

Soil Erosion in Developing Countries: A Politicoeconomic Explanation¹

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ABSTRACT / Soil erosion is accelerating in developing countries of Asia, Africa, and Latin America. It has threatened the livelihood of millions of peasants, for agriculture is their economic mainstay. A probe into the forces causing erosion re-

veals that the elite's resolve to accumulate ever more wealth and to maintain, consolidate, or expand their sociopolitical power and the necessity of the poor to fulfill their requirements of food, fuelwood, and fodder are the two major factors accelerating soil erosion. Unless the vast masses of poor people are integrated into the national mainstream through the implementation of equitable and redistributive development policies, it is impossible to control the accelerating rate of soil erosion and thus to achieve the objective of sustainable development.

Developing countries in Asia, Africa, and Latin America are severely affected by soil erosion. According to a document jointly published by the World Resources Institute and the International Institute for Environment and Development (WRI and IIED 1987), Ethiopia was losing 500 million metric tons of soil annually from her total 12 million hectares of cropland. Similarly, Madagascar was experiencing erosion at rates of 12–40 million metric tons of fertile soil from its high central plateau alone. On the Asian continent, India annually lost 6 billion metric tons of soil from its total 80 million hectares of cultivated land. Although part of the erosion is attributed to natural causes, there is ample evidence that a substantial proportion of erosion is caused by human activities in the form of increasing encroachment of forests, overgrazing of rangelands, and expansion of arable agriculture into marginal lands. In China's Yellow River, the output in river sediment was found to exceed the rainfall input by 14 times. Likewise, the output in the river sediment exceeded the rainfall input by a factor as high as 24 for India's Narbada River (WRI and IIED, 1987, p. 174). Conventionally, the excess amount of sediment yield is attributed to accelerated erosion. There is growing adherence to the opinion that a considerable proportion of so-called accelerated erosion is related to mass-wasting, glacial lake outbursts and on-going geomorphological processes of

mountain-building (Carson 1985, Ives and Messerli 1989). It is not the objective of this paper to engage in a debate of whether anthropogenic or natural factors played the predominant role in soil erosion. Desolate scenes of severe erosion, deforestation, and degraded pastures (Blaikie 1988, p. 138) or even scenes of boulder and soil deposition along the foothills of degraded mountains in developing countries (Thapa 1990) are stark evidence in support of the proposition that increased encroachment into areas of natural vegetation and expansion of agricultural lands into marginal areas also have contributed to yielding excessive amounts of sediment.

Environmentalists, policy makers, and planners have become increasingly concerned about soil erosion, notably its severe environmental effects such as desertification,² drought, flood, siltation, and land degradation and its economic impact from decline in land productivity and food deficit.³ Much time and effort have been expended on research exploring the technical causes of erosion, for example, cropping systems and grazing practices, and on recommending curative policy measures. Recognizing encroachment of forests and rangelands and expansion of agricultural production into marginal lands as dominant factors determining soil erosion (Eckholm 1976, Blaikie 1985), most researchers related these disaster-prone proliferations to population growth per se

KEY WORDS: Soil erosion; Developing countries; Shifting cultivation; Land distribution; Commercial agriculture; Logging; Farming system; Soil management

¹In this article, the phenomenon "soil erosion" is studied with the sole focus on causation through anthropogenic factors.

²A detailed discussion on causes of desertification is presented in E. Eckholm and L. R. Brown (1977).

³The growing public concern over the environmental problem is well synthesized in M. K. Tolba (ed.). 1988. *Evolving environmental perceptions from Stockholm to Nairobi*. Butterworth, London; and WCED (1988).

(Mgeni 1985, Bilsborrow 1987, Dregne 1987, Ives and Messerli 1989). Others have tended to seek fault with and put blame on inappropriate land use practiced by the poor (Pereira 1980, Baral 1982). Little attention has been paid, however, to appraising the extent to which poor people can be held responsible for causing soil erosion and to exploring the factors that made the poor resort to encroaching into forests and rangelands for agricultural purposes. Based on our first-hand observation and research experience in South and Southeast Asia, we have reiterated that it has not been poor people's preferential choice to devote their time and labor to clearing forests located in steep slopes or in areas infested with malaria (Thapa and Weber 1989, 1990). Focusing on this research lacuna, an attempt has been made to explore structure and forces accelerating soil erosion. The findings presented in this article might be conducive to formulating an effective soil management and conservation strategy.

Causes of Soil Erosion

Gradual depletion and degradation of natural vegetation, expansion of agricultural lands into marginal areas, and unsuitable land use practices are the three major factors determining soil erosion. The following sections examine why and how such practices have come to exist.

Shifting Cultivation

In upland areas of Asia, Africa, and Latin America, shifting cultivation is practiced sporadically. According to an FAO document, this type of economic activity, which, it is maintained, explains 45% of the elimination of closed tropical forests, purportedly is the single most important determinant of forest destruction. This implies that shifting cultivation was held largely responsible for soil erosion. Ambiguous estimates and statements of this kind, however, revive fundamental controversies. First, inherent to such information is deforestation for land speculation and illicit timber wood extraction in areas under shifting cultivation, since most countries either have never established or have not maintained any scientific records of forest encroachment for various reasons. Secondly, the FAO statement leads one to condemn the so-called "primitive tribes" living in upland forest areas as "predators" of forest resources, since conventionally the term shifting cultivation has been applied to their agricultural land-use system (Spencer 1966). This entails examining whether and how shifting cultivation has been liable for soil erosion.

Evidence from Thailand, the Philippines, Sri

Lanka, and Indonesia reveals that shifting cultivation is, in fact, practiced by both tribal and nontribal people. The latter usually come from adjacent valleys or lowland areas from which they were pushed because of political, economic, or religious reasons (Weber 1969, Walker 1975, Atal and Bennagen 1983, p. 3, Soewardi 1983, p. 93, Uhlig 1984, pp. 19–20, Russel 1986, p. 43). In countries like Thailand, which maintained her political independence and core territorial integrity throughout history, shifting cultivators have been confronted, challenged, and ultimately oppressed by internal colonists, viz., venturesome spontaneous settlers often of urban origin (Uhlig 1984).

In the hills of Nepal, villagers resorted to shifting cultivation in public forests, for their small landholdings could not fulfill their food requirements. Although this type of activity has declined considerably, some villagers are still practicing shifting cultivation locally known as *khoriya*. Villagers confirm that the large tracts of barren and unprotected lands surrounding their settlements had been forest lands that were taken under shifting cultivation (Thapa 1990). Referring to the large-scale intrusion of outsiders into areas traditionally under shifting cultivation, Hirsch (1990, p. 168) concludes that overall shifting cultivation has played a much smaller role in the depletion of forests than have logging and land settlement for upland cash cropping.

Shifting cultivation in its original form—working the ground sporadically and thus implicitly allowing for perennial growth of secondary forests in agricultural lands through fallowing the farm plot for a period of five to six years—is the ecologically most suitable practice (Sauer 1956, p. 57, Spencer 1966, p. 33, Atal and Bennagen 1983, p. 3). In the typical small-scale plot, both slashing and burning is often incomplete, which helps to protect the soil, especially during the early stages of crop growth, ensures a steady release of nutrients as partially burnt woody material decays, and permits rapid regrowth from stumps and suckers once the field is abandoned (Walker 1975, Charlton 1987, p. 162). Under the traditional system of shifting cultivation in northern Zambia, known as *chitemene*, the Bemba tribe does not slash and burn a large area of forests, which is a typical feature associated with most practices of shifting cultivation. Rather, the tribe grows crops in an ash garden after burning a pile of branches lopped from trees in an area many times larger than the ash garden. The *chitemene* system, therefore, helps to maintain soil fertility as well as keeps forests protected from degradation, as tree felling is seldom practiced (Stromgaard 1988, p. 364). In the northeastern region of the Indian subcon-

continent, some tribes are still practicing shifting cultivation known in Bengali as *jhum* under five-, ten-, or 20-year cycles (Maikhuri and Ramakrishnan 1990). While their practice of partial slashing and long fallowing allows forest regeneration, mixed cropping of wide varieties of cereal, tuber crops, vegetables, and fruits maintain soil fertility and protect the lands from degradation (Table 1).

With the advent of colonialism and accelerated population growth, substantial proportions of areas under shifting cultivation were expropriated by internal and external colonists for commercial or cereal crop cultivation, eventually displacing shifting cultivators from their traditionally occupied lands (Geertz 1968, Uhlig 1984). As a result, shifting cultivators were compelled to encroach into forests located in critical areas where there were very limited opportunities for forest encroachment, and shifting cultivators were forced to adopt strategies of shortening the fallowing period and intensifying crop production. Consequently, the practice of shifting cultivation has become environmentally destructive in its perverted contemporary form. Given the rapidly swelling population of shifting cultivators and the shrinking of forests, it is neither feasible nor justifiable to restore the original type of shifting cultivation. Taking into consideration this fact, soil erosion in areas of shifting cultivation can be effectively controlled by motivating tribal people to adopt sedentary agriculture. Recognizing and promoting their traditional agroforestry system, emphasis should be laid on the cultivation of ecologically and environmentally suitable crops. Through the provision of adequate social and economic support services and facilities, the socioeconomic and spatial integration of niches of shifting cultivation into the national mainstream could be accomplished. In contrast, shifting cultivators from the hills of northern Thailand were relocated forcibly to areas at the foothills mostly covered with forest and endowed with poor soils and without any adequate support services and facilities. Frustrated by adverse physical conditions and poor support services and unaware of agricultural innovations, many of those resettlers returned to their place of origin, leaving their allotted land barren, thus aggravating soil erosion and land degradation in both places.

Skewed Land Resource Distribution

Land has been a symbol of wealth and power throughout history. Above all, it is the major source of food. Most settlements and agricultural lands now in existence had been either rangelands or forest lands. Those erstwhile forests and rangelands in developing

countries had been cleared extensively by the political elites—rulers, chief administrators, and military officers—in the pursuit of accumulating wealth and gaining or strengthening power. Large areas of forests in India (Farmer 1974), Nepal (Regmi 1977) and the Amazon basin of Latin America (Redclift 1984) were cleared by the state elites in coordination with their local allies using forced labor or granting small plots of land to peasant laborers. Particularly in the Kingdom of Nepal, large forest areas were bestowed on members of the royal family and councillors by royal decree. Likewise, bureaucrats and military officers were allocated forest lands in lieu of monetary remuneration. All these granted forest lands were gradually cleared and converted into agricultural lands using corvee or forced labor, eventually introducing the slavery system, which survived until the first quarter of the twentieth century. Besides, people were openly encouraged to register forest areas as private lands so as to increase the national revenue required for territorial expansion campaigns (Regmi 1977). This is still reflected in the contemporary state policy of promoting the expansion of agricultural lands, leading to the elimination of substantial expanses of forests and grazing lands (Table 2) and causing soil erosion and land degradation.

Although developing countries went through periods of transition, political changes remained largely restricted to shifts in leadership. The basic power structure, particularly the control over the state mechanism, has hardly changed irrespective of the type of political system. Even in India, known as the largest democracy in the world, overall state executive power is exerted by a deeply entrenched elite (Lipton 1977). Given the abysmal illiteracy and rampant poverty of the masses, the elite have gained firm control over decision making and implementation mechanisms thus enabling them to continue sanctioning the encroachment into forest and grazing lands (Figure 1). As a result, the overwhelming majority of the population has been restricted to a small proportion of the land (Table 3). Such manifestations of keeping the masses in tutelage and of perpetuating alienation, deprivation, and economic marginalization have been reinforcing the downward spiral of environmental deterioration and impoverishment in developing countries.

Skewed distribution of land resources is caused not only by encroachment and enclosure of public lands for private gains of influential individuals. Taking advantage of small farmers' poverty, poor marketing facilities, and inadequate credit delivery, the elite has virtually set the debt trap for small farmers by extending loans at terms that are not conducive to im-

Table 1. Importance value indices (IVI) of crop species under different *jhum* cycles of different tribal communities of Meghalaya in northeastern India^a

Crop Species	<i>jhum</i> cycle								
	20 years			10 years			5 years		
	Garos	Khasi	Mikir	Garos	Khasi	Mikir	Garos	Khasi	Mikir
Grain and seed									
<i>Oryza sativa</i>	154	142	146	141	136	163	157	124	155
<i>Zea mays</i>	23	36	64	29	52	39	29	78	64
<i>Eleusine coracana</i>	—	—	—	—	—	—	—	—	61
<i>Sesamum indicum</i>	30	40	33	25	24	52	25	17	—
<i>Ricinus communis</i>	13	—	—	12	—	—	10	—	—
Leaf and fruit vegetables									
<i>Hibiscus sabdariffa</i>	17	13	11	9	10	12	10	13	—
<i>Capsicum frutescens</i>	12	16	12	14	13	13	13	13	—
<i>Cucurbita maxima</i>	6	—	—	7	8	—	10	10	8
<i>Cucumis sativa</i>	6	9	—	8	10	—	12	9	—
<i>Solanum melongana</i>	—	—	—	5	—	—	—	—	—
<i>Musa sapientum</i>	—	9	—	13	12	—	—	—	—
<i>Lagenaria leucantha</i>	7	10	12	9	7	—	6	9	12
Tuber and rhizome									
<i>Colocasia antiquorum</i>	18	18	22	17	16	21	15	27	—
<i>Zingiber officinalis</i>	6	—	—	—	—	—	—	—	—
<i>Manihot esculentus</i>	8	—	—	11	12	—	13	—	—

Source: Maikhuri and Ramakrishnan (1990, p. 25). NB: IVI is the sum of relative frequency, relative density, and relative abundance with a maximum value of 300.

Table 2. Land use change in developing countries, 1900–1980^a

Region	Land use type (area in million hectares)								
	1900			1980			Change (in %)		
	F&W	G&P	C	F&W	G&P	C	F&W	G&P	C
Tropical Africa	1306	1075	73	1074	1158	222	-17.8	7.7	204.1
Latin America	1394	634	33	1151	767	142	-17.4	21.0	330.3
South Asia	299	189	89	180	187	210	-39.8	-1.1	136.0
Southeast Asia	249	118	15	235	92	55	-5.6	-22.0	266.7

^aSource: WRI and IIED (1987, p. 272). F&W = forests & woodlands; G&P = grasslands & pastures; C = cultivated land.

proving the status of the poor. Once the small farmers were unable to repay their compounded loan, the lender would take control over their land. This process explains the widening inequality in land distribution in developing countries (FAO 1988, p. 8). In Dang Valley of mid-western Nepal, thousands of households of indigenous people (*Tharu*) had to migrate to districts in the western Tarai where they encroached into virgin tropical forests, after their ancestral lands had been taken over by landlords mostly belonging to the Brahmin and Chhetri castes. This is only one of innumerable instances where encroachment into forest areas is the secondary consequence of capitalist penetration into hitherto remote although well-endowed and old settled areas.

Considering the unequal land distribution and its adverse impact on development, international agencies and organizations such as the Inter-American Committee for Agricultural Development and the World Bank strongly recommended land reform. During the 1960s and 1970s, governments of many countries launched land reform programs, but surprisingly little land was redistributed (Redclift 1989, p. 370). In Nepal, only 21,050 hectares of land had been redistributed since the beginning of implementation of the land reform program in 1964, while some 60% of the land identified as excess land was still held in ownership by landlords (APROSC 1978, p. 10). Referring to the problem inherent to land reform implementation in the third Five-Year Plan of India (PIC 1960), it was

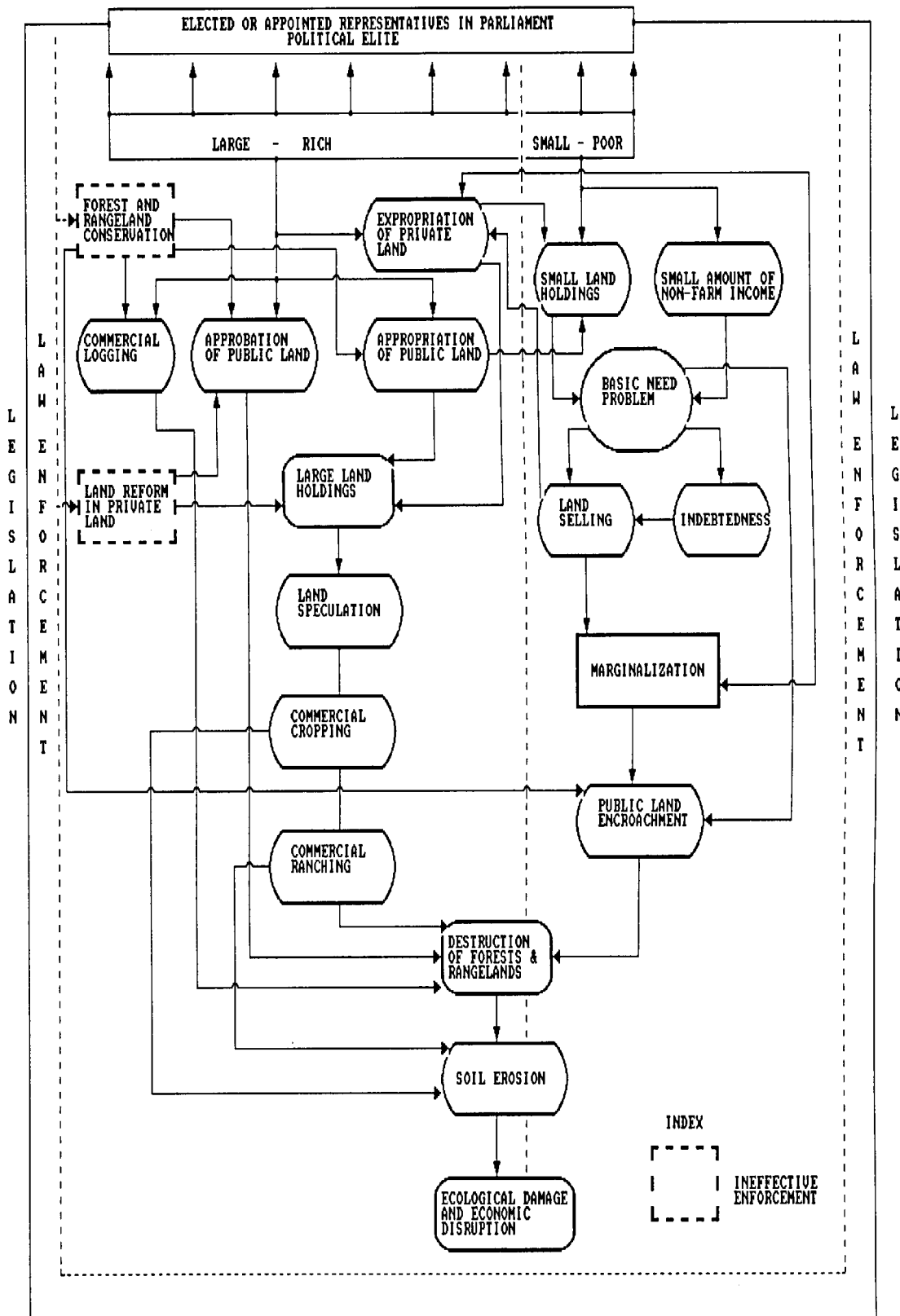


Figure 1. Politicoeconomic explanation of soil erosion.

Table 3. Distribution of agricultural holdings in selected developing countries by size of holdings and proportionate area, 1980^a

Country	Size of holdings (%)			Area (%)		
	<5 ha	5–50 ha	>50 ha	<ha	5–50 ha	>50 ha
Asia						
India	91	9	0 ^b	51	46	3
Phillipines	86	14	0	51	37	12
Thailand	72	28	0	39	61	0
Africa						
Algeria ^c	69	30	1	14	63	23
Zaire ^c	99	1	0	60	5	35
Zambia ^c	94	6	0	34	19	47
Latin America						
Argentina ^d	15	39	47	0	2	98
Brazil	37	45	16	1	12	87
Colombia ^d	60	32	8	4	19	78

^aSource: WRI and IIED (1987, pp. 278–279).

^b0 = zero or less than half of 1%.

^c1970.

^d1960.

remarked candidly that the predominance of vested interests in the decision making process had thwarted any effective implementation of the land redistribution program. It was in this context that Acharya Vinoba Bhave had to resort to *bhoodan* to acquire land donated voluntarily for redistribution to the landless.⁴

Expropriation of lands combined with rapid population growth has been steadily increasing pressure on lands retained by or available to small farmers. In the absence of gainful alternative employment opportunities, those farm enterprises gradually have been miniaturized through fragmentation, which has resulted in a substantial increase in numbers of near-landless or landless people. According to a FAO estimate for 1979 (1988, p. 5), some 30 million agricultural households in developing countries were landless and about 138 million were near-landless. While the occurrence of landlessness or near-landlessness was highest in South Asia, it was growing in Southeast Asia, Latin America, and even in Africa. In Nepal, for instance, the landless accounted for nearly 50% of the total population; in Thailand the number of landless, near-landless, small and marginal farmers combined was equivalent to about one-third of its total population. In Pakistan, one-quarter of the population was landless or near-landless (CIRDAP Newsletter 1987, pp. 2–3).

Constrained by small landholding size and growing

household demand for cereals, marginal and small farmers have been compelled to adopt strategies of out-migration, of expansion of agricultural lands into marginal areas, as experienced in the Middle Hills of Nepal (Thapa and Weber 1989), of land use intensification as in Java (Geertz 1968), and of renting or share-cropping. Evidence of land use intensification in any favorable physical environment, for example, flat topography, alluvial soil, warm and humid climate and moderate precipitation proves that it would not accelerate soil erosion. Agricultural intensification in steep slopes, on poor soils, and under extreme climate, however, would almost invariably lead to accelerated soil erosion, as found by Metzner (1977) in the area of Baucau-Viqueque in eastern Timor, Indonesia.

Most lands owned by absentee landlords have been cultivated by landless, marginal, or small farmers. Being the weak partner in an oppressive sociopolitical system, tenants have been forced to yield the major proportion of their field crops to their landlords, as they might be evicted if they refused to follow the rules set arbitrarily and unilaterally by their landlords (Ladejinsky 1977). Given this insecurity of land tenure, tenants have not had any incentive to employ farm conservation and improvement measures to rented lands (Hudson 1987, p. 7, Repetto 1987, p. 45).

In spite of peasants' evident concern with soil management (Angeles 1986), their small amounts of income do not allow them to adopt appropriate and adequate conservation measures. They need most of their income to meet their basic requirements, to pay their

⁴For a detailed account of Acharya Vinoba Bhave's *bhoodan* movement, refer to Suresh Ram (1962), Vinoba and his mission. ABSSS, Kashi.

landlord, to buy some indispensable agricultural inputs, and to maintain the farm capital including the tenure of land (Dudal 1980, pp. 9–10, Sampson 1987, p. 317). In contrast, individual large land holders and corporate firms are likely to be more concerned about the balance in their quarterly statements than about the long-term impact of their actions on the land and its resources (Sampson 1987, p. 317). Farming decisions of producers for the market, such as crop type and cropping system, are thus most likely determined by market prices of commodities irrespective of land suitability.

All evidence corroborates the conclusion that the skewed distribution of land resources is a major cause of soil erosion. The disparity between those who are too poor to safeguard themselves against the disastrous consequences and those who are too rich to become concerned about the immediate adverse effects of their practices of land use has widened the socioeconomic gap. Lack of means, on the one hand, and lack of care, on the other, have led to a situation where soil erosion is increasing through a process of fending off impoverishment and of pursuing aggrandizement. The middle path, so fundamental to Asian thinking and so valid in any socioeconomic context, has become ever more shrouded in the fallout of the man-made deterioration of the natural environment and the depletion of such vital resources as its forests.

Commercial Crop Cultivation

Large-scale commercial agriculture was rare before the era of colonization. Following the conquest of most areas constituting present-day developing countries, European colonial administrators declared all virgin lands crown land. In due course, extensive stretches of forests and rangelands in crown lands were brought under cultivation of various cash crops to fulfill the growing demand for industrial raw materials in the so-called "mother" countries. In this pursuit, they had introduced large-scale cotton cultivation in Africa, pararubber and coffee cultivation and livestock ranching in Latin America, sugarcane and pararubber cultivation in Southeast Asia, and tea and sugarcane cultivation in South Asia. In some areas, as on the island of Java in Indonesia, where there was not much scope for forest and rangeland encroachment, the colonists, in collaboration with the local elite, had forcibly taken control of paddy lands for sugarcane cultivation, ultimately compelling peasants to bring marginal lands under cultivation and to embark on intensified land use aptly described as agricultural involution (Geertz 1968). This led to accelerated erosion both in traditionally and newly cultivated lands. Following the suc-

cessful independence movements in the former colonies, the European colonists had to retreat but left behind the legacy of poverty and environmental deterioration, as they had made little investment in improving the peasants' quality of life.

Owing to steadily growing demand for cash crops and rising market prices, governments of developing countries have directed their agricultural policies and programs towards land use intensification and cash crop cultivation, providing entrepreneurs with appropriate support services. Tempted by the possibility of earning foreign exchange and encouraged by favorable national trade policies, domestic entrepreneurs, in collaboration with multinational firms, have expanded commercial monocropping in areas traditionally under peasant-operated food crop cultivation or pasture, eventually pushing food crop cultivation into marginal areas (Whitlow 1988, p. 89) and reducing the duration of the grazing cycle interval in remaining rangelands. Such changes were reported from Sudan, where commercial enterprises, with the connivance of influential individuals, have encroached into traditional semiarid and arid grazing lands for mechanized cash crop cultivation, thus exacerbating soil erosion by thorough plowing of fields using heavy farm machinery and by overgrazing in remaining pasture areas. Similarly, large-scale commercial cropping and ranching enterprises intruding into the Brazilian Amazon region have compelled small and marginal farmers to practice unsustainable shifting cultivation and worsen forest encroachment (Barbier 1988, pp. 4–5). In Brazil, land held by indigenous peasant communities has been considered as legally unclaimed. This lack of tenure has enabled ranchers to stake their claims in purportedly unpossessed lands. Sometimes ranchers would offer some token compensation money to peasants for relinquishing their claim to the land. If the offer was rejected, the colonists would threaten indigenous people with burning down the surroundings or with turning their cattle loose on native peasants' land. As peasants were not able to protect themselves, their settlements, and their crops, they were coerced into abandoning their farms, either moving into the nearest town or farther away into the deep forests (Bunker 1981, p. 52).

In Thailand where poor people usually have been held responsible for forest destruction, influential, urban-based individuals had upland areas in its northern, northeastern, and eastern regions deforested to cultivate cash crops such as sugarcane, manioc, and kenaf on a large scale (Uhlir 1984, p. 87). Poor local peasants have worked these lands as tenants or landless laborers. Owing to large-scale encroach-

ment, approximately 41% of forests in Thailand were destroyed between 1962 and 1984 (WRI and IIED 1987, p. 249). The deforested areas have been populated largely by landless, marginal, and small farmers.

Wherever the national political framework is geared to benefit the rich, the poor cannot gain access to economic resources and political power. Attempts at challenging this system sometimes were suppressed brutally. Peasants have thus remained restricted, in their desire to sustain their livelihood, to encroaching into forests. For all obvious reasons, their liability for deforestation is smaller than that of large landholders.

Commercial agriculturists have been accumulating wealth at the expense of environmental degradation and human misery in rural areas, while making little contribution, if any, to repairing these damages. Being urban based or based abroad, commercial agriculturists would invest profit generated by their rural enterprises in metropolitan rather than in rural areas (Redclift 1984, p. 68). In some countries of Africa and Latin America, where the large commercial agricultural enterprises, known as estates, were owned and operated by European or North American firms (Whitlow 1988, Bunker 1981), most revenues accruing from these enterprises were never invested in the host countries.

Commercial agriculture at the scale of large agribusiness or agroindustrial enterprises has caused environmental and economic backwash effects in developing countries. In the absence of law enforcement, or out of sheer lack of legal provisions, entrepreneurs have not been liable for maintaining the ecological balance. Their pursuit of maximizing profits has not been impaired by any social or economic costs to be paid for the repair of damages caused by deforestation and soil erosion. While the blame is hastily and widely put on the poor recruited by entrepreneurs into their labor force and attracted by marginal opportunities of gleaning the remnants and leftovers after large-scale encroachment and deforestation, the financial burden is to be shouldered by entire nations, even the international community, after a certain time.

Wood-Fuel Collection

Wood fuel, i.e., fuelwood and charcoal, is the most important type of fuel in developing countries. It accounted for 98% of the total energy consumption in Nepal, 36% in India, and 63% in Thailand. On the African continent, wood-fuel consumption in Angola and Tanzania represented 74 and 94% of the total energy consumption, respectively. While wood fuel accounted for 33% of the total consumption in Brazil, it

was 16% in Chile (Eckholm and others 1984, WRI and IIED 1987). According to an FAO study covering 76 developing countries in Asia, Africa, and Latin America (Lanly 1982, p. 62), there was a general tendency of high fuelwood consumption in the poorest countries. This indicates that fuelwood was mostly consumed by the poor.

Being confined to marginal lands and living in a state of structural underemployment or unemployment, the majority of rural people in developing countries are struggling just to sustain themselves. Buying fuel is, therefore, beyond what they can afford. Given free access to forests and availing themselves of their underemployed or unemployed labor force, fuelwood has become a "free" good⁵ in developing countries. If the people had adequate landholdings, or if they could avail themselves of nonfarm employment opportunities, they would seldom have resorted to fuelwood collection. The steadily increasing extraction of fuelwood, however, has led to gradual degradation and depletion of forests (Eckholm 1980).

Ecologically, fuelwood collection does not lead to erosion unless it depletes the forest stock. The major point to be noted is that those forests utilized for fuelwood collection are steadily being degraded, even if there is sustainable supply on the whole because not all forests in a particular area are equally accessible. Forests in the most accessible locations are thus prone to degradation due to the villagers' concentrated fuelwood collection in the pursuit of saving time and labor (Thapa 1990).

Depletion of forests accelerates on-farm erosion. Accelerated erosion in cultivated fields actually starts as soon as farmers use dung and crop residues as fuel for cooking and heating purposes, mainly because of increasing distance to forests and the scarcity of fuelwood. In India, between 300 and 400 million tons of wet dung, which shrink to become 60–80 million tons when dried, are burnt annually as fuel, which is equal to or more than one-third the total of chemical fertilizers used in the entire country (Eckholm 1980, p. 65). Likewise, the tendency to burn dung and crop residues gradually has become stronger in other South Asian and African countries (FAO 1988, WRI and IIED 1987). In eastern Nigeria, firewood scarcity forced the Tiv people to uproot crop residues after harvesting for use as fuel (Eckholm 1980, p. 66). The collection of crop residues deprives soils of nutrients,

⁵As there is zero opportunity cost, labor cost is not priced.

deteriorates its structure, and diminishes crop productivity.

Logging

Timber export has become a lucrative business for developing countries, whose trade balances would otherwise have remained negative or further deteriorated. Every year, according to Myers (1981, p. 6), 20–34 thousand square miles of tropical forest are affected or erased by logging. The intensity of logging is highest in South Asia where year after year, tropical forests of estimated areas ranging between 4000 and 11,000 square miles are affected. In Latin America, estimates for the total area affected by logging range from 3000 to 10,000 square miles. For Africa the estimate is 13,000 square miles. Likewise, in China, commercial logging has been surpassing new plantings despite continuous reforestation and afforestation campaigns (Smil 1981).

The real extent of logging, however, is probably much larger, if large-scale illicit felling of trees is taken into account. It is an undisputed matter that influential individuals—politicians, businessmen, military officers, and chief bureaucrats—under the umbrella of the government dominated by their allies, are mostly responsible for logging. Uhlig (1984) conducted an in depth study at the southern rim of the Khorat Plateau of northeast Thailand and found large tracts of forests cleared by private entrepreneurs or land speculators. Despite the logging ban in Thailand at the outset of 1989, incidents of illicit logging with the connivance of influential politicians and military officers are reported every other day in the Thai and English language newspapers. Although within the guaranteed freedom of assembly and expression under the parliamentary system, occasional demonstrations organized to protest against unabated log poaching or forest encroachment for the establishment of tourist resorts and golf courses sometimes ended with demonstration leaders being threatened or harassed. In one recent instance, one of the leaders was even murdered.

It seems that the lack of law enforcement in forest areas pertinent to their conservation has created a state of lawlessness or a vacuum in which influential log poachers wield power and dictate the terms under which they maintain “law and order.”

A personal visit to the camp of one such notorious entrepreneur in one of the provinces of Thailand was informative. Surrounded by palisades so high that neither buildings nor heavy equipment were visible from the outside and guarded by heavily armed sentries, the camp gave the appearance of a fortification that was entered only after prior introduction to its owner

during a meeting arranged by another influential individual and held in the provincial town. The major building with the living quarters was surrounded by a verandah on which the visitor was courteously received by the entrepreneur, with several armed guards in attendance. The verandah served as an inner cordon where guards could patrol and closely watch living quarters, palisades, and yard. The space between the residential building and palisades was used for parking trucks and large earth-moving vehicles such as bulldozers; sheds housed repair shops, machinery, and supply stores. While the access route on the ground was expertly camouflaged, leading the unsuspecting to follow a beaten track used to haul out logs and thus bypassing the camp, the sprawling camp area with its neat structure was undoubtedly clearly visible to aerial reconnaissance and on aerial photographs. This fact, at least, supports the assumption of manifest relationships and shared interests among politicians, administrators, military officers, and large-scale log poachers.

On-going large-scale logging, particularly in tropical zones, triggers soil erosion, as it leaves thin soils exposed to torrential rain and leads to disasters like that in southern Thailand in late November 1988. The actual extent of erosion, however, varies by the type of soil, topography, and the technique used to fell trees. On the northern tip of Palawan Island in the Philippines, logging on steep slopes has caused so much erosion that an average of 141 metric tons of topsoil and debris is washed off per hectare and year, whereas the rate of erosion is 0.6 metric tons in primary forest areas (Myers 1988, p. 210). Logging companies have exacerbated erosion using heavy machinery. On the island of Sumatra in Indonesia, which exports 5000 m³ timber annually (WRI and IIED 1987, p. 288), erosion in areas with mechanized logging ranges from 90 to 500 mt/ha/yr on slopes with gradients of 3.5%–15%, respectively (Suardjo 1986, p. 135).

Traditional Soil Management Systems

How peasants tactically or forcibly driven to marginal lands have been using the land and managing soils are questions that deserve to be examined in some detail.

Farming System

Land is the single most important source of livelihood of most peasants and supplements farmers' fodder and fuel requirements. Cognizant of the importance of the land, farmers in developing countries have been managing their farm lands very efficiently

by adopting suitable farming systems. In the hills of Nepal, where adverse physical conditions prohibit intensive crop cultivation, farmers practice a field crop/forest/livestock-based farming system. Farmers obtain fuelwood and fodder from forests and food from farm lands. Assorted species of livestock fulfill their requirements of draught power, manure, dairy products, and meat. This type of system is not peculiar to Nepal, and is found in other highland regions in Asia, Africa, and Latin America. (Murton 1980, Den-even 1980, Beyer 1980). In adopting an ecologically suitable farming system, farmers have practiced multiple cropping and intercropping. The technique of combining a range of different crops in the same field is a basic feature of many long-established agricultural systems (Charlton 1987, p. 158). Intercropping is prominent in Africa, where 98% of cowpeas, probably the most important legume on the continent, are grown interspersed with other crops (Beets 1982). Similarly, in some countries of South Asia pigeonpea, lentil, pea, and millet are grown simultaneously with staple crops like paddy, maize, and wheat. In the hills of Nepal, upland paddy is found intercropped with maize, and millet is found grown in a crop mix with maize (Thapa 1990).

In the dry zones of Africa and the Middle East, where crop cultivation is severely restricted by very low moisture, any effort to cultivate crops means accelerating the rate of soil erosion and exposing oneself to the danger of crop failure and ultimately starvation. Being aware of these environmental and economic consequences, people have opted for livestock ranching as a suitable source of livelihood (Manners 1980, Beyer 1980) which, in fact, helps to maintain the ecological balance and to satisfy human needs.

Agroforestry is another important feature of peasants' ergology. Farmers in most developing countries plant trees in close association with field crops for fruit, fodder, fuelwood, nuts, shade; to protect other crops; or simply for ornamental purposes or social prestige (Eckholm and others 1984, p. 47). Extensive field surveys undertaken in the hills of Nepal show that farm fodder and fuelwood trees were instrumental in controlling the pace of erosion, as trees grown on farms had helped to prevent forests from rapid degradation by supplying substantial amounts of fuelwood and fodder (Bajracharya 1983, Fox 1983, Thapa 1990).

Soil Management

Terracing is one of the most effective measures to control soil erosion, particularly on steep slopes. The upper elevations of the Himalayas in Asia and of the Andes in Latin America are cultivated extensively

through constructing terraces all over the mountain slopes to protect soils from sliding. Likewise, bunds are built in lowlands for purposes of soil stabilization and efficient supply of irrigation water (Klee 1980). Excluding abandoned fields, all terraced lands, particularly in the hills of Nepal, are plowed two to three times before planting any field crop. In this endeavor, terrace risers are repaired and reconstructed to safeguard the whole farm plot against being swept away by landslides, especially during the rainy season. Aware of the lowering of terrace risers by rainfall and its adverse effect on soil stabilization, new soil is heaped onto the risers while plowing fields in preparation of crop cultivation.

The importance of mulching as a means of increasing the moisture retention capacity of the soil and of improving its structure and quality has been well appreciated by farmers. Accordingly, stubbles are left in the ground and mixed with the soil by plowing. Having been confronted with the increasing scarcity of fuelwood and fodder, farmers are using crop residues for cooking food, heating houses, and feeding livestock (Charlton 1987, pp. 155–156).

How to Control Erosion?

The critical factors causing acceleration of erosion in many developing countries are deeply rooted in their neofeudal social systems. Given the concentration of politicoadministrative power and production resources in the hands of a numerically small elite, soil erosion cannot be checked effectively unless strategies of sustainable development are adopted and implemented that would lead to the reforming of existing systems. Policy makers and planners must be made aware of the causal nexus, implying that their policies and programs could not possibly yield lasting positive effects unless the economies of millions of peasants are improved who are still living either just at or below the subsistence level. The underlying dilemma is whether the political and administrative power should be decentralized first or whether the resources should be redistributed first. In the past, nearly all efforts to implement effective resource redistribution had failed, since decision-making power was exerted exclusively by the very same elite whose members' privileges would thus have been curtailed. It has become mandatory, therefore, to decentralize the political and administrative decision-making power through the introduction of a broad-based democratic system, followed by implementation of agrarian reforms, namely, land redistribution, land tenure security, and provision of agricultural support services and facilities.

After having been dormant for nearly three decades, there is reason to place renewed emphasis on land reform as one of the important means controlling environmental degradation (WCED 1988, Redclift 1989). Without agrarian reform in many countries with skewed land distribution, policy changes to protect the resource base might actually aggravate inequalities by shutting the poor off from resources and by favoring those with large farms (WCED 1988, p. 141). WCED's appeal for land reform again stresses its necessity as emphasized earlier during the 1960s (World Bank 1974) and reiterated ever since (Ladejinsky 1977). Most serious attempts to redistribute land were successfully resisted (Redclift 1989, p. 371) due to firm control exerted by groups with vested interest over decision making and implementing organizations. As noted above, land has been redistributed from poorer to richer landowners. Following the overthrow of the Marcos regime in the Philippines in February 1986, Mrs. Aquino, the incumbent president, promised to implement a land reform program. Despite some attempts, the land reform bill was not even discussed in Parliament, since Parliament is dominated by those absentee landlords and businessmen who own large estates producing sugarcane, coconut, or paddy.

Based on the past and recent failure of land reform and other related development initiatives, international development aid organizations and development assistance agencies should make it mandatory for governments of developing countries to implement agrarian reform as a prerequisite to qualify for financial and technical aid. In this endeavor, emphasis must be laid on low land ceiling, agricultural credit facilities and extension services, and monitoring of program implementation by a committee including representatives of international aid organizations and development assistance agencies involved. If development aid, which actually is taxpayers' money provided for improving the quality of life of the poor in developing countries, is allowed to continue flowing into developing countries without any structural reforms, the pace of deforestation, soil erosion, and land degradation would accelerate further. A most important by-product of the proposed reform and control measures would be the curtailment or even termination of the ruthless exploitation of forest resources by influential business partners of foreign or multinational corporations with head offices in so-called donor countries.

Summary

Soil erosion in developing countries is caused mainly by the concentration of politicoadministrative power and resources in the hands of the elites—including politicians, administrators, businessmen, and

military officers. Advantaged through their firm control over the state mechanism and the abysmal illiteracy and rampant poverty of the majority of the population, the elite, in coordination with their international and local allies, encroached into extensive stretches of forests and rangelands for commercial crop cultivation, livestock ranching, logging, and for land speculation. Moreover, the policy of permitting encroachment on public land for increasing the national revenue to finance the expenses of territorial expansion and a rapidly proliferating bureaucracy had eliminated substantial proportions of forests and rangelands. Such on-going elimination of "commons" for fulfilling the individual interest of influential people exacerbated the pace of soil erosion both in newly cleared areas and in remaining forests and rangelands. Peasants and landless people worked as laborers on land clearing but could not use the cleared lands. Alternatively, they were compelled to settle for the status of permanent wage laborers who cultivate the lands that they had cleared. Those who did not like it squatted elsewhere, encroaching into marginal public lands.

Beside encroaching into forests and rangelands, the elite had taken control over areas under traditional shifting cultivation and food crop farming by using tactical and coercive measures, eventually forcing shifting cultivators and peasants to encroach into marginal lands and to intensify soil erosion to their immediate detriment. In the absence of alternative, gainful nonfarm employment and income opportunities, combined with steadily increasing family size, shifting cultivators and peasants had to resort to bringing marginal areas under crop cultivation and to do intensive agriculture to fulfill their subsistence requirements. This on-going process of steady accumulation of land resources by members of the elite, of gradual displacement of peasants and shifting cultivators from their traditional lands, and of agricultural intensification in marginal areas has severely accelerated the pace of soil erosion.

Peasants appreciate soil resources and their appreciation is manifest in their adoption of a wide range of soil conservation and management measures employed in farm and field crop enterprises. Peasants, however, failed to control soil erosion effectively because of their marginal landholdings and their poor economic condition.

Commercial agriculturists extensively damaged the rural environment in their pursuit of profit maximization, while they made little contribution, if at all, to repairing these damages. Their costs are being paid by the poor, thus prolonging their physical and economic hardship.

Recognizing the skewed distribution of decision-making power and resources as the major factors causing soil erosion, any prospective soil conservation program entails the integration of the peasants into the national mainstream through promotion of their active participation in decision making and implementation of an ecologically sound agrarian reform program with emphasis on land redistribution and provision of adequate support services and facilities.

Literature Cited

- APROSC (Agricultural Projects Services Center). 1978. Agrarian reform and rural development in Nepal. Kathmandu. 40 pp.
- Angeles, M. S. L. 1986. Upland economics and economic impact analysis. Pages 169–188 in S. Fujisaka, P. E. Sajise and R. A. del Castillo (eds.), *Man, agriculture and the tropical forest: Change and development in the Philippine uplands*. Winrock International, Bangkok.
- Atal, Y., and P. L. Bennagen. 1983. Introduction. Pages 1–12 in *Swidden cultivation in Asia*, Vol. 1. UNESCO, Bangkok.
- Bajracharya, D. 1983. Fuel, food or forest? Dilemmas in a Nepali village. *World Development* 11:1057–1074.
- Baral, J. C. 1982. Nepal: Its land and its uses. Pages 523–534 in F. T. Last, M. C. B. Hotz, and B. G. Bell (eds.), *Land and its uses—actual and potential: an environmental appraisal*. Plenum Press, New York.
- Barbier, E. B. 1988. Sustainable agriculture and the resource poor: Policy issues and options. International Institute for Environment and Development, London. 28 pp.
- Beets, W. C. 1982. Multiple cropping and tropical farming system. Westview Press, Boulder, Colorado.
- Beyer, J. L. 1980. Africa. Pages 5–38 in G. A. Klee (ed.), *World systems of traditional resource management*. Arnold, London.
- Bilsborrow, R. E. 1987. Population pressure and agricultural development in developing countries: A conceptual framework and recent evidence. *World Development* 15:183–203.
- Blaikie, P. 1985. The political economy of soil erosion in developing countries. Longman, New York. 188 pp.
- Blaikie, P. 1988. The explanation of land degradation. Pages 132–158 in J. Ives and D. C. Pitt (eds.), *Deforestation: Social dynamics in watersheds and mountain ecosystems*. Routledge, New York.
- Bunker, S. G. 1981. The impact of deforestation on peasant communities in the Medio Amazonas of Brazil. Pages 45–60 in V. H. Sutliv, N. Altshuler, and M. D. Zamora (eds.), *Where have all the flowers gone? Deforestation in the Third World*. Department of Anthropology, College of William and Mary, Williamsburg, Virginia.
- Carson, B. 1985. Erosion and sedimentation process in the Nepalese Himalaya. ICIMOD occasional paper No. 1, International Center for Integrated Mountain Development, Kathmandu. 39 pp.
- Charlton, C. A. 1987. Problems and prospects for sustainable agricultural systems in the humid tropics. *Applied Geography* 7:153–174.
- CIRDAP Newsletter. 1987. The landless in rural Asia. 28:1–4.
- Deneven, W. M. 1980. Latin America. Pages 217–244 in G. A. Klee (ed.), *World systems of traditional resource management*. Arnold, London.
- Dregne, H. E. 1987. Soil erosion: Cause and effect. *Land Use Policy* 6:412–418.
- Dudal, R. 1980. An evaluation of conservation needs. Pages 3–12 in R. P. C. Morgan (ed.), *Soil conservation problems and prospects*. Wiley, Chichester, U.K.
- Eckholm, E. P. 1976. Losing ground: Environmental stress and world food prospect. Norton, New York. 223 pp.
- Eckholm, E. P. 1980. The other energy crisis: Firewood. Pages 63–71 in V. Smil and W. E. Knowland (eds.), *Energy in developing world*. Oxford University Press, New York.
- Eckholm, E. P., and L. R. Brown. 1977. Spreading deserts—the hand of man. *Worldwatch* paper 13. Worldwatch Institute, Washington, D.C. 40 pp.
- Eckholm, E. P., G. Foley, G. Barnard, and L. Timberlake. 1984. Fuelwood: The energy crisis that won't go away. International Institute for Environment and Development, London. 107 pp.
- FAO. 1988. Rural development. Special Issue, Rome. 16 pp.
- Farmer, B. H. 1974. Agricultural colonization in India since independence. Oxford University Press, New York. 372 pp.
- Fox, J. 1983. Managing public lands in a subsistence economy: The perspective from a Nepali village. PhD dissertation. University of Wisconsin, Madison. 225 pp.
- Geertz, C. 1968. Agricultural involution: The processes of ecological change in Indonesia. University of California Press, Berkeley/Los Angeles. 176 pp.
- Hirsch, P. 1990. Forests, forest reserve, and forest land in Thailand. *The Geographical Journal* 156:166–174.
- Hudson, N. W. 1987. Keynote address. Pages 4–14 in S. Jantawat (ed.), *Proceedings of the international workshop on soil erosion and its counter measures*. 11–19 November 1984. Chiangmai, Thailand.
- Ives, J. D., and B. Messerli. 1989. The Himalayan dilemma: Reconciling development and conservation. Routledge, London. 295 pp.
- Klee, G. A. (ed.). 1980. *World systems of traditional resources management*. Arnold, London.
- Ladejinsky, W. I. 1977. Tenurial conditions in Nepal. Pages 316–323 in L. J. Walinsky (ed.), *The selected papers of Wolf Ladejinsky. Agrarian reform as unfinished business*. Oxford University Press, New York.
- Lanly, J. 1982. Tropical forest resources. FAO, Rome. 106 pp.
- Lipton, M. 1977. Why poor people stay poor. A study of urban bias in world development. Temple Smith, London. 467 pp.
- Maikhuri, R. K., and P. S. Ramakrishnan. 1990. Ecological analysis of a cluster of villages emphasising land use of dif-

- ferent tribes in Meghalaya in north-east India. *Agriculture, Ecosystem and Environment* 31:17–37.
- Manners, I. R. 1980. The Middle East. Pages 38–66 in G. A. Klee (ed.), *World systems of traditional resource management*. Arnold, London.
- Metzner, J. 1977. Man and environment in eastern Timor: A geoecological analysis of the Baucau–Viqueque area as a possible basis for regional planning. Australian National University, Canberra. 380 pp.
- Mgeni, A. S. M. 1985. Soil conservation in Kondoa District, Tanzania. *Land Use Policy* 2:205–209.
- Murton, B. J. 1980. South Asia. Pages 67–99 in G. A. Klee (ed.), *World systems of traditional resource management*. Arnold, London.
- Myers, N. 1981. Deforestation in the tropics: Who gains, who loses? Pages 1–23 in V. H. Sutlive, N. Altshuler, and M. D. Zamora (eds.), *Where have all the flowers gone? Deforestation in the Third World*. Department of Anthropology, College of William and Mary, Williamsburg, Virginia.
- Myers, N. 1988. Environmental degradation and some economic consequences in the Philippines. *Environmental Conservation* 15:205–214.
- Pereira, H. C. 1980. Land use improvement in the Himalayas. FAO/UNDP/HMG, Kathmandu. 5 pp.
- PIC (Planning Commission, India). 1960. Third five-year plan, 1961–1965. New Delhi. 774 pp.
- Redclift, M. 1984. *Development and the environmental crisis. Red or green alternatives?* Methuen, London. 149 pp.
- Redclift, M. 1989. The environmental consequences of Latin America's agricultural development: Some thought on Brundtland Commission report. *World Development* 17:365–377.
- Regmi, M. C. 1977. *Land tenure and taxation in Nepal*. Ratna Pustak Bhandar, Kathmandu. 895 pp.
- Repetto, R. 1987. Economic incentives for sustainable production. *Annals of Regional Science* 21:44–59.
- Russel, S. D. 1986. Mountain people in the Philippines: Ethnographic contributions to upland development. Pages 43–85 in S. Fujisaka, P. E. Sajise, and R. A. del Castillo (eds.), *Man, agriculture and the tropical forest: Change and development in the Philippine upland*. Winrock International, Bangkok.
- Sampson, R. N. 1987. The restructuring of agriculture and forestry. *Journal of Soil and Water Conservation* 42:316–320.
- Sauer, C. O. 1956. The agency of man on the earth. Pages 49–69 in W. L. Thomas, C. O. Sauer, M. Bates, and L. Mumford (eds.), *Man's role in changing the face of the earth*. University of Chicago Press, Chicago.
- Smil, V. 1981. Land use and management in the People's Republic of China. *Environmental Management* 5:301–311.
- Soewardi, B. 1983. Indonesia. Pages 13–140 in Swidden cultivation in Asia, Vol. 1. UNESCO, Bangkok.
- Spencer, J. E. 1966. *Shifting cultivation in southeastern Asia*. University of California Press, Los Angeles. 247 pp.
- Stomgaard, P. 1988. Soil and vegetation changes under shifting cultivation in the Miombo of East Africa. *Geografiska Annaler* 70B:363–374.
- Swardjo, A. 1986. Land development for transmigration areas in Sumatra and Kalimantan. Pages 131–139 in R. Lal, P. A. Sanchez, and R. W. Cummings (eds.), *Land clearing and development in the tropics*. A. A. Balkema, Rotterdam.
- Thapa, G. B. 1990. *Integrated watershed management in the Upper Pokhara Valley*. PhD dissertation submitted to the Division of Human Settlements Development, Asian Institute of Technology, Bangkok. 401 pp.
- Thapa, G. B., and K. E. Weber. 1989. Population and environment in the hills of Nepal. *Asia-Pacific Population Journal* 4(2):49–70.
- Thapa, G. B., and K. E. Weber. 1990. Actors and factors of deforestation in tropical Asia. *Environmental Conservation* 17(1):19–27.
- Uhlig, H. (ed.). 1984. *Spontaneous and planned settlement in Southeast Asia*. Institute of Asian Affairs, Hamburg. 331 pp.
- Walker, A. R. 1975. Northern Thailand. Hills and valleys, hillmen and lowlanders. Pages 1–17 in A. R. Walker (ed.), *Farmers in the hills: Upland peoples of north Thailand*. Penerbit Universiti Sains Malaysia, Pulau Pinang.
- Weber, K. E. 1969. Shifting cultivation among Thai peasants. Some working hypotheses. Pages 67–87 in *Problems of land use in South Asia*. Harrassowitz, Wiesbaden.
- Whitlow, R. 1988. Potential versus actual erosion in Zimbabwe. *Applied Geography* 8:87–100.
- World Bank, 1974. *Land Reform*. New York. 70 pp.
- WCED (World Commission on Environment and Development). 1988. *Our common future*. Oxford University Press, Oxford. 400 pp.
- WRI and IIED (World Resources Institute and International Institute for Environment and Development). 1987. *World Resources 1987*. New York. 369 pp.