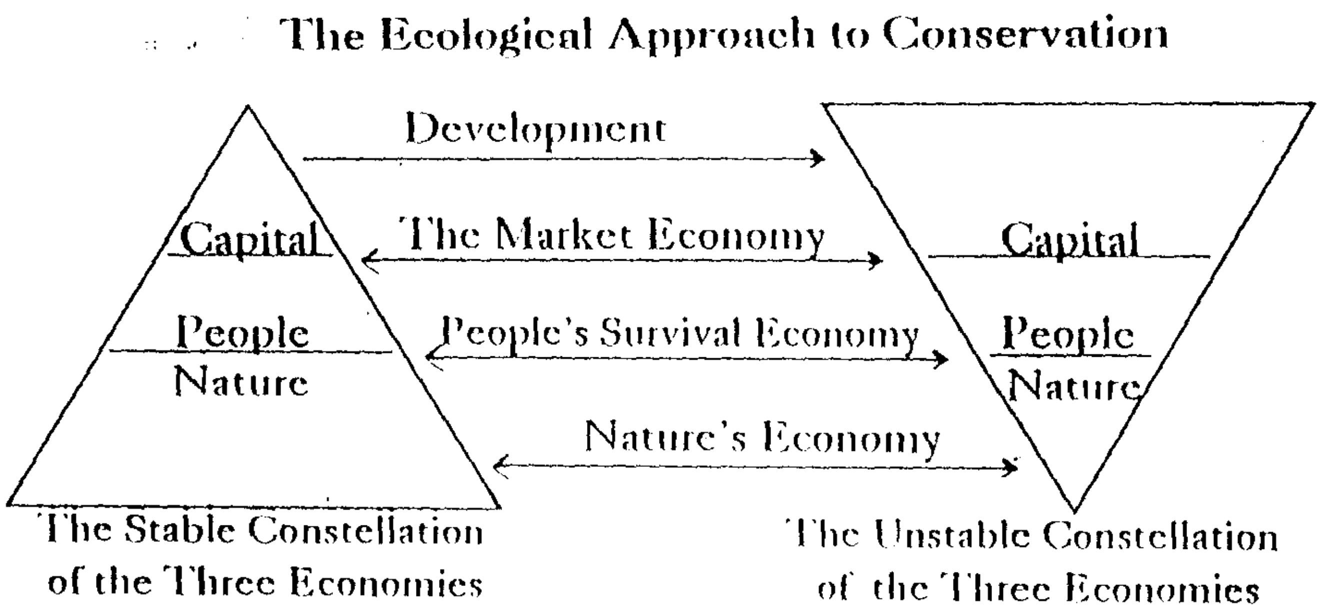
The tomato crisis in South India is a clear example of how for the poor surpluses do not translate into abundance. The market is not class, or gender neutral. A market gain for rich consumers, business and industry is usually a market loss to Third World farmers especially when subsidies are withdrawn or reduced.

Consumption patterns that benefit small Third World producers needs to ensure two aspects:

a) the market participation should not destroy the natural capital of the farm, the biodiversity, the soil, the water

b) the market participation should not undermine the food security of the farming family and farming community

Figure 11



Source: V.Shiva, "Ecology and Politics of Survival, SAGE Publications and UNU Press, 1991

This implies that what is purchased as a market input and what is sold to the market does not destroy nature's economy and the people's economy. For small resources poor farmers, the purchase of costly external inputs violates both (a) and (b). Similarly, the cultivation of commercial monocultures and the sale of the entire product in periods of overproduction, followed by purchase of staple food grains at high prices leads to a vicious cycle of debt, and dependency, and ultimately displacement.

Ethical consumption requires a new partnership with nature and with Third World producers. Producers' strength in market participation is based on whether the farmer enters the market on her/his terms, or in terms of agribusiness and trading interests and northern consumers. The farmers interests are protected if the natural capital is maintained, domestic food security is maintained and the market participation is diversified and stable.

3.2 (f) Chemical Intensification Vs Biodiversity Intensification

Chemical intensification of agriculture is non-sustainable. It also does not create abundance, but merely an illusion of surplus by converting polycultures into monocultures of a single commodity and by market extraction of resources needed for nature's economy and people's economy.

Biodiversity intensification builds all three economies and leads to sustainable increases in productivity. Geertz has called this process of the organic intensification strategy of the Green Revolution, involution offered higher yields with sustainability, not higher yields at the cost of sustainability. If one further recognises that sustainability involves sustainable livelihoods, not just sustainable output, 'involution' was also a more efficient policy for utilising the labour available in high population regions than the policy of Green Revolution or industrial agriculture.

Comparative studies of 22 rice-growing systems have shown that indigenous systems were more efficient in terms of yields, and in terms of labour use and energy use.[28]

The possibilities and potential of biodiversity intensification does not have a limit since it does not undermine the ecological basis of agriculture but strengthens it.

Biodiversity intensification is based on intensifying species diversity as well as the function and output of each species.

Chemical intensification is based on a monoculture of a single species with a single function and single output. The increase in output of a single function of a species is based on external manipulating of the species, and its environment and its increase in inputs. The manipulation of the species and its environment creates disease such as the Mad Cow Disease, the diseases in shrimp production and the thousands of crop diseases threatening food security. The increase in inputs and intensive feed creates an inefficient food system in which more food is used as input or feed than is obtained as output. If these "ecological footprints" of industrial food production were taken into account, we would recognise that the industrial system create scarcity rather than abundance. The claim that we need to have more chemical intensification for higher output is an illusion maintained by these corporations who benefit from the concentration of control over the food system.

Living systems are not mechanical artifacts. They are not designed to perform a single externally determined function, nor are they dependent on external management or organisation. Living systems have many functions, among which are the creation of the conditions of their life. The creation of the condition of living by living systems is not achieved in isolation but through exchange and reciprocity with other living systems. The more dense these relationships become, the more resilient the system is. Biodiversity intensification of agriculture is the increase in the density of species and their functions which contributes to a strengthening of the three economies -- nature's economy, people's economy and the market economy.

Creating a balance between the three economies is necessary for reasons of sustainability and justice. People's movements are also growing worldwide, focussing on the ethical issues emerging from non-sustainable consumption patterns, non-sustainable technologies, patents on life and biopiracy.

New social and environments are emerging as a response to the widespread destruction of biodiversity and livelihoods dependent on it.

These movements are usurping shifts towards ethical consumption which avoids the theft of the resources of the poor by the rich. According to Gandhi,

> Non-stealing does not mean merely not to steal. To keep or take what one does not need is also stealing. And, of course, stealing is frought with violence.

Consumption based on taking away from the survival needs of the poor is probably the most systematic yet invisible theft in the contemporary period.

As we approach the new millenium, new paradigms are emerging which question the mantra of "monopoly" and "monocultures" as recipes for "more". Sharing and diversity can actually be the basis of an abundance in which the basic needs of the poorest are also met.

As Gandhi had said,

> The world has enough for every one's needs, but it does not have enough for some people's greed.

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