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Constitutional Orders and Deforestation

A Cross-National Analysis of the Humid Tropics

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CONSTITUTIONAL ORDERS AND DEFORESTATION: A CROSS-NATIONAL ANALYSIS OF THE HUMID TROPICS

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It is said that the researching and writing of a dissertation is a lonely experience. Whether being hypnotized by a computer screen for hours on end or engaged in an interminable search for a book long since stolen from the library stacks, popular images of the doctoral candidate working to complete a dissertation portray such a daily existence as hopelessly solitary, even monastic. Indeed, this dissertation did in fact demand that I spend large amounts of time "in the monastery." However, this dissertation also afforded me the opportunity to travel to new places, to meet new people, to encounter new ideas, and to establish new relationships, both personal and professional. Thus, while a certain amount of loneliness may permeate the words that cover the following pages, this loneliness is hopefully drowned out by more resonant echoes of discovery.

As much as I would like to say that I have arrived at this point solely on the strength of my own efforts, this dissertation simply would not have been possible without the help of the following cast of characters. Elinor Ostrom, my dissertation committee chair, has been the source of unflagging support throughout my entire academic career at Indiana University. Without her encouragement, constructive criticism, and gentle prodding, this dissertation would have certainly been much less than it currently is and taken much longer than it already has. Thank you, Lin, for believing that I could produce something worthwhile. I would also like to thank the other members of my dissertation committee—Kathryn Firmin-Sellers, John Williams, and Kerry Krutilla—for their comments, criticisms, and suggestions on earlier drafts of this dissertation. Without doubt, their counsel helped to move this study well beyond its earlier incarnations.

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In terms of financial support, I would like to thank the Workshop in Political Theory and Policy Analysis; the Social and Ecological System Linkage Group of the Project on Property Rights and the Performance of Natural Resource Systems at the Beijer International Institute of Ecological Economics; the Research and University Graduate School at Indiana University; and the Center for the Study of Institutions, Population, and Environmental Change (CIPEC). Finally, I would like to thank all those at the Workshop and CIPEC who contributed to the collegial atmosphere in which I worked during my time in Bloomington.

Paul Warren Turner

Constitutional Orders and Deforestation: A Cross-National Analysis of the Humid Tropics

In this study, I explore the intermediary role of national political institutions in the context of deforestation in the humid tropics. More specifically, I focus on those institutions that shape the *constitutional order*—that is, the basic macropolitical framework that defines a polity's most fundamental rules regarding political roles and relationships. I give special attention to those rules that determine the locus of policymaking authority and the accountability relationships that obtain between politicians and citizens. I hypothesize that open constitutional orders will suffer lower levels of deforestation because such orders are more likely to be responsive to the policy preference of peasant producers—the predominant occupational class in the humid tropics—for a more diffuse distribution of landed property rights. Where the distribution of landed property rights is more diffuse, fewer *shifted cultivators* (peasant producers displaced to frontier regions) will be created and, therefore, the pressures to clear tropical forest cover will be less pronounced.

To examine this hypothesis, I conduct a statistical analysis of fifty-eight (58) countries in the humid tropics using data from the period 1976-1990. Because of the presence of several influential cases in the data set, I employ robust regression methods, supplemented with bootstrap methods. To probe the potential fragility of the relationship between constitutional openness and tropical deforestation, I also perform a sensitivity analysis. This consists of the estimation of various alternative model specifications, controlling for additional factors that existing theory suggests are also important in explaining cross-national variation in tropical deforestation levels. The results of the analysis reveal that the relationship between constitutional openness and tropical deforestation levels is consistently in the hypothesized direction, and generally within the limits of conventional levels of statistical significance.

Among the important conclusions of the study are that tropical deforestation processes are inextricably linked to landed property rights struggles within tropical countries and that national political institutions matter in determining the outcomes of such struggles.

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CHAPTER ONE

INTRODUCTION

Justification of the Study

The problem of tropical deforestation has proven to be one of the most divisive transnational issues of our time. Contentious debates over its causes and possible solutions have revealed deep cleavages along several distinct dimensions: North-South; traditional-modern; male-female; rich-poor; rural-urban. These debates have been waged at international conferences, on the floors of national legislatures, in scholarly books and journals, and in numerous popular media outlets. At least in terms of public attention, then, the problem of tropical deforestation has not suffered from neglect.

Given the amount of attention that the problem of tropical deforestation has already received, one might reasonably ask what new knowledge yet another study of tropical deforestation might produce. Indeed, this type of question should be asked of any prospective research endeavor: What meaningful insights will this research uncover that previous efforts have left untouched?

To answer this question in the context of this study requires that I first provide a brief overview of the literature that has evolved to explain the incidence of tropical deforestation. Typically, works on tropical deforestation make the distinction between *proximate* and *underlying* causal mechanisms (e.g., Rowe, Sharma, and Browder 1992: 34-40; Grainger 1993: 17-18). Proximate causes are the immediate causes of deforestation—the alternative land uses to which forested lands are put or the physical activities that lead directly to forest loss. The most commonly cited proximate causes of deforestation are clearing for agriculture (both shifting and permanent), logging activity, fuelwood gathering, clearing for pasture, mining activity, and clearing for large development projects (Williams 1989: 189-193; Amelung and Diehl 1992: 15-21; Myers 1992a: 91-185; Park 1992: 43-80; Rowe, Sharma, and Browder 1992: 34-36; Grainger 1993: 49-68).

Because the proximate causes of tropical deforestation are relatively well established, the tropical deforestation literature has shifted in recent years to focus on the *underlying* causes—that is, the indirect, or secondary, mechanisms that lead individuals to clear forested lands for agriculture, timber, fuelwood, pasture, mineral deposits, and development projects. Explanations concerning the underlying causes of tropical deforestation are generally subsumed under one of three categories: (1) neo-Malthusian explanations; (2) neoclassical explanations; and (3) dependency/world-systems explanations (Stonich 1993: 21-25; Jolly 1994: 63-78; Browder 1995: 124-125). While adherents of the neo-Malthusian perspective point to increasing population pressures in tropical countries as the underlying cause of forest loss, proponents of the neoclassical position cite the absence of well-functioning markets in tropical countries—markets that would yield clearly defined property rights and, thereby, create incentives to conserve—as the key factor underlying the clearance of tropical forest

cover. In contrast to these two "inward-looking" approaches, dependency and world-systems explanations underscore the disadvantaged position that tropical countries occupy in the world economy, a position from which they exercise only marginal control over their economies and, consequently, over the disposition of their natural resources.

The purpose of this study is not to attempt to resolve the debate over which of these three perspectives is "the best" at explaining tropical deforestation. Because tropical deforestation is such an inherently complex problem, any effort to distill one, and only one, theoretical approach from the explanatory brew would almost certainly result in more obfuscation than illumination. The contribution that I seek to make, rather, is to accent the role of yet another set of factors that have heretofore been largely neglected in the explanatory literature on tropical deforestation—national political institutions. As I conceptualize the role of national political institutions in the context of this research, such institutions act as *mediating forces* between the underlying and proximate causes of tropical deforestation. Thus, it is my contention that rising population pressures, market failures, and expanded contacts with the world economy need not—and do not—lead deterministically to higher levels of tropical deforestation. Rather, the impact of these factors on tropical forest land-use outcomes (i.e., the proximate causes) is filtered through the prevailing national political institutions of individual tropical countries.

The impact of these factors on tropical forest land-use outcomes is filtered most importantly, I maintain, by the institutions operative at the *constitutional* level of analysis. At the constitutional level:

> ...one is concerned with basic questions of why human beings have recourse to political institutions, and what options are available.... The constitutional level of analysis has a fundamental role in clarifying the design of structural arrangements that apply to the play of the games of politics. The play of a game is determined by the rules of the game; and the rules establishing the terms and conditions of governance are constitutional in character. The constitutional level of analysis, then, informs the operational level of analysis of who gets what, when, and how. (V. Ostrom 1982: 237)

The importance of this last point can not be emphasized enough: "The constitutional level of analysis ... informs the operational level of analysis of who gets what, when, and how." Thus, the *constitutional order*—tentatively defined as the general character of the rules establishing the terms and conditions of governance—has a significant impact on how a polity distributes, and redistributes, its resources among its members.

To begin to appreciate the importance of constitutional orders for the study of tropical deforestation, it is important to understand the "who, what, when, and how" of the tropical country political economy. The chief point to be made in this regard is that the vast majority of tropical countries are less-developed countries (LDCs) (Kamarck 1976: 3-12; Ooi 1983: 1-2; Baker 1993: 6-10). For the purposes of this research, this

fact has two major implications. First, economic production in tropical countries is typically based on a large primary sector, usually agriculture (Nafziger 1990: 64-67). Thus, land is often the dominant factor of production in tropical country economies. Second, the bulk of tropical country populations are located in rural areas and consist primarily of peasant producers who rely upon land and the resources that it sustains for their subsistence needs and limited commercial activities (ibid.). Historically, this central location of land in the productive activities of LDCs has also meant that it has been the focal point of conflict, a point lucidly recognized by Prosterman and Riedinger:

> Land is the chief source of livelihood, security, and status for most people in the less developed countries. In Asia and Africa about 70 percent of the population are still rural; in Asia an estimated 56 percent of the entire population, and in Africa 61 percent, still make their living from the land. In the world as a whole there are still well over 400 million agricultural families, constituting very nearly half of our planet's population. Thus, it should not be surprising that in many societies the principal subject of grievances and the principal occasions for blame should be land-related; specifically, that a very high proportion of the most violent twentieth-century civil conflicts should have occurred in situations where a substantial percentage of the population were blocked, by human agents, from having a secure and remunerative relation with the land they tilled. (1987: 10)

Indeed, the modern history of tropical country political economies with regard to the control of landed resources is essentially one of "blockage." In general, participation in the decisions affecting the use of landed resources has been limited to urban-based actors, namely domestic and transnational producers and their central government patrons who supply them with favorable government policies (e.g., timber concessions, agricultural subsidies, mineral rights) in exchange for their political support (e.g., Lipton 1977; Bates 1981). To expand and consolidate their stores of landed resources, thereby maintaining the enticements they are able to offer their political clients, central government politicians have actively—and often violently—excluded peasant producers from the policymaking process. Thus, over time, control over landed resources has become increasingly concentrated in the hands of central government politicians and their clients, most often at the expense of peasant producers.

Thus, tropical country political economies are marked by a fundamental tension: the majority of tropical country populations consists of peasant producers located in rural areas, drawing their subsistence needs from the same landed resources that central government politicians seek to acquire for use as political patronage. Given such structural conditions, the proclivity for conflict between these two groups of actors is obvious.

Yet, while tropical countries share many of the structural conditions that give rise to conflicts over landed resources, they clearly differ in how they resolve such conflicts. Though most tropical countries follow the general pattern of central governments resolving land-use conflicts in favor of their urban-based political clients, there are instances where peasant producers do prevail. It is my position that this variation can be explained by the relative openness or closure of tropical country constitutional orders. And, it is upon this basis, as I will argue in subsequent chapters, that we can account for additional variance in the levels of deforestation across the humid tropics beyond that explained by neo-Malthusian, neoclassical, and dependency/world-systems explanations alone.

Scope of the Study

As the subtitle of this study indicates, it is an analysis of the humid tropics. More specifically, it is an analysis of the humid tropics undertaken at the level of the nation-state. Thus, the study is bounded in terms of the political unit it takes as its focus and the ecological zone from which these political units are drawn for purposes of analysis. My decision to delimit the analysis at the level of the nation-state, however, is not meant to convey that this is the only valid level of analysis at which studies of deforestation might be undertaken. To the contrary.

Following Blaikie and Brookfield (1987: 64-83), Turner, Moss, and Skole (1993: 49-51), and Lambin (1994: 14-16), the approach I take here derives its inspiration from the belief that there is no one "correct" scale or level of analysis for analyzing land-use processes, generally, or deforestation processes, more specifically. Rather, there are multiple scales or levels of analysis at which researchers might reasonably focus their analyses, depending upon the specific nature of the research question being addressed. The decision here to focus at the level of the nation-state is driven by the hunch that differences in constitutional orders—differences of particular salience at the level of the nation-state—are linked to variations in the levels of deforestation observed across nation-states.[1]

The analysis is also delimited to focus exclusively on the tropics, or, more specifically, the *humid tropics*, an ecological zone located within the broader tropical region bounded by the Tropics of Cancer and Capricorn at twenty-three degrees north latitude and twenty-three degrees south latitude, respectively. The decision to focus the analysis on the humid tropics is driven by the two predominant forest types found within this zone: *tropical rain forest* and *tropical moist deciduous forest*, collectively referred to as *tropical moist forest* (Grainger 1993: 29). It is the loss of tropical moist forest over the last twenty years that has raised the greatest concern within the global scientific community, primarily because of its implications for such concerns as the conservation of biological diversity and climate change. The choice to focus on the humid tropics, then, is a reflection of the desire to make a timely contribution to the understanding of deforestation processes in that ecological zone where the global consequences of deforestation appear to be the most serious.[2]

Organization of the Study

Having provided a general overview of the concerns and parameters of this study, I now provide a thumbnail sketch of how this study will be carried out. In chapter 2, I begin to set the stage for my study of the relationship between constitutional orders and tropical deforestation through discussions of the ecological and economic attributes of tropical forest resources, the magnitude of contemporary tropical deforestation, and the consequences of tropical deforestation. In chapter 3, I survey the proximate causes of tropical deforestation and provide a directed review of the various explanations (i.e., underlying causes) of tropical deforestation advanced by other authors. The review is directed in the sense that I only include those explanations amenable to analysis at the level of the nation-state, the operative unit of analysis in this study. While this approach necessarily entails some exclusion, it is helpful in maintaining a greater sense of continuity throughout the study.

The purpose of chapter 4 is to illuminate the political economy of tropical deforestation. I start with the elaboration of a "composite sketch" of the tropical country political economy. Highlighting the more salient features of this sketch, I then attempt to demonstrate that distortions in the landed property rights regimes of the contemporary humid tropics lie at the heart of the tropical deforestation problem. In chapter 5, I advance the claim that constitutional orders are pivotal in determining the magnitude of these distortions. More specifically, I assert that a more open constitutional order can act as an important hedge against such distortions; based upon this assertion, I hypothesize that more open constitutional orders are conducive to lower levels of tropical deforestation.

In chapter 6, I undertake a cross-national statistical analysis of fifty-eight countries in the humid tropics over the period 1976-1990. Before carrying out the analysis, however, I first engage several methodological points, including the general merit of cross-national statistical research and the merit of cross-national statistical research for the study of tropical deforestation. I address these points not to simply rehash what others have said, but to offer my beliefs about what cross-national statistical methods bring to the study of land-use change processes such as tropical deforestation. I also speak to the limitations of the data that I use in the analysis, most notably the tropical deforestation data. After acknowledging the limitations of these data, I then discuss why I believe that an analysis including these data remains a worthwhile endeavor. Following these methodological discussions, I then present the analysis and discuss the general findings.

Finally, in chapter 7, I synthesize the central propositions and findings of the study in the context of three scholarly literatures and offer suggestions for further research.

Endnotes

1. For a representative sampling of studies of deforestation in tropical/developing countries undertaken at the *subnational* level, see Southgate, Sierra, and Brown (1991); Kummer (1991); Chakraborty (1994); Lombardini (1994); Panayotou and Sungsuwan (1994); Reis and Guzmán (1994); Chomitz and Gray (1995); Krutilla, Hyde, and Barnes (1995); and Cropper, Griffiths, and Mani (1997).

2. Studies containing cases from non-tropical latitudes include Deacon (1994) and Shafik (1994).

CHAPTER TWO

TROPICAL FOREST RESOURCES AND TROPICAL DEFORESTATION

The central purpose of this chapter is to introduce the problem of tropical deforestation. In order to address the problem of tropical forest loss knowledgeably, it is first necessary to become better acquainted with the resource itself. Thus, I devote the initial section of this chapter to a general overview of tropical forest resources, placing special emphasis on their ecological complexity and fragility. In the second section, I consider the magnitude of contemporary tropical forest loss, highlighting the fact that the current episode of tropical deforestation, while certainly not the first in human history, is unprecedented in its magnitude. Finally, I discuss the consequences of tropical forest loss, concentrating primarily on the environmental, economic, and social effects.

Tropical Forest Resources

My aim in this section is to provide a *general* overview of tropical forest resources, focusing chiefly on the ecology of tropical forests; my aim is not to make the reader an expert in tropical forest ecology. Those interested in detailed, yet accessible, expositions of tropical forest ecology would do well to consult Whitmore (1990: 9-152), Caufield (1991: 44-81), Myers (1992a: 21-88), or Park (1992: 1-30). In contrast to these more exhaustive treatments of the subject, my intent here is simply to familiarize the reader at a general level with the defining characteristics of tropical forest resources and to accent their ecological complexity and fragility. The first two parts of this section, therefore, are dedicated to these two topics. In the third and final part of the section, I shift the focus from ecology to economy, introducing tropical forest resources as economic goods that are used, managed, and often abused, by disparate groups of human agents in pursuit of disparate sets of goals.

Defining and Locating Tropical Forests[1]

As indicated by the title of this study, this is a study of constitutional orders and deforestation in the *humid tropics*, an ecological zone located within the broader tropical region bracketed by the Tropics of Cancer and Capricorn. The humid tropics form a belt straddling the equator marked by high rainfall and moderately high temperatures throughout the year. The large amounts of rainfall, generally averaging 1,800 to 4,000 millimeters (mm) per year, result from the ascent of warm moist air at the meeting of the two sets of trade winds that flow toward the equator from the subtropical latitudes (30-40° North and South). The fairly even distribution of solar radiation during the year assures constantly high temperatures with little variation—mean monthly temperatures are generally 24-28° Celsius and never fall below freezing. In terms of continental coverage, the humid tropics extend over parts

of Central and South America, Africa, and Asia, as well as islands in the South China Sea and the Pacific Ocean.

Yet, the humid tropics are not homogenous. One simple ecological division of this zone would be into permanently humid and seasonal regions. *Tropical rain forest* is found in the permanently humid tropics, the region closest to the equator where rainfall is distributed fairly uniformly throughout the year. The seasonal humid tropics may receive the same (or even more) annual rainfall but have a distinct dry season (60 mm of rainfall per month or less) that promotes the growth of *tropical moist deciduous forest*. This forest type features a prominent component of leaf-shedding deciduous trees and is also known as "monsoon forest," owing to the link made in Asia between rainfall seasonality and monsoon winds.

These two dominant forest types of the humid tropics—tropical rain forest and tropical moist deciduous forest—are referred to jointly as *tropical moist forest* (Grainger 1993: 29). In terms of their global importance, it is the loss of tropical moist forests in recent years that has generated significant concern within scientific and policy circles, due primarily to the attendant implications for climate change and the loss of biological diversity (Myers 1992a, 1992b, 1994; Salati and Nobre 1992; Sharma 1992; Grainger 1993; Ramakrishna and Woodwell 1993). And, it is because of this concern that I focus the present analysis on the humid tropics and the tropical moist forests that they contain. In the text, however, I will use the phrases "tropical forest," "tropical forest resources," "tropical forest ecosystems," and "tropical moist forest" interchangeably; for the purposes of this study they are synonymous. This usage is not meant to mislead or misinform, but rather to enhance the study's readability.

In table 2.1 below, I provide regional figures for tropical moist forest cover, by constituent forest type, for the year 1990. Summing the totals of the two constituent forest types, we see that the Latin America/Caribbean region contains the majority of the remaining tropical moist forest cover (748 million hectares; 57 percent of total tropical moist forest cover), followed by Africa (338 million hectares; 26 percent) and the Asia/Pacific region (219 million hectares; 17 percent).

In table 2.2, I shift the level of resolution down one notch to focus at the country level, listing the five countries with the most expansive tracts of tropical moist forest in 1990. The leader in this category is Brazil, containing some 489 million hectares of tropical moist forest, followed by Zaire (105 million hectares), Indonesia (97 million hectares), Peru (52 million hectares), and Colombia (51 million hectares). Taken together, these five countries constituted 61 percent of global tropical moist forest cover in 1990, with Brazil alone accounting for 37 percent of the global total.

Table 2.1. Tropical Moist Forest Cover by Region - 1990

Region	Tropical Moist Forest			
	Tropical Rain Forest		Tropical Moist Deciduous Forest	
	Millions of Hectares	Percent of Total	Millions of Hectares	Percent of Total
Africa	87	12	251	43
Asia/Pacific	177	25	42	7
Latin America/ Caribbean	454	63	294	50

Source: Food and Agriculture Organization (1993: tables 7a-7c).

Table 2.2. Top Five Countries in Tropical Moist Forest Cover - 1990
(millions of hectares)

Country	Tropical Moist Forest	
	Tropical Rain Forest	Tropical Moist Deciduous Forest
Brazil	292	197
Zaire	60	45
Indonesia	94	3
Peru	40	12
Colombia	47	4

Source: Food and Agriculture Organization (1993: tables 7a-7c).

Tropical Forest Ecology[2]

Having provided a broad overview of the defining qualities of tropical moist forest and its geographic incidence across the tropical latitudes, I now turn to the subject of tropical forest ecology. As suggested at the outset of this chapter, my purpose here is not to delve into the minutia of tropical forest ecology. Rather, my aim is to instill in the reader a general awareness of the ecological complexity and fragility of tropical forest resources. Awareness of these attributes is a prerequisite of sorts for chapters 4 and 5, where I discuss the implications of politically marginalizing those often most cognizant of these attributes—long-established peasant producers in tropical forest areas.

Ecological Complexity

Probably the most notable characteristic of tropical forest ecosystems is the vast number of plant and animal species that they support. According to one estimate, tropical forests, though comprising only 7 percent of the Earth's land surface, contain between two and four million of the planet's five to ten million plant and animal species (Myers 1992a: 50). Comparisons at lower levels of resolution are no less striking. The richest tropical forest region, Amazonia, is believed to support at least 30,000 different species of plants, compared to only 10,000 in all of temperate South America (ibid.). To illustrate this point at a still lower level of resolution, Grainger (1993: 147) uses the example of the island of Britain and the small country of Brunei, located on the northwest tip of the island of Borneo: though Brunei is only one-fortieth the size of Britain, it contains some two to three thousand native tree species compared to Britain's thirty-five.

One important by-product of the high species diversity of tropical forests is the complex web of interactions that connects the resident plant and animal species. To use a mechanical metaphor, the high species count means that there are an inordinately large number of "moving parts" in a tropical forest, each linked together by an even more staggering number of "pulleys" and "levers." The complexity of tropical forest ecosystems is a feature that continues to impress even long-time students of tropical forest ecology:

> However hard it is for me to visualize the scale of biological richness in a tropical forest, I find it far more difficult to imagine the complexity of interactions between plants and animals, and between them and their physical environs. After all, if there are 1,000 species within one particular square kilometer of forest, their relationships with each other—their comings and goings, their incessant encounters with associates and enemies—certainly number tens of thousands of interactions, probably hundreds of thousands, possibly many more. (Myers 1992a: 69)

One of the more noteworthy manifestations of the complexity of tropical forests is the process of nutrient cycling (Myers 1992a: 75-79; Park 1992: 21-23). Despite being generally characterized by old and highly infertile soils (see table 2.3 below), tropical forests are highly productive habitats. The explanation of this paradox lies in the highly adapted forms of nutrient cycling that have evolved over long periods of stability in tropical forest ecosystems. Unlike temperate forests, where most of the nutrients released from decaying plant and animal material are stored within the soil and then made available to growing plants, most of the nutrients in tropical forest ecosystems are held in the living tissues of the vegetation itself (Jordan 1985).

Table 2.3. General Distribution of Main Soil Types in the Humid Tropics
(% of total land area)

General Soil Grouping	Africa	Asia	Latin America	Total Humid Tropics
Acid, infertile soils (Oxisols and Ultisols)	56	38	82	63
Moderately fertile, well-drained soils (Alfisols, Vertisols, Mollisoils, Andepts, Tropepts, Fluvents)	12	33	7	15
Poorly drained soils (Aquepts)	12	6	6	8
Very infertile sandy soils (Psamments, Spodosols)	16	6	2	7
Shallow soils (lithic Entisols)	3	10	3	5
Organic soils (Histosols)	1	6	—	—

Source: National Research Council (1982: 50).

Given the general infertility of soils in tropical forest ecosystems, it is "inefficient" for forest organisms to allow nutrients to stay in the soil. Evolutionary processes have responded by developing a virtually leak-proof system for cycling nutrients through the ecosystem. When the main source of nutrients—rainfall—hits the forest canopy, it can bring with it three kilograms of phosphorous, two kilograms of iron, and ten kilograms of nitrogen per hectare per year (Falkenmark and Lindh 1976). The multilayered structure of the forest then serves to filter out nutrients from the rainwater as it makes its way toward the forest floor, a process in which *epiphytes* (i.e., herbaceous plants living on forest trees) such as lichens and bryophytes play a central role.

On the forest floor itself exist still more nutrient-conserving mechanisms. Tree roots, some of which extend 100 meters along the surface of the ground, form a network that can be three times as dense as it would be in a temperate forest. Some roots even emerge from the soil to climb up the tree trunks in order to capture nutrients before they enter the soil. The root mat, as much as thirty centimeters thick, is extraordinarily efficient at absorbing nutrients washed into the soil, whether from rainfall or rotting vegetation. One field experiment in southern Venezuela showed that when calcium and phosphorous were sprinkled on these root mats, nutrient recycling was over 99 percent efficient (Stark and Jordan 1978).

Closely associated with the root mats are fungus-root combinations known as *mycorrhizae*. These micro-organisms, together with their associated bacteria, are essential to the health of many tropical trees in that they are the main conduits through which tree roots recover phosphorous, zinc, copper, molybdenum, and other minerals from the leaf litter on the forest floor. Mycorrhizae grow on or near the surface layers

of the feeder roots of plants, where they work in close symbiotic relationship with their plants hosts. By colonizing the roots, the fungi enhance the functioning of root systems. They not only enable plants to absorb more minerals from the soil, but also help them to resist root pathogens, to withstand drought, and to tolerate other adverse conditions. In return for this support, the fungi obtain energy from their plant hosts in the form of fixed carbon.

Ecological Fragility

The highly efficient recycling of nutrients within tropical forest ecosystems has two main consequences: recycling is rapid, and only small quantities of mineral nutrients are available in the forest soils at any given time. The management implications of these realities are straightforward, if not always recognized (Park 1992: 23). Given the general infertility of tropical forest soils, plans to clear tropical forest lands for intensive farming make little sense. Such designs fail to recognize the inherent complexity of tropical forest nutrient cycles and the essentially unproductive nature of most tropical soils. When tropical forest lands are cleared, tropical soils are badly damaged through exposure to sun and rain and through the resulting scarcity of dead organic material necessary to sustain them. Thus, forest clearance has direct effects on the recycling of nutrients: the limited stock of nutrients are quickly leached out, the sun-baked soils develop hard and impenetrable crusts, and valuable topsoil is eroded by rainfall and surface runoff. The net result is that the fertility of cleared areas is rarely sustained for more than a few years, after which time the soils quickly become barren and economically worthless.

Yet, despite the long-standing awareness of the basic infertility of tropical forest soils, the historical record is surprisingly rich with examples of agricultural projects whose designers believed their plans would somehow be excused from the ecological realities of tropical forest environments. Hecht and Cockburn (1990: 97-99, 129-132), in their study of the historical development of the Brazilian Amazon, cite the failed projects of United States industrialists Henry Ford and Daniel Ludwig as two of the more notable exemplars of this general pattern.

Though also plagued by acute labor problems, the efforts of Henry Ford in the 1930s to establish rubber plantations in the Amazonian state of Pará were fated in large part by inhospitable soils and ignorance of tropical-tree defense mechanisms. Oblivious to the fact that the considerable distances between trees of the same species were evolved defense mechanisms against the spread of diseases and pests, Ford and his team persisted with their plans to plant rubber trees in close proximity to one another. Once the canopies of the young trees began to close upon each other, the trees were soon decimated by disease. Even relocation to more fertile soils and the importation of disease-resistant grafts and clones from Sumatra and Liberia could not save the project. In all, fifty-three introductions of grafts and clones turned out to be susceptible to disease. Finally, in 1945, after an overall investment of nearly $10

million dollars, Henry Ford sold his assets in Pará to the Brazilian government for $500,000.

More ambitious in both scope and expense, the project begun in 1967 by shipping magnate Daniel Ludwig was marked by many of the same problems that beset Ford. Ludwig's plan in buying approximately 1.2 million hectares in northern Pará was to raise plantations of a fast-growing East Indian tree known as *Gmelina arborea*, in anticipation of a future shortage of wood fiber. Ludwig's scheme also included the world's largest rice plantation, mining and livestock operations, and planned communities for workers. However, much like Ford's project, things went wrong from the start. The bulldozers used for clearing forest scraped off precious topsoil and most of the seedlings of *Gmelina* failed. Laborers had to be hired to replace the bulldozers, resulting in vastly increased costs and an annual labor turnover rate of 200 to 300 percent. By mid-1970, less than a quarter of the anticipated 100,000 hectare plantation had been planted and yields were up to 50 percent below projection—*Gmelina* did very poorly on the sandy soils where it had been ignorantly planted. Over the course of the project, the only profitable operation was a kaolin mine inadvertently discovered on the property. By the early 1980s, the project, into which Ludwig had invested some $750 million, was in ailing health. Denied clear title to the property and a guarantee to back the purchase of a second pulp mill by the Brazilian government, Ludwig finally sold his holdings to a consortium of twenty-seven companies for $280 million in 1982.

As these examples demonstrate, the economic costs of projects conceived by those with little knowledge of tropical ecology can be quite consequential. Yet, these projects have profound environmental costs as well. As I will show later in this chapter, the deforestation associated with such projects has been linked to deleterious environmental outcomes at local, national, regional, and global levels. And, as I will suggest in chapters 4 and 5, such projects are more likely to arise in settings that marginalize peasant producers long established in tropical forest areas, thereby excluding both their preferences and ecological knowledge from the policymaking process.

The Economic Attributes of Tropical Forest Resources

Having provided a thumbnail sketch of the ecological qualities of tropical forest resources, I now turn to a brief analysis of their economic attributes. More specifically, I examine tropical forests as economic goods that provide a wide range of products to a wide range of users across multiple spatial and temporal scales. If the previous few pages gave the reader at least some appreciation of the ecological complexity of tropical forests, the next few pages will hopefully give the reader a comparable appreciation of the complexity of these resources from an economic perspective.

I begin by highlighting the many resident users of tropical forest resources. According to Ascher (1995: 12-13), these users include: timber cutters; fuelwood

gatherers in countries as diverse as India and Nigeria; *xate* palm gatherers in Guatemala who sell these fronds for use in floral arrangements; resin tappers in Honduras; durian fruit gatherers in Indonesia; rubber tappers in the Amazonian countries and Southeast Asia; tourist guides in Costa Rica; game hunters in Liberia; Brazil nut gatherers in Brazil and Peru; herders who rely upon forest areas for fodder; and cassava (or manioc) growers in many African, Asian, and Latin American countries who raise their crops among forest trees. Thus, the economic products that tropical forests provide are by no means limited to tropical timber alone (Panayoutou and Ashton 1992). Indeed, the broad assortment of products that tropical forests provide constitute the backbone of many tropical country subsistence economies (Ascher 1995; Barraclough and Ghimire 1995).

Yet, the users of tropical forests are not confined to the forested areas of tropical countries. Individuals living in the world's temperate and boreal zones are voracious consumers of tropical timber, tropical foodstuffs, and tropical spices, as well as numerous pharmaceuticals derived from plants indigenous to tropical forests (Myers 1992a: 189-246). In fact, according to one estimate, up to twenty-five percent of all prescribed drugs in the United States are derived from tropical forest plants (Park 1992: 89). Moreover, temperate and boreal residents are "consumers" of the regional and global climate systems to which tropical forests contribute. Insofar as tropical forests participate in regional and global carbon cycles through the process of carbon sequestration (Houghton 1992; Heimann 1993; Faeth, Cort, and Livernash 1994; Apps and Price 1996), individuals in temperate and boreal zones can be looked upon as consumers of the stable climate regimes that tropical forests help to maintain.

From an economic goods perspective, then, tropical forests exhibit the attributes of both *common-pool resources* and *public goods*. Insofar as tropical forests house such products as timber, fruits, resins, and medicinal plants, tropical forests are illustrative of common-pool resources (CPRs), a class of goods distinguished by their difficulty of exclusion and high level of subtractability (E. Ostrom, Gardner, and Walker 1994: 6-7). Absent a sturdy fence or vigilant monitoring presence, both costly options in the tropical country setting, it is generally difficult to exclude individuals from accessing tropical forests and the products they contain. Additionally, the fruit that one user takes from the forest is "subtracted" from the forest stock, and is thus unavailable for consumption by others.

In their contribution to the regulation of regional and global climate regimes, tropical forests embody the attributes of public goods, a class of goods from which, like CPRs, exclusion is difficult, but which, unlike CPRs, exhibit a low level of subtractability. Thus, it is difficult, if not impossible, to exclude individuals from consuming the climate services provided by tropical forests; however, the consumption of these services by one user does not prevent others from also consuming these services.

The fact that tropical forests exhibit the attributes of both CPRs and public goods makes these resources inherently difficult to manage. E. Ostrom (1990) and E. Ostrom, Gardner, and Walker (1994) argue that because of the innate differences

between these two classes of goods, their sustainable management requires different sets of management arrangements. Indeed, managing CPRs strictly as public goods, or vice versa, can frequently lead to resource exhaustion, the generation of significant negative externalities, or both.

Adding to the difficulty of sustainable tropical forest management are the multiple time horizons encountered in tropical forests. While many non-timber forest products such as fruits, spices, and medicinal plants are collected annually, the maturation of valuable tropical timber species can take anywhere from twenty to seventy years (Panayotou and Ashton 1992: 97). And, though in principle, timber and non-timber forest products can exist side by side in the forest, harvesting biases toward the slower maturation rates of tropical timber have generally decreased the availability of those non-timber products that provide crucial, and more frequent, inputs to tropical country subsistence economies (ibid.: 96-97).

Whether tropical forests are managed as common-pool resources, public goods, or a balanced combination of the two, and whether tropical forests are harvested for their full range of products or for timber alone are inherently political questions. According to Panayotou and Ashton (1992: 4-6), the rule of thumb that most tropical country governments have used to resolve these questions has been to look upon tropical forests either as repositories of tropical timber or as land to be cleared for agricultural cover. Thus treating tropical forest resources as two-dimensional rather than multi-dimensional resources, tropical country governments have severely undervalued tropical forests, which, in turn, has lead to excessive deforestation. In chapters 4 and 5, I explore in greater detail the reasons behind the tropical country government tendency to undervalue tropical forest resources. In the next section of this chapter, I review the extent of the tropical deforestation witnessed in recent years, due in large part to this penchant of tropical country governments for undervaluing their forest resources.

The Magnitude of Tropical Deforestation

Estimating the extent of tropical forest loss has been the subject of much interest and much controversy in recent years. After all, the perceived scale of the problem largely determines how forcefully, or timidly, policymakers will respond to the problem. Furthermore, it is not inconceivable that policymakers wishing to downplay the significance of deforestation will underestimate its magnitude. For example, in the early 1980s, the Philippine government claimed that 58 percent of its land area was covered by tropical forest; yet, satellite imagery later showed the figure to be closer to 38 percent (Park 1992: 37). And, while greater reliance upon satellite technologies should help to mitigate the politicization of deforestation estimates in the future, the current limitations of satellite technologies are significant enough to make the self-interested interpretation (i.e., politicization) of deforestation estimates a continuing possibility (Park 1992: 36-39; Grainger 1993: 140-144).

Despite these limitations, deforestation researchers have made progress in recent years in their effort to quantify both the extent and rate of tropical forest loss. Probably the most noteworthy project in this regard is the Food and Agriculture Organization's (FAO) *Forest and Resources Assessment 1990: Tropical Countries* (Food and Agriculture Organization 1993). Drawing upon data derived from satellite imagery, forest inventories, and statistical models, the FAO report provides deforestation estimates at global, regional, and national levels. Below, I briefly review the global and regional estimates; in chapter 6, I examine the national estimates in the context of a cross-national statistical analysis of the relationship between constitutional orders and deforestation.

Table 2.4 below provides a summary look at deforestation in the humid tropics during the period 1981-1990. In terms of total area deforested, the Latin America/Caribbean region experienced the greatest deforestation (51.265 million hectares), while Africa (27.171 million hectares) and the Asia/Pacific region (28.187 million hectares) were roughly equal in the levels of forest loss that each endured. In terms of relative forest loss, however, the Asia/Pacific region witnessed the greatest decline, losing 11.4 percent of its tropical moist forest over this ten-year period. Africa and the Latin America/Caribbean region, by comparison, lost 7.4 and 6.4 percent, respectively. From a global perspective, the total amount of tropical moist forest loss for the 1981-1990 time period was 106.623 million hectares, or roughly 10.7 million hectares annually over these ten years.

Table 2.4. Deforestation in the Humid Tropics by Region, 1981-1990

Region	Tropical Moist Forest	
	Area Deforested (millions of hectares)	Deforestation Rate (%)
Africa	27.171	7.4
Asia/Pacific	28.187	11.4
Latin America/ Caribbean	51.265	6.4

Source: Food and Agriculture Organization (1993: tables 8a-8c).

How do these figures generated to estimate the magnitude and pace of deforestation in the humid tropics during the 1980s compare with those from earlier time periods? Unfortunately, because of differences in definitions, geographical coverages, and data-collection technologies, inter-temporal comparisons across estimation efforts are problematic (Park 1992: 35; Grainger 1993: 126-133). What can be said, however, is that tropical deforestation has accelerated rapidly since the turn of the century and particularly rapidly since 1945 (Myers 1992a: 14; Park 1992: 34). According to a 1982 FAO report (Food and Agriculture Organization 1982), half of the world's tropical forests have been lost just since 1950. The biggest relative losses have

been in Central America (66 percent) and Central Africa (52 percent), though South America and Southeast Asia have each lost over a third (37 percent and 38 percent, respectively). According to Myers (1992a), this relatively recent episode of tropical deforestation represents the fastest land-use change of its scale in human history.

The Consequences of Tropical Deforestation[3]

What, then, are the consequences of tropical forest loss? In this section, I elaborate upon the effects of tropical deforestation, focusing primarily on the environmental, economic, and social repercussions. I employ this tripartite division not to mask the fact that, in reality, there is much interaction between these consequences, but to make their presentation more accessible to the reader.

Environmental Consequences

The environmental consequences of tropical deforestation can themselves be broken down into three categories: (1) the loss of local environmental services; (2) the loss of biological diversity; and (3) regional and global climate change. Below, I discuss of these consequences in turn.

Loss of Local Environmental Services

Soil Changes

One of the main by-products of tropical deforestation at the local level is the damage done to tropical forest soils through the agents of nutrient loss and soil erosion. As mentioned above, tropical forest soils are inherently nutrient-poor to begin with. Once crops are planted on cleared soils, soil fertility declines by even greater orders of magnitude. One field study conducted by Hecht (1980) showed pronounced drops in concentrations of phosphorous, calcium, and magnesium upon clearing tropical forest for pasture.

Soil erosion can have an even more profound effect on tropical forest environments. A serious side-effect of deforestation in all environments, soil erosion is particularly acute where levels of rainfall are high—as in tropical forest environments. Under tropical forest cover, various factors serve to minimize soil erosion: the tight and multi-layered canopy cover of tropical forest vegetation; the humic material deposited on the soil by the overlying vegetation which acts as a sponge; and the root holes and holes made by burrowing animals underneath the forest cover which allow water to be transported through the soil with relatively little surface erosion. Once the protective tropical forest cover is cleared, however, surface runoff is increased and erosion rates usually rise dramatically, particularly on slopes.

Torrential rains and sweltering summers in the humid tropics encourage even greater erosion. The Trans-Amazon Highway in Brazil, for example, is often seriously damaged by soil erosion and the weakening of embankments during the rainy season;

the damage done then has to be repaired by the end of the next dry season (Smith 1981). Forest clearance also leads to large-scale loss of topsoil by erosion, which diminishes soil productivity. Approximately 5,000 km^2 of overworked shifting-cultivation land in the Brazilian state of Pará has been virtually destroyed by soil erosion (Schneider 1989). Furthermore, severe erosion can strip all of the topsoil from tropical forest soil, leaving an impermeable hardpan layer known as *laterite*. Laterite, rich in both iron and aluminum, compounds and hardens upon exposure to the air. Because plant roots cannot penetrate through this layer, the soil has no productive land-use potential and natural recolonization by trees or other plants is often impossible (Fox 1976).

The worst soil erosion is usually associated with the building of logging roads into tropical forest areas. Logging roads are completely bare and create artificial channels along which runoff can flow. Additionally, logging activities themselves can seriously damage soils, normally through compaction by heavy machinery.

Downstream Silting

The extensive soil erosion occasioned by tropical deforestation also leads to the downslope transfer of sediment to river channels, which, in turn, can cause silting and flooding of rivers downstream. Water supplies can be contaminated, particularly where sudden massive erosion rapidly increases the sediment load to produce "brown-outs," common in Ecuador, Kenya, and Thailand (Myers 1988c). Over a billion people worldwide depend upon water from tropical forests for drinking and crop irrigation (Friends of the Earth 1989); thus, any reduction in water quality is likely to affect many people directly.

Rapid increases in soil erosion caused by forest clearance can leave downstream reservoirs and irrigation systems silted up, river beds clogged, and farmland enveloped in sediment. Moreover, the power-generating capacity of major hydroelectric projects can also be reduced if turbines become silted up. Some previously navigable rivers, such as the Betsiboka River in Madagascar, can no longer be used by large craft because of such deposition (Wells 1989).

Downstream Flooding

Low-lying land downstream from deforested areas is often subjected to increased depth and frequency of river flooding as a result of several factors conspiring together (Myers 1988c). Forest clearance removes the protective vegetation cover, resulting in greater amounts of rainfall reaching the ground. Evapotranspiration losses fall dramatically when the rich vegetation is removed such that a greater proportion of the rainfall is available to produce runoff. And, where bulldozers are used for forest clearance, forest soils become compacted. This decreases infiltration rates such that more water becomes surface runoff. Soil erosion can strip topsoil and expose the impermeable laterite hardpan, so that all the runoff is surface flow, rather than sub-

surface or groundwater flow. Channel silting reduces the capacity of rivers to carry large amounts of floodwaters, producing a situation in which over-bank flooding is almost inevitable.

The net result of all these events is that a much higher proportion of rainfall finds its way more or less directly into river systems, greatly increasing the likelihood of damaging flash floods. Evidence from the Philippines, for example, suggests that widespread flooding following typhoons and monsoons in the mid-1980s was a direct result of deforestation (McDonagh 1986). The land area liable to river flooding in India has doubled to around 800,000 km^2 in recent years as a fifth of the country's forests have been cleared (World Wide Fund for Nature 1988). And, deforestation has increased flooding in the Upper Amazon, where most human settlements are located along rivers and livelihoods are intimately tied to annual flood cycles (Gentry and Lopez-Parodi 1980).

Loss of Biological Diversity

The second major environmental consequence of tropical deforestation is the loss of biological diversity, or "biodiversity" for short. As alluded to above, the incomparably rich mixture of plant and animal species that tropical forests contain make them the world's most diverse ecosystems. Yet, underlying this richness is a fragility and susceptibility to change. The biggest problem associated with the clearance of tropical forest is species loss. There are several reasons why species decline can result from deforestation (Lovejoy 1989). One important factor is the great diversity of species within tropical forests, meaning that each species usually has very few individuals and is thus very sensitive to change and stress. Stress comes directly through the removal of habitat and the associated removal of ecological niches when a patch of forest is burned or felled. Fragmentation of the forest ecosystem, as occurs as a result of selective logging or when shifting cultivators encroach, also creates stress for the individuals that are removed or displaced. Habitat loss means a declining geographical range for each species, as well as increased competition for food and resources in the remaining areas suitable for habitation.

The species that remain are also affected. A declining number of habitats means that the remaining species are forced to survive in a smaller area, facing greater competition from each other as well as from other species. Forest clearance might also remove all or part of the food chain for a species, which can create serious problems for those with special feeding requirements.

Establishing the number of species being lost as a result of tropical forest clearance is not without its problems since there are many estimates from which to choose. According to Friends of the Earth (1989), some think it probable that one species becomes extinct every half-hour as a result of tropical deforestation, making for an annual extinction rate of 8,760 species. Other estimates vary between one and fifty species per day worldwide (i.e., between 365 and 18,250 species extinction per year) (ibid.).

Forecasts of likely future losses are even more alarming, particularly when based upon the pessimistic estimates of present rates. One study suggests that if present deforestation trends continue a total of 750,000 species are likely to become extinct by the year 2000; within the next century, some 1,600,000 species are projected to be lost (World Wide Fund for Nature 1988). One factor underlying these pessimistic forecasts is the likelihood of what ecologists refer to as an impending "extinction spasm" or "cascade of extinction" (Myers 1988a). According to this perspective, the complex forest ecosystem has established a fragile and finely poised equilibrium. Consequently, the loss of one or more species can trigger the downfall of many other interrelated species. At their most bombastic, the adherents of this perspective claim that complete destruction of tropical forests would be "the greatest biological disaster ever perpetrated by man, creating a spasm of extinction unequalled since the disappearance of the dinosaurs, over 60 million years ago" (World Wide Fund for Nature 1988: 2).

Regional and Global Climate Change

Regional Climate Change

Clearance of tropical forests can affect climate in a number of different ways and on different scales (Myers 1988b, 1989). Local and regional climates are affected mainly by changes in surface albedo (i.e., reflectivity of the ground surface) and changes in local hydrology (particularly in evapotranspiration and rainfall). A rise in the albedo means greater heating of the local atmosphere and a greater likelihood of local warming. If large patches of forest are cleared, local warming could extend to the whole region, though the linkages between changes in the albedo and changes in regional temperatures have yet to be conclusively proven (Henderson-Sellers and Gornitz 1984).

What is more certain is that soils previously kept cool by the forest shade are heated after deforestation. Studies carried out in Guatemala, for example, have shown that as little as 4 percent of solar radiation reaches the soil surface under forest cover, while twenty-five times more radiation reaches bare soil (Schneider 1989). Heating of forest soils speeds up the formation of laterite and the leaching of nutrients, events that quickly deplete the productive potential of soils so affected.

Deforestation is also known to bring more extreme local variations in air and soil temperatures. Under forest cover, daily variations in surface temperature are moderated because air is effectively trapped beneath the forest canopy, shaded from sunlight. Forest clearance can disrupt local weather patterns by warming air previously kept cool and by producing surface conditions which are hotter during the day and cooler during the night (World Wide Fund for Nature 1988).

Closely associated with the impacts of albedo change are the consequences of deforestation on evapotranspiration and the regional hydrological cycle. Evapotranspiration, a combination of evaporation and transpiration, is the main

mechanism by which moisture and energy are transferred between land and the overlying atmosphere. Trees are particularly effective in recycling a large proportion of the rainwater that falls on them, drawing it up from the soil below via their roots and then releasing it as water vapor through their foliage.

However, forest clearance can seriously disrupt evapotranspiration. Evidence of reductions in local rainfall attributed to deforestation is available from India, Malaysia, the Philippines, Cote d'Ivoire, and Costa Rica (Myers 1988b, 1989). One consequence of these reductions in rainfall is that dry periods will be extended in these areas, which, in turn, may be serious enough to accelerate the natural death of the surviving tropical forest cover (Myers 1988a).

Finally, deforestation can set in motion a chain of events that significantly increase the threat of drought (Salati and Vose 1984). Increased runoff, reduced evapotranspiration, declining soil water storage, increased temperatures, and reduced precipitation can quickly lead to a cycle of drying and the progressive onset of drought. The reduction in cloud cover associated with the disruption of evapotranspiration is a significant link in the chain—reduced cloud cover increases the proportion of incoming solar radiation that reaches the surface and thereby guarantees increased heating. This particular link can even affect areas downwind of the deforested areas, which receive less rainfall and can suffer from increased aridity and possibly drought.

Global Climate Change

Deforestation can also trigger global climate change by altering atmospheric circulation patterns (via changes in the earth's latent heat flux) and altering atmospheric chemistry (via changes in greenhouse gases). These tend to have different impacts in different places (especially at different latitudes), but the suspected net effect is global warming.

The reductions in evapotranspiration and cloud cover in the tropics brought about by deforestation could have worldwide consequences because of what is known as the global latent heat flux (Bunyard 1985). This is the transfer of heat and energy from low (hot) latitudes to high (cooler) latitudes which maintains thermal equilibrium on earth by using tropical heat to compensate for polar cold. Under normal conditions, heavy cloud cover is formed in the tropics through evapotranspiration. These clouds reflect incoming short-wave solar radiation and thus prevent overheating in the tropics. Convection currents in the lower atmosphere carry the tropical clouds to the higher latitudes where the water vapor falls as rain. Thus, the evapotranspiration that takes place within tropical forest ecosystems plays a critical role in maintaining thermal balance in the earth's atmosphere and preventing a significant increase in temperature differences between different latitudes. Any marked reduction in evapotranspiration and cloud cover in the tropics could trigger widespread changes in the global climate.

The clearing and burning of tropical forests is also thought to be related to the heating of the global climate through the so-called "greenhouse effect" (Bolin 1977; Woodwell et al. 1978; Revelle 1982; Jager 1986; Detwiler and Hall 1988). The

heating comes about through greenhouse gases which trap long-wave radiation reflected back into space from the earth's surface. The four main greenhouse gases are carbon dioxide (CO_2), methane, chlorofluorocarbons, and nitrous oxides, although only the first two are believed to be significantly increased by tropical deforestation. Carbon dioxide accounts for roughly half of all greenhouse gas emissions, and is thus a major contributor to global warming. It is also the most important greenhouse gas associated with tropical deforestation.

Tropical forests store more carbon in their plant tissues, decaying material, and soil than any other vegetation type. When forest is cut and burned, carbon is returned to the atmosphere as carbon dioxide in the smoke from the fire. Clearance also reduces the amount of CO_2 that can be removed from the atmosphere through photosynthesis. The net effect is a progressive build-up of CO_2 in the atmosphere, to add to that already put there by air pollution. Direct measurements are impossible, but calculations suggest that deforestation injects between 5 and 10 billion tons of CO_2 into the atmosphere each year, between 3 and 6 billion tons of it coming from the tropical forests (Independent Commission on International Humanitarian Issues 1986).

Debate continues on what the precise consequences of greenhouse warming are likely to be. Some estimates predict that atmospheric CO_2 levels will double by the year 2050 (Goudie 1984). Such an increase would mean that an extra 1.5 percent of solar radiation would be trapped in the earth's atmosphere, causing an increase in the average air temperature of between 2° and 3° Celsius. Such warming might increase evapotranspiration in many areas outside the tropics, which would, in turn, increase cloud cover, thereby inhibiting further temperature rises. In the tropics, however, evapotranspiration is likely to fall, producing less cloud cover and a significant increase in desertification.

Other projected consequences are well-documented in other sources (Bunyard 1985; Myers 1988c; Hekstra 1989; Tyler 1989; Park 1991). To summarize, there would be relatively few winners. Some high latitude areas currently too cold for extensive arable farming may be able to increase crop yields, and places like India and the Middle East could become wetter and more fertile. Other areas, however, would be losers. The earth's main fertile regions are likely to become drier and less productive. Many areas could be plagued by much larger seasonal temperature variations and more erratic weather patterns. Tropical storms are likely to become more frequent and more violent. Thermal expansion of the warmer seawater, coupled with the melting of polar ice caps, would probably cause a rise in sea level putting many low-lying areas under serious risk of permanent flooding. Some areas would suffer from drought while other areas nearby could be under floodwater.

Economic Consequences

Tropical forests provide a wide array of products for humans in the form of fruits, foodstuffs, timber, industrial raw materials, and medicines. Species extinction means the loss of these products. However, the loss of known resources is only part of

the problem, because known and named species constitute only a fraction of those species that might be suitable for human use. Of those forest species that are known, relatively few have been examined for possible human use—less than 1 percent according to some estimates. Those that are used can generally be classified into one of three main product areas: (1) industrial raw materials; (2) food and agriculture; and (3) medicines.

Industrial Raw Materials

Space limitations prevent a complete listing of all the important industrial products obtained from tropical forest plants, but providing just a few examples should help to illustrate the diverse mix of industrial products that tropical forests do contain. In 1985, the World Bank and other international agencies compiled a fairly comprehensive list of these products (World Wide Fund for Nature 1988). This list included oils, gum, latexes, tannins, steroids, waxes, edible oils, rattans, bamboo, spices, pesticides, and dyestuffs, in addition to the potentially lucrative tropical hardwoods that tropical forests hold. The list also included consumer goods made from forest products, such as wicker chairs, coffee, lubricants, glue for postage stamps, golf balls, chewing gum, nail varnish, deodorant, toothpaste, shampoo, mascara, and lipstick. The market for these products is worth millions of dollars a year. Exports of Indonesian rattan, for example, is worth some $90 million a year (Myers 1988c).

Forest materials, however, are not just used by large industries—they support numerous craft industries that provide livelihoods for many people in tropical countries. For example, leaves from forest plants and trees are used to weave mats and baskets, and cane is made into furniture. Much of the craft produce is exported or sold to tourists.

Food and Agriculture

While coffee and bananas are two of the more well-known foodstuffs that originated in tropical forest ecosystems, there are many more. Tropical forests yield many different types of fruits, cereals, and nuts; half of the world's main crops were originally discovered in tropical forests (Elsworth 1990). Among the more widely used are tea, coffee, sugar, bananas, oranges and lemons, pineapples, avocados, rice, maize, cocoa, cashews, and peanuts. About twelve crops provide 90 percent of the world's food and half of them are descended from tropical forest plants, including rice and maize (World Wide Fund for Nature 1988).

Much of the concern over tropical forest species extinction relates to the loss of genetic diversity (Prescott-Allen and Prescott-Allen 1988; Smith and Schultes 1990). Because the dozen crops that comprise nearly 90 percent of world food supply are susceptible to pests, disease, and environmental (particularly climate) change, it is essential to maintain the rich genetic diversity of tropical forests as a safeguard for existing crops. Preservation of genetic diversity is also crucial for cultivating new

plants and breeding new animals. Some tropical forest species were very important ingredients in the hybridization of new crops for the Green Revolution. Additionally, wild relatives of many commercial crops continue to provide new genetic material to improve yields and increase resistance to pests and disease.

Medicines

Tropical forest species also provide a wide range of materials used in medicine. Tropical forests provide the raw materials used in antibiotics, heart drugs, hormones, tranquilizers, ulcer treatments, and anti-coagulants. Tropical forest plants supply at least seventy-six major drug compounds used in prescriptions in the United States, only seven of which could be commercially synthesized according to a 1973 survey (World Wide Fund for Nature 1988). Among the more notable examples are leaves from the rosy periwinkle plant found in the tropical forests of Madagascar that contain alkaloids used for treating Hodgkin's disease and childhood leukemia (Myers 1988c), quinine derived from the cinchona tree in Peru used to treat malaria, and diosgenin from Mexican and Guatemalan wild yams that constitutes a major component of oral contraceptives (World Wide Fund for Nature 1988). Tropical forest plants also offer much promise for new treatments, particularly as cures for cancer and AIDS (Elsworth 1990). If tropical forests are completely destroyed, cures for some diseases may be never found.

Social Consequences

Finally, tropical deforestation also has profound social consequences. Most directly affected are the estimated 500 million forest peoples, nearby residents, and recent settlers who rely upon the products and environmental services that tropical forests provide for their daily subsistence needs (World Bank 1991a: 24). The social impact of tropical deforestation, however, is not confined to those who have a direct subsistence relationship with tropical forests. The World Resources Institute (1990), for example, calculates that the lives of as many as a billion people are "periodically disrupted by flooding, fuelwood shortages, soil and water degradation and reduced agricultural production caused directly or indirectly by the loss of tropical forest cover." Thus, the scope of the social repercussions resulting from tropical deforestation is by no means trivial.

In this section, I review the social consequences of tropical deforestation, dividing the discussion into *local* and *translocal* consequences (Barraclough and Ghimire 1995: 20-27). While this division is admittedly arbitrary, it does help to highlight the fact that the social reverberations of tropical forest loss can often ripple well beyond the area of immediate impact. Before embarking on this discussion of the social consequences of tropical deforestation, however, I should mention that my treatment of the subject does not seek to be exhaustive. Rather, the approach that I

take here is to highlight only those consequences that appear to have the greatest social impact.

Local Consequences

As stated above, the most directly affected populations are those who rely upon tropical forest ecosystems for their daily subsistence needs. Deforestation implies a reduction in the availability of the forest products that these populations require as inputs for their household production systems, including fuel, construction materials, fodder, fibers, and medicinal plants. Increased scarcity of these products, in turn, has its own consequences. Decreased supplies of fuelwood, for example, means increased time spent on gathering firewood. Moreover, time spent on searching for increasingly scarce sources of fuelwood, a task generally carried out by women and children, means less time is available to devote to agricultural tasks (Kumar and Hotchkiss 1988). Frequently, poorer forest peoples are forced to reduce cooking and heating levels while substituting valuable manure for use as fuel.

Tropical deforestation can also disrupt local food supplies. Forests provide numerous edible leaves, shoots, roots, fungi, fruits, and saps upon which forest peoples—especially poorer forest peoples—depend for survival. Forests also supply many kinds of meat and fish. In the forested regions of West Africa, for example, bush meat is by far the principal source of animal protein (Food and Agriculture Organization 1990: 6-9). Forest food sources are often essential for the sustenance for many of these forest residents, particularly during times of climatic stress or social disruption. Thus, when these traditional sources of food and medicines are diminished by deforestation, the very survival of forest peoples can be placed in jeopardy.

Yet another important social side-effect of tropical deforestation is an increased incidence of disease among long-established forest peoples. Because long-established forest peoples are highly susceptible to the diseases carried by outsiders, owing to their historical isolation, the influx of non-local populations (e.g., peasants from other regions, loggers, and ranchers) that generally goes hand-in-hand with tropical deforestation can often spell disaster for these peoples. In 1977, for example, up to half of the Yanomami tribe living in northern Brazil was wiped out in a matter of weeks when an epidemic of measles was brought in by outsiders (Park 1992: 111). Malaria is another growing problem to which forest peoples have little or no natural resistance. Between 5 and 15 percent of the tribes in Amazonia are believed to suffer from malaria (most likely imported from north-east Brazil) at any given time, putting them out of action for up to one month at a stretch (ibid.). The spread of malaria is further exacerbated by the very act of felling trees, as it brings forest canopy mosquitos that formerly preyed upon canopy animals to the ground, where they feed on humans and transmit the disease (Yuill 1983).

Decreased availability of subsistence forest products, disruptions of local food supplies, and an increased incidence of disease are among the more prominent negative social consequences of tropical deforestation. Yet, no discussion of the social

consequences of tropical deforestation would be complete without mention of some of the positive consequences. Forest clearance can be associated with the creation of employment opportunities, the construction of new infrastructure (e.g., roads), better access to arable land, and increased land availability. Furthermore, according to Barraclough and Ghimire, deforestation "sometimes contributes to new production systems that are occasionally as productive and sustainable as those they replaced" (1995: 22). However, Barraclough and Ghimire go on to point out that "the beneficiaries of the new systems ... are seldom the same as those who have lost their traditional livelihoods. Moreover, the new systems are often less productive, and even more frequently they are less sustainable, than the old ones" (ibid.). The sustainability of these new production systems notwithstanding, the question of whether or not tropical deforestation can truly spawn "positive" social outcomes, therefore, frequently depends upon one's social location. In general, it is government officials, transnational corporations, ranchers, loggers, and landless peasants from other regions who benefit, usually at the expense of those peoples long established in tropical forest regions. This is a theme to which I return in chapters 4 and 5.

Translocal Consequences

As mentioned above, the social consequences of tropical deforestation can often be felt well beyond the locus of deforestation. Taken to the extreme, one could argue that tropical deforestation effects social change all the way up to the global level, insofar as tropical deforestation is related to such phenomena as biodiversity loss and climate change. For the purposes of this discussion, however, I truncate the analysis at the national level, primarily because the linkages between tropical deforestation and transnational social change have yet to be clearly specified. Any attempt to draw linkages between tropical deforestation and transnational social change at the present time, therefore, would be overly speculative (but see Suhrke 1994 and Hugo 1996).

Probably one of the more notable translocal consequences of tropical deforestation is migration, more specifically out-migration. While tropical deforestation is often the result of significant in-migration into a forested area, it is also often the cause of significant out-migration. Hurst (1990: 207-244), for example, traces a rise in Thailand's rural-to-urban migration streams to decreasing rural livelihood opportunities—decreases brought about in large part by the soil erosion and exacerbated cycles of flood and drought occasioned by deforestation. Barraclough and Ghimire (1995: 124-125) report a similar dynamic in Tanzania, where increasing numbers of men migrated from rural districts to the capital of Dar es Salaam in the 1970s and 1980s in the face of worsening livelihood opportunities. Interestingly, in the case of Tanzania, this out-migration led to an *acceleration* in the pace of deforestation, as "there was simply not enough manpower, leadership or concern with the future left ... to enforce customary forest management rules in the face of the short-term gains to be made by overexploiting the mangroves and other forest areas" (ibid.: 124).

A second noteworthy translocal consequence of tropical deforestation is increased social conflict. The idea that generalized environmental degradation, and the resource scarcity that results from such degradation, can spur violent social conflict has received increasing attention in recent years (Westing 1986; Mathews 1989; Homer-Dixon 1991, 1994; Myers 1993; Renner 1996). Regarding the specific case of tropical deforestation, Myers (1993: 85-100) makes the case that the political insurgency witnessed in the Philippines in recent decades can be explained in part by central government complicity in rural deforestation. In order to generate and maintain a firm base of political support, a common tactic of the Marcos regime was to dole out favorably termed timber concessions to key political clients, frequently members of the military. The sites of these timber concessions, however, were frequently the same lands that rural populations had traditionally worked to meet their subsistence needs. Thus, with the advent of these concessions, and the environmental degradation that they produced, the subsistence capacity of the affected rural populations in the Philippines was significantly diminished. It was this increasing impoverishment, Myers argues, that heightened resentment among rural populations and drove them to raise their levels of support for anti-government rebel forces operating in rural areas, thus furthering political unrest (see also Homer-Dixon 1994: 28-29). Looking at the Philippines' Asian neighbors, Myers (1993) asserts that similar cycles of deforestation-impoverishment-alienation have also operated to exacerbate political instability in India, Malaysia, Myanmar, and Thailand.

Thus, the consequences of tropical deforestation are numerous and varied. The preceding pages have served merely to introduce the reader to the wide variety of environmental, economic, and social consequences associated with tropical forest loss, and thus to give the reader at least some sense of why the study of tropical deforestation remains a timely endeavor. In the following chapter, I shift the analysis from a focus on the effects of tropical deforestation to a survey of its causes. In chapter 1, I presented a brief overview of the causes of tropical deforestation, making the distinction between *proximate* and *underlying* causes. The purpose of this overview was both to familiarize the reader with these terms and to help establish what I see as the main contribution of this research to the explanatory literature on tropical deforestation—that national political institutions, more specifically, those operative at the constitutional level, act as important mediating forces between the underlying and proximate causes of tropical deforestation. The aim of the next chapter is to provide a more detailed look at the proximate and underlying causes so that a more informed exposition of *how* national political institutions act as mediating forces between these two sets of causal mechanisms can be undertaken in chapters 4 and 5.

Endnotes

1. This section draws significantly from Grainger (1993: 29-30).

2. This section draws significantly from Myers (1992a: 21-88), Park (1992: 1-30), and Grainger (1993: 30-39; 146-155).

3. This section draws significantly from Myers (1992a: 189-293) and Park (81-125).

CHAPTER THREE

THE CAUSES OF TROPICAL DEFORESTATION

Proximate and Underlying Causes

As I stated in chapter 1, researchers writing on tropical deforestation commonly make the distinction between proximate and underlying causes of tropical deforestation. Again, proximate causes are the immediate causes of deforestation, that is, the alternative land uses to which forested lands are put or the physical activities that lead directly to forest loss. Underlying causes, on the other hand, are the indirect, or secondary, mechanisms that lead individuals to clear forested lands. This dichotomy is also found in the emerging global environmental change literature, where it is used to analyze not only tropical deforestation, but other types of large-scale land-use change as well (e.g., Turner and Meyer 1994).[1] In this chapter, I use this dichotomy to survey the causes of tropical deforestation, beginning with the proximate and then moving to the underlying causes. I conclude the chapter with a commentary on the gaps in the explanatory literature on tropical deforestation, as I see them, and suggest why I think a spotlight on constitutional orders can help bring greater analytical clarity to the study of this inherently complex problem.

The Proximate Causes of Tropical Deforestation

The chief proximate causes of tropical deforestation include: (1) clearing for agriculture; (2) logging activity; (3) fuelwood gathering; (4) clearing for pasture; (5) mining activity; and (6) clearing for large development projects (Williams 1989: 189-193; Amelung and Diehl 1992: 15-21; Myers 1992a: 91-185; Park 1992: 43-80; Rowe, Sharma, and Browder 1992: 34-36; Grainger 1993: 49-68).[2] Agreement among researchers of tropical deforestation regarding the identity of these causes is nearly unanimous (Amelung and Diehl 1992: 15-21; Colchester 1993: 2-4; Barraclough and Ghimire 1995: 12), though some controversy does remain over the exact contribution of individual proximate causes to overall tropical deforestation totals. As depicted in table 3.1 below, agriculture—more specifically, shifting agriculture—is generally cited as the greatest contributor to tropical forest loss, followed by logging activity, fuelwood gathering, and clearing for pasture, with mining activity and development projects accounting for the balance.

The figures contained in table 3.1 also suggest, however, that the relative importance of proximate causes varies by region. In his assessment, Myers (1992a: 127-142) estimates that conversion to pasture for livestock accounted for 8 percent of total tropical forest loss in the early 1980s, but that such conversion took place almost exclusively in Latin America. This fact of regional variation in the proximate causes of tropical deforestation is further supported by Rowe, Sharma, and Browder (1992: 34),

who report notable regional differences in the relative contribution of shifting cultivation—from 35 percent in Latin America to 50 percent in Southeast Asia to 70

Table 3.1. Relative Contribution of Individual Proximate Causes to Tropical Deforestation (percentage of total)

	Lanly (1982)	Bruenig (1989)	EK (1990)	Myers (1992a)
	1981-1985	1980-1988	1981-1985	early 1980s
Agriculture	—	—	90	—
* shifting	44	60	(40)	64
* permanent	—	[30][a]	(50)	----
Logging	—	10	10	18
Fuelwood Gathering	—	—	—	10
Pasture	—	—	—	8[b]
Mining	—	[30]	—	—
Development Projects	—	[30]	—	—

Source: Amelung and Diehl (1992: 17) and Park (1992: 45).
[a] Permanent agriculture, mining, and development projects jointly account for 30 percent.
[b] Latin America only.

percent in tropical West Africa. Kummer (1991: 16-30) provides additional evidence of such variation, concluding that logging activity as a proximate cause is most salient in tropical West Africa and Southeast Asia, while fuelwood gathering is most prominent in Africa and South Asia.

Thus, the masks of deforestation do change from Africa to Asia to Latin America. However, as I argue briefly at the end of this chapter and more extensively in the next, the political realities behind these masks are often quite similar. And, it is for this reason that I place a premium in this research on attempting to gain a better understanding of the politics of tropical deforestation.

Clearing for Agriculture

As illustrated in table 3.1, most researchers agree that clearing for agriculture is the most important proximate cause of tropical deforestation; more precisely, that shifting agriculture is the most important proximate cause, though there are those who maintain that the contribution of permanent agriculture to tropical deforestation totals is somewhat greater (e.g., EK 1990). In the next two sections, I provide broad

overviews of shifting and permanent agriculture as they pertain to tropical deforestation.

Shifting Agriculture

In his discussion of shifting agriculture as a proximate cause of tropical deforestation, Grainger (1993: 49-53) identifies three distinct shifting cultivation sub-types: (1) traditional shifting cultivation; (2) short-rotation shifting cultivation; and (3) encroaching cultivation.

Traditional shifting cultivation, one of the few proven sustainable land-use practices in the humid tropics (Brookfield and Padoch 1994), involves the clearing of a small patch of forest (usually one to two hectares per family), burning of the vegetation to free up nutrients, and the growing of crops on the land for a period of one to two years. The land is then abandoned and cultivation then moves to a different site, where the process is repeated. As customarily practiced, the fallow period between successive clearings of the same patch of land is at least fifteen to twenty years, and often longer. This allows the forest to regenerate and the nutrient contents of both the vegetation and soils to be replenished. Regeneration also protects the soil from erosion and controls the spread of weeds, pests, and diseases. While traditional shifting cultivation is an extensive practice (i.e., requiring large tracts of land), it usually poses little threat to the integrity of forested areas. The emphasis is on the subsistence cultivation of staple crops such as rice, maize, and cassava, though the exact choice of crops varies from country to country. One notable drawback of traditional shifting cultivation is that it can generally support only low population densities, typically less than twenty people per square kilometer. Consequently, it is now found only in fairly remote areas where enough land is still available for such an extensive practice.

Short-rotation shifting cultivation, as the name implies, employs shorter rotations than does traditional shifting cultivation, with fallow periods of only six to fifteen years, and even shorter in some locations. With rising populations and the encroachment of commercial land uses into shifting cultivation areas, resulting land scarcities often preclude the possibility of the longer rotations practiced under traditional cultivation. Shorter fallow periods mean that the forest has less time to regenerate and that there is less time for fertility to be replenished, which, in turn, leads to declining yields and increased soil erosion. Additionally, as the frequency of clearing and burning increases, so too does the probability of invasion by weeds (such as *alang-alang* in Southeast Asia), which often inhibit forest regrowth when they become dominant.

In contrast to traditional and short-rotation shifting cultivation, whose practitioners both aspire to some semblance of long-term sustainability, the aim of encroaching cultivation is nothing more than short-term survival. Additionally, whereas traditional and short-rotation cultivators are typically individuals long established in tropical forest areas, encroaching cultivation is carried out by migrant populations forced to tropical forest areas by poverty and stark inequities in land

distribution in their home regions—that is, by *shifted* cultivators (Myers 1992a: 146-151).

The common pattern followed by shifted cultivators is to clear forest land and then cultivate it for three to four years or more until all soil nutrients have been exhausted, weed infestation is severe, and crop yields are low. Only then do they move on to repeat the process still deeper into the forest, leaving behind tracts of land on which forest does not easily regenerate. Moreover, the arrival of encroaching cultivators to tropical forest areas signifies increasing population densities, which, as alluded to above, make the practice of traditional shifting cultivation much more difficult to sustain. As a result, the advent of encroaching cultivation usually means that *shifting* cultivators with intimate knowledge of the ecological limits of tropical forest ecosystems are numerically overwhelmed by *shifted* cultivators who possess neither detailed knowledge of tropical forest ecology nor much interest in long-term sustainability.

Speaking more specifically of numbers, Myers (1992a: 156) estimated the total number of shifting cultivators across the entire tropics to be 200 million in 1980. By contrast, he assessed the total landless population in the tropics to be some 800 million during this same time period—that is, some 800 million potential shifted cultivators (ibid.: 148). While these estimates refer to the tropics as a whole, and not directly to the humid tropics, they are nevertheless indicative of the magnitude of the problem confronting the practitioners of the more sustainable land-use methods in humid tropical forest environments. In chapters 4 and 5, I examine how closed constitutional orders exacerbate the shifting-shifted cultivator problem and, thereby, exacerbate the problem of tropical deforestation.

Permanent Agriculture

Clearing for the establishment of permanent agriculture—the continuous cultivation of the same tract of land—is another proximate cause of deforestation in the humid tropics (Park 1992: 65-66; Grainger 1993: 54-62). Permanent cultivation of staple crops by both small and large farmers occurs throughout the humid tropics, with rice, cassava, and maize grown extensively in Asia, Africa, and Latin America, respectively. Tropical forests are also cleared, however, for the cultivation of cash crops. In Southeast Asia and Africa, the prominent form of large agricultural estate is the tree crop plantation. A legacy of colonial rule, tree crop plantations have expanded in the years since independence, largely on the basis of government backing. Of the ten leading primary commodities exported by tropical countries, four are tree crop products: rubber; vegetable oils (such as palm and coconut oil); cocoa; and coffee (Grainger 1993: 60-61).

Rubber, made from the latex tapped from the rubber tree *Hevea brasiliensis*, grows naturally in the Amazonian territories of Brazil, Peru, and Bolivia. And, while a limited amount of tapping still takes place in these regions, the vast majority of

rubber tapping occurs in Southeast Asia, where three countries—Malaysia, Indonesia, and Thailand—account for 75 percent of world production (ibid.: 61).

Early supplies of palm oil, used to make margarine, cooking fats, soap, and detergents, came from wild oil palm trees in the rain forests of West Africa, but these were later overtaken by plantations first in Zaire and later in Southeast Asia. Today, Malaysia accounts for two-thirds of world production and established 60,000 hectares of new plantations in 1989 alone (ibid.: 62). The market share of Indonesia, however, the second largest palm oil producer, is growing rapidly.

Of the other prominent plantation crops, coconut palm is grown on small and large plantations in Asia, which constitute some 85 percent of world production. Coffee cultivation is more widespread, with Brazil and Columbia the leading coffee producers. The center of the Brazilian coffee industry is in the state of Minas Gerais, outside of Amazonia, but coffee production is popular on resettlement schemes in the Amazonian state of Rondônia (CEPA-RO 1980). The cocoa tree grows wild in Brazilian Amazonia, but there are now plantations throughout the tropics, including those on smallholdings in resettlement schemes in Rondônia and along the Trans-Amazonian Highway (Fearnside 1985). Sugar cane plantations were historically a major cause of deforestation in Brazil, the Philippines, and Cuba, particularly, but Indonesia and Colombia now have plantation areas of similar size to those in the Philippines, while those in Thailand are even larger still (Grainger 1993: 62).

Logging Activity

Despite popular perceptions, the *direct* contribution of logging activity to tropical deforestation is relatively modest in comparison to that of agricultural conversion. Recall from table 3.1 that logging activity accounts for only 10 to 18 percent of tropical forest loss, depending on the particular estimate. The belief that logging activity directly leads to the destruction of vast tracts of tropical forest arises from the confusion between logging and deforestation (Grainger 1993: 69-70).[3] Logging in the humid tropics differs from deforestation since the preferred practice is not clear-cutting, as in temperate forests where whole stands are cleared to harvest timber, but selective cutting. Because only a few of the thousands of tree species encountered in tropical forests are in commercial demand, typically only between two and ten commercially viable trees are felled and removed per hectare out of a total of approximately 350 trees (ibid.).

The real contribution of logging activity to tropical deforestation comes through the construction of feeder roads into the forest necessary to access the more valuable trees and transport them to markets where they can be sold. When linked up with major highways, these roads greatly enhance the accessibility of previously inaccessible tropical forest areas to impoverished shifted cultivators in search of lands to clear for the cultivation of subsistence crops. This entire process, whereby logging activity serves as the catalyst for the onset of deforestation is commonly referred to as "logging-deforestation feedback" (Grainger 1993: 98, 115). The Food and Agriculture

Organization of the United Nations estimates that as much as two-thirds of all primary forest clearance in the tropics is possible only as a result of the roads and infrastructure built for logging operations (cited in World Wide Fund for Nature 1988). Additionally, over 90 percent of the 40,000 to 50,000 km^2 of commercially productive closed tropical forests that are logged every year eventually become cropland (World Resources Institute 1987). Thus, while the direct contribution of logging activity to overall tropical deforestation totals is nominal, its indirect contribution is significant indeed.

On a regional basis, logging activity as a proximate cause of tropical deforestation has historically been most salient in Africa and Southeast Asia. By 1985, about 20 percent of productive tropical forests had been logged over in Africa, while in Asia and Latin America the figures were about 19 percent and 9 percent, respectively (Rowe, Sharma, and Browder 1992: 35). And, while Latin America's forests have been the least affected by logging operations, this situation is changing as commercially valuable timber species are rapidly being depleted from African and Asian forests. Recent inroads made by Asian timber companies in Guyana and Suriname are indicative of this trend toward greater commercial exploitation of Latin America's tropical forest resources (Colchester 1994; Sizer and Rice 1995; Sizer 1996).

Fuelwood Gathering

The collection of fuelwood by people living in tropical forest areas is a third proximate cause of tropical deforestation (Park 1992: 45-46). In tropical countries, it is estimated that roughly 80 percent of wood consumption is for use as fuel, with industrial use accounting for the balance (World Wide Fund for Nature 1988). The amount of wood collected for fuel is significant, and it has risen sharply in recent decades. The World Resources Institute (1986) calculated that total annual production of fuelwood and charcoal in developing countries more than doubled from less that 600 million cubic meters in 1963 to some 1,300 million cubic meters in 1983, with fuelwood production accounting for the majority of the increase.

The collection of fuelwood normally threatens the forest margins first. Once these accessible areas have been cleared or over-collected, fuelwood gatherers are forced to travel further into the forest interior in search of adequate supplies. According to United Nations estimates, 1.5 of the 2 billion people around the world who rely on fuelwood for cooking and heating are cutting wood faster than it is able to grow back naturally (cited in Elsworth 1990). The problem is particularly serious in Africa, where upwards of 180 million people faced acute shortages of fuelwood in 1980 (ibid.).

Clearing for Pasture

The conversion of forest cover to pasture for livestock as a proximate cause of tropical deforestation is more or less confined to Latin America (Myers 1992a: 127-142; Park 1992: 67-70; Grainger 1993: 59-60). The expansion of cattle ranching in South America, and particularly in Brazilian Amazonia, has received a good deal of attention as a proximate cause of tropical deforestation (e.g., Hecht 1985; Hecht, Norgaard, and Possio 1988). Cattle ranching is also prominent in Central America, where it accounted for one-third of all deforestation in Costa Rica, Guatemala, Honduras, and Nicaragua between 1960 and 1980 (Myers 1992a: 131-135). The rise of cattle ranching in Central America is often traced to increased demand for beef in the United States—the so-called "hamburger connection" (Myers 1981; but also see Edelman 1995)—which obtains three-fourths of its beef imports from the region. Brazil, on the other hand, exports mostly to Western Europe, rather than to the United States.

As an economic activity, cattle ranching is a very land-extensive operation, in that it requires the clearance of large tracts of forest to be profitable (Park 1992: 69-70). Yet, the inherently nutrient-poor soils found in tropical forest regions mean that cattle grazing is neither a suitable nor a sustainable use of converted forest land. Soil fertility and yield quickly decline after ranching starts, and even a few years of intensive cattle grazing can destroy the physical and chemical integrity of the soils. The number of cattle that tropical soils can sustain falls sharply over a ten-year cycle; ranches are often run for a five- to eight-year period, after which time the rancher moves on to repeat the process elsewhere. Opening up new land is often seen as cheaper than trying to prolong the commercial viability of existing ranchland through such measures as increased use of fertilizers, soil conservation, disease control, and improved breeding. Moreover, the decision of ranchers to clear new land is often tipped by generous subsidies and tax holidays granted by Latin American governments highly receptive to ranching interests (Browder 1988; Mahar 1989; Binswanger 1991).

Mining Activity

Tropical deforestation also occurs as a result of mining activity, though the extent of deforestation depends on whether opencast (strip) or underground (shaft) mining is used (Grainger 1993: 63-66). In general, clearing for the establishment of opencast mines, which can cover thousands of hectares, is much more extensive than clearing for the establishment of underground mines. Among the more sought after minerals and ores in the humid tropics are tin (Bolivia, Brazil, Indonesia, Malaysia, Thailand), gold (Brazil, Indonesia, Papua New Guinea, the Philippines), copper (Papua New Guinea, Peru, Zaire), and bauxite (Brazil, Guinea, Guyana, Suriname, Venezuela). Additionally, opencast coal mines are an increasingly important cause of deforestation in Latin America and Southeast Asia. The world's largest steam coal mine is located at El Cerrejón in Colombia. Coal mining is also expanding in

Indonesia, which has proven reserves in Sumatra, East Kalimantan, South Kalimantan, and Irian Jaya.

Several countries in the humid tropics—including Cameroon, Congo, Ecuador, Gabon, Indonesia, Malaysia, and Nigeria—are also major producers of petroleum and natural gas. And, while the amount of deforestation associated with the establishment of an oil well is less than that for an opencast mine, the building of roads, pipelines, and testing and well sites for oil exploration can have a significant impact on forest cover. Probably one of the more well-known exemplars of tropical deforestation as a result of oil exploration is the Ecuadorian Amazon, where exploration by Texaco over the past thirty years—exploration backed by the Ecuadorian government—has not only occasioned significant environmental degradation, but severe dislocation of the region's indigenous populations as well (Kimerling 1996).

Clearing for Large Development Projects

Lastly, the realization of large-scale development projects in the humid tropics has led to the loss of forest cover. The more notable examples of these types of projects come from Brazil and Indonesia (Park 1992: 51-57, 70-78; Grainger 1993: 56-59, 66-67). In Brazil, initiatives such as the Trans-Amazon Highway and the Grande Carajas project have produced relatively modest amounts of direct forest clearance, but have indirectly led to more significant quantities of forest loss by increasing forest access to land-hungry shifted cultivators. Much more direct in their impact on forest cover have been Brazilian government schemes to relocate large populations from Brazil's coastal regions to the Amazonian interior. Overall, Brazilian government resettlement schemes accounted for 1.6 million hectares of forest clearance, or about 11 percent of all Amazonian forest cleared, by 1983 (Browder 1988: 281-282). Even more ambitious in scope, the Indonesian Transmigration Program (ITP), begun in 1950, was originally designed to move 140 million people over a 35-year period; by the late 1980s, however, only 3.6 million people had been moved (Grainger 1993: 56-57). Still, the ITP has resulted in significant amounts of forest clearance. Between 1978 and 1983, forest clearance associated with the program may have averaged up to 280,000 hectares per year.

Thus, the proximate causes of tropical deforestation range from agricultural conversion and logging to mining and government resettlement programs. This section has provided a general overview of these proximate causes—that is, a general overview of *how* tropical deforestation takes place. In the next section, I explore the contending explanations of *why* tropical deforestation takes place.

The Underlying Causes of Tropical Deforestation

Previous efforts to explain the incidence of deforestation in the humid tropics, and environmental degradation more generally in this zone, have drawn primarily from one of three perspectives: (1) neo-Malthusianism; (2) dependency/world-systems

theory; and (3) neoclassical economics (Stonich 1993: 21-25; Jolly 1994: 63-78; Browder 1995: 124-125). In this section, I summarize the logic of these three perspectives and review the existing empirical support for each. In keeping with the national-level focus of this research, the empirical evidence that I assess derives mainly from studies that take the nation-state as the basic unit of analysis, the vast majority of which are cross-sectional statistical analyses.

Neo-Malthusian Explanations

From the neo-Malthusian perspective, population growth is the main underlying cause of environmental degradation (Ehrlich 1968; Ehrlich and Ehrlich 1970, 1990; Eckholm 1976; Meadows, Meadows, and Randers 1993). Proponents of this perspective maintain that the Earth has a finite carrying capacity, and that resource destruction occurs when too many people intensify their efforts to grow food and meet other consumptive needs. In specific reference to tropical deforestation, neo-Malthusians point to growing populations and the declining resource productivity of agriculture in many areas of the tropics and assert that these factors work in concert to stimulate increased migration and human settlement in tropical forest regions. One prominent outcome of this ecologically onerous human onslaught borne by tropical forest regions is deforestation.

Lester Brown (1987), one of the more audible of the contemporary neo-Malthusian voices, traces environmental degradation in the tropics more specifically to an insidious "demographic trap." Brown argues that many developing (tropical) countries are stuck in the middle stage of the demographic transition—high birth and low death rates. These countries are ensnared in a "demographic trap" from which they are unable to extricate themselves and move to the final stage of the demographic transition—low birth and death rates—because they are caught in a vicious cycle where high population growth and environmental degradation reinforce each other. Both place strains on the ability of an economy to provide for its population, and the resulting poverty sustains adults' desires to have large families. Without increasing economic growth or family planning, a growing population will lead to continued environmental degradation (Brown and Jacobson 1986).

Empirical Support

Several cross-national statistical studies of tropical deforestation have considered some operationalization of population pressure as a leading explanatory variable. Allen and Barnes (1985), in one of the first cross-national statistical analyses of deforestation in the tropics, found a statistically significant relationship between population growth and the loss of forest cover in a panel regression analysis of thirty-nine countries across Africa, Asia, and Latin America during the period 1968-1978. Subsequent analyses using similar methods, but more recent data, have reported comparable findings (e.g., Rudel 1989; Barbier et al. 1994; Rock 1996).

However, in a meta-analysis (i.e., an analysis of analyses) of several studies exploring the relationship between population pressure and deforestation, Palloni (1994) rejected the blanket assertion that population pressure leads directly to deforestation, based on his findings that: (1) the magnitude of the effects of population pressure on deforestation were, at best, modest; (2) the effects of population pressure on deforestation change depending upon the presence (or absence) of reasonable control variables; and (3) the relationship between population pressure and deforestation may be unduly biased by influential cases. In light of such findings, as well as findings derived from micro-level studies that suggest that population growth may actually be *beneficial* to forest health (Fox 1993), scholars have begun rethinking the fundamental logic of the entire neo-Malthusian enterprise (Arizpe, Stone, and Major 1994).

Dependency/World-Systems Explanations

In contrast to neo-Malthusian explanations, which tie environmental degradation to the internal demographics of tropical countries, dependency and world-systems explanations point to the disadvantaged position of tropical vis-à-vis industrialized countries in the larger world economy (Redclift 1984; Blaikie and Brookfield 1987; Barbosa 1993; Smith 1994). From this perspective, tropical countries are seen as the reluctant producers of primary commodities, specifically agro-exports and timber, whose extraction by multinational capital both directly degrades the natural environment and immiserates rural populations, leading to further environmental destruction. In short, dependency and world-systems explanations postulate a causal chain linking capital accumulation, agricultural modernization, and marginalization of the peasantry to environmental degradation.

Recent works in this vein have more explicitly accented the historical dimensions of deforestation, stressing the need to view the current episode of tropical deforestation in proper historical context. According to the authors of these works, the current episode of tropical deforestation is but the latest in a long line of global deforestation events—to include Western Europe, North America, and China—occasioned by the incorporation of new geographical regions into the capitalist world economy (Chew 1997).

Empirical Support

In their study of deforestation in thirty-nine tropical countries during the period 1968-1978, Allen and Barnes (1985) found statistically significant relationships between both wood exports per capita and percent land area under plantation crops and deforestation, thus lending support to the notion that the production of primary commodities for export does lead to notable reductions in forest cover. However, in his analysis of roughly the same thirty-nine countries during the period 1976-1980, Rudel found no significant relationships between agro-export production and deforestation or between tropical hardwood production for export and deforestation,

leading him to conclude that "these findings suggest caution in attributing rapid deforestation to relations of dependency between peripheral and core nations in the world system" (1989: 336).

To the extent that heavy debt burdens are indicative of the subservient position of tropical countries in the world economy (George 1992), demonstrated relationships between the existence of such burdens and deforestation are suggestive of dependency and world-systems arguments. And, in regression analyses of fifty-five and forty-five tropical countries, respectively, Kahn and McDonald (1995) and Capistrano and Kiker (1995) both found confirming evidence of the debt-deforestation linkage. Analysis undertaken by Inman (1993), though not confined exclusively to the tropics, furnished additional support for the idea that tropical countries capitalize their natural resources in order to meet the rigorous debt repayment schedules established by international lending agencies.

Lastly, recent analyses undertaken by Burns et al. (1994) and Kick et al. (1996) examined the importance of world-system position, using the core/semiperiphery/periphery trichotomy developed by Wallerstein (1974, 1979). In a regression analysis of ninety-nine countries over the period 1965-1990, Burns et al. (1994) found a highly significant relationship between "semiperipheral" status and deforestation. Burns et al. attributed this finding to the "deforestation profile" of semiperipheral countries—rapid population growth (a feature shared with peripheral countries) combined with increasing technological prowess (approaching that of core countries). This combination gives semiperipheral countries both the necessity (population pressure) and the ability (technology) to deforest as they strive to industrialize and achieve core status. Kick et al. reported similar findings, adding however that while the leaders of semiperipheral countries may see deforestation as a means to industrialization, the main beneficiaries of such deforestation continue to be the countries of the core (1996: 79).

Neoclassical Explanations

Explanations derived from neoclassical economics share the assumption that well-functioning markets are the best means of allocating natural resources and that competition in such markets necessarily leads to appropriate resource management (Panayotou 1993). Where well-functioning markets exist, the resource scarcities generated by deforestation will induce price increases and investments in forestry well before deforestation attains its physical limit (Hyde, Amacher, and Magrath 1996). Much of the mismanagement and outright abuse of forest resources in the tropics, therefore, is attributed by neoclassicists to malfunctioning, distorted, or even totally absent markets. Moreover, "Prices generated by such markets do not reflect the true social costs and benefits of resource use. Such prices convey misleading information about resource scarcity and provide inadequate incentives for management, efficient use, and conservation of natural resources" (Panayotou 1993: 33). Thus, market

failure—that is, the dearth of robust markets—is seen as the main factor underlying much tropical forest loss.

Specific examples of market failure that have been linked to forest resource degradation include ill-defined or nonexistent property rights, unpriced and underpriced resources, absent or "thin" markets, pervasive spillover effects (i.e., externalities), lack of competition in the form of local monopolies and oligopolies, and high discounting of the future, arising, for example, from insecurity of tenure (ibid.: 34-55). Where such conditions are pervasive, neoclassicists contend, individual resource users have little incentive to invest in future conservation. Rather, their incentive is to maximize present consumption, the main result of which is resource degradation.

Empirical Support

Empirical work grounded in neoclassical assumptions can be gleaned from both the case-study and statistical literature. The neoclassically inspired volume edited by Repetto and Gillis (1988) focused on government interventions designed to correct market failures in the forest sector, yet resulted in further distortions—government failures—that led to even greater environmental degradation.[4] In the conclusion to their study, Repetto and Gillis (Gillis and Repetto 1988) explicitly tied deforestation to specific tropical country government policies that exacerbated market failures in cases from West Africa, Southeast Asia, and South America. Timber concessions that captured only a fraction of forest resource rents (thereby underpricing the resource) and heavily subsidized credit and direct government subsidies that stimulated competing—but unsustainable—land uses were among the more prominent examples cited by Repetto and Gillis of policies that muted important market signals and intensified forest clearance. Couching their findings in the unmistakably utilitarian terminology of neoclassical economics, Repetto and Gillis asserted that "there is little doubt that the policies of government have been inimical to the *rational utilization* of valuable forest resources" (ibid.: 388; emphasis added).

In a subnational statistical analysis, Southgate, Sierra, and Brown (1991) examined the effects of tenure security on deforestation in eleven of eastern Ecuador's twenty cantons during the early 1980s. Using the percentage of a canton's agricultural land that had been legally adjudicated as their measure of tenure security, Southgate, Sierra, and Brown did find a strong negative relationship between tenure security and deforestation. In other words, cantons with higher percentages of legally adjudicated lands were found to have experienced lower levels of deforestation over the study period than those cantons with lower percentages of adjudicated lands.

Lastly, and most significantly for the purposes of this research, Deacon (1994) investigated the tenure security-deforestation linkage in a cross-section of countries during the period 1975-1985. Adding an important twist to the neoclassical contention that tenure insecurity underlies steep deforestation profiles, Deacon sought to locate the origins of tenure insecurity, rather than take it as a given. According to Deacon, tenure insecurity arises from two principal sources: (1) government instability or

inability to enforce ownership; and (2) an absence of government accountability. Where governments are unable to enforce the laws of property and where they are able to selectively redistribute property to themselves or their allies with impunity, Deacon maintains, forest occupants have little incentive to invest in forest cover. Rather, the incentive that they have under such conditions is to clear forest in the present in order to reap any short-term benefits (e.g., through agricultural cultivation or timber sales) because it is unlikely that they will enjoy access to such benefits in the future. And, in a regression analysis of 120 countries drawn from the tropical, sub-tropical, and temperate latitudes, Deacon did find general support for his claim that insecure tenure environments, as proxied by several measures of government stability and accountability, were conducive to higher levels of deforestation.

The Neglected Role of Political Institutions

The importance of Deacon's work stems from his insight that market failure and government failure are intertwined processes; that the seeds of market failure often lie in the incentive structures created by government policies. In this regard, Deacon's work parallels that of Repetto and Gillis, summarized above. Yet, unlike Deacon, Repetto and Gillis shy away from the notion that political motivations may underlie those government policies linked to deforestation, being content to conclude that "the policy weaknesses identified in this study arose despite well-intentioned development objectives. The shortcomings have been failures of understanding and execution" (Gillis and Repetto 1988: 388-389).

In sharp contrast to these conspicuously apolitical conclusions, the argument that I develop over the next two chapters is that tropical country government policies linked to deforestation are not simply the products of ignorance and faulty implementation, but, rather, the carefully crafted reward packages of tropical country political elites seeking to attract and retain political supporters. Put another way, "Governments do not mismanage resources by accident" (Paarlberg 1994: 38). The extent to which tropical country political elites pursue such policies is determined, in large part, by the relative openness or closure of the constitutional order of a given tropical country. In short, I argue that policies antagonistic to forest conservation are more likely to arise in closed, rather than open, constitutional orders.

Before embarking upon my elaboration of this claim, however, it is important to distinguish my position from that of Deacon. At first glance, the two positions may seem interchangeable—ecologically malign market failures derive from government failures, which are themselves attributable, in part, to unaccountable governments. For Deacon, the importance of unaccountable (and unstable) governments vis-à-vis forest resources is that they engender short time horizons among forest resource users. While acknowledging this point, the significance of unaccountable governments for me is the very fact that they are unaccountable, and, therefore, generally unresponsive to the policy preferences of the majority of their citizens.[5] In the tropical country setting, this means

that unaccountable governments neglect the policy preferences of those who derive their basic livelihoods from landed resources, setting in motion a chain of events that places increasing pressure on tropical forest resources. Thus, while Deacon and I both share a concern for the ecological consequences of unaccountable governments, the particular dimensions of unaccountability that we emphasize are somewhat different.

Finally, before concluding the present chapter, I return briefly to the three explanatory approaches to tropical deforestation outlined above. Over the course of the last few paragraphs, I have implicitly spelled out what I believe these approaches lack, namely, a focus on political institutions. This does not mean that I think the underlying causes identified by the proponents of these perspectives are irrelevant to the explanation of tropical deforestation. Neo-Malthusian proponents justifiably raise the possibility that human population pressures may indeed be stretching the carrying capacities of natural resource systems "beyond the limits" (Meadows, Meadows, and Randers 1993). Dependency and world-systems advocates provide the valuable service of accentuating factors external to the tropical country political economy through their focus on processes of capital accumulation in the world economy. Lastly, neoclassically inspired researchers of tropical deforestation supply the crucial behavioral microfoundations of resource degradation by exposing the perverse incentives that can result from both market and government failures.

However, neo-Malthusians generally fail to acknowledge that humanly devised institutional arrangements can play an important role in determining the carrying capacities of natural resource systems. For their part, dependency and world-systems analysts of tropical deforestation, much like the larger theoretical movements from which they draw, tend to treat capitalist expansion as a globally monolithic process, leaving little room for the possibility that cross-national differences in institutions may lead to differences in outcomes. And, though neoclassicists correctly highlight the critical role of market failures, and the government policies that intensify such failures, "The drawback to this ... approach is that it pulls attention away from power relations and real conflicts of interest. It implies that suboptimal economic and environmental outcomes in the developing world are largely unintended and result from little more than technical oversight" (Paarlberg 1994: 37). As a result of this naivete, neoclassicists fail to consider how power relations and the resolution of conflicts are structured by political institutions. Thus, it is my contention that the underlying causes identified by each of these approaches do not act deterministically to reduce tropical forest cover, but, rather, that their impact is filtered by national political institutions, most importantly, those operative at the constitutional level.

Endnotes

1. While those writing on global environmental change and tropical deforestation both use the term "proximate causes," global environmental change authors generally substitute the phrase "human driving forces" for "underlying causes." I eschew the phrase "human driving forces" in this research because, for whatever reason, it has generally not been adopted in the tropical deforestation literature.

2. Grainger (1993: 67) also includes clearing for the cultivation of illegal narcotics as a proximate cause of tropical deforestation. While such clearing is an important proximate causes in some areas (e.g., South America, Southeast Asia), I judged its incidence to be too localized to be included in a general overview such as this.

3. In chapter 6, I review in some depth the technical definitions of deforestation that have been developed by international organizations such as the Food and Agriculture Organization of the United Nations to monitor tropical forest conversion.

4. Other studies focusing on the government failure-deforestation linkage in the tropics include Mahar (1989), Binswanger (1991), Mahar and Schneider (1994), and Osgood (1994).

5. It is worth noting that Deacon (1996) himself recognized the possibility of this second connection between government accountability and forest resource use in a subsequent publication, but did not explicitly pursue it.

CHAPTER FOUR

THE POLITICAL ECONOMY OF TROPICAL DEFORESTATION AND THE CONTEST FOR LANDED PROPERTY RIGHTS

Illuminating the Political Economy of Tropical Deforestation

This chapter and the next (chapter 5) constitute the core of this study. It is over the course of these two chapters that I develop the claim that national political institutions operative at the constitutional level play an important mediating role between the proximate and underlying causes of tropical deforestation. In order to develop this claim adequately, a certain division of labor between the two chapters is necessary. Thus, the present chapter is devoted to illuminating the general political economy of tropical deforestation, while the objective of the following chapter is to explore more specifically why variations in the openness or closure of constitutional orders might plausibly be related to variations in levels of tropical forest loss.

The organization of the present chapter is as follows. First, in order to set the proper empirical context, I construct a composite sketch of the tropical country political economy. Second, drawing upon the more prominent features of this sketch, I attempt to demonstrate that the central political struggle of tropical societies is that for control over landed property rights. I then identify the two main groups of actors involved in this contest—peasant producers and political executives—and discuss their respective behavioral objectives and operational strategies in the context of the contest for landed property rights. Finally, I conclude the chapter with discussions of the often irreconcilable needs of peasant producers and political executives vis-à-vis the contest for landed property rights in the tropical country setting as well as the general pattern of executive dominance in this contest.

Constructing the Tropical Country Political Economy

In this section, I construct a composite sketch of the tropical country political economy in order to establish the empirical basis for the theoretical claims that I advance in the following chapter. While I am well aware that the use of such an approach runs the risk of obscuring important variations in the political economies of the humid tropics, I am also aware of the fact that these political economies are marked by notable similarities. Most salient among these similarities for the purposes of this research are: (1) large agricultural populations; (2) economies based predominantly on primary production; (3) polities characterized by executive dominance; and (4) polities marked by uncertain executive tenure. I consider each of these four factors in turn.

Large Agricultural Populations

One of the first things that one notices when considering the political economies of the humid tropics is the fact that the populations of these countries are located primarily in rural areas and are primarily agrarian in nature. Table 4.1 below lists the agricultural populations of the three geographical regions that lie within the humid tropics[1] for the period 1976-1980.[2] Note that the African countries of the humid tropics had the highest agricultural populations during this period, followed closely by the countries of the Asia-Pacific region, and more distantly by the countries of the Latin America-Caribbean region, whose agricultural population was less than half of the region's total population. However, in the aggregate, the agricultural population of the humid tropics stood at nearly 63 percent.

For purposes of comparison, I have also included the average agricultural population of the member states of the Organization for Economic Cooperation and Development (OECD), an international governmental organization comprised almost exclusively of industrialized countries.[3] I employ this comparison to illustrate the radically different occupational structures of this group of industrialized countries versus those less-developed countries (LDCs) that fall within the tropical latitudes. While some 63 percent of all individuals in the humid tropics derived their livelihood from agricultural production during the period 1976-1980, this same figure evaluated in the context of the industrialized world amounted to only 12 percent.

Table 4.1. Agricultural Populations in the Humid Tropics and the OECD, 1976-1980
(percentage of total population)

Region	Agricultural Population
Africa	76.2
Asia-Pacific	66.2
Latin America-Caribbean	39.0
Humid Tropics	62.8
OECD Countries	12.4

Source: Food and Agriculture Organization (1995).

A second important distinguishing feature of tropical agriculture is that the vast majority of agricultural producers in the tropics are subsistence producers (Upton 1996: 18). In other words, the vast majority of agricultural producers in the humid tropics are *peasants*. For the purposes of this study, I define peasants as individuals who "derive their livelihoods mainly from agriculture, utilize mainly family labor in farm production, and are characterized by partial engagement in input and output markets which are often imperfect or incomplete" (Ellis 1993: 13).[4] This last component of the definition—partial engagement in markets—overtly recognizes the reality that modern peasant communities are never the completely isolated communities that they may have been in the past, and that peasants as a social group are always part of a larger

economic system (Wolf 1966: 8; Ellis 1993: 51-54). However, it should be remembered that peasant involvement with external markets is only partial, and that the bulk of the peasant's agricultural output is directed not toward commercial sale but toward meeting the subsistence needs of the peasant household. Put another way, "The peasant ... runs a household, not a business concern" (Wolf 1966: 2).

Primary Production Economies

Closely related to the highly pronounced rural and agrarian orientation of the countries that occupy the humid tropics is the fact that the economies of these countries are based largely upon primary production. By primary production, I mean the production of such commodities as foodstuffs, raw materials, minerals, and organic oils and fats (Nafziger 1990: 71). One rough measure of the importance of primary production to the countries of the humid tropics is the size of the agricultural sector relative to the total gross domestic product (GDP). In table 4.2 below, I list the contribution of the agricultural sector to total GDP for the three geographical regions of the humid tropics and for the humid tropics as a whole. For the period 1976-1980, the agricultural portion of GDP was highest in the countries of the Asia-Pacific region, followed by those in Africa and those in the Latin America-Caribbean region. Across the entire humid tropics, the contribution of agricultural production to total GDP was 30.5 percent, more than four times as much as the contribution of agriculture to total GDP in the OECD countries. Again, this comparison with OECD countries helps to illustrate the distinctly agrarian flavor of economic production in the humid tropics.

Before proceeding further, a few clarifying comments on the figures presented in table 4.2 are necessary. First, the reader may wonder why the figures for agricultural GDP are noticeably smaller than those for agricultural population. This has to do mainly with inherent differences in productivity between the agricultural and industrial sectors of a given economy. Because of the use of advanced technology and greater capital intensity in the industrial sector, labor productivity in the industrial sector is generally higher than that of the agricultural sector (Nafziger 1990: 64-65). Thus, while the agricultural population of the humid tropics between 1976 and 1980 was some 63 percent of the total population, the contribution of this population to total GDP was only 30.5 percent.

Table 4.2. Agricultural GDP in the Humid Tropics and the OECD, 1976-1980
(percentage of total gross domestic product)

Region	Agricultural GDP
Africa	35.1
Asia-Pacific	38.9
Latin America-Caribbean	17.1
Humid Tropics	30.5
OECD Countries	6.8

Source: World Bank (1994a).[5]

However, it should also be mentioned that the figures for agricultural GDP reported in table 4.2 most likely underestimate the true contribution of agriculture to national production, especially in the case of the LDCs in the humid tropics (World Bank 1994a). Due to the vast size of the peasant-based subsistence sector in the humid tropics, a large portion of agricultural production in these economies is either not exchanged at all or not exchanged for money. As a result, such production is generally not reflected in national accounts data. Thus, when considering the figures presented in table 4.2, we should remind ourselves that the actual contribution of agricultural production to total GDP in the tropical country setting is probably higher than these figures suggest.

The importance of primary production to tropical country economies can also be evidenced in the interaction of these countries with the world economy. Indeed, entire research programs have been built upon the observation that the economies of LDCs specialize in the production and export of primary commodities. Probably the most well-known of these are the dependency (Furtado 1968, 1970, 1973; Frank 1969a, 1969b; Cardoso and Faletto [1971] 1979) and world-systems (Wallerstein 1974, 1979) schools, whose proponents view the position of LDCs as primary commodity producers as being detrimental to their long-term prospects for economic development. And, while this is not the place to debate the merits of such an argument, table 4.3 below does clearly demonstrate the significance of primary product exports for the economies of the humid tropics. Whereas nonfuel primary products[6] accounted for approximately 32 percent of total export earnings in the OECD countries during the period 1976-1980, the nonfuel primary product share of total export earnings was more than twice that amount—73 percent—in the humid tropics.[7] Additionally, nonfuel primary product export earnings accounted for some 16 percent of the total gross national product (GNP) in the humid tropics, while only 7 percent of total GNP derived from nonfuel primary product export earnings in the OECD countries. Again, the contrasts between tropical and industrial modes of production are striking.

Table 4.3. Primary Product Exports in the Humid Tropics and the OECD, 1976-1980

Region	Nonfuel Primary Product Export Earnings as a % of Total Export Earnings	Nonfuel Primary Product Export Earnings as a % Total GNP
Africa	76.9	15.9
Asia-Pacific	68.3	12.6
Latin America-Caribbean	69.4	18.2
Humid Tropics	72.6	15.9
OECD Countries	32.2	7.0

Source: World Bank (1994b).

Executive Dominance

The previous two sections have highlighted some of the more salient

economic attributes of the countries that occupy the humid tropics. In the next two sections, I begin to address the significant political realities of these countries. Much of the discussion that I present refers to the political features of less-developed countries in general, and thus is not specifically confined to those countries that occupy the humid tropics. However, as I explained in chapter 1, the overlap between LDCs and tropical countries is significant. Thus, any discussion of LDC politics becomes pertinent to the politics of tropical countries as well.

One of the first political realities that presents itself to any attentive observer of LDC politics is the relatively high concentration of power in the hands of the political executive. Whereas the three putative functions of government—legislation, execution, and adjudication—are generally assigned to three separate and distinct bodies—the legislature, the executive, and the judiciary—in industrialized democracies, these functions in the less-developed world tend to be carried out almost exclusively by the political executive. This phenomenon is commonly referred to as *executive dominance*: "In the struggle among and between competing institutions of government in the developing world, it is the executive power that has won" (Bertsch, Clark, and Wood 1991: 596).

A brief survey of 102 LDCs in 1983 helps to illustrate the prevalence of executive supremacy in the polities of the less-developed world (Banks and Overstreet 1983). In twenty-nine countries, the legislature had been summarily dismissed, dissolved, or suspended indefinitely. In twenty-four other countries, while there was an elected legislature, it was primarily comprised of members of the single official party who, in most instances, were elected without opposition. In another twenty-two cases, a more or less freely elected legislature was so dominated by executive power that it wielded few real powers. Thus, in only twenty-seven instances could it be said that a country's legislature was an effective counterweight to the political executive.

A second indicator of executive dominance is the degree to which chief executives manipulate or suspend the constitution, or engage in other electoral irregularities, in order to remain in office beyond their legally prescribed term.[8] One of the more noteworthy examples of this type of constitutional manipulation in recent history is that of President Alberto Fujimori of Peru. When opposition mounted in the Peruvian congress over his neoliberal economic reforms and draconian counterinsurgency measures in April 1992, Fujimori undertook a "self-coup" (*autogolpe*), dissolving the Congress and gutting the Peruvian constitution (see NACLA 1996). Thus free of constitutional constraints, Fujimori continued with his neoliberal restructuring of the Peruvian economy and granted the military sweeping authority in the counterinsurgency war. Notably, when the Peruvian constitution was later rewritten by a new Peruvian congress largely hand-picked by Fujimori, it abolished Peru's one-term presidential limit, thereby allowing Fujimori to run for re-election, and established a judiciary with few independent powers of its own.

Such manifestations of executive dominance are indicative of another closely related truth of political rule in LDCs: the preeminence of individuals over institutions. Observers of LDC politics have labeled regimes defined by personal prerogative—rather than institutional procedure—as *neopatrimonial* regimes:

> In neopatrimonial regimes, the chief executive maintains authority through personal patronage, rather than through ideology or law. As with classic patrimonialism, the right to rule is ascribed to a person rather than an office. In contemporary neopatrimonialism, relationships of loyalty and dependence pervade a formal political and administrative system and leaders occupy bureaucratic offices less to perform public service than to acquire personal wealth and status. The distinction between private and public interests is purposely blurred. The essence of neopatrimonialism is the award by public officials of personal favors, both within the state (notably public sector jobs) and in society (for instance, licenses, contracts, and projects). In return for material rewards, clients mobilize political support and refer all decisions upward as a mark of deference to patrons. (Bratton and van de Walle 1994: 458)

On the historical pervasiveness of personal rule in Latin American politics, Kamrava notes:

> Before the wave of democratization that appeared in the 1980s ... little respect for constitutional mandates could be found in the region and the majority of political leaders there observed constitutional procedures only when suited to their purposes. The element of *personalismo* in Latin American culture and politics has also encouraged the predominance of leaders with strong personalities over political institutions and principles, thus further reducing the practical viability of constitutions. (1993: 5-6)

On the incidence of neopatrimonialism in the African setting, Bratton and van de Walle assert that "neopatrimonial practice ... is the *core* feature of politics in Africa," given that "personal relationships ... in Africa ... constitute the foundation and superstructure of political institutions" (1994: 459). In reference to the neopatrimonial proclivities of Southeast Asian politics, Scott has remarked: "The dynamics of personal alliance networks are as crucial in the day-to-day realities of national institutions as in local politics; the main difference is simply that such networks are more elaborately designed by formal facades in modern institutions" (1972b: 92).[9] And finally, in considering the entire range of polities that constitute the less-developed world, Clapham concludes that neopatrimonialism is "the most salient type [of authority] in third world societies" because it "corresponds to the normal forms of social organization in precolonial societies" (1985: 49). The possible origins of neopatrimonialism notwithstanding, its ubiquity in the less-developed world is difficult—if not impossible—to ignore.

Uncertain Executive Tenure

The second political reality of the LDC setting that I examine is the precarious nature of executive tenure. Though the political executive may occupy the pivot point of power relations in LDC polities, his continued occupation of that location is far from guaranteed: "... political instability, arising out of legitimacy crises and raw inter-elite political competition, has become endemic to Third World polities. Palace coups and

personality changes have become commonplace ..." (Kamrava 1993: 170). One common indicator of the general insecurity of executive tenure in the LDC setting is the relative frequency of the coup d'etat. While cognizant of the fact that the coup d'etat is not completely alien to the industrialized world, Clapham observes:

> The difference between industrial states ... and the third world is nonetheless striking. Fully three-quarters of the twenty Latin American regimes have had military coups since 1960.... Just on half the states in third world Asia, and rather more in Africa, have had military coups and governments over the same period, even though (since many states did not become independent until after 1960) these have been less at risk. (1985: 137)

Returning to the comparison of humid tropical and OECD countries, table 4.4 below provides data on the occurrence of coups and revolutionary events for the period 1976-1980. Whereas the coup data reflect the actual removal of the executive through extraconstitutional means, the data on revolutionary events, defined as "any illegal or forced change in the top governmental elite, [or] any attempt at such a change" (Banks 1995), are suggestive of the demand for extraconstitutional removal. By either measure, the differences in the fluidity of the macropolitical environments in which tropical and industrial country executives operate are obvious. Thus, despite popular images that often project strong executives with a firm grip on the reins of power, the reality of LDC politics bespeaks a tenure that is much more tenuous.

Table 4.4. Coups d'Etat and Revolutionary Events in the Humid Tropics and the OECD, 1976-1980

Region	Coups d'Etat	Revolutionary Events
Africa	8	38
Asia-Pacific	3	18
Latin America-Caribbean	7	13
Humid Tropics	18	69
OECD Countries	1	7

Source: Banks (1995).

The Contest for Landed Property Rights

The content of the preceding two sections is relatively well established. Most observers of the less-developed world would accept that agrarianism, primary production, executive dominance, and the insecurity of executive tenure are common, if not cornerstone, features of LDCs in general, and tropical countries more specifically. Much less studied, however, is the relationship between these factors and tropical deforestation. In this section, I advance the claim that it is the *confluence* of these four factors in the tropical country setting has led to notable distortions in the contest for landed property rights, thus making these countries particularly susceptible to high levels of forest loss.

At the heart of this claim lies the notion that the central struggle driving the politics of agrarian societies is that between the "modern" industrializing sectors of these societies and their "traditional" peasant-based counterparts: "Politics centers on the contest for control over the extent to which rural resources are rewarded as they contribute to the growth of the nonfarm sector" (Bates 1987: 169).[10] More to the point, politics in these societies centers on the contest for control over land and landed resources: "As rural societies are predominantly agrarian and thus dependent on land, control of land is the strongest force in shaping their economic, social and political structure" (Christodoulou 1990: 7). Therefore, "Land becomes the pivot of power because people depend on it for their vital needs: the greater the dependence, the more strategic becomes control of land and the more power it confers" (ibid.: 1).

Thus, the importance of land in the tropical country setting derives from its status as the key factor of production. Just as power in industrial societies accrues to those who control capital, technology, and organization (Galbraith 1985), power in agrarian societies accrues to those who command authority over the disposition of landed resources. Land sustains such primary production activities as livestock production in South and Central America (Hecht, Norgaard, and Possio 1988; Kaimowitz 1996); commercial plantation agriculture in Southeast Asia and West Africa (Grainger 1993: 60-62); mineral extraction in Guinea, Papua New Guinea, Peru, and Zaire (ibid.: 63-65); oil exploration in Cameroon, Congo, Ecuador, Gabon, Nigeria, Indonesia, Malaysia, and Venezuela (ibid.: 65-66); and the felling of trees for timber in numerous countries throughout the humid tropics (Rietbergen 1993). Last but certainly not least, at the risk of belaboring the obvious, land makes possible the subsistence agriculture practiced by hundreds of millions of peasant producers across the entire humid tropical belt (Upton 1996: 165-187).

At a more fundamental level, however, politics in the humid tropics centers on the contest for *landed property rights*, that is, the property rights that pertain to land and the various resources that is supports (e.g., soils, timber, minerals). And, while land and the various resources that it supports may be the chief commodities over which political battles are fought in the tropical country setting, "Individuals and interest groups are really seeking *command over property rights*" (Benson 1984: 397). At a more fundamental level still, I would argue, politics in the humid tropics is a contest to decide who will participate in the "contracting for property rights"—the efforts of individuals to assign or modify property rights (Libecap 1989). In contrast to those excluded from this process, those who take part enjoy a distinct comparative advantage in determining who the property rights holders will be and how property rights will be distributed. To paraphrase Harold Laswell ([1936] 1958), "who gets *landed property rights*, when, where, and how" depends significantly on the ability to participate in the contracting for landed property rights.

Privileging Property Rights

At this point, it is perhaps worth stating more explicitly why I have chosen to characterize tropical country politics as a contest for "landed property rights" rather than a contest for "landed resources." My purpose in accenting the importance of

property rights to landed resources stems from my desire to maintain the focus on the institutional dimensions of human-land relationships. By focusing on property rights—i.e., "the social institutions that define or delimit the range of privileges granted to individuals to specific assets" (Libecap 1989: 1)—we are reminded that the contest for landed resources in the humid tropics is embedded in a network of institutional arrangements—broadly defined as "the humanly devised constraints that shape human interaction" (North 1990: 3). That is, the contest for landed resources in the humid tropics is won or lost on the ability to participate and prevail in the contracting for landed property rights.

Of course, this begs the question, does a focus on the possession of property rights not obscure the fact that in some settings, especially those encountered in the tropics (Bromley 1991: 104-106), the enforcement of property rights is highly problematic and, therefore, that the possession of property rights is of little value? Firmin-Sellers maintains that "property rights are most likely to be enforced when actors possess ample information about the asset, few individuals or groups press for an alternative definition of property rights, rights holders have ready access to adjudicatory institutions, and those institutions are backed by the coercive authority of the state" (1995: 867)—all conditions, she notes, that are frequently absent in the LDC setting. In response, I would assert that the conspicuous absence of these conditions in the tropical country setting is due in large part to the exclusion of tropical peasantries from the contracting for landed property rights. And, as I will suggest in the next chapter, where tropical peasantries are meaningfully incorporated into this process, these enforcement deficiencies are less prominent and, therefore, the pressures exerted on tropical forest resources less pronounced.

A Framework for Analysis

To structure my analysis of the contest for landed property rights, I employ a simple framework that addresses five questions that I believe to be fundamental to comprehending the dynamics of this contest in the tropical country setting:

- Who are the principal actors involved?
- What are the economic modes of production under which each actor functions, if different?
- What is the primary behavioral objective of each actor, given the constraints imposed by the relevant mode of production?
- What are the various landed operational strategies that each actor pursues, given their primary behavioral objective?
- What is the nature of the constitutional order in which the contest for landed property rights is conducted?

These core elements of the framework are depicted at the top of figure 4.1 below. Immediately below this base template, I have also included profiles of the two actors that I believe to be most central to the contest for landed property rights in the contemporary humid tropics: the *peasant producer* and the *political executive*. I provide these profiles as a means of previewing the discussion that I undertake in the

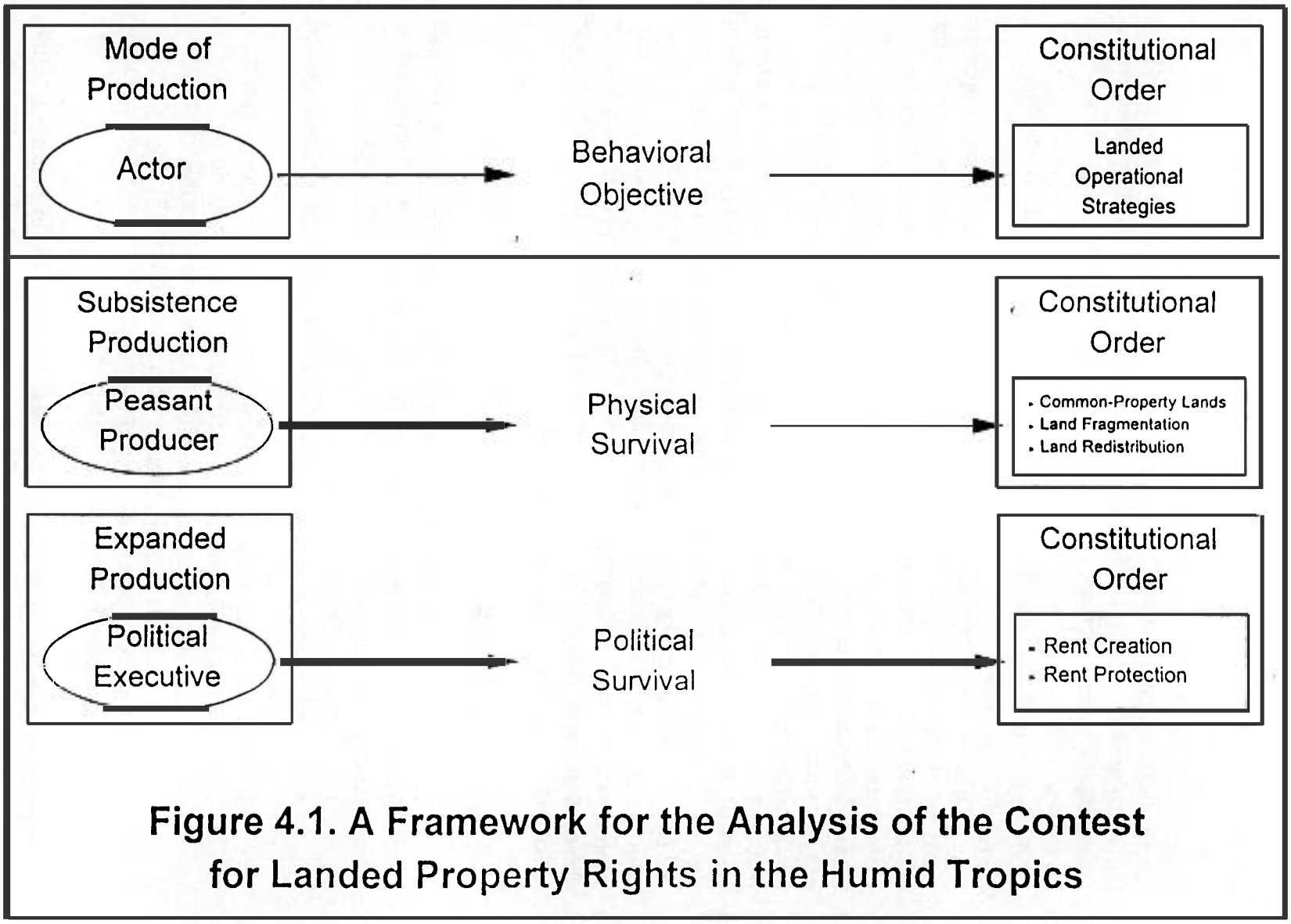

Figure 4.1. A Framework for the Analysis of the Contest for Landed Property Rights in the Humid Tropics

pages below. Note that the actor, mode-of-production, behavioral-objective, and landed operational-strategies elements differ across these two profiles while the constitutional-order element remains invariant. Of course, this is not meant to imply that constitutional orders are invariant from polity to polity. Rather, this is merely to indicate that I postpone consideration of this element until the next chapter, where I examine in some depth how variation in the constitutional order affects the ability of peasant producers and political executives to pursue their respective operational strategies.

The Actors

As mentioned above, the participants in the contest for landed property rights in the humid tropics tend to coalesce into two major groups: the members of the "traditional" rural-based peasant sector and the members of the "modern" urban-based industrial sector. It is worth mentioning, however, that key rural actors—most often large landowners—frequently form an integral part of ruling urban-based coalitions in the tropics (e.g., Bates 1981: 109-112). Thus, it is perhaps more accurate to refer to the counterpart of the peasant sector as the "agro-industrial" sector. And, while there are certainly other interested parties involved in this contest (e.g., multinational corporations, international lending agencies, non-governmental organizations), I presume that such parties align themselves with the members of either one or the other of these two sectors. Furthermore, while there are certainly important within-group differences in these two sectors, the between-group differences, I would affirm, are even more salient.

In the pages that follow, I explore these differences in terms of: (1) alternative modes of production; (2) how these modes of production lead to distinct behavioral objectives; and (3) how these objectives are pursued through disparate operational strategies. I consider these differences first in terms of the *peasant producer* and then in terms of the *political executive*. Designating the *peasant producer* to represent the peasant sector is an obvious choice and requires no further explanation. Selecting the political executive to represent the agro-industrial sector, however, is a decision whose logic is less readily apparent and, therefore, in need of additional clarification.

In short, my selection of the political executive to represent the agro-industrial sector derives both from the critical historical role of the LDC state as the vanguard of industrial transformation (e.g., Haggard 1990; Evans 1995; Maxfield and Schneider 1997) and the pivotal institutional role of the political executive as the ultimate arbiter of his polity's property rights arrangements (North 1981, 1990). Thus, it is ultimately the political executive who decides how "rural resources are rewarded as they contribute to the growth of the nonfarm sector"—that is, to the advancement of industrialization. And, it is because of this fact that I have chosen the political executive as the paramount embodiment of agro-industrial sector interests.

The Peasant Producer

Mode of Production.[11] One of the key distinguishing features of peasant producers is their subsistence mode of production (Chayanov 1966).[12] Under subsistence production, social labor produces just enough to ensure that the group subsists at the same material level year after year. This "just enough" must be sufficient, though, to enable production to continue at the recurrent level. In an agrarian community, for example, enough of the previous season's crop must be set aside for sowing in the next season, and a certain proportion of labor expenditure must be reserved for repairing and maintaining the community's existing productive resources (e.g., land, tools, draft animals). Thus, under subsistence production, the main goal of the peasant producer is not *surplus accumulation*, as the Marxist would phrase it, but *simple reproduction.*

This is not to say, of course, that the modern peasant producer generates no surplus. Implicit in the definition of peasants delineated above was the notion that the partial engagement of peasant producers in input and output markets requires the generation of at least some surplus in order to participate in such markets. Thus, peasant producers trade or sell a portion of their crop to obtain or purchase necessities that they themselves cannot produce. Additionally, peasant producers may sell their labor or participate in other off-farm activities in order to obtain cash for the purchase of such necessities. However, it must be remembered that the acquisition of cash is undertaken primarily to satisfy basic household consumption requirements—not to enter into expanded production for profit.

Behavioral Objective. Scholars who assume that peasant behavior is, at least in some sense, "optimizing" (Lipton 1968) have long debated the question of precisely what peasant producers seek to optimize. Ellis (1993: 63-168) offers a broad overview of five alternative perspectives on this question. From the *profit-maximizing* perspective (e.g., Schultz 1964; Ali and Byerlee 1991), peasants are held to be "efficient but poor" profit maximizers, beset by "comparatively few significant inefficiencies in the allocation of the factors of production" (Schultz 1964: 37-38). For those scholars who portray peasant producers as existing in ecologically and economically uncertain decision-making environments (e.g., Roumasset 1976; Scott 1976), peasants are *risk averse*, and seek to advance their chances of physical survival through the avoidance of risk. For scholars such as Chayanov (1966), peasants are *drudgery averse*, and act to achieve the optimal trade-off between the necessity to secure a minimum level of household consumption and the desire to avoid the travail of farm work. Scholars adopting the *farm-household* perspective (e.g., Barnum and Squire 1979; Low 1986) depict peasant producers as general utility maximizers and emphasize the role of external labor markets in the decision-making behavior of peasant producers, proposing that the on-farm decisions of peasants must be evaluated in terms of their opportunity cost vis-à-vis the prevailing wage rate. Finally, for those scholars who focus on the *sharecropping* peasant (e.g., Cheung 1969; Hayami and Otsuka 1993), share tenancy is characterized as the contractual response of peasants (and large landowners) with imperfect information striving to minimize the transaction costs associated with exchanges carried out in land, labor, and credit markets.

For the purposes of this research, I assume that the foremost behavioral objective of peasant producers is *physical survival*, secured most fundamentally through the aversion of risk:

> Living close to the subsistence margin and subject to the vagaries of weather and the claims of outsiders, the peasant household has little scope for the profit maximization calculus of traditional neoclassical economics. Typically, the peasant cultivator seeks to avoid the failure that will ruin him rather than attempting a big, but risky killing. In decision-making parlance his behavior is risk-averse; he minimizes the subjective probability of the maximum loss. (Scott 1976: 4)

I adopt this position not to discount the insights of the other four perspectives, but rather to select the one perspective that I believe to be the most broadly applicable, given the general parameters of this study. Because the profit-maximizing and farm-household perspectives both assume competitive markets (Ellis 1993: 166), their usefulness in the tropical country setting is severely limited. As I describe in a forthcoming section, the tendency of the tropical country political executive to favor agro-industrial interests in the contest for landed property rights has meant the introduction of severe distortions in both land and labor markets. To assume these distortions away, therefore, would seriously misrepresent the realities of contemporary tropical-country agrarian structures. Because the drudgery-averse approach proceeds on the assumption that there is no hiring in or hiring out of labor by the peasant household (ibid.: 120), its utility in the tropical country setting is also limited, given the fact that labor markets, though often imperfect and incomplete, are nevertheless present in the rural areas of most humid tropical countries. Finally, because sharecropping is not a truly pan-tropic agrarian institution (ibid.: 164), the sharecropping perspective fails to provide the geographically sweeping vista necessary to understand peasant-producer behavior throughout the entire humid tropical zone.

Thus, each of these four approaches betrays certain limitations when evaluated in the tropical country setting. By contrast, the risk-averse perspective, I believe, more accurately captures the fundamental challenge confronting the contemporary tropical peasant producer—physical survival:

> It is widely recognized that a high level of uncertainty typifies the lives of people in peasant farm households in developing countries. This uncertainty is more pervasive and serious for them than for farm families in temperate zones for several reasons. Variations of climate are more unpredictable and tend to be more severe in their impact on crop yields in the tropics than in the temperate zones. Also markets are more unstable where information is poor and other imperfections abound. Insecurity of poor peasant families due to low social and economic status is important in some countries; insecurity due to the vagaries of state action is important in others. And looming above all these kinds of uncertainty is the poverty of many peasant families meaning that the outcome of

> uncertain events can often make the difference between survival and starvation. (Ellis 1993: 82)

Given the myriad ecological, economic, and political uncertainties that mark peasant life, therefore, the assumption that peasants are averse to risky behavior—as such behavior may endanger their physical survival—would seem a reasonable inference.[13]

Operational Strategies. If peasant conduct is predicated on the logic of risk aversion, what then are some of the observable manifestations of this risk-averting behavior? In this section, I review the operational strategies that peasant producers have developed to manage risk. In order to sustain the primary analytical focus of this chapter—human-land relationships and their institutional dimensions—I restrict the discussion to those strategies directly related to land tenure; thus, operational strategies unrelated to land tenure are not addressed.[14] Moreover, in order to direct the review to those operational strategies most prominent in the tropical country setting, I restrict the discussion to three strategies in particular: (1) common-property lands; (2) land fragmentation; and (3) land redistribution. For each strategy, I briefly examine its rationale and then provide representative examples drawn from each of the three major continental regions within the humid tropical zone.

Probably one of the most widely studied strategies of risk management practiced by the members of peasant communities is the creation of common-property lands.[15] Again, in light of the various uncertainties that peasants encounter in their daily routines, the establishment of common-property lands, and common-property institutions more generally, can be seen as the logical response of individuals bound together by an uncertain future:

> In the face of the uncertainty characteristic of life in a developing economy, no individual can be assured that he or she will be spared failure. Given the intimate connection between basic resources and subsistence, unpredictable events such as floods or drought may bring disease or death. In the face of this environmental uncertainty, common-property institutions may be created; rather than emphasizing the right to exclude some, these institutions provide instead for the right of many to be equally included as a hedge against uncertainty. The expectation is that when one is in need, aid will be forthcoming from others in return for a like commitment—a more agreeable prospect than "going it alone" in the face of nature.... Poverty, natural resource dependency, and resulting uncertainties thus create an incentive structure that may make common property a comparatively rational solution to certain problems of resource management. (Runge 1992: 20-21)

Thus, for a variety of reasons, common-property lands continue as an important form of land tenure in the contemporary humid tropics.[16] In Burkina Faso, for example, Şaul (1993) documents how common-property lands held by patrilineal groups ("agnatic corporations") of ethnic Bobo have endured despite the presence of considerable demographic and market pressures—pressures commonly thought to hasten

the demise of common-property institutions.[17] Conklin's (1980) monograph describes the common-property arrangements in agricultural and forest lands of the Ifugao, an ethnic group occupying the Philippine island of Luzon. And, in his book on the Huanca of central Peru, Smith (1989) traces the 100-year struggle of the Huanca to defend their communal lands and pastures against the encroachments of neighboring *hacienda* (large estate) owners.

A second strategy that peasant communities have devised to mitigate risk is land fragmentation. Where land fragmentation is practiced, common lands are divided among peasant producers so as to supply them with several discrete parcels of land—rather than one contiguous parcel—scattered over a relatively large area (Bentley 1987). In this way, peasants are able to spread the risk of failure across a wider assortment of soils and growing conditions. Thus, if a crop fails in one parcel, the peasant producer has other parcels upon which he can fall back to satisfy the subsistence needs of himself and his family.

Tindituuza and Kateete's (1971) study chronicles the ubiquity of land fragmentation in the Kigezi district of Uganda. In their detailed examination of communities in rural Bangladesh, Ahsan et al. (1989) report that land fragmentation continues to be "one of the most striking characteristics" of the rural Bangladeshi landscape. And, among *ejido* (a type of communal landholding body) members in the Mexican state of Chiapas, Bellon (1996) discovers that land fragmentation serves not only to attenuate risk, but to uphold a relatively equitable distribution of lands containing high quality soils.

Finally, peasant communities engage in various forms of land redistribution in order to ensure that land is available for all who need to cultivate it. And, while the particular method of redistribution varies from place to place, "The common element is assured land access. Mechanisms of land redistributive rites and festivals ... all attempt to keep land distribution relatively equal and to protect the relative security of community members" (Flora 1990: 28). By preserving relative parity in landholdings, no one member becomes dominant enough to exclude others—a compromise that those close to the edge of physical survival are generally willing to accept.

In his overview of indigenous land tenure systems in Africa, Bruce (1988) posits that redistribution stemming from inheritance rules and institutional responses to rising population pressures have helped to preserve relatively, though certainly not absolute, egalitarian patterns of land distribution across the continent. Based upon their investigation of the Iban, a society of longhouse-dwellers who practice shifting cultivation of hill rice in the Malaysian state of Sarawak, Cramb and Wills declare:

> In most cases, Iban land tenure has ... maintained an equitable distribution of access to land in the face of population growth and the spread of cash crops.... Equitable access has been maintained ... by the temporary transfer of cultivation rights between households ... and, in some cases, by the pooling of cultivation rights such that the longhouse meeting allocates individual hill rice plots each year on the basis of household needs. (1990: 350)

Lastly, in his study of the cacao-growing region of Colombia's Cauca Valley, Taussig (1980) underscores the central place of the *baptism of the peso*—a local mechanism of land redistribution—among the social norms of peasant-producer communities in competition with commercial sugar interests for the prime agricultural lands on the valley floor.

Summary

When approached with the understanding that peasant producers are risk averse, therefore, "many superficially odd village practices make sense as disguised forms of insurance" (Lipton 1968: 341). Thus, as Scott cautions, these practices should not be idealized as utopian achievements, but seen as the products of individuals seeking some minimal level of subsistence in the face of generalized uncertainty:

> It is all too easy, and a serious mistake, to romanticize these social arrangements that distinguish much of peasant society. They are not radically egalitarian. Rather, they imply only that all are entitled to a living out of the resources within the village, and that living is attained often at the cost of a loss of status and autonomy. They work, moreover, in large measure through the abrasive force of gossip and envy and the knowledge that the abandoned poor are likely to be a real and present danger to better-off villagers. These modest but critical redistributive mechanisms nonetheless do provide a minimal subsistence insurance for villagers. (1976: 5)

It is perhaps worth mentioning, however, that my reliance upon the work of Scott here is not meant as a wholesale endorsement of the "moral economy" school of peasant behavior with which he is often associated.[18] What I take from my reading of Scott is his assertion that a "safety-first" principle "lies behind a great many of the technical, social, and moral arrangements of a precapitalist agrarian order" (ibid.). What I dismiss is his claim that the assumption of methodological individualism necessarily entails "treating the peasant purely as a kind of marketplace individualist who amorally ransacks his environment so as to reach his personal goal—that is, the stabilization of his subsistence arrangements" (ibid.: 166). As Booth (1993: 950-951) has so lucidly argued, to assume that individuals are the fundamental actors in social situations does not automatically mean they are, as is usually claimed by moral economists, *profit* maximizers. What individuals choose to maximize (i.e., optimize) in a given situation will depend upon the constraints that they face. In the context of peasant behavior in the contemporary humid tropics, the main constraint confronting the peasant producer is a generalized scarcity of subsistence resources, which, in turn, tends to breed risk-averse behavior. Under alternative sets of constraints, peasant conduct is apt to be different: "Relax the scarcity constraints either by stipulating greater wealth or a state that ensures [*sic*] peasants against risk, and peasants select different institutions and behaviors" (ibid.: 951). However, under conditions of subsistence production and an indifferent (or even hostile) central government, peasants

are likely to evolve crudely egalitarian institutional arrangements based not upon altruism, but upon self-interested reciprocity.

The Political Executive

Mode of Production.[19] In contrast to peasant production, based as it is upon the satisfaction of subsistence needs, agro-industrial interests in the humid tropics, and elsewhere, operate under the logic of *expanded production*. Expanded production requires both that society produce beyond simple subsistence levels and that the resulting surplus is utilized to raise production still further over time. Thus, under expanded production, surpluses are constantly reinvested in society's productive resources (e.g., land, labor, equipment) in order to lay the groundwork for continued growth in the future.

The logic of expanded production can be witnessed in the highly instrumentalist approach that agro-industrial elites take toward the disposition of landed resources. For those elites who perceive economic success to be attainable only through industrialization—the predominant modern paradigm of expanded production—landed resources are to be exploited—and sacrificed, if necessary—in the drive to fuel industrial growth. Such a view arises from the belief held by these elites that only through profound economic transformation can their countries attain the sought-after Western levels of material well-being:

> ... all nations in the developing world ... seek rapid development. Their people demand larger incomes and higher standards of living. Common sense, the evidence of history, and economic doctrine all communicate a single message: that these objectives can best be secured by shifting from economies based on the production of agricultural commodities to economies based on industry and manufacturing. (Bates 1981: 11)

Or, put another way, these objectives can best be secured by shifting from economies based on *subsistence production* to economies based on *expanded production*.

Given the pivotal role played by LDC governments in the push toward industrialization (Kamrava 1993: 34-70), it should not be too surprising, then, that these governments have adopted attitudes and policies that rationalize the liquidation of their natural resource endowments (Ascher and Healy 1990). For example, based upon his assessment of Indonesian forest politics, Dauvergne concludes: "Indonesian central government decision makers view forests as a valuable, *yet expendable* resource, useful for generating foreign exchange to finance industrialization" (1993: 507; emphasis added). Wilkie (1996) reports similar central government attitudes vis-à-vis forest resources in the Congo. And, in his study of the 350-year history of extractive economies in the Brazilian Amazon, Bunker paints a picture of an industrially oriented modern central government heavily dependent upon Amazonian landed resources:

> The Amazon has increasingly been used as a stopgap solution to imbalances in the Brazilian national government's programs for rapid industrialization and the

> socioeconomic integration of the country. During the past two decades the Amazon has come to represent a great reserve of natural resources to government planners searching for ways to reduce the foreign indebtedness caused by Brazil's heavy reliance on international capital. Mining, lumbering, and ranching concessions granted to various multinational and large national corporations have been seen as an effective way to tap these resources and to attract foreign equity capital. (Bunker 1985: 81)

Behavioral Objective. Without denying the importance of industrialization as a motivating factor in the policy decisions of LDC governments, it must also be acknowledged "that more personal motives animate political choices. Governments want to stay in power. They must appease powerful interests" (Bates 1981: 4). Moreover, given the uncertain nature of executive tenure in the less-developed world, the pursuit of political survival becomes all the more urgent: "In the turbulent politics of developing nations, leaders can never take tenure for granted. Political survival must be actively pursued by manipulating public policy to construct supporting coalitions" (Ames 1987: 7). Thus, as the most critical member of the agro-industrial sector, owing to his position as the ultimate arbiter of property rights arrangements (North 1981, 1990), the first priority of the political executive in the less-developed world is to maintain office. Without this, he can never hope to achieve any of the substantive policy goals to which he and his constituents aspire (Lindbeck 1976; Bates 1981; Bennett and DiLorenzo 1984; Anderson and Hayami 1986; Ames 1987).[20]

This approach is somewhat different, then, from those who would model political leaders as wealth maximizers (North 1981), revenue maximizers (Levi 1988), the mediators of competing group interests (Truman 1951), or as the instruments of the ruling capitalist class (Jessop 1982).[21] In these formulations, the first-order problem of political survival is generally overshadowed by second-order considerations of policy choice. Yet, as I attempted to demonstrate earlier in the chapter, political survival in the LDC setting is far from a trivial matter. Therefore, for the purposes of this study, I assume that the first and foremost priority of the political executive is *political survival*.

Operational Strategies. In light of the centrality of landed resources in the tropical country setting, and the highly instrumental approach that tropical country governments take toward such resources, it therefore becomes logical for the political executive to use these resources—or, more correctly, the property rights to these resources—to "appease powerful interests" and to "construct supporting coalitions." Because of the primary-production orientation of tropical country economies, landed resources are frequently the only resources available to political executives seeking to entice and retain supporters. Additionally, to the extent that the tropical country political executive believes that natural resource endowments should be exploited in the drive toward industrialization, the use of such resources as patronage fulfills a dual purpose—economic industrialization and political survival.[22]

Of course, this is not to say that landed resources are the only resources that the tropical country political executive employs in his quest for political survival. Public budgets (Ames 1987) and bureaucratic appointments (Migdal 1988: 217-223; Geddes

1994: 131-181) are two of the more commonly cited examples of other types of assets that LDC executives trade for political support. However, to focus exclusively on these types of assets neglects a wide range of mechanisms through which political leaders essentially exchange landed property rights for assurances of political backing.

In the ensuing paragraphs, I review two broad classes of operational strategies pursued by tropical country political executives designed to help them retain office: (1) *rent creation* and (2) *rent protection*. More specifically, I review rent-creation and rent-protection activities that involve the manipulation of landed property rights. As with the previous section on peasant operational strategies, I first present the rationale of each strategy and then offer representative examples.

What makes the acquisition of landed property rights particularly alluring to the members of the agro-industrial elite are the *rents* that can be created through the manipulation of such rights. For the purposes of this study, rent is defined as a return in excess of a resource owner's opportunity cost, while *rent seeking*—the general activity encompassing both rent creation and rent protection—is defined as the pursuit of such returns through governmental action (Tollison 1982: 575).[23] Or, more precisely, from the property rights perspective on rent seeking that I adopt here, "If we substitute 'holder of property rights' for 'owner of resources' ... rent accurately describes the goals of many individuals and groups who seek property rights modifications" (Benson 1984: 397).

What, then, are some of the concrete policy manifestations of these transfers of landed property rights—i.e., *rent creations*—for political support? Among the more well-known exemplars of these types of transfers in the tropical country setting are timber concessions, that is, contracts between government officials and concessionaires whereby the concessionaire is assessed a predetermined payment in return for the harvesting rights to a particular stand of timber over a specified period of time. In his study of forest politics and policy in Southeast Asia, Hurst (1990) identifies several instances of the use of timber concessions by political leaders to garner political support. In 1971, for example, the Weyerhauser corporation of the United States entered into a joint venture with the International Timber Corporation of Indonesia (ITCI), whereby the partnership gained rights to 386,000 hectares of primary hill forest in the East Kalimantan region of Indonesia. Under the terms of the agreement, Weyerhauser could never buy out its partner because ITCI was a trust set up by Indonesian President Suharto. Nevertheless both parties gained from the agreement. Though Weyerhauser, on paper, owned only 65 percent of ITCI, it alone provided the joint venture's total investment of $32 million. Thus, Weyerhauser exercised financial control over ITCI and ITCI acquired a large working capital while incurring no investment costs of its own. More notably, President Suharto amassed important political support among Indonesia's military establishment—ITCI's major shareholders were the top seventy-three generals in Suharto's "New Order" government: "In effect the partnership was a form of pay-off from Suharto for the loyalty of Indonesia's military elite" (ibid.: 34).

In her comparative analysis of the Indonesian and Philippine forest sectors, Broad corroborates the existence of timber-concession patronage in Indonesia, tracing it back at least to the violent coup that brought President Suharto to power in 1965:

> In Suharto's desire to reward top military officials who were loyal to him in the coup and to guarantee their future support (as well as to earn foreign exchange), he carved forest concessions out of the country's periphery. Thus, in the so-called "Outer Islands," including Kalimantan, Irian Jaya, and Sumatra, 72 . percent of the land became classified as "state forest." Top military officers found themselves with 20-year leases, distributed through a closed, noncompetitive system. (1995: 323)

As a result, there are currently some 584 timber concessions covering about 65 million hectares, or roughly one-half of Indonesia's 143 million hectares of state forest land (ibid.). However, Broad contends that the concentration of timber concessions is actually much higher than these figures suggest: "Although the identity of forest concessionaires is treated much like a state secret in Indonesia, interviews suggest that only about 50 conglomerates are represented [among these 584 concessions] and, according to one source, these are in the hands of as few as '15 players'" (ibid.).

In her survey of the Philippine forest sector, Broad finds comparable levels of timber concession concentration: "... by one estimate, only 480 over the last 20 years" (ibid.). As a result of this allocation of timber concessions, more than half of the 30 million hectares of Philippine land area has become public land: "The state, then, has become the country's largest landlord, and as in Indonesia forest concessions have become a prime instrument for rewarding presidential allies and engendering patronage" (ibid.).[24]

Again, the attractiveness of the timber concession to the political patron (i.e., the political executive) and his clientele (i.e., the concessionaires) derives not only from the fact that the timber concession entails a transfer of landed property rights to the client, but a capture of resource rents as well. In the context of timber operations, Repetto describes rent as

> ... a value in excess of the total costs of bringing trees to market as logs or wood products, including the cost of attracting the necessary investment.... Theoretically, all rent can be captured by governments as a revenue source that stems from the country's advantageous natural resource assets.... To the extent it is not captured, it remains as a source of greater than normal profits for the timber contractor, or as a cushion for defraying excess costs. (Repetto 1988: 18-19)

And, based upon his examination of various forest sector policies in the less-developed world, Repetto concludes: "Most developing countries with large mature forests have failed to adopt forestry revenue systems that come close to capturing these rents for the public treasury" (ibid.: 19).

Table 4.5 below helps to illustrate this fact. Column 5 shows that in the Philippines, the central government captured only 16.5 percent of logging rents between 1979 and 1982. In Indonesia, the central government captured only 37 percent over this same time period, while Ghana's central government captured a comparable level of logging rents in an earlier period. And, across three Malaysian

states during the period 1966-1985, government capture of logging rents ranged from 18.5 percent in Sarawak to 48.2 percent in Sabah.

Table 4.6 offers further evidence of the failure of tropical country governments to capture available forest resource rents. This table enumerates monetary residuals accruing to loggers after subtracting forest taxes, fees, and transport costs for three value classes of timber species in five West African countries in 1974. During this period, "Liberia and Gabon shared the dubious distinction of having the least effective rent capture policies among Africa's major timber-exporting nations" (Gillis 1988b: 324-325). This can be seen in the figures revealing that loggers in these two countries, for the two high-value species, captured rents approaching one hundred dollars per cubic meter. And, while the rents captured by loggers in the other three countries were not as high, they were nevertheless significant.

Table 4.5. Government Rent Capture in Tropical Timber Production

(1) County and period	(2) Potential rent from log harvest[a]	(3) Actual rent from log harvest[b]	(4) Official government rent capture[c]	(5) Col. 4 ÷ Col. 3	(6) Col. 4 ÷ Col. 2
Indonesia, 1979-82 ($US millions)	4,954	4,409	1,644	37.3	33.2
Philippines, 1979-82 ($US millions)	1,505	1,033	171	16.5	11.4
Ghana, 1971-74 ($US millions)	—	—	29	38.0	—
Malaysia, 1966-85 (M$ millions)					
Sabah	17,720	16,990	8,190	48.2	46.2
Sarawak	7,290	7,260	1,340	18.5	18.4
Peninsular Malaysia	11,030	11,000	2,410	21.9	21.8

Source: Gillis (1992: 169).
[a] Potential rent assumes that all harvested logs are allocated to uses that yield the largest net economic rent.
[b] Actual rent totals arising from the actual disposal of harvested logs.
[c] Rent capture totals timber royalties, export taxes, and other official fees and charges.

Table 4.6. Logging Residuals in West Africa, 1974
($US per cubic meter)

Timber Species	Ivory Coast	Liberia	Cameroon[a]	Congo[b]	Gabon
High-value species					
Sapelli	46	80	51/42	76/64	78
Sipo	47	98	72/63	86/74	100
Middle-value species					
Tiama	28	55	37/29	49/47	53
Kossipo	38	63	33/24	56/44	61
Iroko	26	55	27/16	50/35	49
Low-value species					
Llomba	9	25	13/5	22/11	20
Fromager	25	25	15/8	24/15	23

Source: Gillis (1988b: 325).
[a] Douala Route/Pointe Noire Route.
[b] Southern Sector (Mossendjo)/Northern Sector (Quesso).

A second form of rent creation deriving from the manipulation of landed property rights involves the appropriation of governmental fiscal resources such as subsidized credits and tax holidays. This pattern has been particularly evident in the growth of livestock operations throughout South and Central America (Hecht 1985; Browder 1988; Hecht, Norgaard, and Possio 1988; Mahar 1989; Edelman 1995; Kaimowitz 1996; Sunderlin and Rodríguez 1996). Reflecting on the proliferation of cattle ranches in Latin America generally, Edelman observes:

> Increasingly, the economic rationality of ranching has hinged ... on significant state subventions, including favorable fiscal, land titling, and road-building policies; artificially low interest rates; price controls and duty exonerations for inputs; and government technical assistance programs. Usually, it has been based on extracting these diverse income streams—ground rent, speculative rent, and institutional rent—rather than on high profitability according to acceptable accounting conventions. (Edelman 1995: 38)

Moreover, the beneficiaries of these policies have tended to be small groups of large ranchers with strong ties to national governments, as has historically been the case in the Central American republics:

> Large cattle ranchers have always been among the most powerful and well organized groups in Central America. The annals of Central American history are filled with presidents, generals, ministers and congressmen whose family wealth had its origins in extensive cattle ranches. In addition, ranchers associations ... have traditionally been quite successful in lobbying to protect their interests. These groups' major concerns have been to increase their access to subsidized credit, avoid land expropriations and squatting, limit government

> price controls, eliminate cattle rustling, and protect dairy producers from foreign competition. (Kaimowitz 1996: 35)

That small groups of large ranchers have been the primary beneficiaries of governmental support of livestock operations on the Central American isthmus is suggested by several studies. In Honduras, for example, in the mid-1970s, some 200 ranchers received 45 percent of all public-sector livestock credit (Slutsky 1979). In the World Bank PRODEGA livestock project in Guatemala, 232 ranchers received loans averaging $24,600 each, as well as free technical assistance, valued at $4,823 per farm. These ranchers' average herd size was 162, at a time when there were only 2,511 ranchers in the country with over 100 head of cattle (World Bank 1978; RUTA 1993). And, in the World Bank's Third Livestock Project in Panama, seventy-two percent of the available credit went to ranchers with over 150 hectares of landholdings (World Bank 1991b).

Similar patterns of benefit concentration can be witnessed in the livestock projects of SUDAM (*Superintendência do Desenvolvimento da Amâzonia*), the Brazilian governmental agency charged with the economic development of the Brazilian Amazon. As of 1983, there were 470 cattle projects averaging 23,000 hectares each that had received financial assistance from SUDAM; in comparison, non-SUDAM properties averaged "only" 9,300 hectares. And, on average, the SUDAM projects had converted 5,500 hectares to pasture, accounting for some 30 percent of forest cover reduction between 1973 and 1983, or more than four times as much deforestation as those projects that received no SUDAM support (Browder 1988).

The lure of the SUDAM-backed projects emanated from the favorable tax treatment that they conferred upon their beneficiaries. According to the terms of the projects, tax credits could contribute up to 75 percent of the capital requirements of a project if the investing individual or corporation had other tax liabilities to offset. These capital grants have totaled more than $500 million in tax forgiveness, or more than 40 percent of the total amount granted to all investments in the Amazon (ibid.).

Such cases are suggestive of a more general phenomenon in the Brazilian political economy whereby agricultural investment is driven by its ability to provide a tax shelter, a phenomenon studied in detail by Binswanger (1991). Because the Brazilian tax code virtually exempts agricultural income from taxation, Binswanger maintains, urban investors and large corporations have used the acquisition of land along the Amazonian agricultural frontier as a means of tax protection, inducing increased land concentration as large farms have bought out smaller ones: "Therefore, the demand for land by corporations and individuals in high income tax brackets increases, resulting in a faster expansion of agriculture into frontier areas. It also provides incentives for the accumulation of large landholdings" (ibid.: 822).

And, though peasant populations in the Brazilian Amazon are also technically eligible to compete for these benefits, they "cannot benefit from the tax breaks because they do not pay income tax" (ibid.). Furthermore, the draw of these tax breaks to corporations and individuals in high tax brackets lessens the ability of peasants to purchase land of their own: "If agricultural income is taxed at lower rates than nonagricultural income and agriculture is a tax shelter, the market price of land will

contain a component capitalizing these tax preferences. The market price for land becomes too high for the poor to buy, even if given credit" (ibid.).

How, then, do these types of rent transfers to select domestic constituencies link back to the contest for landed property rights? Continuing with the Brazilian example, Binswanger affirms that the receipt of fiscal transfers and the consolidation and expansion of property-rights claims constitute a self-reinforcing loop. Because corporations and wealthy individuals are the main beneficiaries of fiscal transfers, they have more capital available to build roads into forested areas, thereby allowing them to lay claim to even larger tracts of land. This dynamic is further strengthened by property-claims rules that allow for the claimant to obtain title for up to three times the area cleared by the claimant of forest cover (ibid.: 823). Thus, those corporations and individuals using agricultural investment as a tax shelter achieve "external economies of scale" (Johnson and Ruttan 1994: 693)—because of the sheer size of their holdings, they are better equipped to take advantage of governmentally provided transfers relative to parties with smaller holdings.

One additional case from Africa that helps to illustrate the intersection of macroeconomic transformation and patronage politics is the scheme of the Malawian government in the post-independence period to shift agricultural production away from the peasant-based subsistence sector to the estate-based commercial sector. The Malawian government accomplished this, according to Kydd and Christiansen (1982), by imposing a heavy tax on peasants through the state crop marketing board—ADMARC.[25] As a result of ADMARC's pricing policies, ADMARC was able to extract some 155.9 million Malawian *kwachas*—the difference between the price paid by ADMARC to peasant growers and the price received by ADMARC at auction—from the peasant sector across six categories of crops over the nine-year period from 1972 to 1980 (ibid.: 367). For the most profitable of these crops—dark-fired tobacco—peasant growers received only 28.3 percent of the price obtained by ADMARC at auction (ibid.: 369).

The bulk of this "surplus" was then used to fuel the growth of large-scale agricultural estates, engaged primarily in the cultivation of tobacco and sugar. A full 66 percent of ADMARC's 1978 investment and loan portfolio was devoted to financing the establishment and upkeep of estates growing these two crops (ibid.: 368). It is important to note, however, "that these funds were loaned out at the discretion of the government, with scant regard to standard lending criteria. Most of the new estate companies formed in the mid-1970s were capitalized entirely from commercial bank loans" (ibid.: 368-369).

In addition to this preferential access to credit, estate owners realized two additional benefits from the Malawian government's agricultural transformation program. First, because the prices paid for peasant output were kept artificially low, the real rate of return to peasant labor diminished significantly, thus prompting a transfer of labor from peasant to estate agriculture. This increase in the labor supply, in turn, allowed estate owners to reap *labor rents*—that is, reductions in wage rates generated by the politically induced expansion of the labor supply. Second, estate owners received favored treatment in the allocation of Malawi's rapidly shrinking stock of arable land: "Most of the land for the new estates has been acquired by senior

politicians, public servants and military and police officers using their influence to secure the remaining uncultivated arable land in their home areas. Generally, this has not involved eviction of peasants, but has further constrained land availability for peasants" (ibid.: 374). Thus, while the landed property rights claims of the Malawian elite to the diminishing stores of arable land were expanded, those of the Malawian peasantry were effectively narrowed.

While these examples drawn from Africa, Asia, and Latin America evoke distinct regional manifestations of the rent-creation dynamic as it pertains to patronage politics and tropical forest loss, they are also suggestive of a phenomenon widely shared by the countries of the humid tropics in the post-World War II era—the centralization of the ownership of forest lands into the hands of tropical country central governments (Thomson, Feeny, and Oakerson 1986; Panayotou and Ashton 1992: 198-205; Baland and Platteau 1996: 235-262). In Ghana, for example, forest lands owned by traditional communities until independence were completely transferred to the central government in 1973. During the same year in the Congo, the forest law that provided for private communal forests was abolished and all forest lands became central government property. As suggested above, however, the centralization of the ownership of forest lands into the hands of central governments is not a phenomenon limited to tropical Africa. Indeed, one estimate made in the early 1980s placed some 80 percent of *all* tropical forest lands under the ownership of tropical country central governments (Lanly 1982: 49-53).

Looked at from what I would term the *benign* view of governmental action, such steps toward centralization of forest-land ownership are the attempts of tropical country political executives to protect and husband their rapidly diminishing inventories of forest resources for the benefit of the "common good." Looked at from the *opportunistic* perspective on governmental action that I employ in this study, such moves are the purposive acts of tropical country political leaders to integrate tropical forest regions into the larger system of agro-industrial production and, more fundamentally, to enlarge their holdings of patronage resources, thereby making initiatives such as timber concessions, livestock projects, and agricultural projects possible.

The above discussions of rent capture vis-à-vis timber concessions, livestock projects, and agricultural projects have focused primarily on rent creation. While these endeavors certainly constitute an important component of the political executive's portfolio of operational strategies, they do not reveal the entire range of strategies that the executive plies in his quest for political survival. Of equal, if not greater, importance are the designs of the agro-industrial elite to secure *rent protection*: "Not only do individuals deploy scarce resources to seek out rents, they also deploy scarce resources to protect their rents from other rent-seekers and from rent-avoiders" (Tullock 1993: 70). Nowhere has this been more evident than in the efforts of tropical country political executives to defend the (often exclusive) claims of their clientele to those factors of production most valued in the tropical country setting—*land* and the *labor* required to work it.

The roots of contemporary elite claims to land and labor in the agrarian context often run deep. In their wide-ranging survey of the history and development of land

tenure institutions, Binswanger, Deininger, and Feder contend, "Nearly always, there has been ... a class of rulers who extracted tribute, taxes or rent from cultivator families" (1995: 2669). Moreover, they insist, strictly neoclassical explanations of institutional change that tie increasing land scarcity (stemming primarily from rising population densities) to a "better definition of rights" and, therefore, to an allocation of land to the "most efficient uses and users," are misplaced. Rather, the evolution of landed property rights regimes in LDCs has been inextricably linked to relations of power:

> ... rights over land and the concentration of ownership observed in most developing countries at the end of World War II are outgrowths of power relationships. Landowning groups used coercion and distortions in land, labor, credit, and commodity markets to extract economic rents from the land, from peasants and workers, and more recently from urban consumer groups or taxpayers. Such rent-seeking activities reduced the efficiency of resource use, retarded growth, and increased the poverty of the rural population. (ibid.: 2664)

However, while the infrastructure of elite preeminence in agrarian land and labor markets is long standing, this is no guarantee of enduring elite control. Because of the heavy social and economic costs that elite supremacy has imposed upon rural peasantries—the primary cost-bearers of elite ascendancy—the demand for changes in the status quo among rural peasantries continues to be strong. If elite control is to endure, therefore, it must be constantly "reproduced." For the "property rights holders" of these factors, failure to do so not only means the surrender of large caches of wealth, but the economic and political power that attaches to them. For the tropical country political executive, failure to vigorously reproduce elite claims to land and labor runs the risk of alienating key sources of political support, thereby weakening his ability to repel the challenges of contenders and placing his political survival in jeopardy.

The contemporary reproduction of elite control over the factors of agricultural production has taken many forms. Probably the most obvious manifestation is the active stance that most tropical country governments have taken against any reform efforts designed to diminish elite control over landed property rights regimes.[26] In fact, not only have tropical country governments generally thwarted such efforts, they have used them to consolidate—and even extend—elite control. Based upon both in-depth and summary case studies of land reform programs in twenty-five LDCs, mostly in the humid tropics, Powelson and Stock infer:

> Instead of benefiting the peasants—as they promised they would do—many states undertaking land reform have enriched themselves. Thus land reform has become another policy instrument to skim off the "agricultural surplus." It has also enhanced the power of government officials, particularly at high levels, increasing their ability to demand patronage. (1990: xiii)

However, tropical country executives and their political clientele, fearful that peasant demands for land reform might gain unstoppable momentum if left unchecked, have generally preferred more proactive measures. Chief among these is repression. Christodoulou (1990: 50) observes that the repression of peasant movements in Latin America has involved the assassination of their leaders, as in Guatemala at the hands of the vigilante group *Mano Blanco*; the organization of bands of *fieles* (faithful) by landlords to monitor and bully "questionable" tenants, as in Colombia; and the murder and kidnapping of peasants aspiring to land ownership under a proposed reform in Brazil, as well as the Catholic priests who supported them. Reflecting upon the close historical relationship between serious attempts at agrarian reform and the subjugation of those spearheading such efforts, Christodoulou concludes:

> If ideas are resented, organizations promoting agrarian conflict are even more objected to and easier to eradicate. There is a long ... record of persecution, repression, and even assassination of peasant organization ... leaders and presumed promoters.... Repression is common in all landlord-dominated societies, especially where landed interests feel their position seriously threatened. (ibid.: 86)

Yet, there are also non-violent measures available to elites seeking to forestall peasant demands for alterations in the status quo. Foremost among these types of measures are clientelist and populist modes of political co-optation "which facilitate state control and regimentation" (Mouzelis 1989: 20-26). Thus, production schemes in postcolonial Africa (Bratton 1994: 240-243), "cultivation committees" in Sri Lanka (Moore 1985: 57-60), the *panchayati raj* in India (Nicholson 1973), as well as such patron-client structures as *caciquismo* in the Philippines (Wolters 1983) and *coronelismo* in Brazil (Leal 1977), can all be seen as integral components of strategies to preempt peasant calls for more equitable patterns of land distribution. "The net result is that power remains in the hands of large or otherwise powerful landowners who become power holders locally and power brokers nationally" (Christodoulou 1990: 51).

It is important to note that repression and co-optation of peasant aspirations of land reform are fashioned not only to retain elite control over landed resources in general, but over the most valuable landed resources, more specifically. Certainly among the most highly valued landed resources in the contemporary tropical country setting are those containing fertile soils. Recall from chapter 2 that soil quality in the humid tropics is generally very poor: a full 78 percent of humid tropical lands contain soils characterized as "acid infertile soils," "poorly drained soils," or "very infertile sandy soils"; only 15 percent of humid tropical lands feature soils described as "moderately fertile well-drained soils" (National Research Council 1982: 50). Given the marked agrarian orientation of tropical country economies, it should come as no surprise, then, that the scarcity of productive soil resources has engendered significant political conflict. It should also not be too astonishing that it has primarily been tropical country political leaders and their clientele who have prevailed in this conflict. Thus, it is the general pattern in the tropics today that the best agricultural lands are

concentrated among the select membership of the economic and political elite (e.g., Durham 1979; Blaikie 1985; Leonard 1985; Blaikie and Brookfield 1987; Thiesenhusen 1991; Kates and Haarmann 1991; Dorner and Thiesenhusen 1992; Forster 1992; Stonich 1992).[27]

To help reproduce this pattern some tropical country governments have even taken the step of initiating large-scale resettlement projects. Probably the most well known of these are Indonesia's transmigration program (World Bank 1988) and Brazil's National Integration Program (Browder 1988: 278-280). However, such resettlement schemes have also been carried out in Central America (Jones 1990), Malaysia (Gillis 1988a: 138-139), and the Philippines (Boado 1988: 196), among other countries. And, while these projects are often championed by their government sponsors as providing "land for the landless" or "sound entrepreneurship for the people," they are more often than not devised to ease peasant demands for land in fertile regions through the promise of parcels in frontier regions, which, in the humid tropics, are typically dominated by tropical moist forests and the infertile soils that house them (see chapter 2): "The real motivation, especially in Latin America and Indonesia, is that of providing a political alternative to the redistribution of existing cropland along more egalitarian lines" (Plumwood and Routley 1982: 9). Thus, rather than being seen by tropical country political leaders as the agriculturally marginal areas that they are, tropical moist forests are instead viewed as "political safety valves" (Ledec 1985: 210; Weinberg 1991: 21-25), or vents for the surplus populations that persisting patterns of fertile-land concentration have created.

However, tropical country political executives need to be concerned that their resettlement projects do not siphon too much of this surplus. After all, one important reason to maintain large landholdings is to provide landholders with cheap labor—by limiting the land available to peasant producers, peasant producers often have little alternative but to sell their labor at buyer's prices to the large landholders of their regions. According to Binswanger, Deininger, and Feder (1995: 2673-2677), this practice of manipulating land markets to augment labor supplies dates back at least several centuries, and has been "remarkably similar across continents and over time.... Material conditions of production and rent seeking rather than culture seem to have led to the emergence of such distortions" (ibid.: 2677). And, according to Griffin, it is a practice that has continued into the contemporary era, as his exhaustive study of systems of labor control in Ecuador so ably shows (1981: 172-220). Thus, "monopoly of material resources gives the landlords monopsony power over labor. In this way, landlords are able to exploit labor by reducing the wage rate below what it would have been in a fully competitive market, i.e., below its social opportunity cost" (Griffin 1979: 31).

Summary

When considered from the perspective that the primary motivating factor of the tropical country political executive is political survival, therefore, policy initiatives involving rent transfers reveal themselves as veiled forms of political patronage. In order to construct "survival coalitions" (Ames 1987), tropical country executives

manipulate timber concessions, agricultural projects, and livestock projects—and the landed property rights regimes underlying these initiatives—to bestow super-normal economic returns upon prospective supporters; in order to preserve the coalition, tropical country executives manipulate land and labor markets to sustain the flow of these returns. Thus, resource rents uncaptured by LDC governments are not simply instances of technical oversight or administrative impotence (Paarlberg 1994; Ascher 1997), but manifestations of the drive of political executives to assemble and perpetuate a supportive clientele.

A Clash of Interests

In the two previous sections, I have attempted to specify how different constraints upon the peasant producer and the political executive lead to alternative behavioral objectives, which, in turn, encourage the pursuit of divergent operational strategies. Peasant producers, driven by the necessities of physical survival, pursue strategies designed to avert risk, as evidenced in such land-tenure practices as common-property lands, land fragmentation, and land redistribution. Political executives, driven by the compulsion to survive politically, pursue strategies tailored to serve this compulsion; to this end, they use their position as the paramount arbiter of property rights arrangements to create and protect rents in order to cultivate and maintain a base of political support.

Yet, the distinct requirements of peasant producers and political executives in the tropical country setting eventually produce a clash of interests. To provide for their physical survival, peasant producers require land as the basic input for their systems of subsistence production. For their part, political executives require land as the basic input for their systems of patronage production. Given the scarcity of productive lands in the tropical country setting, a function of large agricultural populations *and* ecological constraints, it is generally difficult for tropical societies to reconcile these divergent interests; conflict is often inevitable.

The Outcomes

As indicated above, it has primarily been political executives and their clients who have prevailed in the conflict over landed resources, or, more correctly, the contest for landed property rights. In the ecologically fragile regions of tropical countries dominated by tropical moist forest, central governments are the primary landlords as they hold title to some 80 percent of all tropical forest lands. And, while formal ownership alone does not give tropical governments effective control over these vast expanses of land (Panayotou and Ashton 1992: 198-205; Johnson and Cabarle 1993: 10-11; Baland and Platteau 1996: 246-247), it does give them the ultimate discretionary authority over how these lands will be used. In the agriculturally fertile regions of tropical countries, generally distant from the nutrient-poor soils of tropical moist forest zones, central governments are the staunch defenders of the property rights claims of their political clientele, provoking skewed patterns of land distribution

whereby the best agricultural lands are concentrated among a select number of large landholders.

In figure 4.2 below, I summarize these dynamics schematically. Beginning at the left of the page, we first see the political executive and his clientele embedded in concentric processes of landed patronage and expanded production. The synergy of these processes—ultimately driven by the executive's desire to retain office—produces two fundamental outcomes. First, the protection of client claims to prime agricultural lands on the part of the political executive leads to land scarcity in the area that I refer to as the *agricultural center*, that is, that region (or regions) characterized by generally fertile soils and generally moderate slopes; in other words, that region best suited for permanent agriculture in the tropical setting (National Research Council 1993: 51-57; Upton 1996: 25-27). This land scarcity in the agricultural center, in turn, occasions the displacement of peasant producers from the agricultural center. As a result, these peasant producers become *shifted* cultivators (see chapter 3), driven to agriculturally marginal frontier regions where they clear the tropical moist forest cover indigenous to these regions in order to meet their subsistence needs.

What makes the threat to tropical forest resources in frontier regions even more immediate is the fact that this first outcome often feeds into the second: the shifted cultivators created by the scarcity of land in the agricultural center are frequently the same individuals who exacerbate the effects of expanded agro-industrial property rights claims in frontier regions. Be it in the form of the logging-deforestation feedback, whereby the advent of logging operations in frontier regions opens up these regions to shifted cultivators in search of workable lands, or the sizeable migrations of shifted cultivators prompted by large-scale resettlement projects, the mixture of displaced peasant producers and sweeping government-backed policy initiatives in tropical frontier regions has generally boded very poorly for both the forest resources of such regions and the peoples who inhabit them. Not only does the expansion of agro-industrial property rights claims extend the agricultural frontier still deeper into the forest, but it also provokes a scarcity of land among the peasant producers long established in these regions. As a result, these peasant producers are displaced from their native lands and, as a consequence, added to the swelling ranks of shifted cultivators. Moreover, growing numbers of shifted cultivators in frontier regions not only signify diminished physical space for peasant producers long established in these regions, but diminished *institutional* space as well:

> The serious threat for natural resources ... is that the migrants [i.e., shifted cultivators] bring with them an alien institutional structure for guiding resource use and these patterns may fit quite badly in the new location. If they have the ability to impose their will on the original residents then serious problems can arise in terms of resource use. Even if they fit in with prevailing resource-use patterns, their numbers will be enough to pose a serious threat to the resource base. (Bromley 1986: 324).

Thus, the threat to the forest resources of tropical forest regions arises not only from the large influx of shifted cultivators to these regions, but from the importation of alien

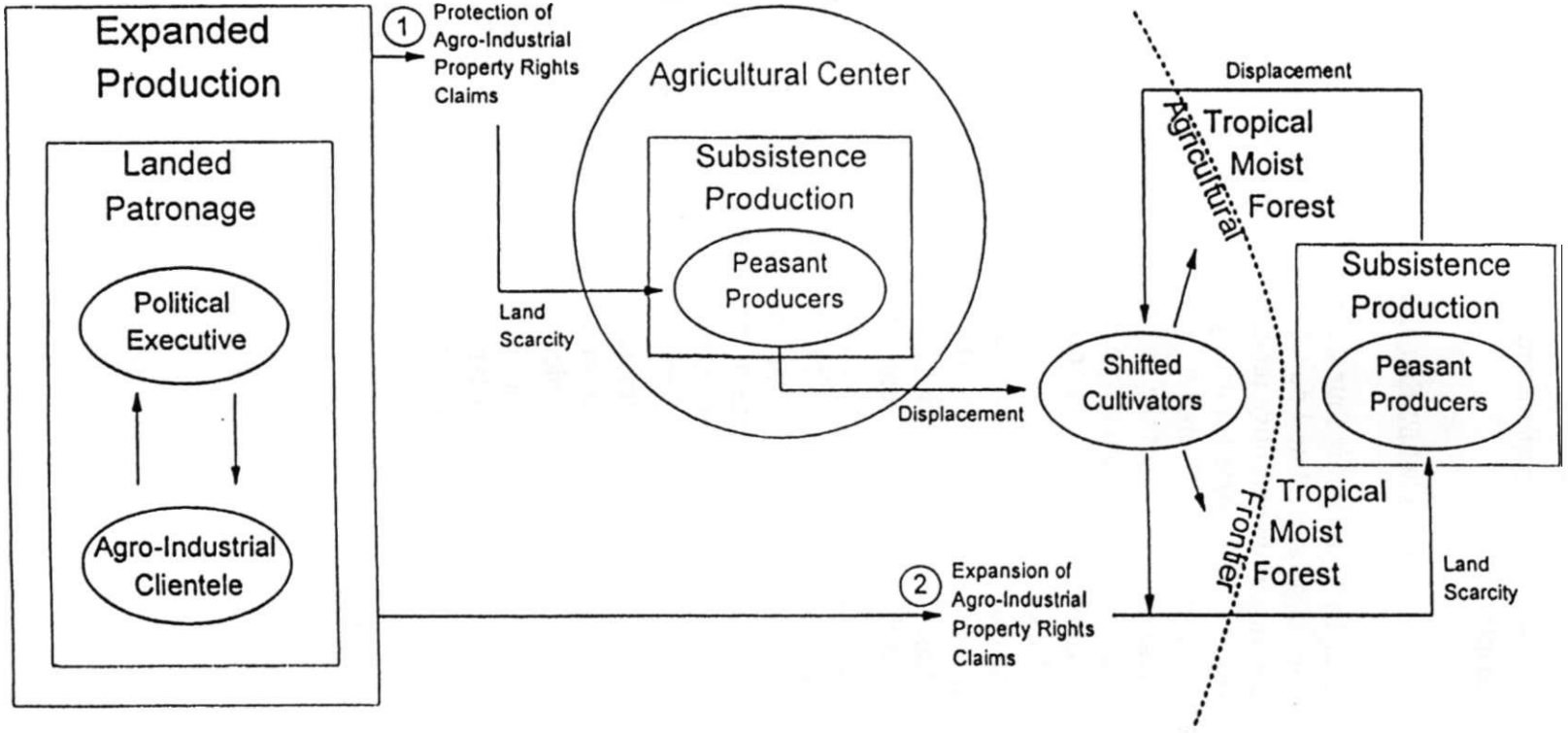

Figure 4.2. The Political Economy of and Deforestation in the Humid Tropics

institutional systems with little or no sensitivity to the ecological complexity and fragility of the tropical moist forest ecosystems encountered in the frontier regions of the humid tropics (see chapter 2).

Concluding Remarks

I began this chapter by highlighting four defining features of the tropical country political economy: large agricultural populations, primary production, executive dominance, and uncertain executive tenure. Over the remainder of the chapter, I attempted to explain how these features predispose tropical countries to particularly high levels of forest loss. Central to my explanation was the observation that the confluence of these features makes the contest for land and landed resources the most significant contest in tropical country political life. More specifically, I highlighted the institutional dimensions of this contest by framing it as a contest for landed property rights. I identified the major stakeholders in this contest—the peasant producer and the political executive—and discussed how the modes of production under which each operates privilege disparate behavioral objectives and, therefore, divergent operational strategies. Lastly, I addressed the general supremacy of the political executive and his agro-industrial clientele in the contest for landed property rights, and how such dominance has placed increasing pressures on tropical forest resources, primarily by shifting large numbers of peasant producers to the ecologically fragile—and agriculturally marginal—frontier regions of the humid tropics.

Thus, we begin to see that "the source of most tropical deforestation lies in an amalgam of factors that are usually far removed from the forests—and lie outside the purview of traditional forestry measures (Myers 1995: 823); that tropical deforestation results from the drive of tropical country political executives to industrialize their economies and, perhaps more importantly, to remain in office. Yet, the picture that I have provided of the political economy of tropical deforestation in this chapter remains incomplete. No mention has been made of the pivotal role that national political institutions play in structuring the contest for landed property rights. More specifically, no mention has been made of the national political institutions that shape the *constitutional order* in which this contest for landed property rights is conducted. It is to this task that I now turn.

Endnotes

1. In order to arrive at these figures, I first had to decide which countries to classify as humid tropical countries. Given that this study focuses primarily on one specific land cover within the humid tropics—tropical moist forest (see chapter 2)—I concluded that the qualification criterion should reflect this fact. For the purposes of this study, therefore, I classified a country as a humid tropical country if it contained at least 100,000 hectares of tropical moist forest within its borders and if this tropical moist forest covered at least 5 percent of the national land area. (For a more thorough discussion of these selection criteria, see chapter 6.) Based upon data provided in tables 7a-7c and 8a-8c of Food and Agriculture Organization (1993), I determined that twenty-five African, thirteen Asian-Pacific, and twenty Latin American-Caribbean countries met these selection criteria as of 1980, the earliest year for which tropical moist forest areas could be estimated. These names of these fifty-eight countries—listed by region—are provided below:

- Africa (25): Angola; Benin; Burkina Faso; Cameroon; Central African Republic; Congo; Cote d'Ivoire; Equatorial Guinea; Gabon; Ghana; Guinea; Guinea-Bissau; Liberia; Madagascar; Malawi; Mozambique; Nigeria; Senegal; Sierra Leone; Sudan; Tanzania; Togo; Uganda; Zaire; Zambia.

- Asia-Pacific (13): Bangladesh; Cambodia; India; Indonesia; Laos; Malaysia; Myanmar; Nepal; Papua New Guinea; Philippines; Sri Lanka; Thailand; Vietnam.

- Latin America-Caribbean (20): Bahamas; Bolivia; Brazil; Colombia; Costa Rica; Cuba; Dominican Republic; Ecuador; Guatemala; Guyana; Honduras; Jamaica; Mexico; Nicaragua; Panama; Paraguay; Peru; Suriname; Trinidad and Tobago; Venezuela.

I then calculated the agricultural populations of each of these fifty-eight countries to derive the regional averages reported here. I use these same fifty-eight countries to determine the regional averages reported in tables 4.2, 4.3, and 4.4.

2. It is worth noting that I did not choose the period 1976-1980 simply because this was the only period for which data were available. Rather, I chose this period in order to anticipate the quantitative analysis that I present in chapter 6, where I attempt to justify the importance of this particular five-year period for the deforestation processes that I examine.

3. During the period 1976-1980, the OECD numbered twenty-four members: Australia; Austria; Belgium; Canada; Denmark; Finland; France; Germany; Greece; Iceland; Ireland; Italy; Japan; Luxembourg; the Netherlands; New Zealand; Norway; Portugal; Spain; Sweden; Switzerland; Turkey; the United Kingdom; and the United States. Since that time, five new members have been added: the Czech Republic; Hungary; Mexico; and Poland; and South Korea. The agricultural populations of these more recent additions, however, were not included in the calculation of the figure reported here.

4. For cogent discussions of the difficulties associated with defining "peasants," see Landsberger (1974) and Shanin (1987).

5. While the vast majority of the country figures used to derive these regional averages were taken from World Bank (1994a), this source did not provide figures for all fifty-eight countries meeting the selection criteria. Data for the following countries were obtained from different sources: Angola, Guinea, and Laos (World Bank 1980); Cambodia (Kurian 1982); Cuba and Guatemala (Economic Commission for Latin America and the Caribbean 1983); and Vietnam (Cima 1989). There was also one country—Equatorial Guinea—for which data were unavailable.

6. World Bank (1994b) classifies nonfuel primary products as those products classified under Sections 0, 1, 2, and 4 and Division 68 of the Standard International Trade Classification, Revision 1. Goods falling within these categories include food and live animals, beverages and tobacco, inedible crude materials, oils, fats, waxes, and nonferrous metals.

7. Data on nonfuel primary product exports were unavailable for seven countries in the humid tropics (Angola, Cambodia, Cuba, Equatorial Guinea, Guinea, Mozambique, and Vietnam) and one OECD country (Luxembourg).

8. For a trenchant analysis of the historical roots of this practice in Latin America, see Loveman (1993).

9. For descriptions of the politics of neopatrimonial rule in Indonesia and the Philippines, see Crouch (1979) and Hutchcroft (1991), respectively.

10. Such a characterization of the politics of agrarian societies is nothing new. This line of reasoning can be gleaned in such classics as Lewis (1955), Polanyi (1957), Moore (1966), and Kuznets (1971), as well as several more forceful statements of recent years, including Lipton (1977), Bates (1981), and Sah and Stiglitz (1992).

11. This section draws from Schmink and Wood (1987: 40-42) and Ellis (1993: 45-60).

12. Scholars have expended considerable energies on the question of whether the peasant mode of subsistence production constitutes a separate and distinct mode of production. For discussions of the contending perspectives, see Thorner (1987) and Alavi (1987).

13. With regard to ecological uncertainties, Low (1990) suggests that the risk of physical survival increases with environmental "extremeness." To the extent that the humid tropics constitute an extreme environment, either in terms of heat or soil infertility (see chapter 2), the assumption of risk-averse peasant behavior would seem all the more fitting.

14. For discussions of peasant-producer operational strategies not directly related to land tenure, see the works collected in Cashdan (1990) and the brief overview provided by Flora (1990: 30-31).

15. The case literature on common-property lands is extensive. For listings of case studies of common-property arrangements in land, see the bibliographic collections compiled by Martin (1989, 1992).

16. For a recent analysis of common property as an institutional response to ecological uncertainty, see Thompson and Wilson (1994).

17. See Agrawal and Yadama (1997: 439-441) for a concise summary of this argument.

18. For other works in the moral economy mold, see Polanyi (1957), Tawney (1966), Wolf (1969), Migdal (1974), and Booth (1993, 1994).

19. This section draws from Schmink and Wood (1987: 42-43) and Ellis (1993: 45-60).

20. The notion that a politician's first order of business is survival in office has also been used to study politics in the non-LDCs setting. See Mayhew (1974) and Roeder (1993).

21. For a succinct bibliographical essay on alternative approaches to state theory and the behavior of political rulers, see Levi (1988: 185-204).

22. Geddes (1994) refers to the choice between policy objectives and political survival as the "politician's dilemma." While I would agree that such choices sometimes do amount to a true dilemma—i.e., an either-or proposition—I would also argue that there are those instances when the imperatives of policy programs and political survival are both served. The liquidation of landed resources in the LDC setting, I would contend, is one such instance.

23. For a lucid discussion that distinguishes "rent seeking" from "profit seeking," see Buchanan (1980). For discussions of rent seeking in non-governmental settings, see Buchanan (1983) and Frank (1986). For accessible reviews of the rent-seeking perspective, see Tollison (1982, 1987, 1997).

24. For a more exhaustive analysis of the interplay between timber concessions and patronage politics in Southeast Asia, see Ross (1996).

25. For additional cases of marketing board extraction of surplus from the peasant sector in tropical Africa, see Bates (1981).

26. The literature on land reform in the LDC setting is extensive. For general overviews, see Lehmann (1974), Griffin (1981), Ghose (1983), Montgomery (1984), Prosterman and Riedinger (1987), Christodoulou (1990), and Sobhan (1993).

27. Just as elite claims to land and labor are not entirely recent phenomena, neither are elite claims to prime agricultural lands anchored exclusively in contemporary history. As Blaikie and Brookfield (1987: 100-121) point out, the pattern of elite control over choice lands in Africa and Asia owes much to the legacy of European colonialism. Under colonial rule, colonial administrators either expropriated choice lands for European settlers or established land taxes which were payable only in export crops, in effect forcing indigenous populations to

devote these lands to the cultivation of export, rather than staple, crops. Thus, Africa and Asia's best agricultural lands were brought immediately under colonial control or integrated through land taxation into the expanding world economy. Given the proven ability of these lands to generate wealth for their colonial holders, "It is not therefore surprising that almost none of the independent states have abandoned the instruments [of control] developed under colonialism" (ibid.: 105).

That contemporary patterns of land tenure are rooted in long-standing historical processes is perhaps even more apparent in tropical Latin America. Barraclough (1973), for example, traces the pattern of elite control of high-potential agricultural lands in Brazil, Colombia, Ecuador, Guatemala, and Peru to the advent of the *latifundio* (large estate), a land tenure institution introduced by the Spanish and maintained, largely intact, by postcolonial political leaders and their clientele to the present day. The accounts of *hacienda* (a type of large estate) and plantation development in tropical Latin America contained in Keith (1977) bespeak a similar historical trajectory.

CHAPTER FIVE

CONSTITUTIONAL ORDERS AND TROPICAL DEFORESTATION

Contemplating Constitutional and Operational Linkages

The primary aim of this chapter is to clarify the relationship between constitutional orders and tropical deforestation; or, in the conceptual language that I will be developing over the course of the chapter, to articulate the linkages between institutions established at the *constitutional* level and actions taken at the *operational* level. I freely acknowledge that these linkages are neither direct nor immediately obvious. Just as the relationship between the underlying and proximate causes of tropical deforestation is tempered by political institutions, so too is the relationship between constitutional- and operational-level processes moderated by important intervening forces. Thus, in both cases, we must be wary of adopting deterministic mind-sets, of believing that inputs of a certain type and magnitude at one end of the causal chain necessarily produce outputs of a certain type and magnitude at the other. However, as I attempt to demonstrate, decisions rendered at the constitutional level can have significant operational-level consequences. My task in this chapter is to translate this general theoretical proposition to the specific case of tropical deforestation.

The chapter proceeds in four steps. First, in order to bridge the content of this chapter with that of the preceding chapter, I review some of the conventional explanations of the outcomes in the contest for landed property rights, particularly those focusing on specific group attributes of the contending parties. Yet, group attributes alone do not account for all of the variance in such outcomes—institutions also play a pivotal role. Therefore, I devote the second part of the chapter to an exposition of the role of political institutions, more specifically those that structure the constitutional order of a national polity. This then lays the groundwork for my claim in the third section of the chapter that more open constitutional orders are conducive to lower levels of tropical deforestation, a claim that I derive from the more fundamental assertion that more open constitutional orders are conducive to a distribution of landed property rights that is more diffuse than concentrated, given the preferences of the peasant producer in the tropical country setting. Finally, in the fourth part of the chapter, I discuss the limitations of the argument that I develop in parts two and three.

Collective Action and The Contest for Landed Property Rights

For many authors, the general pattern of agro-industrial preeminence—and peasant marginality—in the contest for landed property rights results from the relative ability (or inability) of each group to overcome collective-action problems. According to Mancur Olson's (1965) seminal work on collective action, smaller groups will suffer fewer collective-action problems because their small size (1) ensures a large share of the collective good to those who contribute to the group effort and (2) permits easier

detection, and punishment, of those who do not contribute to the group effort (i.e., "free riders").[1] Thus, in small groups, *ceteris paribus*, rational individuals are more likely to contribute to the group effort, thereby increasing the likelihood of group success, both because the potential rewards are relatively large and the opportunity costs comparatively low.

Applied to the contest for landed property rights in the humid tropics, the logic of collective action holds considerable explanatory power: agro-industrial elites prevail precisely because their group is small, relative to peasant producers, and because their members are often concentrated in the capital city, greatly facilitating communication and coordination. And, as suggested above, it is in the self-interest of the members of the agro-industrial sector to ensure that group size remains limited: "... the reason for exclusion is that there will be more to distribute to each member of the coalition if it is a minimum winning coalition. A [coalition] ... will have less to distribute to each member if it admits more members than are necessary for success" (Olson 1982: 66). Thus, small group size, for those fortunate enough to be included in such a group, may be seen as the key component of a "virtuous" collective-action circle: smallness begets success, success yields benefits, benefits encourage smallness.

By contrast, peasant producers enjoy neither smallness nor geographical concentration. Recall from the previous chapter that peasant producers comprise the majority share of the populations of the humid tropics, scattered as they are throughout the rural hinterlands of their home countries. Because of their large size, groups of peasant producers are less likely to organize for collective action, given that any benefits derived from collective action would be dissipated over a large number of individuals, and given that free-rider problems are much more acute in larger groups. Additionally, the geographical dispersion of peasant producers throughout the countryside makes communication and coordination much more problematic. Therefore, in light of "the differences in the size distribution of rural as opposed to industrial producers, we should expect agriculture to stand at a relative disadvantage in organizing collective efforts to defend its interests" (Bates 1981: 89).[2]

Peasant producers contemplating collective action designed to challenge the prevailing distribution of landed property rights are further hampered by the unique nature of their existential circumstance. Because peasant producers are subsistence producers, they generally have little free time to dedicate to collective action—the vast majority of their time is devoted to meeting their subsistence needs (Huntington 1968: 53; Gurr 1970: 131; Welch 1980: 54; Feeny 1983: 782; Mason and Krane 1989: 181-185). Additionally, collective action intended to transform the existing allocation of landed property rights is likely to elicit negative sanctions from national political leaders, as such action constitutes a fundamental threat to leaders' supplies of patronage resources. Thus, collective action among peasants is also infrequent because it requires them to abandon, at least to some extent, their general predisposition toward risk-averse behavior:

> A dissident living at a subsistence level risks his or her life by supporting a dissident group. Survival is at issue because any action by the regime that disrupts the dissident's efforts at eking out a living may mean death. The poor are too concerned about their short-run survival to engage in [collective action] to promote their long-run welfare; they are risk averse. (Lichbach 1995: 97)

Yet, despite the many obstacles that peasant producers confront in their daily routines, they do initiate collective action:

> ... if all peasants thought as Olson says they do, none would ever rebel; history reveals, however, that peasants do rebel, sometimes in large numbers. The paradox of peasant rebellion is thus that rational peasants do choose to participate in peasant struggles. The question then is, what explains the logic of collective action (rather than "collective inaction"); that is, "why so much cooperation" (rather than defection) or "why free rides are spurned" (rather than taken)? (Lichbach 1994: 387).

It is my contention here that we can explain some of the variance in peasant collective action by focusing on the constitutional orders in which peasant producers exist. Simply stated, the probability of peasant collective action is higher the more open the constitutional order. I base this assertion on the assumption that the potential group benefits from peasant collective action, vis-à-vis the contest for landed property rights, are almost always significant enough to warrant collective action, given the marginal position that most peasant producers occupy in the contemporary humid tropics. It is the costs of collective action, however, that are much more variable. In more closed constitutional orders, where repression is commonplace and the political efficacy of the peasantry is negligible, these costs are relatively high. Conversely, in more open constitutional orders, where peasants are less likely to face violent repression and more likely to influence policy outcomes, the costs of collection action are relatively low. And, while it is certainly naive to believe that peasant producers will *always* organize in low-cost environments, it is equally naive to believe that constitutional structures that reduce organizing costs will have *no* impact on observed levels of peasant political activity.

Before turning to a more detailed discussion of the relationship between constitutional structure and political activity, I should first explain that the type of peasant political activity of primary interest in this study is *not* large-scale armed rebellion. While it is true that peasants have resorted to violence throughout the course of history to advance their grievances (e.g., Wolf 1969; Paige 1975), it is also true that peasants have undertaken nonviolent collective action carried out within the confines of prevailing national political arrangements. Yet, it is exactly this type of activity that is often overlooked in studies of peasant behavior:[3]

> The extensive literature on peasant politics is dominated by a rich and eloquent discussion of violent peasant rebellion and revolution. More recently, researchers have turned towards "everyday forms of peasant resistance." Yet the dichotomy in the theoretical literature between grand historical cataclysms and the daily texture of local power relations excludes a great deal of rural political activity, and in particular, the dynamics specific to the many intermediate social and political institutions which link rural and national politics. (Fox 1990: 3)

My reason for emphasizing this point is simple: theoretical expectations will vary depending upon the type of behavior under consideration. For example, consistent support has been found for the hypothesis of an inverted U-curve relationship between political opportunities and *violent rebellion* (Muller 1985; Muller and Seligson 1987; Boswell and Dixon 1990; Muller and Weede 1990):

> ... the basic logic is that in closed systems opportunities are restricted and challengers suppressed; in open systems, extensive opportunities eliminate the need for noninstitutionalized actions. Mixed systems with moderate opportunities, then, are most likely to experience unruliness. (Jenkins and Schock 1992: 172)

However, I expect no such curvilinear relationship to prevail between political opportunities and *institutionalized collective action*. Indeed, as outlined above, I anticipate institutionalized collective action to increase in a linear fashion as political opportunities expand, *ceteris paribus*.

Specifying Constitutional and Operational Linkages

The objectives of this section are to articulate what I mean by the term *constitutional order* and to elucidate why a focus on constitutional orders is important to the study of *operational* processes such as tropical deforestation. Except for the brief discussion of constitutional orders in the introductory chapter, I have been somewhat general in my usage of the term up to this point. In order fully grasp the importance of the relationship between constitutional and operational processes, however, much greater conceptual clarity is necessary.

Constitutional Orders

I begin with an analytical construct that identifies three distinct, yet highly interdependent, levels of activity that can be discerned in the context of any national polity: (1) the *operational* level; (2) the *collective-choice* level; and (3) the *constitutional* level (Kiser and E. Ostrom 1982).[4] The operational level is the world of action: "The operational level is the only level of analysis where an action in the

physical world flows directly from a decision" (ibid.: 209). At the operational level, individuals cast a vote, participate in a protest, join a political party, sell their crops, migrate to another city, and so on. Actions taken at the operational level, however, are themselves constrained by the policies created at the collective-choice level. At the collective-choice level, policymakers fashion rules designed to influence behavior at the operational level. Thus, policymakers may pass laws to designate the eligible electorate, ban political protests, outlaw certain political parties, fix the prices of staple crops, or restrict internal travel. Additionally, at the collective-choice level, policymakers set penalties for noncompliance. Yet, collective-choice activities are, in turn, circumscribed by constitutional activities. That is, "constitutional choices precede and constrain collective choices" (ibid.: 210). At the constitutional level, individuals devise the basic structural features of the polity, most notably its collective-choice mechanisms and the fundamental patterns of accountability that obtain between "the rulers" and "the ruled."

Thus, every polity, at least to some extent, can be said to have a recognizable *constitution*. By constitution, however, I do not mean a formal, written document:

> A constitution, in the sense this term is used here, is not necessarily a formal document, but it is always a polity's most fundamental rules (whether written or not) defining political roles and relationships.... It creates roles that exercise the policymaking powers of a political community and defines relationships such as decision rules and accountability. (Roeder 1993: 6)

Thus, we can think of the *constitutional order*, construed in this manner, as the *general character of a polity's most fundamental rules*. Moreover, we can assess the character of these rules both in terms of (1) the locus of policymaking authority and (2) the exercise of accountability. In other words, "Where does the state's policymaking power effectively reside?" and "To whom are the holders of this power ultimately accountable?" (ibid.: 23).

Based upon the answers to these questions, we can construct a continuum along which any given constitutional order might be located. At one end of the continuum, policymaking authority is concentrated in the hands of a single individual accountable only to that coalition of interests just large enough to ensure that the prevailing constitutional order persists from one day to the next. I characterize these types of constitutional orders as *closed*. At the other end, policymaking authority is distributed uniformly—both horizontally and vertically—throughout the polity to collective-choice bodies accountable (usually through some type of selection mechanism) to all citizens resident within these bodies' respective jurisdictions. I characterize these types of constitutional orders as *open*. And, while these ideal types are rarely encountered empirically, they do serve as useful guideposts for bracketing the rich diversity of constitutional orders generated by the historical process.

Constitutional Orders, Collective Choices, and Operational Consequences

We can begin to appreciate the importance of constitutional orders for the understanding of operational processes by recognizing that it is at the constitutional level where individuals determine *who is eligible* to participate at the level of collective choice (E. Ostrom, Gardner, and Walker 1994: 46). In essence, then, it is at the constitutional level where individuals determine to whom the polity will be responsive in the policymaking process. In closed constitutional orders, the policy process is responsive to the signals of the political executive, in his capacity as the agent of the political clients that he represents. In open constitutional orders, however, the policy process is responsive to the preferences of the majority, given that politicians in these types of orders must ultimately concern themselves with the preferences of the majority if they wish to continue in office (Olson 1993: 570).

In some instances, it may be the case that the policy preferences of the political executive and the majority are congruent—even identical. Under these circumstances, differences in the constitutional order become uninteresting given that the collective choice will be similar regardless of how constitutional rules structure participation at the collective-choice level. In other instances, however, political executive and majority preferences diverge quite sharply. It is in these situations that differences in the constitutional order become especially salient; that is, the relative openness or closure of the constitutional order determines whether it will be the policy preference of the majority that will be followed, or that of the political executive.

The particular preferences that the political executive and the majority express at the level of collective choice, of course, will vary across policy domains. That is, preference convergence or divergence will depend significantly upon the specific policy question at hand. However, given a specific policy issue, I assume the behavioral logic of the political executive and the majority to be same: the policies that these actors seek at the collective-choice level are those that they perceive will increase benefits and reduce costs at the operational level. In other words, the policy preference of each actor derives primarily from his perceptions of expected operational-level consequences.

Thus, individual choice in a national political context is nested in a hierarchy of institutional relationships that span multiple levels of analysis: individuals pursue policies at the collective-choice level that they expect will increase benefits and reduce costs at the operational level; yet, the pursuit of policy preferences at the collective-choice level is contingent upon the ability to participate at the collective-choice level—an ability determined by the rules in use at the constitutional level. It is in this sense, therefore, that constitutional orders influence operational outcomes: "The constitutional level of analysis, then, informs the operational level of analysis of who gets what, when, and how" (V. Ostrom 1982: 237). Or, phrased in slightly different terms, the constitutional level of analysis informs the operational level of analysis of who reaps the benefits and who bears the costs.

As I attempted to convey in the previous chapter, I view the problem of tropical deforestation at the collective-choice level not as an issue of population policy, macroeconomic policy, or even forest policy, but as an issue of land tenure policy. More fundamentally, I view the problem of tropical deforestation as a clash over the distribution of landed property rights. In this respect, my views are analogous to those of such authors as Eckholm (1979), Dorner and Thiesenhusen (1992), and Colchester and Lohmann (1993), all of whom posit some type of land distribution-tropical deforestation linkage. However, while these authors correctly discern the importance of this relationship, they fail to specify fully the central conflict driving this relationship—that between peasant producers seeking to expand access to land and landed resources in order to guarantee their physical survival and political executives working to limit access to these same resources in order to secure their political survival.

Contrasting Preferences for the Distribution of Landed Property Rights

To help tease out the contrasting policy preferences that underlie this conflict, I locate the peasant producer—the embodiment of the majority in the tropical country setting (see chapter 4)—and the political executive in a unidimensional policy space depicting preferences for the distribution of landed property rights in figure 5.1 below. In this representation, I assert that the preference profiles of these two actors are such that the peasant producer prefers a distribution of landed property rights that is more *diffuse*, while the political executive prefers a distribution that is more *concentrated*. Upon what specific grounds do I base this assertion?

Recall my claim from chapter 4 that the behavior of the peasant producer is predicated upon the logic of risk aversion: "... the peasant cultivator seeks to avoid the failure that will ruin him rather than attempting a big, but risky killing. In decision-making parlance his behavior is risk-averse; he minimizes the subjective probability of the maximum loss" (Scott 1976: 4). I contend that this logic of risk aversion, most

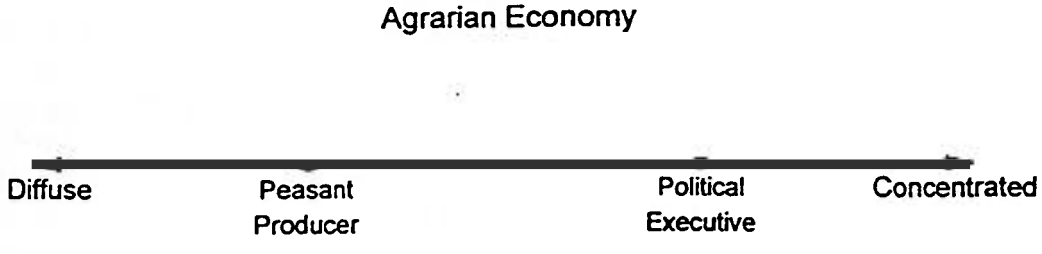

Figure 5.1. Peasant Producer and Political Executive Preferences for Landed Property Rights Distribution

often applied to the analysis of peasant land-use practices, applies with equal validity to peasant preferences vis-à-vis national distributions of landed property rights. Given the precarious nature of his existence, the peasant producer will seek that allocation of landed property rights that increases the probability that he will *at least* secure that minimal amount of land necessary to meet his subsistence needs. This probability increases as the allocation of landed property rights becomes more diffuse; that is, as the supply of land expands. Put another way, the peasant producer will seek that allocation that least threatens his ability to pursue those landed operational strategies (i.e., common-property lands, land fragmentation, land redistribution) fundamental to his physical survival. Therefore, because I assume that the peasant producer values his physical survival first and foremost, I expect him to opt for those allocations of landed property rights that favor diffusion over concentration.

The political executive, on the other hand, embraces those exclusionary allocations that the peasant shuns. In order to maintain office in the fluid macropolitical environments of the tropical latitudes, the executive must be able to amass and maintain large stores of patronage resources in order to cultivate and perpetuate a supportive political clientele. As described in the previous chapter, one of the main fonts of these resources in the tropical country setting is land and the physical assets (e.g., soils, timber, minerals) that it contains. Thus, political survival in the tropical country setting is contingent upon the ability of the executive to skew landed property rights regimes to the benefit of the state apparatus that he heads and the political clientele that he seeks to appease. That is, successful rent creation and rent protection requires a concentrated distribution of landed property rights under the firm control of the political executive. Therefore, because I assume the political executive values political survival above all else, I expect him to seek out those allocations of landed property rights that privilege concentration over diffusion.

Thus, the main point to be taken from figure 5.1 is that the peasant producer and the political executive in the tropical country setting hold contrasting preferences for the distribution of landed property rights—preferences that stem from conflicting operational necessities.

The affirmation, or negation, of these policy preferences at the collective-choice level, in turn, has important operational implications for tropical forest cover. As I discussed in chapter 4, where the preferences of the political executive win out—the predominant pattern in the tropical latitudes—a chain of events is set in motion that results in the increased clearance of tropical moist forest cover. First, the rent protection activities of the executive in the agricultural center occasion a land scarcity. As a result, large numbers of peasant producers are displaced from the agricultural center to the agriculturally marginal frontier zones dominated by tropical moist forest. In the process, the forest cover in these zones declines as the demand for subsistence agricultural cover increases. At the same time, the arrival of these "shifted cultivators" tends to overwhelm those populations long established in these zones—populations whose time-tested land-use practices tend to be more sensitive to the inherent complexity and fragility of tropical moist forest ecosystems.

Second, the rent creation activities that the executive pursues in these frontier zones further intensifies the pressures exerted on the peoples and forest resources of

these regions. Be it in the form of a timber concession, an agricultural investment program, or some other type of rent transfer, such activities further constrain the supply of land available to peasant producers resident in these areas, resulting in additional displacement and, therefore, additional forest clearance. Further exacerbating this cycle of scarcity-displacement-clearance are the nutrient-poor soils endemic to these regions—an environmental constraint that all but guarantees that the peasant producer must clear additional forest cover every one to two years as the productivity of his current plot begins to decline.

Where the preferences of the peasant producer prevail, however, the operational implications for tropical forest cover are somewhat different. Most importantly, the ability of the peasant producer to contest land concentration in the agricultural center decreases the likelihood of his displacement from the agricultural center, thereby diminishing the pressures exerted on the tropical moist forests along the agricultural frontier. While it is unlikely that all displacement from the fertile lands of the agricultural center would cease where the preference of the peasant producer prevailed, it is equally unlikely that the magnitude of displacement would be as large. Where peasant producers are able to challenge land concentration, they would presumably challenge such concentration in those areas with the best agricultural lands. Additionally, the ability of the peasant producer resident in frontier regions to contest land concentration decreases the likelihood that he will be displaced and extend the agricultural frontier still deeper into the forest.

The Moderating Effects of Constitutional Openness

Thus, where the preference of the political executive for a concentrated distribution of the landed property rights is reflected at the collective-choice level, I expect levels of tropical deforestation to be higher. Conversely, where the preference of the peasant producer for a diffuse property rights allocation is affirmed, I expect levels of tropical deforestation to be lower. If lower levels of tropical deforestation are contingent upon the adoption of the policy preference of the tropical country majority, however, then lower levels of tropical deforestation are also contingent upon polity responsiveness to majority preferences. Whether a polity is responsive to majority preferences, or to the preferences of the political executive is a constitutional question. To round out the logic of the argument, therefore, I hypothesize that tropical countries with more open constitutional orders will experience lower levels of tropical deforestation because it is these types of polities that are more responsive to the majority preference for a more diffuse distribution of landed property rights.

Constitutional Openness or Network Density?

At this point it is perhaps worthwhile to ask: Does the argument advanced above capture the *central* dynamic at work in the relationship between political patronage and tropical forest loss? That is: Should the theoretical spotlight be focused on the openness of the constitutional order, or is there some other variable that is more critical in explaining the functioning of patron-client networks as they pertain to the

distribution of landed property rights in the contemporary humid tropics and, therefore, to the observed levels of tropical forest loss?

One alternative take on this question would focus not on constitutional openness, but on the *density* of the patron-client linkages in the population. According to Scott:

> "Density" refers to the proportion of a given population that is a part of the patron-client network. In some situations, for example, a large part of the lower classes may not actually have any vertical links of clientage to a patron. To gauge accurately the explanatory power of patron-client politics in a political field requires that we know for how much of the population such ties are effective. (1972b: 101)

Thus, where the density of patron-client networks is greater, it is more likely that the peasant producer will enjoy membership in a patron-client network. Where this is the case, the peasant producer is less likely to be concerned about meeting his daily subsistence needs, given that such needs are now met by the patron (ibid.: 102). Thus, the peasant producer in a network-dense environment is less likely to be risk averse and, therefore, more likely to approximate the preference of the political executive for a concentrated distribution of landed property rights. That is, given that his minimum subsistence needs are more or less assured, he can now imagine—and demand—larger shares of the landed property rights endowment. Rounding out this line of reasoning, then, where network density is greater, levels of tropical deforestation are more likely to approach those witnessed under closed constitutional orders, as described above.

However, while a focus on network density may offer some additional insight into the dynamics of patron-client networks in the contemporary humid tropics, such insight is likely to be of only marginal utility. In brief, network density has declined to the point where it has become much less of a variable and much more of a constant. In the case of Southeast Asia, Scott (1972a, 1972b, 1976) describes how colonial administrative structures, and succeeding national administrative structures, served to erode the traditionally strong patron-client bonds that joined peasants to local elites, thereby significantly reducing the density of patron-client networks. Lemarchand (1988) traces a similar pattern in postcolonial Africa, while Roniger (1990) documents this process in Latin America's two largest economies—Mexico and Brazil.

According to Lemarchand, this general historical trend toward less dense patron-client networks was linked to a parallel trend toward more repressive patron-client networks:

> The expansion of the apparatus of the state into the rural sectors implied a drastic redefinition of patron roles. Instead of being largely a creature of the locality who dealt with the center, the patrons became increasingly creatures of the center who dealt with the local community. The backing of the state thus greatly reinforced the security and bargaining position of the patrons while at the same time lessening their dependence on community norms. Moreover, as the extractive capabilities of the state came to depend increasingly upon the

> collaboration of traditional authority figures, the claims they made on the local communities became correspondingly heavier and difficult to reconcile with their traditional roles as benevolent patrons.... Despite notable variations in the depth and extent of social corrosion, almost everywhere the result has been to drastically alter the patterns of social exchange to the advantage of the rural notables, and to make the conditions of dependence of their rural clienteles increasingly oppressive. (1981: 18)

Thus, with the advent of national patron-client networks, resources that previously fueled local network systems were now appropriated to fuel national network systems, resulting in ever diminishing terms of trade for the vast majority of peasant producers in rural areas. Therefore, not only did the density of patron-client networks decline, but the resources generated by these networks became increasingly concentrated in the upper tiers of these networks.

Given the decline of traditional, locally based patron-client networks, and the concomitant rise of national patron-client networks linked to the state, I would assert that it becomes all the more important to focus on variations in national political institutions, rather than on those minor variations in network density that may persist in the contemporary humid tropics. Only by maintaining the primary focus on those political institutions that shape the constitutional order of a polity can we adequately assess the possibility that peasant producers can affect change in the national distribution of landed property rights.

Qualifying the Argument

Before proceeding to the empirical analysis of the proposition linking constitutional openness and tropical deforestation in the next chapter, I wish to make two important points. First, as indicated in figure 5.1, the preferences of the peasant producer and the political executive vis-à-vis the distribution of landed property rights are contingent upon the agrarian structure of the tropical country economy. Where a country's population is comprised primarily of peasant producers engaged in subsistence agricultural production, I would argue that a policy preference for a more diffuse distribution of landed property rights is a reasonable approximation of the desires of this majority population. Once the population becomes more urbanized—a nearly indispensable step on the path toward industrialization—this preference almost certainly changes. Moreover, once the tropical country economy shifts from an agrarian to an industrial base, the political executive is likely to be able to choose from a wider array of patronage resources in his quest for political survival. Thus, rather than relying almost exclusively on landed resources, the executive may increasingly look to those rents made available through industrial production (e.g., production quotas, exclusive contracts) as fonts of political patronage. As a result, the preference of the political executive vis-à-vis the distribution of landed property rights is also likely to change. Suffice it to say, then, that the argument that I have developed over the last two chapters is best suited to a static analysis of the predominantly agrarian economies of the contemporary humid tropics.

Second, although touched upon briefly above, I do not wish to leave the reader with the impression that given an open constitutional order, peasant producers will *always* be able to organize to successfully advance their policy preferences at the collective-choice level. As I discussed earlier in the chapter, peasant producers in the tropical country setting confront significant collective-action problems, problems that stem primarily from their geographic dispersion and the all-encompassing nature of their subsistence enterprise. However, any reasonable examination of the historical record will reveal that peasant producers, both inside and outside of the tropical latitudes, have overcome these problems to fashion viable political organizations. It is my contention that more open constitutional orders—in effect—reduce the costs associated with forming these organizations and, therefore, make their emergence more likely.

Endnotes

1. See Sandler (1992) and Udehn (1993) for qualifications, refutations, and revisions of Olson's original propositions.

2. It is interesting to note that public choice scholars such as Bates were not the first to observe the tendency of peasant communities toward political dormancy. Karl Marx, writing on the condition of French peasantry some 130 years prior to Bates, noted:

> The smallholding peasants form a vast mass, the members of which live in similar conditions but without entering into manifold relations with one another. Their mode of production isolates them from one another instead of bringing them into mutual intercourse.... In so far as there is merely a local interconnection among these smallholding peasants, and the identity of their interests begets no community, no national bond and no political organization among them, they do not form a class. They are consequently incapable of enforcing their class interest in their own name, whether through a parliament or through a convention. (Marx [1852] 1987: 332)

3. For a recent work that makes this point in the context of Central American peasantries, see Anderson (1997).

4. Obviously, this applicability of this analytical construct is not limited to national polities. For examples of applications to enterprises other than national polities, see E. Ostrom (1990) and E. Ostrom, Gardner, and Walker (1994).

CHAPTER SIX

CONSTITUTIONAL ORDERS AND DEFORESTATION: A CROSS-NATIONAL STATISTICAL ANALYSIS

In this chapter, I conduct a cross-national statistical analysis of the central proposition advanced in the previous chapter—namely, that tropical countries with open constitutional orders will suffer lower levels of tropical moist forest loss than countries with closed constitutional orders. Before fully developing this analysis, however, I first briefly discuss the strengths and weaknesses of cross-national statistical analysis, both in the generic context and in the context of such land-use transformations as tropical deforestation. Upon completing this discussion, I then move to the preliminaries of my statistical analysis, where I cover the topics of case selection, model construction, data collection, and data limitations. Finally, I present the analysis and interpret the results, paying particular attention to the role of influential cases in the determination of the statistical estimates.

The Merits and the Limits of Cross-National Statistical Analysis

Beginning with the works of such individuals as Lipset (1959) and Deutsch (1961), cross-national statistical analysis (CNSA) has come to occupy a central place in the analytical toolkit of social scientists seeking to project theoretical statements beyond national borders. Cross-national statistical analyses have been used to study social corporatism (e.g., Lange and Garrett 1985, 1987), coups d'etat (e.g., Jackman 1978; Zuk and Thompson 1982), economic growth (e.g., Grier and Tullock 1989; Barro 1991), gender inequality (e.g., Rosenfeld and Kalleberg 1991; Moore and Shackman 1996), political violence (e.g., Muller and Seligson 1987; Boswell and Dixon 1990), and voting behavior (e.g., Powell and Whitten 1993; Pacek and Radcliff 1995), to name just a few of the many substantive areas of inquiry where they have been deployed.

The ubiquity of CNSA, however, should not be interpreted as a sign of universal acceptance. Within the discipline of political science, for example, Jackman (1985) points out that its use in the subfield of comparative politics has received particularly spirited criticism. The critics of CNSA, Jackman notes, both question its ability to yield meaningful causal inferences and point to a tendency to oversimplify a complex political reality through the use of imprecise aggregate indicators, leading them to the conclusion that "many cross-national studies have resembled data-driven fishing expeditions that ignore issues of measurement and causal inference, and that are uninformed by and make little contribution to any substantive issue" (1985: 162).

Similar criticisms of CNSA have been put forth in the field of deforestation research. Kummer, for example, contends that this brand of analysis offers little insight into the deforestation processes of individual countries:

> A major difficulty with cross-sectional regression dealing with nations is that the regression coefficients are virtually impossible to interpret, since they represent an average of all the nations in a sample.... Thus, it is not clear how much, if anything, cross-national studies tell us about an individual country. (1991: 131)

Continuing with the same line of thought in a subsequent publication, Kummer extends his critique by challenging the ability of CNSA to offer authoritative policy prescriptions and by reaffirming the concerns of earlier skeptics vis-à-vis the topic of causal inference:

> ... the statistical results across a sample of nations cannot be applied to individual nations within the sample; as such, they provide virtually no information that can be useful to a particular country. In terms of policy recommendations, cross-national analysis would appear to be at a decided disadvantage. Lastly, even if a cross-section analysis does determine a strong positive relationship ... this is not proof that the relationship in fact exists. (Kummer and Sham 1994: 152)

While I am certainly sensitive to these criticisms, both in the generic context and in the specific context of deforestation research, I do not find them sufficiently compelling to warrant the wholesale rejection of CNSA. With regard to the perceived inability of CNSA to yield viable causal inferences, I refer the reader to the response issued by Jackman: "An odd feature of this complaint is the suggestion that causation can in some way be proven empirically.... The fact is, of course, that causation can never be empirically demonstrated ..." (1985: 172). Indeed, as King, Keohane, and Verba have shown (1994: 75-114), the problem of causal inference is just as salient for qualitative analysts of social phenomena as it is for their quantitative counterparts. Thus, "while statistical analyses do not demonstrate causality, the problems of drawing causal inferences in cross-national studies are not unique to this genre ..." (Jackman 1985: 179).

The charge that the practice of CNSA inherently projects an overly simplistic picture of reality, however, is a criticism that I believe carries more weight. In order to test their theoretical arguments, practitioners of CNSA develop aggregate measures (e.g., gross national product per capita) as proxies for those concepts most central to their arguments. In this process of aggregation, of course, at least some information will be lost; in some instances, a good deal of information will be lost. Yet, I would argue, as others have argued, such information loss is an unavoidable consequence of working at such a gross scale of resolution. In choosing the nation-state as the basic unit of analysis, and in choosing the statistical method as the empirical approach to be used to explain variation across these units, the researcher must be prepared to accept a certain degree of simplicity (i.e., abstraction), both in terms of measurement and

explanation. Thus, as Blalock has observed, the dilemma is not whether to simplify, but "how much to oversimplify" (1964: 8).

Finally, with regard to the charges advanced by Kummer, I would simply say that he is asking something of CNSA that it is not intended to supply. That is, if the goal of one's research is solely to "provide ... information that can be useful to a particular country," then CNSA is probably not the method that one should choose. Rather, the fulfillment of a mandate such as this would be better served by focusing intensively on that particular country, bringing to bear those methods—quantitative, qualitative, or a combination of the two—that provide the most well-rounded picture of that individual case. Indeed, it is precisely this strategy that Kummer (1991) realizes admirably in his own study of deforestation in the Philippines.

However, if the goal of one's research is to develop generalizations that transcend the idiosyncracies of particular country cases, and one is prepared to abandon these idiosyncracies to a certain extent, then "the cross-national statistical method can be a powerful tool as we seek to give substance to generalizations" (Jackman 1985: 171). In this study, I seek to develop generalizations about the relationship between constitutional orders and deforestation processes in the humid tropics, based upon the hunch that cross-national differences in constitutional orders give rise to the empowerment of different political actors and, therefore, to the actualization of different land-use patterns. Given this goal, and the availability of the data necessary to examine the central proposition of this study, the use of CNSA would seem a reasonable course of action to follow. It is to this analysis that I now turn.

Research Design and Analysis

Case Selection

In choosing cases for inclusion in the statistical analysis, I was guided by three primary selection criteria. First, I wished to focus only on those countries that contained substantial absolute amounts of tropical moist forest. This stems from the concern that I voiced in chapter 1 to include in the analysis those countries that contribute most significantly to the global pool of tropical moist forest. The determination of what constitutes a "significant" contribution to the global pool of tropical moist forest, of course, is necessarily arbitrary. For the purposes of this study, I establish a 100,000-hectare minimum as of 1980—the first year for which data on tropical moist forest cover are available (I discuss these data in greater detail below).

In addition to this absolute minimum, however, I also employ a relative minimum, requiring that tropical moist forest cover constitute at least 5 percent of the national land area. In this way, I exclude from the analysis those countries where the economic—and, therefore, political—salience of tropical moist forest resources is likely to be negligible. Thus, with these first two selection criteria, I attempt to strike a balance between the desire to include all countries with large tracts of tropical moist

forest (in absolute terms) and the need to restrict the sample to those countries where tropical moist forest resources are likely to feature more prominently in national economic and political life.

Third, I wished to include only those countries legally recognized by the international community as independent nation-states as of 1976 (I discuss the significance of this date below). Because the theoretical argument presented in this study largely depends upon the political survival of the national executive, it would seem logical to exclude those entities (e.g., colonies or territories) not in possession of full political independence, if only for the simple reason that such entities are not headed by a fully sovereign and independent executive. In table 6.1 below, I list the fifty-eight (58) countries across the three regions of the humid tropics that met these three selection criteria.

Table 6.1. Case Selection Criteria

Country	Tropical Moist Forest Cover: 1980 (1,000 ha)	Tropical Moist Forest Cover as % of Total Land Area	Year of Independence
AFRICA (n = 25)			
Angola	12,841	10	1975
Benin	4,750	43	1960
Burkina Faso	2,265	8	1960
Cameroon	18,947	41	1960
Central African Republic	30,206	48	1960
Congo	20,188	59	1960
Cote d'Ivoire	12,020	38	1960
Equatorial Guinea	1,881	67	1968
Gabon	19,399	75	1960
Ghana	10,491	46	1957
Guinea	7,413	30	1958
Guinea-Bissau	2,180	78	1974
Liberia	4,887	51	n/a
Madagascar	8,972	15	1960
Malawi	3,398	36	1964
Mozambique	7,146	9	1975
Nigeria	14,290	16	1960
Senegal	2,767	14	1960
Sierra Leone	1,985	28	1961
Sudan	14,605	6	1956
Tanzania	16,406	19	1964
Togo	1,534	28	1960
Uganda	1,229	6	1962
Zaire	112,264	50	1960
Zambia	24,221	33	1964

continued on next page

detailed statistical data on dictatorial governments." Indeed one of the cornerstone features of closed constitutional orders is a carefully crafted restriction on the flow of information regarding governmental activity, set in place to conceal or downplay the extent of governmental indulgence. Thus, what little data are available on the magnitude of rent distortions are generally limited to Western democracies (see Tollison 1997: 512-515). Any systematic analysis of the relationship between constitutional openness and rent distortions, therefore, would likely suffer from a severe censored-sample problem (see Achen 1986: 73-95). Nevertheless, the magnitude of this *empirical* problem notwithstanding, there do appear to be compelling *theoretical* reasons why distortions arising from rent-seeking activity would be less exaggerated in open constitutional settings.

Constitutional Effects Literature

In this study, I have sought to understand the incidence of an operational-level process—tropical deforestation—as a function of constitutional-level structures. Admittedly, the "causal distance" between constitutional structures and operational outcomes is not a short one. That is, constitutional and operational linkages are mediated by a variety of intervening process that can alter the signals generated at the constitutional level, the most important of which are collective-choice, or policymaking, processes (see chapter 5). Thus, any study seeking to draw *deterministic* linkages between the constitutional and operational levels should be viewed with a healthy dose of skepticism. Hopefully, I have avoided such determinism here.

However, it would be a mistake to conclude that because the causal distance between these two levels of activity is lengthy, and therefore analytically difficult to traverse, that constitutional-operational linkages are theoretically uninteresting or empirically insignificant. Recent developments is several diverse literatures would suggest otherwise, literatures that I refer to collectively here as the "constitutional effects" literature, given that each perceives constitutional structures as having important consequences for operational outcomes.

In the economic growth literature, various authors have suggested that open constitutional orders are a prerequisite for sustained economic development. Perhaps the most forceful theoretical statement of this position is North (1990), who argues that open polities enjoy superior economic performance because they reduce the uncertainty that surrounds the enforcement of individual property rights, thereby spurring individual investment—an operational action—which leads to higher rates of capital accumulation and, therefore, higher rates of growth. Similar arguments can be found in Barro (1991) and Scully (1992), among others. Empirical studies (e.g., Kormendi and Meguire 1985; Vorhies and Glahe 1988) confirming this relationship have been reported, though the relationship has proven fragile in at least one sensitivity analysis (Levine and Renelt 1992).

the preferences of the majority if they wish to retain office. Therefore, assuming that the majority accounts for a significant share of the productive output of society, the majority's interest in sustaining that output induces it to redistribute less to itself than an autocrat would redistribute to himself and his clientele (ibid.: 570). Similarly, Tullock (1994) has suggested that the social costs of rent distortions are greater in closed constitutional orders because such orders are more conducive to the creation of monopolies (i.e., concentrated property rights arrangements). Additionally, in the foreign policy context, Lake (1992: 26) posits that "the relatively low cost of political participation in democracies constrains the state's rent-seeking ability, whereas the relatively high cost of political participation in autocracies frees the state to earn rents" (see also Brawley 1993). Finally, Nalin and Torstensson (1995), following the lead of Bhagwati (1982), submit that rent distortions are less prominent in open constitutional orders because such orders not only permit lobbying to induce distortions, but also lobbying to eliminate distortions; lobbying in closed constitutional orders, by contrast, is generally limited to that designed to introduce distortions. Thus, egregious distortions that run contrary to the interests of the majority are less likely to arise in open constitutional settings precisely because the majority enjoys the ability to eradicate them (see also Wintrobe 1997).

Set against the backdrop of these theoretical statements, therefore, this study can be viewed as another affirmation of this general line of argument linking open constitutional orders to less substantial distortions arising from rent-seeking activity, from the perspective of the median citizen. The simple premise that I advanced was that, given the agrarian context of the contemporary humid tropics, the distortions typically promulgated by political executives on behalf of their cliques of supporters would not be tolerated by peasant populations if such populations wielded the ability to redress these distortions. The distortion of greatest concern to tropical peasant populations is a concentrated distribution of landed property rights. Where landed property rights are concentrated, the ability of the peasant producer to access the resource most fundamental to his physical survival—land—is severely constrained. Thus, as I argued, the peasant producer, operating under the logic of risk aversion, prefers an allocation of landed property rights that is more diffuse than concentrated. The expression of this preference, however, is contingent upon the existence of an open constitutional order. Without an open polity, the preference of the peasant producer—the median citizen in the humid tropics—is likely to be disregarded and even suppressed, given that the political executive does not require the support of the peasant producer in order to retain office, and given that the executive wishes to extract the maximum surplus possible from society (short of fomenting a revolution) in order to increase his supplies of patronage resources and, thereby, improve his chances for political survival.

Of course, the entire debate over the relationship between constitutional openness and distortions arising from rent-seeking activity must remain somewhat speculative, given that the data necessary to resolve the debate are not likely to be forthcoming. As Tullock (1994: 152) has pointed out, "There just isn't much very

Finally, the argument that I have developed borrows from the work of neoclassical scholars who highlight the importance of both government and market failure as underlying causes of tropical deforestation. As stated previously, though, I disagree with neoclassical scholars who portray such failures as the innocent oversights of tropical country governments. Rather, such "failures," as I have claimed, are the logical by-products of mutually beneficial exchange relationships constructed by tropical country political executives and their clients. In summary, then, a more accurate headline seeking to assign culpability vis-à-vis deforestation processes in the contemporary humid tropics would read: POLICIES OF TROPICAL COUNTRY POLITICAL ELITES COULD LEAD POOR FARMERS TO DESTROY HALF OF REMAINING TROPICAL FOREST.

Comparative Rent Seeking Literature

Central to the argument that I have advanced here is the notion that distortions in the landed property rights regimes of the humid tropics are less severe under more open constitutional orders. Such a claim can be linked to the broader debate in the comparative rent seeking literature as to whether rent seeking is more pronounced in autocracies or democracies, or, in the language of this study, closed or open constitutional orders. In order to evaluate the present research in the context of this debate, however, it is first necessary clarify the terminology that shapes this debate.

In chapter 4, I defined rent seeking as the *pursuit* of returns in excess of a resource owner's opportunity cost through governmental action. Rent seeking should be distinguished, however, from the amount of rents actually delivered by governmental actors. That is, while individuals may pursue rents, they may not be granted by governmental officials. Similarly, while individuals may capture rents, they may not be that large. Thus, the debate introduced above actually splinters into two debates: (1) Is rent seeking more pronounced in closed or open constitutional orders?; and (2) Is the amount of distortion created by the rents actually bestowed greater in closed or open constitutional orders?

With regard to the first question, the general consensus seems to be that rent seeking is more prevalent in open constitutional orders. This should not be too surprising if one assumes that all actors wish to have more material benefits rather than less, and, therefore, will lobby for rents if provided the opportunity. Thus, given the expanded opportunities for political access available to citizens in open polities, we should expect that citizens in such polities would seek to press their political officials for materials gains sanctioned by governmental authority (e.g., Brawley 1993). However, this is not the question of central interest here.

Of greater significance for the purposes of this study is the question of whether or not the distortions generated by the rents actually granted are larger in open or closed constitutional orders. Here the answer appears to favor the former. According to Olson (1993), political leaders in open constitutional orders are imbued with a more "encompassing interest" in the societies that they govern, given that they must satisfy

> poor peasants moving into the forests are often singled out as the causal force behind deforestation, in most cases it is the action of the wealthier segments of that is the most destructive. Profits and other incentives inherent in cattle ranching, commercial farming, mining, and timber harvesting are underlying causal factors. And such profitability is frequently enhanced by various government policies: taxation, subsidies, credit, and so on. (Dorner and Thiesenhusen 1992: 34)

As the results of the empirical analysis demonstrate, however, there is variation tropical forest land-use outcomes. More specifically, those tropical countries with more open constitutional orders suffered less tropical moist forest loss over the period 1981-1990 than those tropical countries with more closed constitutional orders. As I asserted in chapters 4 and 5, my explanation of this fact is that in more open constitutional orders—given the tropical country setting—the policy preference of peasant producers for a more diffuse distribution of landed property rights is more likely to be reflected in actual policy than is the case in more closed constitutional orders. That is, where peasant producers enjoy the ability to participate meaningfully in the policy process and where they can hold their political officials accountable, the probability that their policy preferences will be translated into public policy will be increased. Where this is the case, then, the more diffuse distribution of landed property rights will reduce the supply of shifted cultivators, thereby easing the pressures exerted on tropical moist forest cover.

Thus, the argument that I have developed in this study is not completely divorced from the existing strands of thought that comprise the tropical deforestation literature. It is neo-Malthusian to the extent that I acknowledge that increasing numbers of individuals pursuing agrarian livelihoods on fixed quantities of land can and do produce outcomes of environmental degradation. What I find lacking in the neo-Malthusian approach, however, is any sense that political—and not just biological—processes are at work in spawning these outcomes. Similarly, the argument that I have developed takes some inspiration from the insights of dependency and world-systems scholars to the extent that I recognize that national networks of landed patronage are embedded in internationally driven processes of expanded production. However, this does not mean that such processes operate uniformly throughout the humid tropics; national-level factors, such as political institutions, play an important intermediary role. As Hecht has asserted vis-à-vis the relationship between international capital and deforestation in the Brazilian Amazon:

> Ultimately, control over the processes of deforestation will be resolved at the national and not the international level. This view is not popular with those who place the blame for deforestation on the vast tentacles of international capitalism, but I believe it is important to understand that the Amazon is not a First World colony, and that the destiny of the region will be shaped through national politics to a greater degree than international pressure. (1993: 178).

In light of the argument that I have developed over the course of this study, the eagerness of Minister Wong to condemn the land-use practices of "the natives," while exonerating logging, should not be too surprising. It should be even less surprising upon learning that Minister Wong held a 100,000-thousand hectare timber concession in Sarawak at the time of his statement (ibid.). Thus, a major beneficiary of a property rights allocation that made 100,000-thousand hectare timber concessions possible—and an important link in the Malay network of landed patronage—sought to direct attention away from the land tenure issues underlying tropical forest loss and onto the backs of the main agents of tropical forest loss.

That *shifted* cultivators are the main agents of tropical deforestation in the humid tropics is not in dispute. I acknowledge this fact in chapter 3. What is in dispute is the notion that *shifting* cultivation and its practitioners bear the ultimate responsibility for tropical forest loss. As Warner (1991) and Brookfield and Padoch (1994) have shown, shifting cultivation, as practiced in the humid tropics, can be a sustainable land-use practice, capable of adaptation even in the face of rapid population and commercial intensification. Problems arise, however, where shifting cultivators are displaced and "shifted" to regions where their land-use practices are ill-suited to their new surroundings. In the humid tropics, the regions to which shifting cultivators are typically shifted are those dominated by tropical moist forest and the infertile soils that house them. Indeed, it is precisely because these regions are agriculturally marginal that they are the recipients of large numbers of shifted cultivators. Displaced by the inequalities in land distribution prevailing in the agriculturally rich regions of tropical countries, shifting cultivators are often left with little choice as to where they will relocate. Yet, in choosing to relocate to these regions, shifting cultivators not only bring with them land-use practices poorly adapted to these regions, but they also displace the resident populations of shifting cultivators long established in these regions in the process. As a result, those most qualified to manage the fragile lands of these regions are numerically overwhelmed by those least qualified; as a result of this, tropical moist forest cover is cleared in increasing amounts as increasing numbers of shifted cultivators seek to secure their most basic subsistence needs.

As I have endeavored to demonstrate throughout the course of this study, this entire process of peasant displacement and tropical deforestation is inextricably linked to networks of landed patronage. Central to the workings of these networks are political executives seeking to secure their political survival. To this end, they manipulate landed property rights such that current and prospective supporters are rewarded in exchange for political support. As a result, landed property rights become increasingly concentrated into the hands of tropical country governments and their political clientele, setting in motion the chain of displacement discussed above. Thus, while it is true that shifted cultivators are often the chief "proximate causes" of tropical deforestation:

> Land tenure relationships in areas far removed from where the forest destruction occurs are quite commonly linked to such destruction. And while

CHAPTER SEVEN

CONCLUSION

In this final chapter, my purpose is twofold. First, I synthesize the central propositions and findings of this study in the context of three scholarly literatures: (1) the tropical deforestation literature; (2) the comparative rent seeking literature; and (3) the constitutional effects literature. While this study may hold implications for other literatures, it is these three to which I devote my exclusive attention, given the particular nature of the questions that I have addressed in this study. Second, I close the chapter with some thoughts on possible directions for further research on the linkages between constitutional orders and land-use transformations such as tropical deforestation.

LITERATURE SYNTHESIS

Tropical Deforestation Literature

In August 1996, the Consultative Group on International Agricultural Research (CGIAR)—a research consortium jointly sponsored by the World Bank, the United Nations Development Program, the United Nations Environment Program, and the Food and Agriculture Organization of the United Nations—issued a press release on the status of the world's forests (Consultative Group on International Agricultural Research 1996). Set in large, bold type at the top of the press release, the headline read: "POOR FARMERS COULD DESTROY HALF OF REMAINING TROPICAL FOREST." Though the press release did go on to suggest that the destructive behavior of poor farmers was itself a function of various underlying factors, including poverty, rising population pressures, and even distorted forest policies, the insinuation of the headline was clear: peasant farmers in tropical countries constitute the primary threat to the future viability of tropical forest resources.

The vilification of tropical peasant farmers in the debate over the causes of tropical deforestation, however, is nothing new. Such a tactic has been a favorite of tropical country governments seeking to deflect attention away from their own contributions to tropical forest loss. Witness the 1987 statement of the Environment and Tourism Minister of the Malaysian state of Sarawak, Datuk Amar James Wong:

> Nature is very resilient and five years after an area is logged, one would not be able to tell the difference between it and a primary forest. But in shifting cultivation, which causes irreparable destruction to the forest, we lose everything. The natives use chain saws to cut the trees, destroying everything in the process. It is a fact of life that the biggest curse to the Sarawak forest is shifting cultivation which eats into the forest. (quoted in Dauvergne 1993: 499)

10. This estimator has also been referred to as the "least absolute deviations" estimator, the "least absolute error" estimator, the "least absolute value" estimator, and the "minimum absolute deviation" estimator. Following Berk (1990) and Western (1995), I use the label "least absolute residuals" estimator.

11. For a discussion of the relationship between sample size and significance levels, see Leamer (1978: 78-120).

12. To explore the possibility that liberalization of the constitutional order over the period 1976-1985 may have been important, I created a dummy variable to assess the impact of constitutional liberalization. To those countries whose constitutional openness score over the period 1981-1985 was greater than its score over the period 1976-1980, indicative of increased liberalization, I assigned a 1; to those countries whose score over the period 1981-1985 was less than its score over the period 1976-1980, or whose score remained the same, I assigned a 0. Thus, whereas the purpose of the constitutional stability variable was to measure change in the constitutional order, the purpose of this alternative variable was to measure the *direction* of change. However, inclusion of this alternative variable in the base model neither altered the estimates of the other variables in any meaningful way, nor indicated that the relationship between constitutional liberalization and tropical deforestation was significantly different from zero.

13. Because bootstrapping is a random process, it was necessary to reset the seed for the random number generator after the estimation of each model to ensure that the differences across the models were not due to differences in the bootstrap samples (Berk 1990: 364). Thus, after the estimation of each model, I reset the seed to 123456789, the "start-up" value used by the statistical software that I employed for the analysis—STATA®.

Endnotes

1. Jackman is well aware that his position contrasts sharply with that taken by Olson (1982), who posits that institutional sclerosis increases with constitutional age. For a trenchant critique of Olson's argument, see Rogowski (1988: 301-310).

2. For a brief discussion of the differences between the approach taken by Leamer vis-à-vis other econometricians, see Kennedy (1992: 74-77).

3. Another data series that has been commonly used in cross-national statistical analyses of deforestation (e.g., Cropper and Griffiths 1994) are the annual estimates of total "forest and woodland" cover reported in the *FAO Production Yearbook* (these data are available on-line from the Food and Agriculture Organization at http://apps.fao.org/lim500/nph-wrap.pl?LandUse&Domain=LUI). However, because the forest and woodland estimates are exclusively self-reported by national governments, their validity is highly suspect. For example, if these data are to be believed, twenty-seven of the fifty-eight countries under analysis in this study actually experienced an *increase* in forest cover over the period 1981-1990, whereas the FAO forest resources assessment reported that all fifty-eight countries experienced a *reduction* in total forest cover during this period. Given the results of the validity check of the forest resources assessment, which largely corroborated the deforestation estimates of the assessment program, this increase in forest cover reported by the forest and woodland data series would seem highly unlikely.

4. Beginning with the 1995 survey, Freedom House researchers dropped the checklist question dealing with the decentralization of political power, reasoning that the lack of decentralization does not necessarily translate into a lack of freedom (Freedom House n.d.). However, given that this change occurred some ten years after the period of interest in this study, it obviously had no impact on the data used in the present analysis.

5. See Babbie (1992: 169-190) for a discussion of index construction.

6. For two additional analyses that corroborate the validity of the Freedom House measures, see Bollen (1993) and Burkhart and Lewis-Beck (1994).

7. It is for this reason, therefore, that I date the selection criteria of political independence to 1976.

8. For an accessible introduction to bootstrap methods, see Mooney and Duval (1993).

9. Berk (1990), Kennedy (1992: 278-289), and Western (1995) provide accessible surveys of the various robust estimators typically employed in empirical research.

Discussion

Thus, the hypothesized relationship between constitutional openness and tropical deforestation appears to hold up under a relatively broad range of empirical conditions, lending solid support to the theoretical assertions advanced in chapter 5. Equally compelling, however, is the lackluster performance of the variables that proxy for the four alternative priors. Examination of appendix tables 2a through 2d reveals that *none* of the Neo-Malthusian, Neo-Marxist, neoclassicist, or regionalist variables exhibit a statistically significant relationship with the tropical deforestation variable. At least in terms of the empirical parameters that guide this study, therefore, it would appear that population pressure, economic underdevelopment, manifestations of civil unrest, or regional idiosyncracies (as captured by the regional dummy variables) are not important determinants of tropical forest loss.

However, while I feel confident in these findings, I also feel that I must offer some qualifying remarks. The purpose of the sensitivity analysis was to gauge the "sturdiness" of the relationship between constitutional openness and tropical deforestation. This was done by introducing four sets of "doubtful" variables to the estimation process and observing the effects of these introductions on the constitutional openness variable. Such a procedure can be thought of as a "local" sensitivity analysis in that I compartmentalized the doubtful set into four individual doubtful sets. A "global" sensitivity analysis, on the other hand, would have pooled all of the variables from each of these doubtful sets into one all-encompassing doubtful set and searched for extreme estimates based upon this expanded set. In the context of this study, such a doubtful set would have included fourteen variables. However, given the limited degrees of freedom that were available to me ($n = 58$; $k \approx 20$), I determined this option to be unworkable. And, while I believe that such a decision was warranted given the circumstances, it is not outside the realm of possibility that combinations of variables *across* the four individual doubtful sets would produce even more extreme estimates of the constitutional openness variable, including the possibility that such extremes might cover zero. Thus, the reader should keep this fact in mind when assessing the results reported here.

(i.e., farthest from zero) was -132.211; the maximum estimate (i.e., closest to zero) was -87.354. All other estimates fell somewhere within this range, thus indicating tight bounds for the estimate to the negative side of zero. Additionally, the *t* statistics associated with the extreme estimates for each prior, though obviously exhibiting a certain degree of variation, all remained significant at the .10 level.

With regard to the results of the sensitivity analysis vis-à-vis the other focus variables, the evidence, like that suggested by the base model, is mixed (see appendix tables 3a-3e). The minimum and maximum estimates for the constitutional stability, constitutional age, agricultural population, and tropical moist forest cover variables all exhibit tight bounds in the predicted direction with respect to the four alternative priors. However, only the tropical moist forest cover variable exhibits large *t* statistics across these four sets of extreme estimates. While both the constitutional age and agricultural population variables exhibit large *t* values at their maximum (minimum) estimates, these large values evaporate at the opposite extreme. The results are similar for the constitutional stability variable, though only three of the eight *t* values are large for this variable. Finally, the arable land per agricultural capita variable exhibits both loose bounds and small *t* values, suggesting that this

Table 6.4. Extreme Estimates of the Effect of Constitutional Openness on Tropical Moist Forest Deforestation vis-à-vis Four Alternative Priors

Alternative Prior	Minimum Estimate	Maximum Estimate[a]
Neo-Malthusian	-126.934	-96.384T
(standard error)	(60.718)	(61.255)
[*t* statistic]	[-2.091]*	[-1.573]*
{marginal probability}	{.021}	{.061}
Neo-Marxist	-132.211	-95.915T
	(66.864)	(59.074)
	[-1.977]*	[-1.624]*
	{.027}	{.056}
Neoclassicist	-95.643	-87.354T
	(56.591)	(60.744)
	[-1.690]*	[-1.438]*
	{.049}	{.079}
Regionalist	-103.301	-91.764T
	(65.303)	(66.119)
	[-1.582]*	[-1.388]*
	{.060}	{.086}

[a] T = tight bounds.
* $p \leq .10$ (one-tailed).

variable is not a good predictor of peasant collective action in the tropical country setting, given an open constitutional environment.

variables were listed in table 6.2. As Fowles and Merva (1996) point out, a sensitivity analysis is Bayesian in spirit to the extent that including a particular variable is equivalent to a prior belief that the effect of that variable is significantly different from zero. In this spirit, then, I derived four priors based upon the doubtful variables listed in table 6.2: the neo-Malthusian, the neo-Marxist, the neoclassicist, and the regionalist. I opted for the label "neo-Marxist" rather than the more cumbersome "dependency/world-systems theorist" in light of the Marxist origins of this theoretical position.

For the first three priors, I estimated the number of models sufficient to exhaust all possible linear combinations of the variables associated with the prior. For both the neo-Marxist and the neoclassicist prior, this involved the estimation of seven alternative specifications, given that these two priors feature three doubtful variables each ($2^k - 1$; $k = 3$). However, this number was increased to fifteen for the neo-Malthusian prior, given that three different lags were used to assess the impact of total population growth (based upon different beliefs about the temporal relationship between total population growth and deforestation). For the regionalist prior, however, I estimated only three alternative specifications, that is, one for each regional dummy. This was done because previous studies provided no *a priori* theoretical guidance for any particular combination of regional dummies. In fact, despite suggestions of distinct regional patterns of tropical deforestation in the literature, previous empirical work has been extremely sparse in the use of regional dummies. Nevertheless, to capture any possible regional effects, I decided to include regional dummies in the sensitivity analysis. In total, then, I estimated thirty-two alternative specifications, using 1,000 bootstrapped replications to derive LAR estimates for each specification.[13]

Rather than overwhelm the reader with the results of all thirty-two models, I summarize the results of the sensitivity analysis in table 6.4 below (the results of all thirty-two models are provided in appendix tables 2a-2d). For each alternative prior, I list the minimum and maximum estimates that could be obtained for the constitutional openness variable, the primary focus variable in this study (I provide similar results for the secondary focus variables in appendix tables 3a-3e). For inferential purposes, I also provide standard errors, *t* statistics, and marginal probability levels. Though some proponents of sensitivity analysis shy away from such values, I chose to follow the example of Fowles and Merva (1996), who advocate the use of *t* statistics as a complement to sensitivity analysis. Strong evidence of a relationship between two variables exists, they contend, where *t* statistics are large and the minimum and maximum bounds of the estimate are "tight," that is, where they do not cover zero; evidence is weakened when only a statistically significant coefficient or tight bounds is uncovered, but not both together. The data are not supportive of the relationship where *t* statistics are small and the bounds of the minimum and maximum estimates are "loose," that is, where they cover zero.

As the figures in table 6.4 below illustrate, the constitutional openness variable performed well across the various alternative specifications. The minimum estimate

deforestation—that is, more openness equals less deforestation—the estimate is not significantly different from zero, as evidenced by the large standard error. By contrast, the bootstrapped LAR estimate is nearly double that of the OLS estimate, while the standard error remains essentially unchanged. Thus, when the median is used as the gauge of central tendency, the hypothesized relationship between constitutional openness and tropical deforestation is borne out by the data.

Table 6.3. Base Model Estimates: OLS and Bootstrapped LAR

Variable	OLS	Bootstrapped LAR
Intercept	1071.429	2219.596*
	(1100.206)	(1337.250)
Constitutional Openness	-56.260	-103.245*
	(61.277)	(59.080)
Constitutional Stability	-39.585	-189.198
	(168.640)	(161.624)
Constitutional Age	25.581*	19.878*
	(13.953)	(13.740)
Agricultural Population	-5.790	-14.270*
	(9.297)	(8.949)
Arable Land Per Agricultural Capita	-177.716	-54.791
	(401.870)	(540.615)
Tropical Moist Forest Cover	.054*	.052*
	(.002)	(.016)
N	58	58
R^2	.92	.59

* $p \leq .10$ (one-tailed); standard errors in parentheses.

Evidence of a relationship between the other variables included in the base model and tropical deforestation levels is mixed. The coefficients for both the constitutional age and agricultural population variables indicate relationships in the expected direction and at a level of significance ($\alpha = .10$) that seems reasonable given the modest number of cases that comprise the analysis.[11] The estimates for the constitutional stability and arable land per agricultural capita variables, however, while possessing the theoretically expected signs, cast doubt on the existence of a relationship between these variables and tropical forest loss, especially in the case of the arable land variable.[12]

Sensitivity Analysis

In order to assess the strength of the constitutional openness estimate, I then performed the sensitivity analysis. As outlined above, this involved the specification of alternative models that included variables that previous researchers suggested were also important in explaining cross-national variation in the levels of tropical deforestation, while retaining the variables that comprised the base model. These "doubtful"

explanatory variables and nonnormal residuals (Berk 1990; Western 1995). Thus, robust methods are resistant to the effects of influential cases, where such cases are present. Yet, the ability to make inferences based upon robust estimates alone is problematic. Dietz, Frey, and Kalof (1987: 384), for example, suggest that robust estimators are often too optimistic, given that they tend to generate small sample standard errors. "Applying the bootstrap technique to robust regression methods," however, "provides efficient and unbiased parameter estimates and unbiased estimates of standard errors" (ibid.: 385).[8]

Yet, in choosing to apply robust regression methods, I was also faced with the decision of which robust estimator to choose.[9] I based my decision on the fact that, in the case of my particular data set, the median provided better insight into patterns of central tendency than did the mean. That is, the mean value of the dependent variable—tropical moist deforestation—was 1,822 thousand hectares, while the median value was 831 thousand hectares, a difference of nearly 120 percent. Again, in my judgment, this relates back to the presence of a few countries with vast expanses of tropical moist forest in the data set: countries with large absolute amounts of tropical moist forest cover are the same countries that suffer large absolute losses of tropical moist forest (Rudel 1989). And, because OLS, in effect, fits a set of conditional means to the data (Berk 1990: 321), OLS estimates in this case were more responsive to those countries with large absolute amounts of tropical forest cover, to the extent that they drove the mean sharply upward from the median.

Therefore, to capture patterns of central tendency based upon the median, rather than the mean, I chose the robust estimator known as the "least absolute residuals" (LAR) estimator, so called because it minimizes the sum of the absolute values of the residuals (Western 1995: 791).[10] In contrast to OLS, which, as mentioned above, fits a set of conditional means to the data, LAR fits a set of conditional medians to the data (Berk 1990: 321). Again, because the median provided a better picture of central tendency in this particular case, the selection of LAR seemed a logical choice.

In table 6.3 below, I provide both the OLS and LAR estimates of the base model. In accord with common practice, the LAR estimates are based upon 1,000 bootstrapped replications (e.g., Efron and Tibshirani 1993; Mooney 1996). As the reader will notice, the OLS estimates for the constituent variables of the base model all possess the theoretically predicted signs, but are not significantly different from zero, with the exception of constitutional age and tropical moist forest cover estimates. As discussed above, the relationship between tropical moist forest cover and tropical moist forest deforestation is especially strong, so much so that it explains nearly all the variance, as evidenced by the astronomical R^2.

Once again, though, due to the disproportionate influence exerted by countries with large tracts of tropical forest, these results do not typify the underlying patterns of central tendency present within the data. This can be seen most dramatically in the bootstrapped LAR estimate of the constitutional openness variable, the main variable of interest in this study. While the OLS estimate does reflect the theoretically predicted direction of the relationship between constitutional openness and tropical

1990 and Fox 1991). Fox (1991: 21) suggests that influence can be thought of as a product of *leverage* and *discrepancy*. Leverage, that is, the potential for the model as a whole to be influenced by a few large values on a given explanatory variable, is assessed through the calculation of two influence statistics: Cook's D and DFITS. Discrepancy is assessed by studentized residuals, which help to highlight those cases that feature large residuals. Additionally, DFBETA, another influence statistic, aides in identifying those cases whose inclusion exhibits an abnormally large effect on the coefficient of a particular variable of interest—in this case, constitutional openness. Values for these influence statistics based upon the estimation of the base model are provided in appendix table 1.

And, in fact, inspection of these influence statistics did reveal the presence of several cases that suggested caution in the use of straightforward OLS. With regard to Cook's D and DFITS, Brazil, Guyana, Indonesia, Suriname, and Venezuela all exceeded the cutoff points for these statistics, as suggested by Bollen and Jackman (1990). Bolivia, Brazil, Indonesia, Thailand, and Venezuela all demonstrated large residuals, based upon examination of the studentized residuals. And, Brazil, Cuba, Indonesia, Myanmar, Papua New Guinea, Suriname, Thailand, and Venezuela were all found to exert unusual influence on the constitutional openness coefficient, as evidenced by the inspection of the DFBETA values. Indonesia, for example, shifted the coefficient down (toward zero) by .80 standard deviations.

The identification of Brazil, Indonesia, and Venezuela as influential cases by all three classes of influence statistics is most likely attributable to the fact that they held (and still hold) large tracts of tropical moist forest at the beginning of the study period. That is, they featured unusually high values on one of the explanatory variables included in the base model—standing tropical moist forest cover. Thus, much like Inman (1993) and Bilsborrow and Geores (1994), I discovered that countries possessing large tracts of tropical forest cover exerted a large and problematic influence on traditional OLS estimates.

At this point, I was faced with the prospect of how to handle the influential cases. One possible course of action was simply to delete the influential cases from the data set and re-estimate the model. For several reasons, I chose not to follow this option. Dietz, Frey, and Kalof (1987), for example, point out several problems with this course of action, including the fact that the truncated data set may also contain influential cases (based upon the new estimates) and the fact that such deletion is difficult to justify on theoretical grounds. Indeed, given that one of my case selection criteria is driven by a concern for the inclusion of countries with large absolute amounts of tropical moist forest, the exclusion of countries with the largest absolute amounts of tropical moist forest from the analysis would be methodologically incongruent, to say the least.

Rather than deleting the offending cases from the data set, I chose to pursue a course of action that combined the use of robust regression methods with the nonparametric technique known as bootstrapping. Robust regression methods provide parameter estimates that are generally insensitive to such problems as unusual values on

several years to translate into real changes in the constitutional fabric of the society witnessing such deforestation.

With regard to the other variables included in the analysis (both focus and doubtful), however, I limit the evaluation period to 1976-1980. I do this because the potential for immediate feedback between deforestation levels and the other variables of interest is much more real. With regard to the relationship between deforestation levels and the size of a country's agricultural population, for example, we could imagine a scenario where rapid forest loss occasions a reduction in the agricultural population (e.g, through urbanization), through the disruption of the local ecosystems upon which agricultural populations rely for their livelihoods. We could envision similar reciprocal relationships between deforestation and population growth (deforestation decreases population growth by diminishing the supply of subsistence resources), deforestation and export activity (deforestation stimulates export activity through an increase in the supply of cropland and timber), and deforestation and debt levels (deforestation reduces debt burdens as the liquidation of forest resources generates additional foreign exchange that is then used to service debt obligations). Because of the potential for these feedback processes, therefore, I delineate an "end date" of 1980 for all of the additional variables considered in the analysis, with the exception of the coup and revolution variables, which I extend to 1985, based upon the assumption specified above that any significant reduction in forest cover takes some time to manifest itself in the form of profound political change.

Model Estimation

Base Model

To provide a point of departure, I first estimated the base model using ordinary least squares (OLS). The popularity of the OLS estimator among social scientists engaged in empirical research is well known (e.g., Kennedy 1992: 10-12; 44-47; Western 1995: 786-788). However, the ubiquity of OLS does not necessarily mean that it is suited for all empirical circumstances. One circumstance in which the utility of OLS is thought to be suspect is in the presence of influential cases. Cases become influential when they have unusually large residuals associated with them, when they possess an unusual value on an explanatory variable, or both (Kennedy 1992: 279-280). Where influential cases are present, OLS estimates give disproportionate weight to such cases and may mask the patterns of central tendency in which the researcher is ultimately interested.

Because previous cross-national analyses of tropical deforestation had demonstrated the distortionary effects of influential cases in the OLS context (e.g., Inman 1993; Bilsborrow and Geores 1994), I was particularly sensitive to the possibility of this problem. In order to determine whether this problem was in fact a concern in the context of this study, I performed a series of regression diagnostics, primarily based upon the calculation of influence statistics (see Bollen and Jackman

Moreover, because the Polity project imposes a national population minimum of 500,000 for inclusion in the data set, use of the Polity data would have resulted in the loss of three cases (Bahamas, Equatorial Guinea, and Suriname). And, given that I am already dealing with a relatively small number of cases, this is a compromise that I choose not to make.

A Note on Time

Finally, before moving on to the substance of the analysis, I offer a brief discussion of the temporal relationships of the variables included in the analysis. The reader may have noticed that the time coverages of the variables included in the analysis are not coterminous. For example, the deforestation data cover the period 1981-1990, yet the constitutional openness and stability data cover the period 1976-1985. This was done for two reasons. First, it is my argument that if we wish to understand land-use dynamics over the period 1981-1990, and we think that political processes are important determinants of these dynamics, we need to take a step back in time in order to determine the *accumulated* political strength that the relevant actors possess at the "time of impact." That is, peasant producers previously and completely excluded from the workings of a polity will have little accumulated political strength in 1981 if the constitutional opening that empowers them occurs only in 1980. Learning to overcome collective-action problems, once given the opportunity, takes time; it does not occur overnight. It is for this reason, then, that I begin the evaluation period for constitutional openness and stability in 1976, a choice predicated upon the assumption that, given an open constitutional setting, five years would be sufficient time to work out some (but certainly not all) of the more significant organizational problems that peasant producers face in the tropical country context, if they are overcome at all.[7]

Second, the reason that I end the evaluation period for constitutional openness and stability at 1985 has to do with the potential for *simultaneity bias*. In simple terms, this is a situation where changes in the dependent variable may produce changes in the independent variables. Thus, the independent variables may not be completely exogenous; that is they may be *weakly exogenous* (Kennedy 1992: 89). Where this is the case, the presence of endogenous variables—through their correlation with the error term—may produce biased estimates (ibid.: 151-175). Thus, in the context of this study, deforestation may lead to changes in the constitutional order. Homer-Dixon (1991, 1994), for example, has speculated that states undergoing rapid environmental degradation may become more authoritarian in order to manage the growing internal stresses (e.g., displacement, food shortages) associated with such degradation. Therefore, those tropical countries that experienced rapid forest loss early in the period between 1981 and 1990 may have experienced constitutional closure at later stages within that same period. To account for this possibility, then, I terminate the evaluation period for constitutional openness, stability, and age at 1985, based upon the assumption that any scarcities arising from acute deforestation would take at least

election of executives and legislators through free and fair elections; the ability of citizens to endow their freely elected representatives with real political power; the opportunities to organize political parties or other competitive political groupings; the strength of opposition power; the decentralization of political power; the absence of domination by the military, foreign powers, totalitarian parties, religious hierarchies, economic oligarchies, or other powerful groups; and the opportunities for minority (e.g., cultural, ethnic, religious) groups to take part in the political process.[4] The civil rights checklist contains items that speak to: the existence of a free and independent media; freedom of demonstration; protection from political terror; the presence of free trade unions or peasant organizations; and freedom from extreme government indifference and corruption. Based upon these checklists, Freedom House then assigns political rights and civil liberties scores ranging from 1 to 7, with higher scores representing *diminished* rights and liberties.

For the purposes of this study, I sum these two scores and transpose the sum to derive the more logical interpretation where higher scores represent *increased* rights and liberties. Thus, for each of the ten years between 1976 and 1985, each of the fifty-eight countries included in this study is assigned a score ranging from 2 to 14. To derive the final constitutional openness score, I take the mean of these ten scores. To obtain the constitutional stability score, I take the standard deviation of these ten scores and transpose it to derive the more logical interpretation where higher scores represent more stable macropolitical environments. Thus, to the extent that Freedom House researchers perceive political rights and civil liberties as dynamic properties—a belief explicitly incorporated into their methodology (ibid.)—the standard deviation of the sum of the political rights and civil liberties scores indirectly measures short-term change in the constitutional parameters of a given polity.

Given my discussion of constitutional orders in chapter 5, therefore, I am satisfied that the Freedom House measures of political rights and civil liberties adequately capture the two constitutional dimensions of central interest—those pertaining to the locus of policymaking authority and the accountability relationships that obtain between citizens and officials. Additionally, the high correlation ($r = .88$) between these measures across the 580 country-years (58 countries $\times$ 10 years per country) considered in this study indicates that they are empirically related and, therefore, that their combination into a constitutional openness index is justifiable on methodological grounds.[5]

It should be said, however, that other data sets might have been used to construct comparable indicators of constitutional openness and stability. Perhaps the most obvious choice in this regard would be the Polity III data set (Jaggers and Gurr 1995). However, a validity assessment performed by the compilers of Polity III revealed high correlations between the Polity III democracy score (the most likely candidate for a constitutional openness measure) and the Freedom House scores of political rights ($r = .92$) and civil liberties ($r = .87$) across approximately 130 countries during the period 1973-1994 (ibid.: 475).[6] Thus, opting for the Polity III data would probably not make a notable difference in the results of the present analysis.

Deforestation and Forest Cover Data

Perhaps the most controversial of the indicators listed in table 6.2 is that for tropical moist forest deforestation. The controversy, however, stems not from the indicator itself, but from the source upon which the indicator data are based. Both the tropical moist forest deforestation data and the tropical moist forest cover data are derived from the Food and Agriculture Organization's (FAO) (1993) forest resources assessment for tropical countries, an assessment that has received criticism. Grainger (1996), for example, while acknowledging certain advantages that the assessment carries over earlier efforts to quantify tropical forest cover and loss, cites several shortcomings. Foremost among these, according to Grainger, are a limited comparability with previous assessments, the use of questionable forest classification maps, and a reliance upon national surveys and modelling adjustments where remote-sensing data were unavailable or inadequate.

While I am certainly sensitive to the concerns raised by Grainger, I do not believe such concerns are serious enough to warrant the wholesale rejection of the data. Unavailable to Grainger at the time of his critique were the results of a subsequent FAO study designed to evaluate the validity of the earlier forest cover and deforestation estimates. Based *exclusively* on remote-sensing data, this subsequent study reported correlation coefficients of .969, with regard to forest cover estimates, and .793, with regard to deforestation estimates, across a common sub-sample of sampling units at the *stratum* (i.e., forest type) level (Food and Agriculture Organization 1996: 77). Thus, while the two sets of estimates are not perfectly correlated, they are highly correlated, a finding that suggests caution in the use of the data—not their outright rejection. Moreover, the FAO data are the only data to disaggregate forest cover and deforestation estimates by forest type. Therefore, because I focus in this study only on tropical moist forest (a "super-type" that combines the types of tropical rain forest and tropical moist deciduous forest), the possibility of using other data sets is precluded.[3]

Constitutional Openness and Stability Data

To measure constitutional openness and stability, I rely upon the annual scores of political rights and civil liberties reported by Freedom House for the period 1976-1985 (Freedom House 1976-1985). Freedom House defines political rights as those rights that "enable people to participate freely in the political process. By political process, we mean the system by which the polity chooses the authoritative policy makers and attempts to make binding decisions affecting the national, regional or local community" (Freedom House n.d.). Civil liberties, on the other hand, "are the freedoms to develop views, institutions and personal autonomy apart from the state" (ibid.).

In deriving the scores of political rights and civil liberties, Freedom House researchers employ separate checklists to gauge the extent of right and liberties within a given polity (ibid.). The political rights checklist includes items that speak to: the

Table 6.2. *Continued*

Variable	Indicator/Time Frame	Source
* Population Growth	* total population growth (%)/1966-1980; 1971-1980;1976-1980	* Food and Agriculture Organization (1995)
* Rural Population Growth	* rural population growth (%)/1966-1975	* Food and Agriculture Organization (1995)
Dependency/World-Systems Variables		
* Agricultural-Forestry Products Exports	* agricultural-forestry products exports ÷ gross national product (%)/1976-1980	* Food and Agriculture Organization (1995); World Bank (1994a); Banks (1995)
* Debt Service Ratio	* total debt service ÷ value of exports (%)/ 1976-1980	* World Bank (1995)
* Gross National Product Per Capita	* gross national product ÷ total population (current $US)/1976-1980	* World Bank (1994a); Banks (1995)
Neoclassical Variables		
* Coups d'Etat	* # of coups d'etat/1976-1985	* Banks (1995)
* Guerrilla Warfare	* # of guerrilla warfare events/1976-1985	* Banks (1995)
* Revolutions	* # of revolutionary events/1976-1985	* Banks (1995)
Regional Variables		
* Africa	* dummy variable (0 = no; 1 = yes)	* n/a
* Asia-Pacific	* dummy variable (0 = no; 1 = yes)	* n/a
* Latin America-Caribbean	* dummy variable (0 = no; 1 = yes)	* n/a

Table 6.2. Variable Indicators and Sources

Variable	Indicator (Units)/Time Frame	Source
Dependent Variable		
* Deforestation - Tropical Moist Forest	* tropical moist forest deforestation (thousands of hectares)/1981-1990	* Food and Agriculture Organization (1993)
Focus Variables		
* Constitutional Openness	* sum of Freedom House political rights-civil liberties scores (2-14)/1976-1985	* Freedom House (1976-1985)
* Constitutional Stability	* inverse of standard deviation of constitutional openness score/1976-1985	* computed by author
* Constitutional Age	* age of effective constitution (years)/1985	* Jackman (1993)
* Agricultural Population	* agricultural population ÷ total population (%)/1976-1980	* Food and Agriculture Organization (1995)
* Arable Land Per Agricultural Capita	* arable land ÷ agricultural population (hectares per person)/1976-1980	* Food and Agriculture Organization (1995)
* Tropical Moist Forest Cover	* tropical moist forest (thousands of hectares)/1980	* Food and Agriculture Organization (1993)
Doubtful Variables		
Neo-Malthusian Variables		
* Population Density	* total population ÷ national land area (persons per square kilometer)/1980	* World Bank (1994a)

continued on next page

possible dimensions of tenure security not directly related to constitutional stability, as envisioned above. This does not mean, of course, that I think these alternative theoretical positions are unimportant. Rather, as I have attempted to suggest throughout the course of this study, these alternative positions are *incomplete*. Thus, in the previous two chapters, I have focused exclusively on what I believe these three alternative positions lack, namely a focus on political institutions, or, more specifically, a focus on those institutions that shape the constitutional order of a given polity. This temporary theoretical myopia was necessary for purposes of exposition. However, to ignore these alternative explanations at the stage of empirical analysis would be irresponsible.

Thus, in order to account for these alternative explanations empirically, I also perform a sensitivity analysis in the spirit of the approach articulated by Leamer (1983, 1985).[2] In such a sensitivity analysis, the researcher divides explanatory variables into two categories: *focus* variables and *doubtful* variables. As the name implies, focus variables are those variables of the greatest interest to the researcher in the context of a given study. In the context of this study, therefore, the *primary* focus variable would be constitutional openness, while constitutional stability, constitutional age, agricultural population size, potentially available arable land relative to agricultural population, and standing tropical moist forest would be considered *secondary* focus variables. Whether primary or secondary, though, focus variables are included in every model.

What changes across model specifications are the doubtful variables, that is, those variables that the researcher believes to be possibly important, but not as important as the focus variables. Thus, in this study, the doubtful variables would be those variables that neo-Malthusians, dependency/world-systems researchers, and neoclassicists feel are important vis-à-vis tropical deforestation. Because of the collinearity between the explanatory variables, different model specifications—as determined by the choice of variables from the doubtful set—will result in different estimates on the coefficients of variables from the focus set. An estimate of a focus variable is said to be fragile (i.e., sensitive) if the possible range over a wide variety of specifications from the doubtful set covers zero; that is, if the coefficient changes sign. Thus, sensitivity analysis is an attempt to move beyond conventional reporting styles where only the best-fitting—but potentially fragile—model is reported (Leamer and Leonard 1983).

Data Collection

In order to carry out the analysis specified above, it was necessary to gather data from multiple sources. In table 6.2 below, I list the variables considered in the analysis, providing the indicator that I use for each variable, the time frame over which I evaluate the indicator, and the source for each indicator. While most of the indicators or their sources require no further elaboration, there are a few that do require additional discussion.

extent of the subsistence sector and, therefore, the intensity of the demand for a more diffuse distribution of landed property rights. Other things being equal, therefore, I expect levels of tropical deforestation to be *negatively* related to the size of the agricultural population.

Just as the ability of the political executive to effectively shrink the supply of landed property rights is constrained by the availability of adequate organizational resources, so too is the ability of the peasant producer to effectively expand the supply of landed property rights limited to some extent by factors external to his immediate circumstances. As I mentioned in the previous chapter, the opportunity costs of peasant collective action in the tropical country setting are substantial: time spent petitioning governmental authorities for access to land, access to better lands, or in defense of existing property rights arrangements is time not spent on ensuring that basic subsistence needs are met. Yet, as I also mentioned in chapter 5, the historical record is replete with examples of peasant collective action; peasant producers do overcome collective-action problems. As I have argued throughout the course of this study, one factor that increases the probability of peasant collective action is an open constitutional order, as such a constitutional order essentially lowers the costs of collective action. One additional factor that may increase the probability of peasant collective action—a factor more specific to the scope of this research—is the *potentially* available supply of arable land, relative to the size of the agricultural population. (I say "potentially" to highlight the fact that, again, in most tropical country settings, good agricultural lands are available but are typically monopolized by political elites and their clients.) Where the supply of arable land—the resource most fundamental to the physical survival of the peasant producer—is greater, there exists a greater likelihood that action on the part of the peasant producer will yield benefits. That is, where the supply of the sought-after good is larger, the peasant is more willing to engage in collective action, given the higher probability of a payoff. For these reasons, therefore, I expect levels of deforestation to be *negatively* related to the supply of arable land, relative to the size of the agricultural population.

Finally, levels of tropical moist forest loss over a given period of time also depend significantly upon the extent of tropical moist forest cover at the beginning of the time period in question. Previous empirical studies of deforestation in the tropical latitudes have demonstrated a strong positive relationship between the extent of forest cover at time t and the amount of deforestation at time $t + 1$ (e.g., Rudel 1989). In other words, countries with large absolute amounts of tropical forest cover suffer large absolute amounts of forest loss. In light of these findings, therefore, I expect levels of tropical moist forest loss over the study period to be *positively* related to the amount of standing tropical moist forest cover at the beginning of the study period.

Sensitivity Analysis

As the reader may have noticed, nowhere in the base model do I include variables that adequately capture the theoretical positions taken by neo-Malthusians, dependency/world-systems scholars, or neoclassicists, as outlined in chapter 4. That is, I do not include proxies for population pressure, economic subservience, or other

given tropical country over a given period of time. To control for the influence of these other factors, I pursued a two-pronged strategy.

Base Model

First, I constructed a model most congruent to the ideas developed in this study. I refer to this model as the base model. In this model I perceive the magnitude of tropical moist forest loss that a country experiences not only to be a function of constitutional openness, but of (1) constitutional stability, (2) constitutional age, (3) the size of the agricultural population, (4) the amount of arable land *potentially* available to the agricultural population, and (5) the amount of standing tropical moist forest within a country's borders.

By constitutional stability, I mean the short-term stability of those constitutional parameters that structure the rules pertaining to the locus of policymaking authority and the patterns of accountability. Knowledge of the stability of these parameters is important insofar as it yields insight into the probable time horizons of the political executive and the peasant producer. Where these parameters are more stable, the political executive is likely to feel more secure in office and, therefore, to take a longer time horizon vis-à-vis policy decisions. Thus, in this type of setting, the political executive will feel somewhat less compelled to dole out landed patronage, thereby easing the pressures exerted on tropical moist forest resources. For his part, the peasant producer is likely to feel less compelled to clear forest cover in the present, as he also develops a somewhat longer time horizon in more stable constitutional settings (Deacon 1994). Thus, for these reasons, I expect levels of tropical deforestation to be *negatively* related to constitutional stability.

In contrast to constitutional stability, constitutional age refers to the duration of the constitutional order prevailing within a given country at any given point in time. Thus, while there may be periodic alterations in a polity's constitutional rules (e.g., amendments), the underlying constitutional order endures. The issue, then, "is to differentiate fundamental changes in the rules governing political life from less substantial amendments ..." (Jackman 1993: 130). Why I think constitutional age is important in the context of this study has to do with the extractive capacity of tropical country central governments, that is, the capacity of central governments to secure and withdraw resources from the physical and social environments over which they claim authority (Almond and Powell 1966: 195). Jackman (1993), for example, suggests that the political capacity of nation-states increases with the aging of the constitutional order, as older constitutional orders, he asserts, enjoy higher levels of organizational development.[1] Thus, the ability of the tropical country political executive to amass landed property rights for use as patronage depends upon the ability to muster organizational resources (e.g., compliant bureaucracies) sufficient to the task, an ability that derives from constitutional longevity. Based upon this reasoning, therefore, I expect levels of tropical deforestation to be *positively* related to constitutional age.

As I argued in chapters 4 and 5, levels of deforestation in the tropical country setting also depend significantly upon the size of the agricultural population. It is the size of this population in the tropical country setting that more or less determines the

Model Construction

Over the course of the last two chapters, I have primarily looked upon deforestation as a function of constitutional openness. Of course, it would be naive to assume that the relationship is this simple; clearly, other factors are at work in determining the extent of tropical moist forest loss that occurs within the borders of a

Table 6.1. *Continued*

Country	Tropical Moist Forest Cover: 1980 (1,000 ha)	Tropical Moist Forest Cover as % of Total Land Area	Year of Independence
ASIA-PACIFIC (n = 13)			
Bangladesh	1,144	9	1971
Cambodia	5,872	33	1949
India	16,161	5	1947
Indonesia	107,947	60	1949
Laos	9,325	40	1949
Malaysia	20,028	61	1957
Myanmar	25,834	39	1948
Nepal	2,031	15	n/a
Papua New Guinea	30,962	68	1975
Philippines	7,344	25	1946
Sri Lanka	969	15	1948
Thailand	11,780	23	n/a
Vietnam	7,310	22	1945
LATIN AMERICA-CARIBBEAN (n = 20)			
Bahamas	154	15	1973
Bolivia	39,993	37	1825
Brazil	515,864	61	1822
Colombia	54,735	53	1810
Costa Rica	842	16	1821
Cuba	1,498	14	1902
Dominican Republic	814	17	1844
Ecuador	10,574	38	1822
Guatemala	4,957	46	1821
Guyana	16,665	85	1966
Honduras	2,141	19	1821
Jamaica	499	46	1962
Mexico	15,809	8	1823
Nicaragua	4,898	41	1821
Panama	2,205	29	1903
Paraguay	8,254	21	1811
Peru	54,181	42	1821
Suriname	14,896	95	1975
Trinidad and Tobago	192	37	1962
Venezuela	39,911	45	1811

Sources: absolute and relative tropical moist forest cover computed from Tables 1a-1c, 7a-7c, and 8a-8c of Food and Agriculture Organization (1993); independence dates taken from Central Intelligence Agency (1996).

Another (relatively recent) literature that explores constitutional-operational linkages is the democratic peace literature, which examines the proposition that democracies, while no less likely to fight wars in general, are less likely to fight wars with each other (e.g., Chan 1984; Doyle 1986; Lake 1992). Explanations of the democratic peace are generally either normative or structural (Maoz and Russett 1993). Normative explanations suggest that democracies do not fight each other because norms of compromise and cooperation prevent their conflicts from escalating into violent clashes. Structural explanations posit that political mobilization processes impose institutional constraints on the leaders of two democracies confronting each other to make violent conflicts unfeasible. Regardless of the particular explanation that one chooses to accept regarding the existence of the democratic peace, the essential thrust of the literature remains the same: differences at the constitutional level lead to differences in the policies that officials choose at the collective-choice level which then lead to either belligerent or pacific behavior at the operational level.

Finally, it should be said that the salience of constitutional differences for operational outcomes is not limited to the context of national polities. Normally, we think of constitutions as pertaining primarily to nation-states. However, if we take the more expansive view of constitutions as sets of fundamental rules (whether written or not) that define roles and relationships, then the concept can be applied to a wide variety of social entities, both public and private. For example, Lam (1994) examined how constitutional differences affect individual incentives and capabilities to cope with collective-action problems across 150 irrigation systems in Nepal. The primary constitutional difference that he examined was whether irrigation systems were farmer-managed or agency-managed (i.e., managed by government agencies), finding the farmer-managed systems to be superior performers across a range of outcome measures. And, in the context of the contemporary United States, Cornell and Kalt (1990) explored constitutional differences in the governance structures of various American Indian tribes, positing (tentatively) that tribes with accountable decision-making bodies achieve superior economic performance because such bodies help to curb the rent-seeking activities of individual members.

If the fundamental premise of the new institutionalism is that institutions matter (e.g., Drobak and Nye 1997), then the fundamental premise of the constitutional effects literature, as evidenced by the examples provided above, is that constitutions matter. Indeed, interest in the political economy of constitutional issues has increased significantly in recent years (Mueller 1997). Witness the 1986 awarding of the Nobel Memorial Prize in Economic Science to James M. Buchanan, a leading scholar in the field of constitutional public choice, and the founding in 1990 of *Constitutional Political Economy*, a journal devoted exclusively to the exploration of constitutional issues from a public choice perspective. Thus, the situation of some fifteen years ago, when Vincent Ostrom (1982) cautioned that analysis at the constitutional level had become "a forgotten tradition," appears to have changed considerably.

Future Research Directions

One of the messages that I have hopefully conveyed with this study is that tropical deforestation, like most issues relating to environmental degradation, is not merely a "green" technical issue, despite the tendency of the popular media, international organizations, and tropical country governments to portray it as such. Rather, the incidence of tropical deforestation is inextricably linked to the political—and, therefore, spatial—marginalization of the tropical peasantry, a dynamic that is ultimately *constitutional* in nature. The purpose of this research has been to articulate this linkage and to examine it empirically by means of the statistical method.

And, while I believe that the realization of these two tasks is sufficient to allow this study to stand on its own, I also believe that the study remains somewhat incomplete. A more comprehensive study would also include carefully structured qualitative analysis designed to specify more clearly the linkages between constitutional realities, collective choices, and operational actions. The research strategy known as *process tracing* could be particularly useful in this regard:

> The process-tracing approach attempts to uncover what stimuli the actors attend to; the decision process that makes use of these stimuli to arrive at decisions; the actual behavior that then occurs; the effect of various institutional arrangements on attention, processing, and behavior; and the effect of other variables of interest on attention, processing and behavior. (George and McKeown 1985: 35)

In short, the process-tracing approach counsels the researcher to concentrate on "the decision process by which various initial conditions are translated into outcomes" (ibid). Rather than treating the ultimate outcome (in this case, tropical deforestation) as the sole dependent variable, however, new dependent variables are constructed. Thus, the initial condition of a closed constitutional order could be contrasted with the initial condition of an open constitutional order to determine the impact of such variation upon a polity's collective choices—the "intermediate" dependent variable— regarding the distribution of landed property rights. The next step, therefore, would be to investigate the consequences of these collective choices (i.e., policy decisions) for the operational actions of peasant producers, political executives, large landholders, and so on. That is, how do the collective choices affect the distribution of landed property rights, and how does this distribution impact the operational decisions of the relevant actors?

As I theorized in this study, given the tropical country setting, closed constitutional orders lead to more concentrated allocations of landed property rights, while open orders lead to more diffuse allocations. In turn, concentrated allocations produce large numbers of shifted cultivators, which exacerbates the pressures to clear tropical forest cover, while diffuse allocations produce smaller numbers of shifted cultivators, thereby easing the pressures to deforest. A qualitative analysis that specified each of these linkages in the context of concrete tropical country cases would go a long way in adding greater detail to the portrait of tropical deforestation that I have rendered here.

APPENDIX

Table 1. Influence Statistics

Country	Cook's D	DFITS	Studentized Residuals	DFBETA (Constitutional Openness)
Angola	.0007166	-.0702013	-.3200688	.0406222
Bahamas	.0075115 .0001078	-.2274421	-.4184030	-.0601615
Bangladesh	.0002488	.0272023	.0973658	.0072085
Benin	.0516053	-.0413340	-.1749493	.0207287
Bolivia	8.9620910*	.6187909	2.0146170*	-.0020127
Brazil	.0002267 .0003381	-8.3744080*	-2.6481350*	-.3844951*
Burkina_Faso	.0067154	.0394518	-.1087835	-.0130703
Cambodia	.0069274 .0034781	-.0481804	-.1529677	.0171011
Cameroon	.0208853	-.2157882	-.7207117	.0419381
Central_African_Republic	.0110892	-.2189833	-.6587165	.0117866
Colombia	.0005130	-.1548565	-.4833771	-.0567693
Congo	.0413015 .0009598	-.3850099	-1.3077050	.2398572
Costa_Rica	.0136593	-.2769872	-.6379015	-.1656941
Cote_d'Ivoire	.0019870	-.0593779	-.2758243	.0194962
Cuba	.0042289	-.5386361	-1.0860960	.3919573*
Dominican_Republic	.0019664 .0004826	-.0812403	-.3192764	-.0557910
Ecuador	.0001176	.3081735	.8102643	.0056183
Equatorial_Guinea	.0011126	-.1169713	-.4122094	.0322455
Gabon	.1522817*	.1711187	-.6685356	.0439142
Ghana	.0005347 .0137034	.1163034	.3438676	-.0364480
Guatemala	.3561181*	.0575831	.2476534	.0019743
Guinea	.0022926 .0006122	.0284146	.1030019	-.0098054
Guinea-Bissau	.0009013	-.0875101	-.3865126	-.0018515
Guyana		-1.0434160*	-1.4450470	-.0884844
Honduras		.0606042	.2088298	.0406423
India		-.3086391	-.8037647	-.1589674
Indonesia		1.8352010*	4.3478920*	-.8015339*
Jamaica		-.1256440	-.4098691	-.0448759
Laos		-.0648590	-.2577357	.0398153
Liberia		-.0787318	-.3275460	-.0075288

continued on next page

Table 1. *Continued*

Country	Cook's D	DFITS	Studentized Residuals	DFBETA (Constitutional Openness)
Madagascar	.0001942	-.0365218	-.1820370	-.0071663
Malawi	.0017961	-.1112278	-.4295701	.0372841
Malaysia	.0318578	.4813599	1.7292280	-.0458660
Mexico	.0257349	-.4212987	-.4992597	.1030289
Mozambique	.0006290	-.0657531	-.2769595	.0258988
Myanmar	.0166842	.3435928	1.2462830	-.2654278*
Nepal	.0102482	-.2662077	-.6173123	-.0685949
Nicaragua	.0005981	.0640985	.2282151	-.0005407
Nigeria	.0005854	.0634027	.1852633	.0218529
Panama	.0028404	-.1398959	-.4461576	.0768336
Papua_New_Guinea	.0328179	-.4781337	-.8676463	-.3999225*
Paraguay	.0139624	.3154574	1.3882370	-.0407581
Peru	.0291394	-.4603132	-1.7257750	-.0368676
Philippines	.0097795	.2628267	1.2095440	-.0718326
Senegal	.0031359	-.1470298	-.4737885	-.0820381
Sierra_Leone	.0007936	-.0738782	-.3270929	-.0121195
Sri_Lanka	.0161829	-.3361593	-.9354922	-.0554712
Sudan	.0227365	.4012388	1.2604160	.1277443
Suriname	.1227448*	-.9352842*	-1.3865720	.3515229*
Tanzania	.0054596	.1944907	.6920272	-.0231806
Thailand	.0616776	.6967649*	2.7106970*	.3609526*
Togo	.0002896	-.0445845	-.1293643	-.0017014
Trinidad_and_Tobago	.0109488	-.2752900	-.6553529	-.0613377
Uganda	.0001723	-.0343868	-.1172380	-.0027101
Venezuela	.1496294*	1.0654650*	2.2968670*	.5180375*
Vietnam	.0000103	.0084186	.0281324	-.0053599
Zaire	.0007214	-.0703934	-.2181858	.0336810
Zambia	.0127022	.2968920	.7469044	.0815875

* denotes that case exceeds suggested cutoff point for influence statistic (see Bollen and Jackman 1990); Cook's D: 4/n; $|DFITS|$: $2(k/n)^{1/2}$; studentized residual: $\pm$ 2; $|DFBETA|$: $2(n)^{1/2}$; where *n* is the number of cases and *k* is the number of explanatory variables (including the constant); n = 58, k = 7.

Table 2a. Sensitivity Analysis: Neo-Malthusian Prior

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	1834.433	2495.689*	2242.577*	2562.667*	2570.854*
	(1430.272)	(1262.502)	(1256.019)	(1292.106)	(1458.265)
Constitutional Openness	-96.384*	-109.585*	-106.725*	-122.272*	-110.913*
	(61.255)	(56.638)	(56.985)	(58.067)	(60.974)
Constitutional Stability	-176.905	-220.211*	-197.476	-223.775*	-186.582
	(174.649)	(159.050)	(160.510)	(160.909)	(169.218)
Constitutional Age	22.054*	13.225	17.269	15.030	12.854
	(13.951)	(13.066)	(13.365)	(13.431)	(13.223)
Agricultural Population	-10.975	-18.771*	-15.728*	-18.169*	-19.674*
	(9.403)	(8.877)	(8.846)	(8.963)	(10.352)
Arable Land Per Agricultural Capita	-23.079	-234.890	-108.303	-294.678	-170.735
	(587.174)	(511.703)	(506.055)	(489.398)	(606.334)
Tropical Moist Forest Cover	.052*	.052*	.052*	.052*	.052*
	(.016)	(.015)	(.016)	(.016)	(.015)
Population Density	.491	—	—	—	—
	(1.624)				
Population Growth (1966-1980)	—	147.840	—	—	—
		(171.539)			
Population Growth (1971-1980)	—	—	80.476	—	—
			(144.677)		
Population Growth (1976-1980)	—	—	—	156.772	—
				(140.640)	
Rural Population Growth	—	—	—	—	134.860
					(196.808)
N	58	58	58	58	58
R^2	.59	.60	.60	.60	.60

* $p \leq .10$ (one-tailed); standard errors in parentheses.

Table 2a. *Continued*

Variable	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	1967.189*	1940.826*	2451.784*	2348.520*	2499.930*
	(1346.766)	(1338.305)	(1365.311)	(1550.436)	(1327.481)
Constitutional Openness	-101.852*	-104.190*	-126.934*	-108.165*	-106.998*
	(59.676)	(59.961)	(60.718)	(63.331)	(59.042)
Constitutional Stability	-148.644	-132.364	-184.118	-152.426	-201.017
	(172.037)	(172.491)	(171.037)	(185.026)	(168.485)
Constitutional Age	12.469	12.065	15.637	12.341	11.308
	(14.348)	(14.036)	(14.026)	(13.820)	(13.511)
Agricultural Population	-15.810*	-15.403*	-18.314*	-19.219*	-18.857*
	(9.353)	(9.262)	(9.392)	(10.486)	(9.762)
Arable Land Per Agricultural Capita	54.441	82.913	-327.415	-111.903	-250.055
	(554.594)	(544.034)	(543.953)	(649.345)	(590.435)
Tropical Moist Forest Cover	.052*	.052*	.052*	.052*	.052*
	(.016)	(.016)	(.016)	(.016)	(.015)
Population Density	.339	.368	.117	.211	—
	(1.556)	(1.630)	(1.661)	(1.851)	
Population Growth (1966-1980)	113.730	—	—	—	66.697
	(185.412)				(238.544)
Population Growth (1971-1980)	—	96.239	—	—	—
		(150.785)			
Population Growth (1976-1980)	—	—	158.161	—	—
			(156.090)		
Rural Population Growth	—	—	—	144.061	81.899
				(199.880)	(272.224)
N	58	58	58	58	58
R^2	.60	.60	.60	.60	.60

* $p \leq .10$ (one-tailed); standard errors in parentheses.

Table 2a. *Continued*

Variable	Model 11	Model 12	Model 13	Model 14	Model 15
Intercept	2549.823*	2567.585*	2508.596*	2440.810*	2423.498*
	(1371.209)	(1421.528)	(1456.873)	(1484.741)	(1502.807)
Constitutional Openness	-108.425*	-107.717*	-111.812*	-107.074*	-105.581*
	(60.496)	(62.270)	(64.488)	(66.019)	(66.542)
Constitutional Stability	-193.640	-205.663	-183.950	-171.089	-174.791
	(173.150)	(177.908)	(183.719)	(187.248)	(192.536)
Constitutional Age	13.036	13.519	11.912	11.303	11.372
	(13.727)	(13.715)	(14.658)	(14.840)	(14.556)
Agricultural Population	-19.665*	-19.633*	-19.405*	-19.643*	-19.604
	(10.140)	(10.405)	(10.181)	(10.492)	(10.597)
Arable Land Per Agricultural Capita	-166.509	-192.295	-252.012	-104.754	-92.609
	(601.821)	(627.679)	(641.093)	(641.464)	(668.063)
Tropical Moist Forest Cover	.052*	.052*	.052*	.052*	.052*
	(.015)	(.015)	(.016)	(.016)	(.015)
Population Density	—	—	.147	.139	.142
			(1.900)	(1.919)	(1.908)
Population Growth (1966-1980)	—	—	66.597	—	—
			(254.874)		
Population Growth (1971-1980)	12.264	—	—	16.193	—
	(178.648)			(186.971)	
Population Growth (1976-1980)	—	30.288	—	—	27.704
		(184.173)			(198.013)
Rural Population Growth	127.876	110.860	69.915	132.765	122.915
	(243.211)	(228.942)	(281.740)	(248.636)	(235.087)
N	58	58	58	58	58
R^2	.60	.60	.60	.60	.60

* $p \leq .10$ (one-tailed); standard errors in parentheses.

Table 2b. Sensitivity Analysis: Neo-Marxist Prior

Variable	Model 16	Model 17	Model 18	Model 19
Intercept	1976.929*	2641.599*	2332.510*	2475.587*
	(1365.150)	(1285.802)	(1413.065)	(1401.506)
Constitutional Openness	-95.915*	-113.558*	-105.018*	-116.078*
	(59.074)	(62.697)	(61.881)	(68.710)
Constitutional Stability	-142.757	-233.985*	-185.634	-228.078*
	(166.723)	(143.422)	(166.187)	(167.568)
Constitutional Age	20.320*	12.202	21.584*	14.476
	(14.246)	(14.184)	(14.453)	(16.411)
Agricultural Population	-12.219	-16.203*	-15.273*	-14.954*
	(9.508)	(8.634)	(9.978)	(9.648)
Arable Land Per Agricultural Capita	-106.647	-178.678	-82.938	-133.325
	(571.083)	(582.343)	(560.669)	(621.613)
Tropical Moist Forest Cover	.052*	.051*	.052*	.051*
	(.016)	(.015)	(.016)	(.015)
Agricultural-Forestry Products Exports	-7.400	—	—	4.133
	(13.931)			(17.167)
Debt Service Ratio[a]	—	10.736	—	9.150
		(14.648)		(17.905)
Gross National Product Per Capita	—	—	-.081	—
			(.253)	
N	58	52	58	52
R^2	.59	.63	.60	.63

[a] the *n* size for models that include the debt service ratio decreases to fifty-two due to missing data for six cases (Angola, Cambodia, Cuba, Mozambique, Suriname, and Vietnam).

* p ≤ .10 (one-tailed); standard errors in parentheses.

Table 2b. *Continued*

Variable	Model 20	Model 21	Model 22
Intercept	2465.260*	2836.442*	2476.109*
	(1399.639)	(1447.735)	(1563.790)
Constitutional Openness	-103.938*	-132.211*	-114.747*
	(64.318)	(66.864)	(75.402)
Constitutional Stability	-192.936	-195.398	-214.766
	(172.537)	(153.608)	(173.040)
Constitutional Age	23.362*	13.058	13.494
	(15.595)	(15.238)	(16.895)
Agricultural Population	-14.742*	-17.847*	-15.763*
	(10.038)	(11.062)	(11.985)
Arable Land Per Agricultural Capita	-285.467	-328.085	-54.604
	(577.900)	(613.846)	(653.945)
Tropical Moist Forest Cover	.053*	.051*	.051*
	(.016)	(.015)	(.015)
Agricultural-Forestry Products Exports	-9.396	—	4.703
	(14.440)		(17.817)
Debt Service Ratio	—	12.833	10.041
		(16.170)	(19.436)
Gross National Product Per Capita	-.095	-.071	-.047
	(.288)	(.287)	(.307)
N	58	52	52
R^2	.60	.63	.64

* p ≤ .10 (one-tailed); standard errors in parentheses.

Table 2c. Sensitivity Analysis: Neoclassicist Prior

Variable	Model 23	Model 24	Model 25	Model 26
Intercept	1429.094	2171.229*	1667.011	1339.851
	(1417.165)	(1356.236)	(1350.736)	(1431.388)
Constitutional Openness	-95.643*	-96.088*	-87.354*	-93.773*
	(56.591)	(60.352)	(60.744)	(60.760)
Constitutional Stability	-65.797	-250.669*	-127.270	-69.882
	(202.780)	(165.580)	(167.264)	(213.182)
Constitutional Age	22.167*	20.707*	18.203	22.427*
	(15.354)	(13.952)	(14.138)	(15.980)
Agricultural Population	-11.184	-11.632*	-11.251*	-10.446
	(8.789)	(8.926)	(8.446)	(9.131)
Arable Land Per Agricultural Capita	-29.062	11.718	-37.941	10.624
	(543.463)	(537.913)	(567.230)	(551.457)
Tropical Moist Forest Cover	.053*	.052*	.052*	.053*
	(.015)	(.016)	(.015)	(.015)
Coups d'Etat	241.121	—	—	243.726
	(228.542)			(249.628)
Guerrilla Warfare	—	18.093	—	4.34
		(43.096)		(45.641)
Revolutions	—	—	72.058	—
			(69.388)	
N	58	58	58	58
R^2	.60	.60	.60	.60

* $p \leq .10$ (one-tailed); standard errors in parentheses.

Table 2c. *Continued*

Variable	Model 27	Model 28	Model 29
Intercept	1420.702	1738.070	1307.595
	(1436.626)	(1444.606)	(1512.720)
Constitutional Openness	-92.403*	-90.812*	-88.235*
	(61.829)	(65.427)	(65.134)
Constitutional Stability	-83.505	-135.132	-63.660
	(212.006)	(180.067)	(223.717)
Constitutional Age	20.802*	18.556	19.717
	(15.960)	(14.954)	(17.363)
Agricultural Population	-10.329	-11.602	-9.671
	(8.954)	(9.151)	(9.695)
Arable Land Per Agricultural Capita	-24.012	-32.725	-49.374
	(564.882)	(581.471)	(577.537)
Tropical Moist Forest Cover	.053*	.052*	.053*
	(.015)	(.015)	(.015)
Coups d'Etat	98.139	—	107.131
	(257.986)		(270.534)
Guerrilla Warfare	—	.810	-1.085
		(46.429)	(47.252)
Revolutions	58.821	69.011	60.225
	(74.328)	(80.236)	(84.645)
N	58	58	58
R^2	.61	.60	.61

* $p \leq .10$ (one-tailed); standard errors in parentheses.

Table 2d. Sensitivity Analysis: Regionalist Prior

Variable	Model 30	Model 31	Model 32
Intercept	1645.492	2197.054*	1149.179
	(1504.702)	(1493.407)	(1574.756)
Constitutional Openness	-91.764*	-101.360*	-103.301*
	(66.119)	(67.887)	(65.303)
Constitutional Stability	-133.030	-206.066	-111.606
	(187.412)	(181.281)	(173.905)
Constitutional Age	16.507	21.287*	17.407
	(15.742)	(16.377)	(15.041)
Agricultural Population	-6.076	-13.628	-3.228
	(11.904)	(10.450)	(14.077)
Arable Land Per Agricultural Capita	-14.086	-61.325	-91.553
	(583.640)	(638.105)	(558.519)
Tropical Moist Forest Cover	.052*	.052*	.052*
	(.016)	(.015)	(.016)
Africa	-316.841	—	—
	(358.175)		
Asia-Pacific	—	240.476	—
		(606.514)	
Latin America-Caribbean	—	—	464.684
			(697.623)
N	58	58	58
R^2	.60	.60	.59

* $p \leq .10$ (one-tailed); standard errors in parentheses.

Table 3a. Extreme Estimates of the Effect of Constitutional Stability on Tropical Moist Forest Deforestation vis-à-vis Four Alternative Priors

Alternative Prior	Minimum Estimate	Maximum Estimate[a]
Neo-Malthusian	-223.775	-132.364T
(standard error)	(160.909)	(172.491)
[*t* statistic]	[-1.391]*	[-.767]
{marginal probability}	{.085}	{.224}
Neo-Marxist	-233.985	-142.757T
	(143.422)	(166.723)
	[-1.631]*	[-.856]
	{.055}	{.198}
Neoclassicist	-250.669	-63.660T
	(165.580)	(223.717)
	[-1.514]*	[-.285]
	{.068}	{.389}
Regionalist	-206.066	-111.606T
	(181.281)	(173.905)
	[-1.137]	[-.642]
	{.131}	{.262}

[a] T = tight bounds.

* $p \leq .10$ (one-tailed).

Table 3b. Extreme Estimates of the Effect of Constitutional Age on Tropical Moist Forest Deforestation vis-à-vis Four Alternative Priors

Alternative Prior	Minimum Estimate	Maximum Estimate[a]
Neo-Malthusian	11.303	22.054T
(standard error)	(14.840)	(13.951)
[*t* statistic]	[.762]	[1.581]*
{marginal probability}	{.225}	{.006}
Neo-Marxist	12.202	23.362T
	(14.184)	(15.595)
	[.860]	[1.498]*
	{.197}	{.071}
Neoclassicist	18.203	22.427T
	(14.138)	(15.980)
	[1.288]	[1.403]*
	{.102}	{.084}
Regionalist	16.507	21.287T
	(15.742)	(16.377)
	[1.049]	[1.300]*
	{.150}	{.100}

[a] T = tight bounds.
* $p \leq .10$ (one-tailed).

Table 3c. Extreme Estimates of the Effect of Agricultural Population on Tropical Moist Forest Deforestation vis-à-vis Four Alternative Priors

Alternative Prior	Minimum Estimate	Maximum Estimate[a]
Neo-Malthusian (standard error) [*t* statistic] {marginal probability}	-19.674 (10.352) [-1.901]* {.032}	-10.975T (9.403) [-1.167] {.125}
Neo-Marxist	-17.847 (11.062) [-1.613]* {.057}	-12.219T (9.508) [-1.285] {.103}
Neoclassicist	-11.632 (8.926) [-1.303]* {.099}	-9.671T (9.695) [-.998] {.162}
Regionalist	-13.628 (10.450) [-1.304]* {.099}	-3.228T (14.077) [-.229] {.410}

[a] T = tight bounds.
* $p \leq .10$ (one-tailed).

Table 3e. Extreme Estimates of the Effect of Tropical Moist Forest Cover on Tropical Moist Forest Deforestation vis-à-vis Four Alternative Priors

Alternative Prior	Minimum Estimate	Maximum Estimate[a]
Neo-Malthusian	.052	.052T
(standard error)	(.016)	(.015)
[*t* statistic]	[3.265]*	[3.392]*
{marginal probability}	{.001}	{.001}
Neo-Marxist	.051	.053T
	(.015)	(.016)
	[3.420]*	[3.388]*
	{.001}	{.001}
Neoclassicist	.052	.053T
	(.016)	(.015)
	[3.333]*	[3.430]*
	{.001}	{.001}
Regionalist	.052	.052T
	(.016)	(.016)
	[3.329]*	[3.262]*
	{.001}	{.001}

[a] T = tight bounds.

* $p \leq .10$ (one-tailed).

Table 3d. Extreme Estimates of the Effect of Arable Land Per Agricultural Capita on Tropical Moist Forest Deforestation vis-à-vis Four Alternative Priors

Alternative Prior	Minimum Estimate	Maximum Estimate[a]
Neo-Malthusian	-327.415	82.913
(standard error)	(543.953)	(544.034)
[*t* statistic]	[-.602]	[.152]
{marginal probability}	{.275}	{.440}
Neo-Marxist	-328.085	-54.604T
	(613.846)	(653.945)
	[-.534]	[-.083]
	{.298}	{.467}
Neoclassicist	-49.374	11.718
	(577.537)	(537.913)
	[-.085]	[.022]
	{.466}	{.492}
Regionalist	-91.553	-14.086
	(558.519)	(583.640)
	[-.164]	[-.024]
	{.435}	{.491}

[a] T = tight bounds.
* $p \leq .10$ (one-tailed).

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