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GENDER, ENVIRONMENT AND POVERTY INTERLINKS IN RURAL INDIA

REGIONAL VARIATIONS AND TEMPORAL SHIFTS, 1971-1991

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Preface

This paper analyses the interrelationships between gender, poverty and environmental change in rural India, focusing especially on variations across regions and shifts over time during the past two decades. After briefly identifying the major factors leading to environmental degradation, it traces why and how this degradation and the appropriation of natural resources by the state (statization), and by a minority of individuals (privatization), tend to have particularly adverse implications for the female members of poor rural households. Regional variations and temporal shifts in the intensity of these effects are traced both descriptively and through the specification of an index, termed by the author the GEP index, for measuring gender-environment-poverty vulnerability. Governmental and community-initiated responses to environmental degradation and natural resource appropriation are also examined, and the necessity of gender-directed policies highlighted.

Among the adverse class-gender effects noted in the paper are an increase among poor rural households in women's and female children's time and energy spent in fuel, fodder, and water collection; a decrease in women's incomes from non-timber forest products and agriculture; an adverse effect on the health and nutrition of household members in general, and female members in particular; an erosion of social support networks built by women to tide the household over economic crises; and a marginalization and decline in peasant women's traditional knowledge of plants and species.

The gender specificity of these effects is seen to arise from pre-existing gender inequalities in, especially, the division of labour; the intra-household distribution of subsistence resources; access to productive resources, other assets, and income-earning opportunities; and participation in public decision-making forums.

However, the noted effects vary in form and intensity across India, due to geographic differences in gender bias, in environmental risk, and in poverty incidence. Rural women are worst-off in regions where all three forms of disadvantage are strong and reinforce each other, as in many parts of northern India, and especially Bihar. They are best-off where all three types of disadvantage are weak, as in southern and northeast India, and especially Kerala. Other regions fall in between.

The author asserts that regions of high gender-environment-poverty vulnerability warrant special attention in terms of schemes which give poor women greater control over economic resources in general, and common property resources in particular. Women's active participation in forest protection and wasteland development schemes is especially important not only for improving family welfare, but also for ensuring scheme success, promoting gender equity, enlarging local knowledge systems, increasing women's participation in public decision making bodies, enhancing women's bargaining power both within and outside the household, and contributing to their overall empowerment.

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Dharam Ghai
Director

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◆ Abbreviations and Acronyms

FSI	Forest Survey of India
J & K	Jammu and Kashmir
NGO	non-governmental organization
NRSA	National Remote Sensing Agency
NTFP	non-timber forest produce
RFLFPR	rural female labour force participation rate
RFLR	rural female literacy rate
RLFPR	rural labour force participation rate
RLR	rural literacy rate
RTFR	rural total fertility rate
UP	Uttar Pradesh
VC	village commons

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INTRODUCTION

This paper examines the interlinks between gender, poverty and environmental change in rural India, focusing in particular on regional variations and temporal shifts over the past two decades. The paper is divided into five sections. Section I gives an overview of the kinds of links that can be established between gender, poverty and environmental change. In particular, it focuses on the factors underlying the declining availability of natural resources, and the implications of this decline for women in poor rural households. On the basis of selected indicators, section II outlines the broad regional differences in gender bias, environmental disadvantage, and poverty incidence. Section III presents a series of indices (which I term the GEP indices) which measure variations in gender-environment-poverty vulnerability across different states of India, and shifts in vulnerability over the period 1971-1991. Section IV takes a brief look at grassroots and governmental responses to environmental degradation, and Section V offers some concluding comments.

I. AN OVERVIEW OF INTERLINKS[1]

◆ (1) Environmental Degradation and Forms of Appropriation

The discussion below focuses briefly on the nature and causes of natural resource depletion before examining its gender implications for poor rural households.

In India the availability of natural resources to a large section of the rural population, and especially to the poor, has been eroded severely over the past two decades by two parallel, and interrelated, processes: first, their growing degradation both in quantity and quality; and second, their increasing statization (appropriation by the State) and privatization (appropriation by a minority of individuals), with an associated decline in what was earlier communal. These two processes, both independently and interactively, underlie many of the differential class-gender effects (that is, gender effects mediated by class) of environmental degradation outlined further below. Independently, the former process is reducing overall availability, and the latter is increasing inequalities in the distribution of what is available. Interactively, an altered distribution in favour of the State and some individuals, and away from community control, can contribute to environmental degradation insofar as community resource management systems have often proven more effective in environmental protection and regeneration than systems managed solely by the State or by individuals. These two processes I term the primary factors underlying the class-gender effects of environmental change. Impinging on these primary factors are several intermediary ones, of which those especially important are the

[1] This section draws substantially from Agarwal (1991, 1992), as well as from new material (including data from a primary survey undertaken by the author).

following: the erosion of community resource management systems resulting from the shift in "control rights" over natural resources away from community hands;[2] population growth; consumption patterns; and technological choices in agriculture. Most of these are discussed in detail in Agarwal (1991) and summarized briefly below.

(a) Forms of environmental degradation

Although there is as yet only an inadequate data base to indicate the **exact** extent of environmental degradation in India and its cross-regional variations, available macro-information provides sufficient pointers to warrant serious concern. Degradation in India's natural resource base is manifest in disappearing forests, deteriorating soil conditions, and depleting water resources. Data obtained through remote sensing methods reveal that in 1985-1987 only 19.5 per cent of India's geo-area was forested (GOI, 1991a). By official estimates, in 1980, 56.6 per cent of India's land was suffering from environmental problems, especially water and wind erosion (GOI, 1980-1985: 343). Unofficial estimates are even higher. In some canal projects, **half** the potentially irrigable and cultivable area has been lost due to water-logging (Joshi and Agnihotri, 1984). The area under periodic floods is estimated to have doubled between 1971 and 1981, and soil fertility is declining due to excessive use of chemical fertilizers. Likewise, the availability of both ground and surface water is falling. Groundwater levels have fallen permanently not only in the Deccan plateau but even in parts of the Indo-Gangetic plains, due to indiscriminate sinking of tubewells — the leading input in the green revolution technology (Dhawan, 1982). As a result, many drinking water wells have dried up or otherwise been rendered unusable (CSE, 1986:30). In addition, fertilizer and pesticide run-offs into natural water sources have destroyed fish life and polluted water for human use in several areas (CSE, 1986: 30).

Such degradation of natural resources has gone on alongside their increasing concentration in the hands of a few, as discussed below.

(b) The process of statization

Both under colonial rule and continuing in the post-colonial period, State control over forests and village commons has grown, with selective access being granted to a favoured few. To begin with, several aspects of British colonial policy have had long-lasting effects (Guha, 1983). The British established State monopoly over forests, reserving large tracts for timber extraction. Associated with this was a severe curtailment in the customary rights of local populations to these resources; rights of access were granted only under highly restricted conditions, with a total prohibition on the barter or sale of forest produce by such rightsholders. At the same time, the forest settlement officer could give concessions to those he chose to so privilege. The colonial State also promoted the notion of "scientific" forest management

[2] For a brief but useful discussion on property rights in relation to environmental resources see Dasgupta and Maler (1990). I prefer to use the term "control rights" here, since what appears critical in this context is less who owns the resources, and more who has control over them. Hence, for instance, the control of State-owned resources could effectively rest with the village community.

which often cloaked the encouragement of commercially profitable species at the cost of species used by the local population. Alongside, there was virtually indiscriminate forest exploitation by private contractors, especially for building railways, ships and bridges; and tree clearing was also encouraged for establishing tea and coffee plantations, and expanding the area under agriculture to increase the government's land revenue base.

Effectively, these policies: (i) severely eroded local systems of forest management; (ii) legally cut off an important source of sustenance for people, even though illegal entries continued; (iii) created a continuing source of tension between the forestry officials and the local people; and (iv) oriented forest management to commercial ends.

Post-colonial policies, at least up to the early 1980s, showed little shift from the colonial view of forests as primarily a resource for commercial use and gain. State monopoly over forests persisted, with all the attendant tensions, as did the practice of forestry in the interests of profit. Restrictions on local people's access to non-timber forest produce actually increased and the harassment and exploitation of forest dwellers by the government's forest guards was widespread (Chand and Bezboruah, 1980). The decade of the 1980s, however, saw some shift towards State recognition of the positive role that local communities could play in the regeneration of wastelands and the launching of joint forest management schemes, although the long-term positive effects on the ground of this shift in policy still remain to be seen.

(c) The process of privatization

Especially over the past four decades, a growing privatization of community resources in **individual** (essentially male) hands has paralleled the process of statization. Customarily, large parts of village common lands, especially in northwest India, were what could be termed "community-private": they were private insofar as use rights to them were usually limited to members of the community and were therefore exclusionary; at the same time they were communal in that such rights were often administered by a group rather than by an individual.[3]

Table 1 reveals a decline in village commons (VCs) ranging between 26 and 63 percentage points across seven states, between 1950 and 1984. This is attributable mainly to State policy acting to benefit selected groups over others, including illegal encroachments by farmers, made legal over time; the auctioning of parts of VCs by the government to private contractors for commercial exploitation; and government distribution of common land to individuals under various schemes which were, in theory, initiated for benefiting the poor, but in practice benefited mainly the well-off farmers (Jodha, 1986). For 16 of the 19 districts in the seven states studied by Jodha, the share of the poor was less than that of the non-poor. **Hence the poor (who depend on these resources more than the better off) lost out collectively while gaining little individually.**

[3] See e.g. Baden-Powell (1957), and Bromley and Cernea (1989). However, the degree to which the village community acted as a cohesive group and the extent of control it exercised over communal lands varied across undivided India: it was much greater in the northwest than elsewhere (Baden-Powell, 1957).

Table 1
Distribution of village common land to individual households in different regions

States and districts	VCs as per cent of village area 1982-84	Per cent decline in VC area, 1950-84	Per cent of land to		Per cent of recipients among the		Per household area owned (ha)			
			Poor	Others	Poor	Others	Poor		Others	
							Before[1]	After[2]	Before	After
Andhra Pradesh										
Mahbubnagar	9	43	50	50	76	24	0.3	0.9	3.0	5.1
Medak	11	45	51	49	59	41	1.0	2.2	3.1	4.6
Gujarat										
Banaskantha	9	49	18	82	38	62	0.8	2.0	5.4	8.8
Mehsana	11	37	20	80	36	64	1.0	1.7	8.0	9.8
Sabarkantha	12	46	28	72	55	45	0.5	1.1	7.0	9.8
Karnataka										
Bidar	12	41	39	61	64	36	1.0	2.0	6.4	9.2
Gulbarga	9	43	43	57	60	40	0.8	2.4	4.5	7.7
Mysore	18	32	44	56	67	33	0.9	1.9	4.1	11.6
Madhya Pradesh										
Mandsaur	22	34	45	55	75	25	1.2	2.5	7.7	12.4
Raisen	23	47	42	58	68	32	1.3	2.2	6.2	9.0
Vidisha	28	32	38	62	48	52	1.3	2.5	4.9	6.8
Maharashtra										
Akola	11	42	39	61	58	42	1.0	1.6	3.1	4.6
Aurangabad	15	30	30	70	42	58	1.1	2.2	6.4	6.3
Sholapur	19	26	42	58	53	47	0.7	2.2	3.4	5.6
Rajasthan										
Jalore	18	37	14	86	37	63	0.3	1.7	7.2	12.5
Jodhpur	16	58	24	76	35	65	0.4	1.3	2.3	3.8
Nagaur	15	63	21	79	41	59	1.3	2.5	2.4	5.2
Tamil Nadu										
Coimbatore	9	47	50	50	75	25	0.8	2.5	3.8	5.8
Dharmapuri	12	52	49	51	55	45	1.0	1.9	4.6	7.5

Notes: [1] Before the distribution of VC land; [2] After the distribution of VC land.
Source: Jodha (1986)

Similarly, in the tapping of groundwater through tubewells, there are dramatic inequalities in the distribution of what is effectively an underground commons. Tubewells are concentrated in the hands of better-off farmers and the noted associated fall in water tables has, in many areas, dried up many shallow irrigation wells and drinking water wells used by the poor. In some regions, they have also depleted soil moisture from land used by poor households (Bandhyopadhyay, 1986).

(d) The erosion of community resource management systems

The statization and privatization of communal resources have, in turn, systematically undermined traditional institutional arrangements of resource use and management. The documentation on this is still growing, but existing research reveals systems of water management, methods of gathering firewood and fodder, and practices of shifting agriculture which were typically not destructive of nature.[4] Some traditional religious and folk beliefs also

[4] On traditional systems of community water management see Sengupta (1985) and Seklar (1981). On communal management of forests and village commons see Guha (1985), Gadgil (1985), and Moench (1988). On firewood gathering practices, see Agarwal (1986a): firewood for

contributed to the preservation of nature, especially trees or orchards deemed sacred, as in the sacred groves still found in parts of India.

Of course, much more empirical documentation is needed on how regionally widespread these traditional systems of management were, and the contexts in which they were successful in ensuring community co-operation. However, the basic point is that where traditional community management existed, as it did in many areas, **responsibility for resource management was linked to resource use** via local community institutions. Where control over these resources passed from the hands of the community to those of the State or of individuals, this link was effectively broken.

In turn, the shift from community control and management of common property to State or individual ownership and control appears to have increased environmental degradation (Dasgupta and Maler, 1990; and Bromley and Cernea, 1989). Property rights vested in individuals are also no guarantee for environmental regeneration. Indeed individual farmers attempting tree planting for short-term profits in the 1980s tended to plant quick-growing commercial trees such as eucalyptus, which many argued to be environmentally costly.

(e) Population growth

Excessive population growth is often identified as the primary culprit in environmental degradation. However, the evidence on this does not justify such a simple conclusion. It is far from clear what threshold of population density would lead to environmentally detrimental effects in particular contexts. In parts of Africa, in fact, significant increases in population have been associated with a shift from highly degrading agricultural practices to more sustainable ones.[5] At the same time, in India, with much higher population densities than found in most parts of Africa, a rapidly growing population impinging on a limited land/water/forest base may be expected to degrade the environment over time.

However, political economy dimensions clearly underlie the **pace** at which such a process may occur and **how the costs of it are distributed**. The continuing (legal and illegal) exploitation of forests, and the increasing appropriation of village commons and groundwater resources by a few, leave the vast majority to subsist on a shrinking natural resource base. Added to this is the noted erosion of community resource management systems which had enforced limitations on what people could and did take from communal resources, and which could perhaps have ensured their protection despite population pressure, for some time.[6] The almost unidimensional focus on population in many national and international forums has detracted attention from these and other basic causes of environmental deterioration. And it is questionable that interventions to control population growth can, **in**

domestic use in rural households was customarily collected in the form of twigs and fallen branches, which did not destroy the trees. Even today, 75 per cent of firewood used as domestic fuel in northern India (and 100 per cent in some areas) is in this form.

[5] I understand from Paul Streeten (personal communication, 1995) that this was found in a study of the Machakos district of Kenya.

[6] See e.g. the discussion on this in Bromley and Cernea (1989).

themselves, stem environmental degradation. What they can do, as Shaw (1988: 7) argues, is "buy crucial time until we figure out how to dismantle more ultimate causes".

Any policy for reducing population growth must also contend with the complexity of the relationship between environmental degradation and people's desired family size. On the one hand, environmental degradation could induce a variety of fertility-increasing responses over time. Young girls could be kept away from school to help with fuel and fodder collection, and given the negative correlation between female education and fertility, this could constrain fertility reduction in the long term. Again, if environmental degradation leads to higher infant mortality rates, parents may seek to have more children to ensure a desired completed family size. Families may also want more children to diversify incomes as a risk-reducing mechanism, in environmentally high-risk areas (Rosenzweig and Wolpin, 1985).

On the other hand, environmental degradation could lead people to want smaller families because of the difficulties of maintaining large ones on a limited resource base. Preliminary results from a primary survey undertaken by the present author in 1993-1994 in Rajasthan, Gujarat, and the Kumaon region of the Uttar Pradesh (UP) hills, point in this direction. Some of the replies by women respondents (mostly in the 40-45 age group) to the question "Is it better to have many or few children to cope with the fuel/fodder/water problem?" are reproduced below:

- "Large families mean more hands, but where is the land?"
- "Large families need more land and food. If the family is large we will need to collect more [fuel and fodder], so that does not solve the problem. Smaller families are more caring."
- "Small families are better. More children won't solve the problem in the long run because there will be less land to till."
- "More children will help the mother for a while, but the problem will return when the children leave home. A smaller family is better because then all the children can be cared for.
- "Small families are better in every respect, each member gets more attention. Big families have to spend more money. Joint families are best if the members co-operate."
- "One or two children are enough; more children means fragmentation and small plots."
- "Fewer children means good food, good education. Two sons and one daughter is ideal."

In other words, there appears to be an emerging recognition of the need to limit family size, given the resource crunch. But there is still a wide gap to be bridged in the supply of better health and contraceptive services that would enable women to make informed and safe choices.

These aspects highlight yet another facet of the complex link between women's status, population growth, and the state of the environment.

(f) Consumption patterns

The effect of a given population size on the natural resource base also cannot be delinked from income distribution, people's lifestyles, and associated consumption patterns. These issues are too wide ranging and complex to be detailed here, but it needs mention that the question is not just one of quantity consumed but also of the nature of product demanded. This, in turn, has implications for choice of production technologies and potential for environmental degradation, including pollution, the creation of non-biodegradable waste, and so on. The costs of this are, however, borne by many whose own lifestyles have neither contributed to the degradation, nor have they had a say in the decisions regarding the products produced or the technologies used.

It is also important to recognize that the question of consumption and lifestyles does not only have a well-recognized class dimension, but a gender dimension as well, stemming for instance from gender differences in control over decisions about household purchases. To cite one example, it is noteworthy that even in middle peasant homes, investment, say, in a tractor (a technology which men use) tends to have priority over the replacement of a smoky kitchen stove (a technology which women use).[7]

(g) Choice of agricultural technology and erosion of local knowledge systems

Several forms of environmental degradation are associated with the green revolution technology adopted to increase crop output. While dramatically successful in the latter objective in the short-run, it has had high environmental costs: falling water tables due to the overuse of tubewells, waterlogged and saline soils from many large irrigation schemes, declining soil fertility with excessive chemical fertilizer use, water pollution with pesticides, and so on. This is likely to affect the long-term sustainability of the output increases achieved so far. Deteriorating soil and water conditions are already being reflected in declining crop yields.[8] Genetic variety has also shrunk, and many of the indigenously-developed crop varieties (long-tested and adapted to local conditions) have been replaced by "improved" seeds which are more susceptible to pest attacks. The long-term annual growth rate of agricultural production in India over 1968-1985 was 2.6 per cent, that is, slightly lower than the pre-green-revolution, 1950-1965, rate of 3.08 per cent. Crop yields are now also more unstable (Rao et al., 1988). All this raises doubts about the long-term sustainability of agricultural growth, and more generally of rural production systems, under present forms of technology and resource management in India. Indeed indiscriminate agricultural expansion, with little attempt to maintain a balance between forests, fields, and grazing lands, assumes that the relationship between agriculture, forests and village commons is an antagonistic one, rather than one of complementarity.

The choice of agricultural technology and production systems also reflects the dominant view of what constitutes scientific agriculture. The green revolution embodies a technological mix which gives primacy to laboratory-based

[7] Personal observation in Rajasthan, Punjab and Haryana.

[8] Under some large-scale irrigation works, crop yields are **lower** than in the period immediately prior to the project (Joshi and Agnihotri, 1984).

research and manufactured inputs, and treats agriculture as an isolated production system. Over the years there has been a systematic devaluation and marginalization of indigenous knowledge about species-varieties and sustainable forms of interaction between people and the natural environment. And the people who use this knowledge in their daily lives — farmers and forest dwellers and especially women of these communities — have tended to be excluded from the institutions which create what is seen as scientific knowledge.

All these factors have widespread implications for rural livelihoods, poverty and gender equity.

◆ (2) Implications: Class-Gender Effects

(a) The specificity of class and gender

The effects of natural resource degradation, statization and privatization (and of their underlying causes) have a location, class and gender specificity. Households located in environmentally vulnerable zones are likely to be most at risk; and within these zones, the effects would be especially negative for poor households because of their particular dependence on communal resources.

For instance, a wide variety of essential items are gathered by rural households from the village commons (VCs) and forests, for personal use and sale: food, fuel, fodder, fibre, small timber, manure, bamboo, medicinal herbs, oils, materials for house building and handicrafts, resin, gum, honey, spices, and so on (KFRI, 1980; Fernandes and Menon, 1987). Although all rural households use the VCs to some degree, for the poor they are critically important given the unequal distribution of private land in the country (GOI, 1986, 1987). Data for the early 1980s, from 12 semi-arid districts in seven Indian states, indicate that for poor rural households (the landless and those with less than 2 hectares dryland equivalent) VCs account for at least 9 per cent of total income and in most cases 20 per cent or more, but contribute only 1-4 per cent of the incomes of the non-poor (see table 2). The dependence of the poor is especially high for fuel and fodder: across the regions studied by Jodha (1986), VCs were found to supply 91-100 per cent of the firewood and 69-89 per cent of their grazing needs, compared to the relative self-sufficiency of the larger landed households. Access to VCs reduces income inequalities in the village between poor and non-poor households. Also there is a close link between the viability of small farmers' private property resources and their access to VCs for grazing or collecting fodder for their draft animals or milch cattle (Jodha, 1986; Blaikie, 1985).

Forests, likewise, have always been significant sources of livelihood, especially for tribal populations, and provided the basis of swidden cultivation, hunting, and the gathering of non-timber forest produce (NTFP). In India, an estimated 30 million or more people depend wholly or substantially on NTFP for a livelihood (Kulkarni, 1983). These sources are especially critical during lean agricultural seasons, and during acute food shortage contexts such as drought and famine (Agarwal, 1990).

The health of forests, in turn, can affect the health of soils (especially in the hills), and the availability of ground and surface water. For a large percentage of rural households, the water for irrigation, drinking, and various domestic uses comes directly from rivers and streams in the hills and plains. Again there are class differences in the nature of their dependency and access: the richer households are more able to tap the (relatively cleaner) groundwater for drinking and irrigation by sinking more and deeper wells and tubewells, while the poor are mainly dependent on surface sources.

Table 2
Average annual income derived from village commons by poor and non-poor households in different regions (1982-1985)

States and districts	Per household average annual income from village commons			
	Poor households[1]		Other households[2]	
	Value (Rs)	Per cent of total household income	Value (Rs)	Per cent of total household income
Andhra Pradesh				
Mahbubnagar	534	17	171	1
Gujarat				
Mehsana	730	16	162	1
Sabarkantha	818	21	208	1
Karnataka				
Mysore	649	20	170	3
Madhya Pradesh				
Mandsaur	685	18	303	1
Raisen	780	26	468	4
Maharashtra				
Akola	447	9	134	1
Aurangabad	584	13	163	1
Sholapur	641	20	235	2
Rajasthan				
Jalore	709	21	387	2
Nagaur	831	23	438	3
Tamil Nadu				
Dharmapuri	738	22	164	2

Notes: [1] Landless households and those owning < 2 ha dryland equivalent; [2] those owning >2 ha dryland equivalent.
Source: Jodha (1986).

However, focusing on the **class** significance of communal resources provides only a partial picture — there is also a critical **gender** dimension, women and female children being the ones most adversely affected by environmental degradation. There are especially four reasons for this.

First, there is a pre-existing gender division of labour. It is women in poor peasant and tribal households who do much of the gathering and fetching from the forests, village commons, rivers and wells. Women of such households also carry a significant responsibility for family subsistence and are not uncommonly the primary or (in most female-headed households) the sole, economic providers. But women's ability to fulfil this responsibility is more constrained than is men's because of gender inequalities in access to productive and subsistence resources.

Second, there is a systematic anti-female bias in the intra-household distribution of subsistence resources within rural households in many parts of India, as revealed by a range of indicators such as anthropometric indices, morbidity and mortality rates, hospital admissions data, and especially the sex

ratio (which in 1991 was 929 females per 1000 males for the whole country).[9] These differences are especially acute in northwest India, but are found to some degree in most parts of the country.[10]

Third, there are significant inequalities in men's and women's access to productive resources, other assets, and income-earning opportunities. For instance, there is a notable concentration in male hands of the most critical productive resource in rural economies, viz. agricultural land, and associated production technology (Agarwal, 1994). Again, women have a systematically disadvantaged position in the labour market, with fewer employment opportunities, less occupational mobility, lower levels of training, and lower payments for the same or similar work, compared with men.[11] Due to the greater task-specificity of their work, they also face much greater seasonal fluctuations in employment and earnings than do men, with sharper peaks and longer slack periods in many regions, and have less chance of finding employment in the slack seasons (Agarwal, 1984; and Ryan and Ghodake, 1980).

Given their limited rights in private property resources such as agricultural land, rights to communal resources such as the village commons have always provided rural women and children (especially those of tribal, landless, or marginal peasant households) an independent source of subsistence. For instance, access to village commons is usually linked to membership in the village community, and therefore women are not excluded in the way they may be in a system of individualized private land rights. This acquires additional importance in regions with strong norms of female seclusion (as in northwest India) where women's access to the cash economy, to markets, and to the market-place itself, is constrained and dependent on the mediation of male relatives (Agarwal, 1994; Sharma, 1980).

Fourth, there is a considerable gender gap in access to decision-making authority at all levels, including decisions about resource use.

It is against this analytical backdrop that we need to examine what I term the class-gender effects of the processes of environmental degradation, statization and privatization.

(b) The effects

The class-gender effects relate to at least six critical aspects: time, income, nutrition, health, social support networks, and knowledge systems. Each of these effects is important. However, their intensity and interlinkages vary regionally, with variations in ecology, agricultural technology, land distribution, and social structures, and associated variations in the gender

[9] For a review of issues and literature on this question see Agarwal (1986b) and Harriss (1990).
[10] Sex ratios are particularly female-adverse in the agriculturally prosperous northwestern states of Punjab and Haryana. For a discussion on the causes of this regional variation see section II of this paper. Also see Agarwal (1986b) and Miller (1981).
[11] See discussions in Agarwal (1986b, 1984) and Bardhan (1977).

division of labour, livelihood possibilities, and kinship systems.[12] Although a systematic regional decomposition of effects is not attempted in this section, all the illustrative examples are regionally contextualized.

On time: As the main gatherers of fuel, fodder and water, it is primarily women's working day (already averaging 10-12 hours) that is lengthened with the depletion of and reduced access to forests, waters and soils. Firewood, for instance, is the single most important source of domestic fuel in India (providing over 65 per cent of domestic energy in the hills and deserts of the north). Much of this is gathered and not purchased, especially by the poor. In recent years, there has been a notable increase in firewood collection time, to a small degree in some regions, dramatically in others (see table 3). In the 1980s, in parts of Gujarat (western India), even a 4-5 hour search was found to yield little apart from shrubs, weeds, and tree roots which do not provide adequate heat (Nagbrahman and Sambrani, 1983).

Fodder shortages are being felt even more acutely, and across large parts of India. The above-mentioned primary survey (undertaken by me in Rajasthan, Gujarat, and the Kumaon region of the UP hills) indicates not only an increase in the time spent in fodder collection (done primarily by women and children), but also a growing dependence on market purchase. In the Kumaon village, for instance, 84 per cent of the sample households now purchase some proportion of their fodder needs, compared with only 8 per cent two decades ago. The number of large animals that rural households can afford to keep has also fallen in all of the regions surveyed, due to the decline in grazing lands and the increase in fodder prices. Moreover, in regions where grazing is still possible, while 20 years ago boys and/or men usually took the animals out, now (as in the Kumaon village) girls are often sent for grazing while their brothers attend school. Over time this could widen the gender gap in literacy in such areas.

Similarly, any exacerbation of the problem of drinking water if wells dry up or go saline (say, near irrigation works) places an additional burden of time and energy on women and young girls (Agarwal, 1981).

As a woman in the Garhwal region of the UP hills, quoted in Bahuguna (1984: 132), puts it:

[12] For a detailed regional mapping of some of these variables in the context of women's land rights in South Asia, see Agarwal (1994).

> When we were young, we used to go to the forest early in the morning without eating anything. There we would eat plenty of berries and wild fruits... drink the cold sweet [water] of the *Banj* [oak] roots... In a short while we would gather all the fodder and firewood we needed, rest under the shade of some huge tree and then go home. Now, with the going of the trees, everything else has gone too.

Table 3
Time taken and distance travelled for firewood collection in different regions

State/region	Year of data	Firewood collection*		Data source
		Time taken	Distance travelled	
Bihar (plains)	c.1972	NA	1-2 km/day	}Bhaduri and Surin (1980)
	1980	NA	8-10 km/day	}
Gujarat (plains)		once every 4 days	NA	}
(a) Forested	}	once every 2 days	4-5 km	}Nagbrahman and Sambrani (1983)
(b) Depleted	}1980	4-5 hr/day	NA	}
(c) Severely depleted	}			
Karnataka (plains)	NA	1 hr/day	5.4 km/trip	Batliwala (1983)
Madhya Pradesh (plains)	1980	1-2 times/week	5 km	Chand and Bezboruah (1980)
Rajasthan				
Alwar plains	1986	5 hr/day (winter)	4 km	Author's observation in 1988
Ajmer plains	1970s	2 hr/journey	1.9 km	}Survey by author in 1993
(average all seasons)	1990s	2 hr/journey	2.1 km	}
Uttar Pradesh				
Chamoli (hills)				
(a) Dwing	}1982	5 hr/day[@]	over 5 km	}Swaminathan (1984)
(b) Pakhi	}	4 hr/day		}
Garhwal (hills)	NA	5 hr/day	10 km	Agarwal (1983)
Kumaon (hills)	1982	3 days/week	5-7 km	Folger and Dewan (1983)
Kumaon (hills)	1970s	1.6 hrs/journey	1.6 km	}Survey by author in 1993
(average all seasons)	1990s	3-4 hrs/journey	4.5 km	}

Notes: * firewood collected mainly by women and children. [@] average computed from information given in the study.
NA: information not available

In this region of UP, according to a woman grassroots activist, the growing hardship of young women's lives with ecological degradation has led to an increasing number of suicides among them in recent years. Their inability to obtain adequate quantities of water, fodder and fuel is reported to have increased tensions with mothers-in-law (in whose youth forests were plentiful), and soil erosion has compounded the difficulty of producing enough grain for subsistence in a region of high male out-migration (Bahuguna, 1984).

On income: To begin with, the decline in gathered items from forests and VCs has reduced incomes directly. In addition, the extra time needed for gathering reduces that available to women for crop production, and can adversely affect crop incomes, especially in hill communities where, due to high male out-migration, women are the primary cultivators. A study in Nepal is indicative (Kumar and Hotchkiss, 1988): it found that the substantial increase in firewood collection time due to deforestation has significantly reduced women's crop cultivation time, leading to an associated fall in the production of maize, wheat and mustard, the cultivation of which is primarily dependent on female labour in the region surveyed. These are all crops grown

in the dry season when there is increased competition from fuel and other collection activities. The same is likely to be happening in the hills of India.

Similar implications for women's income arise with the decline in village grazing land and associated fodder shortage. Many landless widows I spoke to in Rajasthan (northwest India) in 1987 said they could not take advantage of the government's poverty alleviation scheme of providing subsidized credit to the poor for purchasing a buffalo, as they had nowhere to graze the animal, nor cash to buy fodder.

With the erosion of other sources of livelihood, for many years now selling firewood has been common in some regions, especially in eastern and central India. Most "headloaders", as they are called, are women, barely eking out a living (Bhaduri and Surin, 1980). With thinning forests, however, such sources of livelihood are becoming increasingly difficult to sustain, even as this activity itself exacerbates the problem of deforestation.

On nutrition: As the area and productivity of village commons and forests fall, so does the contribution of gathered food in the diets of poor households. Fuelwood shortages can have additional nutritional effects: efforts to economize can induce shifts to less nutritious foods which need less fuel to cook, or can be eaten raw; or force people to eat partially cooked food which could be toxic, or to eat leftovers which could rot in a tropical climate, or to miss meals altogether. While, as yet, there are no systematic studies on this for India, those for rural Bangladesh are indicative, and show that the total number of meals, as well as the number of cooked meals eaten daily in poor households has been declining (Howes and Jabbar, 1986). A trade-off between the time spent in fuel gathering vs. cooking can also adversely affect the meal's nutritional quality.

Although these adverse nutritional consequences impinge to some degree on all household members, women and female children bear an additional burden because of the noted gender biases in intra-family distribution of food and health care. There is also little likelihood of poor women being able to afford the extra calories for the additional energy expended in fuel collection.

On health: Apart from the health consequences of nutritional inadequacies, poor rural women are also more directly exposed than are men to water-borne diseases, and to the pollution of rivers and ponds with fertilizer and pesticide run-offs, because of the nature of the tasks they perform: fetching water for various domestic uses and animal care, washing clothes near ponds, canals and streams; and so on (Agarwal, 1981). The burden of family ill-health associated with water pollution likewise falls largely on women who take care of the sick.

An additional source of vulnerability is the agricultural tasks women perform. For instance, rice transplanting, which is usually a woman's task in most parts of Asia, is associated with a range of diseases, including arthritis and gynaecological infections (Mencher and Saradamoni, 1982; UNDP, 1980). Chemically-polluted irrigation water could compound the risk of such illnesses. Similarly, cotton picking, also done mainly by women, exposes them to pesticides which are widely used for cotton cultivation. In China several times the acceptable levels of DDT and BHC residues have been found in the

milk of nursing mothers, among women agricultural workers (Wagner, 1987). It is not unlikely that the same would be true for India.

On social support networks: Population displacements arising from the submersion of villages in the building of large irrigation and hydro-electric works, or from large-scale deforestation in itself, has another (little recognized) class and gender implication: the disruption of social support networks. Social relationships with kin and with other villagers provide economic and social support that is important to all rural households, but especially to poor households and to women. These can include reciprocal labour-sharing arrangements during peak agricultural seasons, loans taken in cash or kind during severe crises such as droughts, the borrowing of small amounts of foodstuffs, fuel, fodder, etc., even in normal times, and so on. Women typically depend a great deal on such informal support networks, which they also help to build through daily social interaction, marriage alliances that they are frequently instrumental in arranging, and complex gift-exchanges (Sharma, 1980). Also the social and economic support this represents for women in terms of strengthening their bargaining power within families needs to be recognized, even if it is not easy to quantify (Agarwal, 1990). These networks, spread over a range of nearby villages, cannot be reconstituted easily, an aspect ignored by rehabilitation planners.

Indeed large-scale deforestation, whether or not due to irrigation schemes, erodes a whole way of living and thinking. Two close observers of life among the Orissa tribals in eastern India note that: "the earlier sense of sharing has disappeared....Earlier women could rely on their neighbours in times of need. Today this has been replaced with a sense of alienation and helplessness...the trend is to leave each family to its own fate" (Fernandes and Menon, 1987: 115). Widows and the aged are the most neglected.

On indigenous knowledge systems: The gathering of food and medicinal items demands an elaborate knowledge of the nutritional and medicinal properties of plants, roots and trees, including a wide reserve knowledge of edible plants not normally used, but critical for tiding over prolonged shortages during climatic disasters. An examination of household coping mechanisms during drought and famine reveals a significant dependence on famine foods gathered mainly by women and children for survival (Agarwal, 1990). Also, among hill communities it is usually women who do the seed selection work and have the most detailed knowledge about crop varieties.[13] This knowledge about nature and agriculture, acquired by poor rural women in the process of their everyday contact with and dependence on nature's resources, has a class and gender specificity, and is linked to the class specificity and gendering of the division of labour.

The impact of existing forms of development on this knowledge has been twofold. First, the process of devaluation and marginalization of indigenous knowledge and skills, discussed earlier, has impinged especially on the knowledge that many poor peasant and tribal women traditionally possessed.

[13] Among the Garo tribals of northeast India in the early 1960s, Burling (1963) found that the men always deferred on this count to the women, who knew of some 300 indigenously cultivated rice varieties. In Nepal, even today, it is women who do the seed selection work in virtually all communities (Acharya and Bennett, 1981).

Indeed it is not unusual for village women to deny possessing any to outsiders. In my above-mentioned field survey, women both in Kumaon and in Rajasthan initially denied any knowledge of local medicinal herbs, roots, etc., before finally admitting they knew of several traditional remedies based on local plants. Existing development strategies have made little attempt to tap or enhance indigenous knowledge and understanding. At the same time, women have been excluded from the institutions through which modern scientific knowledge is created and transmitted. Second, the degradation of natural resources and their appropriation by a minority are destroying the material basis on which indigenous knowledge of natural resources and processes is founded and kept alive, leading to its gradual eclipse. This, in turn, will further undermine the ability of poor households to cope with subsistence crises.

II. REGIONAL VARIATION IN GENDER INEQUALITIES, ENVIRONMENTAL DISADVANTAGE AND POVERTY INCIDENCE

So far we have examined the noted and likely class-gender effects of environmental degradation and natural resource appropriation in general terms. However, as mentioned earlier, these effects vary regionally across India, since there are distinct regional differences in the extent of environmental vulnerability, incidence of poverty, and women's status. This section will examine some of these regional differences in gender, environment, and poverty disadvantages, and shifts in them over the past two decades.

◆ (1) Regional Variations in Gender Inequalities

Although women in relation to men are disadvantaged to some degree in all parts of India, the extent varies, being much greater in northern India, especially the northwest, than elsewhere in the country.[14] This variation is reflected, for instance, in measures such as sex ratio (females per 1000 males), rural labour force participation rates, rural literacy rates, access to inherited property, and rural fertility rates. Regional variations in social practices such as dowry, cross-cousin marriages, and *purdah* (female seclusion) also impinge on the above factors, as elaborated below.

(a) Sex ratio

We note (from table 4 and map 1) that sex ratios (females per 1000 males) are female-adverse in all parts of India, except Kerala. However, they are the most adverse in northwest India (with the exception of Himachal Pradesh) and the

[14] In the discussion below, the terms "northern India" and "north India" are used only when a very broad comparison of the northern and southern (viz. the peninsular) parts of the country is intended, and would roughly include the northwestern, western, central and eastern states, but exclude the northeastern (mainly tribal) states. Typically, however, the six-fold geographic division is used in the discussion.

least adverse in south India. Notably, the lowest values tend to be found in Punjab and Haryana, two of India's most agriculturally prosperous states.

Female-adverse sex ratios embody the effects on female survival of an anti-female bias in intra-household distribution of food and especially of health care. In the absence of a bias we would expect there to be more females than males in the population, that is for the ratios to be over 1000, as they are in most parts of the developed and developing world, with the exception of South Asia, China, West Asia, Iran, and northern Africa (Dreze and Sen, 1989: 52).

Map 1
Sex ratios (1991)

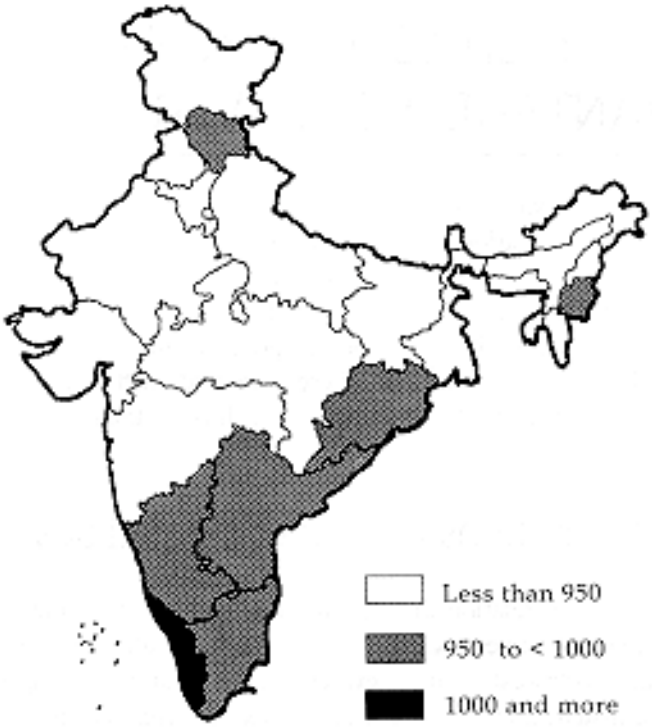


Table 4
Indicators of gender, environment and poverty vulnerability

States	Sex ratio	RFLFPR	RFLR	RTFR	Normal annual rainfall levels (mm)	% forest area	% rural non-poor	Male - Female differences	
								RLFPR	RLR
	1991	1981	1991	1988	1989	1987-89	1987-88	1981	1991
INDIA	929	24.4	25.37*	4.3		19.49	55.12	60.2	22.0
NORTHERN INDIA									
Northwest									
Haryana	874	7.6	27.09	4.5	722.9	1.27	76.83	74.2	24.7
Himachal P.	996	29.2	41.94	3.7	1664.2	24.00	75.25	51.6	19.0
J & K	923	9.2	NA	4.9	1179.1	9.20	66.89	75.0	NA
Punjab	888	2.6	36.86	3.5	768.5	2.32	78.98	79.4	13.7
Rajasthan	913	16.1	9.24	4.8	529.2	3.80	58.11	69.2	28.8
Uttar P.	881	9.4	16.00	5.6	1217.6	11.49	52.30	76.1	25.8
West and Central									
Gujarat	936	20.2	32.78	3.6	834.2	5.90	58.43	65.4	23.4
Madhya P.	932	39.7	15.66	5.1	1195.0	30.03	50.17	49.5	24.9
Maharashtra	935	47.3	33.83	3.9	1190.3	14.32	45.83	38.2	23.9
Eastern									
Bihar	912	15.3	14.63	5.5	1254.3	15.50	33.74	68.5	24.1
Orissa	972	16.7	25.78	3.9	1456.3	30.26	34.36	69.6	23.8
West Bengal	917	10.0	31.39	4.0	2123.8	9.46	42.81	69.1	19.0
SOUTH INDIA									
Andhra P.	973	46.6	20.77	3.4	897.3	17.40	68.44	43.7	19.3
Karnataka	961	33.4	29.05	3.7	1783.6	16.80	57.71	54.1	20.9
Kerala	1040	20.2	74.16	2.0	2718.6	26.11	55.98	44.2	5.8
Tamil Nadu	972	39.8	36.75	2.7	1000.6	13.62	48.70	47.2	21.5
NORTHEAST INDIA									
Arunachal P.	861	67.1	19.68	NA	4334.0	81.80	NA	22.0	18.3
Assam	925	55.4	31.88	3.9	2365.7	33.10	46.92	NA	15.7
Manipur	961	61.2	35.39	NA	2026.3	80.10	79.76	15.2	18.3
Meghalaya	947	60.8	30.14	NA	2365.7	70.98	NA	28.1	4.8
Mizoram	924	60.6	54.01	NA	2026.3	89.47	NA	23.0	8.4
Nagaland	890	72.6	41.87	NA	2026.3	86.12	NA	5.3	11.0
Tripura	946	14.3	36.18	NA	2026.3	50.78	75.78	65.8	18.8

Note: NA information not available

Sources: For sex ratio and rural literacy rates 1991: computed from GOI (1991b). For rural labour force participation rates 1981: computed from GOI (1987). For rural total fertility rates: GOI (1991c), p. 26. For rural poor 1987-88, head count ratio: Minhas et al. (1991), p. 1676. For normal rainfall: GOI (1992), p. 41. For forest area: GOI (1991a), pp. 23, 28.

This anti-female bias in the distribution of basic necessities within the household in large parts of India, but especially in the northwest, is also revealed (as noted earlier) by other indicators such as gender differences in anthropometric indices, morbidity and mortality rates, the quality of medical treatment received during illness, hospital admissions and so on (Agarwal, 1986b). On intra-household distribution of food, the evidence is more mixed: surveys reveal a notable bias in northern India but no clear-cut bias in southern India (see e.g. Harriss, 1990).

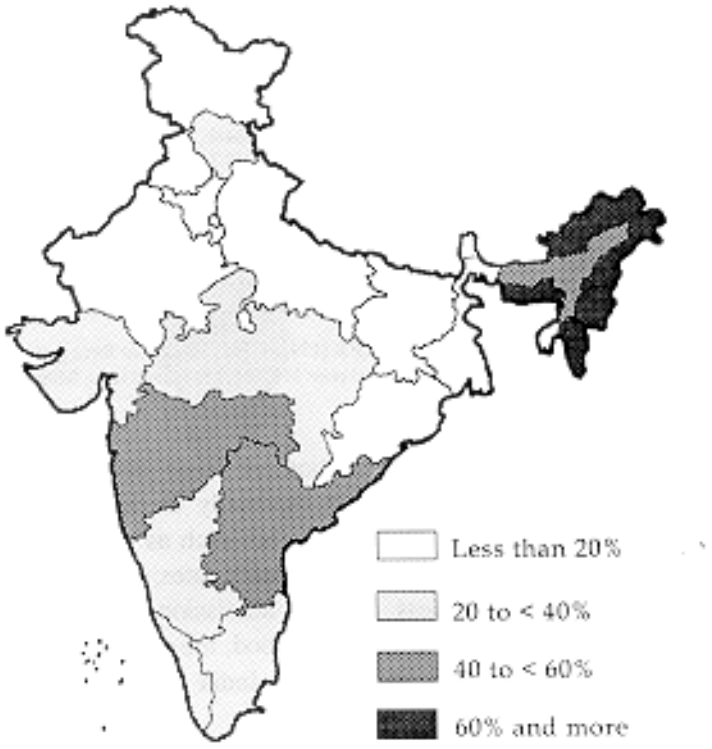
The economic reasons for this regional variation in intra-household gender bias appear to lie in the female child being seen as an economic burden much more in northern India (especially the northwest) than in the south. At least

three factors contribute to this view: (i) the much lower female labour force participation rates in the northwest than in other parts of the country; (ii) the higher female/male marriage costs because of the greater incidence of dowry practices (and amounts of dowry given) in the north relative to the south (see e.g. Miller, 1981; and Agarwal, 1986b); and (iii) the taboo on upper-caste Hindu parents in northern India seeking any kind of material support from married daughters, while parents in south India socially can and have been known to seek such support during drought or other crises.[15] Also conducive to such support-seeking is the prevalence of the system of close-kin (cross-cousin and uncle-niece) marriages in south India (see Agarwal, 1988; 1994).

(b) Rural female labour force participation rate (RFLFPR)

This serves as a proxy for several factors such as: (i) the degree of physical and economic visibility of women's work which affects social perceptions about women's productive contributions to the household and to the economy — the greater the visibility, the greater the likelihood of a woman's needs being better taken into account by the family; (ii) the extent of a woman's familiarity with her physical environment; and (iii) the extent of a woman's physical mobility, which impinges on her ability to undertake a better job search and assert her legal rights, including in family property.

Map 2
Rural female labour force participation rates (1981)



[15] For north India see references in Agarwal (1994). For information on south Indian parents seeking financial help from married daughters during crisis, see Caldwell et al. (1988).

We note from table 4 and map 2 that regionally, northwest and eastern India (which constitute a large part of northern India) are areas of low female labour force participation in work outside the home confines;[16] while south and northeast India are areas of relatively higher participation rates. Within northwest India, the rates for Punjab, Haryana, and Uttar Pradesh are much lower than those for Himachal Pradesh and Rajasthan, but even taking that into account, the overall rates for the northwest are lower than for the south and northeast.

These differences reflect regional differences in a mix of factors, especially: (i) the emphasis on female seclusion (*purdah*), which is high in northern India (and especially in the northwest), but is not practised among Hindus in south or northeast India, and is also less strict among Muslims in these parts; (ii) the incidence of tribal and low-caste populations in a state: women in these communities are less constrained than women of upper-caste households in working outside the home, due especially to the absence of *purdah* among tribal groups (northeast India has a significant tribal population), and the lesser emphasis on it even among low-caste Hindus; and (iii) the prevailing cropping patterns: women's labour input is typically much greater in rice and millet cultivation (the former dominates south and east India) than in wheat cultivation which dominates the northwest.[17]

It is notable that male-female **differentials** in rural labour force participation rates follow a regional pattern very close to that of female labour force participation rates (see table 4). Indeed the correlation coefficient between the two variables is -0.96. The states that fall in the lowest ranges of RFLFPR (below 10 per cent) also have the highest gender differentials in participation rates, and vice versa. This is as one might expect given that rural male labour force participation rates show very little variation across states (the coefficient of variation being 0.07), since men are not subject to the same social constraints to working outside the home or seeking employment as women are in northern India, nor are male labour participation rates subject to the same biases in survey reporting.

(c) Rural female literacy rate (RFLR)

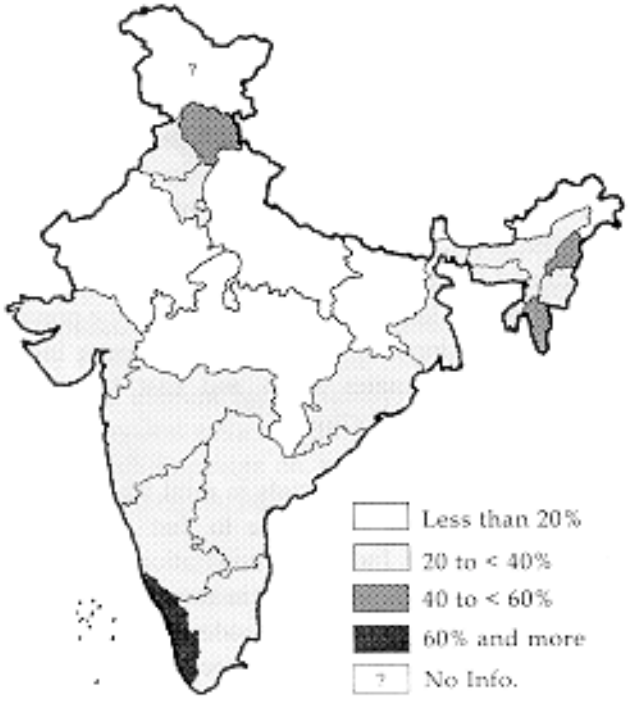
Female illiteracy is taken here as indicative of women's vulnerability to being duped and exploited, and as reducing their ability to function autonomously. Female literacy rates in rural India show dramatic variations across the country

[16] The 1981 figures are used for discussion here since those for 1991 are not yet available. The 1981 census divides the workers into "main" and "marginal", depending on whether or not they have worked for the major part (that is for over 183 days) of the previous year. The figures for main workers have been used (rather than for main plus marginal), since my concern here is with capturing the physical and economic **visibility** of women's work and women's physical mobility: these are better indicated by taking only the "main" workers category. The "marginal" workers would also include many women who are involved in work within the home compound, such as looking after family cattle and poultry. Although undeniably this is important to capture if our purpose were to measure women's economic contribution, the main worker category better captures social perceptions about their contributions, and it is the latter, as noted, which have implications for gender-bias within the home.

[17] The effect of cropping pattern differences may, however, be offset by the other factors mentioned: for instance, in West Bengal although rice cultivation dominates, female labour force participation in field related work is low.

(see table 4 and map 3). They are highest in Kerala, on the higher side in northeast India, but extremely low in several of the northern states, most notably Rajasthan (where the rate is as low as 9.2), Uttar Pradesh, Bihar, and Madhya Pradesh — the states which constitute the "Hindi heartland" of India.

Map 3
Rural female literacy rates (1991)



The high female literacy rate in Kerala is striking and is due to several favourable factors, including the traditional dominance of matrilineal inheritance practices in the state, the importance given to women's education historically both by local rulers and by communities such as the Nayars,[18] missionary educational activity, and, in more recent years, the state-funded expansion of basic education. Himachal Pradesh also stands out, particularly in the context of northwest India, in having relatively high female literacy (indeed second highest in the country after Kerala), just as it does relatively well on its sex ratio (again coming second to Kerala), and RFLFPRs.

Gender **differentials** in rural literacy rates depict a broadly similar regional pattern as rural female literacy rates, in that the regions of low gender differentials in literacy, like the regions of high female literacy, lie mainly in the south and northeast (see table 4). (The correlation coefficient between the two variables is -0.73.) At the same time, regional variations are less for gender differentials than for female literacy rates *per se*.

[18] In 1891, almost half the female literates in Kerala were Nayars (Nayar, 1989: 211). Notably also, in 1817, the young queen of Travancore, Rani Gouri Parvati Bai, placed clear responsibility for promoting education on the State: "The state should defray the entire cost of education of its people in order that there might be no backwardness in the spread of enlightenment among them, that by diffusion of education they might be better subjects and public servants and that the reputation of the state might be advanced thereby" (cited in Sen 1990: 66).

(d) Access to property, especially arable land

Traditionally, in India, both in law and in practice, the pattern of property inheritance in general, and the inheritance of arable land (the most important form of property in rural areas) in particular, was overwhelmingly patrilineal (that is, inheritance was through the male line). The exceptions were a few pockets of matrilineal inheritance (that is, inheritance through the female line) or of bilateral inheritance (that is, inheritance to and through both sons and daughters), among some tribal and Hindu communities located in parts of the northeast (principally Meghalaya) and the southwest (principally Kerala). Historical evidence also suggests that women of affluent households in patrilineal Hindu communities of the south and west occasionally inherited landed property in practice, unlike women in the north. Among patrilineal Muslim communities scattered across India, although women were legally entitled to half their brothers' shares under the Koran, traditional practices (especially in northern India) were often very similar to those of local Hindus, who typically disinherited women from landed property. But again among affluent families, Muslim women occasionally inherited.

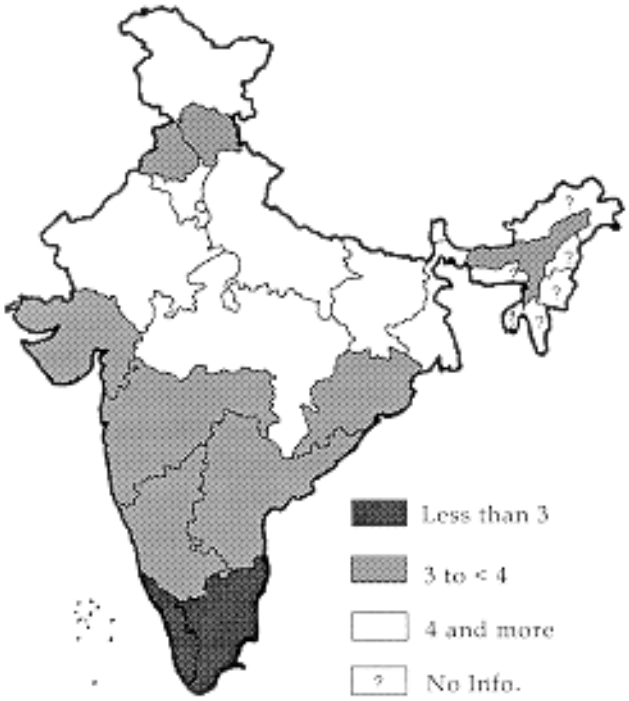
Today women have legal rights to inherit parental land among most communities and regions of India. Although these largely remain rights on paper, there are some notable regional differences which follow the observed historical patterns. In the traditionally matrilineal communities of southwest and northeast India, women of propertied households often do inherit some landed property. Among the traditional patrilineal communities also there is somewhat greater likelihood of women inheriting land in south India than in northern India, due especially to differences in marriage and seclusion practices. For instance, in-village and cross-cousin marriage is permitted in south India. This allows any land inherited by a woman to remain within the overall purview of the extended family, and makes for less resistance and hostility toward her inheritance claims. In northern India, village exogamy (marriage outside the village) and marriage to a stranger is the norm. Distant marriages also make it more difficult for women to assert their property claims, or to manage any land they may inherit, and most forfeit their shares in favour of brothers. The ideology and practice of female seclusion in northern India further compound the difficulties women face in establishing their property claims and in managing land. This is less of a constraint in the southern states.[19]

(e) Rural total fertility rate (RTFR)

These rates again show a distinct regional pattern which reinforces those noted for most of the variables discussed above (see table 4 and map 4). The rates are on top of the scale in the "Hindi heartland" of Bihar, Uttar Pradesh, Madhya Pradesh, and Rajasthan, and at the bottom of the scale in the southern states of Kerala and Tamil Nadu. The four northern states mentioned account for some 40 per cent of the country's population.

[19] For a detailed discussion on these issues, see Agarwal (1994).

Map 4
Rural total fertility rates (1988)



The greater the number of children rural women bear during their reproductive years (that is, the higher the RTFRs) and hence the more time they spend in bearing and rearing children, the less time and energy they will have for income generating work. High rates would also circumscribe the geographic radius of their lives. Although children, when older, could assist in farming, high fertility is likely to be a constraint on women precisely in the periods of their lives when they could be most physically energetic and mobile. Moreover, to the extent that a decline in the rates is a result of women's own decision to have fewer children, this may be seen as an indicator of women's autonomy in decision-making relating to reproductive choices within the household.

In overview then, we find that by most of the noted indicators (relating to 1991 or the late 1980s), women (in relation to men) are much more vulnerable economically and socially in northern India than they are in south or northeast India. And within the northern belt they are especially vulnerable in most of the northwestern states, and in the eastern and central states of Bihar and Madhya Pradesh. Although in comparison with the 1970s rural female literacy has grown and total fertility rates have declined in virtually all parts of rural India, the regional pattern of greater female disadvantage in northern India relative to the rest of the country continues.

In terms of our analysis this means that if all other things were constant, on account of the gender factor alone women in northern India are likely to be affected more adversely than women elsewhere by deteriorating environmental conditions.

◆ (2) Regional Variations in Environmental Disadvantage

A number of indicators could reveal environmental advantage or disadvantage, such as normal rainfall levels, the percentage of geographic area under forests and under village commons, the quality of soils, the groundwater levels and so on. However, given the absence of reliable and comprehensive state-wise data on the latter three variables, the first two (viz. rainfall and area under forests) are discussed here.[20]

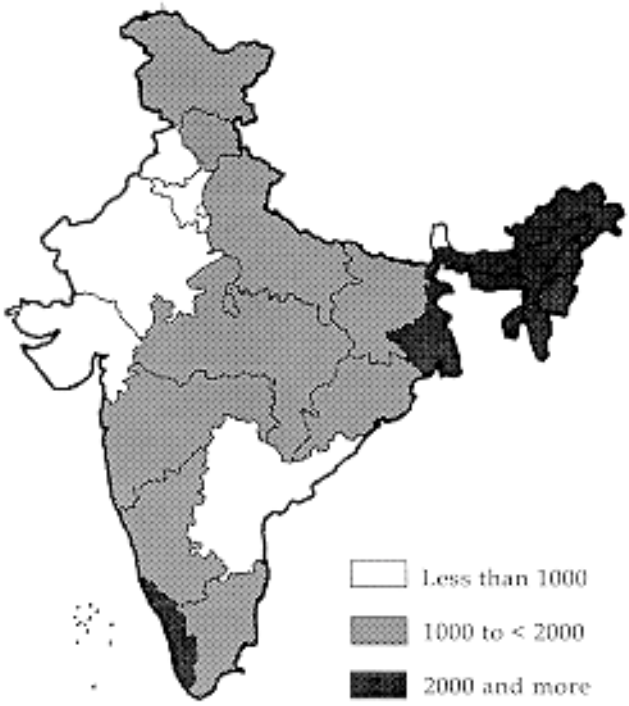
(a) Normal rainfall levels

Rainfall levels serve as an indicator of environmental vulnerability associated with given climatic conditions in different regions of the country. Arid and semi-arid regions, for instance, are more prone to drought conditions than regions of high rainfall. Irrigation technology may mitigate the effect of such vulnerability to some extent, especially in relation to crop production. However, the availability of water for irrigation is not independent of rainfall. Indeed it is complementary to rainfall in many ways: e.g. for replenishing the groundwater table for wells and tubewells, and for replenishing streams, rivers and canals in surface irrigation works. Also, the excessive sinking of tubewells in many semi-arid parts of India (and even elsewhere), as noted earlier, has lowered the water table permanently, and led to the drying up of many ordinary wells. Hence while mitigating climatic disadvantage in the short term, tubewells in a number of regions have increased environmental vulnerability in the long term, especially for those who cannot afford to invest in ever deeper ones. Moreover, rainfall levels affect the availability of biomass in a region, especially biomass in the village commons and forests, which is of particular importance for the livelihoods of poor households with no irrigated land of their own.

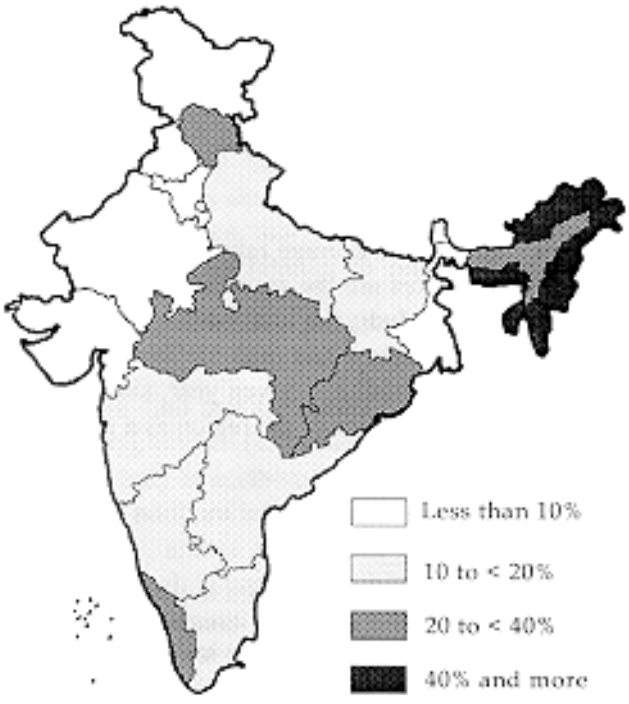
In terms of "normal" rainfall (the average rainfall over a 30-year period), we note that the northeastern states are the most advantaged and large parts of northwest, western and central India the least advantaged, with south and east India falling in between (see table 4 and map 5). "Normal" rainfall has been taken rather than the actual rainfall in a given year, since my interest here is with the overall climatic disadvantage of the region as a general feature, rather than that specific to a particular year.

[20] Although, as discussed earlier, village commons play a very important role in the livelihoods of poor households, especially for women, the data on them are not reliable enough to be used with confidence in a statistical analysis. Jodha's (1986) study, quoted earlier, is based on a survey and only covers some regions in the country. The main method of computing area under VCs for all states of India would be by using the Government of India's "land use statistics". These give information under various headings such as net sown area, current and permanent fallows, culturable wasteland, uncultivable wasteland, and so on. Some of these categories can be grouped together to obtain state-wise assessments of area under VCs (as attempted in Agarwal, 1994). However, these estimates would be rough, and in some cases misleading. For instance, Rajasthan appears to have 40 per cent of its geo-area under VCs (the largest percentage in the country), but this is primarily accounted for by barren land, a significant part of which consists of desert dunes.

Map 5
Normal rainfall levels (1989)



Map 6
Per cent area under forest (1987-1989)



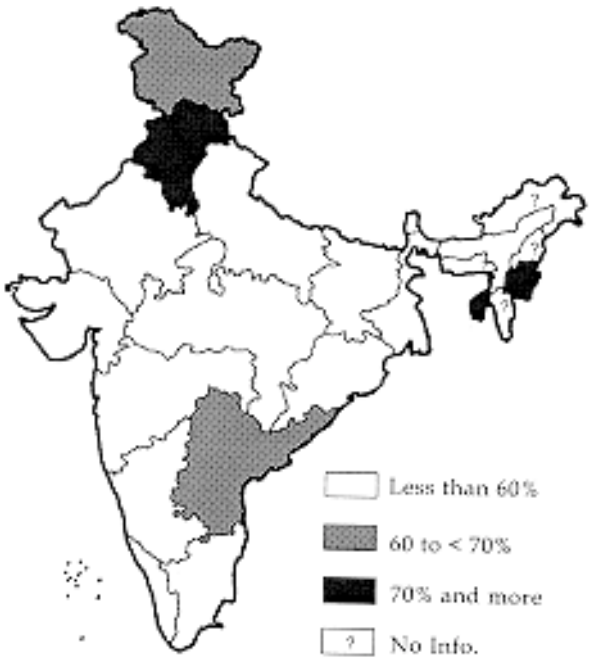
(b) Per cent area under forest

The percentage of geographic area under forest again gives an indication of environmental vulnerability. As noted, forests provide poor households in general, and women in particular, with a variety of basic items for daily use, and deforestation would therefore increase the vulnerability of rural livelihood systems. The northeastern states in general have high to very high levels of forest cover, and northwestern and western India have very low levels, Himachal Pradesh being an exception in the northwest (see table 4 and map 6). The lowest levels are found in Haryana, Punjab, and Rajasthan — a geographic belt which is quite denuded. The remaining states come in between, with Orissa and Madhya Pradesh (in eastern and central India respectively) on the higher side, with about 30 per cent of their area under forest, and most eastern and southern states on the lower side.

◆ (3) Regional Variations in Poverty Incidence

Regional variations are again striking in poverty incidence, measured in terms of the proportion of people in a state who are below the poverty line (taking the head-count ratio), or conversely, as used here, the proportion of non-poor in a state. We note from table 4 and map 7 that the northwestern states have the highest proportion of non-poor in their populations (or the lowest incidence of poverty) while the eastern states have the lowest proportion of non-poor in their populations (or highest incidence of poverty). Southern, central and western India come in between. Poverty estimates are not available for several northeastern states, but where they are the incidence is on the lower side, being closer to the northwestern pattern.

Map 7
Per cent rural non-poor (1987-1988)



The geographic patterns of gender, environment and poverty disadvantage across states indicates that the three "maps" do not necessarily overlap. Indeed some of the areas that are least disadvantaged in terms of poverty are among the most disadvantaged in terms of gender. Women are affected by all three factors: namely by the environmental vulnerability of the state in which they are located, the incidence of poverty in it, as well as the extent of gender bias. They would be best-off if located in regions with low gender bias, a low incidence of poverty, and low environmental disadvantage, and worst off where all three aspects of vulnerability overlap. States like Kerala and Himachal Pradesh do relatively well on all three counts, with low gender bias, medium environmental disadvantage, and medium-to-low poverty incidence. States such as Bihar, however, do badly on all three counts. In broad terms we could thus surmise that although poor rural women everywhere would be affected negatively by environmental degradation, those in Bihar would be among the most adversely affected and those in Kerala and Himachal Pradesh among the less adversely affected.

However, in most states the three elements of vulnerability move in different directions. And it is not possible to say, merely by looking at the absolute figures for each element individually, what the final effects of the three elements coming together would be. For this we now need to examine the GEP indices discussed below, which aggregate the effects of the individual elements.

III. GEP INDICES: MEASURING GENDER-ENVIRONMENT-POVERTY VULNERABILITY CROSS-REGIONALLY AND INTERTEMPORALLY

The aggregations attempted in this section can only capture very broad differences between states, and not the more subtle variations stemming from the qualitative factors discussed above. Also intra-state differences (say between hills and plains), which can be important both environmentally and culturally, are not captured. The results presented here therefore need to be read against the backdrop of the more complex mosaic of gender, environment and poverty vulnerabilities highlighted earlier.

◆ (1) Selection of Indicators

The **gender vulnerability** indices have been computed by using three of the indicators discussed in the previous section: sex ratio, rural female literacy rate, and rural total fertility rate. On literacy I have used the female literacy rates rather than the gender gap in literacy, since what is important is not just women's literacy level relative to men's, but also the overall level of literacy prevailing in the region: this both reflects and affects social attitudes and gender biases on other counts. (In any case, as noted earlier, the female literacy rate and the gender gap in literacy rate are highly negatively correlated.) The lower the sex ratio and rural female literacy rate, and the

higher the rural total fertility rate in a given region, the greater the gender vulnerability in that region.

Environmental vulnerability has been measured here by the level of normal rainfall and the per cent area under forests. The lower the normal rainfall levels in a state and the lower its forest cover, the greater would be its environmental vulnerability.

Poverty vulnerability is measured here by the proportion of people below the poverty line. The higher the proportion of poor, or conversely the lower the proportion of non-poor in a state, the greater its poverty vulnerability.

◆ (2) Computation Method

A formula similar to that used in UNDP's **Human Development Report** to compute the human development index has been used to arrive at the vulnerability indices, GEP(V), first separately for 1971 and 1991, and then in terms of changes over time. Essentially this constitutes an attempt to "gender" and "green" the human development index for different regions of India. The methodology used to compute the indices is given in the appendix note.

The following GEP indices are presented here:

- GEP(V) 1a, 1971: this aggregates the effects of sex ratios, rural female literacy, per cent geo-area under forests, normal rainfall, and per cent rural non-poor in 1971.
- GEP(V) 2a, 1991: this aggregates the effects of sex ratios, rural female literacy, per cent geo-area under forests, normal rainfall, and per cent rural non-poor in 1991.
- GEP(V) 1b and GEP(V) 2b are the same as GEP(V) 1a and GEP(V) 2a respectively, except for the addition of one more indicator, namely rural total fertility rates.

These indices rank states relative to each other for a specified year. To combine a measure of progress over time with interstate comparisons at one point in time, the computation procedure is modified as described in the appendix note. The modified GEP indices so obtained are the following: GEP(VT)1a and GEP(VT)1b, for 1971; and GEP(VT)2a and GEP(VT)2b, for 1991. States are then ranked by the size of the difference between the 1971 values and the 1991 values of the relevant GEP(VT) indices, to assess shifts over time.

In the above measurements, each of the indicators (three for gender vulnerability, two for environmental vulnerability, and one for poverty vulnerability) is assumed to have equal weight in the aggregation. However, another exercise is also attempted by first consolidating the three gender indices into a single index, and the two environment indices also into one index, leaving us with one index each to represent the three aspects of concern: Gender (G), Environment (E),and Poverty (P). The average of these gives us what I term the consolidated GEP(VC) indices for 1971 and 1991 as follows: GEP(VC)1b for 1971, and GEP(VC)2b for 1991. In addition, G(T), E(T), P(T), and GEP(VCT) are the consolidated indices measuring

intertemporal shifts in ranking between states over 1971-1991, computed by a method similar to that followed for GEP(VT).

◆ (3) Results

(a) Extent of gender-environment-poverty vulnerability in 1971 and 1991

From tables 5a and 5b, we note that the indicators chosen take a very wide range of values. For instance, in 1991 (see table 5a), the sex ratio ranged from 861 in Arunachal Pradesh to 1040 in Kerala; the rural female literacy rates varied between 9.2 in Rajasthan to 74.2 in Kerala; total rural fertility rates were as high as 5.6 in Uttar Pradesh compared with 2.0 in Kerala; the percentage of rural non-poor ranged from 79.8 in Manipur and 79.0 in Punjab (which, even in 1971, had one of the lowest levels of poverty in the country) to 33.7 in Bihar; normal rainfall ranged from a low of 529 in Rajasthan to 4334 in Arunachal Pradesh; and the per cent geo-area under forests ranged from 1.3 in Haryana to 89.5 in Mizoram.

Table 5a
GEP(V) indices 1991

States	Sex ratio	RFLR	RTFR	Normal annual rainfall levels (mm)	% forest area	% rural non-poor	GEP (V) 2a index	GEP (V) 2b index
	1991	1991	1988	1989	1987-89	1987-88		
INDIA	929	25.37*	4.30		19.49	55.12	0.68	0.67
Andhra P.	973	20.77	3.40	897.3	17.40	68.44	0.63	0.59
Arunachal P.	861	19.68	NA	4334.0	81.80	NA	0.48	0.48
Assam	925	31.88	3.90	2365.7	33.10	46.92	0.63	0.62
Bihar	912	14.63	5.50	1254.3	15.50	33.74	0.86	0.88
Gujarat	936	32.78	3.60	834.2	5.90	58.43	0.71	0.67
Haryana	874	27.09	4.50	722.9	1.27	76.83	0.73	0.73
Himachal P.	996	41.94	3.70	1664.2	24.00	75.25	0.46	0.46
J & K	923	NA	4.90	1179.1	9.20	66.89	0.67	0.70
Karnataka	961	29.05	3.70	1783.6	16.80	57.71	0.62	0.60
Kerala	1040	74.16	2.00	2718.6	26.11	55.98	0.33	0.28
Madhya P.	932	15.66	5.10	1195.0	30.03	50.17	0.73	0.75
Maharashtra	935	33.83	3.90	1190.3	14.32	45.83	0.72	0.69
Manipur	961	35.39	NA	2026.3	80.10	79.76	0.35	0.35
Meghalaya	947	30.14	NA	2365.7	70.98	NA	0.48	0.48
Mizoram	924	54.01	NA	2026.3	89.47	NA	0.39	0.39
Nagaland	890	41.87	NA	2026.3	86.12	NA	0.49	0.49
Orissa	972	25.78	3.90	1456.3	30.26	34.36	0.71	0.68
Punjab	888	36.86	3.50	768.5	2.32	78.98	0.67	0.63
Rajasthan	913	9.24	4.80	529.2	3.80	58.11	0.83	0.82
Tamil Nadu	972	36.75	2.70	1000.6	13.62	48.70	0.67	0.59
Tripura	946	36.18	NA	2026.3	50.78	75.78	0.45	0.45
Uttar P.	881	16.00	5.60	1217.6	11.49	52.30	0.82	0.85
West Bengal	917	31.39	4.00	2123.8	9.46	42.81	0.73	0.70
Mean							0.616	0.603
S.D.							0.151	0.156

Notes:* does not include J&K where the census was not held. GEP(V) 2a: average for indices relating to % forest area, sex ratio, RFLR, rural non-poor, normal rainfall. GEP(V) 2b: average for indices relating to % forest area, sex ratio, RFLR, rural non-poor, normal rainfall, RTFR.

Sources: For sex ratio and RFLR 1991: computed from GOI (1991b). For rural poor 1987-88, head count ratio: Minhas et al. (1991), p. 1676. For normal rainfall: GOI (1992), p. 41. For forest area: GOI (1991a), pp. 23, 28. For RTFR: GOI (1991c), p. 26.

The situation in 1971 was not markedly different (see table 5b) either in terms of the high regional variation in the values taken by the indicators, or in terms of the states falling at the two ends of the ranges. For instance, in 1971, as in 1991, Kerala had the highest sex ratio and female literacy rate, and among the lowest rural total fertility rates. Similarly, Arunachal Pradesh had the lowest sex ratio, Rajasthan among the lowest female literacy rates, and Uttar Pradesh the highest total fertility rate. A substantial reduction in poverty in Manipur is, however, noteworthy: in 1971 it ranked amongst the lowest in the per cent rural non-poor in the population, while in 1991 the state ranked slightly higher than even Punjab on this count.

Table 5b
GEP(V) indices 1971

States	Sex ratio	RFLR	RTFR	Normal annual rainfall levels (mm)	% area under forests	% rural non-poor	GEP(V) 1a index	GEP(V) 1b index
	1971	1971	1972	1973	1972-75	1970-71		
INDIA	930	13.17	5.80		16.89	42.67	0.68	0.64
Andhra P.	977	10.92	4.77	863.2	17.70	48.43	0.65	0.57
Arunachal P.	861	3.00	7.00	4323.0	61.50	NA	0.52	0.59
Assam	896	16.51	5.68	2417.8	26.87	49.64	0.62	0.59
Bihar	954	6.39	5.07	1308.2	13.05	31.21	0.76	0.67
Gujarat	934	17.19	6.42	893.4	4.85	42.24	0.74	0.73
Haryana	867	9.24	7.39	816.2	1.81	59.98	0.80	0.83
Himachal P.	958	18.15	5.32	1708.2	27.12	71.27	0.48	0.45
J & K	878	4.98	5.06	1098.7	10.03	72.33	0.72	0.64
Karnataka	957	14.54	4.64	1636.6	15.38	47.18	0.63	0.55
Kerala	1016	53.10	4.58	2674.7	22.12	30.97	0.39	0.34
Madhya P.	941	6.10	7.16	1233.4	24.52	37.60	0.72	0.75
Maharashtra	930	17.84	5.06	1189.8	13.22	44.25	0.70	0.62
Manipur	980	16.35	4.47	1950.8	67.53	27.13	0.50	0.32
Meghalaya	942	18.94	4.74	2417.8	64.03	NA	0.43	0.37
Mizoram	946	NA	NA	1950.8	65.91	NA	0.37	0.37
Nagaland	871	16.39	NA	1950.8	49.61	NA	0.64	0.64
Orissa	988	12.06	4.88	1543.9	31.07	25.39	0.65	0.57
Punjab	865	19.88	5.92	640.2	2.18	71.35	0.72	0.69
Rajasthan	911	4.03	6.98	531.0	3.30	45.26	0.84	0.84
Tamil Nadu	978	18.98	4.76	952.7	12.84	33.55	0.69	0.60
Tripura	943	17.27	4.29	1950.8	60.11	45.46	0.46	0.41
Uttar P.	879	6.99	7.45	1312.7	8.80	48.64	0.80	0.83
West Bengal	891	15.02	NA	2151.4	9.45	23.33	0.80	0.80
Mean							0.636	0.599
S.D.							0.138	0.158

Notes: For RTFR, the sample size is small for Meghalaya, Manipur, Tripura. GEP(V)1a: average for indices relating to % forest area, sex ratio, RFLR, rural non-poor, normal rainfall. GEP(V)1b: average for indices relating to % forest area, sex ratio, RFLR, rural non-poor, normal rainfall, RTFR.

Sources: For sex ratio: GOI (1981), p. 30. For RFLR: GOI (1974), pp. xxiv. For rural poor 1970-1971, head count ratio: Minhas et al. (1991), p. 1676. For normal rainfall: GOI (1976), p.38. For forest area: national remote sensing agency data, table reproduced in CSE (1986): p. 80. For RTFR: GOI (1981), p. 68.

From table 5c, map 8, and appendix table 1, which give the results of the GEP(V) indices, we note the following:

- (i) In both 1971 and 1991, by all the GEP indices, the high vulnerability end of the range contains mainly the northern states of the country (covering northwest, west, east and central India), and the low vulnerability end contains Kerala, Himachal Pradesh, and many of the northeastern states. By three of the indices, the states that fall in the highest vulnerability

end include the following five: Bihar, Haryana, Madhya Pradesh, Rajasthan and Uttar Pradesh. And by all four indices the least vulnerable states include the following six: Himachal Pradesh, Kerala, Manipur, Meghalaya, Mizoram and Tripura. (Map 8, which presents the results of GEP(V)2b, also clearly brings this out.)

- (ii) The high rank correlations for comparable indices for 1971 and 1991 (see appendix table 1), indicate that the ranking between states has not changed substantially over the two decades. In other words, the least vulnerable states and the most vulnerable states were broadly the same in 1971 and 1991.

Map 8
GEP(V) 2b index (1991)

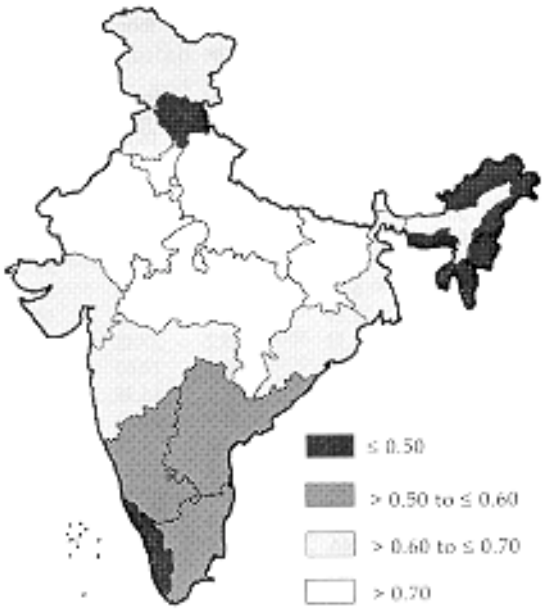


Table 5c
States falling in different ranges of GEP(V) indices in 1971 and 1991

Range	GEP(V) 1a:1971	GEP(V) 2a: 1991	GEP(V) 1b: 1971	GEP(V) 2b:1991
≤ 0.50	Himachal P., Kerala, Manipur, Meghalaya, Mizoram, Tripura	Arunachal P., Himachal P., Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Tripura	Himachal P., Kerala, Manipur, Meghalaya, Mizoram, Tripura	Arunachal P., Himachal P., Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Tripura
> 0.50 - ≤ 0.60	Arunachal P.		Andhra P., Arunachal P., Assam, Karnataka, Orissa, Tamil Nadu	Andhra P., Karnataka, Tamil Nadu
> 0.60 - ≤ 0.70	Andhra P., Assam, Karnataka, Maharashtra, Nagaland, Orissa, Tamil Nadu	Andhra P., Assam, J & K, Karnataka, Punjab, Tamil Nadu	Bihar, J & K, Maharashtra, Nagaland, Punjab	Assam, Gujarat, J & K, Maharashtra, Orissa, Punjab, West Bengal
> 0.70	Bihar, Gujarat, Haryana, J & K, Madhya P., Punjab, Rajasthan, Uttar P., West Bengal	Bihar, Gujarat, Haryana, Madhya P. Maharashtra, Orissa, Rajasthan, Uttar P., West Bengal	Gujarat, Haryana, Madhya P., Rajasthan, Uttar P., West Bengal	Bihar, Haryana, Madhya P., Rajasthan, Uttar P.

Source: Tables 5a and 5b

(b) Intertemporal shifts in indices

Table 6 and appendix table 2 give an idea of the extent to which GEP vulnerability has declined over 1971-1991 and which states have made most progress on this count. Two types of changes are captured here: (a) an improvement or worsening of a state's degree of GEP vulnerability in 1991 relative to 1971, and (b) a shift in its rank in relation to other states.

Table 6
Intertemporal shifts over 1971-1991:
States falling in different ranges of GEP(VT) indices

Range of difference (1971-91)	GEP(VT) (1a-2a)*	GEP(VT) (1b-2b)**
≤ 0.05	Bihar, Orissa, Uttar P.	Bihar, Meghalaya
> 0.05 - ≤ 0.10	Assam, Andhra P., Gujarat, J & K, Karnataka, Madhya P. Maharashtra, Meghalaya, Mizoram, Rajasthan, Tamil Nadu	J & K, Karnataka, Maharashtra, Mizoram, Orissa, Uttar P.
> 0.10 - ≤ 0.15	Arunachal P., Haryana, Himachal P., Punjab, Tripura, West Bengal	Andhra P., Assam, Himachal P., Madhya P., Rajasthan, Tamil Nadu, Tripura
> 0.15 - ≤ 0.20	Kerala	Arunachal P., Gujarat, Haryana, Punjab, West Bengal
> 0.20	Manipur, Nagaland	Kerala, Manipur, Nagaland

Notes: * difference between GEP(VT) 1a and GEP(VT) 2a. ** difference between GEP(VT) 1b and GEP(VT) 2b.
Source: appendix table 2.

We note from the tables that the intertemporal difference is greatest for Manipur, Nagaland and Kerala, all three of which show notable reductions in their GEP vulnerability. In contrast, Bihar has retrogressed slightly, and a number of other states, including Uttar Pradesh, Orissa, and Meghalaya have made very little progress. In between come states such as Gujarat, Haryana, Punjab, West Bengal and Arunachal Pradesh, which have made a fair degree of progress, and the remaining states which have made marginal progress.

(c) The consolidated indices

Tables 7a, 7b, map 9, and appendix tables 3 and 4 give the results for the consolidated indices. We note from table 7a and map 9 that, with the consolidated indices also, the states falling in the more vulnerable part of the range are the northern ones, and those falling in the less vulnerable part of the range are Kerala, Himachal Pradesh and many of the northeastern states.

Moreover, from table 7b (which enables a comparison between G, E and P indices for 1991) it is also interesting to note the following:

- (i) There are several states which do especially poorly on gender (that is, fall in the high vulnerability part of the spectrum on the gender index) but fall in the low vulnerability part of the spectrum on the poverty index: these include Haryana, Punjab, and Rajasthan.

- (ii) All the states, other than the northeastern ones and Kerala, fall in the high vulnerability part of the range in terms of the environment index.
- (iii) Some states, such as Bihar, perform persistently poorly on all three counts (as also noted from other results discussed).

Table 7a
States falling in different ranges of GEP(VC) consolidated indices, 1971 and 1991

Range	GEP(VC) 1b: 1971	GEP(VC) 2b:1991
≤ 0.50	Arunachal P., Himachal P., Kerala, Meghalaya, Mizoram, Tripura	Arunachal P., Himachal P., Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Tripura
> 0.50 - ≤ 0.60	Andhra P., Assam, J & K, Karnataka, Manipur, Punjab	Andhra P., Karnataka, Punjab
> 0.60 - ≤ 0.70	Maharashtra, Nagaland, Orissa, Tamil Nadu	Assam, Gujarat, Haryana, J & K, Tamil Nadu
> 0.70	Bihar, Gujarat, Haryana, Madhya P., Rajasthan, Uttar P., West Bengal	Bihar, Madhya P., Maharashtra, Orissa, Rajasthan, Uttar P., West Bengal

Source: appendix table 3

Table 7b
States falling in different ranges of G, E, P and GEP(VC) consolidated indices, 1991

Range	G: 1991 index	E: 1991 index	P: 1991 index	GEP(VC) 2b: 1991 index
≤ 0.50	Himachal P., Kerala, Mizoram, Tamil Nadu	Arunachal P., Manipur, Meghalaya, Mizoram, Nagaland	Andhra P., Gujarat, Haryana, Himachal P., J & K, Karnataka, Manipur, Punjab, Rajasthan, Tripura	Arunachal P., Himachal P., Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Tripura
> 0.50 - ≤ 0.60	Andhra P., Gujarat, Karnataka, Maharashtra, Manipur, Meghalaya, Orissa, Tripura	Assam, Kerala, Tripura	Kerala, Uttar P.	Andhra P., Karnataka, Punjab
> 0.60 - ≤ 0.70	Arunachal P., Assam, Nagaland, Punjab, West Bengal		Madhya P., Tamil Nadu	Assam, Gujarat, Haryana, J & K, Tamil Nadu
> 0.70	Bihar, Haryana, J & K, Madhya P., Rajasthan, Uttar P.	Andhra P., Bihar, Gujarat, Haryana, Himachal P., J & K, Karnataka, Madhya P., Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar P., West Bengal	Assam, Bihar, Maharashtra, Orissa, West Bengal	Bihar, Madhya P., Maharashtra, Orissa, Rajasthan, Uttar P., West Bengal

Source: appendix table 3

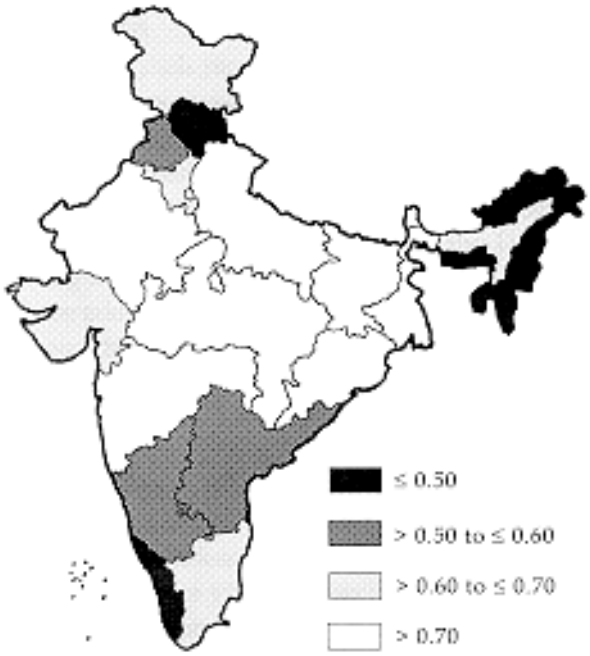
Finally, table 7c and appendix table 4 give an idea of how different states have progressed in terms of reducing their vulnerability over time, taking G(T), E(T), P(T) separately, as well as GEP(VCT). We observe the following:

- (i) Although a number of states have reduced their gender and poverty vulnerability, few have reduced their environmental vulnerability; indeed, in some states, it has increased.
- (ii) Some states, such as Kerala, had a low gender vulnerability even in 1971 and reduced it substantially further by 1991. Other states, such as Punjab and West Bengal, were highly gender vulnerable in 1971 and

became less so in 1991, but despite the improvement they still continue to be in the relatively high vulnerability range on this count.

- (iii) In terms of intertemporal shifts in the GEP(VCT) index, the states that have made the most progress in reducing overall GEP vulnerability are Manipur, Kerala, and Arunachal Pradesh, and those that have made least progress are Bihar, Meghalaya, and Jammu and Kashmir (J & K). In the case of Meghalaya, however, given its initial low GEP vulnerability, the lack of progress is not as much a matter of concern as in the case of Bihar and J & K which started out with high GEP vulnerabilities in 1971.

Map 9
GEP(VC) 2b index (1991)



On the whole, the results indicate that gender, environment and poverty vulnerabilities overlap in some regions and not in others. In Bihar, for instance, the three elements overlap: the state has high gender bias, high environmental vulnerability, and a high incidence of poverty. Madhya Pradesh and West Bengal follow close behind. By contrast, the southern states (especially Kerala) and much of northeast India are relatively favourable for women in terms of lower gender bias, lesser depletion of the natural resource base, favourable rainfall levels, and poverty levels which are medium (that is they are not as high as in the eastern states, even though much higher than in the northwestern ones).

In between are states which perform poorly on one or two counts but not on all three counts. The most notable are the northwestern ones of Punjab and Haryana. They are among the most advanced in terms of agricultural prosperity and have a relatively low incidence of poverty, but perform poorly on gender equality. Clearly low incidence of poverty and overall prosperity can go hand in hand with a high degree of anti-female bias. And although the position of women has improved over time in both states by some indicators,

such as a rise in female literacy and a fall in total fertility rates, in overall terms northwest India continues to be a region of high gender vulnerability relative to other parts of the country. This is also a region of environmental vulnerability in that, in most northwestern states, there is virtually no area left under forest and little under village commons.

In terms of all three elements (gender, environment and poverty) taken together, the states that are most vulnerable today are all located in northern India, while the states that are relatively least vulnerable are all located in the south and northeast.

Table 7c
Intertemporal shifts in consolidated indices over 1971-1991:
States falling in different ranges of G(T), E(T), P(T) and GEP(VCT)

Range of difference (1971-91)	G(T) index	E(T) index	P(T) index	GEP(VCT) index (1b-2b)
≤ 0.05	Bihar, Manipur, Meghalaya	Andhra P., Assam, Bihar, Gujarat, Haryana, Himachal P., J & K, Karnataka, Kerala, Madhya P., Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar P., West Bengal	Assam, Bihar, Maharashtra, J & K	Bihar, J & K, Meghalaya
> 0.05 - ≤ 0.10	Mizoram, Orissa, Tripura	Manipur	Himachal P., Uttar P.	Assam, Maharashtra, Orissa, Uttar P.
> 0.10 - ≤ 0.15	Andhra P., Karnataka	Arunachal P., Mizoram	Punjab	Himachal P., Karnataka, Madhya P., Mizoram, Punjab, Rajasthan
> 0.15 - ≤ 0.20	Madhya P., Maharashtra, Rajasthan, Tamil Nadu, Uttar P.		Karnataka, Orissa	Andhra P., Gujarat, Haryana, Tamil Nadu, Tripura
> 0.20 - ≤ 0.25	Assam, Gujarat, J & K, Nagaland	Nagaland	Madhya P., Rajasthan	Nagaland, West Bengal
> 0.25	Arunachal P. Haryana, Himachal P., Kerala, Punjab, West Bengal		Andhra P., Gujarat, Haryana, Kerala, Manipur, Tamil Nadu, Tripura, West Bengal	Arunachal P., Kerala, Manipur

Source: appendix table 4

IV. RESPONSES

The noted negative effects of gender inequality and environmental degradation, however, have not gone unchallenged by those affected. The last two decades have seen the emergence both of women's groups and of environmental groups, the former protesting the gender bias in existing patterns of development, the latter their high environmental costs. In some cases gender and environmental challenges have overlapped. Certainly women have been significant actors in major environmental movements (as elaborated further on).

These movements embody an increasing resistance to ecological destruction in India, whether caused by the direct logging of trees, or by the submersion of forest and village land with large irrigation and hydroelectric works. Non-violent movements such as Chipko in the Himalayas and Appiko in Karnataka are among examples of forest-related environmental resistance. Movements resisting large dams include those associated with the Narmada valley project in central India, the Koel-Karo in Bihar, the Silent Valley Project in Kerala (which was shelved due to local protests and central government intervention in 1983), the Inchampalli and Bhopalpatnam dams in Andhra Pradesh (against which 5000 tribals, with women in the vanguard, protested in 1984), and the controversial Tehri Dam in Garhwal.

Women's participation in such movements has some notable features. The Chipko movement is the most illustrative. Chipko women have protested against the commercial exploitation of the Himalayan forests not only jointly with the men of their community, but on occasion even in opposition to the village men, due to different priorities in resource use. On one occasion, women successfully resisted the axing of a tract of the Dongri-Paintoli oak forest for establishing a potato seed farm which the men supported. Cutting the forest would have added five miles to women's fuelwood journeys, while the cash earned from the project would have stayed mainly in the men's hands. Also in tree planting schemes, Chipko women have typically favoured trees which provide fuel and fodder, rather than the commercially profitable varieties often favoured by men.[21] In some Chipko areas women have formed vigilance teams against illegal felling, and are monitoring the use of the local forest by the village community. They have also protested against male alcoholism and domestic violence; and in some villages women are demanding representation in the village councils. Although the movement is rooted in the region's Gandhian tradition which predates Chipko, women's responses go beyond the framework of that tradition in their affirmation of gender concerns.[22]

Similarly, in some parts of the Uttar Pradesh hills, village women have begun to play an active role in the management of village forests through *Mahila Mandal Dals* (women's groups). They have devised rules for the collection of forest produce, and either guard the forest themselves, or employ a guard (Sharma and Sinha, 1993; and personal observation in 1993). Elsewhere too, as noted, women have been active in demonstrations against deforestation, large dams and mining activities.

At the same time, women's involvement in such movements, including Chipko, needs to be contextualized. These movements have emerged primarily in hill or tribal communities among which women's roles in agricultural production has always been visibly substantial and often primary — a context more conducive to their public participation than found in communities practising female seclusion.

[21] This gender divergence in choice of trees in tree-planting schemes was also noted in Rajasthan by Brara (1989).
[22] See Agarwal (1991) for a more detailed discussion of this.

In other words, it is difficult to support the argument (made by some[23]) that women, *qua* women, are closer to nature or more conservationist than men. Rather, poor peasant and tribal women's responses to environmental degradation can be located in their everyday material reality — in their dependence on natural resources for survival, and the knowledge of nature gained in that process. By extension, women who are no longer dependent on or in contact with the natural environment in the same way would be neither so affected nor so knowledgeable about species varieties. And their reactions would differ accordingly.

The government's response to these grassroots movements, and more generally the recognition that environmental degradation may be acquiring crisis proportions in some regions, dates back less than a decade and a half. And the approach to finding solutions has been piecemeal rather than comprehensive. For instance, the problems of deforestation and fuelwood shortage were initially addressed mainly through tree planting schemes, some undertaken under direct government management, others promoted by encouraging village communities and individual farmers to plant. However, many of the government's direct planting ventures had poor tree survival rates and typically did little to alleviate the local fuel/fodder problem.[24] There was, for instance, a preoccupation with monocultural plantations of tree species for commercial use, which at times even replaced mixed forests, and which provided no fodder and poor fuel (such as eucalyptus). Also the take-over of village land used by the local population for various other purposes — including holding fairs — the top-down implementation, and the failure to elicit the approval and support of the villagers when the schemes were initiated, led to widespread local hostility and resistance. And, far from benefiting the poor, these schemes took away even their existing rights to local resources. Also, women typically did not feature at all in such schemes, or at best tended to be allotted the role of caretakers in tree nurseries, with little say in the choice of species or in any other aspect of the project (Agarwal, 1986a).

Community forestry schemes also had a high failure rate in the 1980s, in the absence of effective institutional mechanisms to ensure village participation in decision-making and the equitable distribution of costs and benefits.

The real "success" stories of the 1980s, with plantings far exceeding targets, came from the better-off farmers who, in many regions, sought to reap quick profits by allotting fertile crop land to commercial tree species, eucalyptus again being a great favourite. As a result, employment, crop output, and crop residues (that could be used for fuel) declined, often dramatically (Chandrashekar et al., 1987; Agarwal, 1986a).

Over the years, however, environmental movements, and reporting on the state of the country's environment by journalists, grassroots activists and academics, have had a noticeable impact on developmental thinking in India, and improved environmental awareness in policy formulation. Resistance to the destruction of nature and nature-dependent livelihoods, the demand for

[23] See e.g. Shiva (1988), and also the Western literature on ecofeminism discussed in Agarwal (1992). The latter provides a critique of the ecofeminist approach and outlines an alternative formulation, termed "feminist environmentalism".

[24] For a detailed discussion on these schemes and their shortcomings, see Agarwal (1986a).

environmentally sustainable policies and egalitarian access to natural resources, the lack of success with top-down schemes, and so on, have also led to a shift toward a more participative approach in scheme implementation. And international agencies too now routinely build an assessment of the environmental and social impact of projects into their feasibility reports.

In concrete terms, the effect of all this can be seen in some recent government programmes and initiatives. To begin with, in direct tree planting in and around villages, the species selected in many cases have augmented fuelwood availability. In parts of Rajasthan, for instance, the planting of *prosipus juliflora*, which grows rapidly and whose thorns protect it from animals, has largely solved the problem of fuelwood.[25] But of more far-reaching effect are recent attempts to involve local communities in natural resource protection, regeneration and monitoring, including leasing out degraded forest land to villagers under various **joint forest management** schemes. How well these schemes will work in different socio-economic contexts remains to be seen, but they hold more promise than did most previous ones of some significant benefits reaching the villagers.[26] Similar initiatives taken independently by tribal village communities or catalysed by non-governmental organizations (NGOs) in some states of India hold the same promise.

However, the issues of women's participation in the decision-making forums of these schemes and initiatives, and of ensuring equitable sharing of benefits by gender, have as yet received only marginal attention (Sarin, 1994; personal observation in Gujarat).

V. IN CONCLUSION

The experience of the past two decades offers several insights and lessons on the links between gender, poverty, and environmental change in rural India.

The processes of environmental degradation and appropriation of natural resources by the State, and by a minority of individuals, have specific class-gender implications: it is women and female children of poor rural households who are affected most adversely. These effects take various forms (although there are regional variations in their extent): an increase in women's and female children's time and energy spent in fuel, fodder, and water collection; a decrease in women's incomes from NTFP collection and agricultural production; an adverse effect on the health and nutrition of household members in general, and female members in particular; an erosion of social support networks built by women to tide the household over economic crises; and a marginalization and decline in peasant women's traditional knowledge of plants and species. In other words, the adverse class-gender effects of these processes are manifest in the erosion of both livelihood systems and knowledge systems on which poor rural women, in particular, depend.

[25] Personal observation in Ajmer district in 1993.
[26] See various discussion papers brought out over the past two to three years by the Society for the Promotion of Wastelands Development, New Delhi.

The gender specificity of the above effects arise from pre-existing gender inequalities, especially in: (a) the division of labour; (b) the intra-household distribution of subsistence resources; (c) access to productive resources, other assets and income-earning opportunities; and (d) access to decision-making authority in public bodies at all levels.

However, the noted effects are not experienced uniformly across all regions of India, since there are geographic differences in gender bias, environmental risk, and poverty incidence. Rural women are likely to be worst off in regions where all three forms of disadvantage are strong and reinforce each other, and best off where all three are weak.

If we were to concentrate on the areas where poor rural women are likely to be affected most adversely by further environmental degradation, then the state needing the highest priority is Bihar, followed by several others in northern India, namely Uttar Pradesh, Rajasthan, West Bengal, Orissa, and Madhya Pradesh. These warrant special attention in terms of wasteland and forest development schemes focused on poor rural women which could give the women greater control over common property resources; programmes for increasing female literacy; health and other support services which would help women make informed decisions concerning their fertility; and general support structures (possibly through NGOs) for improving women's effective property rights in the region. (On this last count, as noted earlier, the adverse effects on women of the statization and privatization of communal resources are closely linked not only to the gender division of labour, but also to private property differentials between women and men.)

Insofar as the major success stories of reforestation today relate to communities taking charge of their local natural resource base, a viable solution will need decentralized planning and control, and institutional arrangements that ensure the involvement of the rural poor, and especially women, in decisions about what trees are planted, who holds control over the land on which the planting is done, and how the associated benefits are shared.

Poor rural women's active participation in forest protection and wasteland development schemes is imperative for several reasons. First, resources in women's hands are more likely to be used for the family's well-being than resources in men's hands, given the noted evidence that in poor rural households where both spouses are employed, women tend to spend almost all their earnings on the family's basic needs, and men often a significant part on their personal needs.

Second, without women's co-operation, either rules instituted for protecting communal lands and forests will not work, given women's primary responsibility for fuel and fodder collection, or women may be left worse off than before. It is significant that in some recent joint forest management initiatives, a ban on firewood collection from the local forests, imposed by the all-male village forest management committees without consulting the women, has made it necessary for women to walk several additional miles for this basic household need (Sarin, 1994). Involving women in the decision-making process could have ensured a fairer solution. In the long term, of course, the

challenge lies in ensuring that rural men also share equally in this and other household tasks.

Third, in schemes involving tree planting, women and men are often noted to have different priorities in species selection. Women typically prefer species which fulfil everyday household needs, such as for fuel and fodder, over species which fulfil only sporadic needs, such as for small timber, or which mainly bring occasional cash returns. Involving women in species selection is therefore critical. In particular, trees which provide fuel and fodder (in regions where these have become scarce) can not only decrease poor women's work burden, but the advantage of greater availability can be reaped by all household members. Moreover, girl children who may otherwise be kept back from school for collection purposes can then go to school.

Fourth, improving women's access to communal land resources would help redress, in some small degree, existing severe gender inequalities in access to private land resources. Also, as noted, the privatization of communal resources over the past several decades has affected poor rural women the most adversely, given the noted widespread class and male bias in the privatization process. Initiatives which protect the communal character of village commons, or which create new collective forms of resource control in women's hands, therefore appear vital.

Fifth, involving women could encourage the enhanced use and development of local knowledge about plants and species.

The past two decades of India's experience with development projects that seek to reach the poor and disadvantaged also indicates that schemes which follow a group approach are more likely to be effective than those which follow an individual-oriented approach. This is borne out, too, in the range of recent initiatives by NGOs, state governments and village communities to regenerate forests and village wastelands. Among success stories of NGO initiatives involving women in wasteland development which provide pointers on this count is the Bankura wasteland development project in West Bengal. Initiated in 1980, it had by 1988 spread to 36 villages involving about 1500 (mostly poor tribal) women as members of groups which collectively planted trees for sericulture on wasteland donated by the villagers (Singh, 1988). Many of these plantations are today yielding a fair profit (personal visit in 1993). The above-mentioned cases of forest management by village communities, under a variety of institutional arrangements, in some of which women are playing a significant role (including through *Mahila Mandal Dals*) also point to the importance of a group approach.

Indeed, environment, poverty and gender concerns taken together highlight both the need for re-examining, and the possibility of finding new resolutions for, many long-standing issues relating to development, redistribution and institutional change.

APPENDIX NOTE
GEP INDICES: COMPUTATION METHOD AND DATA SOURCES

◆ Computation method[27]

The individual indices of vulnerability (one for each indicator) by states have been computed as follows, for all indicators other than the rural total fertility rate (RTFR):

$$Z_{ij} = \frac{[\max_j X_{ij} - X_{ij}]}{[\max_j X_{ij} - \min_j X_{ij}]}$$

where X_{ij} denotes the actual value of an indicator (i = 1,...n); max X_{ij} denotes the maximum value of the indicator attained by any state (j = 1,...k) in the sample, and min X_{ij} denotes the minimum value attained.

For the RTFR the individual index has been computed as: 1 - Z_{ij}, since for this variable the higher the value the greater the vulnerability, while for the other variables the higher the value the lower the vulnerability.

The average of the individual indices gives us the GEP indices, expressed algebraically as follows:

$GEP(V) = 1/n \Sigma Z_{ij}$
where n is the number of indicators used.

These indices rank states relative to each other for a specified year; and the maximum and minimum values that define the distance to be travelled by each indicator are specific to that year. Over time, the actual values of the indicators chosen change, as do their maximum and minimum values across all the states. To combine a measure of progress over time with interstate comparisons at one point in time, the calculation procedure is modified as follows. The maximum and minimum values are defined here not for each point of time but over a period of time. Thus to measure reduction in vulnerability between 1971 and 1991, the minimum would be the minimum of all values of a given indicator (say sex ratio) for all states over the 20 years. Similarly for the maximum. The distance to be travelled by each indicator is thus stretched out over the 20 year period. This helps us to make comparisons over time as well as across regions. The GEP values are obtained by taking the average of the individual indices for each indicator as before. The difference between the GEP values for 1971 and 1991 obtained in this way gives the extent to which

[27] Also see "Technical Notes" in UNDP, 1992: 91-96.

that state has moved over time in relation to itself and in relation to other states.

◆ Data Sources

Information relating to each of the above indicators was obtained for years that fall as close as possible to 1971 and 1991. Sex ratios and rural female literacy rates are computed from the censuses in the respective years. Rural total fertility rates are again obtained from the census. Estimates of poverty incidence are taken from Minhas et al. (1991) who derive them from national sample survey data on consumption. Estimates for poverty are often controversial and vary widely depending on the underlying assumptions and the deflators used. My choice of source was dictated especially by two considerations: (a) the availability of figures for both 1970-1971 and a year close to 1991, namely 1987-1988; and (b) the availability of estimates for a larger number of states (including some in the northeast), than provided by most other sources. Figures for normal rainfall are those published by the meteorological survey of India. The information relating to forests, however, warrants some comment.

It is now well-established that the estimates of area under forests provided in the government's "land use statistics" are grossly inaccurate since they reflect forest area in administrative terms, rather than actual forest cover. It is the latter that is of interest to us in measuring environmental vulnerability. The figures used here for 1972-1975 are those obtained through the national remote sensing agency (NRSA). The figures for 1987-1989 are those assessed by the forest survey of India (FSI) on the basis of NRSA information. The FSI has argued that NRSA figures may somewhat underestimate actual forest cover, especially for the northeastern states (due, among other things, to cloud cover when the survey was done). From 1980 onwards, therefore, the FSI have provided assessments that seek to compensate for this underestimation. However for 1972-1975 I understand such a modification exercise was not undertaken by the FSI. This means that the rise in forest cover between 1972-1975 and 1988-1989, which is especially noticeable in the northeastern states, may in some part represent actual increases (due to, say, a decline in area under shifting cultivation and an associated increase in land with open forests in the northeast); and in part it would represent an improvement in the accuracy of the estimates. However, given the absence of other figures I have used the NRSA 1972-1975 estimates. For ranking states in terms of environmental vulnerability in 1972-1975 this does not present a problem. A problem could arise in comparisons over time between 1972-1975 and 1988-1989, in that some of the noted increases in forest area may be spurious. I therefore also tried computing the GEP indices by omitting the area under forest, but this did not substantially affect the overall results in terms of shifts in the relative rankings of states over time.

APPENDIX TABLES

Appendix table 1: States ranked by GEP(V) indices, 1971 and 1991

Rank	GEP(V) 1a index 1971	GEP(V) 2a index 1991	GEP(V) 1b index 1971	GEP(V) 2b index 1991
1	Mizoram	Kerala	Manipur	Kerala
2	Kerala	Manipur	Kerala	Manipur
3	Meghalaya	Mizoram	Mizoram	Mizoram
4	Tripura	Tripura	Meghalaya	Tripura
5	Himachal P.	Himachal P.	Tripura	Himachal P.
6	Manipur	Meghalaya	Himachal P.	Meghalaya
7	Arunachal P.	Arunachal P.	Karnataka	Arunachal P.
8	Assam	Nagaland	Andhra P.	Nagaland
9	Karnataka	Karnataka	Orissa	Andhra P.
10	Nagaland	Andhra P.	Assam	Tamil Nadu
11	Orissa	Assam	Arunachal P.	Karnataka
12	Andhra P.	J & K	Tamil Nadu	Assam
13	Tamil Nadu	Punjab	Maharashtra	Punjab
14	Maharashtra	Tamil Nadu	J & K	Gujarat
15	J & K	Orissa	Nagaland	Orissa
16	Madhya P.	Gujarat	Bihar	Maharashtra
17	Punjab	Maharashtra	Punjab	J & K
18	Gujarat	West Bengal	Gujarat	West Bengal
19	Bihar	Madhya P.	Madhya P.	Haryana
20	Uttar P.	Haryana	West Bengal	Madhya P.
21	Haryana	Uttar P.	Uttar P.	Rajasthan
22	West Bengal	Rajasthan	Haryana	Uttar P.
23	Rajasthan	Bihar	Rajasthan	Bihar

Rank correlations: GEP(V)1a and GEP(V)2a : 0.928; GEP(V)1b and GEP(V)2b : 0.876

Appendix table 2: Intertemporal shifts in GEP(VT) indices over 1971-1991

States	1971		1991		Difference (1971 - 1991)	
	GEP(VT) 1a	GEP(VT) 1b	GEP(VT) 2a	GEP(VT) 2b	GEP(VT) 1a - 2a	GEP(VT) 1b - 2b
INDIA	0.74	0.73	0.63	0.59	0.11	0.14
Andhra P.	0.70	0.67	0.61	0.55	0.09	0.12
Arunachal P.	0.58	0.65	0.46	0.46	0.12	0.19
Assam	0.67	0.67	0.60	0.55	0.07	0.12
Bihar	0.79	0.75	0.80	0.78	-0.01	-0.03
Gujarat	0.78	0.79	0.68	0.62	0.10	0.17
Haryana	0.83	0.86	0.72	0.67	0.11	0.19
Himachal P.	0.56	0.57	0.44	0.42	0.12	0.15
J & K	0.75	0.72	0.66	0.63	0.09	0.09
Karnataka	0.69	0.65	0.59	0.55	0.10	0.10
Kerala	0.50	0.49	0.31	0.26	0.19	0.23
Madhya P.	0.76	0.79	0.69	0.67	0.07	0.12
Maharashtra	0.75	0.71	0.69	0.63	0.06	0.08
Manipur	0.59	0.57	0.34	0.34	0.25	0.23
Meghalaya	0.53	0.52	0.47	0.47	0.06	0.05
Mizoram	0.47	0.47	0.38	0.38	0.09	0.09
Nagaland	0.71	0.71	0.48	0.48	0.23	0.23
Orissa	0.70	0.68	0.66	0.61	0.04	0.07
Punjab	0.77	0.76	0.66	0.60	0.11	0.16
Rajasthan	0.86	0.87	0.80	0.75	0.06	0.12
Tamil Nadu	0.74	0.70	0.64	0.55	0.10	0.15
Tripura	0.58	0.55	0.43	0.43	0.15	0.12
Uttar P.	0.82	0.85	0.78	0.76	0.04	0.09
West Bengal	0.83	0.83	0.69	0.63	0.14	0.20
Mean	0.694	0.689	0.590	0.558	0.103	0.132
S.D.	0.111	0.114	0.142	0.131	0.058	0.062

Appendix table 3: GEP(VC) consolidated indices, 1971 and 1991

States	Consolidated indices 1971				Consolidated indices 1991			
	G index	E index	P index	GEP(VC) 1b index	G index	E index	P index	GEP(VC) 2b index
INDIA	0.61	0.77	0.61	0.66	0.67	0.40	0.54	0.53
Andhra P.	0.42	0.84	0.49	0.58	0.53	0.86	0.25	0.54
Arunachal P.	0.95	0.05	NA	0.50	0.61	0.04	NA	0.33
Assam	0.65	0.56	0.46	0.56	0.61	0.58	0.71	0.63
Bihar	0.53	0.81	0.84	0.73	0.87	0.82	1.00	0.90
Gujarat	0.64	0.93	0.61	0.73	0.55	0.93	0.46	0.65
Haryana	0.94	0.96	0.25	0.72	0.78	0.97	0.06	0.61
Himachal P.	0.47	0.65	0.02	0.38	0.40	0.72	0.10	0.41
J & K	0.70	0.86	0.00	0.52	0.73	0.87	0.28	0.63
Karnataka	0.42	0.75	0.51	0.56	0.54	0.75	0.48	0.59
Kerala	0.03	0.56	0.84	0.48	0.00	0.57	0.52	0.36
Madhya P.	0.78	0.73	0.71	0.74	0.79	0.75	0.64	0.73
Maharashtra	0.50	0.83	0.57	0.63	0.58	0.84	0.74	0.72
Manipur	0.34	0.31	0.92	0.53	0.52	0.36	0.00	0.29
Meghalaya	0.43	0.28	NA	0.36	0.60	0.36	NA	0.48
Mizoram	0.45	0.33	NA	0.39	0.48	0.30	NA	0.39
Nagaland	0.83	0.45	NA	0.64	0.67	0.32	NA	0.49
Orissa	0.40	0.64	0.96	0.67	0.55	0.71	0.99	0.75
Punjab	0.72	0.98	0.02	0.57	0.61	0.96	0.02	0.53
Rajasthan	0.84	0.99	0.55	0.79	0.83	0.99	0.47	0.76
Tamil Nadu	0.36	0.86	0.79	0.67	0.38	0.87	0.67	0.64
Tripura	0.40	0.37	0.55	0.44	0.56	0.52	0.09	0.39
Uttar P.	0.93	0.84	0.48	0.75	0.93	0.85	0.60	0.79
West Bengal	0.78	0.73	1.00	0.84	0.63	0.74	0.80	0.73
Mean	0.587	0.666	0.461	0.598	0.598	0.683	0.386	0.580
S.D.	0.232	0.255	0.346	0.134	0.187	0.251	0.334	0.162

G (consolidated) = Average of individual indices for sex ratio, rural female literacy rates, RTFR
E (consolidated) = Average of individual indices for % area under forest, normal rainfall
P (consolidated) = Individual index for % rural non-poor
GEP(VC) = sum of individual (consolidated) indices/no. of individual (consolidated) indices

Appendix table 4: Intertemporal shifts over 1971-1991 in G(T), E(T), P(T) and GEP(VCT) consolidated indices

States	Difference in indices, 1971-1991			
	G(T)	E(T)	P(T)	GEP(VCT)
INDIA	0.14	0.42	0.22	0.26
Andhra P.	0.12	0.00	0.36	0.16
Arunachal P.	0.38	0.12	NA	0.25
Assam	0.23	0.03	- 0.05	0.07
Bihar	- 0.06	0.01	0.04	0.00
Gujarat	0.24	0.00	0.28	0.18
Haryana	0.28	- 0.01	0.30	0.19
Himachal P.	0.28	- 0.02	0.07	0.11
J & K	0.22	0.01	- 0.10	0.05
Karnataka	0.14	0.02	0.19	0.12
Kerala	0.30	0.03	0.44	0.26
Madhya P.	0.16	0.03	0.23	0.13
Maharashtra	0.16	0.01	0.03	0.06
Manipur	0.04	0.08	0.93	0.35
Meghalaya	0.04	0.04	NA	0.03
Mizoram	0.06	0.15	NA	0.11
Nagaland	0.23	0.22	NA	0.23
Orissa	0.09	- 0.01	0.16	0.08
Punjab	0.27	0.02	0.14	0.14
Rajasthan	0.16	0.00	0.23	0.13
Tamil Nadu	0.20	0.01	0.27	0.16
Tripura	0.06	- 0.04	0.54	0.19
Uttar P.	0.16	0.00	0.06	0.07
West Bengal	0.28	0.00	0.35	0.21
Mean	0.176	0.030	0.194	0.143
S.D.	0.103	0.058	0.227	0.082

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