



Annu. Rev. Environ. Resour. 2006. 31:2.1–2.37  
doi: 10.1146/annurev.energy.29.102403.140729  
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## NEOLIBERALISM AND THE ENVIRONMENT IN LATIN AMERICA

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**Key Words** free trade, neoliberal

■ **Abstract** This review examines how neoliberal policies that include free trade and less government have altered environmental management of industry, forests, water, agricultural land, and fisheries in Latin America. We examine theories and case studies about the privatization and pricing of environmental services and common property resources, the environmental impacts of free trade, and the transfer of environmental management to local or nongovernmental institutions. We conclude that neoliberalism has had some profound influences on the environment and on environmental management in Latin America and that the implementation and impacts of neoliberal policies on local environments have varied greatly by nation and by place as a result of different political, institutional, economic, environmental, and social conditions. Although many studies of neoliberalism and environment paint a negative picture, there are places and people that have adapted well to and benefited from neoliberal policies. Unfortunately, judgements on the success of neoliberal policies are limited by data and by the lack of detailed and balanced case studies.

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## INTRODUCTION

Some of the most significant changes in environmental management over the past 25 years have been those associated with so-called neoliberal policies. Neoliberalism is generally associated with free trade and reduced government and with a belief in market- rather than state-led solutions to social and environmental problems. In terms of the environment, neoliberalism has been linked to the privatization and commodification of unowned, state-owned, or common property resources such as forests, water, and biodiversity; payments for environmental services; deregulation and cuts in public expenditure for environmental management; the opening up of trade and investment; and transfer of environmental management to local or nongovernmental institutions. The theoretical basis and empirical impacts of these changes to environments, economies, and peoples are highly contentious and, in some cases—such as that of water privatization, have provoked radical social responses (1).

Latin America has provided a broad arena for the experimentation and implementation of neoliberal processes and policies. Latin America is the site of the first major neoliberal experiment in Chile from the 1970s and of the subsequent spread of continent-wide privatization of land, water, ecosystems, and state institutions. The North American Free Trade Agreement (NAFTA) between Canada, the United States, and Mexico provides an important case of trade liberalization that is now promoted as a model for the Free Trade Area of the Americas (FTAA). However, free trade, privatization, and the dismantling of state institutions are perceived to have produced widespread destruction of livelihoods and landscapes to the point where even the promoters of neoliberalism, such as the World Bank, are trying to cushion the impact. In Latin America, millions of Bolivians, Argentines, and Brazilians have taken to the streets and the ballot box to overthrow neoliberal governments and policies, and the FTAA is stalled by opposition (2).

A growing literature on neoliberalism in Latin America provides varied insights into this important moment in the management of environment and resources and provides useful lessons that can make future trade agreements, privatizations and modifications to governance more environmentally and socially sustainable. In this

review, we analyze the literature on neoliberalism and the environment in Latin America. We have organized the core of the paper around major environmental resources—water, forests, fisheries, agricultural land—and the industrial ecologies of mining and manufacturing. The review is not comprehensive and is mainly focused on publications in English and on scholars who are making a sustained contribution to the debate about neoliberalism. We begin with a definition of neoliberalism, followed by a review of major theoretical positions, and a general history of neoliberal reforms in Latin America.

## DEFINING NEOLIBERALISM

Neoliberalism is simply defined as a political philosophy or world view of free markets and less government. The mainstream argument in favor of neoliberalism is framed in terms of the efficiency of the market in contrast to the inefficiencies and high costs of government interventions (3). It originates in the analysis of Friedrich Hayek and Milton Friedman and colleagues at the University of Chicago, endorsed by Thatcher in Britain and Reagan in the United States, adopted enthusiastically by Pinochet in Chile, and promoted as a set of policy prescriptions as the “Washington consensus” by international financial institutions as they implemented structural adjustment in the developing world. The Washington consensus included fiscal discipline; refocusing public spending on education, health, and infrastructure; tax reform; interest and exchange at market rates; reduced or uniform trade tariffs; openness to foreign investment; privatization of state enterprises; deregulation; and securing of property rights (4).

Neoliberal policies often imply reregulation rather than deregulation, replacing controls on the market and the behavior of firms (such as tariffs and pollution limits) with rules that ensure the smooth functioning of the market (such as those that protect property or investments) (5). In “softer” versions of neoliberalism, such rules can include those that protect environmental quality to ensure that economic sectors do not undermine essential components of production, such as a healthy workforce or clean water (6).

The “neo” refers to an earlier period of liberalism that defended individual and private property rights and was linked to the economic beliefs of Adam Smith who argued for unrestricted trade, competition, and reduced government intervention in the economy. In Latin America, the liberals came to power in the nineteenth century, pushing export-oriented economies and foreign investment with a concentration of land, production, and wealth within a few families or international firms. For example, Porfirio Díaz (1876–1889 and 1884–1911) opened up Mexico to foreign investment with mines, railways, ranches, and oil concentrated in the hands of U.S. and U.K. businessmen. Beginning in 1880, liberal Argentinean governments reoriented the economy to export grain and cattle products to Europe. In Guatemala from 1871, liberal politicians fostered an export boom in coffee, and in Bolivia the liberal period from 1889 saw a boom in the mining industry (7–9).

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In Latin America, contemporary neoliberal processes include the dismantling of protectionist tariff and trade barriers established during the import substitution period when government sought to substitute expensive manufactured imports with domestic industrial goods. Neoliberalism also brings (a) the signing of regional and hemispheric free trade agreements; (b) cuts in public expenditure that include the elimination of subsidies, the sale of public utilities, and job layoffs in the public sector; (c) the titling and privatization of property rights in land, water, forests, fisheries, and other resources that had previously been commonly or state owned; and (d) the rolling back of environmental and labor regulations. In some cases, Latin American neoliberalization has coincided with the emergence of more democratic political systems out of long-standing authoritarian or one party governments and with the decentralization of responsibility from national to state and municipal levels.

The environmental effects of neoliberalism are both direct and indirect as well as negative and positive. Although environment was not part of the original neoliberal world view of Friedman, it is inextricably linked to neoliberal policies because many economic sectors are directly dependent on the natural environment (e.g., for water or waste disposal) and because reduced state intervention may mean less environmental regulation. Nature and the environment also complement the neoliberal market agenda in that they provide new opportunities for commodification and privatization and thus for capital accumulation—what left theorists have called “accumulation by dispossession” (10) wherein even nature conservation becomes a private-sector profit-making activity (11).

In terms of free trade, critics argue that changes in the composition and amount of trade can result in increased resource demands and pollution, whereas advocates suggest that environmental protection can improve as a result of environmental provisions of trade agreements or increases in average incomes. Government cutbacks produce reductions in subsidies that change incentives for agricultural production and mineral extraction and alter the pattern of land-use change or water use. General cuts in public expenditure may constrain environmental enforcement, shift environmental management to nongovernmental or local authorities, and increase poverty in ways that promote environmental degradation.

Establishing private property rights directly influences the management of land, water, forests, and fish, as well as the newly defined resources of biodiversity and carbon, especially when privatization is associated with the commodification, sale of nature’s services, or allocation of rights to pollute. As elaborated below, whereas some argue that privatization and monetization promote more efficient use and conservation of resources, others believe that nature is best managed as common property or regulated by governments and that the market does not place a high enough value on environmental quality or ecosystems.

The idea of payments for environmental services can also be associated with a neoliberal agenda in that these are closely linked to the granting of property rights to nature so that they can then be used as a basis for sale or compensation (12).

Upstream holders of forest rights are to be paid for protecting watersheds by those who hold water rights downstream. Reforestation is paid for as a service to those who wish to obtain credit for carbon sequestration.

It has been argued that neoliberalism is perhaps best viewed as a set of processes, rather than an end point, contingent on history and place and thus produces diverse rather than monolithic outcomes (13, 14). As we show below, the effects of neoliberal policies on the environment in Latin America depend not only on the specifics of the policy changes but also on the past experience of environmental management and on the nature of local landscapes and livelihoods.

## THEORIZING NEOLIBERAL ENVIRONMENTAL MANAGEMENT

The basis for debates about neoliberalism and environment includes theories from environmental economics, political science, the new institutionalism, geography, and political ecology. A large part of the argument for free trade and private markets derives from economic theories that suggest that the costs of pollution and environmental degradation should be included in the market and that private property is preferred for efficient resource management—what has been called (free) market environmentalism.

The underlying economic theory sees environmental degradation as an ecological and social cost not included in the cost of production (a negative externality). Externalities can be dealt with by government regulation through standards and fines as well as private litigation for damages that force producers to reduce or pay for their environmental impacts. Free-market economists argue that this “command and control” policy is inefficient because it limits flexibility, provides no incentive to improve environmental performance beyond the limits set by government, and is expensive (15). Free-market approaches are based on internalizing costs through the polluter pays principle or by allocating quotas for pollution or resource use that could be used, saved, or traded (16). This is the basis, for example, of the Kyoto protocol, wherein a cap was set to reduce greenhouse gas emissions to 1990 levels and any reduction provides carbon credits that can be traded.

Market environmentalism usually assumes the establishment of private property rights to pollute or otherwise use resources, many of which were previously unowned, state owned, or commonly owned. Neoliberal policies that assign private property rights over resources rest on the theory that the environment is best managed when resource rights are definable, defendable, and divestible. This partly responds to Hardin’s theory of the tragedy of the commons (17), which argued that resources held in common will be overused by individuals who see immediate personal benefit but not the longer-term damage of accumulated exploitation by many. Private owners, it is argued, have a greater incentive to protect resources that they own. But as discussed below, Ostrom and colleagues show that Hardin’s

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case was for resources with unlimited access, whereas most common property regimes are held in common by a community and exclude use by those outside the community (18, 19).

Neoliberalism thus assumes that land and other resources such as forests are most efficiently managed by private owners. Timber and wild species such as fish have long been commodified and sold in the market. Other aspects of the environment are now becoming commodified as property rights are established over biodiversity and the atmosphere so that their benefits can be valued and traded. The assumption is that the market will set a price that reflects the value of protecting the environment or using it sustainably. Thus market-based mechanisms have been endorsed as the most effective method of protecting ecosystems whereby a forested watershed can generate income as a store for carbon and water, as an ecotourism or park destination, as a biodiversity prospecting zone of value to pharmaceutical and food industries, or as a source of sustainability-produced wood products (20).

The debate about the impacts of trade uses several approaches to analyze environmental impacts. One approach for estimating the environmental impacts of free trade uses scale, technique, and composition effects to measure the likely consequences of free trade where scale generally expands economic activity, technique changes the technology or method of production, and composition changes in the structure of the economy (e.g., from heavy manufacturing to electronics). Antweiler et al. (21) show how higher levels of pollution derived from increased scale of production and composition changes (moving to a more pollution intense industry) can be offset by positive technique effects, through investment in cleaner technologies, assuming that trade raises gross domestic product (GDP). The authors conclude that, in the case of certain pollutants, free trade is good for the environment.

A second approach is based on the environmental Kuznets curve and assumes that wealthier societies are more likely to demand and implement environmental protection because they can afford to pay for it and because higher incomes are associated with greater concern for environmental quality (22). Grossman & Krueger (23) concluded that pollution initially increases as industrialization and GDP increase but then falls with higher GDP when the economy shifts to cleaner technologies and service-based activities and when residents demand investment in cleaner habitats. Most countries in Latin America are below the average income level at which pollution would theoretically begin to decrease. The environmental Kuznets curve is starting to be used to model environmental effects of growth in other sectors, such as agriculture and forestry, although with mixed results, prompting some authors to try to combine additional variables associated with property rights and income to explain environmental conditions (22). Forest transition theory uses similar assumptions to argue that development eventually produces a decline in deforestation as increased agricultural productivity and urban employment opportunities reduce pressure on forest lands (24).

Critics of neoliberal environmental management argue that free trade, deregulation, privatization, and commodification are more likely to destroy the environment

than protect it. For example, the Environmental Kuznets curve hypothesis is rejected because it only works for a limited number of countries, for per capita not absolute pollution data, and for only a few pollutants (e.g., SO<sub>2</sub> but not CO<sub>2</sub> or water quality) (25). Critics of trade argue that liberal trade and investment rules are likely to result in a race to the bottom in the search for pollution havens as companies flee tough environmental standards in the developed world for lower or unenforced environmental regulations in developing regions (26). Forest transition theory is criticized by Koop & Tole (27) who argue that the highly unequal distribution of income in developing countries means that, even when national economic indicators improve poverty, inequality will continue to drive deforestation.

The privatization of environmental commons has been condemned from human rights theory [e.g., that clean water or air are a common good that should not be commodified (28)] and by those who argue that the state or common property institutions are better able to protect nature than private interests. For example Ostrom (18, 19) has documented commons systems that have worked for centuries to manage water and forests in cases where boundaries and members of the commons community are well defined and there are strong institutions for conflict resolution and rule making.

Left theorists argue that neoliberal processes are a new form of imperial or colonial control whereby new resources are identified, expropriated and assigned to private property, commodified, and exported to support capital accumulation by powerful interests (10). Political ecology provides a framework that identifies the changes in political and economic structures, power relations in markets and property rights, as well as ideas and discourses that promote neoliberal policies (29). Thus the selling of rights to prospect for biological material of use to the pharmaceutical industry is seen as a slippery slope toward the wholesale privatization, patenting, and marketing of biodiversity that is not easily valued or separated from the livelihoods of indigenous groups (30).

## NEOLIBERALISM IN LATIN AMERICA

The timing and nature of neoliberal policy reform in Latin America varies considerably among countries and coincides with moves from mostly authoritarian (15 of 18 countries) to democratic rule by 1999 (31). According to Morley et al. (32), the southern cone countries, especially Chile, began to open up trade and investment in the early 1970s, although there were reversals following the debt crisis in 1982. The structural reform packages of the International Monetary Fund forced more widespread adoption of freer trade and privatization from 1985, accelerating in the 1990s with average protectionist tariffs declining from 46% in 1985 to 12% in 1995. State-owned enterprises, including utilities and manufacturing, played an important role in the import substitution development model adopted by many Latin American countries in the 1950s. Chile privatized many government firms beginning in 1974, and the Mexican government sold off more than 1000

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government-owned or -managed companies (parastatals) after 1988. Each country retained state involvement in the key sectors of mining (Chile) and oil (Mexico). Argentina, Bolivia, and Peru began significant privatization in the 1990s.

Linking these reforms to specific or national level environmental impacts is very difficult, although most general reforms such as removal of tariffs or cuts in government expenditure have had indirect environmental impacts. Mexico and Chile appear to have made the deepest reforms in terms of environment and resources and hence provide many of the case studies discussed in this review.

### INDUSTRIAL ECOLOGIES OF NEOLIBERALISM

Neoliberal processes alter the impacts of industrial activities on the environment mainly through changes in trade, investment, and environmental regulation. The majority of studies on industry and environment under neoliberalism in Latin America focus on the impacts of NAFTA in Mexico, especially on the manufacturing enterprises known as “maquiladoras.” Maquiladoras (or maquilas) predate NAFTA, originating in the 1958 Border Industrialization Program that promoted in-bond export manufacturing zones along the U.S.-Mexican border where companies could take advantage of cheap Mexican labor to assemble products without paying high tariffs to reimport them back into the United States. NAFTA opened up foreign investment to the whole country, and maquila type operations have now spread to remote areas of Mexico, such as the Yucatan where labor is even cheaper. Many other countries, such as Guatemala and Costa Rica, have also established low-tariff export manufacturing zones. Advocates of free trade argued that economic growth would result in environmental improvements and that the NAFTA environmental side agreement would further support environmental quality.

In the case of Mexico, authors such as Cooney (33) and Roberts & Thanos (34) assert that predictions of environmental improvement in Mexico due to NAFTA have not come true and that maquiladoras have led to greater environmental degradation and health risks in the U.S.-Mexico border region. They argue that a lack of legislation and enforcement, together with a weak institutional framework, have allowed foreign-owned manufacturing companies to continuously violate environment (and labor) laws. Together with lower environmental standards than on the U.S. side of the border, maquilas in Mexico have caused serious environmental damage in the border cities, evidenced through increased air pollution, water pollution and depletion, and inadequate waste management.

In contrast, a number of studies find no evidence of pollution havens nor a race to the bottom in Mexico (26). A survey conducted by Husted & Rodriguez-Oreggia (35) showed that foreign-owned maquiladoras tend to be cleaner and more sensitive to local regulation than local industry. This is attributed to several factors, including compliance with international corporate requirements and Organization for Economic Cooperation and Development standards; the need to have more efficient technology to compete in the international market; external pressures



from investors' export markets demanding environmentally sensitive production; increased enforcement of environmental regulation in the manufacturing sector; and higher costs of energy and water.

Whatever the environmental impact of individual manufacturing plants, there is general agreement that the scale effects of NAFTA have had serious environmental effects in terms of the overall growth of industrial activity and the environmental footprint of rapidly increasing employment in the sector (26, 35, 36). An increase in the number of border maquiladora plants, from 2000 to 3500, between 1995 and 2000 was concentrated mostly in five cities (Tijuana, Mexicali, Ciudad Juárez, Matamoros, and Reynosa) where environmental degradation became increasingly evident.

Several authors highlight the role of employment and associated rapid and unplanned urban growth in environmental degradation at the border. Employment in Mexican border states between 1995 and 2000 doubled to approximately 1.2 million workers, most of whom emigrated from southern Mexico. The growing population has increased water, energy, and transport demands and according to Pope (37) "All along the border, more people are competing for limited supplies of drinking water and electricity, generating more solid refuse and sewage, and being exposed to ever higher levels of toxic wastes." Liverman et al. (38) document a range of environmental problems in border cities including air pollution from dirt roads and expanding auto ownership in border cities such as Ciudad Juárez, untreated sewage and unclean drinking water, as well as an accumulation of household and industrial waste in cities where infrastructure has not kept up with urban sprawl. Border industrialization and population growth have increased vulnerability to flooding in some cities, for example, Tijuana and Nogales where unplanned settlements encroach on floodplains or are located on steep devegetated slopes (39).

Studies have analyzed overall environmental performance in Mexico since NAFTA was signed. For example, an econometric analysis of environmental compliance in the manufacturing industry in Mexico showed that 51% of firms generally complied (and sometimes over-complied) with environmental regulations, even when monitoring and enforcement are weak or nonexistent, as their pollution abatement decisions are strongly affected by extralegal factors (36). Of the analyzed national companies, 42% were occasionally compliant, and only 7% had poor and very poor compliance. The study also highlights the nonregulatory incentives that encourage environmental performance in export industries, such as the international standards of ISO 14001, market competitiveness, access to credit through commercial banks, and public shareholding.

Aguayo & Gallagher (40) found that between 1988 and 1998 Mexican manufacturing industry reduced its energy intensity by 15%. A detailed analysis of five main manufacturing sectors shows energy intensity reductions in cement (-12.5%), iron and steel (-36.2%), pulp and paper (-35%), petrochemicals (-20%), and sugar (-20%). The authors conclude that the increasing trend of energy intensity during the 1970s and early 1980s was more than reversed during the period studied owing to a combination of the composition (shifts in economic activities) and

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technological factors. These ranged from reduction of value-added activities (as “value-added” items were now imported) to the energy efficiency improvements needed to remain competitive with higher energy prices (as subsidies were reduced following neoliberal budget adjustment policies). The authors also highlight the positive effects of privatization in the reduction of energy intensity within the sugar, iron, and steel industries but note that efficient technology and equipment is only accessible to large oligopolies and export-oriented sectors. Lack of credit and local adaptive technology makes it impossible for medium and small enterprises to increase their efficiency. Furthermore, they argue, cleaner national production of manufactured products is partially compensated by increased import of pollution-intensive products from developed countries, making difficult to evaluate the net environmental effect (see also Reference 41). Increased production, especially when it is concentrated in industrial belts, can increase environmental pollution. For example, the improvement in energy intensity described by Aguayo & Gallagher (40), though positive, has not been enough to counteract the overall growth in total energy consumption of the manufacturing sector, which grew 24.86% between 1988 and 1998 (42). This, in turn, has resulted in industrial CO<sub>2</sub> emissions increasing 17%, including a 12% for the industry in general, 25% for the energy industry, and 51% for electricity generation (43).

Controversy over potential environmental impacts during the NAFTA negotiations resulted in the establishment of institutions designed to mitigate any environmental damages and to prevent the establishment of pollution havens (38). The trilateral Commission on Environmental Cooperation (CEC) was established to address regional environmental concerns, help prevent potential trade and environmental conflicts, and to promote the effective enforcement of environmental law (<http://www.cec.org>). The CEC has coordinated research studies on a variety of topics, including biodiversity and pesticides, and has evaluated citizens’ submissions regarding government failures to enforce environmental laws under Articles 14 and 15 of the North American Agreement on Environmental Cooperation. Citizens can become whistle-blowers on lack of environmental enforcement and trigger investigations that can eventually produce a “factual record,” which requires a response from the relevant government. Examples include a claim from several Canadian environmental groups that logging permitted by the British Columbia provincial government was violating the fisheries act through damage to fish habitat and a claim from Mexican citizens’ groups that a hazardous waste processing plant (Molymex) was breaking the Mexican environmental laws. Although 62 submissions have been received since 1995, only 10 factual records have been published, and there is little evidence that the resultant investigations have had a significant impact on environmental practices in North America (44).

The Border Environment Cooperation Commission (BECC) certifies environmental infrastructure projects as to their sustainability, thus making them eligible for preferential grants and loans (<http://www.cocef.org/>). BECC has provided more than 30 million dollars in technical assistance to 131 communities and has certified 105 projects (69 in the United States and 36 in Mexico) mostly for water provision

or water or waste treatment facilities (45). Although BECC has been praised for providing opportunities for public participation and for some environmental improvements, it is also accused of bias toward the United States and larger projects as well as of tokenism in participation (46, 47).

These attempts to mitigate the environmental impacts of NAFTA contrast with the potential of NAFTA's trade provisions to paralyze environmental protection efforts in North America. Designed to protect investors, Chapter 11 sets out to protect investors against the taking or devaluation of their property through direct expropriation or regulations that reduce the benefits of an investment (48). In the case of a landfill, built by a U.S. company (Metalclad) in Mexico with federal and state permission, the landfill was prevented from operation by the municipality because of concerns about water pollution. This was seen as a taking by a Chapter 11 panel who awarded Metalclad \$15 million in compensation. When California banned a gasoline additive, the Canadian manufacturer (Methanex) sued the United States for \$970 million in lost business. Some scholars see this clash between environmental protection and trade as an example of the larger regulatory "chill" associated with the neoconservative property rights movement in the United States (49).

Foreign investment has also fostered industrialization in other Latin American countries. For example, in Costa Rica maquila development grew from 10 to 186 companies between 1986 and 1995. Quijandria et al. (50) conclude that this industrial growth was undertaken with little environmental control from the government and within the context of a "serious lack of information" on the environmental performance of the industry. They found that the legal framework for the free trade zones lacked specificity as to which government agencies were accountable for enforcement and monitoring of environmental conditions and that the government's laissez-faire approach did little to increase enforcement and compliance because they feared that stricter control will lead to an exodus of companies to other countries. Additionally, lack of coordination between the ministries attracting external investment (commerce and industry) and the environment ministry meant that the former was unaware of the environmental requirements applicable to the export trading zones. Because few companies at the time acknowledged the benefits of becoming cleaner (in terms of market access and environment protection), they did not assess it as a competitive factor. The combination of all these factors meant that only 2 of the 183 companies in the free trade zone had an environmental program by 1996; and these two were motivated by "green consumerism" opportunities and corporate standards, not by government action. However, by the mid-1990s, the Costa Rican government was beginning to reward companies that were taking a proactive approach to environmental protection in the free zones.

The mining sector has been the focus of several analyses of neoliberalism, especially in Chile and Peru where the mineral sector is economically important. As Chile and other countries opened the doors to foreign direct investment in what had been a heavily protected or state-owned mining sector, there was a boom in the mining and extractive industry. By the end of the 1990s, mining represented over 40% of total export earnings in countries such as Chile, Bolivia, and Peru

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(51). Total exploration investment in Latin America grew from US\$100 million at the end of the 1980s (representing 10% of global investment) to US\$1170 million by the end of 1990s (29% of global investment)—a 10-fold growth, with Chile receiving 51% of this investment.

The mining industry worldwide has been blamed for environmental problems such as land and soil degradation, depletion and pollution of rivers and aquifers, air pollution, high-energy use, inadequate disposal and clean up of liquid and solid residue, impacts on flora and fauna, and workers health (51). The substantial restructuring of the mining industry in Latin America in recent years provides an important test of theories about the globalization of trade and investment and impacts on environmental management (52).

Several authors (53, 54) suggest that neoliberal policies, especially privatization, foreign investment, and export orientation, have brought improvements in environmental policies and practices to the mining industry in most developed countries. They argue that private mining firms are more efficient in extracting minerals and thus better at protecting the environment because they have better production methods, technologies, and environmental practices (in essence that there are scale, technique, and composition effects) and because they wish to avoid liability risks, comply with home country regulations, and conform to export market expectations. As a result, companies that remained state or locally owned had to adapt to higher production and environmental standards to remain competitive in the international market.

Borregaard et al. (53) studied the Chilean copper mining industry following privatization and found that foreign mining companies adopted environmental policies that go far beyond national regulations while introducing environmental measures between 5–10 years earlier than their national counterparts (both private and public). The authors cite studies that show that environmental impact assessments conducted by foreign mining companies were instrumental in defining the environmental impact assessment framework for the Chilean Environmental Law and that foreign environmental technology and management systems have enabled the transfer and diffusion of technology within the country. Improvements in Chilean mining practices occurred in the context of the transition to more democratic government from the military regime that had repressed public, including environmental, protest. Additional pressure came from several law suits filed and processed against mining companies during the late 1980s and from lobbying by U.S. copper producers to raise import tariffs of Chilean copper on environmental grounds during the early 1990s (53).

The International Institute for Environment and Development (IIED) (51), finding that historical problems of waste, water acidification, high-energy consumption, and atmospheric pollution have been greatly minimized, except in old pre-1990 mining sites, agrees with the positive influences of foreign investment on environmental performance in Chile. However, they also find that water extraction in northern arid areas (where mining activities are concentrated) is of considerable concern and has created conflicts with other traditional users such as farmers

and indigenous groups. The use of underground water in some northern regions in Chile has reduced the availability of surface water for irrigation and even for supplies to small towns.

Bridge (55) and Bury (56) have analyzed neoliberalism, mining, and the environment in Guyana and Peru, emphasizing the role of broader institutional changes in land and property rights in environmental conditions. For example, Bridge discusses how structural adjustment in Guyana in the 1990s increased exports and foreign direct investment in the gold industry with associated scale effects on the environment. He highlights the significance of changes in laws that opened access to mining claims in driving more fundamental shifts in waste generation as well as land and water use. Bury's case study of mining in Cajamarca, Peru, examined the neoliberal policies of the 1990 Fujimori presidency, which opened the country to foreign investment, guaranteed investment and tax stability, and set out to revise land tenure in favor of private ownership. In 1996, Fujimori specifically increased the security of mining claims so as to attract transnational companies that increased exploration, and by 2000 had increased the number of claims from 4 million to 22 million, generated more than \$10 billion in foreign investment, and increased mining to 45% of exports by 2000. Private operations grew from 55% to 95% of the total production between 1990 and 1999. The Cajamarca case study shows that this rapid growth has had serious environmental effects at the local level, reporting that open-pit mining and cyanide leaching have damaged land and water over 10,000 ha (hectares). Redistribution of land in favor of mining at higher elevations has increased agricultural intensification, water scarcity, and erosion at lower levels.

This literature only scratches the surface of the multiple and varied environmental impacts of industrial development associated with neoliberal processes in Latin America. Framed by theoretical arguments for and against the spread of free trade, there is little agreement as to whether neoliberal policies have improved the environmental performance of industry. Given the heated discussions on the FTAA, there is a great need for good empirical studies that cover a range of countries, scales, as well as institutional and geographic conditions to understand under what conditions and institutions trade and other neoliberal policies can improve (or degrade) livelihoods and ecologies in the region.

## WATER REFORM: THE FLASHPOINT FOR NEOLIBERAL POLITICS

The privatization of the water sector in many regions of Latin America has been very controversial, most notably in the case of the "water war" in Cochabamba, Bolivia. Water privatization can include the whole resource (supply, distribution, waste) or just the services that provide water to consumers and usually differs in form between rural and urban areas. Market advocates believe that water should be a fully private, tradable commodity subject to the rules and forces of the free market

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wherein everyone would pay for water and its treatment, and major international water companies would invest in water provision with a profit motive. Critics argue that water is a basic need or public good that should be provided by the community or the public sector at no profit and little cost, especially to the poor. A middle ground would provide the poor with a minimum level of water as a public good or at very low cost and charge progressively higher prices for larger or wealthier water users.

### Chile

Chile has provided one of the classic examples of water privatization and has been promoted by the World Bank as a model of success in water reform. The basis for the Chilean reform is the 1981 Water Code, which strengthened private property rights, increased private autonomy in water use, and favored free markets in water rights. Bauer, who has published extensively on the Chilean case (57–59), reports the key features of the code to be the separation of water rights from land ownership and a sharp reduction in government involvement in water management, regulation, and development. He indicates that environmental issues were not addressed in the water code.

Bauer argues that the early accounts by the World Bank of success in Chile in the trading of water rights, increased water-use efficiency, private investment, benefits to small farmers, and environmental improvement were “ideologically biased and lacked empirical foundation” (59). His own research found some examples where increased legal security of private property rights encouraged investment in agricultural water use, especially in areas growing high-value export crops such as fruit. Stronger property rights have also helped to consolidate the autonomy of local canal associations, which vary greatly in organizational capabilities but in many places do a reasonable job of day-to-day water management (58).

But he also finds that, almost 20 years after the reforms, water markets have been inactive and have had a limited impact on the efficiency of water use and the reallocation of resources. Sales and transfers of water that are separate from land are uncommon in most Chile, even in the desert North, mainly because of high transaction costs and price signals that are confusing or contradictory. He suggests that improvements in water-use efficiency have been limited because water rights were privatized at no cost to the new owners and with no legal obligations to actually use the water. Thus there is no incentive to conserve water or to sell it, and this distorts market prices. Bauer also finds several weaknesses in the Chilean reform that have been intensified with increased water demand in recent years, including a water crisis for poorer peasant farmers, water pollution, and loss of water supplies to natural ecosystems. The government’s water agency (Dirección General de Aguas) has attempted to establish minimum in-stream flows for ecological purposes, but this is difficult task as most water rights have already been allocated and regulatory authority is weak. Bauer’s analysis focuses mostly on agricultural rather than urban water.

Other analyses of the Chilean water reforms include Galaz (60) and Budds (61). Galaz confirms Bauer’s assessment of a limited water market, concluding

only 5% of water rights in areas of highest demand have been sold and also that water-use efficiency in agriculture is still very low. He reports the positive impacts of the reforms to include investment in infrastructure, leasing of water during droughts in northern Chile, and purchase of agricultural water rights by urban water companies. He uses case studies and game theory to show that Chile's water markets disadvantage poor and indigenous groups because weak institutions mean that it is easier for powerful interests to steal rather than buy water from underprivileged users. Budds (61) also highlights increasingly unequal access to water in Chile, using a case study from the Norte Chico where she finds that the water code makes it easier for large-scale farmers to gain access at the expense of peasants. These Chilean cases clearly illustrate how water reform has varying spatial and social impacts.

## Mexico

Mexico's neoliberal water reform came much later than that of Chile and involved, from about 1989, the transfer of irrigation systems from the public to the private sector and the sale or lease of urban water systems to private companies. Assessments of water reform in Mexico are complicated by simultaneous privatization of land, decentralization, democratization, and free trade, but authors generally conclude that water reform has been more successful in the rural than the urban sector. Johnson (62) and Vermilion (63) both highlight the inefficiency of Mexican irrigation systems prior to the transfer program, including a deterioration of infrastructure and the government's inability to collect water fees. The Water Users Associations (WUAs), established through the reforms, were expected to improve performance through joint management with the National Water Commission. A special feature of the Mexican transfer model is that users do not have individual water rights, but instead each WUA has a proportional right (the proportion is based on area) to the supply of water (normally the estimated surface supply) available to the district for that season. Concessions are for a fixed term, 5 to 50 years, and can be taken away if an association does not fulfil its agreement with the government. More than 90% of the 3.3 million ha of public irrigation land have been transferred.

While Johnson sees considerable successes in the water system with high rates of fee collection and improved maintenance, Romero-Lankao (64) is less optimistic and claims that, although users are now starting to pay higher prices for water to cover the costs of delivery (including administration, operation and maintenance) from dams to agricultural fields, revenues from water bills are not enough for the Mexican water sector to recover its costs nor to induce more efficient patterns of water use even where there is volumetric pricing. She argues that the significant increase in water charges (five times in Mexicali and more than double in Yaqui Valley) have combined with increases in the costs of other agricultural inputs and droughts to create economic problems for many farmers. Johnson (62) argues that producers are reluctant to pay their water fees because they are uncertain about the security of the water supply (as producers do not have access to firm volumetric

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water rights, but only a proportional right to the supply of water available to the district for that season). This issue is exacerbated because Mexico's legal system does not clearly specify what rights exist for irrigated agriculture and how those rights can be protected against demands for water from municipal and industrial use. When a major city can expropriate the total water supply from an irrigation district that is operating under a legal water concession, such as the case of the Bajo Río San Juan Irrigation District, then the irrigation districts are in a vulnerable position.

Wilder et al. (65, 66) suggest that decentralization of irrigation management allows more sectors to be involved in decisions, keeps revenues in the irrigation districts that are sometimes used to increase efficiency, and has allowed water user associations to respond better to drought. But, they argue, it has not addressed deeper problems of conflicting demands between agriculture, urban areas, and ecosystems (65, 66). The general lesson from irrigation reform in Mexico is that, although there is no evidence that it has made things any worse, there is also little indication that promised efficiency increases have been achieved (see also Reference 67). In addition, it is important to note that water demand has been driven by exports oriented to free trade.

### Argentina

Argentina's neoliberal reforms brought the privatization of urban water services in 1993, responding to a legacy of inefficiency and contamination under the state agency "Obras Sanitarias de la Nación" (68). A consortium of foreign investors formed Aguas Argentinas and were allocated the concession for the capital city of Buenos Aires. Gentry & Fernandez (68) claim considerable success with 500,000 new water supply connections and 300,000 sewer connections as well as a 25% increase in treatment plant pumping and frequent monitoring. Galiani et al. (69) found that child mortality fell 8% in the areas that privatized their water services and that the effect was largest (26%) in the poorest areas. Loftus & Macdonald (70) provide a much more negative interpretation arguing that Aguas Argentinas has failed to provide concrete plans for sewage treatment investments and has failed to meet any of its first five-year targets for sewerage network expansion with the deeply inadequate sewerage coverage, increasing only 3% to 61% while secondary treatment grew from 4% to 5%. The authors also point out that the rapid expansion of the water network, with the concomitant neglect of the sewerage network, has worsened the problem of the "napas," rising water tables in Great Buenos Aires, which has had some serious consequences for low-lying areas since the start of the concession. As a result, uncollected wastewater is draining into overflowing aquifers instead of being carried for treatment, and surface water supplies (especially the Matanza and Riachuelo rivers) are seriously contaminated, posing a substantial health risk. They suggest that the focus on water and not the sewerage network may lie in the different costs for the two services in that they have equal fees, whereas the cost to remove and treat sewage from a household



is roughly twice as expensive than it is to supply treated water. Aguas Argentinas have pursued the more profitable route by connecting more people to the water network than to the sewerage network. In both the Chilean and Argentinean water reforms, environmental issues were not clearly addressed in the reform process, and this has been highlighted by the World Bank as priority for future privatizations along with the need for a postprivatized independent regulatory structure that can set standards as well as public participation in the reform process (71, 72).

## Bolivia

Bolivia has become one of the international symbols of what can go wrong with water privatization, with the infamous Cochabamba case appearing on antiglobalization Web sites and in popular magazines (73). With the advice of international lending agencies and inspired by the Chilean model, in 1999, Bolivia passed a new water law that removed the government from water management through a regime of private concessions to supply drinking water. The Bolivian law gave priority to financial and economic efficiency over social and environmental considerations. At the moment of privatization, only half of the rapidly growing city of Cochabamba had access to clean piped water or sanitation, and there was increasing competition for water with irrigated commercial farms around the city (74). In 1999, a 40-year concession was granted to Aguas de Tunari, a consortium led by Bechtel, to manage the city water system. A rate hike of up to 150% was designed to provide capital not only for the existing system but also for a new water transfer project (the Misicuni dam) and to provide a guaranteed 15% profit. This prompted a revolt by an alliance of workers, farmers, and environmentalists in 2000, and after a series of protest marches, the government was forced to revoke the concession. The consortium filed lawsuit against the Bolivian government for compensation of \$25 million.

The Cochabamba privatization is presented as an environmental issue by many activists; Victor Olivera, the leader of the Coordinadora por la Defensa del Agua y la Vida, was awarded the Goldman Environmental Prize (1). But the conflict was really centered on social inequities, and there is very little empirical data about the environmental consequences of either the privatization or subsequent policy reversal. Some of the policies proposed by social movements such as the Coordinadora por la Defensa del Agua y la Vida could actually promote environmental degradation because they assume free or low-cost water with long-term unmonitored extraction rights to local communities. Laurie et al. (75) show how the social movements opposing the Cochabamba concession used the indigenous Andean images of “usos y costumbres” (traditional uses and customs) to make claims for rights to water in both urban and rural contexts, and they highlight the importance of such identity politics in local opposition to neoliberalism in Latin America.

The water issue is a litmus test for neoliberal policies in Latin America, opposed by many poorer citizens and environmentalists across the region on the grounds that water privatization and pricing threatens basic rights, equity, and environmental

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quality. Water has also become a symbol for larger antiglobalization movements. With many national and local governments unable to pay for public water systems, water is an area where reregulation in many regions may be the only feasible solution, using rules that require private water companies to ensure that the poor and ecosystems receive adequate water, perhaps with continuing subsidies from the state or through utility boards that review and monitor contracts and performance.

## FORESTS

Latin America's forests were the focus of worldwide attention when in the 1980s scholars and activists drew attention to the rapid deforestation rates in countries such as Costa Rica and Brazil (76, 77). In the forestry sector, the objective of neoliberal policies has generally been to promote privatized forestry and exports, often through plantations that have higher yields more suitable for exports or through industrialized extraction of natural forests for wood chips. Forest protection is often closely linked to biodiversity conservation and carbon sequestration and has been the main arena for promoting payments for environmental services. It is also a sector where nongovernmental organizations have become involved with environmental management through certification programs (e.g., fair trade, sustainable production) as governments have often withdrawn from management of production and marketing.

### Chile

With the state forest land and plantations sold off beginning in 1975, Chile again provides one of the earlier examples of forest reform focused on exports and private enterprises. The rapid growth in exports doubled the contribution of the forest industry to 10% of GDP by 2000 with exports trebling to \$3 billion a year (78). From at least 1931, the Chilean government encouraged forest plantations through tax incentives, afforestation subsidies, and state-run processing such as pulp mills (79). The Forest Law of 1974 consolidated tax exemptions and introduced a 75% subsidy for reforestation for 20 years with a guarantee of secure tenure. Privatization of the state forest sector transferred thousands of hectares to four Chilean conglomerates, and in 1975, all export restrictions were lifted. Clapp (79) also highlights the repression of unions by the military government that kept wages down and shifted forest employment to temporary contracts (79). A slump in the forest sector, following the debt crisis in 1982, recovered when a second round of privatizations brought a flow of foreign direct investment from New Zealand, Japan, and Scandinavia partly through debt swaps. Clapp concludes that the apparent success of neoliberal forest policies rests more on prior decades of government investment in the forest sector. Together with Silva (80) and the World Resources Institute (81), he demonstrates strong links between the expansion of exports and loss of ancient forests, arguing that the fast-growing, low-value-added hardwood chip industry has subjected the Valdivian forest to the most intensive logging in

its history (82). A “rush to cut” caused by intensive competition, a fear that the market for Chilean hardwood was temporary, and endless demand from Japanese markets are increasing the pressures. Despite its ecological value and wildlife richness, the commercial value of conserving it is low, and thus it is seen as not worth managing. This has led not only to wholesale clear-cutting and overchipping without planning for regeneration, but also to the conversion from natural forests to more economically valuable plantations. The World Rainforest Movement (83) estimates that 40% of natural forest loss is from conversion to plantations. The latter has happened despite opposing views of the environmental (and social) impacts of forest plantations worldwide, as well as with no knowledge of the consequences of rain-forest conversion or substitution. Silva (84) and White (85) believe that plantations deplete nutrients and moisture and replace diverse ecosystems with vulnerable monocultures. However, the growth of plantation forestry to almost 15% of the forest area is seen by Victor & Ausubel (86) as a long-term solution to protection of the remaining natural forests because intensively managed plantation forests provide the opportunity for high yields and reduce pressures for further land-use change.

## Mexico

Mexico has implemented forest reform much more recently, and in this case, much of the debate focuses on the fate of community forestry and on the causes of deforestation rates of ~2% per year (87). In Mexico, 80% of the forests are owned by communities, often under communal systems, in contrast to the rest of Latin America where an average of 80% of forests were managed by the state until recently (88).

Klooster has undertaken a sustained analysis of Mexican forest communities. He uses fieldwork, primarily in the states of Oaxaca and Michoacan, to empirically test theories about the tragedy of the commons, institutions for common property management, forest transition theory, and neoliberal reforms (88, 89). He finds that even under communal ownership prior to neoliberal reforms outsiders were able to extract wood under concessions that often generated very little income for communities and ignored laws that sought to ensure selective logging and reforestation (88). From 1975 to 1992, especially through a 1986 Forest Law, the government established comanagement with communities, with state oversight of planning, replanting, and processing, and rescinded concessions to third parties (88). Some communities increased their income sixfold once the concessions were removed, and by 1992, 40% of commercial timber was coming from community forests.

Klooster shows that forest management was most sustainable in communities with governance systems rooted in cultural norms in contrast to those that were hierarchical and inequitable, often with an established elite who had profited financially from concessions to outsiders and where corruption had driven deforestation (89). In terms of forest transition theory, which suggests that pressures on the forest decline at higher incomes, he finds that land-use changes are far more complex

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(88). Although deforestation may be slowing in some of his case study communities, this is a result of economic and agricultural decline associated with neoliberal agricultural policies, such as reduced maize subsidies, matched with increased off-farm employment opportunities, including temporary international migration. People continue to use the forest for fuelwood, but land use is driven by large-scale political and economic forces.

Major changes in the Mexican forest laws in 1992 deregulated timber cutting and dismantled government institutions that had monitored and licensed forestry, moving them to the private sector. The most significant changes came with the Article 27 land tenure reforms in 1992 and with the signing of the NAFTA in 1994 when almost all barriers to exports and imports in the forest sector were removed. The Article 27 reforms focused on the opening up of the communal ejido lands, established constitutionally after the Mexican Revolution to provide land to the landless, which would be held by a community (although often farmed independently) and which could not be sold, rented, or used as collateral. Another 1997 Forest Law reestablished some of the regulations over the transport and sale of wood and established a plantation incentive program (90). By 2000, plantations were still less than 1% of Mexican forest cover, and the Mexican forest sector had not seen the economic success of Chile, with imports of forest products more than triple that of exports in 2000 (78).

Klooster (88), along with other researchers such as Bray et al. (91), Taylor & Zabin (92), and Zabin (93), points out that the reforms all but ignored community forestry, focusing on foreign investment in private pulpwood plantations through tax credits, subsidies, and tenure guarantees to private investors for up to seven years. Despite the land reform, 80% of forestland remains in ejidos and is used primarily for resin extraction and fuelwood. The major change is that most communities now obtain technical advice from private firms.

Guerrero et al. (90) suggests a more direct impact of neoliberalism in the form of the NAFTA on forests in northern Mexico, especially in the Sierra Tarahumara of Chihuahua. They find that following NAFTA extraction of pine increased significantly along with a doubling in the number of private sawmills (to a total of 209 in the state of Chihuahua) and consolidation of the commercial forest industry under transnational corporations. Chihuahua has become the leading exporter of wood products in Mexico, second only to Durango in wood production. However, the removal of import tariffs and quotas into Mexico over a 10-year period has increased the flow of U.S. and Canadian pulp and paper into Mexico, forcing down prices and increasing pressures for cheaper labor, reduced regulation, and clear-cutting. Guerrero et al. are particularly concerned about social conditions in the forest ejidos where individual power brokers negotiate timber sales with companies and very little value reaches most members of the ejidos. They also identify conflicts and problems of illegal logging by outsiders in forests owned by indigenous communities. However, the NAFTA environmental side agreement has created the opportunity for environmental groups to protest the environmental impacts of logging in the Sierra Tarahumara. Under Article 14/15 of the agreement,

complaints can be filed with the Commission on Environmental Cooperation regarding failures to enforce environmental laws, and such a complaint was filed in 2000 by the Northwest Mexico Center for Environmental Law but has had no practical impact.

The neoliberal era has also brought market-based approaches to forest management in Mexico that include payment for environmental services, carbon sequestration, and forest certification. To date, most programs are experimental rather than operational, but researchers are starting to evaluate their potential (94, 95). Their findings suggest a rapid growth in participation in forest certification and carbon sequestration but with no significant impact on forest protection or, in the case of forest certification, on local incomes.

### Costa Rica

Costa Rica has also supported its forestry sector with a similar pattern of promotion of private investment and trade liberalization combined with strong central government intervention. According to the Fondo Nacional Para el Financiamiento Forestal de Costa Rica (96), 54% of Costa Rica's forest budget between 1987 and 2003 has been focused on financing forest plantations and forest industry. The government promotes forest plantations through projects such as REFOR-ESTA, partially financed by a US\$300,000 donation of the Japanese government (through the World Bank). This project intends to plant 500,000 ha of monoculture plantations—equivalent to one third of the total forested areas in the country—in a period of 10 years.

Costa Rica is internationally renowned for protecting more than 25% of its forest areas from exploitation and for the income that the country generates from ecotourism. Each foreign tourist pays \$6 a day to enter national parks and about double this for private forest parks.

Costa Rica's forests are also the cornerstone for creating new markets associated with payment for environmental services, such as watershed protection, carbon trading, and biodiversity (12). This market-based approach to conservation has been identified as a neoliberal strategy. A World Bank study identified potential values ranging from \$10 ha/year for watershed protection for hydroelectric development to \$120 ha/year for carbon sequestration (12). A 1996 Forest Law (funded through a sales tax on fossil fuels, private companies, and the Kyoto Clean Development Mechanism for carbon sequestration) introduced payments for environmental services to owners of forests and forest plantations who maintained forests for carbon mitigation, water resources, and biodiversity. Only those with a registered land title can benefit, discriminating against many small farmers and peasants who have insecure or common property titles (97). Several important services are not included in these new markets, including flood protection, soil erosion control, nutrient provision, or pest control. Almost \$50 million in grants and loans (including \$32.6 million from World Bank) was made available for services that included forest protection around national parks, the MesoAmerican

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Biological Corridor, and major rivers, as well as for rehabilitating degraded forests (98).

Until recently only two carbon sequestration projects had received significant funding (\$4.4 million) covering about 6500 ha. Watershed protection payments include amounts up to \$40/ha to communities protecting watersheds upstream of hydroelectric schemes, and \$45/ha for forest conservation in the recharge zone for an aquifer supplying the country's largest brewery (98). The Costa Rican forest industry also participates in a variety of forest certification schemes to guarantee that wood, especially teak, is produced sustainably. Rojas & Aylward (98) summarize a number of criticisms of the Costa Rican approach to forest management through payment for environmental services, including the problems of monitoring and placing values on services, the challenges of protection in areas with no one willing to pay for services such as carbon mitigation, and the economic sustainability of the schemes once the initial subsidies from taxes, international development, and the government disappear.

Again, the record of neoliberal approaches to Latin America's forests has been mixed. Trade has increased dramatically in some countries such as Chile, and new market approaches to forest conservation are emerging in Mexico and Costa Rica. These policies are often underpinned by heavy government intervention and reregulation and may have unequal social and environmental benefits. Privatization and plantations characterize Chile, whereas Mexico has so far sustained a tradition of community forest management.

## AGRICULTURAL LAND

The literature on the direct and indirect effects of neoliberalism on agricultural land use in Latin America is extensive, encompassing work on privatization of communal lands, patterns of crop and livestock production in a globalizing commodity system, and the impacts of withdrawal of state subsidies, credit, marketing agencies, and input provision. A detailed discussion is beyond the scope of this review, which describes briefly those studies that directly focus on links between neoliberalism and the environmental impact of agriculture.

David et al. (99) examine the impact of what they call the "New Economic Model" in Latin American agriculture. Focusing on Brazil, Mexico, and Chile they see the key elements of this model as

- Export-oriented policies promoting trade liberalization and reduction of tariffs and protective measures
- Reduction of direct government intervention through elimination or underfunding of rural development banks, specific credit lines, income support mechanisms, and extension services
- Demand-driven, cofinanced investment in rural infrastructure and demand-driven, remunerated private extension services

- Deep changes to property rights regimes in land and water, but also for intellectual property rights such as plant breeding and biotechnology
- Land market liberalization and the deregulation of the labor market

They conclude that in most cases the new model has resulted in increases in production but that there has been a reduction in rural employment and in the number of small farmers, resulting in increased rural poverty. Saying little about the environment, they do argue that the rollback of state programs has resulted in problems in maintaining infrastructure and extension services. Other general studies of neoliberalism in Latin America that mention agriculture, and briefly environment, include books by Barry (100), Chase (101), Cornelius & Myhre (102), Loker (103), Otero (104), and Veltmeyer & O'Malley (105). The majority of these studies take a critical perspective in contrast to more positive vision portrayed by institutions such as CEPAL (106).

## Mexico

Mexico provides the classic case of agricultural liberalization—combining the titling and privatization of commonly held ejidos with cuts in government support and services and the opening of markets through NAFTA in 1994. As explained by Nadal (107), the objective of NAFTA and the neoliberal package in the agricultural sector was to promote industrialization. Mexico was projected to increase exports of products for which it was considered to enjoy significant comparative advantages in labor or climate, such as labor-intensive vegetables, nuts, coffee, and tropical fruits. Mexican producers were expected to move from corn and grain production because they could not compete with the United States and Canada to cultivation of other crops that were, in theory, economically and environmentally more efficient. Similarly, the reforms to article 27 of the Mexican constitution were designed to encourage investment and efficiency in agriculture because, it was argued, the common property ejido sector was inefficient as a result of the lack of private ownership.

Some researchers are highly critical of the impact of NAFTA and land reform on Mexican agriculture claiming that the sector has suffered under NAFTA because of imports from the United States and because subsistence and small-scale farmers have not been able to participate in the new open economy, especially as subsidies have been withdrawn (107–110). Large-scale commercial farms, especially in northern Mexico, have been able to increase production of vegetables, fruit, and forage at the expense of pressure on water supplies and with heavy use of agricultural chemicals. Smaller and poorer farmers have found it more difficult to access the credit, water, and technical expertise to convert to exports and because of low grain prices and difficult economic conditions have actually expanded the area in corn in order to maintain even modest incomes. In some cases, this has resulted in deforestation and the farming of marginal lands. De Janvry and colleagues (111) have provided a sustained analysis of the social and economic effects of neoliberal reforms on the ejido sector. They note that in 1992, 2.4 million

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farmers were producing maize on more than 7 million ha on mostly rain-fed plots of under 5 ha with the government subsidizing about half the value of production. A survey of more than 2800 ejidos confirms that more than half of the farms are not producing maize for the market (111). The analysis also showed that only farms with sufficient labor, institutional support, and land can modernize production to increase maize yields or shift to higher value crops. Similar large-scale surveys were used to demonstrate the importance of off-farm income strategies (111) and to test theories about ejido privatization following land reform (112). The latter study showed that ejidos with less land and/or higher value land, greater equality, and less evidence of cooperation were more likely to privatize than those with extensive, marginal land that is unequally distributed but with good cooperation.

Audley et al. (113) attempt to analyze the environmental impacts of agricultural liberalization in Mexico, focusing on fertilizer use, groundwater depletion, and deforestation as they relate to trade in wheat, maize, and fresh fruit and vegetables. Their analysis is limited by a lack of detailed data, especially on environmental conditions. They suggest that a shift from bread wheat to durum wheat production in northern Mexico is linked to a 50% decline of water tables in the Yaqui valley and to an increase of fertilizer use. An increase in fruit and vegetable exports of 80% is linked to increased use of water and agricultural chemicals. They also suggest that persistent poverty in southern Mexico has driven deforestation of over 600,000 ha/year since 1993 and is linked to an 18% increase in maize production in marginal areas.

Nadal (107, 114, 115) raises concerns about the impact of NAFTA on genetic diversity in Mexico, particularly the tendency for agricultural intensification to focus on a narrow range of varieties and the introduction of genetically modified (GM) maize varieties to Mexico through imports. He concentrates especially on the reports of contamination of traditional maize in Oaxaca by farmers' experiments with imported GM maize and the associated risks to the genetic pool in this center of domestication. He argues that market pressures are also reducing the extent of traditional cultivation as knowledgeable farmers migrate out of the region and local varieties are displaced by hybrid seeds.

Snyder (116) provides an important analysis of how the liberalization of the coffee sector through the elimination of the federal marketing institution IME-CAFE produced different impacts in various parts of Mexico, depending on the relative strength of political elites and social movements. In each region, there was a struggle to control and reregulate the coffee market in the space vacated by federal regulation. In Oaxaca and Guerrero, strong social movements based on small producers were able to control elites and coffee markets, whereas in Chiapas and Puebla local producers were unable to restrain the resurgence of traditional powerful elites controlling the coffee market. Although his research does not examine environmental impacts, it provides a useful model of how local and historical factors mediate the effects of neoliberal processes and how the withdrawal of national controls can open up new forms of control and regulation at local level.



Kay (117) provides a sustained examination of agricultural liberalization in Chile, considered one of the success stories of nontraditional export expansion—especially for wine and grapes. The first round of agricultural reforms in Chile, under military dictatorship, included promotion of exports, privatization of agroindustries and marketing institutions, reduction of trade barriers, and reconcentration of land following earlier land reforms. Economic crises in the 1980s brought some support and protection for the peasant sector, including technical assistance, price supports, and modernization of crop production. Agricultural intensification and exports, as in Mexico, involved the use of agricultural chemicals, which cause pollution and health risks for agricultural workers, and also focused on a narrow range of crop varieties (118).

The agricultural sector across Latin America as a whole has generally seen a gradual shift to exports, rather than the more abrupt shifts that have occurred in forestry and industry. Many Latin American countries have slowly moved toward nontraditional agricultural exports such as vegetables, replacing traditional exports such as sugar or coffee. The area in crops of tomatoes, berries, broccoli, and grapes has expanded dramatically.

The environmental implications of this shift are partly associated with the increased use of water and agrochemicals that these crops require as reported by researchers such as Thrupp (119, 120) in Central America and Wright in Mexico (121–122). Thrupp highlights problems of pest resistance and worker poisoning in export areas of Costa Rica but focuses on banana plantations, which existed long before the current round of neoliberal policies. Wright documents the use and risks of pesticide use on export crops in the Culiacan Valley of Sinaloa, Mexico, finding that border controls on persistent pesticide residue on exported crops have forced a shift to more acutely toxic chemicals that damage local health and ecology where migrant workers live and obtain drinking water adjacent to the fields that they often spray with inadequate safety equipment. NAFTA created pressures, through the trinational intergovernmental Commission on Environmental Cooperation and collaborations between environmental groups, to improve the regulation of agrochemical use in Mexico. But lack of funds and enforcement has meant continued vulnerability in regions where export crops are heavily sprayed in order to ensure high yields and unblemished appearance for the export market.

Other environmental concerns include the problems of a focus on a narrow range of species and varieties that reduce biodiversity and increase vulnerability to disease and the debate about whether more intensive export agriculture reduces or increases the expansion of cropland into forest and other natural ecosystems.

At the same time that free trade has been changing environmental impacts, smaller-scale moves toward fair trade and green labeling are promoting more sustainable agriculture under neoliberal models. Throughout Latin America, non-governmental organizations are joining with producers to develop certification programs and markets for sustainably produced coffee, vegetables, wine, and other products. Although these activities have considerable potential for lessening

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environmental impacts, poorer farmers may have trouble obtaining the paperwork and accessing markets (123, 124).

The relationship between agriculture and the environment has been altered by the processes of neoliberalism that include free trade, export promotion, privatization, and reduction in subsidies. An empirical assessment of the overall impacts is limited by data and by the highly complex interaction of policies at different scales.

## FISHERIES

The fisheries of Latin America have become a grand experiment that tests assumptions about common property management and the benefits of free trade in the context of a rapid growth in worldwide demand for fish and seafood. Declines in catches of species such as sardines, anchovy, tuna, and hake have been blamed on over-fishing and natural variability, with a particular focus on the potential tragedy of the commons in the absence of private property rights and on government subsidies of the fishing industry (125). Latin America produces 20% of world marine fish production and employs more than one million people in predominantly artisanal production (126).

Several authors analyze the impacts of neoliberal policies and the “boom and bust” they promoted (126–129). All of them show that short-term growth was achieved at the cost of long-term sustainability. Though the boom years generated a vibrant and profitable industry, especially in Chile, they caused overexploitation, overcapitalization, and conflict over management of resources. As a result, most of the main commercial fisheries in Latin America were harvested at or beyond their maximum levels by 1995. The bust that followed somewhat reduced the pressure on some of the fisheries because some competitors left the market. The collapse also promoted the growth of fish farming through aquaculture, where property rights and fish stock replenishment were perceived to be easier to achieve.

## Chile

Chile fostered an export boom beginning in the mid-1970s, following deregulation of the industry, privatization of previously state-owned fishing fleets, allocation of fishing permits, loans to artisan producers for boat purchases and processing facilities, and promotion of exports. At the same time, demand was growing internationally for sea bass and salmon, and transport costs were declining (128). The size of the commercial fishing fleet and the number of processing plants grew by an order of magnitude between 1970 and 1995. The average annual capture grew from 1.5 million to 8 million tonnes in the early 1990s and then fell dramatically to 4 million tonnes by 2000.

Although the government agency in charge of fisheries in Chile imposed improved fishing legislation and norms, including temporary bans on certain species, establishing annual capture quotas and minimum catch sizes for some shellfish

species, and placing small number of gear restrictions on particular fisheries, these did not improve the biological condition of stocks nor avoided the “race to fish.” Though the reasons for this failure are broad, including intersections with the natural variability of El Niño, most authors highlight lack of law enforcement, including underfunding of national fisheries services in charge of monitoring and enforcement as a main factor. The solution to the collapse of wild fisheries in Chile has been the establishment of aquaculture, especially salmon farming. Salmon production grew from 70 tonnes in 1980 to 100,000 in 1995, and salmon exports have risen from 1.8% of total Chilean exports in 1991 to 5.4% in 2000. Chile has become the second largest exporter of farmed salmon in the world, with the archipelago of Chiloe accounting for the vast majority of aquaculture production in the country (130).

There are opposing views on the environmental impacts of aquaculture worldwide, and salmon farming in Chile is no exception. Some authors (131) stress that the environmental consequences of intensive aquaculture activities in the marine coastal areas of Chile, in terms of sediments and faunal abundance, appear to be minimal. They suggest that other human activities such as urban discharge, intensive agriculture fertilizer, and pesticide use are more to blame in terms of environmental degradation and water pollution. Further, the authors highlight that evidence for other environmental problems associated with fish farming—such as use of antibiotics, the ecological effect of introducing new species, and the installation of net pens related to the mortality of sea lions and birds—is lacking.

Contrary to this view, Barton (132) argues the large scale of salmon farming in Chile has had undesirable effects on the environment as aquaculture inevitably contaminates the aquatic ecosystem owing to high fish densities and artificial feeding regimes. His analysis outlines the impacts of fish diseases on the industry as well as the problems of environmental contamination from feed, chemical treatments, and intensive use of fungicides and pesticides. Further, he highlights that the use of antibiotics to prevent disease transmission is largely unregulated in Chile, despite the potential negative environmental impacts on marine flora and fauna beyond the production cages. Barton also mentions other environmental impacts such as the unattractive visual appearance, the use of space in competition with other uses such as tourism, and concerns relating to water quality and disease, including the atrophying effects of fecal matter and unconsumed feed on the benthic community.

Barton shows how bad husbandry and overly intensive fish management practices led to a large-scale disease outbreak in the Chilean fish farms in 1989 and argues that the problem of intensive farming has been exacerbated by the export-led regime and “free-market” forces, which have led to concentration and further intensification of production. Though the industry acknowledges that better husbandry, and not the reliance on antibiotics, is the solution to the disease problem, self-regulation by companies leads to a competitive rather than preventive approaches to environmental management and thus to unsustainable practices.

## Mexico

In Mexico, the biggest source of revenues in the fisheries sector has historically been inshore fisheries, especially shrimp. The boom in Mexican fisheries started in the mid-1970s, following the 1977 National Fisheries Plan, which set out to raise Mexico from twenty-eighth to fifth place among fishing countries. Although this policy change occurred before the main neoliberal period in Mexico, the plan promoted private investment by offering substantial government financial support through a specialist fisheries bank Banpesca. The fisheries sector in Mexico was already seeing the effects of overfishing by the mid-1980s, but nevertheless, a full neoliberal package was implemented during the 1990s, in the hope that the market forces would increase the profitability of the sector.

The fishing industry in Mexico was the center of a controversial case on trade and environment: the tuna-dolphin conflict between the United States and Mexico, where the United States embargoed tuna imports from Mexico between 1990 and 1999 in response to Mexican failure to adopt dolphin-excluder devices on tuna nets (126, 127). Although Mexico reduced the by-catches of dolphin per set from 15 to 0.6 between 1986 and 1993 to comply with the U.S. requirements (133), the embargo was not lifted until 1999, and previous levels of trade have not been reestablished. This was a controversial case because the World Trade Organization ruled initially in favor of Mexico and against what was perceived as a nontariff trade barrier imposed by the United States. It highlights how increased market access pressures brought about by free trade can sometimes promote positive actions for conservation and protection of species.

According to several authors (127, 129, 134), inshore fisheries in Mexico exemplify the problems arising from unclear property rights. Historically, unclear property rights under Mexican federal law have created overlapping access rights to marine resources for commercial cooperatives and subsistence fishers. This overlap generated conflict and overfishing in some areas, problems that were exacerbated when the fisheries law was modified in 1992, allowing private investors access to these same marine resources.

As with salmon in Chile, catch declines and high demand has fostered the aquaculture industry for shrimp. The numbers of producers quadrupled between 1988 and 2000 to nearly 400 farms while production increased at a rate of 22% per year between 1990 and 1997 to a total of approximately 24,000 tonnes per year. The growth was promoted by (a) the changes to the fisheries law in 1992 that expanded rights to shrimp cultivation beyond cooperatives (ejidos), (b) the modification of the water law in 1992 that removed restrictions on the use of water for aquaculture, and (c) fiscal reforms providing a 50% exemption on income taxes to cooperatives and private firms involved exclusively in aquaculture. Although liberalization of foreign investment laws permits 100% foreign ownership of aquaculture production, processing, and marketing, most private investment in the sector has been domestic, with 80% of shrimp farms still owned by cooperatives and ejidos, exporting 53% of the production (135, 136).

A study commissioned by a consortium, including the World Wildlife Fund and the UN Food and Agriculture Organization, on shrimp farming portrays potential environmental impacts, including concerns about water quality, use of antibiotics and chemicals, diseases, and introduction of exotic species (137). The study concludes that shrimp aquaculture in Mexico has had relatively low environmental impacts because only 6% of shrimp farms in Mexico use “intensive” farming methods, with heavy use of feed, nutrients, chemicals, and antibiotics. Although the study shows that increased treatment of water discharge and better husbandry would reduce water pollution and use of chemicals, it also concludes that the environmental impacts of aquaculture have been minor compared to other many other activities such as agriculture or urban discharge. There is a growing practice to introduce exotic species in shrimp aquaculture, with genetically improved varieties becoming more common. It is not known what kind of threat this can pose to native shrimp or other species.

In much of tropical Latin America, coastal mangroves are popular sites for aquaculture development. In Mexico, despite some destruction of mangroves in the early years of aquaculture in Mexico, most shrimp farming is now occurring in zones of salt flats, and environmental legislation in Mexico now gives mangroves special protection, with the government taking legal action against two farms that have destroyed small areas of mangrove.

## Honduras

Honduras has generated several case studies of the aquaculture boom, loosely associated with the type of export promotion and privatization of common areas associated with neoliberalism. DeWalt et al. (138) and Stonich (139) have documented the rise of the Gulf of Fonseca as a major producer of farmed shrimp and the associated destruction of mangroves, lagoons, and water quality. Conflicts have arisen between shrimp producers and traditional fishermen who believe that the decline in fish catch offshore is related to the shrimp farms. Careful analysis of mangroves showed a loss of 7000 ha of mangroves from 1973 to 1992 in shrimp farming areas and declines in water quality and increases in diseases.

## Peru

Peru has also liberalized a fishery famously associated with anchovies in the cold offshore currents and with vulnerability to collapse provoked by the regular warming of Pacific waters, called El Niño. A nationalized fleet and processing industry encouraged overfishing in the 1970s, contributing to the dramatic fall in catch during the 1982–1983 El Niño. The neoliberal policies of the Fujimori administration from 1990 onward include privatization and financial deregulation that encouraged modernization of the fleet and of processing. A 1994 fisheries law failed to control overfishing and was followed by a subsidized decommissioning scheme to try eliminating overcapacity (140).

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One general conclusion of Thorpe et al. (126) about Latin American fishery reform is that there has been a tendency to “privatize the fleet before privatizing the resource,” promoting the entrance of new private players into the fisheries environment. Far from promoting the expected private efficiency, the reliance on market signals has resulted in an intensification of overfishing, overcapitalization, and conflict. Market signals have been exacerbated by exchange rates that have promoted exports. This is a tendency common in industries that rely on open-access natural resources for their subsistence. As they explain, recent efforts in the region’s major fishing countries to introduce total allowable catches at maximum sustainable yield levels, fishing and fishing quotas might be regarded as tacit acceptance of the earlier oversight.

## CONCLUSION

The emerging literature on neoliberalism and the environment in Latin America shows a complex and geographically varying pattern of the impacts of neoliberal processes, with researchers coming to different conclusions about the costs and benefits of neoliberal policies, even when considering the same cases or data. Many studies contradict the proneoliberal wisdoms that free trade will protect the environment, that private is better than common or state resource management, or that the market is the best way to conserve nature. There is little evidence in this review that the Latin American environment is better protected under neoliberal policies, but it is also not clear that a revival of state regulation, state and common ownership, and trade protections would be affordable and effective in a global economy. Most studies tend to be case specific and difficult to generalize, a chronic problem of comparative research, which is not set within a rigorous a priori framework. It is also important to reiterate that this review focuses on several key countries and mainly on English language publications. In many cases, environmental changes cannot be clearly linked to a specific neoliberal action because of multiple and sometimes contradictory policy changes. In others, careful research shows that apparent positive or negative impacts are better explained by earlier resource management decisions, by weak or uneven implementation of policy, or by inadequate regulatory regimes.

There are some indications from the literature on water and forest reform that environment and livelihoods do better where there are strong local institutions, where local people have diverse income sources, or where some subsidies are provided during transitions. There is also evidence that the social and environmental effects of neoliberal policies are politically volatile, sparking local protests and bringing national electoral defeat to governments too closely identified with the neoliberal agenda.

Despite the surge in antineoliberal sentiment in Latin America, it is unlikely that many environmentally significant neoliberal policies will be reversed because governments do not have the financial resources to reinstate subsidies and renationalize

land and water and are unlikely to disengage from the global trading system. More probable is a search for institutional solutions that mediate the most negative social and ecological effects of free trade and less government. This might include stronger oversight of private water and fisheries, enforceable standards for forest use and industrial activities, and targeted financial assistance from government, international institutions, and nongovernmental organizations to certain ecological regions or social groups. This suggests a need for more empirical and comparative studies that assess what policies and institutions best sustain landscapes and livelihoods in particular places, especially under pressures of global integration and in the context of local conditions.

#### ACKNOWLEDGMENTS

We would like to thank Dan Klooster and Margaret Wilder for their comments on this manuscript and members of the 2004 and 2005 M.Sc. seminars on Latin American environmental policy at Oxford University who read and discussed many of the articles mentioned in this review.

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#### LITERATURE CITED

1. Olivera O, Lewis T. 2004. *Cochabamba! Water War in Bolivia*. Cambridge, MA: South End. 208 pp.
2. Carlsen L. 2005. *Timely Demise for Free Trade Area of the Americas*. Silver City, NM: Int. Relat. Cent.
3. Friedman M. 1963. *Capitalism and Freedom*. Chicago: Univ. Chicago Press
4. Williamson J. 2000. What Should the World Bank Think about the Washington Consensus? *World Bank Res. Obs.* 15:251–64
5. Jonas A, Bridge G. 2003. Governing nature: the reregulation of resources, land use planning, and nature conservation. *Soc. Sci. Q.* 84:958–62
6. O'Connor J. 1988. Capitalism, Nature, Socialism: A Theoretical Introduction. *Capital. Nat. Social.* 1:1–4
7. Bulmer-Thomas V. 2003. *Economic History of Latin America Since Independence*. Cambridge, UK: Cambridge Univ. Press
8. Bushnell DW, Neill. 1994. *The Emergence of Latin America in the Nineteenth Century*. Oxford, UK: Oxford Univ. Press
9. Burns EB, Skidmore T. 1979. *Elites, Masses and Modernisation in Latin America, 1850–1930*. Austin: Univ. Texas
10. Harvey D. 2005. *A Brief History of Neoliberalism*. Oxford, UK: Oxford Univ. Press
11. Katz C. 1998. Whose nature, Whose culture? Private productions of space and the “preservation” of nature. In *Remaking Reality: Nature at the Millenium*, ed. B Braun, N Castree, pp. 46–63. London, UK: Routledge
12. Chomitz K, Brenes E, Constantino L. 1998. *Financing Environmental Services: The Costa Rican Experience*. Washington, DC: World Bank.
13. Castree N. 2006. From neoliberalism to neoliberalisation: consolations, confusions, and necessary illusions. *Environ. Plan. A* 38:1–6

2.32 LIVERMAN ■ VILAS

14. Peck J, Tickell A. 2002. Neoliberalising space. *Antipode* 34:380–404
15. Anderson TL, Leal DR. 1991. *Free Market Environmentalism*. San Francisco: Pac. Res. Inst.
16. Portney PR, Stavins RN, eds. 2000. *Public Policies for Environmental Protection*. Washington, DC: Resour. Future
17. Hardin G. 1968. The Tragedy of the Commons. *Science* 162:1243–48
18. Ostrom E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK: Cambridge Univ. Press
19. Ostrom E. 1992. The rudiments of a theory of the origins, survival, and performance of common-property institutions. In *Making the Commons Work: Theory, Practice and Policy*, ed. DW Bromley, pp. 298–318. San Francisco: ICS Press
20. Daily GC, Ellison K. 2002. *The New Economy of Nature: The Quest to Make Conservation Profitable*. Boulder, CO: Island Press.
21. Antweiler W, Copeland BR, Taylor MS. 2001. Is Free Trade Good for the Environment? *Am. Econ. Rev.* 91:877
22. Yandle B, Vijayaraghavan M, Bhattarai M. 2002. The environmental Kuznets curve. A primer. *PERC Res. Study 02(1) Rep.*, Prop. Environ. Res. Cent, Montana. <http://www.perc.org/perc.php?id=207>
23. Grossman G, Krueger AB. 1991. *Environmental impacts of a North American Free Trade Agreement*. Natl. Bur. Econ. Res. Work. Pap. 3914, Washington, DC
24. Grainger A. 1995. The forest transition: an alternative approach. *Area* 27(3):242–51
25. Stern DI. 2004. The rise and fall of the environmental Kuznets curve. *World Dev.* 32:1419–39
26. Wheeler D. 2001. Racing to the bottom? Foreign investment and air pollution in developing countries. *J. Environ. Dev.* 10(3):225–45
27. Koop G, Tole L. 2001. Deforestation, distribution and development. *Glob. Environ. Change* 11:193–202
28. Barlow M. 2001. Blue gold: the global water crisis and the commodification of the world's water supply. Int. Forum Glob. (IFG) *Spec. Rep.* [http://www.canadians.org/display\\_document.htm?COC\\_token=23@@73951d6147134bc230e3a1d7c2ab04d2&id=245&isdoc=1](http://www.canadians.org/display_document.htm?COC_token=23@@73951d6147134bc230e3a1d7c2ab04d2&id=245&isdoc=1)
29. Robbins P. 2005. *Political Ecology*. Oxford, UK: Blackwell
30. Shiva V. 1997. *Biopiracy: The Plunder of Nature and Knowledge*. Cambridge, MA: South End
31. Smith P. 2004. *Cycles of electoral democracy in Latin America 1900–2000*. Work. Pap. 6, Cent. Lat. Am. Stud., Univ. Calif., Berkeley
32. Morley SA, Machado R, Pettinato S. 1999. *Indexes of Structural Reform in Latin America*. LC/L.1166-P/I Econ. Reforms Ser. 12, 36 pp. Available on line from CEPAL, <http://www.cepal.cl/cgi-bin/getProd.asp?xml=/publicaciones/xml/5/4275/P4275.xml&xsl=/de/tpl-i/p9f.xsl&base=/tpl/top-bottom.xslt>
33. Cooney P. 2001. The Mexican crisis and the maquiladora boom. A paradox of development or the logic of neoliberalism? *Lat. Am. Perspect.* 28(3):55–83
34. Roberts JT, Thanos ND. 2003. *Trouble in Paradise. Globalization and Environmental Crises in Latin America*. London: Routledge
35. Husted BW, Rodriguez-Oreggia E. 1998. Mexico—impact of environmental policy instruments on international investors. See Ref. 141, pp. 108–26
36. Dasgupta S, Hettige H, Wheeler D. 1999. What improves environmental compliance? Evidence from Mexican industry. *J. Environ. Econ. Manag.* 39:39–66
37. Pope C. 2001. Big river between us: social and environmental impact of North American Free Trade Agreement. *Sierra Club Mag. Sept.* <http://www.finda>



- rticles.com/p/articles/mi\_m1525/is\_5\_86/ai\_77279544
38. Liverman DM, Varady RG, Chávez ORS. 1999. Environmental issues along the United States-Mexico border: drivers of change and responses of citizens and institutions. *Annu. Rev. Energy Environ.* 24:607-43
  39. Bocco G, Sánchez RA, Riemann H. 1993. Evaluación del impacto de las inundaciones en Tijuana (Enero de 1993): uso integrado de percepción remota y sistemas de información geográfica. *Front. Norte* 5:53-79
  40. Aguayo F, Gallagher KP. 2003. *Economic reform, energy, and development: the case of Mexican manufacturing*. Glob. Dev. Environ., Tufts Univ. Work. Pap. 03-05, July. <http://ase.tufts.edu/gdae/publications/working-papers/03-05mexicanmanufacturing.PDF>
  41. Gallagher KP. 2004. *Free Trade and the Environment: Mexico, NAFTA, and Beyond*. Palo Alto, CA: Stanford Univ. Press
  42. INEGI. 2004. Banco de información económica, sector energético. *Geografía e Informática Rep.*, Instituto Nacional de Estadística, Mexico City, Mex.
  43. INE. 2000. Inventario nacional de emisiones de gases de efecto invernadero 1994-1998. *Secretaría de Medio Ambiente y Recursos Naturales Rep.*, Instituto Nacional de Ecología, Mexico City, Mex.
  44. Comm. Environ. Coop. 2005. *Citizen submissions on enforcement matters: current status of filed submissions*. <http://www.cec.org/citizen/index.cfm?varlan=english>
  45. BECC. 2005. *Status report*. [http://www.cocef.org/files/Proj\\_eng\\_12\\_05.pdf](http://www.cocef.org/files/Proj_eng_12_05.pdf)
  46. Mumme S. 1999. NAFTA's Environmental Side Agreement: Almost Green? *Borderlines* 7. <http://www.irc-online.org/us-mex/borderlines/PDFs/bl60.pdf>
  47. Sánchez RA. 2002. Governance, trade, and the environment in the context of NAFTA. *Am. Behav. Sci.* 45:1369-93
  48. McCarthy J. 2004. Privatizing conditions of production: trade agreements and environmental governance. *Geoforum* 35:327-41
  49. Echeverría J, Eby RB. 1995. *Let the People Judge: Wise Use and the Private Property Rights Movement*. Boulder, CO: Island
  50. Quijandria G, Rivera J, Brenes ER. 1998. Manufacturing free zones in Costa Rica. See Ref. 141, pp. 126-42
  51. IIED. 2002. Minería, minerales y desarrollo sustentable en América. *Sustain. Dev. Rep.*, Int. Inst. Environ. Dev., World Bus. Council., Montevideo, Urug.
  52. Bridge G. 2004. Contested terrain: mining and the environment. *Annu. Rev. Environ. Res.* 29:205-59
  53. Borregard N, Blanco H, Wautiez F. 1998. *Export-led growth and the environment in Chile—an analysis of the induced environmental policy response in the mining sector*. Int. Cent. Trade Sustain. Dev. (ICTSD), Cent. Investig. Planificación Medio Ambiente (CIPMA). <http://www.cipma.cl/hyperforum/papermining.doc>
  54. Warhurst A. 1998. Mining and the environment, case studies from the Americas. *Rep.*, Int. Dev. Res. Cent., Ottawa, Canada
  55. Bridge G. 2002. Grounding globalization: the prospects and perils of linking economic processes of globalization to environmental outcomes. *Econ. Geogr.* 78:361-86
  56. Bury J. 2005. Mining mountains: neoliberalism, land tenure, livelihoods, and the new Peruvian mining industry in Cajamarca. *Environ. Plan. A* 37:221-39
  57. Bauer C. 1997. Bringing water markets down to Earth: the political economy of water rights in Chile, 1976-95. *World Dev.* 25(5):639-56
  58. Bauer C. 2003. Marketing Water, Marketing Reform. Lessons From the Chilean Experience. *RFF Resources Summer*. <http://www.rff.org/Documents/RFF-Resources-151-Marketingwater.pdf>

2.34 LIVERMAN ■ VILAS

59. Bauer C. 2004. *Siren Song. Chilean Water Law as a Model for International Reform*. Washington, DC: Resour. Future
60. Galaz V. 2004. Stealing from the poor? Game theory and the politics of water markets in Chile. *Environ. Polit.* 13:414–37
61. Budds J. 2004. Power, nature and neoliberalism: the political ecology of water in Chile. *Singap. J. Trop. Geogr.* 25:322–42
62. Johnson SHI. 1997. *Management Transfer in Mexico: A Strategy to Achieve Irrigation District Sustainability*. Colombo, Sri Lanka: Int. Irrig. Manag. Inst.
63. Vermillion DL. 1997. *Impacts of Irrigation Management Transfer: A Review of the Evidence*. Colombo, Sri Lanka: Int. Irrig. Manag. Inst.
64. Romero-Lankao P. 2001. *Mexico, effectiveness of new water policy schemes for managing climate change, and water scarcity and quality*. Presented at Open Meet. Glob. Environ. Change Res. Community, Rio de Janeiro, Brazil
65. Wilder M, Whiteford S, eds. 2006. *Flowing Uphill Toward Money: Groundwater Management and Ejidal Producers in Mexico's Free Trade Environment*. New York: Sharpe. In press
66. Wilder M, Romero-Lankao P. 2007. Paradoxes of decentralization: neoliberal reforms and water institutions in Mexico. *World Dev.* In press
67. Whiteford S, Melville R, eds. 2002. *Managing a Sacred Gift: Changing Water Management Strategies in Mexico*. La Jolla, CA: Cent. US/Mex. Stud., Univ. Calif. San Diego
68. Gentry BS, Fernandez LO. 1998. Argentina–Buenos Aires water and sewerage. See Ref. 141, pp. 150–87
69. Galiani S, Gertler PJ, Schardgrotsky E. 2005. Water for life: the impact of the privatization of water services on child mortality. *J. Polit. Econ.* 113:83–120
70. Loftus AJ, McDonald DA. 2001. Of liquid dreams: a political ecology of water privatization in Buenos Aires. *Environ. Urban.* 13(2):179–200
71. Briscoe J, Anguita SP, Pefia H. 1998. *Managing water as an economic resource: reflections on the Chilean experience*. World Bank Environ. Econ. Ser. Pap. 62, World Bank, Washington, DC
72. World Bank. 2002. *The environmental implication of privatization. Lessons from developing countries*. World Bank Discuss. Pap. 426, World Bank, Washington, DC
73. Finnegan W. 2002. Leasing the rain. *New Yorker*, 8 Apr. [http://www.newyorker.com/fact/content/?020408fa\\_FACT1](http://www.newyorker.com/fact/content/?020408fa_FACT1)
74. Assies W. 2003. David versus Goliath in Cochabamba. *Lat. Am. Perspect.* 30(3):14–36
75. Laurie N, Radcliffe S, Andolina R. 2002. The new excluded ‘indigenous’? The implications of multi-ethnic policies for water reform in Bolivia. In *Multiculturalism in Latin America. Indigenous Rights, Diversity and Democracy*, ed. R Seider, pp. 252–76. New York: Palgrave
76. Caulfield C. 1986. *In the Rainforest*. Chicago: Univ. Chicago Press
77. Hecht S, Coburn A. 1989. *The Fate of the Forest: Developers, Destroyers, and Defenders of the Amazon*. New York: Verso
78. UN Food Agric. Organ. 2000. *Global Forest Resource Assessment*. Rome, Italy: UN Food Agric. Organ.
79. Clapp RA. 1995. Creating competitive advantage: forest policy as industrial policy in Chile. *Econ. Geogr.* 71(3):273–96
80. Silva E. 1997. The politics of sustainable development: native forest policy in Chile, Venezuela, Costa Rica and Mexico. *J. Latin Am. Stud.* 29:457–93
81. World Resour. Inst. 2002. *Chile's Frontier Forests: Conserving a Global Treasure*. Washington, DC: World Resour. Inst.
82. Clapp RA. 1998. Waiting for the forest law: resource-led development and environmental politics in Chile. *Latin Am. Res. Rev.* 33(2):3–36
83. World Rainfor. Mov. 2000. Chile: invasion of Mapuche territory by tree

- plantation companies. *World Rainfor. Mov. Bull.* 57(Apr.). <http://www.wrm.org.uy>
84. Silva E. 1996. Democracy, market economics and environmental policy in Chile. *J. Interam. Stud. World Aff.* 38(4):1–33
85. White A. 2003. *Forest plantations: good for what and for whom? Invited commentary to Asian Timber*. [http://www.katoombagroup.org/docs/pdf/Media/FP\\_AsianTimber6-03.pdf](http://www.katoombagroup.org/docs/pdf/Media/FP_AsianTimber6-03.pdf)
86. Victor DG, Ausubel JH. 2000. Restoring the forests. *Foreign Aff.* 79:127–44
87. Segura G. 2000. *Mexico's forests sector and policies: a general perspective*. Presented at Const. Commons: Crafting Sustain. Commons New Millenium, 8th Conf. Int. Assoc. Study Common Prop., Bloomington, IN
88. Klooster D. 2003. Forest transitions in Mexico: institutions and forests in a globalized countryside. *Profes. Geogr.* 55:227–37
89. Klooster D. 2000. Institutional choice, community, and struggle: a case study of forest co-management in Mexico. *World Dev.* 28(1):1–20
90. Guerrero MT, Reed C, Vegter B, Kourous G. 2000. The timber industry in northern Mexico: social, economic and environmental impacts. *Borderlines* 8(2):1–4, 15–16
91. Bray D, Merino-Perez L, Barry D. 2005. *The Community Forests of Mexico: Managing for Sustainable Landscapes*. Austin: Univ. Texas
92. Taylor PL, Zabin C. 2000. Neoliberal reform and sustainable forest management in Quintana Roo, Mexico: rethinking the institutional framework of the Forestry Pilot Plan. *Agric. Hum. Values* 17:141–56
93. Zabin C. 1998. Free markets and forests: community-based forestry in an era of neoliberal reform. In *The Transformation of Rural Mexico*, ed. WA Cornelius, D Myhre, pp. 401–26. La Jolla, CA: Cent. US/Mex. Stud., Univ. Calif. San Diego
94. Klooster D, Masera O. 2000. Community forest management in Mexico: carbon mitigation and biodiversity conservation through rural development. *Glob. Environ. Change Hum. Policy Dimens.* 10:259–72
95. Klooster D. 2005. Environmental certification of forests: the evolution of environmental governance in a commodity network. *J. Rural Stud.* 21:403–17
96. FONAFIFO. 2004. *Fondo nacional de financiamiento forestal de Costa Rica*. <http://www.fonafifo.com/>
97. Ferroukhi L, ed. 2003. *Municipal Forest Management in Latin America*. Bogor, Indones.: CIFOR/IDRC
98. Rojas M, Aylward B. 2003. What are we learning from experiences with markets for environmental services in Costa Rica? A review and critique of the literature. *Mark. Environ. Serv. Rep. MES 2*, Int. Inst. Environ. Dev., London, UK. <http://www.iied.org/pubs/display.php?o=9247IIED&n=7&l=8&s=MES>
99. David BDA, Dirven M, Vogelgesang F. 2000. The impact of the new economic model on Latin America's agriculture. *World Dev.* 28(9):1673–88
100. Barry T. 1995. *Zapata's Revenge*. Cambridge, MA: South End
101. Chase J, ed. 2002. *The Spaces of Neoliberalism: Land, Place and Family in Latin America*. West Hartford, CT: Kumarian
102. Cornelius WA, Myhre D, eds. 1998. *The Transformation of Rural Mexico: Reforming the Ejido Sector*. La Jolla: Cent. US/Mex. Stud., Univ. Calif. San Diego
103. Loker WM, ed. 1999. *Globalization and the Rural Poor in Latin America*. Boulder/London: Rienner
104. Otero G. 1996. *Neoliberalism Revisited: Economic Restructuring and Mexico's Political Future*. Boulder, CO: Westview
105. Veltmeyer H, O'Malley A, eds. 2001. *Transcending Neoliberalism: Community Based Development in Latin America*. West Hartford, CT: Kumarian
106. CEPAL. 2005. *El nuevo patrón de desarrollo de la agricultura en América Latina*

2.36 LIVERMAN ■ VILAS

- y el Caribe. Santiago, Chile: UN CEPAL. <http://www.eclac.cl/publicaciones/DesarrolloProductivo/0/LCW30/panorama2005.pdf>
107. Nadal A. 2000. *The Environmental and Social Impacts of Economic Liberalization on Corn Production in Mexico*. Oxfam/WWF Int. [http://www.oxfam.org.uk/what\\_we\\_do/issues/livelihoods/corn\\_mexico.htm](http://www.oxfam.org.uk/what_we_do/issues/livelihoods/corn_mexico.htm)
108. Patel R, Henriques G. 2003. *Agricultural trade liberalization and Mexico*. Food First, Inst. Food Dev. Policy, Policy Brief 7, San Francisco, CA: Inst. Food Dev. Policy
109. Rodríguez JMM. 2003. *Acuíferos y Agroquímicos en un Región Fronteriza: Retos y Oportunidades del TLCAN para la Agricultura Mexicana*. Presented at 2nd Simp. Anál. Sobre Ef. Comer. Medio Ambient., Com. Coop. Ambient., Montreal, Can.
110. Rodríguez JMM. 2003. *Acuíferos y Agroquímicos en un Región Fronteriza: Retos y Oportunidades del TLCAN para la Agricultura Mexicana*. Presented at 2nd Simp. Anál. Sobre Ef. Comer. Medio Ambient., Com. Coop. Ambient., Montreal, Can.
111. De Janvry A, Sadoulet E, De Anda GG. 1995. NAFTA and Mexico's maize producers. *World Dev.* 23:1349–62
112. Muñoz-Pina C, De Janvry A, Sadoulet E. 2003. Re-crafting rights over common property resources in Mexico. *Econ. Dev. Cult. Change* 2:129–58
113. Papademetriou D, Audley J, Polaski S, Vaughan S. 2003. NAFTA's promise and reality: lessons from Mexico for the hemisphere. *Rep. Carnegie Endow.*, Washington, DC
114. Nadal A. 1999. *Issue Study 1. Maize in Mexico: Some Environmental Implications of the North American Free Trade Agreement (NAFTA)*. Montreal, Can.: Comm. Environ. Coop.
115. Nadal A. 2002. *Corn in NAFTA: Eight Years After*. Comm. Environ. Coop. Montreal, Can. [http://www.cec.org/pubs\\_docs/documents/index.cfm?varlan=english&ID=1447](http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=1447)
116. Snyder R. 2001. *Politics after Neoliberalism: Reregulation in Mexico*. Cambridge UK: Cambridge Univ. Press
117. Kay C. 2002. Chile's neoliberal agrarian transformation and the peasantry. *J. Agrar. Change* 2(4):464–501
118. Gwynne RN. 1998. Globalization, commodity chains and fruit exporting regions in Chile. *R. Dutch Geogr. Soc.* 90(2):211–25
119. Thrupp LA. 1995. *Bittersweet harvests for global supermarkets. Challenges in Latin America's export boom*, World Resour. Inst., Washington, DC
120. Thrupp LA. 1988. Pesticides and policies: approach to pest-control dilemmas in Nicaragua and Costa Rica. *Lat. Am. Perspect.* 15(4):37–70
121. Wright A. 1990. *The Death of Ramon Gonzalez: the Modern Agricultural Dilemma*. Austin: Univ. Texas Press
122. Wright A. 1986. Rethinking the circle of poison: the politics of pesticide poisoning among Mexican farm workers. *Lat. Am. Perspect.* 13(4):26–59
123. Mutersbaugh T. 2005. Just-in-space: certified rural products, labor of quality, and regulatory spaces. *J. Rural Stud.* 21:389–402
124. Mutersbaugh T, Klooster D. 2005. Certifying rural spaces: quality-certified products and rural governance. *J. Rural Stud.* 21:381–88
125. Porter G. 2004. *Fisheries subsidies and overfishing: towards a structured discussion*. Presented at UN Environ. Programme Workshop Fish. Subsid. Sustain. Fish. Manag., Geneva
126. Thorpe A, Aguilar-Ibarra A, Reid C. 2000. The new economic model and marine fisheries development in Latin America. *World Dev.* 28(9):1689–702
127. Hernandez A, Kempton W. 2003. Changes in Fisheries Management in Mexico: Effects of Increasing Scientific

- Input and Public Participation. *Ocean Coast. Manag.* 46:507–26
128. Schurman RA. 1996. Snails, southern hake and sustainability: neoliberalism and natural resource exports in Chile. *World Dev.* 24(11):1695–709
129. Young E. 2001. State intervention and abuse of the commons: fisheries development in Baja California Sur, Mexico. *Ann. Assoc. Am. Geogr.* 91(2):283–306
130. Barrett G, Caniggia MI, Read L. 2002. “There are more vets than doctors in Chile”: social community impact of globalization of aquaculture in Chile. *World Dev.* 30(11):1951–65
131. Buschmann AH, Lopez DA, Medina A. 1996. A review of the environmental effects and alternative production strategies of marine aquaculture in Chile. *Aquac. Eng.* 15(6):397–421
132. Barton JR. 1997. Environment, sustainability and regulation in commercial aquaculture: the case of Chilean salmonid production. *Geoforum* 28(3–4):313–28
133. OECD. 1997. *Towards sustainable fisheries. Country reports: Mexico.* Organ. Econ. Co-op. Dev. [http://www.oecd.org/document/15/0,2340,en\\_2649\\_33901\\_344\\_27151\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/15/0,2340,en_2649_33901_344_27151_1_1_1_1,00.html)
134. Vásquez-León M. 1998. Neoliberalism, environmentalism, and scientific knowledge: redefining natural resource use rights in Mexico. In *States and Illegal Practices*, ed. JM Heyman, pp. 233–59. Oxford, UK: Berg
135. Cruz Torres M. 1992. Shrimp Mariculture in Mexico. *World Aquac.* 23:49–51
136. Cruz Torres M. 2001. “Pink Gold Rush:” shrimp aquaculture, sustainable development and the environment in northwestern Mexico. *J. Polit. Ecol.* 7:63–90
137. DeWalt BR, Ramírez-Zavala JR, Noriega L, González RE. 2002. Shrimp aquaculture, the people and the environment in coastal Mexico. *Rep. for World Bank/Netw. Aquac. Cent. Asia-Pac/World Wildl. Fund/UN FAO/Consort. Program Shrimp Farming Environ.* <http://www.enaca.org/Shrimp/Case/Latin America/Mexico/FinalMexico.pdf>
138. DeWalt BR, Vergne P, Hardin M. 1996. Shrimp aquaculture development and the environment: people, mangroves and fisheries on the Gulf of Fonseca, Honduras. *World Dev.* 24:1193–208
139. Stonich S. 1997. Globalization and the shrimp mariculture industry: the social justice and environmental quality implications in Central America. *Soc. Nat. Resour.* 10:161–79
140. Ibarra AA, Reid C, Thorpe A. 2000. Neoliberalism and its impact on overfishing and overcapitalisation in the marine fisheries of Chile, Mexico, and Peru. *Food Policy* 25:599–622
141. Gentry BS, ed. 1998. *Private Capital Flows and the Environment. Lessons from Latin America.* Northampton, MA: Edward Elgar