NATURAL RESOURCES AND THE RURAL ECONOMIC GROWTH STRATEGY FOR ASIA AND THE NEAR EAST IN THE 1990'S

by

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The Challenge

Agricultural growth in Asia and the Near East during the past two decades has been no less than remarkable, whether by comparison to earlier years or to other regions (see Tables 1 and 2). Food production, income levels, nutrition and poverty alleviation have all registered significant real improvements. AID's agricultural strategy that focussed on agricultural production and basic needs through programs aiming to improve the productivity of small and marginal farmers, has been a significant factor in this success. The instruments of this strategy have been the expansion of the supply of critical inputs, water, fertilizer and agrochemicals, the development of new agricultural technologies, and the formulation of price incentives to promote adoption of the new inputs and technologies.

The challenge for the 1990's is to sustain agricultural growth into the future and to spread its benefits more widely. The threats to sustainability come from both the demand and the supply sides. The demand for agricultural growth has diminished as a result of past successes. Large food deficit countries such as India, Indonesia and Philippines have attained self-sufficiency in their main staples and agricultural exporters, such as Thailand, Malaysia and Pakistan, have faced surpluses and depressed

commodity prices. Despite a recent price recovery, it is unlikely that agricultural growth will be as consuming a goal in the 1990's as it was in the 1960's and 1970's. This is particularly true for the middle-income industrializing countries such as Thailand and Tunisia and some of the low-income transitional economies such as Morocco and Indonesia. Governments facing tight budgets are looking for ways to reduce subsidies associated with food, fertilizer and pesticide policies that have become major drains on the budget.

On the supply side, the past "extensive" sources of growth are no longer available. The land frontier is all but exhausted. The most suitable sites for irrigation have already been taken up; further expansion of irrigation faces a steeply rising supply curve. High yielding varieties, especially for cereals, have already been adopted; where they have not, it is largely due to natural resource constraints and environmental problems. Few technological breakthroughs are expected in the next few years, and given the adoption lag they cannot become a major source of growth in the 1990's. Heavier use of pesticides is probably counterproductive and environmentally imprudent. Above and beyond these resource constraints there are underlying environmental problems and stresses which are the legacy of past policies and growth patterns. A major such problem is degraded watersheds due to indiscriminate logging and uncontrolled agricultural extensification. Degraded watersheds result in loss of water control, soil erosion and flooding during the rainy season (as experienced recently in Bangladesh, Thailand and the Philippines), inadequate water supply during the dry season and siltation of water bodies

and irrigation systems downstream.

A second major problem is rapidly deteriorating irrigation systems due to siltation and poor maintenance, the result of inadequate cost recovery and overemphasis on construction of new systems than improving the efficiency of existing systems (see Tables 4 and 5). A third problem is the expansion of saline and waterlogged soils due to overirrigation, itself the result of failure to attain rational allocation of scarce irrigation water via water pricing or other effective mechanisms (see Tables 4, 5, and 6). A fourth problem is soil erosion and inefficient land use, the result of insecurity of land ownership (see Tables 7-15). A fifth problem is the destruction of natural predators of agricultural pests and the emergence of pesticide-resistant strains of pests (see Figure 1), the documented result of excessive use of pesticides in the past (e.g. Java) (see Tables 15a and 15b). Last but certainly not least, is the increasing loss of genetic material and the narrowing of the genetic resource base of agriculture due to tropical deforestation and expansion of monocultures (see Tables 16 and 17). These problems are already manifesting themselves in slowing and slipping yields despite increased input use in many Asian and Near East countries (see Figure 1).

The challenge for the 1990's is to rekindle the interest in continued agricultural growth, find new dynamic sources of growth and ensure the sustainability of yield growth by addressing effectively the resource-base degrading legacies of the past. This is not a small challenge. Yet is is not all. As the AID draft agricultural strategy for the 1990's states,

"past increases in average per capita consumption levels, while a significant accomplishment, mask the fact that millions in the regions remain in the grip of poverty and malnutrition" (ANE/TR/ARD January 1989, p. 3). This is the rest of the challenge: to develop cost-effective strategies to spread the benefits from agricultural growth more widely especially to people in areas of low agricultural productivity, fragile environment and scarcity of employment opportunities.

An Opportunity

The challenge appears formidable enough, perhaps impossible if it is to be met with reduced rather than increased budgetary outlays. Yet, there is an opportunity, a unique yet subtle opportunity that could easily be missed, as wel look for a spectacular new discovery, a new miracle seed that would start a new Green Revolution. No such technological fix is in sight and even if one comes about soon it is unlikely to have an impact during the 1990's. What about the use of more imputs: more land, more irrigation, more fertilizer and pesticides, more adoption of high-yielding varieties? As we have indicated earlier, these factors are facing either supply constraints (land and irrigation), reduced incentives (fertilizer and agrochemicals), or environmental constraints (adoption of high-yielding varieties). In certain areas selective expansion of input use will help but this is not the great opportunity facing agriculture in Asia and the Near East in the 1990's.

The opportunities for the future are to be found in the "failures" of

the past: (1) excessive government intervention at the expense of private sector initiative; (2) excessive protection of domestic agriculture at the expense of agricultural trade; (3) inadequate integration of agriculture into the larger economic system and lack of coordination of agricultural policy with macroeconomic policy; (4) overemphasis on "extensive" development of physical, financial and human resources at the expense of intensive management; and (5) inadequate attention to the preservation and maintenance and management of the resource base of agriculture, the very foundation of sustainable agricultural growth. These may not be policy failures when viewed from the perspective of the past. The 1960's and the 1970's were facing different constraints and opportunities: those were times of resource abundance, major agricultural breakthroughs, rapid population growth, and large food deficits. Agriculture was the dominant sector, food security a paramount national concern, and the need for development of physical, human and financial resources intense. Extensive government intervention and protection of domestic producers was necessary to provide price incentives for adoption of the new technologies to increase food production and incomes. These policies may have been appropriate and successful, perhaps too successful, under those conditions. But, they are no longer relevant as a general policy prescription or strategy, because circumstances have changed.

The 1980's and 1990's are times of rapid structural change and transition, times of relative food "abundance" and increasing resource scarcity, times of tight budgets and increased opportunities for agricultural trade. Inward-looking trade policies and many agricultural

subsidies have outlived their usefulness. As stated in the draft agricultural policy: "The increased profitability associated with the widespread acceptance of new technologies and the government cost increases call into question both the continued need for and the financial sustainability of current subsidy packages" (p. 2).

A Response

The changing circumstances in both Asia and the Near East and the United States present AID with a unique opportunity to meet the challenge even with a dwindling foreign assistance budget. The response outlined in the draft strategy goes a long way towards meeting the challenge in an effective way. There is no doubt that continued growth production, agroprocessing, trade and market development, human capital institutional development and agricultural policy are critically important and should rank as top priorities.

Unfortunately, natural resource management has barely made the list of priority activities even though the strategy states that "sound management of a nation's natural resource base is an important component of ANE's strategic objective of sustained income and employment growth" (emphasis mine). Yet natural resource management is ranked last, because of low marks for impact on income and employment. This is, in turn, the result of viewing the maintenance and management of the resource base of agriculture as an important component, not as an integral part and the very foundation of sustainable agricultural growth.

The mere inclusion of natural resource management in the agricultural strategy is a major step forward, a pioneer step that one hopes will have a catalytic impact on developing countries and other development assistance agencies such as Japan and the multilaterals. Yet, one fears that as the 1990's draw to a close, it may turn out that the inclusion of natural resource management as an "important," yet low in priority, component rather than an integral part of the strategy was too little, too late and for the wrong reason.

Too little, because the attainment of other objectives and priorities, such as increased staple cereal production, intrinsically depend on the health of the resource base. How is the staple cereal production to increase on a sustainable basis if the irrigation systems continue to deteriorate and siltate, if soil erosion and flooding accelerate, if pesticide-resistant pests proliferate and if the genetic base of crops continues to narrow? Certainly, the development of flood-, drought-, and pest-resistant crop varieties is part of the answer. This is why it is critical that agricultural production technology remains a top priority of the strategy. Yet, one fears that technological improvements may not be sustainable or may be offset by losses in area and productivity if the resource base continues to be eroded.

Too late because the strategy seems to suggest that the emphasis of the natural resources component would be in middle-income industrializing economies, not in low-income agricultural economies (or even low-income

transitional economies) because "governments in low-income agricultural economies do not view natural resource conservation investments as matters of high priority. Officials often regard objectives of increased production and natural resource conservation as conflicting at least in the short-run" (draft agricultural strategy, p. 12). Evidence, however, from both Asia and Africa strongly suggests that the poorer the country, the more interdependent are agricultural production and resource conservation, even in the very short run. Java, for instance, almost lost half of its crop to the brown planthopper because of heavy pesticide use encouraged by generous pesticide subsidies. The decline of agricultural production in Africa is due in no small measure to the degradation of the resource base.

A second difficulty with the adopted approach is that it seems to assume that the environmental degradation is reversible. At least in the tropics, land degradation is often irreversible because of the poverty of the soils, the heavy rainfall and high temperatures. But even in the Near East, desertification is thought to be largely an irreversible process. Thailand is a prime example from the tropics. Reforestation and land rehabilitation are becoming formidable tasks.

Lastly, and perhaps more importantly, although it is true that agricultural production and natural resource management are perceived by host governments as competing with each other for limited resources, AID could play a catalytic role in changing this perception, as it has done in countless other cases in the past.

While the increased power of special interest groups, particularly environmental, and the pressures from U.S. Congress are good reasons for including natural resource management in AID's agricultural strategy, there is an even more fundamental reason: without protection and rehabilitation of agriculture's deteriorating resource base, the other objectives and activities of AID's agricultural strategy might be in jeopardy. Moreover, AID has a unique opportunity to be a pioneer and a catalyst in a critical area of development and it can do this with very limited resources. It is a unique opportunity that should not be left unexploited.

A natural resources strategy for sustainable agricultural development is outlined in the following related papers:

Panayotou, T., "Natural Resource Management: Strategies for Sustainable Asian Agriculture in the 1990's," a paper prepared for the USAID/HIID Symposium on Agricultural Strategy in the 1990;s in Asia and the Near East, Washington, DC, September 6-9, 1988.

_____, "Management of Natural Reources for Sustainable Development: Market Failures, Policy Distortions and Policy Options," a paper prepared for USAID/Thailand, Bangkok, May 1988.

_____, "Economics, Environment and Development," Development Discussion Paper No. 259, Harvard Institute for International Development, Cambridge, MA, December 1987.

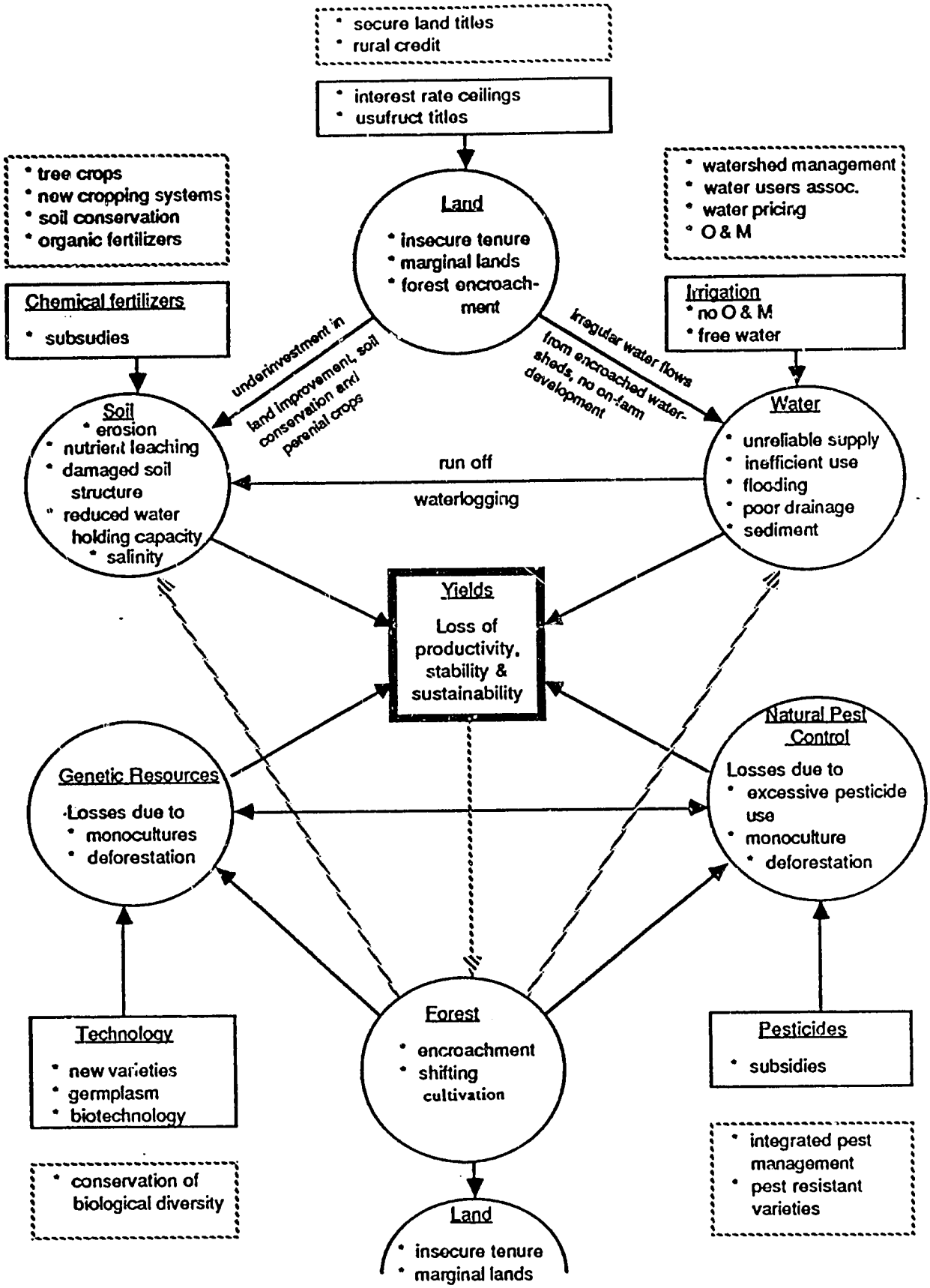


Figure 1: Loss of agricultural growth due to mismanagement of the agricultural resource base. Entries in the solid line rectangles indicate inferior or inadequate management policies. Entries in broken-line rectangles indicate superior or supplementary policies for improved resource management.

Source: Panayotou, T., "Natural Resource Management: Strategies for Sustainable Asian Agriculture in the 1990s," HIID/USAID Symposium on Agricultural Strategies in the 1990s in Asia and the Near East, Washington, DC, Sept. 6-9 1988.

Table 1.

Production of Selected Food Crops, 1965–86

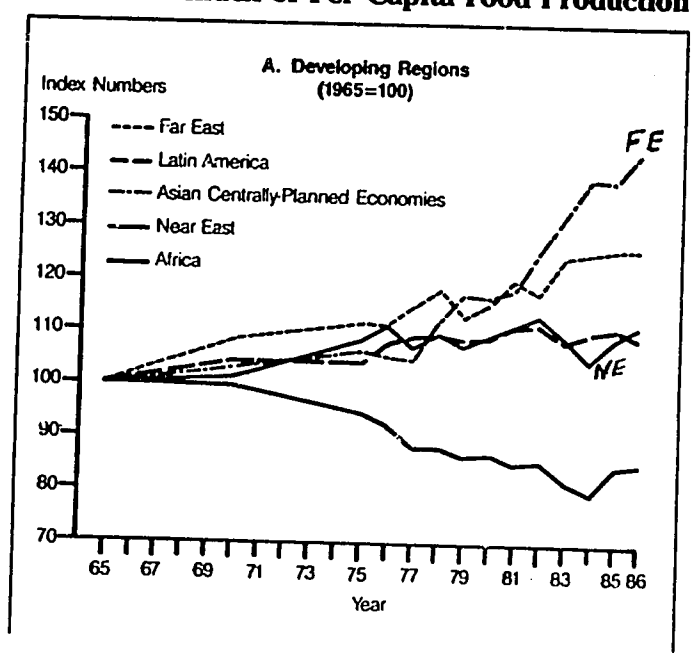
(thousand metric tons)

	1965	1970	1975	1980	1982	1983	1984	1985	1986
World	1,005,926	1,205,128	1,372,727	1,567,472	1,701,537	1,643,156	1,803,902	1,847,436	1,870,109
Developing Countries	470,248	587,418	683,263	770,799	831,546	889,742	920,2[illegible]	928,135	949,654
Africa	37,877	43,087	47,679	49,957	51,244	45,229	46,094	60,528	62,966
Far East	157,652	212,254	239,075	273,652	275,965	316,348	318,692	325,197	328,949
Latin America	57,640	71,307	80,545	88,498	105,318	98,593	106,667	109,441	108,678
Near East	37,821	39,962	51,689	55,536	58,541	56,746	53 829	62,785	67,078
Asian Centrally Planned Economies	179,240	220,779	264,245	303,114	340,434	372,788	394,946	370,142	381,938

Quoted from World Resources Institute, World Resources 1988-89, New York, Basic Books, Inc., p. 52.

Table 2.

Index of Per Capita Food Production



Quoted from World Resources Institute, World Resources 1988-89, New York, Basic Books, Inc., p. 53.

Table 3.

Deforestation in Tropical Countries, 1981–85

Country	Closed Forest Area, 1980 (thousand hectares)	Annual Rate of Deforestation 1981–85 (percent)	Area Deforested Annually (thousand hectares)
Indonesia	123235	0.5	600
India	72521	0.2	147
Burma	32101	0.3	105
Kampuchea, Dem	7616	0.3	25
Papua New Guinea	34447	0.1	22
Malaysia	21256	1.2	255
Thailand	10375	2.4	252
Lao People's Dem Rep	8520	1.2	100
Philippines	12510	0.7	91
Nepal	2128	3.9	84
Vietnam	10810	0.6	65
Sri Lanka	2782	2.1	58

Quoted from World Resources Institute, World Resources 1986, New York, Basic Books, Inc., p. 72.

Table 4.

Irrigation Service Fees Paid by Farmers Compared to Public Irrigation System Costs, Selected Asian Countries[a]

Country	Actual Revenue from Service Fees (dollars per hectare)	Operating and Maintenance Costs (dollars per hectare)	Fees as a Proportion of Operating and Maintenance Costs (percent)	Total Capital and Operating Costs (dollars per hectare)		Fees as a Proportion of Total Costs (percent)	
				Moderate Estimate	High Estimate	Moderate Estimate	High Estimate
Indonesia	25.90	33.00	78.5	191	387	13.6	6.7
South Korea	192.00	210.00	91.4	1057	1523	18.2	12.6
Nepal	9.10	16.00	56.9	126	207	7.2	4.4
Philippines	16.85	14.00	120.4	75	166	22.5	10.2
Thailand	8.31	30.00	27.7	151	272	5.5	3.1
Bangladesh (major surface systems)	3.75	21.00	17.9	375	X	1.0	.X

Sources: For Bangladesh: Q. Shahabuddin, "Irrigation Water Charges, Subsidies, and Cost Recovery in Bangladesh, paper prepared for the World Resources Institute, September 1985; for all other countries: Leslie E. Small, Marietta S. Adriano, and Edward D. Martin, "Regional Study on Irrigation Service Fees: Final Report," International Irrigation Management Institute, Kandy, Sri Lanka, January 1986, as adapted from R. Repetto, *Skimming the Water: Rent-Seeking and the Performance of Public Irrigation Systems* (World Resources Institute, Washington, D.C., 1986) Table 1, p. 5.
Note: a. Figures obtained by converting local currency values at official exchange rates prevailing in June 1985.
X = not available.

Quoted from World Resources Institute, World Resources 1988-89, New York, Basic Books, Inc.

Table 5.

Economic Rents in Public Irrigation Systems

Country	Charges as a Percentage of Farmer Benefits
Indonesia	8–21
Korea	26–33
Nepal	5
Philippines	10
Thailand	9
Pakistan[a]	6
Mexico	11–26

Sources: Based on Leslie E. Small, Marietta S. Adriano, and Edward D. Martin, "Regional Study on Irrigation Service Fees: Final Report," International Irrigation Management Institute, Kandy, Sri Lanka, January 1986, Table 5, p. 37; Muhammed A. Chaudry, "Water Charges, Cost Recovery, and Irrigation Subsidies in Pakistan," prepared for the World Resources Institute, Washington, D.C., 1985; and Ronald Cummings and Victor Brajer, "Water Subsidies in Mexico's Irrigated Agricultural Sector," paper prepared for the World Resources Institute, Washington, D.C., 1985, cited in Robert Repetto, *Skimming the Water: Rent-Seeking and the Performance of Public Irrigation Systems* (World Resources Institute, Washington, D.C., 1986), Table 3, p. 13.
Note: a. Punjab Province, major irrigated crops, surface irrigation.

Quoted from World Resources Institute, World Resources 1988-89, New York, Basic Books, Inc.

Table 6.

Irrigation and Salinization, 1974–84

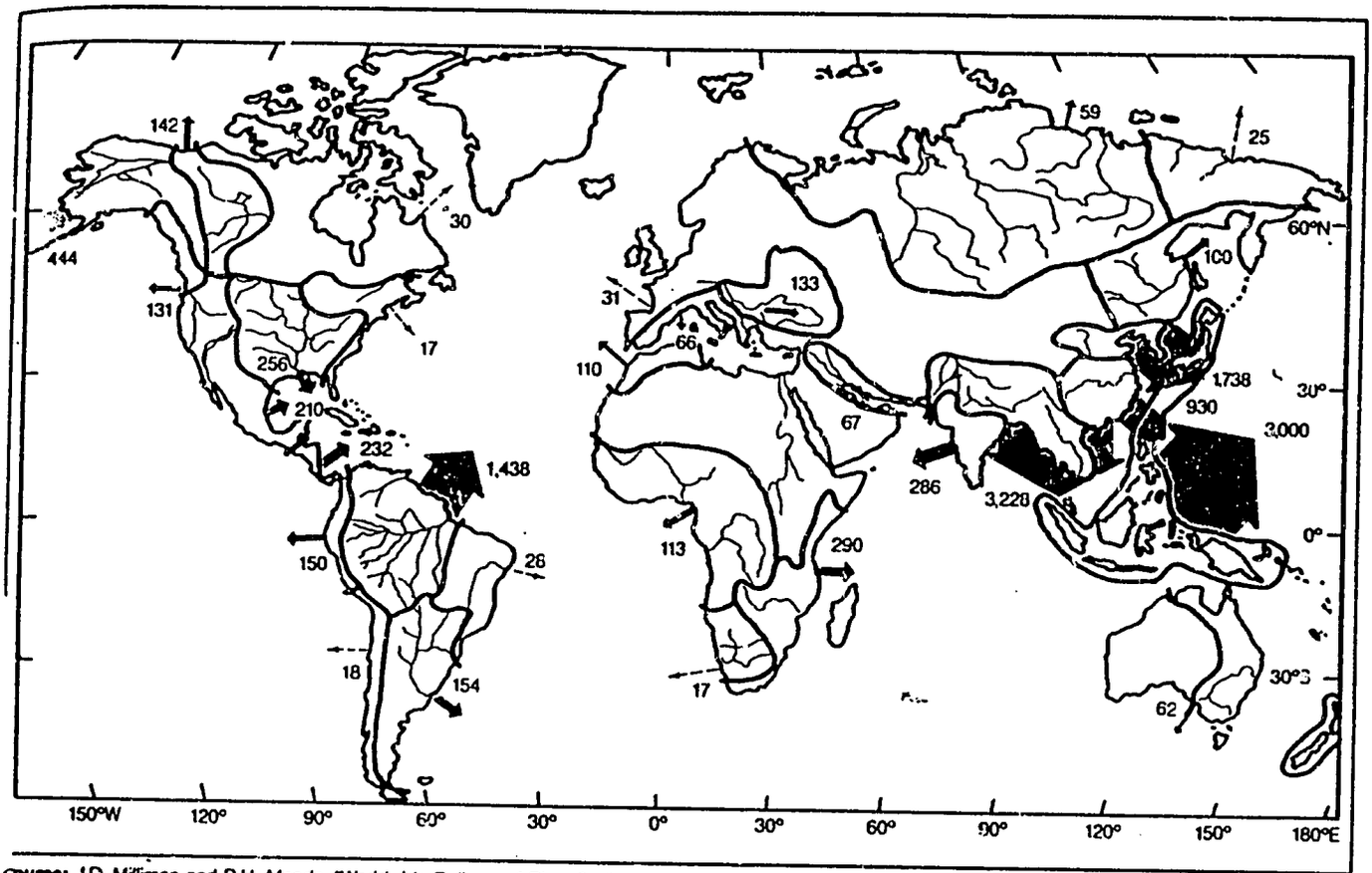
	Area Irrigated 1984 (thousand hectares)	Percentage Change Over 1974-76	Percentage of Irrigated Lands Affected by Salinization
Bangladesh	1,920	42	
Burma	1,064	9	
Nepal	640	176	
Oman	42	24	
Pakistan	15,320	13	<40
Philippines	1,430	30	
India	39,700	18	27
Indonesia	5,420	12	
Thailand	3,550	47	
Morocco	520	22	
Egypt	2,414	−12	30–40
Jordan	38	6	16
Sri Lanka	550	15	13
Tunisia	210	71	
Yemen	245	7	
Yemen, Dem	62	9	

Sources: U.N. Food and Agriculture Organization; and other sources.
0 = zero or less than half of 1 percent; X = not available; blank = no data available or salinization not a significant problem.
For additional information, see Sources and Technical Notes.

Quoted from World Resources Institute, World Resources 1987, New York, Basic Books, Inc., p. 280.

Figure 2.

Annual Discharge of Suspended Sediment from Various Drainage Basins of the World



Source: J.D. Milliman and R.H. Meade, "Worldwide Delivery of River Sediment to the Ocean," *Journal of Geology*, vol. 91 (January 1983), p. 16.
Note: Width of arrows corresponds to relative discharge of sediment. Numbers refer to average annual input in millions of metric tons. Direction of arrows does not indicate direction of sediment movement.

Quoted from World Resources Institute, World Resources 1986, New York, Basic Books, Inc.

Table 7.

Soil Erosion in Selected Countries, 1970–86

	Extent and Location	Affected Area as Percentage of National Area	Amount of Erosion (metric tons per year)	Rate of Erosion (metric tons per hectare per year)	Year of Estimate
ASIA					
Burma	Irrawaddy River basin (43,000 ha)	.07	X	139	1980s
China	Loess Plateau region (60 million ha)	6.4	X	11-251	1980
India	Seriously affected cropland (80 million ha)	27	6 billion	75	1975
	Cultivated land Deccan Black Soil region	X	X	40-100	1980s
Indonesia	Brantas River basin, Java	X	X	43	1970s
Nepal	Entire country	100	240 million	35-70	X
Turkey	Entire country	100	5 million	X	1980s
Yemen	Abandoned terraces Serat Mountains (4,900 ha)	0.03	X	150-400	1984

Source: World Resources Institute and International Institute for Environment and Development. X = not available.
For additional information, see Sources and Technical Notes.

Quoted from World Resources Institute, World Resources 1987, New York, Basic Books, Inc., p. 281.

Table 8.

Estimated Annual Soil Erosion, Selected River Basins

River	Outflow	Area of Drainage Basin (thousand square km)	Average Annual Suspended Load (million metric tons)	Estimated Annual Soil Erosion From Field (metric tons per hectare)
Niger	Gulf of Guinea	1,114	5	0
Congo	Atlantic Ocean	4,014	65	3
Nile	Mediterranean Sea	2,978	111	8
Amazon	Atlantic Ocean	5,776	363	13
Mekong	South China Sea	795	170	43
Irrawady	Bay of Bengal	430	299	139
Ganges	Bay of Bengal	1,076	1,455	270
Huang (Yellow)	Yellow Sea	668	1,600	479

Source: El-Swaify et al., Soil Erosion and Conservation in the Tropics, American Society of Agronomy (Madison, Wisconsin, 1982), p. 8.

Quoted from World Resources Institute, World Resources 1986, New York, Basic Books, Inc., p. 53.

Table 9.

ESTIMATED ANNUAL COSTS OF IRRIGATION AND HYDROELECTRIC POWER LOSSES DUE TO SEDIMENTATION OF RESERVOIRS

	Hydropower (Annual)	Irrigation (Annual)	Total Capitalized Value
Estimated Output	2,738,412 MWh	277,671 ha	
Value (Rp/unit)	70/KWh	1,244,000/ha	
Annual Losses Due to Sedimentation			
Based on Loss of Total Storage (0.5)			
Lost Output	13,692 MWh	1,388 ha	
(Rp)	958,440,000	1,726,672,000	26,851,120,000
(US$)	580,873	1,046,468	16,273,410
Based on Loss of Dead Storage (2.3%)			
Lost Output	62,983.5	6,386 ha	
(Rp)	4,408,800,000	7,944,184,000	123,529,840,000
(US$)	2,672,027	4,814,657	74,866,840

Source: W.B. Magrath and P.L. Arens, "The Costs of Soil Erosion on Java -- A Natural Resource Accounting Approach," World Resources Institute, 1987.

Table 10.

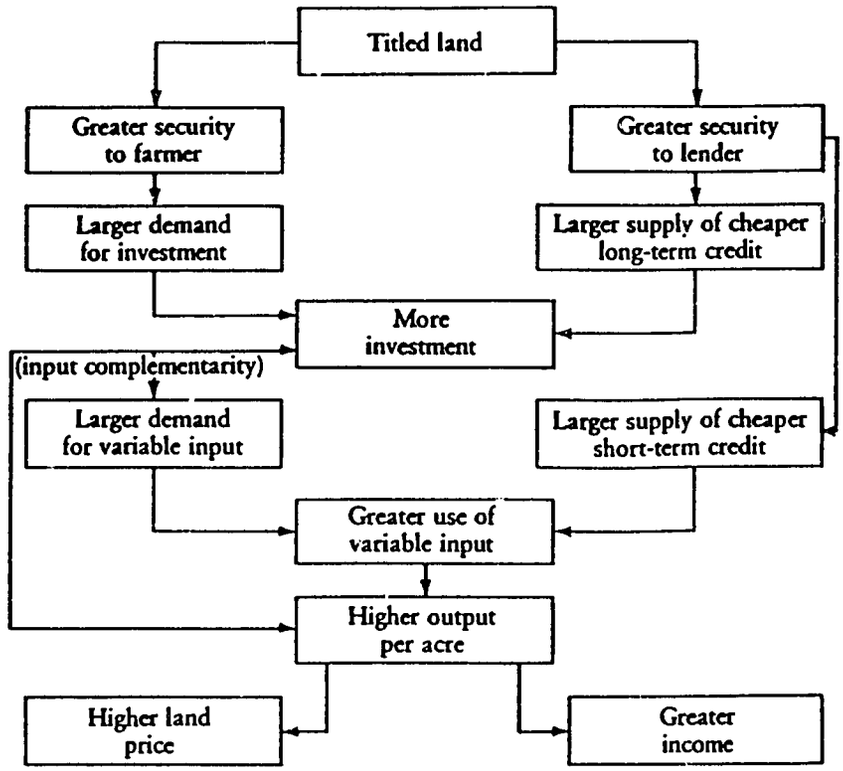
TOTAL ESTIMATED ANNUAL COSTS OF SOIL EROSION ON JAVA
($ 000,000)

	West Java	Central Java	Jogyakarta	East Java	Java
On Site	141.5	27.0	5.7	149.6	323.9
Off Site					
Irrigation System Siltation	1.7--5.7	0.8--2.7	0.1--0.5	1.2--4.0	7.9--12.9
Harbor Dredging (1984/85)	0.4--0.9	0.1--0.3	---	0.9--2.2	1.4--3.4
Reservoir Sedimentation	9.0--41.3	3.5--16.3	---	3.8--17.3	1.63--74.9
TOTAL	152.6--189.4	31.4--46.3	5.8--6.2	155.5--173.1	349.5--415.1

Source: W.B. Magrath and P.L. Arens, "The Costs of Soil Erosion on Java -- A Natural Resource Accounting Approach," World Resources Institute, 1987.

Table 11

Security of Landownership and Farm Productivity: A Conceptual Framework



Source: G. Feder, et. al., Land Policies and Farm Productivity in Thailand, Baltimore, Johns Hopkins University Press, 1988.

Table 12.

Capital per Rai Owned, by Title Status

Item	Province							
	Lop Buri		*Nakhon Ratchasima*		*Khon-Kaen*		*Chaiyaphum*	
	Untitled farmers	*Titled farmers*	*Untitled farmers*	*Titled farmers*	*Untitled farmers*	*Titled farmers*	*Untitled farmers*	*Titled farmers*
Capital value (baht per rai)	729	915	809	1,332	700	1,378	694	738
Capital value adjusted for differences in land quality[a]	729	906	809	1,177	700	1,238	694	738
Mean land-quality index[b]	92	93	76	86	71	79	83	83
Number of plots in sample	100	84	89	72	61	82	120	112

Note: 6.25 rai = 1 hectare.

a. To adjust for differences in quality of land, the capital per rai of the titled farmers is divided by the ratio of the quality index of titled land to the quality index of untitled land.

b. The quality index is based on parameters estimated in the hedonic price equations reported in chapter 7.

Source: G. Feder, et. al., Land Policies and Farm Productivity in Thailand, Baltimore, Johns Hopkins University Press, 1988.

Table 13.

Costs and Benefits of Land Ownership Security in Thailand

Province	Price of untitled land (P_{nt})	Cost of titling: Full title (% P_{nt})	Benefits from titling: Private benefits (% P_{nt})	Gross social (% P_{nt})	Net social % P_{nt}	Net social (baht/rai)
Naichon R.	3,448	3.3	130	82.9	79.6	2,745
Khun-Kaen	3,204	3.5	113	80.5	77.0	2,467
Chaiyaphun	719	5.6	54	41.3	35.7	719
Northeast	1,852	4.1	NA	68.2	64.1	1,852

P_{nt} = price of untitled land (in baht)

Source: G. Feder, et.al., Land Policies and Farm Productivity in Thailand, Baltimore, Johns Hopkins University Press, 1988.

Table 14.

Estimates of extent (thousand ha) of shifting cultivation for selected countries in Asia, 1981. Rao 1983.

Country	Population dependent on shifting cultivation (1.000)	Total area affected by shifting cultivation
Bangladesh	108	1000
Brunei	20	120
Burma	2600	1420
Fiji	-	200
India	2700	10 000
Indonesia	12000	35 000
Lao	1000	3000
Malaysia	1640	4700
Papua New Guinea	1000	4000
Philippines	830	2000
Solomon Islands	20	?
Sri Lanka	60	1000
Thailand	1000	4000
Vietnam	5000	8000
Total	27 978	74 443

Source: The International Board for Soil Research and Management, Inc., Tropical Land Clearing for Sustainable Agriculture, Jakarta, 1985.

Table 15.

Forest area and families involved in shifting cultivation in Indonesia, 1985.

Island	Estimated area of shifting cultivation[1] (000 ha)	Total forest area[2] (000 ha)	Proportion of forest area in shifting cultivation (%)	Number of families in shifting cultivation[3] (000)	Proportion of total population in shifting cultivation (%)
Sumatra	924	30 208	3.1	262	4.9
Nusa Tenggara	568	5547	10.2	251	23.0
Kalimantan	4477	44 967	10.0	228	17.3
Sulawesi	1352	12 879	10.5	243	12.7
Total	7321	93 601	7.8	984	9.2

Source: The International Board for Soil Research and Management, Inc., Tropical Land Clearing for Sustainable Agriculture, Jakarta, 1985.

Table 15a.

Pesticide Subsidies in Selected Countries, Early 1980s

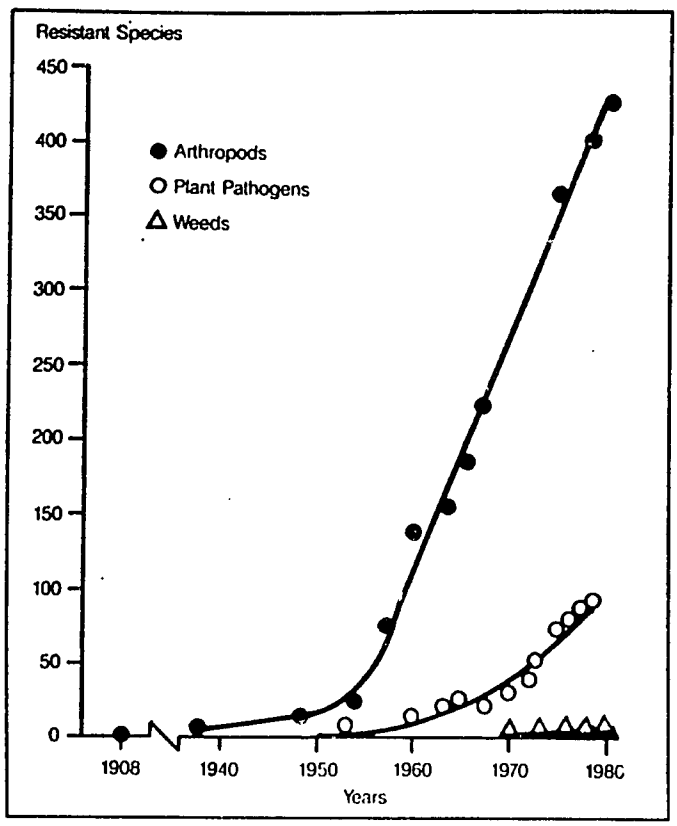
Region and Country	Annual Value of Subsidy (million U.S. dollars)	Size of Subsidy (percentage of full retail cost)
Africa		
Senegal	4	89
Egypt	207	83
Ghana	20	67
Latin America		
Honduras	12	29
Colombia	69	44
Ecuador	14	41
Asia		
Indonesia	128	82
China	285	19

Source: Robert Repetto, *Paying the Price: Pesticide Subsidies in Developing Countries* (World Resources Institute, Washington, D.C., 1985), Table 1, p. 5 and Table 2, p. 6.

Quoted from World Resources Institute, World Resources 1988-89, New York, Basic Books, Inc..

Table 15b.

Growth in Resistant Species of Pests 1900–80



Source: Georghiou and Mellon, "Pesticide Resistance in Time and Space," in Dover, *Getting Tough: Public Policy and the Management of Pesticide Resistance* (World Resources Institute, Washington, D.C., 1985).

Quoted from World Resources Institute, World Resources 1988-89, New York, Basic Books, Inc.

Table 16.

Wildlife Habitat Loss in Indomalayan Nations, 1986[a]

	Original Wildlife Habitat (square kilometers)	Amount Remaining (square kilometers)	Habitat Loss (percent)
Bangladesh	142,77	68,567	94
Bhutan	34,500	22,770	34
Brunei	5,764	4,381	24
Burma	774,817	225,981	71
China[b]	423,066	164,996	61
Hong Kong	1,066	32	97
India	3,017,009	615,095	80
Indonesia	1,446,433	746,861	49
Japan[c]	320	138	57
Kampuchea	180,879	43,411	76
Laos	236,746	68,656	71
Malaysia[d]	356,254	210,190	41
Nepal	117,075	53,855	54
Pakistan	165,900	39,816	76
Philippines	308,211	64,724	79
Sri Lanka	64,700	10,999	83
Taiwan	36,961	10,719	71
Thailand	507,267	130,039	74
Vietnam	332,116	66,423	80
Total	**8,169,860**	**2,487,683**	**68**

Source: John Mackinnon and Kathy MacKinnon, *Review of the Protected Areas System in the Indo-Malayan Realm* (International Union for Conservation of Nature and Natural Resources and United Nations Environment Programme, Gland, Switzerland, 1386), pp. 18-19 and pp. 247-274.

Notes:

a. Excludes Christmas and Cocos Islands (Australia), the Maldives, and the Chagos archipelago (U.K. protection).
b. Tropical portion only (i.e., area south of Yunnan high hills, including the southern coastal strip and the island of Hainan).
c. Tropical portion only (i.e., southern Ryukyu archipelago).
d. Includes Singapore.

Quoted from: World Resources Institute, World Resources 1988-89, New York, Basic Books, Inc.