

INCOME DISTRIBUTION AND ENVIRONMENTAL DEGRADATION IN THE ARGENTINE INTERIOR*

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Abstract: This article analyzes the environmental degradation of the Argentine interior, emphasizing the roles played by different income groups. Argentina beyond the pampa is composed of fragile ecosystems that have been substantially degraded through decades or even centuries of overuse and abuse. This study ascertains the nature and extent of environmental degradation for each part of the interior, the relative importance of various income groups in agricultural production, and the differential tendency to degrade the environment of agriculturalists at different income levels. These variables are used to show that both the wealthy and the poor have played crucial roles in the environmental degradation of the Argentine interior.

This research analyzes the processes by which the environment has been degraded in the Argentine interior in order to establish the roles played by different income groups in that degradation. A substantial body of literature has appeared in recent decades seeking to identify the actors who produce environmental degradation in developing countries. Frequently, these actors are identified according to their position in the income distribution. The premise of the article is that a one-size-fits-all approach is inappropriate, that no single income group is the chief agent of environmental degradation in the developing world. Each ecosystem is unique in important ways. The sources of environmental degradation and the actors who bring it about vary widely from place to place. Neither the poor nor the rich are homogeneous within countries or among them. The purpose of the present article thus is not to disprove the conclusions of other research that has found either the poor or the rich (or particular subgroups among the poor or the rich) to be the major contributors to environmental degradation but rather to add to the literature by showing how the Argentine interior resembles and yet diverges from other developing countries.

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The literature on income distribution and environmental degradation dates back at least to the 1970s. In 1987 the Brundtland Commission's well-publicized report, *Our Common Future*, drew the attention of academics and the public alike to the issue (World Commission on Environment and Development 1987). The commission argued that the poor are major degraders of the environment in developing countries. Poverty forces individuals to disregard the long-term consequences of their activities. In their effort merely to survive, they plunder the environment. The notion that the poor produce a significant share of environmental degradation was not a new idea,¹ but the prominence of Gro Harlem Brundtland and the visibility of her commission quickly made the issue a part of the conventional wisdom of the development community (United Nations 1990, 7; World Bank 1992, 23, 30; Kirdar 1992, 26). The belief that the poor ruin the environment provided yet another rationale for alleviating poverty and an answer to environmentalists concerned that economic development would lead to greater environmental degradation.²

Our Common Future stimulated a lively discussion about poverty and the environment. Dissenters soon made their case that the poor were not the major producers of environmental degradation. Some analysts stressed that the poor, using their intimate knowledge of their immediate environment and centuries-old traditions, are experts at environmental preservation (Durning 1992; Clay 1988; Moody 1988; Fay 1989). Others expanded on this point by arguing that the poor, knowing that their survival depends on careful husbandry of the environment, have become vociferous environmental activists (Broad 1994, 813–19; Cheru 1992, 501). Still others argued that while the very poor may fit the Brundtland mold, the “merely poor” conserve the environment (Annis 1992, 11).

In the attempt to exonerate the poor, other analysts asserted that the rich are the ones responsible for environmental degradation. For example, Madhav Gadgil and Ramachandra Guha called the most affluent sixth of the Indian population “omnivores” who are “devouring” the environment. Everyone else in India either tends the environment carefully or has become an “environmental refugee” in the wake of the destruction created by the omnivores (Gadgil and Guha 1995). Similarly, Lloyd Timberlake blamed tropical Africa's environmental degradation on the *wabenzi*, the high-consumption urban elite typified by Mercedes-Benz owners (Timberlake 1986, 9).³

1. For example, Piers Blaikie coined the phrase “desperate ecocide” to describe situations where peasants and pastoralists, under extreme pressure to survive, degraded their environment (1985, 117).

2. As individuals rise out of poverty, for example, they may acquire more cattle or replace their axe with a chain saw and thus exacerbate overgrazing or deforestation (Reardon and Vosti 1995, 1500).

3. This argument appears to have little force in Argentina. Except for pastoral activities, all the important agricultural products of the Argentine interior were produced (at least until the

Others have fixed the blame on a far narrower elite: the wealthy industrialists, loggers, and landowners along with their counterparts in the government who have wrought environmental devastation through pollution and rapacious consumption of resources (Broad and Cavanagh 1993). Long before the Brundtland Commission was formed, the dependency school had ascribed environmental degradation in developing countries to export-oriented agriculture, and by implication to consumers in the industrialized countries, multinational corporations, and the *comprador* elites of the developing countries who make this trade possible.⁴

Some contributions to the debate provoked by the Brundtland Commission have been marred by the attempt to identify a single villain. Most of the accused are probably guilty as charged but often share culpability with unindicted co-conspirators. In certain situations or regions, most of the ecological damage is clearly produced by a single group or perhaps even a single individual or company. Yet as soon as the scope of inquiry is broadened by examining other regions within the country or other forms of degradation, the picture is likely to become complicated quickly. For example, Gilberto Gallopin et al. have argued that the poor overuse the land because of their poverty, but the rich degrade the land too because their wealth allows them to invest elsewhere once resources in a particular locale have been exhausted (1989, 377).

Since the 1970s, political ecology has focused on the interconnections between class and the environment, usually without pursuing the single-villain approach.⁵ While political ecology lacks a coherent theoretical core, analysts in this tradition look for the social, historical, and economic roots of environmental degradation rather than for Malthusian population pressure or mere biological processes. They often view the state as an instrument of one class or another rather than standing above the class system. Susanna Hecht and Alexander Cockburn, for example, have described a complex situation: how impoverished settlers, miners, wealthy cattle ranchers, and loggers and the state through its sponsorship of hydroelectric dams and iron smelters (and the railroads, iron mines, and charcoal cutters that make iron smelting possible) have all played roles in deforesting the Amazon Basin (Hecht and Cockburn 1990, chaps. 7–8). Hecht and Cockburn have explained the relative importance of each of these groups

current liberalization of the economy) at considerable expense to urban taxpayers (by way of subsidies) and to consumers (via tariff protection and regulation) as ways of propping up the poorly performing economies of the interior (Sawers 1996, chaps. 4–7).

4. Marc Edelman has presented an interesting critique of this position (1994, 47–48). Most agricultural products of the Argentine interior are grown for the domestic market. Thus the *dependistas'* complaint about export-oriented agriculture has little relevance to Argentina.

5. See especially Blaikie and Brookfield (1987), Durham (1979), and Goodman and Redclift (1991). Donald Moore has contributed a useful review of the literature on political ecology (1996, 125–26).

in environmental degradation as well as the parts played by native Americans, rubber tappers, and nut harvesters who attempt to defend the forest.

Some of the literature on political ecology goes beyond identifying groups that abuse or protect the environment, dwelling instead on the interaction and feedback among classes. If a small elite seizes control over the bulk of a society's resources, those left without resources are going to be poor. If that elite continuously re-creates, reproduces, and even heightens the existing power and income inequality, the poor are going to stay poor or perhaps become even poorer (Lele 1991, 613). Thus the poor may be the agents of environmental degradation, but the ultimate responsibility lies with the well-to-do whose actions create or maintain poverty. William Durham and Michael Painter, for example, have shown that the profits to be gained in ranching, logging, and export-crop production produce deforestation (Durham 1994, 255; Painter 1994, 161). This deforestation forces the poor into compensatory efforts to expand production on marginal land, intensify existing production, or diversify into cash crops. All of these reactions place further pressure on the environment, further reduce the incomes of the poor, and reinforce the downward spiral of poverty and environmental destruction. Thus the wealthy degrade the environment directly but also indirectly by worsening the plight of the poor.

The purpose of this article is to analyze whether the wealthy or the poor or groups in the middle have produced the environmental degradation of the subregions of the Argentine interior. This research also seeks evidence on other issues raised in the Brundtland debate. Do the poor or the not-so-poor in the Argentine interior mobilize to protect their environment, or do they use traditional skills to husband their resources? The approach used to answer these questions lies within the boundaries of political ecology in that it melds the analysis of historical, political economic, and sociological processes to explain the environmental degradation of the Argentine interior. I will not, however, follow the lead of some political ecologists who stress the source of poverty and the role of the rich in making or keeping people poor, nor will I develop an explicit theory of the state. One cannot address every interesting question at the same time or in a single journal article.

It will be useful to some readers to begin by explaining the sharp differences between the more familiar Argentine pampa and the rest of the country, known as the interior (see map). The pampa is a fertile and well-watered grassland that extends in an arc of several hundred miles around Buenos Aires. This relatively resilient ecosystem has experienced a modest loss of topsoil and a noticeable decline in soil fertility in some areas due to continuous crop cultivation. The situation has been exacerbated by the recently introduced practice of double cropping. Nevertheless, most of the Argentine pampa is not threatened with severe degradation.⁶ Much of the

6. In part of the north central pampa where small and medium-sized farms have produced



FIGURE 1. Argentina (map from the U.S. State Department, with modifications by the author).

region is natural or improved pasture that is regenerated by the manure of grazing cattle. Much of the cropland rotates with pastures. The flat terrain does not encourage hydraulic erosion, and the abundant grasses inhibit eolian (wind) erosion. It is nonetheless true that aquifers severely degraded by industrial and human pollution lie beneath the pampean cities, dense smog hovers over them (especially in Córdoba, which is surrounded by low mountains), and some of the most polluted rivers in the world flow through them (such as the Riachuelo in Buenos Aires). But the major cities and most manufacturing on the pampa are narrowly concentrated in urban industrial belts on the eastern and western fringes. Most of the agricultural resources of the pampa have not been severely degraded.

In contrast, the two-thirds of Argentina that lies beyond the pampa is composed of fragile ecosystems. Most of the interior is semiarid or arid and can support only irrigated crop cultivation or land-extensive pastoral activities. Much of the scant precipitation in the arid regions occurs during torrential summer rainstorms that sweep away soil and breach the banks of irrigation canals. The cold climates of Patagonia and the Andean altiplano discourage agriculture. Where it rains enough for rain-fed crop cultivation, agriculture still faces difficult odds. The fragile soils in the hills and low mountains of Misiones erode easily. Low-lying areas of the Northeast are poorly drained and often appropriate only for pasturing cattle and sheep. In the Umbral al Chaco, frequent drought and early frost lead to crop failures every few years. Thus most of the interior is either too dry, too wet, or too cold. Most of it is also excessively steep and subject to erosion or flat and too poorly drained to support crop cultivation. Even before the soil was cultivated, it was poorly structured, with little organic material to bind it together (Barbona et al. 1988, 97; L. Ledesma 1988, 88; Müller 1984, 40). Decades of continuous use—or centuries in some cases—have further undermined organic material and soil porosity. The weakening of the soils has increased susceptibility to wind and water erosion. Large tracts have been abandoned with no reasonable hope that the land could be restored to productive use. The productivity of almost all the rest of these lands has been compromised.

An extended search for studies addressing the issue of who produced the environmental degradation of the Argentine interior turned up only a single unpublished report that attempted to answer the question

crops (mostly corn) continuously since the end of the nineteenth century, the soil has deteriorated markedly. Corn yields between 1971 and 1987 fell by nearly two-thirds, causing farmers to switch to other crops (Senigagliesi 1991, 34). On the semi-arid fringe of the pampa, overpasturing and failure to rotate crops have produced the same sort of problems that are widespread in the rest of Argentina: degeneration of natural pastures, deterioration of the soil, and erosion (Glave 1991, 70; Viglizzo and Roberto 1991, 95). Generally speaking, however, the ecology of the pampa is much less fragile than that of the rest of the country (Darwich 1991).

(Gallopín and Barrera n.d.).⁷ As a result, the methodology employed in this article is to approach the issue indirectly by asking several questions for each part of the interior. What precisely are the nature and extent of environmental degradation, in the past and in the present? Who developed each area's agricultural resources originally, and who continues to exploit those resources today—wealthy ranchers, middle-income settlers, impoverished squatters? What is known or can be conjectured about the tendency of these different groups to degrade their land?

The literature on the Argentine interior allows one to describe environmental degradation only broadly, often producing more questions than answers. Many authors surveyed in this article have made qualitative statements without offering quantitative documentation that would allow readers to judge the validity of their conclusions. For example, several authors writing about different parts of the interior argue that deforestation has led to reduced rainfall. Such an outcome would be a plausible result of clear-cutting in semiarid climates, but no data are presented nor is there any indication that such data exist. When data on other issues are provided, they are often not comparable with other data on the same area or other regions. Careful definitions of terms are also lacking. For example, various authors use the words *severe* and *moderate* to describe environmental degradation without explaining what the terms mean in those circumstances. Soil degradation can mean different things in deserts, rain forests, irrigated farms, or mountain slopes, yet some sources are ambiguous about the nature of the degradation being discussed. The subject matter demands precise information about tons of topsoil lost, measures of decline in species diversity in overgrazed pastures, decline of vegetative cover in areas subject to desertification, and kilograms of salt per hectare of irrigated soils. Such precision, however, is virtually absent from the literature. Environmental science is in its infancy in Argentina. The country's scientific infrastructure has thus far been unable to produce the kind of data expected from industrialized countries, data that Argentina will undoubtedly produce in the future. At present, however, environmental knowledge about the Argentine interior is imprecise and incomplete, and the following account necessarily reflects those limitations.

A related issue is the degree of confidence that can be placed in the authors cited in this review. Many of the studies cited here were published

7. The most useful sources of information in this search were found in Buenos Aires at the Instituto de Geografía of the Universidad Nacional de Buenos Aires, the Instituto Torcuato Di Tella (where I was *investigador visitante*), and the Comisión Económica para América Latina as well as the Fundación Mediterránea in Córdoba. Several U.S. libraries were also used. Newspapers in Argentina and the United States occasionally publish articles on the subject. Furthermore, the Foreign Agricultural Service of the U.S. Department of Agriculture supplies useful data and information. I traveled to every province of the interior to interview business and political leaders, economists, and agronomists.

by the widely respected Instituto Nacional de Tecnología Agraria (INTA), the branch of the Secretaría de Estado de Agricultura, Ganadería y Pesca that carries out agricultural research and extension work. Although many of their studies suffer from imprecision and lack of comparability, they appear to be objective if imprecise descriptions of the country's environmental problems.⁸ The authors cited here reinforce each other's analysis, creating still greater confidence that they have provided an accurate portrayal of Argentina's environmental problems.

Also frustrating is the lack of useful data on the economy of the interior, specifically distribution of income and land tenure. Some systematic data exist on land tenure, but the top bracket includes everything from giant estates to the small spreads operated by the near poor. Even if the data on large farms and ranches were published, they would be of limited use because wealthy individuals, families, or companies usually own more than one farm or ranch. One company in Patagonia, for example, operates sixty sheep ranches, each entailing a hundred thousand hectares (CIDA 1965, 69). The official data thus hide rather than reveal who really owns the land. Systematic data on the distribution of income are nonexistent. Only scattered data can be found on the proportion of households falling below the official Argentine standard of poverty, and most of it pertains to urban poverty rather than to the rural poverty that is the focus of my research. This poverty standard is based on such variables as type of dwelling and educational status of household heads rather than on a direct measure of income.

To understand how the interior's agricultural resources have become so degraded and who are the actors that produced this degradation, one must examine how the area was originally developed and how the land is presently being used. The degradation began soon after agricultural development was initiated and continues to the present day. Cuyo (the present-day provinces of Mendoza, San Juan, and San Luis) and the Northwest were conquered by the Spanish in the late sixteenth century. Native agriculturalists were incorporated into traditional Spanish colonial social and economic structures; native hunters and gatherers disappeared. Agriculture was limited to land-extensive pastoral activities and a little irrigated crop cultivation clustered around a handful of oases. Three centuries later, the economy and the society had hardly changed. Five of the nine provincial capitals in this part of Argentina still had fewer than 8,000 residents, and the largest had only 25,000. Fewer than 700,000 persons inhabited an area as large as all the states on the U.S. Atlantic coast. In the early 1860s, the province of Buenos Aires united with the more developed oases of the

8. In contrast to the other sources cited, the works of Raúl Dargoltz contain impassioned polemics (see 1980, 1983). I have cited some of his statistics nonetheless, believing that his zeal has not distorted his numbers.

Northwest and Cuyo to form Argentina. In the 1870s, the federal and provincial governments began an aggressive program to develop the agricultural resources of the Northwest and Cuyo through import-substituting "agriculturalization." They connected the two regions to the pampa by railroads and offered tariff protection to the wine and sugar industries, with heavy subsidies for sugar production.

The fledgling state quickly conquered or claimed territories in the northeast and the south that doubled the size of the interior. Patagonia was virtually unpopulated at the time, but the new state immediately began to sponsor colonization schemes there. By the 1880s, the army had eliminated the hostile native population from the pampean fringes in the *Campaña al Desierto*, clearing the way for development of Patagonia south of the pampa. Irrigated agriculture, made possible by a new railroad connecting the area to the market, developed slowly in the river valleys of northern Patagonia. As wheat cultivation and later cattle ranching took over the pampa at the end of the nineteenth century, shepherds moved their flocks south into Patagonia. By the end of the 1860s, a war with Paraguay ended with Argentina annexing the southern half of Paraguay, until then populated mostly by hunters and gatherers. Agricultural development could not begin in the eastern part of the newly acquired territory until the boundary between Brazil and Argentina was settled in the late 1890s. In the western part, the native population was not subdued until a military campaign ended all resistance in 1912. In sum, most of the agricultural development of the interior has taken place in the last 80 to 120 years.

As this brief review indicates, the interior of Argentina consists of many contrasting ecosystems, each with strikingly different environmental, economic, and social histories. The following section will attempt to place these disparate environments, economic activities, and histories into a manageable number of categories. In roughly descending order according to the amount of land affected, these categories are logging on the Chaco plain; dryland crop cultivation at the western edge of the Chaco plain; irrigated agriculture in the Northwest, Cuyo, and Patagonia; small farm agriculture in Misiones; and cotton farming in the Northeast. The article will conclude by discussing urban and industrial pollution that has contaminated parts of the Argentine interior, a summary of findings, and the conclusions suggested by this research.⁹

9. The activity with the broadest environmental impact in the Argentine interior is land-extensive pastoralism in the northern deserts and Patagonia. Overgrazing by cattle, sheep, and goats has severely degraded most of these ecologically fragile deserts. The excess burden of livestock on the land produced excessive erosion, replacement of edible species of plants by inedible ones, decline in vegetative cover, and possibly a decline in rainfall. In several provinces, moderate to severe erosion affected more than half of the land. In the areas hit hardest, blowing sand dunes engulfed houses and irrigation canals, and giant gullies swept away the earth. In Patagonia sheep herds are a third smaller than their maximum size a half-

CLEAR-CUTTING THE CHACO

While most of the Argentine interior was covered by desert scrub, substantial forests also grew there. Most of these forests have been cut down since development of the interior began in earnest little more than a century ago. They have been taken over by desert scrub. Since 1905, 100,000 square miles of forests have disappeared—almost 10 percent of the entire country. The remaining 40,000 square miles of forests are mostly inaccessible or degraded by selective cutting that has led to reverse genetic selection (Arias 1991, 46).¹⁰

Most of the forests in the interior grew on the southern Chaco plain that stretches westward from the Paraná River to the eastern edge of the Northwest.¹¹ Clear-cutting of these *quebracho* forests began in the 1880s in Catamarca, Santiago del Estero, and San Luis and continued after the turn

century ago because the land will no longer support so many animals. In parts of northern Patagonia and Salta, the herd size reached a maximum as early as 1910 or 1920. Unfortunately, data on the distribution of landownership do not give a clear sense of who owns these deserts. One group consists of wealthy ranchers: some *estancias* in Patagonia raise a quarter-million sheep (Capitanelli 1988, 724). One company in Patagonia owns six million hectares—more than 23,000 square miles, half again as big as Switzerland (CIDA 1965, 69). Four *estancias* in one department of northeastern Salta share 240,000 hectares or 850 square miles (Reboratti 1989, 25, 32). More than a quarter of La Rioja is covered by royal land grants dating back to the conquest in the sixteenth century (Martínez 1981, 4). In the literature, one can find mention of environmental abuse by the wealthy. For example, cattle ranching spread into eastern Salta and western Chaco and Formosa at the end of the nineteenth century, leading to severely degraded pastures within a few decades. No more than a dozen families in the extremely wealthy elite of Salta owned most of the cattle (León et al. 1985, 402–3). In contrast, most pastoralists in the interior are poor and own only a few head of livestock. A few thousand are nomadic peasants (Bendini and Tsakougmakos 1988, 129). The literature makes scattered mention of the inability of poor pastoralists (many of them squatters) to manage their lands properly. They cannot afford to build fences that might be on someone else's land, and without proper fencing, pastures cannot be rested to allow the grasses to recover (Amigo 1965, 33; Manzanal and Rofman 1989, 141–42; Natenzon 1988, 177–78). The strongest conclusion that can be drawn from the frustratingly fragmentary information available is that both poor and rich have degraded the environment, but the relative importance of each group in this degradation cannot be ascertained. For further information, see Michelena (1988), Caférata (1988, 27–30), Díez et al. (1988, 4), Adámoli et al. (1989, 27–30), Reboratti (1989), Lacorte (1991), Jiménez (1989), Biurrún (1988b), Andrade (1989), Prativiera and Michelena (1988), Walshbuguer (1990, 94–96), Barnes et al. (1988, 211), Berra and Braun (1988, 128–29), Braun (1988, 147–50), Peña Zubiate and d'Hiriart (1988, 153), Román and Santos (1988), Vessuri (1973, 40–41), Slatta (1980, 37–38), Correa (1991), INTA (1986, 68), Auer and Cappannini (1957), Méndez Casariego (1991), Landriscini (1985), Arias (1991, 46), Federación Lanera Argentina (1986, 15), and Andrés et al. (1981). See also Bonnie Tucker, "Will Patagonia's 'Gold' Turn Green?" *Buenos Aires Herald*, 25 Sept. 1994, p. 7.

10. Raúl Roccatagliata, "Choices for Arid, Semi-Arid Areas," *Buenos Aires Herald*, 24 Oct. 1992, 17.

11. The Chaco is a plain stretching from southern Brazil through Paraguay and into north-central Argentina. One province of Argentina is named Chaco (with no "the").

of the century in Tucumán, La Rioja, San Juan, Chaco, and Formosa.¹² Most of the land was sold by the government in gigantic blocks to rich investors. In the last quarter of the nineteenth century, for example, the province of Santiago del Estero sold 46 million hectares for a half-centavo each. The largest single block of land covered 3.8 million hectares (the size of Maryland and Delaware combined) (Dargoltz 1980, 137–39, 155–56). Fifteen million hectares of forested land in Chaco and Formosa Provinces were also sold in huge tracts. The largest landowner in the Northeast was a timber company known as the Forestal Land, Timber and Railway Co. Ltd., which owned 2.3 million hectares (an area one-third larger than Connecticut and Rhode Island combined) and 700 kilometers of railroad tracks (Bolsi 1985, 46). The Forestal also served as the principal logging company in Catamarca and Santiago del Estero (Dargoltz 1980, 137–39, 155–56). The cattle barons of La Rioja, on finding the profitability of cattle ranching declining at the end of the nineteenth century, sold off their cattle and began logging their own land (Natenzon 1988, 149). Most deforestation was carried out by major companies and wealthy landowners, although many small loggers took the regrowth for charcoal or carried on small logging operations in remote areas, a practice that continues today.

Most of this clear-cut land was already semiarid. Various analysts have claimed that deforestation produced a decline in rainfall that has slowed or (more often) prevented spontaneous regeneration of the forests (Dargoltz 1980, 1983; Natenzon 1988; Reboratti 1985, 63; N. Ledesma 1988, 206–10; Biurrún 1988a, 203). Only a few thousand hectares of land have been reforested (Andrade 1989, 287). Because of the aridity of the region, it takes a century or more for the forests to regenerate, even under the best of conditions (Walschbuguer 1990, 96). The many cattle, sheep, and goats that browse the saplings growing on largely unfenced land ensure that the forests do not regenerate (León et al. 1985, 403). As the forest cover disappeared, the grasses and other plants that thrived in the shade and humidity generated by the forests could no longer survive. As the ground cover was lost, the soil became much more susceptible to erosion by wind and water. This outcome exacerbated the risk of flooding in the area and hundreds of miles to the east.¹³ In the province of Chaco during 1985–1986, for example,

12. The eastern slopes of the Andean foothills in Patagonia were logged extensively. Whether the loggers were rich, poor, or in-between is unclear. The regrowth is gathered for firewood, an unlikely activity for the well-to-do. Deforestation has increased wind and water erosion. According to Garriz, this erosion led to a drier climate that discourages spontaneous reforestation and lessens the flow of irrigation water for downstream farmers (Garriz 1992, 180). In Santiago del Estero, plans are under way to clear-cut the remaining major stands of trees on the Chaco plain. See “Quebracho Woods Come under Threat,” *Buenos Aires Herald*, 15 May 1994, p. 4.

13. See Ricardo Bayón and Patrick Dugan, “Floods, Wetlands, and the Environment,” *Buenos Aires Herald*, 30 Jan. 1994, 5. Flooding occurs from the melting snowpack in the

the area flooded was almost as large as West Virginia (Walschbuguer 1990, 98).¹⁴

The eastern edge of the Chaco plain is humid enough to permit spontaneous regeneration of the forests, but logging operations there did not necessarily leave the land ready for other uses. In eastern Chaco and Formosa, suckers sprouted from the stumps left from the clear-cutting, producing in a few years an impenetrable thicket stretching for miles.¹⁵ One could walk under the branches in a natural quebracho forest, but the logged-over forests are difficult to exploit for pastoral or agricultural activities. Giant bulldozers must now be used to clear the land.

In short, deforestation of the Chaco plain has led to severe environmental degradation. Virtually all of it has been produced by the very wealthy.

DRYLAND FARMING IN THE UMBRAL AL CHACO

The western edge of the Chaco is known as the Umbral al Chaco (the threshold of the Chaco). Clear-cutting of the forests and overgrazing in scrub lands had turned this area into a wasteland that grazed only a few scrawny cattle and goats. In the early 1960s, however, increased rainfall in the region permitted an agricultural boom (Reboratti 1985, 61; 1989, 71–75; Jiménez 1989, 396; León 1976, 416–17; Prudkin 1989, 40; N. Ledesma 1988, 210; León et al. 1985, 399–402; Zuccardi et al. 1988, 225–29). Since then, nearly two million hectares of once barren land have been cleared and sown in grains, beans, and oil seeds.

Crop cultivation in the Umbral al Chaco had been initiated on small farms, but by the 1960s, large farms began to take over. Earnings per acre in grains, beans, and oilseeds are small, especially on poor soil with little rain and a short growing season. It therefore takes a large farm to generate much income. To compete in the global market for these crops, a farmer must achieve the high yields that only mechanization and heavy pesticide use

Andes. But torrential downpours can occur even in the semi-arid zones, often coinciding with the spring melt.

14. Another consequence of the deforestation is the spread of Chagas's disease. Insects known as *vinchucas* abounded in the forests. Clearing them disrupted the insects' ecology, and they settled in the straw roofs and the cracks in mud walls of houses that are typical of the region. A single house can shelter several thousand *vinchucas*. When these insects bite humans, they can infest victims with parasites that cause Chagas's disease, an incurable malady that is often fatal (Stillwaggon 1998, chap. 4). In the provinces that were logged intensively, 15 to 25 percent of the army draftees in the early 1980s had contracted Chagas's disease (INDEC 1985, 121). Human migration has now begun to spread the disease to the country's major urban centers.

15. Interview with Esteban Nevares, president of FUNDAPAZ (Fundación para la Paz), 12 Oct. 1993, Buenos Aires.

can generate. Even so, profits depend on mining the soil's fertility in a few years and then moving on to new land that costs almost nothing. Until recently, many of the farmers also received substantial subsidies from the federal and provincial governments. The small growers were quickly squeezed out of the market. By the late 1980s, 94 percent of the land in the area was held in farms of 500 hectares or larger (Reboratti 1989, 43, 62).

The land is cleared with pairs of giant earth-moving machines linked by chains that uproot all vegetation. Only an occasional windbreak is left. The highly diverse ecosystem is replaced by monocultivation that encourages pests, which can be checked only by large doses of pesticides. The farmers used seed varieties developed for temperate zones that are not resistant to the pests abounding in a semitropical climate. Thus the amount of pesticides required is higher than elsewhere (Reboratti 1990, 156). Fertilizer is rarely used because it is cheaper to buy and clear new land than to maintain the fertility of cleared land. An increase in rainfall made the boom possible, but rainfall has waxed and waned in the Umbral al Chaco over the decades. Even now, a crop is lost every four years on average to drought or frost (Reboratti 1989, 44). The climate could again become too dry for crop cultivation at any time. The growers' attention is consequently focused on the very short run, discouraging the careful husbanding of the land's fertility. Because any long-run profit is unlikely, maximizing short-run returns by mining the land is the (individually) rational course.

Once the land is cleared, it quickly loses its residual moisture and fertility. Water and wind erosion then take their toll. The beginning of the frost-free period coincides with the beginning of the seasonal rains. Consequently, the initial preparation of the soil for planting takes place when the ground is dry and eolian erosion is intense. When the rains begin, hydraulic erosion is severe because the land has just been plowed. The period of maximum rainfall also coincides with the period of minimum plant cover. As the land is mined, crops that can grow in less fertile soil are planted, and finally the land is left as pasture or abandoned. Even with the recent amount of rainfall, the land in this region can be cultivated for only six to eight years before it is useless for agricultural purposes.

The next section will give some idea of the environmental degradation in the Umbral al Chaco. One study in Salta showed a 50 percent drop in organic matter after three to four years of bean cultivation, and another showed losses of up to 73 percent in nine to eleven years (Casas and Michelen 1988, 239–41). A study in Santiago del Estero measured a 50 percent drop in nitrogen content of the soil after eight years of cultivation. Furthermore, the structure of the soil deteriorates after a few years of cultivation. In Tucumán, where the boom began, erosion has degraded all the agricultural land. Severe erosion is a problem on 10 to 16 percent of the land, depending on the area. Yields of dried beans are substantially lower than in

areas that have just come under cultivation (Yanes and Gerber 1989, 42; Reboratti 1989, 84). In the part of the Umbral al Chaco found in Salta, 160,000 hectares of agricultural (or formerly agricultural) land showed moderate to severe erosion, and 4,000 have been eroded by deep gullies—together nearly a third of the cleared land in the area (Reboratti 1989, 83–84; Román 1988, 145). Abuse of the soil was particularly acute in the early years of the boom. More recently, some producers have taken up crop rotation and contour plowing (Reboratti 1989, 63).

In sum, the agricultural resources of the Umbral al Chaco have been severely degraded. Wealthy farmers have produced virtually all the environmental degradation in the region.

IRRIGATED AGRICULTURE

Many problems plague irrigated agriculture everywhere: waterlogging, silting, salinization or alkalization of the soil, depletion or salt contamination of subterranean aquifers beneath the irrigated fields, loss of organic material and other nutrients from continuous cultivation, and erosion. These problems are also found in the Argentine interior wherever crops are irrigated (Hansis 1977, 369–71; Morris 1969, 101–3). Various reasons make small irrigated farms more likely than the larger farms to use techniques and practices that abuse the soil. Poor farmers almost always use gravity-fed irrigation systems that let water flow from irrigation canals and down the furrows. These systems tend to produce waterlogging, silting, excessive erosion, and salinization or alkalization of the soil, which lead in turn to a decline in soil fertility that is difficult or impossible to reverse. This outcome can be prevented or slowed by establishing proper drainage or by spraying well water on the fields instead of using gravity-fed systems. But drainage canals, tube wells, pumps, generators or electric transmission lines, and sprayers are expensive investments beyond the means of small farmers. Moreover, many of the poorest farmers are tenants or sharecroppers with little incentive to invest in the land that is not theirs. Finally, poor farmers may be less likely to manage their land to maintain its fertility in the long term if poverty forces them to maximize output in the short run. It is plausible (although undocumented) that poor farmers do less manuring, fallowing, or plowing under of green manure and use excessive irrigation water (which is priced lower than its full economic cost everywhere in Argentina) (Comisión de Tierras Áridas 1978, 21–22). Overwatering the land increases production in the short run but worsens waterlogging, silting, and mineralization in the long run.

Even though most irrigated farms are small (in much of the interior, the overwhelming majority), large landowners may own most of the irrigated land. In that case, even though the poor may abuse their land more,

the rich would be the main source of land degradation. I will examine the distribution of irrigated land by farm size for each of the different regions of the interior. Argentina has some 1.4 million hectares of irrigated land, almost all of it in the interior. The Northwest accounts for 36 percent of this irrigated land, Cuyo, 42 percent, and Patagonia, 18 percent.

The Northwest

Modern agricultural development in the interior began only in the 1870s, with the advent of sugar production in Tucumán. Most sugar was grown on large estates, but a significant fraction was produced on small farms. A series of financial disasters forced many large estates to sell land to small farmers. Although some giant estates remain, table 1 shows that the smaller farms produce an important share of the sugar grown in Tucumán: 35 percent of the crop is grown on farms of fewer than 20 hectares. Sugar cultivation spread northward into Salta and Jujuy in the early 1900s. From the beginning, huge estates produced virtually all of the sugar grown in the two provinces. By the 1980s, the largest grower was cultivating hundreds of thousands of hectares and produced 70 percent of the sugar in the province (Manzanal and Rofman 1989, 118). In the three provinces combined, just over half the sugar is produced on large farms. These three provinces, especially Salta and Jujuy, are also major tobacco growers, although the acreage in tobacco is a tiny fraction of the land devoted to sugar. The tobacco in Salta and Jujuy is grown mostly on small and medium-sized farms, and in Tucumán, mostly on small farms. Even less land is devoted to wine grapes than to tobacco in the Northwest. Table 1 shows that only Salta farmers grow a substantial share (one-third) of the grapes on large farms. About a third of the cotton grown in Santiago del Estero is produced on large farms. Citrus production is concentrated in large groves in Jujuy. Data for other provinces of the Northwest, where citrus production has grown rapidly in recent decades, or in Jujuy since 1969 are not available. Most of the irrigated land in the Northwest is devoted to sugar, about 40 percent of which is grown in Jujuy and Salta. In those two provinces, most of the irrigated land is farmed by the wealthy. In other parts of the Northwest, large farmers maintain a significant presence, but small or medium-sized growers predominate.

Irrigated crop cultivation in the Northwest has degraded 90 percent of the cultivated land in that region (Vargas Gil 1991, 128). A third of the irrigated land has been degraded by mineralization or waterlogging or both (Vargas Gil 1991, 128; Chambouleyron 1988, 153). In Salta 45 percent of the irrigated land exhibits problems with salinization, and 14 percent with waterlogging; in Tucumán the comparable figures are 43 percent and 32 percent (Barnes 1988, 259). In Santiago del Estero, excessive salinization and

TABLE 1 *Size Distribution of Irrigated Farms in the Argentine Interior according to the Percentage of Land Devoted to Different Crops by Farm Size*

Province	Crop	Percentage in Farms
		200 ha. or more (%)
Northwest		
Tucumán (1984) ^a	Sugar	26 ^b
Jujuy (1984) ^a	Sugar	96 ^b
Salta (1984) ^a	Sugar	100 ^b
Salta (1976) ^c	Tobacco	
Jujuy (1976) ^c	Tobacco	
Jujuy (1969) ^d	Oranges	
Salta (1990) ^e	Grapes	
La Rioja (1990) ^e	Grapes	
Catamarca (1990) ^e	Grapes	
Santiago del Estero (1968) ^f	Cotton	
Cuyo		
Mendoza and San Juan (1990) ^e	Grapes	
Patagonia		
Alto Valle (1979) ^g	Fruit, grapes, and tomatoes	
Rest of Patagonia (1986) ^h	Fruit, grapes, and tomatoes	

^a Manzanal and Rofman (1986, 117).

^b Percent of crop, not percent of land.

^c Catania and Carballo (1985, 43–45).

^d Yanes and Gerber (1989, 26).

alkalinization affect more than 60 percent of the irrigated land (Barnes 1988, 259, 263–64; Irurtia and Cantos 1988, 165). These three provinces account for more than 70 percent of the irrigated land in the Northwest.

Cuyo

When the Argentine Republic was formed in the 1860s, most of Cuyo was held in large estates devoted to cattle breeding. As the wine boom began in the 1880s, land suitable for irrigated agriculture was quickly parceled out to Italian and Spanish immigrants who had the skills to produce wine. These immigrants purchased or leased small plots of land or

TABLE 1 (continued)

Percentage in Farms				
100 ha. or more (%)	50 ha. or more (%)	40 ha. or more (%)	20 ha. or fewer (%)	10 ha. or fewer (%)
			35% ^b	
			0 ^b	
			0 ^b	
		41 ^b	34 ^b	12 ^b
		44 ^b	33 ^b	11 ^b
99				
33	41			16
4	19			33
10	16			67
37	60		25	17
9	18			40
2	6		71	38
			71	

^e Crecer (1993, t. 35).

^f Vessuri (1972, 355). Data refer to the most important cotton area in the province.

^g Manzanal and Vapnarsky (1987, 54).

^h Derived from INTA (1986, 73–74).

worked as *contratistas* (sharecroppers).¹⁶ Today, some large farms produce grapes, fruit, and vegetables, but most wine growers in Cuyo are still of modest means (table 1). Two-fifths of the grapes are grown in vineyards of fewer than 10 hectares, rarely enough to support a family above the poverty level. Only 9 percent of the grape land is held in farms of more than 100 hectares.

In Mendoza and San Juan, over three-fifths of the irrigated land are affected by salinization and nearly that much by waterlogging (Barnes 1988, 259). Some of the salt deposited by irrigation water on the fields has perco-

16. Until the 1970s, nearly half the vine land in Mendoza and over a third of the land in San Juan were farmed by *contratistas*.

lated into subterranean aquifers. All the aquifers near the oases of Cuyo are contaminated with salt (Chambouleyron 1991, 157; Barnes 1988, 260). In some parts of Mendoza, wells must be drilled deeper than 600 feet to find potable water. In other places, water that is not too salty for drinking or irrigation cannot be found at any depth.

These aquifers represent a source of irrigation water. Almost 20,000 wells operate in Cuyo, whereas irrigation wells are rare elsewhere in Argentina (Berra and Braun 1988, 124). Nearly half of the irrigated land in Mendoza now uses well water to supplement the irregular flow of river water, and one-sixth of the irrigated land draws on well water exclusively. The contamination of the aquifers now threatens agriculture in the region. During the 1970s, when wine production peaked, water pumped out of the aquifers exceeded what was added naturally. Aquifers are renewable resources, but in Cuyo they renew themselves at a glacial pace because of the extreme aridity of the region. Irrigated acreage thus had expanded beyond the long-term carrying capacity of the environment. Since 1976, a 60 percent reduction in grape production (caused by a collapse in demand for wine) has eased pressure on the aquifers (Mendoza, Gobierno de, 1992, 70). As wells have pumped less water, the water table has risen, but the problem of waterlogging has worsened.

Patagonia

The first colonists in Patagonia settled in the Chubut Valley in the 1860s. Initially, most of the land was divided into medium-sized farms. But the subdivision of land through inheritance and the declining fertility of the soil impoverished many of the farmers. As early as 1902, the area was expelling surplus population moving elsewhere to find land. Little agriculture remains in the Chubut Valley (Barnes 1988, 259). At present 80 percent of the land in the valley is affected by waterlogging and nearly half by salinization (Barnes 1988, 259).

After the *Campaña al Desierto*, farmers followed the shepherds who were moving into Patagonia in substantial numbers. Farmers settled in the river bottoms of northern Patagonia and grew alfalfa for seed or for export via the new railroad. Decades later, farmers switched to tree crops, grapes, and tomatoes. From the beginning, the federal government attempted to shape the colonization effort to keep the cropland from falling into the hands of a few rich landlords. Fruit packers and processors have acquired a few very large farms, while the smaller farms have been subdivided through inheritance. Many farmers sold part of their land to finance investments in orchards or vineyards. Thus medium-sized farms have tended to be replaced by many small farms and a few large ones. As can be seen in table 1, in the Alto Valle in 1979 (which contains three-quarters of the irrigated farm land in northern Patagonia), only 2 percent of the land

was held in farms of 100 or more hectares (Manzanal and Vapnarsky 1987, 54). In all of northern Patagonia, those with fewer than 20 hectares held 71 percent of the irrigated land. The dramatic drop in fruit prices in the last two decades has meant that 10 or 20 hectares cannot keep a family much above the poverty level. Over the last few decades, about half the irrigated farms in northern Patagonia have been acquired by the urban middle class (INTA 1986, 8). Thus while most of the irrigated land in Patagonia is found on farms too small to support a family, many of these small farmers are not poor because they have other sources of income.

In northern Patagonia, 38 percent of the irrigated land is contaminated with salt, and 43 percent is waterlogged (derived from Barnes 1988, 259). Twelve percent of the irrigated land has been completely abandoned, and another 28 percent is not currently cultivated (INTA 1986, 8, 82). In Patagonia as a whole, 12 percent of the irrigated land is used for pasturing cattle, one of the few growth activities in the region. It might be supposed that in a country where 45 million cattle live on some of the most fertile rain-fed pastures in the world, grazing animals on irrigated land in a cold desert would make little sense. But where land has deteriorated enough, it cannot be used profitably for anything else (INTA 1986, 136–37, 141). Yields in apples, the dominant crop, are stagnant, and those in other crops are increasing only slowly (*Indicadores* 1991; Bilder and Garriz 1992, 158).

In sum, irrigation has produced substantial degradation of the agricultural resources of the interior. In Jujuy and Salta, most irrigated land is found on very large farms. Thus the wealthy landowners and corporations have produced the bulk of the environmental degradation there. In Tucumán and Santiago del Estero, an important share of the land is also in large tracts, but it is not clear whether the large or small farms have produced the environmental degradation. In Cuyo, Catamarca, and La Rioja, most of the irrigated land is divided into small farms, and the poor are the principal protagonists in this tale of environmental degradation. In Patagonia, the wealthy and the very poor have played small roles. Those in between have produced many of the environmental problems in irrigated agriculture.

DESTROYING MISIONES

In the space of one week in 1881, the provincial government of Corrientes sold most of the province of Misiones—over two million hectares—to twenty-nine investors. The largest tract totaled 600,000 hectares (almost as large as the state of Delaware), and the average was 70,000 hectares. Correntine government officials thought they were selling the entire province, but because they lacked surveys or maps of Misiones, they mistakenly left the central part of the province in federal hands. Huge properties remain in Misiones, but most of the agriculturally exploited land

is held in small farms. The land was sold in small lots to settlers. At this point, subdivision through inheritance has turned most of the small farms into tiny farms. Squatters invaded the government-owned land. The government encouraged the production of yerba maté on small farms at various times between the 1930s and the 1980s by prohibiting large farms from planting new trees (Sawers 1996, 106–8). This ban also raised the price of the leaf, allowing small growers to survive. The military government in power from 1976 to 1983 treated the small growers more harshly, and the current administration of President Carlos Menem completely liberalized industry in 1991. Both these events caused the number of very small farms to drop sharply. Even so, small farms have dominated agriculture in Misiones throughout the twentieth century.

The four most important cash crops in Misiones are produced mainly by farmers below the poverty line or barely above it. Less than 7 percent of the yerba maté in 1986 was grown on farms larger than 400 hectares, compared with 13 percent in 1935, when the degradation of the province began (Manzanal and Rofman 1989, 217; Baracat n.d., 4). Two-thirds of the yerba acreage were found on farms with fewer than 25 hectares, and only a fifth was on farms larger than 50 hectares. Similarly, about two-fifths of the tea acreage in 1969 were on farms of 25 hectares or fewer, and only a third was on farms with more than 50 hectares.¹⁷ Subdivision of land through inheritance has surely raised the proportion of tea grown on small farms since 1969. A farm of 25 hectares with only 5 or 10 hectares in yerba or tea cannot keep a family out of poverty.¹⁸ Furthermore, most of the tobacco in Misiones is also grown on small plots of land. The average tobacco farm cultivated just over 2 hectares of tobacco (Catania and Carballo 1985, 18). Comparable data on the size distribution of tung orchards in Misiones is not available, but narratives of the crop's development indicate that it too was grown predominately in small groves (Bolsi 1985, 88).¹⁹ Much of the rest of Misiones cropland not devoted to these crops is farmed by subsistence producers (Lacorte 1991, 137).

About 1.1 million hectares—one-third of the land in Misiones—have been deforested and cultivated. Seventy percent of this land (27 percent of the province) has now been abandoned because of loss of fertility (Müller 1984, 40; Lacorte 1991, 136). Most of Misiones is covered with hills or low mountains. Heavy rainfall combined with the clear-cutting of steep hillsides dramatically increases the extent and severity of erosion. Nearly

17. These figures are for the two departments accounting for 70 percent of the province's tea production (Quiroga n.d., 30).

18. Argentine tea generates little revenue because the low-quality tea is mechanically harvested, unlike the hand-picked high-quality tea grown elsewhere. Yerba maté is a kind of tea made from tree leaves. Unlike other orchard crops, yerba maté produces only modest revenues per hectare.

19. Tung oil is used to make oil-based paints.

three-quarters of the land still producing yerba maté and about half of the land in tea and tung have suffered moderate to severe erosion (Casas et al. 1988, 133).

Many of the poorest farmers lack clear title to their land and thus have little incentive to preserve its fertility. About a quarter of the cultivated land in Misiones is farmed by squatters, most of them illegal immigrants from Brazil. They use slash-and-burn cultivation practices that leave the soil barren and useless within two years.²⁰ One group, after squatting for a few years, refused to accept the land from the government at no charge. They had so abused the land that they did not want to own it (Eidt 1971, 211). The settling of small farmers in Misiones has thus produced severe environmental degradation.

COTTON AND ENVIRONMENTAL DEGRADATION

Most of Chaco and Formosa is used for pastoral purposes, but the central third of the two provinces is devoted largely to cropland. After the area was logged over in the early part of the twentieth century, cotton cultivation spread over the deforested land. Cotton peaked at mid-century, when 80 percent of the cultivated land in the area was devoted to the crop. By the 1960s, the expansion of the domestic textile industry had run its course, and the international cotton market soured. Many of the larger farms turned to soy, sorghum, or sunflowers, but small farmers could not afford to abandon cotton because it generated so much more revenue per hectare than alternative crops. The cotton market deteriorated steadily, subdivision through inheritance continued, and by the early 1980s, most of the cotton growers were living below or barely above the poverty line. In Chaco, for example, 63 percent of the farms were *minifundios* (smaller than 20 hectares) in 1982, and 86 percent of the farms had fewer than 50 hectares. Cotton farms with more than 200 hectares cultivated less than 6 percent of the land (Besil and Gelman n.d., 11; Manzanal and Rofman 1989, 86). Ten years later, falling cotton prices, terrible floods, and the arrival of the boll weevil had driven many small producers off the land. A growing fraction of the cotton was grown on medium-sized farms (CFI June 1993, 33). In Formosa (which grew only a quarter as much cotton as Chaco), the minifundios were far more prominent, producing 60 percent of the crop.

Long before the Brundtland Commission popularized the notion, a number of Argentine sociologists and economists had argued that the poor cotton farmers of Chaco and Formosa abused their land more than those who were not poor (Archetti and Stölen 1975, 211; Benencia and Forni 1986, 15; Manzanal and Rofman 1989, 67; Vargas Gil 1991, 124; Rofman 1986, 44–45). Their poverty prevents them from buying the expensive equipment

20. Carmen Pignotti, "Misiones Rainforest Dwindling," *Buenos Aires Herald*, 6 Nov. 1994, p. 4.

needed to apply fertilizer, disallows the possibility of fallowing their land or rotating crops with legumes (which could often double yields), and deters them from switching to crops such as soy that do not deplete the soil's fertility as rapidly (Bermúdez et al. 1965, 2). Furthermore, most of the poorest farmers are squatting on government land. They have neither incentive to invest in the land nor collateral on which to borrow for investment.²¹ Gallopin et al. (1989) have suggested that both rich and poor farmers play prominent roles in the environmental degradation of Chaco province. They argue that the large farmers, especially corporations, "are motivated to maximize profits at the expense of sustainability since their capital can be diverted to new investments once a resource is exhausted" (Gallopin et al. 1989, 377). According to their argument, middle-sized farmers have both a stake in the resources on which they rely to produce their income and the ability to sustain them. Neither of these assertions about the tendency of the rich or poor to abuse the environment is supported by careful quantitative research.

Degradation of the area's agricultural resources is widespread. For example, loss of organic material in the soil of continuously cultivated land is on the order of 50 percent and reached 80 percent in some areas as early as 25 years ago (Archetti and Stölen 1974, 160; Lacorte 1991, 143). Salinization, waterlogging, cementation, and excessive erosion of the soil are frequent. Two-fifths of Formosa and 29 percent of Chaco have been eroded to a moderate or intense degree (Barbona et al. 1988, 96; L. Ledesma 1988, 84; Lacorte 1991, 143).²² According to most observers, the poor are the most likely to degrade their land. But given the extent of environmental deterioration and the proportion of the land actually farmed by the poor, it is likely that middle- and upper-income farmers have also played an important although secondary role in destroying the area's agricultural resources.

CONTAMINATING THE ENVIRONMENT

Most Argentine industry operates on the pampa. Industry in the in-

21. In 1938 when cotton cultivation was beginning to ruin the provinces of Chaco and Formosa, only 11 percent of the land was farmed by the owner. Twenty-eight percent of the cotton land was rented. The rest belonged to the government (Brodersohn and Slutzky 1978, 222). I have been unable to locate more recent data. The government granted clear title to some of the better-off cotton farmers after 1976, and many of the poorest farmers have left. Consequently, the proportion of persons farming government land has almost surely declined.

22. In the cotton-growing areas of the Northeast, the environment has responded to abuse with a plague of insects. See Argentine Cotton Chamber, "Boll Weevil Threatens Cotton Business," *Buenos Aires Herald*, 4 Jan. 1992, p. 14; and CFI (1993, 2). Monocultivation by impoverished farmers has invited boll weevils into the region. These pests arrived in Argentina in 1993. They had already ravaged crops in neighboring Paraguay and Brazil, and sanitary practices that would have delayed or stopped their spread into Argentina were not used. Fighting these pests will exacerbate the environmental decline of the region because the only way to eradicate boll weevils is by repeated doses (as many as forty a year) of a strong pesticide.

terior consists mostly of plants that process agricultural products such as sugarcane, pulpwood, and wine grapes.²³ The interior also contains petroleum wells, refineries, mines, and smelters. Most of these industrial activities have produced considerable pollution in their immediate environs as well as downstream and downwind. Vast tracts of the interior, however, have no manufacturing or extractive industries and thus remain free of industrial pollution.

Quantitative measures of industrial pollution are not available, but several articles have described the problem in general terms. Factories and petroleum refineries in the interior have contaminated groundwater and subterranean aquifers with heavy metals (boron, cadmium, mercury, and lead) and with synthetic toxins (biphenyls, PCBs, and petroleum by-products) (Vargas Gil 1991, 124–28; Chambouleyron 1991, 155–59; Benencia and Forni 1986, 12; Lacorte 1991, 139–46; INTA 1986, 88–91; Manzanal and Rofman 1989, 137). Discharge from sugar and pulp mills of organic wastes with a high biological demand for oxygen has produced algal contamination and reduced the ability of streams and rivers to support aquatic life. The buildup of nitrogen and phosphorous has encouraged eutrophication of reservoirs and lakes from which irrigation water is drawn.²⁴ The resulting decline in quantity and quality of irrigation water prejudices agriculture. In addition, the petroleum industry in Salta, Mendoza, and Patagonia has cleared much land for its operations, producing soil erosion that further degrades water quality in the region (Barnes 1988, 264). Refining operations have also contributed to air pollution as well as surface and subsurface water contamination. In addition, urban growth without proper attention to sewage or solid waste disposal has fouled the environment. In only one example of the contamination of the interior by industrial and agricultural sources, the Río Uruguay along the eastern border of Misiones is now almost devoid of fish because of pollution (Lacorte et al. 1991, 139).

Almost all the interior's industry is owned either by the local elite, investors in Buenos Aires, a few multinational corporations, or the federal government (until the recent wave of privatization). Wealthy factory owners and state-operated enterprises have thus produced nearly all the environmental contamination of the interior by industrial wastes.

In addition to industrial effluents, agricultural runoff pollutes the environment further. Pesticide and fertilizer runoffs come from farms of all sizes. Smaller farmers cannot afford to use large quantities of agricultural chemicals or the machinery to spread them. In some parts of the interior, most of the cropland is cultivated by the poor, but they are the major source

23. The most important exceptions are the environs of the provincial capitals of Mendoza and San Luis.

24. With eutrophication, a body of water becomes enriched in dissolved nutrients that stimulate the growth of aquatic plant life, which usually results in the depletion of dissolved oxygen.

of this form of pollution even though they use less fertilizer and pesticide per hectare than do larger farms. In Misiones, for example, the main source of pesticide runoff is tobacco and yerba maté cultivation, both of which are dominated by small growers.

SUMMARY AND CONCLUSIONS

Any attempt to demonstrate that a single class has produced most of the environmental degradation of the Argentine interior is not supported by the evidence presented in this investigation. Most of the population in most of the rural interior fits the classic Brundtland mold of those who are too poor today to afford the luxury of caring about the environment of tomorrow. In some parts of the interior, the poor have produced most of the environmental degradation. These groups include growers of yerba maté, tea, tobacco, and tung as well as subsistence squatters in Misiones, cotton growers in Chaco and Formosa, and farmers using irrigated land in Cuyo and parts of the Northwest. At the same time, much of the interior is owned by a wealthy few, and they have produced some of the worst environmental devastation in the Argentine interior. Irrigated agriculture in Salta and Jujuy, logging on the Chaco plain, and dryland farming in the Umbral al Chaco have been dominated by the very wealthy, and all these activities have severely degraded the environment. In still other areas and activities, all classes have played significant roles in the environmental degradation. The clearest example is irrigated agriculture in Patagonia.

My search of the literature on agriculture and the environment in the Argentine interior has uncovered no evidence suggesting that any of the poor agriculturalists of the interior are environmental activists who defend the environment because they know their livelihood depends on it. Perhaps the rural poor would have been more likely to organize to protect the environment without the military government's ruthless suppression of their organizations between 1976 and 1983, which left them with little voice on any issue.²⁵ Yet even before the late 1970s, no political organizing had occurred among the poor around environmental issues, and no evidence suggests that organizing would have occurred after 1976 if the government had not suppressed their organizations. In other parts of the world, the poor who act politically to defend their land from degradation typically protest the activities of wealthy loggers, ranchers, landlords, and industrialists or large state-sponsored institutions that encroach on their land and

25. Beginning at the end of 1993, the urban lower and middle classes of the interior began rioting sporadically to protest macroeconomic austerity measures. But the rural poor have been vocal on only a few occasions, and none of their protests focused on the environment. In one case, poor inhabitants of the interior recently welcomed the establishment of a toxic waste dump in their neighborhood as a source of income.

prejudice their survival. In the Argentine interior, in contrast, the environment in which most of the poor live and work had already been degraded by deforestation and overgrazing before they settled there or by the poor themselves after they arrived. Contamination of the environment by industrial or extractive activities accounts for a small part of the environmental degradation of the interior and has not affected most of the poor. Thus even if the poor in the interior were inclined toward activism, the wealthy are not an obvious target for environmental protest by the poor.

Furthermore, one cannot characterize most poor agriculturalists in the Argentine interior as a group that uses ancient traditions and intimate knowledge of their surroundings to preserve their environment. Apart from the Northwest, the interior was agriculturally developed in the last century by migrants from ecologically dissimilar parts of Argentina and from Europe, often by settlers who had little notion of how to cultivate their new crops in their new surroundings. Examples are the Polish settlers in Misiones who started growing tung and tea, crops never before cultivated in Argentina or Poland. In much of the interior, serious agricultural development began only early in the twentieth century. Frequently, environmental deterioration commenced as soon as the land was settled. The settlers' lack of experience with their hostile environment surely heightened the degree of environmental abuse. Moreover, the squatters who are still using slash-and-burn methods to denude Misiones are employing traditional farming methods that destroy rather than husband the environment. This point does not contradict the finding that the poor are ecology experts in other settings. The present research demonstrates instead the heterogeneity of poverty and the environments in which the poor live.

Before degradation of the environment can be slowed or reversed, it must first be determined who has done the degrading and why. This research has described the wide variety of actors and processes involved in the environmental degradation of the Argentine interior. It complements the work of many other investigators who have studied environmental degradation in other parts of the developing world. In Argentina as elsewhere, the desperation of the poor leads them to degrade the environment, but they are joined by a wide array of other actors—wealthy estate owners, cattle barons, logging companies, a handful of transnational corporations, industrialists, and bureaucrats operating state-owned enterprises—whose actions have also produced widespread environmental degradation. Finding a solution to environmental problems thus requires localized knowledge of these complex and heterogenous economic, social, and political processes.

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