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Gender, environment and poverty linkages

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Poverty-environment linkages take different forms in rural and urban contexts. In rural areas, critical issues relate to access to natural resources such as land, forests etc. and their sustainable use. In urban areas, the poverty-environment agenda centres around questions relating to the use of natural resources such as water or air as sinks for the disposal of human and industrial wastes, and their impact on the poor. For the sake of analytical clarity, this paper attempts to outline the main linkages between poverty and sustainable development by distinguishing between rural and urban contexts, in order to focus on the unique features of each in general and overview of current status of environment in Indian context in particular.

Key words: Gender, poverty, livelihood, biodiversity, environmental pollution.

INTRODUCTION

Poverty and environmental degradation are closely associated and causally interlinked and should therefore be addressed together. The international goal of halving the number of people living in extreme poverty by 2015 and reversing environmental degradation will require addressing rural and urban poverty and environmental degradation simultaneously. At the same time, addressing gender disparities should not be reduced to a means of ensuring the effectiveness of poverty reduction strategies. Gender equality is a development objective in its own right, and sustainable development strategies must aim to foster women's empowerment and effective participation. This implies involving women and men as partners and allies in formulating and pursuing strategies for more equal societies. Over half of the world's poor live in rural areas. Although urban poverty is rising, the correlation between poverty and remoteness from urban centres is strong in most countries and is expected to remain so in the foreseeable future. As compared with their urban counterparts, rural people are often isolated from economic opportunities and have less access to basic social services. Resource degradation is an acute problem in rural areas, with some 60% of the world's poorest people living in ecologically vulnerable areas (Angelsen, 1997). The situation is worst in Africa, with two thirds of the continent being deserts or drylands. Africa also has extensive agricultural dry lands, almost three quarters of which are already degraded (UNCCD, Undated). In many developing countries, declining rates of yield growth and accelerating resource degradation contribute greatly to conflict over natural resources. Food insecurity and malnutrition are critical concerns. Even for land-owning households, farming alone often cannot provide sufficient means of survival, notably where rising population leads to reduced farm size. Poor rural families generally rely on a wide variety of on and off-farm activities and income sources. Many of these are based on natural resources. They include activities such as gathering firewood, preparing charcoal, fishing, hunting, handicrafts, and gathering non-timber forest products such as medicinal plants, fruits, and rubber, etc. Many landless poor also work as farm labourers. Survival and livelihood diversification strategies also include various types of migration. For example, some members of a household generally men may live semi-permanently in urban areas while others generally women usually stay in rural areas.

Addressing rural poverty and environmental degradation therefore often requires broad cross-sectoral approaches, which must go beyond agriculture. These efforts must focus on the diversity of livelihood sources and address systemic conditions that constrain the ability

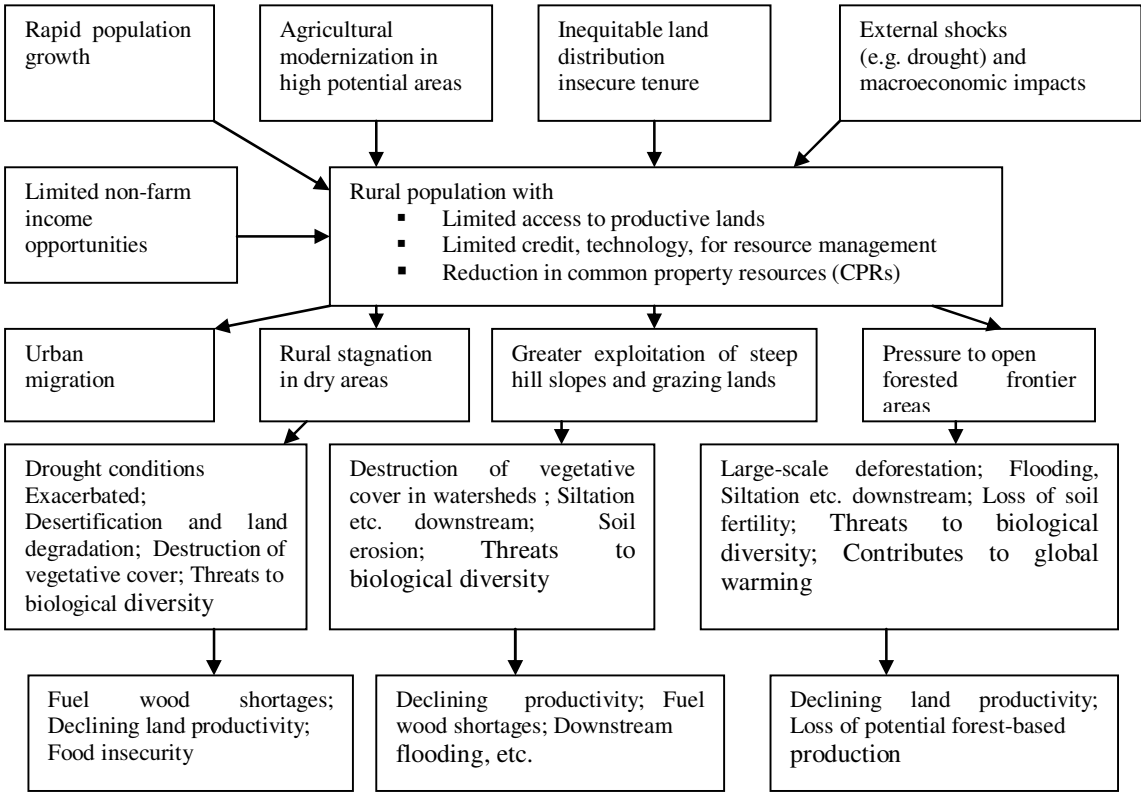

Figure 1. Poverty and environment link in rural areas.

of rural poor to overcome poverty. For example, efforts to increase access to health, education and other basic social services, as well as transport and communication, directly affect the ability of rural poor women and men to pursue alternative incomes on and off the farm. Poor literacy and numeracy make it more difficult for rural poor to obtain information about ways to use resources sustainably and productively. It also limits their ability to develop livelihoods that do not depend on natural resources, or to obtain wage-earning jobs. Thus, improved access to education is critical to lower rural poverty and decrease the dependence of rural poor on natural resources for their livelihood. In many countries girl children are less likely to go to school, and more likely to drop out early, because of economic and cultural pressures. This differentially affects their livelihood opportunities, as they become adults. Similarly, access to effective reproductive health services is also needed to provide people with an ability to manage the size of their family. Issues related to health and education, although crucial, are not addressed in detail here, as the focus is on direct environment-poverty linkages (Figure 1). The interactions shown in Figure 1 are illustrative of certain poverty-environment processes where poor households are “compelled” to degrade environmental resources. However, this should not obscure the fact that much environmental degradation is caused by large-scale commercial operators, and by State policy; and there are many examples of positive actions by poor households and communities to manage environmental resources sustainably.

Nonetheless, there is a positive linkage between increased incomes and increased access to health and education, which in turn is likely to have positive impacts on livelihood diversification. Livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood can be said to be sustainable when it can cope with and recover from stress and shocks, and maintain or enhance its capabilities and assets, without undermining the underlying natural resource base. By placing people at the centre of development, a ‘livelihoods’ approach stresses the importance of influencing policies and institutional arrangements so they support the needs of the poor. For example, achieving conservation objectives in an area has often meant restriction or prohibition of traditional activities of importance for the poor. This raises two problems: Firstly, it is clear that the poor may be harmed when management demands less use in the short-term in return for a better resource later without

access to alternative resources in the meantime. Secondly, such a policy may even be pointless from an environmental perspective for instance, if access to fuel wood from one area is restricted but no alternative provided to the poor, then this may simply shift the resource strain on neighbouring forests. Thus, the concept of "environmental entitlements" addresses the important issue of the extent to which households, especially those highly dependent on natural resources for their livelihoods, actually have adequate access to those resources. The sustainable livelihoods approach stresses participation by the poor in order to identify the key constraints they face and to seek the most promising alternatives.

Until the 1970s, poverty was usually understood in terms of falling below certain minimum levels of food intake, income or consumption. This narrow approach is no longer widely accepted, either by social scientists or by development agencies and practitioners. Progressively more significance has been given to the ways poor people themselves view their situation, and how poverty is conceived in different cultures. Today, a poor person is one who is unable to meet the minimum conditions of well-being, as these are understood in societies around the world. Typically, this involves a range of inadequacies in consumption, several forms of insecurity and an inability to participate in what are considered minimal ways in social life. According to a recent view from the World Bank "poverty is multi-dimensional, extending from low levels of health and lack of education, to other 'non-material' dimensions of well-being, including gender gaps, insecurity, powerlessness and social exclusion". For the United Nations Development Programme (UNDP), human development is defined as "the process of enlarging human choices". Human poverty means therefore "that opportunities and choices most basic to human development are denied to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-respect and the respect of others". Given the multi-dimensional nature of poverty, the precise measurement of who is poor cannot only be restricted to measurement of income-based poverty, but must also define social categories such as gender, ethnicity, location, livelihood status, etc. A distinction can also be drawn between people in chronic (long-term) poverty and those suffering transitory poverty. The latter may be as a result of natural or macro-economic shocks. Households in chronic poverty can also be disaggregated according to their specific characteristics and causal factors. One category of the chronically poor may experience poverty in several dimensions, for example socially excluded groups, people with disabilities, refugees and displaced persons, people suffering from HIV/AIDs etc. Other categories are those who suffer chronic poverty primarily as a result of inadequate access to productive assets. This variation in the dimensions and characteristics of poverty highlights the need for careful analyses using different sources (including participatory poverty assessments) to support the development of appropriate interventions. Also, different manifestations of poverty have different implications for the environment. Table 1 attempts to characterize poor households by rural/urban location and by the chronic or transitory nature of poverty. These categories are illustrative rather than giving a complete picture. Also, given the dynamic nature of poverty processes, there can be movement between the categories, e.g. a poor smallholder in one year may next year be part of the urban informal poor; a transitory poor formal sector worker may slide into chronic poverty through suffering long-term unemployment.

In India a large section of planners and policymakers think that there are no serious environmental problems among rural poor. According to them, if however there be any, a variety of solutions exist. They often are of the opinion that government should come forward to implement the solution. As a remedial package minimization of public sector interference and maximization of government intervention, ensuring suitable prices for infrastructure and urban amenities through removal or reduction of subsidies, generating employment directly through anti-poverty programs, easing private and joint sector projects are being prescribed. However the ultimate solution is being sought through competent and transparent management of environmental projects. Although the desirability of growth is globally accepted and recognized, recent years have provided testimony to raising anxiety about whether environmental constraints will limit development or whether development will cause serious environmental degradation. A number of environmental problems are already very serious and call for immediate attention. Environmental threats evolve because of both resource depletion and negative externalities caused by development process and projects. With a view to achieving the object of sustainable development, it is inevitable to do with both types of problem adequately (Sarkar, 2005).

PRESSURES ON ENVIRONMENTAL RESOURCES

Even for land-owning households, farming alone often cannot provide sufficient means of survival, notably where rising population leads to reduce farm size. Poor rural families generally rely on a wide variety of on and off-farm activities and income sources. Many of these are based on natural resources. They include activities such as gathering firewood, preparing charcoal, fishing, hunting, handicrafts, and gathering non-timber forest products such as medicinal plants, fruits, and rubber, etc. In sub-Saharan Africa, a 30 - 50% range of reliance on non-farm income sources is common; in Southern Africa,

Table 1. Characterization of poor households by rural/urban location and by the chronic or transitory nature of poverty.

Poverty "type"	Rural poor urban poor	Rural poor urban poor
Transitory	Viable farmers, pastoralists and landless rural workers affected by sudden natural shocks or seasonal income losses; rural households affected by civil conflict	Urban formal workers (and dependents) suffering temporary unemployment or real wage declines
Chronic, asset-poor	Smallholders, small herders or landless with limited/no access to productive assets, and/or deteriorating asset base; rural communities isolated from markets and services; labour-poor households	Urban informal sector with limited/no access toproductive assets; labour-poor households, especially-female-headed households
Chronic, multidimensional	Marginalized cultural categories (ethnic or caste groups, marginalized indigenous communities); households with high dependency ratios; chronically sick and disabled	Marginalized cultural categories; households dependent on anti-social activities; refugees, internally displaced persons, undocumented aliens.

Table 2. Land use pattern in India.

	1958 - 1959		1995 - 1996	
	Area ('000 hectares)	Percentage	Area ('000 hectares)	1993 – 1994 percentage
Total geographical area	2,93,972	100	3,04,863	100
Forest	52,675	17.9	68,421	22.4
Non-agricultural use	13,563	4.6	22,035	7.2
Cultivable waste	20,610	7	14,468	4.7
Permanent pastures and grazing	13,112	4.5	11,176	3.7
Other fallows	12,286	4.2	9,703	3.2
Agricultural use	1,43,136	48.7	1,56,428	51.3

Note: Agricultural uses = Current fallows + Net cultivated area.
Source: Nadkani (1999).

however, it may escalate to 80 - 90%. In South Asia, on average, roughly 60% of rural household income comes from non-farm sources. However, this proportion varies widely between, for example, landless households and those with access to land for farming (Ellis, 1999). Many landless poor also work as farm labourers. Survival and livelihood diversification strategies also include various types of migration. For example, some members of a household generally men may live semi-permanently in urban areas while others generally women usually stay in rural areas.

Agriculture constitutes the major use of land in the country as a whole. Clubbing together net sown area and present fallow, it accounted for 48.7% of total geographical area in 1958 - 1959 and 51.3% in 1995 - 1996 in India. Though the proportion of land under agriculture increased by 2.6 per cent in India over this period, the proportion of land under forest with regard to legal status (not essentially under actual tree cover) enhanced in the country as a whole from 17.9 - 22.4% during the same period (Table 2).

Forest on the other hand as a natural resource is not only aggregate of all trees but also a whole of the living and non-living elements which has a cultural and spiritual value. According to a release issued by the Food and Agriculture Organization of United Nations (1995) global forest, woodland and scrub cover decreased by 2% or 100 million hectares during 1980s. In developing countries though the forest cover decreased by only 98.7 million ha in 1980s, the loss of natural forest cover alone was 163 million hectares that is, 8% during the same period. In India despite the initiation of massive plantation programs the actual forest cover is coming down over the years. It has been projected that annual logging of closed forest in India during the period 1981 - 1990 is 42,000 ha that is 1% of closed forest. The Indian Remote Sensing Satellite imagery (1995) reveals that the extent of forest cover of the country was over 19% of the geographical area, but the imagery also discloses that less than 12% was dense cover. Therefore this deforestation has a lot of ill effects like loss of sustainable logging potential and of erosion protection, watershed stability and carbon sequestration provided by the forests. Further loss of bio-diversity tends to potential loss of modern drugs and genetic resources.

Substantive pastures, cultivable wastes and other

CPRs include uncultivable or fallow fields, pasturelands, forests, inland waterways, ponds, and low-lying wetlands. They represent a significant component of the land resource base and have special importance for the poor 1. The range of products drawn from CPRs for subsistence needs or for sale is wide and varied. It includes food, firewood, small timber, manure, fruits, medicinal herbs, roots, leaves, bark, fibres, seeds, nuts, gum, spices, resin, sap, syrup, oils, materials for house construction, handicrafts, etc. Hunting and trapping of mammals, aquatic species and birds often represent important food sources. Fodder and water for livestock are often drawn primarily from CPRs. Wetlands provide a special case in point. They are used by fisher folk, hunters, charcoal makers, pastoralists and agriculturalists under traditional resource sharing regimes at different seasons, and also harbour a wide variety of fauna and flora. Ensuring compatibility among such a wide set of users poses special challenges. Conventional access rights are particularly hard to define, since water levels are not the same each year and patterns of flooding are erratic. Even the most elaborate traditional arrangements seldom extend to upstream water users, often leading to over-extraction or pollution by industrial or agricultural users. This has severe consequences on downstream fisheries resources.

Box 1. Common property resources (CPRs).

fallows combined together can be said to constitute common property resources used for grazing. According to official data, the proportion of such land reduced significantly from 15.7 - 11.6% between 1958 - 1959 and 1995 - 1996 in India. The role of such common property resources as a source of fodder had been decreasing over the years. With the growing trend of population in urban areas and economic development price of livestock products had increased significantly over the years. So trend from official data shows that common property resources appear to have slowed down both in quantity and also in quality and productivity.

Poor households are often highly dependent on “common property resources” (CPRs), which include fallow fields, forests, fishing grounds, pastureland and wetlands for their livelihoods. CPRs are a source of a variety of goods including food, fodder, fuel, medicinal plants, which are important sources of sustenance or income for many land-less poor (Box 1). For many rural poor women and men, CPRs are their main source of food, fuel, building materials, and income. For others, they are a critical source of supplementary income or food in times of crises such as drought, in periods when employment opportunities are scarce, or when food stocks are low before the harvest. Heavy reliance on CPRs thus makes poor women particularly vulnerable to their degradation, depletion, appropriation and/or conversion to other uses. Women, who often are not allowed to own land, make particular use of the resources found in CPRs for household purposes. Depletion of these resources means that women will need to walk further to collect water and fire wood, etc. Women and men tend to use different aspects of CPRs. Where women do not have the voice to directly influence decisions affecting the uses of CPRs, their exclusion from decision-making can result in resource uses, which negatively affect them.

The expansion of agriculture to open access forestlands is a major environmental consequence of poverty, food insecurity, and landlessness in many countries, notably in the tropics. Although nominally managed by the state, forests made accessible by the construction of roads become de facto “open access” in the wake of logging operations by private concessionaires, who often fail to comply with their obligations to manage the forest sustainably after harvest. Where there is a shortage of alternative income opportunities off-farm, landless peasants resort to converting these de facto open-access lands to subsistence agriculture.

Soil erosion is a principal problem affecting particularly in dry and rain fed areas. It reduces fertility of land owned by poor cultivators and invites drought. Apart from field productivity losses, soil erosion increases to costs such as river transport channels and other hydrologic investments. As far as soil conservation is concerned only 20.9% out of total problem area of 52.2% were taken into consideration up to 1992 - 1993. So there is still a long path to go.

Besides water shortages add health hazards and it may be marked as ill effect of water degradation on productivity. It has already been estimated that by 2025 thirty-four countries including India will face water stress and of late about 29 countries are suffering from water scarcity. It is also expecting that number of people dwelling in water scare countries will increase from 132 million in 1990 to between 653 million (with a low population growth projection) and 904 (with a high population growth projection) in 2025. Water pollution on the other hand propagates many water borne diseases like diarrhea, hook worm, cholera, typhoid, paratyphoid etc.

Moreover GREEN India Report of Tata Energy Research Institute (1997) reveals that from 1947 - 1997 availability of fresh water decreased by two thirds and area covered by soil erosion rose by in the neighborhood of 80 million hectares. On water pollution the report indicates that class one and class two cities generated around 20 billion litres of sewage wastewater per day but treated only a-tenth. The total sewage generation from urban areas increased six times in the last fifty years (1947 - 1997). The water need of major water consuming industries like agro-based units, refineries, petrochemicals, fertilizers and chemicals had grown 40 times but these were not treating a large quantity of generated wastewater. Poor water management, combined with high population density compared to available water supplies, results in water shortages in many places. Shortages often have an impact on the poor first and foremost, as they may have intermittent irrigation water and be unable to grow crops reliably. The poor often have to spend many hours collecting water for domestic use, which can significantly limit their ability to generate income. This is a problem for women (and girl children) in particular, who are generally given the task. It can further limit the ability of female-headed households to cultivate land, since the women need to divide their limited time between collecting water and farming. Pollution from industry or urban centres is an important indirect cause of degradation of water bodies and lands. This increases the risk of exposure to toxic chemicals and disease pathogens either directly or through consumption of contaminated fish and shellfish. Women suffer the greatest exposure risk from polluted water because they contact water more than men do. Pollution also lowers the productivity of freshwater and coastal ecosystems, which directly affects the income and livelihoods of poor men and women using these resources.

Solid waste and hazardous wastes cause risks, which are often acute. Solid waste includes all types of solid and semi solid waste products like ashes, garbage, house sweepings etc. It enhances rat population and propagates many diseases. While dry waste is not disposed of local people burnt it in unscientific manners resulting in smoke and toxic gases in the air. Apart from that hospital waste also deteriorates health standards among city dwellers. Nursing homes, clinics, even bigger hospitals dump waste untreated. In lieu of acting as healing centre, hospitals themselves are becoming a source of disease. Moreover untreated wastes are being scattered by the birds and animals from the dumped sites, which often degrade environment. Diseases spread by rotting garbage and blocked drains are equally dangerous. Further these solid wastes create pollution of ground water resources. It has already been reported that municipal solid waste has increased seven times while the disposal of solid waste continues to be unscientific. It is estimated that generation of solid waste in major Indian cities is about 50 kgs per capita per day, while collection and disposal of such waste by the municipal corporation are almost absent.

Efficient municipal collection and disposal systems are essential components to urban environmental management, whether they are in the private or public sector. Developing formal waste management systems that build on the skills and knowledge of informal waste collectors can have important economic, social and environmental benefits. It can help increase the recovery and recycling of valuable resources found in urban waste streams, reduce residual waste volumes to be disposed of, and improve working conditions and incomes for informal waste pickers. This requires paying specific attention to the needs and constraints of informal male and female waste pickers who are often left out of decision-making processes. Instead, decisions concerning waste management generally focus on the priorities of middle and upper income groups who generate the largest volumes of wastes. However, increased use of informal waste pickers must at the same time reduce their exposure to the handling of hazardous wastes, for which specific urban environmental management plans and policy measures are required.

Many developing country towns model their waste management systems on those of developed countries, resulting in socio-economically inappropriate technology choices. Examples include waste collection vehicles that cannot cope with narrow or unpaved roads and lanes, or composting or incineration plants that are unsuited to the volume and composition of waste streams. Similarly, compacting waste reduces the possibilities to reclaim and recycle material, unless re-usable or recyclable material is specifically separated before waste is collected.

The livestock population, however, has continued to grow in the country though not keenly. Total livestock excluding poultry increased by 32.3% in India between 1961 - 1990. The National Family Health Survey (1992 - 1993) reveals that household having livestock in urban areas is 14.3%. The density of livestock per hectare of land clubbing together forest, agricultural land including present fallows, pastures and cultivable waste was only 1.71% in 1990 in India as a whole. The growth of poultry has been more significantly than of livestock. The total number of poultry increased by 141% between 1961 and 1990 in the country as a whole. Livestock pressure on land, number of mammal and bird species and also higher plant species threatened having an adverse effect on regeneration capacity is a traditional source of worry to the environmentalists and foresters in India (Table 3).

LOSS OF BIODIVERSITY

Biodiversity loss is directly threatened by desertification, but is a much wider process observed in all major

Table 3. Mammal, bird and higher plant species threatened environment.

	Mammal and birds species		Higher plant species	
	Number	**Number threatened**	**Number**	**Number threatened**
India	1,239	148	16,000	1,236
Indonesia	1,955	232	29,375	264
Kenya	1,203	67	6,506	240
Malaysia	787	76	15,500	490
South Africa	843	49	23,420	2,215
Sri Lanka	338	25	3,314	455

Source: World Bank (1999), Entering 21st century, World Development Report 1999/2000, Washington DC.

Direct use:
• Commercial goods – natural ecosystem products, agricultural products, non-consumptive use.
• Subsistence and barter goods – food, fuel wood, building materials, medicines.
Indirect use:
• Ecological services – soil retention, water filtration, air cleaning, carbon sink.
Option values:
• Risk reduction through crop diversification
• Potential value as a resource that might yet be unknown
Socio-cultural values:
• Self-sufficiency/autonomy for people
• Integral part of cultural identity and common heritage; symbolic/aesthetic; religious
Intrinsic/Bequest value:
• Maintenance of future options

Box 2. Biodiversity values.

ecosystems. Biodiversity loss in areas experiencing desertification occurs as a result of the extensification process, whereby farmers attempt to compensate for declining productivity by converting more natural ecosystems to agricultural use, destroying habitats of animals and plants in the process. This is a critical issue for food supplies: almost all the globally important cereal grains originate from drylands, and the loss of the genetic forebears of these food plants could impair future ability to adapt their genome to accommodate a changing environment.

Biodiversity values vary significantly in type and amongst different stakeholders. Box 2 shows the different types of use and non-use values of biodiversity. Use values are of most immediate interest to poor households, in terms of supply of consumption items and income generated from marketable crops and animals; but the ecological services provided by biodiversity, and the risk spreading effects of crop diversity, are also valued by poor households.

Some of the benefits of biodiversity, in contrast, appear to accrue to other stakeholders, including biotechnology companies, as well as the global community, which gains from the absorption of atmospheric carbon in well-forested areas. There may be potential conflicts between land users who prioritize increasing productivity through reducing plant diversity, and the broader global community. The Convention on Biodiversity recognizes these tradeoffs and emphasizes the need to maximize the social and economic benefits from the protection and sustainable use of biodiversity, and their equitable distribution. There is some evidence that agricultural biodiversity is greater in areas, which economically are regarded as poorer; but this does not imply a causal relationship. Biodiversity in such areas is particularly important for poorer households for spreading risks, enabling such households to generate livelihoods from a range of products. For marginalized groups maintenance of, and improved access to, agricultural biodiversity can contribute more to sustainable livelihoods than can conversion to cropping patterns with reduced diversity in part because these groups' traditional entitlements to such biodiversity may be stronger than their market access to the production inputs needed to support more "intensive" agricultural systems. One of the key requirements to maintain biodiversity is to reform the system of economic

Table 4. Country-wise share in global carbondioxide emissions and average annual growth of GNP.

Country	Carbondioxide emission (% of world)	Carbon dioxide emission (per capita metric tons)	Share in world population (%)	Average annual growth rate of GNP	Share in world GNP (%)
USA	23.4	20	4.6	3.7	27.4
China	14.9	2.8	21	7.4	3.2
Japan	5.2	9.3	2.1	(-) 2.6	14.1
India	4.4	1.1	16.6	6.1	1.4
Germany	3.8	10.5	1.3	(-) 0.4	7.3
UK	2.5	9.5	1.0	2.0	4.3
Italy	1.8	13.7	0.5	6.1	0.4
Canada	1.8	7.0	0.9	2.3	4.0
Australia	1.4	16.7	0.3	3.8	1.1
South Africa	1.3	7.3	0.7	0.6	0.4
Brazil	1.2	1.7	2.8	0	2.6
Indonesia	1.1	1.2	3.4	(-) 14.8	0.4

Source: World Bank (1999), Entering 21st Century, World Development Report 1999/2000, Washington DC.

incentives, institutional and policy structures, which are currently geared in favour of, industrial-type agricultural models and against systems promoting agricultural biodiversity. Current incentive systems, for example, provide distorted signals by failing to reflect the external effects of biodiversity loss.

Air pollution

Air pollution has many perilous chronic hygienic impacts. The worst pollutants of air include carbon monoxide, sulphur dioxide, nitrogen oxide etc. Automobiles, industries, electric power plants and households are the main sources of air pollution. Indoor and outdoor air pollution breaks out various air borne diseases like pneumonia, bronchitis, asthma and even lung cancer along with many other problems. Vehicle emissions have been identified as the greatest environmental danger in a large number of cities in developing countries. So far as carbon dioxide emissions are concerned, in Table 4 country wise percentage of global carbondioxide emissions reveal that a list of 12 countries taken together contribute 62.8% of total carbondioxide emissions, out of which USA alone share 23.4% of world emissions. Hence, almost one-fourth of the global carbondioxide emissions come from USA alone. Besides, China and India contribute 14.9 and 4.4% of global carbondioxide emissions because of their high population, while their per capita emissions are only 2.8 and 1.1 metric tons respectively compared to 7 - 20 metric tons per capita emissions for rich income countries. Although the low-income countries contribute a high percentage of emission, but as far as per capita emissions are concerned, they contribute a low level as compared to rich income countries. It is interest to note that there is a link between carbondioxide emissions and average annual growth rate of GNP. Countries like China and India with a high average annual growth rate of GNP have largest share of emissions. Indonesia contributes a little percentage of emissions of 1.1 having average annual growth rate of (-) 14.8%. It has further been observed that there is a far correspondence between high percentage of world GNP and percentage of world carbondioxide emission. By and large, countries having a large share in world GNP contribute larger percentage in emission. Obviously, mighty countries are definitely responsible for the emissions of carbondioxide in the atmosphere. Studies run by National Environmental Engineering Research Institute reveals that the level of pollution due to round the clock automobile emissions in Indian cities is on the rise if compared to other cities of the world. Particulate emitted by vehicles pose a hazard to health of human beings, animals and also to longevity of the property. However the damage due to particulate is rather indirect and slow but among the gaseous components, oxides of nitrogen and nitrated organic are considered to be most hazardous. Even very small quantities of these chemicals cause problems like irritation of eyes, nose and other delicate membranes of the body. While not so dreadful, carbon monoxide is also hazardous to human beings and animals. It reacts and neutralizes of a portion of the hemoglobin in the blood and thus reducing respiratory capacity.

Table 5. Adverse impacts of industrial pollution on human health.

Industry	Pollutants	Damaging impacts on human health
Cement	Cement dust	Asthma and other bronical problems
Leather	Sulphur oxide and other acid gas	Suffocation, bronical problems
Paints	Sulphur dioxide, hydrogen sulphide and sticky suspended particulate matter	Suffocation, irritation of throat and eyes, irritation of lung, blockage of oxygen
Aluminum	Ash, acid waste and sewage water	Blood poisoning, suffocation, lung cancer, health diseases
Iron and steel	Slag, dust and sludge	Headache, corrosion of teeth, cold, eye defects, lung diseases
Fertilizer	Urea dust, ammonia, phosphate, solid waste-fly ash	Suffocation, bronchitis, edema of lungs, irritation of throat

Source: Choudhury and Sahu (1999).

The pollutants emitted by selective industries like cement, leather, paints, aluminium, fertilizers, sugar and paper have damaging effects on human health, cattle health, forests and biodiversity. The diseases namely asthma and chronic bronchitis, respiratory troubles, teeth and gum problems, eye and ear diseases and so on frequently attacking the people of industrial regions are attributable to the air pollution caused by industries. The health damage due to environmental pollution has been identified in many studies. Meanwhile all most all state pollution control broads have found pollutants of selective industries and their adverse impacts on human health (Table 5).

Smoke and fumes resulting from indoor use of biofuels jeopardize health standards more than any other outdoor degradation. In India the most important disease associated with indoor and outdoor air pollution is probably acute respiratory infection. The acute respiratory infection among children below five years of age is 86% in India and at global level it is also single largest disease category. A balance sheet of human development (1990 - 1997) highlights that every year nearly 3 million people in the world fall prey to air pollution, out of which more than 80% from indoor air pollution. An analysis of National family Health Survey data reveals that adults over 30 years living in households using biofuels had around 30% more partial blindness and 170% higher tuberculosis rate than those living in households using clean fuel. Estimates available from a recent study on annual premature death to children under 5 years of age and adult women are in the range of 4,10,000 - 7,90,000 (Table 6). These estimates are however only for specific diseases there are certainly on other population groups and from other disease also.

DATA AND METHODOLOGY

In the present endeavour six villages of Jalpaiguri district of West Bengal, India have been selected using multistage sampling design to study environmental impact of pollution on rural poor women in general and health related diseases in particular and to assess the data in comparison with the earlier survey conducted in 2004.The villages were selected to collect detailed information regarding the losses and damages due to environmental pollution. The information was collected through a structured questionnaire and informal group discussion (participatory rural appraisal method) with the rural communities in the villages. A sample of 240 women respondents was drawn using stratified random sampling techniques. This was the second phase household survey being conducted during May - June, 2009 followed by first phase during May - June, 2004. The survey was carried out at three levels, viz. household level survey including individual responses for health status, village level and health centre level survey. At the household level multi pronged approach was used to gather different types of information relating to perceive human health. Village level information was collected from the head of the village *panchayat* whereas health related information was collected from administrative office of the concerned health care centre.

RESULTS

The study of selected villages reveals that women and children are badly affected by pollution. It is found that most of the diseases are indoor air and water borne, such as bronchitis, tuberculosis, asthma, eye disease, adverse pregnancy outcomes, skin infection, joint pain, other respiratory diseases, diarrhea, malaria etc. Also general muscular weakness, phlegm and cough among children have been noticed in the villages. A majority of complaints are about problems regarding bronchitis and tuberculosis. It is also reported during the period of survey that eleven women admitted to the hospital due to drinking contaminated water. The women suffering from respiratory diseases and water related diseases appear to be very high. The women suffering from respiratory diseases are 12% (11% in 2004) and from water related diseases are 9% against 8% in 2004. Asthma was reported by 4% (2% in 2004)). The reporting of symptoms and diseases were kept into account on the basis of respondent's memory recall for all the members of the households. Incidence of asthmatic symptoms noticed to be higher among women who cook inside compared to those who cook open air. An adjusted odds ratio of 2 for blindness among women was found in biomass using households. Adverse pregnancy outcomes (still birth, low birth weight) and early infant death have been linked with outdoor air pollution and passive smoking, and it is found

Table 6. Estimated annual premature deaths from indoor air pollution.

Evidence	Annual premature deaths
Strong evidence	**3,10,000 - 4,70,000**
Acute respiratory infection	Children age below 5 years
Chronic obstructive pulmonary disease	Women
Lung cancer from coal use	Women (few in India)
Moderate evidence	**50,000 - 1,30,000**
Blindness	Women (no death)
Perinatal effects	Insufficient data for estimates
Tuberculosis	Women
Suggestive evidence	**50,000 - 1,90,000**
Cardiovascular disease	Women
Asthma	Women (few in India)
Gross total of all three categories	4,10,000 - 7,90,000

Source: Smith (1998).

that odds ratio in this case has been increasing (2.67 in 2004). On the basis of self reported symptomatic cases of respiratory diseases cough, breathlessness, wheezing are found to be significantly higher among those living *kachcha* houses and using biofuels for cooking compared to those living *pucca* houses and using clean fuels for cooking as found in 2004 survey. The records from health centre disclose that five health centres received more than 30 (two health centres less than 20 in 2004) female patients in a day. Average number of female patients visited in a day by all the surveyed health centres together was 43 against 37 in 2004 survey and average number of female patients treated in a month by these health centres for respiratory or water related problems was 294. The survey signifies that percentage of affected women in each household is higher because women do with entire household work with contaminated water. The average number of days sick and unable to work every woman is about 30 (38 in 2004) a year. It is found that 5% against 3% in 2004 of sample women are suffering from worm infection. Many women were found who have been victimized due to arsenic poisoning. Besides diarrhea and malaria are common among a few women and children in the survey villages and increased over last three years.

Conclusion

The livelihood options available to poor women and men in rural areas include, but are not restricted to, the use of natural resources. Poor households engage in a wide range of other small-scale or micro-enterprises, for example to meet local demand for semi-processed food products, household goods, farm implements, and services. For most households these activities are additional to on-farm production but may in fact be the main source of cash income. As pressure on natural resources increases, the significance of off-farm activities also increases and expanding the scope for such activities will help to relieve resource pressures. Policy measures therefore need to address factors, which may restrict the growth of rural enterprises, including lack of roads and other basic infrastructure, limited access to credit, etc. Improving education and physical infrastructure may have greater impact on expanding income opportunities for the landless poor than investments aimed at enhancing on-farm production. Nonetheless neither should be supported at the expense of the other since both are clearly required. Any measures aimed at stimulating development of off-farm enterprises should pay specific attention to the needs of poor women, who in many areas have shown their ability to develop successful micro-enterprises whilst main-taining loan repayment rates higher than those of men.

Attacking poverty while enhancing the environment requires first and foremost the political will to eradicate poverty. In most cases, this will ultimately require some redistribution of resources or rights of access to resources - toward poorer sectors of society. The search for win-win situations should not divert the state from also reallocating resources towards the poor. The political will of the state in championing the cause of the poor is tested through its commitment to uphold and enhance rights regimes for the poor. Community-based decision-making and transparent dialogue cannot occur without political will at the highest level. While all rights regimes involve some regulatory and supervisory role for the state, in some cases the rights regime may already be relatively favourable for management by the poor, but they are not able to protect their rights. Poor people need

to be protected from or empowered to fight against actors who encroach upon their resources. For example, coastal fisher-folk may have the right to fish in certain waters, but they may be powerless against trawlers that sweep through their fishing grounds. People dependent on the forest may have no recourse against logging taking place in upper watersheds, yet they bear the consequences in the form of floods, drought, and soil erosion. Protecting the asset base requires a wide range of actions, including support to strengthening community-based organizations, which genuinely represent poor people, and actions in the regulatory, and governance areas, which strengthen the legal basis of poor people's rights. Civil society organizations can often play a role in supporting communities in asserting their rights over resources. Beyond protection of resources, there is a need for support to develop the asset base of the poor, including the environmental resources which poor people are heavily dependent on. The protection of resources may not be enough to ensure that resource users can enhance their livelihood options, especially where population growth is increasing pressure on the resources. There is a need for technical and institutional innovations, which support communities in augmenting the resource base (e.g. grazing land enrichment, fisheries management measures which enhance fish stocks, joint forest management, etc.), and/or in finding substitutes, which reduce the pressure on resources (e.g. alternative fuel sources, expansion of off-farm income-earning opportunities etc.).

In India several regulatory measures have been initiated regarding pollution control and environmental encouragement. The rapid changing scenario exhibits that India has learned to depend more on markets and less on government to accelerate development process, the result of which has been most unfavourable. However in order to adding momentum to the development process and to implement strong environmental policies the intervention of government becomes indispensable in the present situation. Usually two sets of policies are advocated to fall on the underlying causes of environmental degradation and both are equally essential. The first set of policy packages includes promoting education, family planning and poverty removal programs, facilitating environmental management research etc. The purpose of second set of policy packages is to fetch the positive links between development and environment. The most common among them include targeted policies to change behaviour. In second set policy packages are based on both incentives and quantitative restrictions. However the government adopts various fiscal measures taking into account incentives based policies to control degradation. Among them, use of environmental taxes is regarded as a part of an integrated policy that has become a subject of considerable interest in most of the countries. The basic facility of environmental taxes is that it can prevent and control degradation to the possible extent on the one hand and ensure availability of funds for environmental programs on the other. The government should impose environmental taxes on those inputs, which result in pollution. Apart from the environmental taxes some countries are moving towards carbon tax to fight with the green house gases or global warming. The imposition of carbon tax helps the customers to use less energy and switch over to less carbon intensive energy sources. However the introduction of environmental taxes and integration of environmental charges with the tax policy requires a set of simple rules and criteria to ease their implementation and strengthen their effectiveness. The government often takes measures to encourage economic efficiency on both national and international levels to minimize the degree of environmental pollution, but the measures so taken are not equal to the need. The National environment policy is designed in such a manner that those policies can provide the benefits to the individual countries only, not the rest of the world. As a result the global environmental goals are not achieved at par. Therefore government must consider the implications of indigenous environmental policy decisions for other countries for successful international co-operation in environmental arena. Side by side apart from the government machinery to enforce it is inevitable to take care of growing environmental threats in regular, rational and systematic ways and consciousness to environmental concerns is to be built up among the general masses by the government (Sarkar, 2005).

Poor people are often constrained in their ability to influence government decisions that affect the resources on which they depend. This creates uncertainty about their future access to resources and undermines incentives to use their resources sustainably. Specific efforts are required to enhance their full participation in decision-making processes that will affect their resources, e.g., citizen oversight boards and community-level review processes for dispute resolution. Governments often neglect the gender dimensions of decisions made on resource use, and particular efforts need to be made to enhance women's participation in decision-making processes. In many cases, the poor already have the formal right to manage key environmental resources, but they are not able to protect their rights, either because they are not aware of them or because they are unable to defend them. Individuals and communities need to be informed of their rights and of the scope for influencing government policies through participation in political processes. Government institutions must also be pro-active in disseminating information, seeking public input, and in working with local communities to identify and meet local needs. Many communities have become more effective in interacting with government decision makers after being trained in such skills as talking in public fora, negotiating, and organizing public meetings. Civil society organizations can often play a critical role in supporting

community-level capacity development for protection and sustainable management of natural resources. Women often face special difficulties participating in local political processes. Social constraints often prevent them from attending and/or speaking openly in meetings with men, or men ignore the women when they do. Efforts to involve the rural poor in governance will need to explicitly involve women. Government officials often need to better understand the social and ecological constraints faced at the local level in order to support local resource management. Capacity development efforts can assist this better understanding, which should increase political will to avoid policies that lead to misuse of resources or inhibit the rural poor from improving their livelihood.

Co-management of natural resources between the State and local resource users provides a framework for sustainable management, which at the same time enhances the livelihoods of poor people.

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