population environment

by Laurel Heydir

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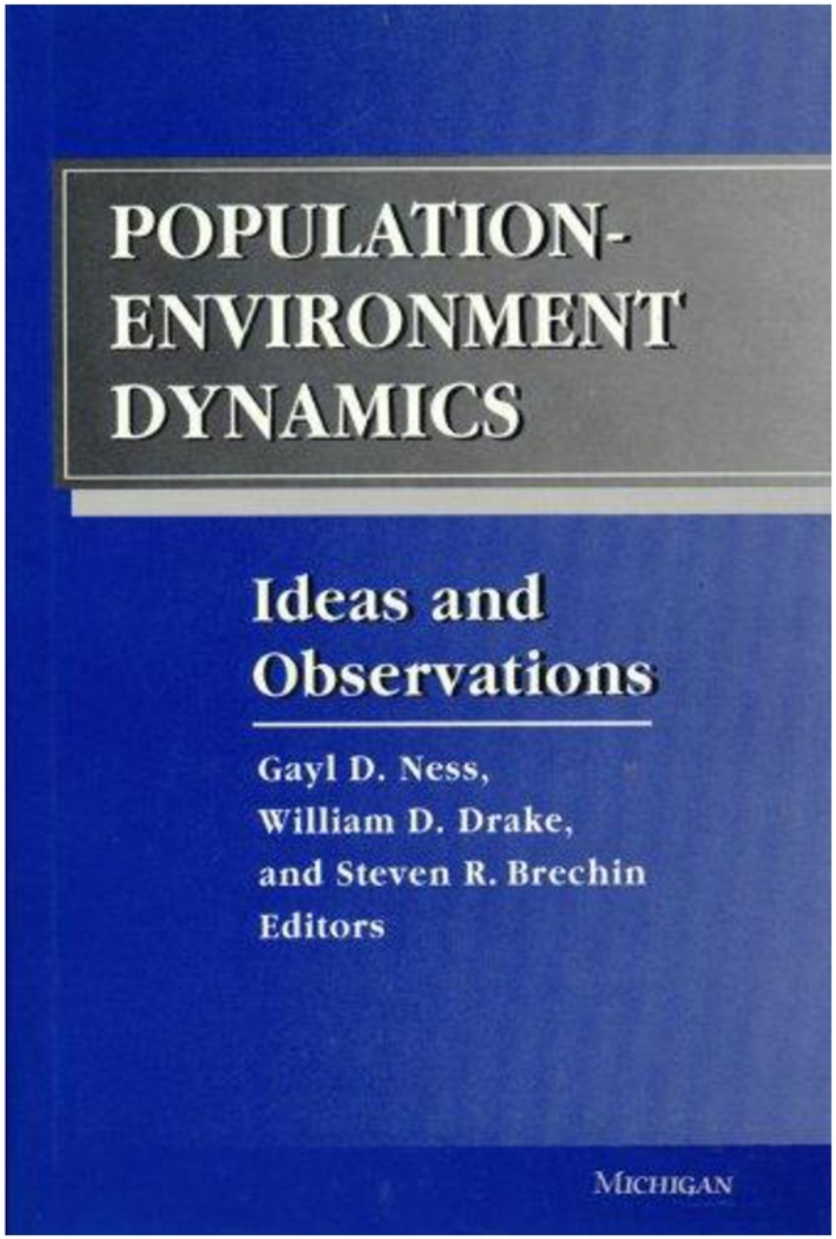

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Contents

SECTION V

Chapter XI

Protected Area Deforestation in South of Sumatera Indonesia

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Introduction

The purpose of this chapter[1] is to explore the relationships between population and the environment found at the local level. Empirically, we attempt to determine why small-scale coffee farmers have deforested large portions of established protected areas (i.e., designated as protection forests and wildlife reserves) within the District of Lahat, South Sumatera, Indonesia. The relationships between population and the environment tend to be complex, fluid, and mediated by a number of additional factors. The relationships between farmers and protected forests found in Lahat are no different.

This more complicated notion of the relationship between population and the environment, however, is frequently overlooked in the literature.[2] Since these are forest areas under a managerial regime, it follows that politico-administrative factors must have contributed to their deforestation. But how important are other factors? And, are they related to changes in population? Finally, from a policy perspective, can we gain any insight from our research into how to best correct local population–environment imbalances?

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1. The information presented here is from an on-going collaborate research effort between The University of Michigan, Ann Arbor, Michigan, USA; Princeton University, Princeton, New Jersey, USA; and Sriwijaya University, Palembang, South Sumatera, Indonesia. Portions of this chapter were presented in a paper at the Third Symposium on Social Science in Resource Management, Texas A&M University, College Station Texas, May 16-19, 1990. This chapter has substantially revised from a paper presented at the International Symposium on Population–Environment Dynamics, The University of Michigan, Ann Arbor, October 1–3, 1990. The authors would like to thank Profs. Stephen Siebert and Jill Belsky, and the Press' reviewers for their useful comments.

2. In his review of the population–environment literature related to development concerns, Myers (1991) is amazed how little actual research has been conducted on the interrelationships of these two important variables. In applying this same observation to a specific resource, the Overseas Development Administration of the United Kingdom makes note strikingly few systematic studies on the links between population and tropical deforestation, hindering our understanding of this important environmental problem (ODA 1991).

The chapter is divided into several sections. It begins with a brief discussion of the literature on tropical deforestation and the status of protected areas. The main body of the chapter contains research findings on the probable causes of protected area deforestation. It also includes a more conceptual analysis of population–environment relationships in general and a review of future policy alternatives.

Tropical Deforestation and Protected Area Status

Deforestation of the world's tropical forests is a major international issue that needs little introduction. Environmentalists and others are concerned about the loss of biological diversity, possible climatic change, the replacement of forests with unsustainable agricultural activities, flooding, erosion, loss of hydrological functions, and more (World Resources Institute 1990-91; Global Coalition 1990; Gradwohl and Greenberg 1988). The pace of tropical deforestation is alarming. The World Resource Institute (WRI) has estimated the rate of tropical deforestation at approximately 20.4 million hectares per year (WRI 1990: 102). This latest estimate almost doubles Food and Agricultural Organization's 1980 estimate of 11.4 million hectares per year (WRI 1988).

From the latest figures on tropical deforestation, Indonesia is ranked third among all countries in annual forest loss, losing an estimated 900,000 hectares of tropical forests each year, (a rate of 0.8 percent per year) (WRI 1990:102). Throughout the tropical countries, including Indonesia, the principal forces behind the deforestation of tropical forests are said to be agricultural expansion (due largely to increasing population), and unsustainable commercial logging. However, both these factors can usually be traced to governmental policies of one form or another (WRI 1988;1990; Repetto 1988); as well as other issues such as the technologies being employed and cultural practices. Specifically, in Indonesia, slash and bum farmers cause about 50 percent of the country's deforestation; the government's resettlement program creates 40 percent and commercial loggers, 10 percent (Repetto & Gillis 1988). Consequently, when attempting to control tropical deforestation in Indonesia, understanding the behavior of rural people and the pressures they face become essential tasks.

Parks and other protected areas throughout the world, likewise, are seriously affected by events originating outside their borders. They include: industrial pollution, excessive tourism, shrinking or nonexistent budgets, land fragmentation, economic development pressures, growing rural populations seeking arable land, and angry residents (Machlis and Tichnell 1985; Meganck and Goebel 1979; Brechin and West 1990; West and Brechin 1991a). Once again the problems facing our world's parks and protected areas can certainly be traced to a number of causes including population growth pressures, economic development activities, changes in lifestyles, poverty, lack of economic alternatives, and short-sighted governmental policies.

In Indonesia, it has been estimated that 17 percent of the country's protected forest areas (i.e., forests that are not to be cut) have either been logged or cultivated by farmers (Vatikiotis 1989). Although there has been some international work to investigate the effect of population factors such as growth and migration on tropical deforestation in general, it has not generally extended to their effects on specific protected areas (Allen and Barnes 1985; Vayda and Sahur 1985; Whitten 1987; Potter 1988; Rudel 1989; and Cruz and Cruz 1990). Likewise, in the study of protected areas, numerous publications have noted the problem of farmers and others encroaching on protected areas (Vogt 1946; Wetterberg 1974; Eckholm 1976; 1978; Meganck and Goebel 1979; Machlis and Tichnell 1985; West and Brechin 1991a). Few, however, have looked at the population–environment dynamics of farmer encroachment in any detail. This case study investigates the socio-political causes of farmer-based tropical deforestation and its effects on conservation management efforts.

Description of Study Site and Methods

South Sumatera is a vast (109,254 square km) province of Indonesia, on Sumatera, one of the country's major outer islands (Sriwijaya University) (figure 11.1). The province was home to about 6.3 million people in 1990, and contains a variety of ethnic groups, 80 percent of whom live in rural areas (1990 Census, and Sriwijaya University). South Sumatera is blessed with natural resources such as forests, oil, gas, coal and other minerals, and produces many agricultural products. Its capital, Palembang, is a national center for the chemical and cement industries. Ecologically, the province consists mostly of lowlands and coastal wetlands. The exception is a mountainous region in the extreme western portion of the province, including its highest point, the volcano Mount Dempo, at 3159 meters (10,425 feet). Mount Dempo is the climax of a larger mountain range, known as Bukit Barisan, which runs north-to-south along the western edge of Sumatera (Dalton 1988).

Geographically, the study area is located in the Kabupaten (district) of Lahat, which is in the western highlands (figure 11.2). A rich agricultural region, Lahat is a major center for the coffee which is cultivated throughout the higher elevations. Within Lahat there are protected areas under several different management categories (conservation/national parks, protection forests, limited production forests, and regular production forests), which, after their expansion in 1982, cover about 290,600 hectares. Consequently, about 41.4 percent of Lahat is technically under forest management (Surapaty et al. 1991)[3] (table 11.1). Such a large protected area has placed considerable pressure on available land resources. Nearly 80 percent of Lahat's protected areas are non-commercial conservation areas (protected forests and wildlife reserves), not meant for harvesting (table 11.1).

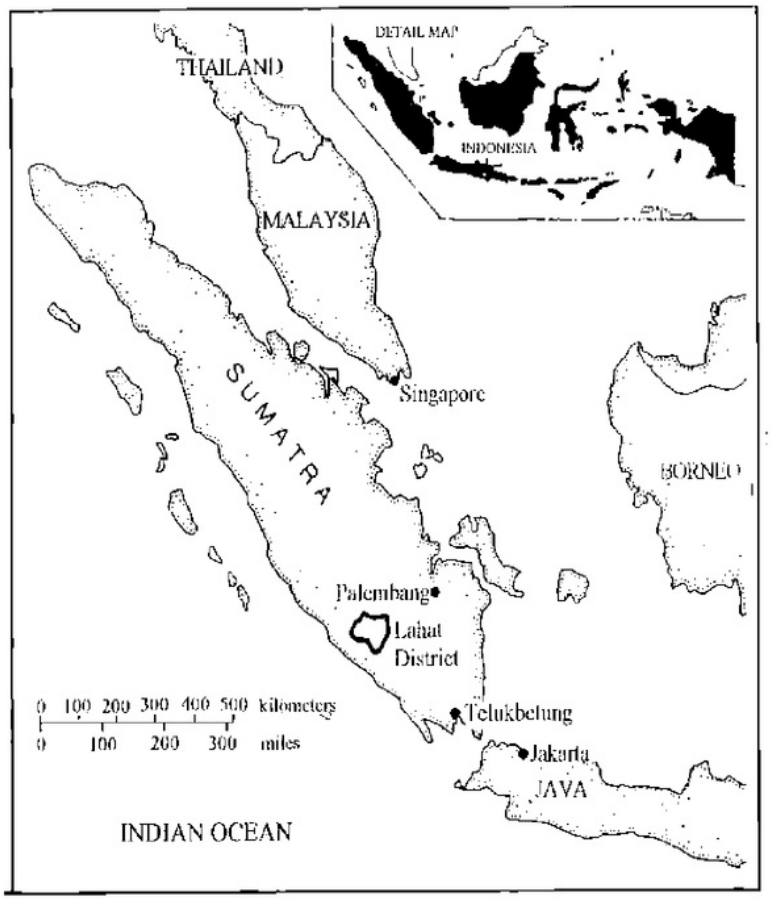

Fig. 11.1. Lahat District of South Sumatra
Source: Imagepro, Inc. Ann Arbor, MI

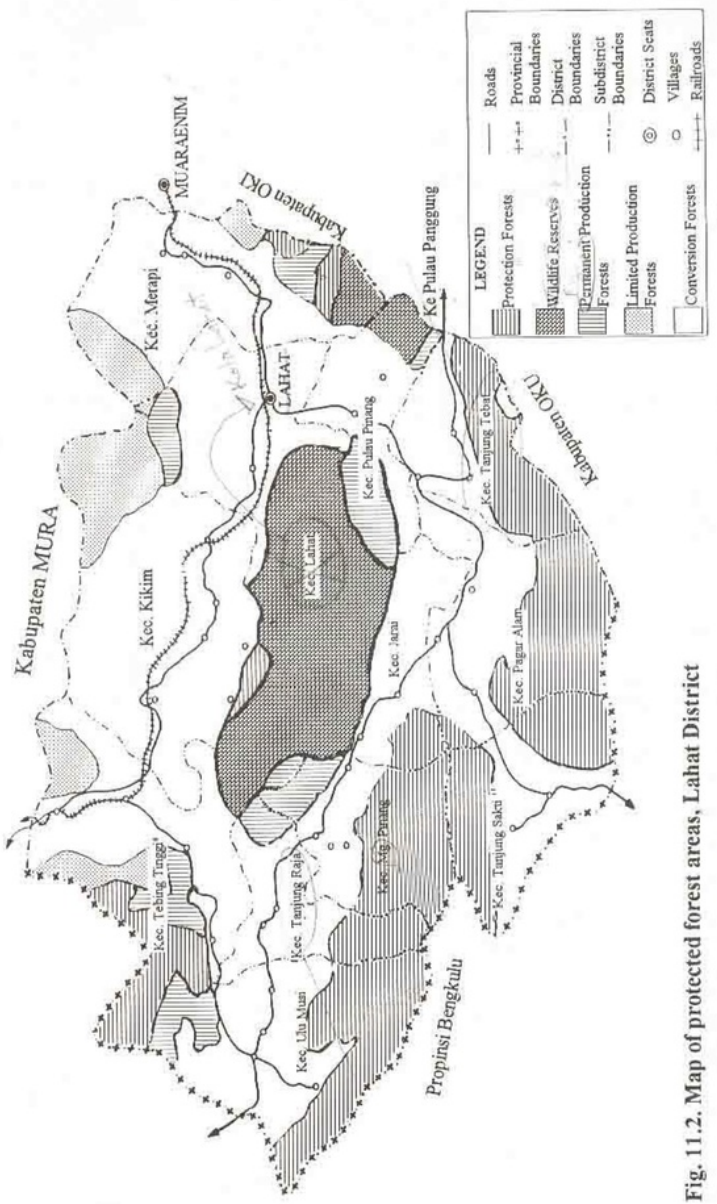

Fig. 11.2. Map of protected forest areas, Lahat District

TABLE 11.1 Protected Forests in Lahat

TYPE	SIZE (HA)	PERCENT TOTAL
Conservation/National Parks (Hutan Suaka Alam)	79,500	27.3
Protection Forests (Hutan Lindung)	149,600	51.5
Limited Production Forests (Hutan Produksi Terbatas)	21,750	7.5
Regular Production Forests (Hutan Produksi Tetap)	39,750	13.7
TOTAL (ALL TYPES)	290,600	100

Source: Lahat Forestry Department; Surapaty et al. 1991

The study, to date, has concentrated only on five southern kecamatans (sub-districts) within Lahat: Pagar Alam, Jarai, Kota Agung, Pulau Pinang, and Tanjung Sakti. These were selected because: (1) their deforestation of protected areas is relatively high and thus they have received considerable attention from the government; (2) the people found in these kecamatans share a common language, Pasermah[4]; (3) coffee is widely grown these; and (4) it is home to many of the illegal farmers. Data is still being collected for this study, but research teams have made field visits in July 1989, August 1990, January 1991, and May 1991. Information has been collected from a number of sources. In-depth, conversational style, interviews with farmers, political officials, and former traditional leaders have been conducted. Secondary data on population, economics, agriculture, and forestry have been obtained from sub-district, district, and provincial governmental agencies, including forestry departments, development planning boards, statistical offices, trade associations; and from published literature.[5]

3. For forest management purposes, Indonesia uses a classification system of Conservation/National Parks; Protection Forest; Limited Production Forest; Continuous Production Forest; and Conversion Forest. Percentage of forest protection area is based on Lahat land area of 7,014.23 Km2 – Table 11.4.

4. There are three other languages in Lahat area: Lematang, Kikim, and Lintang (1991 Field Notes).

Probable Causes of Deforestation

The problem of illegal farming in the protected forests of Lahat appears to have begun in the mid-1970s. The movement of farmers, which began as a trickle became a steady stream by the mid 1980's. Satellite images clearly show dramatic loss of forest cover between 1982 and 1989 and even between 1982 and 1985.[6] In 1988, a government report concluded that illegal farmers in Lahat were responsible for deforesting 29,399 hectares (or about 18 percent) of the district's protected areas (see Tempo 1990; Surapaty et al 1991)[7] (table 11.2).

The environmental consequences have been locally and provincially significant. Complaints from villagers at the foot of these mountains have grown in recent years. In particular, villagers are noting formerly uncommon problems such as floods during the rainy season and the lack of water in the dry season. Irregular water flow has disrupted village life, bringing increased health problems, silting of the traditional irrigation systems used for rice cultivation, and even some deaths (1991 Field Notes, Tempo 1990).[8] Soil erosion throughout the region appears to be clogging important natural waterways. For example, provincial authorities noted that the Musi River, the area's largest river, is rapidly silting-up, affecting both commercial water traffic, and the river's fisheries (1989 Field Notes, Donner 1987).

5. We must note that due to the formality of the Indonesian government, all data collection activities have to be formally approved and are monitored. Before field research begins, colleagues at Sriwijaya University obtain written approval from the Provincial Governor in Palembang. This written approval is hand-delivered to the Bupati (the administrative head of District) in Lahat. After his approval, a representative of the district office, usually a planning officer, accompanies the research team to the field. The accompanying official serves essential functions as local guide and is a formal point of contact to local-level officials, which is essential for obtaining their cooperation. Still, this official is present during all interviews and may even participate in the discussion. Our sense is that the official did not significantly influence the answers we obtained. Still, this possibility needs to be considered.

6. We are working with the Environmental Research Institute of Michigan (ERRA) on remote sensing applications to deforestation issues in South Sumatera. Much of this work is under the Population–Environment Monitoring System (PEMS) program of the Population–Environment Dynamics Project, The University of Michigan.

7. The 18% figure is based on the amount of protected area that existed prior to the 1982 expansion, 165,900 ha.

8. The Environment Research Center at Sriwijaya University with funding from the Ford Foundation has been studying some of these consequences. See also Naning, M.I. et al. 1988.

In a month-long operation from August 1990, government personnel with police escorts used helicopters to forcibly remove all illegal farmers from these protected forest areas including: Mount Dempo, Gumai Pasemah, Mount Patah, Isau-Isau

Pasemah, Isau-Isau Lematang Ulu, and at the mountains near Kota Agung. A number of the farmers, along with a local official, were jailed. At a few locations coffee trees and farmers' temporary houses were burned (Sriwijaya Post 1990ab; Tempo 1990; 1991 Field Notes). This has frightened illegal farmers sufficiently to keep them out of the mountains so far. In so far as the government is concerned, the era of illegal coffee farming in Lahat has come to a close.[9]

TABLE 11.2 Protected Area Deforestation by Forest Name and Sub-district (Unexpanded Area, 1988)

FOREST NAME	SUBDISTRICT	AREA (HA)	DEFOREST-ATION AREA (HA)
Gunung Dempo I	Pagar Alam, Ulu Musi	3,750	100
Gunung Dempo II	Pagar Alam, Tanjung Sakti	8,500	200
Bukit Dingin	Tanjung Sakti, Pagar Alam, Ulu Musi	34,300	1,000
Bukit Runcing	Merapi	8,640	500
Gunung Patah	Pagar Alam, Tanjung Sakti, Kota Agung	33,775	3,000
Bukit Raja Mendaro	Pagar Alam, Jarai	7,450	1,200
Bukit Hitam	Pagar Alam, Jarai	4,460	400
Isau-Isau Pasemah	Pagar Alam, Jarai	3,276	50
Gumai Pasemah	Lahat, Jarai, Tebing Tinggi, Ulu Musi	12,810	4,000
Isau-Isau Lematang Ulu	Kota Agung	2,286	714.5
Gumai Lematang Ulu	Tebing Tinggi, Ulu Musi, Pagar Alam, Lahat	29,210	17,526
Gumai Tebing Tinggi	Lahat, Tebing Tinggi, Ulu Musi, Pagar Alam	3,863	650
Bukit Balai	Tebing Tinggi	13,585	58.5
TOTAL		165,905	29,399

Source: Lahat Regional Forestry Department

From this research there appear to be several factors that have encouraged certain farmers to continue to illegally cultivate coffee in the protection forests. They include: population density pressures from natural growth and in-migration; the coffee production cycle, including the traditional shifting cultivation practices of local coffee farmers; inadequate protected area management practices; and economic incentives created by changes in the international coffee market.

9. These matters are delicate indeed. In 1989, violence broke out in which a number of people were killed when governmental authorities and farmers clashed over, among other issues, the removal of illegal farms from protected areas in Lampung Province (south of South Sumatera) (1989, 1990 Field Notes).

Population Pressure Factors

Numbers and Density

A critical issue of this research concerns the possible impact population pressures may have had on the area's land resources, especially the forests. Increases in Lahat's population size and density over time may have resulted in farmers eventually overwhelming the available arable land for coffee and other types of cultivation. Deforestation of the area's protected forests and nature reserves could be, then, the result of farmers being forced to cultivate the steeper slopes of the protected areas, possibly the only available lands left for cultivation. Indeed, support for this notion comes from population data which compares Lahat to South Sumatera (table 11.3).

Table 11.3 clearly demonstrates the level of population increases for Lahat and South Sumatera. From 1961 to 1990 Lahat increased from 310,035 individuals to 599,347, an increase of about 93 percent. During the same period, the South Sumatera province grew from approximately 2.8 million to about 6.3 million, an increase of about 125 percent. Although Lahat's population has nearly doubled over the last thirty years, it rose considerably less than the average of all the districts. It is not understood why this is the case.

Although population size is commonly linked with discussion about environmental impacts, population density is a more useful indicator for gauging land pressure (table 11.4). It is quite clear that, after excluding the urban areas of Palembang and Pangkal Pinang, Lahat is the second most densely populated district within South Sumatera. This tends to support the possibility that farmers in search of new land were forced up the mountains. A number of those interviewed indicated that farm land began becoming noticeably scarce in the 1970s.[10]

Table 11.5 lists the population density of our study area in 1990, adjusted for the land area under protection status. When the protected areas are subtracted from the total land area, the population density of Lahat and our study area increased significantly.

Table 11.5 demonstrates that the sub-districts of Jarai and Pagar Alam are relatively much more densely settled than the other sub-districts of the study area. Jarai, at 315 people/square km (1990), is near the density of Bali in 1961 (320 people/square km) (Biro Pusat Statistik 1987), which is not an insignificant level. It is important to point out, as well, that most of the protected area deforestation within this study area is found in these two sub-districts.

10. It should be noted that there are no government or private plantations or other large land holdings in the study area. Of course, the establishment of these types of land-uses would place greater strain on remaining lands.

TABLE 11.3 Population Figures in South Sumatra by District: 1961, 1971, 1980, 1990

No.	District	Numbers 1961	1971	1980	1990	%Population Change 61-71	71-80	80-90
1.	Kodya Palembang	474,971	582,581	786,607	1,139,926	2.27	3.50	4.49
2.	Kodya Pangkal Pinang	60,283	74,733	90,068	113,163	2.40	2.05	2.56
3.	Musi Banyuasin	296,226	374,876	591,074	883,719	2.66	5.77	4.95
4.	Ogan Komering Ilir	378,260	445,788	564,031	771,463	1.79	2.65	3.68
5.	Ogan Komering Ulu	381,524	538,575	750,763	963,794	4.12	3.94	2.84
6.	Muara Enim	332,456	363,769	430,827	586,075	.94	1.84	3.60
7.	Lahat	310,035	372,821	484,814	599,347	2.03	3.00	2.36
8.	Musi Rawas	185,693	252,420	366,081	512,077	3.59	4.50	3.99
9.	Bangka	251,639	303,804	399,855	513,946	2.07	3.16	2.85
10.	Belitung	102,375	128,694	163,599	192,972	2.57	2.71	1.80
	Total	2,773,462	3,438,061	4,677,719	6,276,482	2.40	3.46	3.56

Source: 1990 Census
Population Change (61-71) defined by (population 71-population 61)/(population 61)*100 %)/10 years

TABLE 11.4 Population Density in South Sumatra: 1961, 1971, 1980, and 1990

NO. DISTRICT	AREA (KM^2)	1961	1971	1980	1990
1. Kodya Palembang	244	1,946.60	2,387.63	3,223.80	4,671.83
2. Kodya Pangkal Pinang	32	1,883.84	2,335.41	2,814.62	3,536.34
3. Musi Banyuasin	25,669	11.54	14.60	23.03	34.43
4. Ogan Komering Ilir	21,658	17.47	20.58	26.04	35.62
5. Ogan Komering Ulu	10,408	36.66	51.75	72.13	92.60
6. Muara Enim	9,575	34.72	37.99	44.99	61.21
7. Lahat	7,014	44.20	53.15	69.12	85.45
8. Musi Rawas	21,513	8.63	11.73	17.02	23.80
9. Bangka	11,614	21.67	26.16	34.43	44.25
10. Belitung	4,532	22.59	28.40	36.10	42.58

Source: 1990 Census
Population density defined by population in the year divided by land area (People/Square Kilometers)

In comparing the amount of deforestation, with the number of illegal farmers, with the density levels (all by sub-district), a series of striking correlations emerge. When evaluating sub-districts, those with low to high amounts of deforestation correspond exactly to those with low to high numbers of illegal farmers, and again with those with low to high population densities. These numbers are presented in Table 11.6.[11] The figures obviously suggest a strong relationship between population density and deforestation.

TABLE 11.5 Population Density of Study Area (and Other Subdistricts in Lahat), 1990

NO.	DISTRICT/ SUBDIST.	AREA (KM^2)	PROTECTED FOREST (KM^2)	POPULATION 1990	DENSITY (POP/KM^2)
	LAHAT DISTRICT	7,014.23	2,806.00	599,347	146
1.	Pulau Pinang	344.57	169.65	21,612	124
2.	Kota Agung	436.82	167.20	51,179	116
3.	Pagar Alam	586.79	161.50	106,075	249
4.	Jarai	391.86	250.00	44,686	315
5.	Tanjung Sakti	482.71	193.50	24,865	86
6.	Merapi	677.18	228.75	32,659	73
7.	Pendopo	269.83	100.00	41,538	245
8.	Ulu Musi	750.68	399.15	45,360	129
9.	Muara Pinang	441.91	287.85	51,256	333
10.	Tebing Tinggi	703.05	233.95	52,813	113
11.	Kikim	1,215.05	426.65	53,657	68
12.	Kota Lahat	713.78	287.80	93,627	220

Note: Population density = Size of land area of district/subdistrict minus amount of forest protection area, divided by population size, 1990.
Source: Office of Statistics, South Sumatra and 1990 Census

TABLE 11.6 Relationships Between the Amount of Deforestation, Number of Illegal Farmers, and Population Density by Study Area Subdistricts

Subdistrict (STUDY AREA)	Amount of Deforestation (HECTARES)	Ilegal Farmers (NUMBERS)	Density (POP/KM^2)
Jarai	722.25	1782	315
Pagar Alam	559.50	1142	249
Kota Agung	295.25	1034	116
Pulau Pinang	256.50	744	124

Source: BAPPEDA Office, Lahat District and Table 11.5

Migration: Trans-migrants or Local Migrants

The existence of a relatively high population density, however, tells little about how the area became that way or where the illegal farmers come from. In-migration is a likely possibility. In addition to the natural rate of increase (i.e., population growth resulting from number of births exceeding number of deaths) of 2.38 percent per year, South Sumatera, including Lahat, has experienced significant in-migration. The province has, for some time, been a major designation site for the government's transmigration program (Romsan 1989; Whitten 1987). Romsan (1989:54) estimates that between 1934 and 1988, 741,425 persons were relocated to South Sumatera from Java and the other densely populated inner islands of Indonesia. Although most of these families were sent to lowland areas, a number of trans-migrants were relocated to areas within Kabupaten Lahat as well.

11. The only minor exception concerns the inverse order of density between the two lowest sub-districts Pulau Pinang and Kota Agung. This slight anomaly, however, seems to have an explanation. In Kota Agung residents and officials alike said that many farmers have not been cultivating all of their land holdings. Instead, many have been "saving" parcels for future use. Although physically more land exists, socially it is unavailable, as some farmers are withholding parcels of land from production. Those interviewed considered the practice to be selfish and inequitable, noting that some people didn't have land to farm. The result has been a "defacto" increase in density, but the physical availability of the land would tend to decrease the density in the actual figures.

This influx of migrants may well be a possible source of illegal farmers. There are stories throughout Indonesia of failed relocation projects, forcing the trans-migrants to seek livelihoods elsewhere (Secrett 1986; Whitten 1987; Hanson 1981). There have also been cases of trans-migrants invading the protected forests of Indonesia (Whitten 1987 suggests it is a minor problem, while Secrett 1986 suggests it is major). Romsan (1989; Romsan, per. comm. 1991) has found trans-migrants to be important sources of forest destruction in some parts of South Sumatera. Table 11.7 shows the transmigration numbers for South Sumatera and Lahat from 1980 to 1987.Table 11.7 shows that 31,928 or about 11 percent of the trans-migrants to South Sumatera settled in Lahat. Although it only represents about 5.3 percent of Lahat's total population in 1990, it is not an insignificant number. The arrival of thousands of people needing land could have directly or indirectly encouraged the deforestation of the area's protected forests. In addition, the greatest deforestation appears to have occurred during this same time in the mid to late 1980's.

TABLE 11.7 Transmigration in South Sumatera and Lahat 1980–1987
(Number of People)

Year	South Sumatra	Lahat	Percent Within Lahat
1980-1981	67,167	9,014	13.42
1981-1982	103,472	6,851	6.62
1982-1983	50,896	3,600	7.07
1983-1984	17,847	2,012	11.27
1984-1985	20,039	2,764	13.79
1985-1986	4,844	2,872	59.29
1986-1987	32,510	4,815	14.81
TOTAL	296,775	31,928	10.76

Source: Statistical Office of South Sumatera Province

Based upon the interviews with officials and farmers, however, it appears that illegal farmers are not from ill-fated transmigration projects. Rather, the illegal farmers tend to be local migrants, i.e., from other local areas (kecamatans or sub-districts) within Lahat, from an adjacent Kabupaten, or from Bengkulu, a neighboring province. This finding tends to support the conclusion of Whitten (1987) rather than those of Secrett (1986) and Romsan (1989). It is likely, however, that in-migration has indirectly encouraged protected area deforestation by reducing the amount of unused arable land, as reflected in the relatively high density rates.

According to the field research, there appear to be four different groups of illegal coffee farmers in Lahat's protected areas:

1. *Tanjung Sakti*. Many illegal farmers are from this area. They are local people from the Lahat District (from the Kecamatan Tanjung Sakti).
2. *Semendo*. These illegal farmers are from an adjacent kabupaten, Muara Enim. They are then outsiders to the Lahat, but not to South Sumatera. They have their own native land, but arable land is very limited. Many young families are in search of new farms.

3. *Manna*. Outsiders to Lahat from Bengkulu, an adjacent province directly west of South Sumatera. They share a common ancestry with the Pasemah peoples centered in Pagar Alarn and believe they have some claim to the land there.
4. *Javanese/Sudanese* . Only a relatively small number of illegal farmers from Java. Those that are here are not from failed transmigration projects, but have come in search of adventure or for employment. They tend to serve as laborers for the more wealthy local illegal farmers, such as the Tanjung Sakti.

The Semendo are traditionally rice farmers from the low lying sub-district of Muara Enim. Their system of inheritance is "*tunggu tubang*", in which the oldest daughter when married acquires the parent's property. This arrangement forces the remaining family members to find new agricultural land elsewhere. Some have found themselves growing coffee in highland areas. The Manna are more traditional coffee farmers (i.e., practicing farming as a way of life) and generally farm a one to two hectare plot. The third and apparently largest group, the Tanjung Sakti, are very aggressive farmers who cultivate coffee as a short-term means to acquire wealth. Their goal is to save enough money to move to the urban areas to pursue other occupations while maintaining coffee farms in the hills. The Tanjung Sakti frequently establish several farms and hire Javanese "interns" as tenant farmers to occupy one site while they move on to establish another (Heydir et al. 1990; 1991 Field Notes).

There also appears to be a unique combination of illegal farmers in each sub-district of the study area. Table 11.8 shows estimated breakdown (by percentage) of illegal farmers by ethnic group (or home area) in each kecamatan of the study area. From the interviews, it appears that the arriving individuals sent home news of their success which encouraged others to come (1991 Field Notes). This appears to be particularly true of the Tanjung Sakti who tended to illegally farm the wildlife reserve (Gumai Pasemah) north of the towns of Jarai and Pagar Alarn.

TABLE 11.8 Percentage of Illegal Farmers by Ethnic Group or Origin for Each Study Area Sub-district

SUBDISTRICT	GROUP	PERCENT
Pulau Pinang	Tanjung Sakti	50
	Pagar Alam	15
	Jarai	10
	Javanese	5
	Locals/Others	20
Pagar Alam	Manna	90
	Semendo	10
Jarai	Tanjung Sakti	90
	Javanese	10
Kota Agung	Semendo	40
	Pagar Alam	20
	Javanese	10
	Locals	30

Source: Field Notes 1991

Coffee Production Cycle: Shifting Cultivation

Coffee is not native to Indonesia. It was introduced by the Dutch colonialists around 1699 as a cash crop (Heydir et al 1990) and in South Sumatera some time later. Today, coffee is produced in 13 of Indonesia's 27 provinces. In 1989, 369,667 tons of coffee were produced nationwide with approximately two-thirds of it exported, mostly to Japan (26 percent), Germany (23 percent), Netherlands (16 percent), and the United States (11 percent) (Biro Pusat Statistik 1989). Twenty-five percent of all Indonesian coffee comes from South Sumatera alone, the most of any one province (Biro Pusat Statistik 1989). Within South Sumatera, the District of Lahat supplies nearly sixty percent of the province's coffee production (Coffee Exporters' Association, Palembang; 1991 Field Notes; Heydir et al 1990:4). In short, coffee is clearly an important crop in our study area.

Protected area deforestation is likely caused, in part, by the way coffee is produced. In Lahat, at least, coffee farmers have traditionally been shifting cultivators. New ground is broken and coffee trees planted. Fruit is not harvested until usually the third year. Harvesting takes place once a year, extended over about a four month period, usually May through August. At their peak in productivity, trees yield an average of two to three tons per hectare. After about eight years, the coffee yield declines significantly. In anticipation of the decline, the farmers move on to seek new land, thereby restating the cycle only after the third or fourth year (1991 Field Notes; Heydir 1990:34).

Page 241

The shifting cultivation cycle of coffee farmers is significant for at least four reasons. First, established tradition makes opening up new land for cultivation an understandable practice. Shifting cultivation can, of course, be a sustainable practice under conditions of low population density (Dove 1985). It is also a behavior that might not be easily changed. Second, because of the long lead time required to establish new coffee crops, new land is opened ideally while other land is in production. This type of cultivation practice obviously doubles the strain on land resources. Third, farmers who practice shifting cultivation have traditionally had little incentive to cultivate intensively which would ease the pressure on the land. Finally, under conditions of growing population density, local farmers as well as newcomers looking for land would most likely be pushed farther up the mountains in the direction of protected forests, the only unoccupied lands left.

Protected Forest Management

Because these forests are under a managerial regime, their invasion by farmers obviously suggests an administrative failure of one sort or another. Of some interest is the history of these forests. Far from being products of modem conservation efforts, a significant part of these areas were established centuries ago by local authority structures (*marga*) as forests to serve a combination of woodstock reserves and watershed protection functions (*Ayek Tulung*) (1989, 1990, and 1991 Field Notes; Heydir et al. 1990; Brechin et al. 1990).

The Dutch Colonialists made their way to South Sumatera in 1859. In 1874 they initiated "*Domein-Verklaring*" in which all unclaimed land came under state rule. Traditional *marga* systems, while under Dutch control, managed their own lands, including forests. Although *marga* officials still actively helped regulate their use, the Dutch in 1916 formally incorporated the *marga* forests with their forest areas and collectively called them "*Bosch-Wezen*" or registered forests. In 1967 (after independence), the Indonesian government continued this arrangement under Forestry Principle #5. As under the Dutch, the *Pasirah* or *marga* head, with his council, regulated their forest use through traditional law or "*adat*." This arrangement ended in 1983 when the *marga* system in South Sumatera was completely dismantled by the central government and replaced with the "*desa*" or village system. Presently the country's forests are under the jurisdiction of the Ministry of Forestry and are administered in an hierarchical manner from the central government to province to district level.

Page 242

From the research, it seems that under national government control, the managerial regime existed mostly on paper, lines on maps with little actual initial enforcement. Whitten 1987 found the same for other parts of Indonesia as well. Government control of protected area boundaries became a post-hoc matter, years after they were initially invaded. It appears the forests were more tightly controlled under Dutch rule. There are reports that illegal farmers were shot occasionally (Heydir et al. 1990). With national independence, after World War II, the level of supervision of forests fell dramatically due to tight budgets and limited personnel. It was reported that during the 1970's the level of forest supervision became even weaker. Even today there is also, on average, only one forester for every three kecamatans (1991 Field Notes).

Unlike the Dutch foresters, the Indonesian foresters in Lahat today, except for a special police force, are unarmed. They also have no vehicles, i.e., they are completely on foot, and walk alone through the forests. Their tasks in the protection and other non-commercial forests are to observe local situations and report boundary violations to their forestry superiors at the district level (1991 Field Notes). Under this system, sub-district administrative officials, including the head (*Camat*), have no direct authority over the local forestry officials or their activities[12] (1991 Field Notes). There are obvious drawbacks to this supervisory system, including the lack of coverage, but also the creation of an atmosphere of intimidation and corruption which is discussed later.

Economic Factors: Coffee Prices

For farmers, coffee has been a relatively lucrative cash crop. And most coffee farmers are considered fairly wealthy by local standards. Until recently, coffee generally held a 7:1 to 13:1 domestic price advantage over paddy rice, a major staple crop.[13] In 1976 and 1977, however, the price of coffee skyrocketed due to coffee crop failures in Brazil (1991 Field Notes; per. comm. National Coffee Association, New York 1991; and deGraaff 1986). This created a price shock waves throughout the international coffee markets. For Indonesian coffee farmers the domestic price differential between coffee and rice rose to 53:1 in 1977 (1991 Field Notes).[14] Figure 11.3 shows coffee and rice prices, as well as coffee production levels over time. The decline in coffee's advantage over rice reached its lowest mark in at least fifteen years in 1987.

12. One Camat we interviewed complained about his lack of control over forestry officials. He noted that sub-district officials have nothing to say about where they or what they do. He complained that it was 8 months after he arrived as the new Camat before he met the local forestry official (1991 Field Notes).

13. This information is from South Sumatera Commerce Department, the Lahat Statistical Office; and Coffee Exporters' Association, Palembang. Prices were in Rupiah per Kilogram.

14. The numbers presented above are based upon national-level data collected on coffee and rice prices noted above from the South Sumatera Commerce Department. Although no hard figures were collected from the field, local farmers and officials consistently noted a 10:1 coffee price advantage over rice. This probably reflects local price paid to farmers as opposed to the number presented in Figure 11.1 (1991 Field Notes; Heydir et al, 1990).

Discussion

In summary, the protected area deforestation within the study area appears to have been the result of a complicated set of factors, including population density pressures, the coffee production cycle, inadequate protected area enforcement, and a rise in international coffee prices.

The illegal farmers responsible for this deforestation tended to be local migrants, who were lured to the protected forests by the usually high price for coffee, caused by a series of severe frosts in Brazil during the mid 1970s. They were not members of unsuccessful transmigration projects. As local lands were occupied, the protected forests were in effect the only lands available for cultivation. The farmers' entry into the protected forests was facilitated by the initial lack of boundary enforcement from forestry officials, a little corruption, and some confusion as to the precise location of the boundaries.

This study found two groups of illegal farmers. In fact there are many more families within the second group than the first. The first group is those who more or less purposefully invaded the protected forests to cultivate coffee; these have been the focus of the study. The second and much larger group is the farmers whose holdings became illegal as a consequence of the government's 1982 decision to substantially expand the size of many protected areas by redrawing boundaries. Thus, a distant governmental decision has transformed many rural families into illegal occupants of state owned protected areas.

The second group is noteworthy for several reasons. Most important, the government, by its efforts to correct perceived deficiencies in its conservation program, has unwittingly but significantly increased the population density of the region by decreasing the amount of available land. This has greatly complicated the situation and will make solutions that much more difficult to achieve. Second, in its treatment of the matter, the government is making little distinction between the two groups of illegal farmers.

Of considerable interest is the fact that the protected areas under central government control were deforested first. Although all protected forest areas were technically under the control of the Ministry of Forestry, many of the areas included former *marga* forests which effectively remained under the local control of the *marga* head, *Pasirah* and regulated by "*adat*" or customary law. Local control of the forest areas seems to have been quite effective up until the traditional *marga* system was dismantled entirely in 1983 (1989, 1990, 1991 Field Notes; Romsan 1989; Heydir et al. 1990; Poffenberger 1990a). After 1983, farmers began to invade these parts of the protected forests as well (1991 Field Notes).

From a farmer's perspective, the uncertainty regarding the precise location of the areas' boundaries has further complicated the situation. Many markers are missing or have been moved numerous times, both legally and illegally, to the point that no one is certain of the boundaries' correct location. In some cases, it was noted that certain forestry officials had changed boundary markers for a price. Even more honest forestry officials, however, would be powerless to stop a large influx of farmers into the forests. In short, an unarmed, solitarily forester on foot is no match for a group of machete-wielding farmers. In one area there are reports of collusion among local government officials who sold protected land to unsuspecting farmers eager to grow coffee. This greatly complicated the situation with illegal farmers being able to provide documents of ownership (Tempo 1990; 1991 Field Notes). Also of interest, several officials commented that enforcement of the protected area seemed to lessen precisely at the time the coffee prices rose dramatically (1991 Field Notes). This may only be coincidence or the result of more conscious action by powerful figures in more central positions with economic ties to coffee markets. In a similar vein, corrective action is presently taking place at time when coffee's price advantage over other crops such as rice is at a fifteen year low point (fig. 11.3).

It seems that since independence in 1945, the protected forests of South Sumatera have undergone three expansions: in 1971, 1975, and 1982. A fourth change took place in 1986, but it only reorganized the classification of existing protected areas, new areas were not added. Significant change occurred in 1982. This was the result of a decision to change the criteria used for defining protected areas and determining

their classification (1991 Field Notes). The former criteria consisted of forests with elevation greater than 700 meters and slope of 45 percent or greater. The new criteria was a formula which took into account slope, soil type, and rainfall.[15] The result was nearly a 350 percent increase (from 1,562,783 to 5,214,700 hectares) in the size of protected areas in South Sumatera. Many villages and residents are now technically illegal occupation and are expected to be relocated. In Lahat, it appears the amount of protected forests increased from approximately 165,000 to 290,600 hectares, an increase of about 76 percent (Lahat Forestry Department; Surapaty et al. 1991).

15. The formula was (Slope x 20 + Soil x 15 + Rainfall x 10). Total score determined type of area. For example a total score of 175 + = protection forests; 124-174 = limited production forests; < 124 = production forests (South Sumatera Provincial Forestry Department, Palembang).

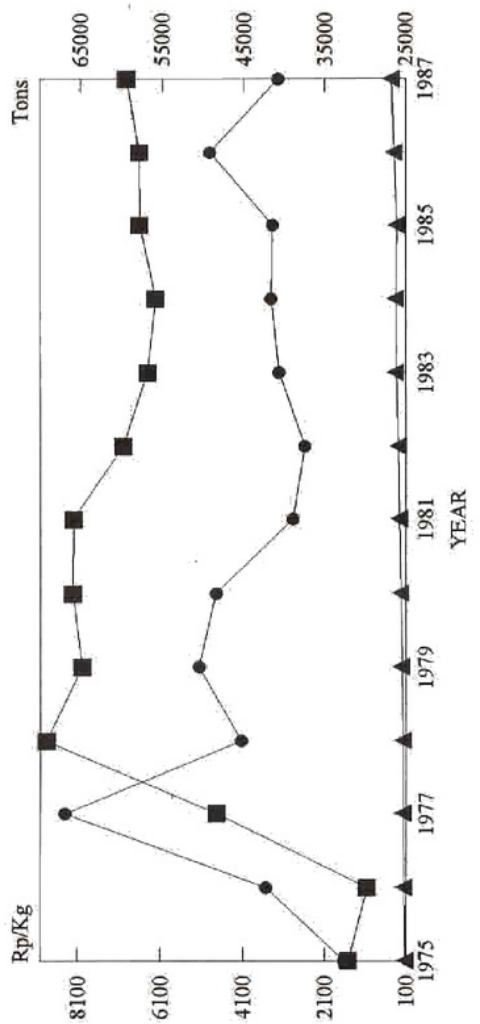

Fig. 11.3. South Sumatra 1975-1987: Coffee & rice prices with coffee export volume
Source: South Sumatra Commerce Department

In attempting to understand the relationships between population and environment from the case study, each of the four factors (population density; coffee production cycle; conservation management practices; and rising coffee prices) appear to have collectively contributed to the deforestation. The most powerful factor, however, in

determining the amount of deforestation seems to be population density. As was noted above in table 11.6, the most densely populated areas were the sites of greatest deforestation.

The four factors, however, are interrelated. For example, the high population density surrounding the protected region encouraged farmers to seek out the protected forests as the only remaining unoccupied lands. However, these farmers could have been stopped from entering the forests given better resource management efforts. The lack of a substantive conservation management regime allowed farmers unimpeded access to the forests, at least initially. This may help explain why population density appears to be highly correlated with the amount of deforestation. More effective boundary enforcement may have forced some other dynamic. The fact the *marga* forests remained intact when the *marga* system was operating while the state-regulated protected forests were invaded suggests that certain control mechanisms might have worked.[16]

Similarly, the dramatic rise in coffee prices alone is an insufficient cause. Coffee prices created tremendous incentives for cultivation. Again, this became a factor due to the lack of alternative arable lands, and was compounded by the tradition of shifting cultivation among the coffee growers and the weak enforcement structures. The increase in demand for more coffee cultivation might have been met by utilizing unused agricultural lands or intensified use of existing lands. A host of other likely scenarios could be conjured up using different dimensions of these same factors.

From the case study, it is obvious that the relationships between population and environment must consider the impact of other variables. The dynamic is not unilaterally determined. Rather, it is actually the result of the confluence of a number of factors occurring at different scales and at different times. For example, the poor weather that destroyed much of the coffee crop in several high production states in Brazil contributed to the deforestation of specific protected areas in Southeast Asia. The obvious link is international market mechanisms. Other factors may be more controllable, such as the character and effectiveness of state conservation management policy. Other factors may depend on local customs, such as the shifting cultivation of coffee farmers and the effectiveness of the *marga* system. These may be so ingrained in everyday life as to be extremely difficult to change without creating other problems. Clearly, though, effective state policies and implementation could have greatly reduced the impact of the exogenous influence of market forces and the movement of people. But from a population perspective, given the uniform lack of enforcement across the study area, the increased land pressure through population increases, as reflected in density, certainly appears to be the single most powerful factor in determining the amount of deforestation in each sub-district of the study site (table 11.6).[17]

16. In many situations within developing countries, resource management problems seem to develop when e resource control responsibilities are shifted from local to state levels. The effectiveness of some local institutions in regulating forestry use in developing countries has become well documented (Uphoff 1986; Brokensha and Riley 1989).

17. This is supported by the data collected so far from four sub-districts within the study site. Obviously more data from similar additional sites, which would allow for statistical tests, are required before we could confidently substantiate this claim.

Possible Policy Directions

It is difficult to predict what will happen to the farmers and forests of Lahat. The future will be determined, in large part, by the implementation of specific governmental policies.

The main policy currently being pursued by the government is the relocation of illegal farmers. This includes both types of illegal farmers discussed above. Here illegal farmers include those individuals who were the subject of our investigation and those villagers who are now considered illegal because of the government's decision to expand the boundaries of protected areas. 1,167 families (or 4,720 individuals) are in this group (Surapaty et al 1991; 1989, 1990, 1991 Field Notes). Because of the number of families involved and the lack of suitable relocation sites, however, it is unlikely this program will be very successful. Little concrete action has been taken so far due to the lack of capital and alternative lands.[18]

In the summer of 1991 most of these illegal farmers were biding their time in the local towns such as Pagar Alam, and harvesting existing crops. The government has agreed to allow illegal farmers to harvest the 1991 crop only if they don't clear any additional land. After this harvest, they are not to return to the protected areas (Tempo 1990; 1991 Field Notes). They are also waiting to see if the whole affair will blow over so they can return to their lucrative enterprise. Thus, this may be only a hiatus in the deforestation of Lahat's protected areas. Relocation by itself is not the answer to the problem. The government has yet to institute any changes in regard to its resource management policies. It appears content with using dramatic means when it becomes necessary to enforce protected area boundaries, some time after they have been violated.

18. One exception is the village of Semidang Alas (Kecamatan Pagar Alam). Villagers are presently being relocated to a site at lower elevation, called Padang Muara Dua. The site is one of only a handful of unoccupied lands left in the District (government owned). At 650 hectares the site will provide land for about 200–250 families, which is slightly more than the present size of Semidang Alas. At a lower elevation within Lahat, the soil and climate are not ideal for coffee. They will be required to cultivate rubber trees, a crop with which they have no experience, nor is it a crop as financially lucrative as coffee (Heydir et al. 1990).

Clearly if the government is to respond effectively to issues involving population–environment relationships, a more integrated, or at least comprehensive, multi-

sectoral approach is required. Piecemeal solutions to complex, interrelated problems will likely succeed only in creating more problems. Likewise a more integrated monitoring system is required to observe the many varied connections that compose this affair. Some elements of a comprehensive policy could consist of the following:

Revised Conservation Protection Policies and Administration

As was discussed in the chapter above, one of the main reasons for the invasion of protected forests was the lack of immediate control over their boundaries. Consequently, tighter control over important forest areas is desperately needed to eliminate similar problems in the future. This is especially true for those farmers who illegally invaded the forests at the higher elevations to plant coffee on the steeper slopes, and, as a result, caused most of the environmental damage. More personnel, better equipped and supervised, would be an important first step to implementing such a policy. Another option would be to return control of forests to more traditional governmental systems. Before they were dismantled, the *margas* were fairly effective in regulating forest use. Empowering traditional governmental authorities with local resource management responsibilities is an option that is gaining some support in the recent resource management literature (Poffenberger 1990a; Brokensha & Riley 1989; and Uphoff 1986). Although this type of action would presently contradict existing government policies, we believe it could be quite fruitful for the government environmental protection efforts. By finding ways to resurrect selected traditional enforcement structures and integration them with the new national governmental structures could possible create more effective regulatory mechanisms.

There may be a need to simultaneously revise existing conservation policies that require the automatic removal of resident people from protected areas. This refers specifically to the class of farmers declared illegal due to the expansion of protected area boundaries. This concern ties in with the relocation option discussed below. Instead of automatically removing residents, perhaps other options could be initiated that would help to achieve the conservation objective but not require moving large numbers of people. Various alternatives that regulate certain land uses or initiate preventative measures may be far more appropriate, especially when alternative lands are scarce (West and Brechin 1991b.) Conservation zones, for example, are widely used throughout the world. In addition, perhaps certain types of agroforestry practices could be established to help encourage more sound and sustainable agricultural activities. This would require substantial changes in the way the Ministry of Forestry is presently pursuing forestry practices in South Sumatera.[19]

19. See Poffenberger 1990be; and Peluso and Poffenberger 1989 for examples of alternative approaches.

Reforestation Activities

As of yet, the government has failed to initiate any program to reforest the damaged protected areas. Flooding and silting of irrigation systems will undoubtedly continue in some form for some time to come, especially in those areas where coffee trees have been destroyed. The government should take active steps to replant trees where needed and to stabilize soil and water resources of the region. An opportunity exists to constructively include local people in these useful conservation activities (see Dani and Campbell 1986).

Population Control

Although Indonesia in general remains a model of effective population control through voluntary family planning programs, rural South Sumatera's fertility rate still remains relatively high. Presently South Sumatera has a growth rate of 3.09 compared with an average of 1.98 for all of Indonesia (Biro Pusat Statistik 1990). More active population programs in this region can be beneficial in reducing the population dimension of future population–environment relationships in the region. This suggests policies geared toward: (1) limiting fertility through family planning programs; (2) limiting in-migration to the area; or (3) relocating some farmers to less densely populated areas if appropriate areas can be found. If relocation is to be pursued and equity maintained, effort will be required to make important distinctions among the two types of illegal farmers.

Agricultural Intensification

On a positive note the government, as part of its general development program, is promoting intensive cultivation practices throughout Indonesia. In Lahat, there appears to be some limited success with coffee. Of course, with little in the way of alternative land resources, most coffee farmers have been forced to stop their more traditional practice of shifting cultivation. In one community, the village head has been actively working with other local farmers and encouraging them to cultivate intensively by using coffee plant waste as fertilizer (1991 Field Notes). To be more effective, however, agricultural intensification needs greater local emphasis, with special attention to coffee cultivation.

Creation of Economic Alternatives

Given the relatively high density of the rural highlands, another option would be to create greater economic opportunities in the urban areas and sectors. Urban pull may help to draw excess populations from the hinterlands where they practice

unsustainable agriculture because they are forced to cultivate the more marginal lands. Another option would be to pursue the development of alternative but equally lucrative crops that could be grown in the less-densely-populated lowland areas. This last option usually requires the development of infrastructure, such as roads, as well as markets. Both options are difficult and would have to be included as part of larger development agendas.

Relocation

West and Brechin (1991b) in their review of parks and people issues note that relocating residents from protected areas should be an option of last resort. In many countries relocation tends to be the first and only option considered. In locations where population density is relatively high and pressure on existing land severe, relocation is likely to only substitute one set of problems for another. This would probably be the case in Lahat. Unless the authorities are prepared to move the illegal residents outside the district, relocating several thousand farm families successfully to alternative sites nearby will be extremely difficult because of the lack of available land.

If it becomes necessary to determine who should remain and who should go, authorities may want to review carefully the characteristics of the various groups of illegal farmers may be classified as "intentional" and "inadvertent." In addition, there are important differences among the intentional group. Some are impoverished people who out of necessity farm one to two hectare plots for subsistence. By contrast, most of the environmental destruction caused by the intentional group came from commercially oriented farmers who frequently cultivated several plots of two to three hectares for profit. Greater compassion should also be directed toward those farmers who are inadvertent victims of changes in resource management regimes and for those who are truly impoverished.

Page 251

Finally, several important governmental officials expressed the need to more strongly regulate the movement of local migrants (i.e., that by individuals and families within the same district which is not recorded presently) (1991 Field Notes). It was their feeling that the problem of illegal farmers stemmed largely from the government's inability to control the movement of its citizens. Although there is a logic to their thinking, the problem of illegal farmers could have been managed without reducing further the personal liberties of its citizens through, among other things, more sophisticated resource management personnel and practices. In addition to the preservation of personal freedoms, a stronger resource management administrative system could provide other benefits as well. Such a system would be in a better position to re-weave conservation practices into everyday village life, sustaining productive livelihoods for future generations. It would also reduce the occurrence of serious environmental problems and destruction. In addition, if conservation measures could be adopted by more rural people, the need for drastic measures, including arrests and relocation and the expense (social, fiscal, administrative, and environmental) that it entails could be avoided for the greater benefit of all.

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