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Disregarding Environmental Law: Petroleum Development in Protected Natural Areas and Indigenous Homelands in the Ecuadorian Amazon*

By JUDITH KIMERLING**

I. INTRODUCTION

Ecuador, a small nation on the Pacific coast of South America, is home to some of the earth's most biologically diverse rain forests. The eastern half of Ecuador, sloping down from the Andes mountains, forms part of the western Amazon basin, encompassing over thirteen million hectares¹ of tropical rain forest. Known in Ecuador as the *Oriente*, this area is the home of 350,000 to 500,000 people, including 8 groups of indigenous people, as well as recent colonists from Ecuador's coastal and highland regions.

The *Oriente* is also home to a thriving and environmentally destructive oil industry. Over the past 2 decades, foreign oil companies led by Texaco, together with Ecuador's national oil company, have extracted almost 1.5 billion barrels of oil from the Ecuadorian Amazon. In the process, oil company roads have opened an estimated one million hectares of rain forests to colonization by incoming settlers. Accidental oil spills from the Trans-Ecuadorian Pipeline alone have dumped an estimated 400,000 barrels (16.8 million gallons) of oil, most of it in the *Oriente*.² Hundreds of oil wells generate more than 4.3 million gallons of

* Portions of this Article are adapted from J. KIMERLING, *AMAZON CRUDE* (Natural Resources Defense Council, 1991).

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1. One hectare equals 10,000 square meters, or 2.47 acres.

2. This figure accounts only for recorded spills from Ecuador's main pipeline.

toxic wastes every day,³ virtually all of which are spilled or discharged into the environment without treatment. This process contaminates countless streams and rivers, often the only sources of water for surrounding communities. Additionally, burning oil and gas contaminate the air, along with volatile organics that enter the air from oil-covered waste pits, roads, and unremediated spills.

Despite provisions in the Ecuadorian Law of Forestry and Conservation of Natural Areas and Wildlife that require that protected natural areas be preserved in an "unaltered state,"⁴ national parks and other protected areas have not been off-limits to the oil industry. Oil development is currently underway or contemplated for every protected area in the *Oriente*.⁵ These areas are also the homelands of indigenous peoples who are seriously threatened by oil development activities, despite their constitutional "right to an environment free of contamination."⁶ This Article will survey the major impacts of oil development on the environment in Amazonian Ecuador, and discuss the growing controversy surrounding oil development in two protected areas, Cuyabeno Wildlife Reserve and Yasuni National Park. Although Ecuadorian law unambiguously recognizes the public interest in a clean and healthy environment, and charges the government with environmental protection responsibilities, the national government has shown little or no willingness to comply with the law and establish meaningful environmental controls over the nation's most powerful industry. This Article concludes with some ideas for implementing the law.

II. THE *ORIENTE*: RAIN FORESTS AND HOMELANDS AT RISK

The tropical forests of the *Oriente* are among the most biologically diverse natural ecosystems on earth. They are full of rare and unique

DIGEMA, Dirección General de Medio Ambiente (DIGEMA) Propone Necesidad de Incorporar Plan de Contingencias para Sistema del Oleoducto Transecuatoriano (SOTE), Boletín de Prensa 1, 5 (1989) [hereinafter Boletín de Prensa, DIGEMA]. Discharges from secondary pipelines and flow lines have not been recorded.

3. MINISTERIO DE ENERGÍA Y MINAS, REPÚBLICA DEL ECUADOR, I. PRODUCCIONES DE PETRÓLEO, AGUA DE FORMACIÓN Y GAS NATURAL, Dic./89, at 3 (1989) [hereinafter PRODUCCIONES DE PETRÓLEO].

4. Ley Forestal y de Conservación de Areas y Vida Silvestre, tit. II, art. 71, para. 1 (1990).

5. Protected natural areas include roughly 10% of *Oriente* lands. Yasuni National Park, Cuyabeno Wildlife Reserve, and Limoncocha Biological Reserve lie entirely within the *Oriente*, along with portions of Cayambe Coca Reserve, and Podocarpus and Sangay National Parks.

6. CONSTITUCIÓN POLÍTICA DE LA REPÚBLICA DEL ECUADOR tit. II, § 1, art. 19, cl. 2.

species, and are potential sources of medicines, fruits, nuts, and other forest foods and products. Ecuador's ancient rain forests lie at the headwaters of the Amazon river system and help control flooding and erosion, even in the river's lower reaches.⁷ The *Oriente's* forests also help regulate the region's rainfall and climate. The forests are storehouses of carbon. When the forests are burned or cleared, carbon dioxide is released into the atmosphere, heightening the potential for global warming. The rain forests of the *Oriente* are also home to the region's indigenous people who depend on the forest for their livelihoods. Without the forests, Amazonian people would be threatened with cultural and, in some cases, physical extinction.

A. The Land

The rain forests of the *Oriente* are known and revered for their high levels of biological diversity and endemism,⁸ which are extraordinary even in relation to other parts of the Amazon basin. Botanists estimate that the lowland forests of the *Oriente* are home to between 9000 and 12,000 species of vascular plants, many of them endemic to the area.⁹ Animal species diversity is also high. In the *Oriente's* Yasuni National Park, for example, scientists have identified more than 600 species of birds, 500 species of fish, and 120 species of mammals. Among the animals of the *Oriente* are a considerable number of threatened or endangered species, including the black caiman, harpy eagle, jaguar, howler monkey, and tapir. According to tropical ecologist Norman Myers, western Amazonia "is surely the richest biotic zone on Earth," and "deserves to rank as a kind of global epicentre of biodiversity."¹⁰

Some scientists believe that the *Oriente's* unusual levels of biological diversity are linked to events of the Pleistocene ice ages over the last million years. According to this theory, known as the Pleistocene Refuge

7. For example, Gentry & Lopez-Parodi, *Deforestation and Increased Flooding of the Upper Amazon*, 210 SCIENCE 1354, 1354-56 (1980), have attributed the marked increase in the flood crest of the Amazon River at Iquitos, Peru, with increased runoff caused by deforestation in the upper parts of the Amazonian watershed in Peru and Ecuador.

8. Endemism refers to the presence of species found nowhere else on earth.

9. A single hectare of primary forest at Jatun Sacha Biological Station in the *Oriente* hosts 246 different species of trees (with a diameter of 10 centimeters or more). D. Neill & W. Palacios, Quantitative Inventory of One Hectare of Tropical Wet Forest on the Upper Rio Napo, Ecuador 4 (Quito 1990) (draft manuscript). By comparison, the entire United States and Canada, with a land mass of almost 2 billion hectares, is home to only 652 native species of trees. D. NEILL & W. PALACIOS, ARBOLES DE LA AMAZONIA ECUATORIANA: LISTA PRELIMINAR DE ESPECIES (Quito, 1989).

10. Myers, *Threatened Biotas: 'Hotspots' in Tropical Forests*, [8 No. 3] ENVIRONMENTALIST 187, 194 (1988).

Hypothesis, much of the Amazon basin dried out during periods of heavy glaciation, but isolated areas, including the Napo River area of the *Oriente*, remained moist, providing refuge for rain forest plants and animals. During these periods of isolation, new species appeared. As a result, refuge areas are characterized today by a high degree of plant and animal diversity, and endemism.

This startling biological richness is perched on a fragile and finely tuned ecological foundation. Most of the *Oriente's* soils are poor. Tropical forest species have survived by developing mechanisms to recycle nutrients quickly and efficiently, and they depend on one another for survival and reproduction. However, scientific knowledge about these mechanisms and interdependencies remains scanty. Most species have not even been identified by scientists. Botanists identify new species every time they study new areas of the *Oriente*.

Experience has shown, however, that monocrop agriculture is not sustainable in a tropical rain forest environment. Scientists do not know whether seriously degraded rain forests can regenerate, and many believe that they cannot. Regeneration would require nearby intact forests to serve as a source of seeds and mycorrhizal fungi, and would require soil that would be conducive to regeneration. Heavily eroded soils most likely could not regenerate a forest. Even small, disturbed areas of the *Oriente's* forests might require centuries to regain a semblance of their current richness, under the best conditions.

Scientists believe that even undisturbed fragments of once contiguous wilderness may be degraded by isolation. Preliminary research in Brazil by ecologist Thomas Lovejoy suggests that the minimum area required for a tract of Amazon rain forest to maintain its characteristic biological diversity exceeds one million hectares.¹¹ In addition, because Amazon forests generate between one-half and three-quarters of their own rain by returning water to the atmosphere through evapotranspiration and direct evaporation, undisturbed rain forests can dry out if surrounding forests are destroyed.¹²

The huge gaps in our understanding of Amazonian ecology mean that we cannot identify the full range of losses that have been caused by oil development in the *Oriente*, or predict the full range of damages that are yet to come. Only the most obvious and acute impacts on the people and the forests can be recognized at this time.

11. Lovejoy, *Amazonia: People and Today*, in KEY ENVIRONMENTS: AMAZONIA 328, 336 (G.T. Prance & T.E. Lovejoy eds. 1985).

12. Salti, *The Climatology and Hydrology of Amazonia*, in KEY ENVIRONMENTS: AMAZONIA, *supra* note 11, at 176, 179.

B. The People

Ecuador's *Oriente* has a rich heritage of indigenous cultures, and is home to eight groups of indigenous people. Estimates of the *Oriente*'s indigenous population range from 85,000 to 250,000—25 to 50 percent of the region's total population.¹³ Two groups, the Quichua and the Shuar, together account for the majority of indigenous people in the *Oriente*. The balance of the population is found among the Achuar, Cofan, Huaorani, Shiwiar, Secoya, and Siona. The Huaorani number roughly 1580 individuals, the Shiwiar number some 600, and together the Secoya and Siona number about 350. The Cofan population, once 15,000, is now less than 1000.¹⁴

Indigenous peoples have lived in Amazonia for thousands of years in harmony with their rain forest environment. Since the Spanish arrived in Ecuador nearly 500 years ago, the *Oriente* has been a magnet for fortune seekers and missionaries. Spanish adventurers first entered upper Amazonia in what is now Ecuador, and the first mission bases were established there in the sixteenth century.¹⁵ It was not until the rubber extraction boom began in the late 1800s, however, that dreams of easy wealth first came true in Amazonia. A handful of rubber barons became rich, but at great expense to the people. Their atrocities throughout Amazonia are well-documented. Thousands of indigenous people in Ecuador, Peru, and Colombia were killed.¹⁶ The boom ended in the early 1900s when rubber seeds were smuggled out of Brazil and successfully cultivated on plantations in Malaysia.

In 1942 Ecuador lost nearly one-third of its national territory when about one-half of its Amazon region was annexed by Peru. Oil companies encouraged Peru's aggression,¹⁷ and today, large quantities of petroleum are being extracted from annexed lands by Occidental Petroleum and the national oil company of Peru. Ecuador has not conceded this loss and includes the annexed area in maps of the country. Government

13. Interviews with Leonardo Viteri, Organización de Pueblos Indígenas de Pastaza (OPIP) and Wilfredo Aragon, Vice President of Confederación de Nacionalidades Indígenas de la Amazonía Ecuatoriana (CONFENIAE); The World Bank, Ecuador: Development Issues and Options for the Amazon Region (Dec. 5, 1989) (discussion paper) [hereinafter The World Bank, Ecuador].

14. In addition to these populations in Ecuador, populations of some of these groups live in Peru and Colombia.

15. Corry, *Ecuadorian Amazonia: The 'Naked', the 'Noble', and the 'Tamed', in An End to Laughter? Tribal Peoples and Economic Development*, SURVIVAL INT'L REV. (No. 44) — (1984).

16. *Id.*

17. *Id.*

letterhead proclaims, alongside the national emblem, that "Ecuador has been, is, and will be an Amazonian country."¹⁸ The *Oriente* is a national security area, and, aided by oil company infrastructure and roads, the Ecuadorian military has become a formidable force in the forests.

Despite centuries of conflict, Amazonian Ecuador has not been "conquered," and its indigenous people, though increasingly threatened, have maintained their cultures and rich family and community life, while adapting in various ways to changes around them. Indigenous cultures remain strong, even though most individuals have not maintained many of the overt signs that contribute to a native Amazonian stereotype. Most people, for example, now wear western clothes. Although most indigenous people rely, to varying degrees, on mixed subsistence, trade, and cash economies, dependence on the rain forests remains high. Hunting, fishing, and gathering typically complement small-scale, shifting cultivation of cash and subsistence crops.¹⁹ Recent studies have identified over 700 plant species that indigenous communities use for nutritional, medicinal, domestic, and religious purposes. Fish and wildlife are important sources of protein and calories, and communities depend on streams, rivers, and lakes for fishing, gathering, drinking, cooking, bathing, and transportation. Manioc is cultivated in family gardens and remains the major source of carbohydrates for the people. Generally, men clear the forests for new gardens, and women cultivate them.

Although many indigenous people, especially the younger ones, speak fluent Spanish, it remains a second language. Native tongues are typically spoken in homes and communities. Despite the nominal Christianity of many indigenous people, belief in balance and reciprocity between humans and nonhuman rain forest species remains strong, and the environment is widely regarded as the source of life for future generations. These values are deeply embedded in traditional cultures and spiritual life, and have long helped to sustain the natural resource base of the people. For example, local taboos that limit or prohibit fishing in lakes that are inhabited by guardian spirits can be important in sustaining fish populations.²⁰

Land use practices of the *Oriente* people are also based on sophisticated knowledge about local ecosystems and an integrated approach to resource management. Indigenous gardens, for example, are frequently designed and cultivated in ways that not only provide a reliable source of

18. See, e.g., PRODUCCIONES DE PETRÓLEO, *supra* note 3, *passim*.

19. Some Achuar, Shuar, and Quichua also have beef cattle.

20. Sponsel, *Amazon Ecology and Adaptation*, in 15 ANN. REV. ANTHROPOL. 67 (1986).

carbohydrates, but also facilitate hunting and gathering, even when they lie fallow. Certain fruit and nut trees are planted to increase the productivity of the gardens, to encourage succession and the return of the forests, and to attract animals which are then hunted.

Scientists are beginning to study the ways that indigenous people throughout Amazonia use and manage the resources of the forests. These scientists believe that an understanding of indigenous wisdom and culture will help them understand how rain forest species survive and interact, so that sustainable alternatives for development in tropical forest areas can be devised and the resources of the forests can be harvested.

The national government of Ecuador, however, continues to view the *Oriente* as a frontier to be conquered. As a result, the *Oriente* people are increasingly threatened by aggressive government policies that seek to develop and colonize their lands, and assimilate them into the dominant Ecuadorian culture. In theory, Ecuadorian national culture is homogeneous; in reality, it is ethnically diverse, with extremes of wealth and poverty. According to one noted anthropologist, "racism in Ecuador is institutionalized to a degree that would shock even black Americans,"²¹ and "ethnocide" is a strategy of the national government to conquer Amazonia.²² For Amazonian people, assimilation means rejecting their traditional beliefs and ways of life, lowering their standard of living, and entering the lowest social and economic levels of Ecuadorian society. The loss of ancestral lands means they cannot and will not survive.

The oil boom in the *Oriente* has greatly accelerated the conquest of Amazonia, and indigenous people and cultures are now more seriously threatened than ever. Oil companies have collaborated with missionaries to "pacify" indigenous people,²³ and have degraded the resources that the people need to live. Land speculators, loggers, ranchers, colonists, agri-industrialists, tour groups, and the Ecuadorian military have followed oil roads into *Oriente* forests, appropriating indigenous lands, and destroying and degrading the forests. Outsiders have set off epidemics of new diseases in indigenous communities. To varying degrees, people are abandoning subsistence activities because important resources are de-

21. N.E. WHITTEN, IWGIA DOC. ECUADORIAN ETHNOCIDE AND INDIGENOUS ETHNOGENESIS: AMAZONIAN RESURGENCE AMIDST ANDEAN COLONIALISM, (Copenhagen 1976).

22. *Id.*

23. J.F. Sandoval Moreano, Corporación Estatal Petrolera Ecuatoriana (CEPE), *Pueblos Indígenas y Petróleo en la Amazonía Ecuatoriana* (Quito 1988) [hereinafter Sandoval Moreano, *Pueblos Indígenas*].

graded or families want cash to buy goods they cannot themselves produce. Dependency on outsiders is growing. Pressures to modernize and adopt the ways of the dominant, "civilized" culture are strong, and some young people no longer learn the methods their ancestors used to manage important rain forest resources.

In response to these threats, indigenous people are organizing themselves. Eight local federations, with representatives from over 960 Amazonian communities, make up the Confederación de Nacionalidades Indígenas de la Amazonía Ecuatoriana (CONFENIAE).²⁴ These organizations are working to preserve the multiethnic and multicultural nature of Ecuadorian society, and to safeguard the rights of indigenous people to ancestral lands and self-determination.

Indigenous people have frequently come into conflict with colonists who have streamed into the *Oriente* in increasing numbers over the last twenty years. Most colonists are poor *campesinos* who migrate to the *Oriente* from the highland (Andes) and coastal regions of Ecuador. Lured by government policies that promise easy credit and land ownership, they come from rural areas where growing populations, ecological deterioration, periodic droughts, and a long history of abuse by the wealthy few who control most of the productive land leave them with little or no means to feed their families. The most recent census, conducted in 1982, showed that the regional population in the *Oriente* had grown by 4.9 percent annually, nearly twice the national rate. Population in oil producing areas, where colonists used oil company roads to penetrate roughly one million hectares of tropical rain forest, grew by eight percent each year.²⁵

The *Oriente* provides the national government with an escape valve for demographic and land distribution pressures. Despite the presence of indigenous people, Ecuadorian law treats the vast majority of Amazonian territory as *tierras baldías*, or unoccupied lands. The law declares colonization of these lands to be an urgent national priority, and offers land titles to settlers who clear the forests for crops or pastures.²⁶

24. The federations include Asociación de Comunidades Indígenas de la Nacionalidad Cofan (ACOINCO); Federación Centros Shuar-Achuar; Federación de Comunas Unión de Nativos de la Amazonía Ecuatoriana (FCUNAE); Federación de Organizaciones Indígenas de Sucumbíos, Ecuador (FOISE); Federación Independiente del Pueblo Shuar del Ecuador (FIPSE); Federación Organizaciones Indígenas de Napo (FOIN); Organización de Pueblos Indígenas de Pastaza (OPIP); Organización Indígena Siona-Secoya del Ecuador (OISSE). Nationally, CONFENIAE is part of Confederación de Organizaciones Indígenas del Ecuador (CONAIE).

25. The World Bank, Ecuador, *supra* note 13.

26. Under Ecuadorian law, clearing the rain forests demonstrates use and domain of the

Despite these policies, public infrastructure in the *Oriente* has been designed principally to support the petroleum industry. As a result, settlement patterns follow the oil transportation network, regardless of the suitability of local soils for crops and pasture, or the presence of indigenous territories or protected natural areas. Poor settlers who migrate to the *Oriente* in search of land and a better life are confronted with the realities of a rain forest ecosystem that does not permit sustainable cash-crop farming or cattle ranching. While some urban settlers have succeeded in building up small, thriving businesses in *Oriente* boom towns, most remain desperately impoverished, with poorer health and nutrition, and a lower standard of living than most indigenous people.

Tens of thousands of colonists live in the shadows of oil production facilities, where their poverty is exacerbated by oil pollution that can contaminate their water supplies, destroy local fisheries, and kill crops and livestock. Public services such as water supply and sanitation are virtually nonexistent in both rural and urban areas, and the urban centers are basically frontier boom towns. Land conflicts with indigenous people frequently occur, and tensions between these groups are often inflamed by politicians who erroneously accuse indigenous organizations of wanting to remove all colonists from the *Oriente* and establish a separate country in the region.²⁷

C. Oil Development Activities

Commercial quantities of oil were first discovered in the *Oriente* in 1967 by Texaco and extraction began in 1972.²⁸ Current oil production activities span nearly 1 million hectares in the *Oriente*, and include over 300 active wells²⁹ and 29 production camps,³⁰ producing roughly 282,000 barrels of crude per day.³¹ A 498-kilometer Trans-Ecuadorian Pipeline, SOTE (Sistema del Oleoducto Trans-Ecuatoriano), carries most

land. Ley de Tierras Baldías (Law of Unoccupied Lands); Ley de Colonización de la Región Amazónica (Law of Colonization of the Amazon Region).

27. Those organizations do not seek the ouster of colonists who are already in the region, but strongly oppose new colonization of their traditional lands. Within those lands, they seek their rights as people to self-determination, as Ecuadorians living in a multiethnic and multi-cultural Ecuador. They do not seek to set up an independent country.

28. CEPE, INFORMACIÓN GENERAL DEL AREA DEL CONSORCIO CEPE TEXACO ECUADOR 4-5 (1988) [hereinafter INFORMACIÓN GENERAL].

29. *Worldwide Production Chart, Ecuador*, OIL & GAS J., Dec. 25, 1989, at 58.

30. Interviews with Fernando Reyes, Head of the Department of Prevention and Regulation (DINAMA) in Quito, Ecuador (July 1990) [hereinafter 1990 Interviews with Fernando Reyes].

31. PRODUCCIONES DE PETRÓLEO, *supra* note 3, at 2.

of the crude across the Andes Mountains to the Pacific coast.³² In addition, there are 391 kilometers of secondary pipelines and 106 kilometers of transfer lines in the *Oriente* and a 305-kilometer gas line between Shushufindi and Quito, the Andean capital of Ecuador.³³ Regional oil refineries are located at Lago Agrio and Shushufindi; Shushufindi is also the site of a gas plant.³⁴

Three consortiums control oil production activities in the *Oriente*. Facilities operated by the Petroecuador-*Texaco* consortium span 442,965 hectares³⁵ and produce approximately 213,840 barrels of petroleum daily.³⁶ Petroecuador-City³⁷ (now operated by *Clyde Petroleum* of the United Kingdom) controls 36,227 hectares, with an output of roughly 6120 barrels per day.³⁸ Petroecuador controls 426,000 hectares,³⁹ with an output of approximately 62,040 barrels per day.⁴⁰

Texaco built the Petroecuador-*Texaco* facilities and operated them until June 1990 when a subsidiary of Petroecuador assumed operational management of those facilities.⁴¹ *Texaco* will remain involved in managing those facilities until at least 1992.⁴² Petroecuador-*Texaco* facilities include two secondary recovery operations at the Shushufindi-Aguarico and Sacha oil fields.

Current oil exploration activities span three million hectares and are carried out by Petroecuador and nine foreign companies. The foreign companies operate in 200,000 hectare concessions, and include: *Oryx*,

32. INFORMACIÓN GENERAL, *supra* note 28, at 13.

33. CEPE, TÉRMINOS DE REFERENCIA PARA LA PREPARACIÓN DE UN PLAN INTEGRAL DE MANEJO AMBIENTAL DE LA ACTIVIDAD HIDROCARBURÍFERA ECUATORIANA 3 (1987).

34. *Id.* at 5.

35. INFORMACIÓN GENERAL, *supra* note 28, at 7.

36. *Id.*; PRODUCCIONES DE PETRÓLEO, *supra* note 3, at 2; When oil extraction began in this concession in 1972, it spanned 500,000 hectares and was controlled by *Texaco*, in a consortium with *Gulf*. The concession was reduced to 491,355 hectares in 1972. Petroecuador's predecessor company, CEPE, bought into the concession in 1973. In 1977 *Gulf* sold its remaining interests in the concession and SOTE to CEPE. In 1983 the area of the concession was reduced to its present size. See INFORMACIÓN GENERAL, *supra* note 28, at 5-7.

37. City Investing Co., a U.S. holding company. City sold its *Oriente* interests to *Clyde Petroleum* in the 1980s.

38. PRODUCCIONES DE PETRÓLEO, *supra* note 3, at 2; J.F. Sandoval Moreano, *Petróleo y Desarrollo Regional* 3a (Quito 1985) [hereinafter Sandoval Moreano, *Petróleo y Desarrollo Regional*].

39. Sandoval Moreano, *Petróleo y Desarrollo Regional*, *supra* note 38, at 3a.

40. PRODUCCIONES DE PETRÓLEO, *supra* note 3, at 2.

41. *Crucial Changes Ahead for Ecuador Oil*, OIL & GAS J., Mar. 25, 1991, at 21.

42. *Texaco*, in a consortium with *Respol*, the Spanish national oil company, has proposed investing one billion dollars in additional enhanced recovery operations in the Petroecuador-*Texaco* concession, and reportedly seeks to extend its contract with the Ecuadorian government beyond 1992.

fomerly a subsidiary of the Sun Company (U.S.); Petro-Canada (Canada); ARCO (U.S.); British Gas (U.K.), operator in a consortium with Total CFP (France), Yukong Ltd. (South Korea), and Maersk Oil and Gas (Denmark); Unocal (U.S.); Elf Aquitaine (France), operator in consortium with Braspetro (Brazil) and YPF (Argentina); Occidental Exploration and Production Company (U.S.); Conoco (a U.S. subsidiary of DuPont), operator in a consortium with Overseas Petroleum and Investment Corporation (OPIC), Maxus Energy Corp., Northern Michigan Exploration Co. (NOMECO), Murphy Ecuador Oil Company Ltd., and Canam Offshore Ltd.; and, Consortium Braspetro, Petrobras (Brazil), operator in a consortium with Elf Aquitaine and Britoil (U.K.). Three of these foreign companies, Conoco, Oryx, and British Gas, have finished exploration and are now negotiating the terms of production with Petroecuador. The government of Ecuador is currently evaluating bids for an additional 800,000 hectares of *Oriente* concessions, and announced that in January 1991 it would offer a new round of concessions totalling 600,000 hectares.⁴³

Over the last 18 years, nearly 1.5 billion barrels of oil have been extracted from the *Oriente*, the equivalent of Ecuador's current estimated reserves.⁴⁴ At the current production rate of approximately 100 million barrels of oil per year, all of Ecuador's oil may be exhausted by the year 2005.⁴⁵

Nearly twenty-five years after the discovery of commercial quantities of oil in the *Oriente*, Ecuador remains dependent on foreign capital and technology to find and develop its reserves.⁴⁶ In addition, Ecuador's economy remains as vulnerable to external markets and fluctuations in the international price of oil as it was in the pre-oil era to fluctuations in the prices of agricultural commodity exports such as cocoa, coffee, and bananas. Revenues from oil development have not been invested in diversifying the national economy, and oil continues to account for over forty percent of the nation's export earnings and government budget.⁴⁷

43. *Ecuador Plans New Round of Tenders for Three Blocks*, Platt's Oilgram News, Dec. 14, 1990, at 5.

44. *Ecuador Country Report: Analysis of Economic and Political Trends Every Quarter*, 3 ECONOMIST INTELLIGENCE UNIT (1990).

45. *Oil Distribution and Production Potential*, OIL & GAS J., Jan. 18, 1989, at 58.

46. Both exploration and development in Ecuador have been carried out predominantly by foreign companies. For its own activities, Petroecuador relies heavily on foreign contractors and imports. Some 94% of the tools, machinery, accessories, campers and vehicles, specialized equipment, chemical products, and piping the company purchased in 1982 were imported.

47. Petroleum revenues accounted for 40.3% of the national budget in 1988, 37.8% in 1987, 39.4% in 1986, 60.2% in 1985, and 46.8% in 1984. Exports of petroleum and its deri-

Rising oil prices in the wake of the Iraqi invasion of Kuwait and the Gulf War offer at best a temporary reprieve for Ecuador's economy. In addition, the benefits of oil development have not been well-distributed. Today, despite higher incomes for some, most of Ecuador's population continues to live in poverty.

Ecuador has used its oil to obtain credit and has amassed an enormous foreign debt, now totaling some 12.4 billion dollars, more than the nation's 1988 Gross National Product (GNP). This debt imposes a considerable burden on the economy and heightens pressures on the government to exploit oil reserves wherever they are found, regardless of the presence of protected areas or indigenous communities.

III. IMPACTS OF PETROLEUM DEVELOPMENT ON THE LAND AND THE PEOPLE⁴⁸

Oil development inflicts adverse impacts on the land and the people of the *Oriente* at every stage, from initial seismic studies and exploratory drilling through production and transportation.

vates provided 48.7% of Ecuador's export earnings in 1989, 44.5% in 1988, 37.6% in 1987, 44.9% in 1986, 66.3% in 1985, and 70.0% in 1984.

48. In addition to the sources cited *supra*, the following documents provided helpful background information for the study in this section: D. Bolze, Testimony Before the Subcomm. on Panama Canal and Outer Continental Shelf of the House Comm. on Merchant Marine and Fisheries, National Audubon Society, New York (Sept. 12, 1989); D. Bolze & M. Lee, Offshore Oil and Gas Development: The Ecological Effects Beyond the Offshore Platform (July 11-14, 1989) (preprint of paper to be presented at and printed in the Proceedings for COASTAL ZONE '89: The Sixth Symposium on Coastal and Ocean Management); F. REYES, DIGEMA, IMPACTO AMBIENTAL CONSORCIO CEPE-TEXACO COMUNIDAD NATIVA COFANES (Quito 1989); C. QUEVEDO & J. MEDINA, LA CONTAMINACIÓN EN LAS ACTIVIDADES HIDROCARBURÍFERAS EN EL ECUADOR (Jan. 1987); N. Smith, L. Speer & J. Bloom, Comments of the Natural Resources Defense Council on EPA's Report to Congress on the Management of Wastes from the Exploration, Development and Production of Crude Oil and Natural Gas, and Geothermal Energy, Docket No. F-88-OGRA-FFFFF (Mar. 14, 1988); L. SPEER & S. LIBENSON, OIL IN THE ARCTIC: THE ENVIRONMENTAL RECORD OF OIL DEVELOPMENT ON ALASKA'S NORTH SLOPE (Jan. 1988); U.S. Environmental Protection Agency, *Report to Congress: Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy* (Dec. 1987); U.S. FISH & WILDLIFE SERVICE, COMPARISON OF ACTUAL AND PREDICTED IMPACTS OF THE TRANS-ALASKA PIPELINE SYSTEM AND PRUDHOE BAY OILFIELDS ON THE NORTH SLOPE OF ALASKA (Dec. 1987) (transcript released May 1988); D.F. WOODWARD, E. SNYDER-CONN, R.G. RILEY & T.R. GARLAND, DRILLING FLUIDS AND THE ARCTIC TUNDRA OF ALASKA: ASSESSING CONTAMINATION OF WETLANDS HABITAT AND THE TOXICITY TO AQUATIC INVERTEBRATES AND FISH 683-97 (1988). The author also wishes to acknowledge the invaluable assistance of CONFENIAE and FCUNAE, who accompanied her on repeated visits to oil facilities and communities in the *Oriente*, and whose insights and hospitality contributed immeasurably to this study.

A. Exploration Activities

Oil exploration begins with seismic studies, which are carried out over a one to two year period. Standard practice involves gridding the entire concession with trails and heliports, and detonating underground explosives at regular intervals along the trails. By monitoring the movement of resulting sound waves through the ground, company geologists can detect the potential presence of oil reserves far beneath the earth's surface.

During seismic studies, noisy helicopters carry equipment and work crews into the forests. They fell trees, clear trails and heliports, destroy crops, drill holes, and detonate explosives, typically without regard for the presence of homes, gardens, streams, lakes, or sacred areas. Indigenous people say these activities make wildlife act "crazy" and flee in terror, abandoning their young.⁴⁹ Fish and wildlife also suffer from uncontrolled hunting and fishing (with explosives) by seismic workers. Clearing the forests destroys habitat, foods, medicines, and commercial woods. Erosion in cleared areas can degrade receiving waters by increasing turbidity, or the amount of sediment and foreign particles in water.⁵⁰

Seismic studies are followed by the drilling of exploratory wells, which results in more environmental degradation and contamination. The average depth of exploratory wells is roughly 10,000 feet. Their numbers vary from concession to concession. After a well is drilled, liquids and gas from underground geologic formations are brought to the surface and tested for oil, gas, and water content. Using this information, oil companies can determine whether commercial quantities of petroleum are available.

Before drilling a well, the oil company clears two to five hectares to build a drilling platform. Up to fifteen hectares of the surrounding forests are disturbed by logging for boards to lie beneath the platform. Wells are typically drilled without regard for the presence of settled areas. For example, Occidental Petroleum recently destroyed gardens and homes in the Quichua community of Limoncocha to drill an exploratory

49. Data from temperate zones indicates that noise can cause avoidance behavior in a wide range of species. This can have particularly serious impacts if the intruded areas are critical feeding or nursing areas.

50. Increased turbidity can interfere with respiration by certain aquatic organisms, causing death by suffocation. It can also cause lesions on the skin of fish, leading to infections, and can hamper photosynthesis by phytoplankton as light penetration through the water is reduced. This can have far-reaching ecological consequences, because phytoplankton are basic elements of the aquatic food chain, and because photosynthesis is a principal source of dissolved oxygen in water, especially in slow-moving waters.

well. Companies may build a new road to a well if it is near an existing road or major river, but access is usually by helicopter. For large helicopters, additional lands are sometimes cleared for flight paths.

At the edge of each platform, oil companies dig a large hole in the ground to serve as a waste pit. Debris from construction activities is typically dumped without regard for natural drainage patterns, creating water impoundments and damming streams. In addition, erosion from cleared lands into surrounding streams can contaminate the drinking water of neighboring communities and disrupt aquatic habitats that serve as local fisheries.

Exploratory drilling and testing generate significant amounts of wastes that contain toxic components. Most of these wastes are discharged into open waste pits, known as reserve pits.⁵¹ Typically, pits are unlined and poorly constructed. The sides of the pits sometimes give way, spilling their contents into the environment. Spills also occur as rainwater and wastes fill the pits and overflow. Most of the spilled wastes drain into small rivers or streams. Wastes that remain in the pits, together with contaminated rainwater, eventually seep into the groundwater, threatening freshwater aquifers and nearby surface waters. Waste oil from the testing process, which amounts to approximately 42,000 gallons per well,⁵² is usually burned in an open fire, without temperature or air pollution controls.⁵³ The question, then, is not whether wastes from exploratory drilling activities will enter the environment, but how quickly and by what means.

Drilling wastes include drilling muds and industrial cleaning solvents that are brought into the forests by oil companies for use in drilling activities, as well as cuttings from the hole, petroleum, natural gas, and formation water that come from the hole during drilling and testing activities. When the wastes leave the hole they are very hot, and the formation water, oil, and gas are toxic. Drilling muds also contain toxic chemicals, and, because the spoils are coated with drilling muds, they can also contain a number of toxic substances. On average, 4165 cubic meters of muds and mud-coated drilling wastes are dumped into open pits every time a well is drilled in the *Oriente*.⁵⁴

51. Sometimes wastes are dumped directly onto surrounding soils or into nearby waters.

52. Interview with Fernando Reyes, Head of DINAMA, in Quito, Ecuador (July 28, 1989) [hereinafter 1989 Interview with Fernando Reyes].

53. Air pollution also results from uncontrolled air emissions from engines and generators that commonly use diesel fuel to power drilling and other activities, and particulates emitted by drilling operations. These particulates can contain heavy metals as well as polycyclic organic matter.

54. This figure was calculated by the Drilling Department of Ecuador's National Direc-

Drilling mud has the consistency of a thick liquid, and, during drilling, it serves as a lubricant, coolant, and pressurizer. It also helps carry debris out of the hole and forms a cake-like lining inside the hole to seal it. The exact chemical composition of drilling muds varies from hole to hole and even within the same hole, but drilling muds are typically made from clays, barite, and chemical additives, and can be water- or oil-based. Many of the additives are very toxic, and can include biocides, bactericides, corrosion inhibitors, thickeners, and chemicals to control the pH. Drilling mud wastes can be mixed with petroleum and salts from the hole, and can be very alkaline.

Despite several requests from environmentalists, oil companies in Ecuador have not made chemical data about their drilling wastes available to the public. Data from the United States, however, shows that drilling wastes can typically contain significant amounts of a wide range of toxic pollutants, including aluminum, antimony, arsenic, barium, cadmium, chromium, copper, lead, magnesium, mercury, nickel, zinc, benzene, naphthalene, phenanthrene, and other hydrocarbons, as well as toxic levels of sodium and chlorides.

Many of these pollutants can foul streams and rivers long after they have been dumped into the water because they persist in sediments which, once contaminated, can continue to pollute the water column. Heavy metals and some hydrocarbons tend to bioaccumulate in the food chain, where they can affect water birds, humans, and other animals because of concentrated levels in food sources. Among other impacts on plant and animal life, arsenic, cadmium, chromium, lead, benzene, and other aromatic hydrocarbons have known or suspected carcinogenic effects.

Pollution from drilling wastes can rob streams and rivers of the oxygen that aquatic organisms need to survive,⁵⁵ and when dumped directly into those waters, the wastes can increase turbidity and asphyxiate bottom-dwelling, or benthic, organisms, and destroy their habitats. Benthic communities are vital links in the food chain. Damage to these communities can have far-reaching ecological consequences.

Recently, several foreign oil companies have landfilled drilling wastes instead of abandoning them in open pits. The landfills, however, are of the pre-Love Canal⁵⁶ variety: there is no pretreatment or monitor-

tive of Hydrocarbons, and does not include the mud that is used but not removed from the hole. DINAMA has estimated that 30% of the mud that is used is not recovered, and significant quantities of this mud enter freshwater formations.

55. That is, the wastes have high biochemical oxygen demand (BOD).

56. The Love Canal landfill, in Niagara Falls, New York, was the first hazardous waste

ing, there are no liners, no leachate collection systems, no cap design, or no maintenance. Moreover, the muds are not solids, and landfilling them in a wet rain forest environment promises special problems for cap maintenance. Over time, the contents of the landfills can be expected to settle. As the contents settle and the cap erodes, it will be breached and the toxic contents of the landfill can find their way to the surface and spill into the environment. Rain passing through the landfills can become contaminated by the toxic wastes, and steady rains and a high water table will carry toxic leachate from the landfills into freshwater aquifers. Between rains, water that has accumulated in depressed areas will continue to percolate into the landfills, where it can generate more toxic leachate.

Contaminated groundwater can be expected to migrate into surface waters or nearby drinking water wells. This is what occurred at Love Canal and other hazardous waste sites throughout the United States. In the geologically dynamic *Oriente*, streams and rivers, especially smaller ones, could also become contaminated as they change course over time and intercept a landfill.⁵⁷

B. Production Activities

If commercial quantities of oil are detected, production wells are drilled. After drilling, these wells are prepared for production in a process known as well development and completion.⁵⁸ During production, oil is extracted in a mixture with formation water and gas, and is typically pumped from a group of wells to a central separation facility.⁵⁹

site to alert the nation to the dangers of improper disposal of toxic wastes. The landfill had been abandoned in 1953. In 1978 the New York State Health Commissioner declared the area to be a threat to human health and welfare because, over the years, hazardous wastes had migrated both to the surface of the landfill and through groundwater into nearby homes. The crisis at Love Canal played a major role in prompting extensive reforms in federal and state laws that govern the disposal and handling of toxic wastes.

57. After exploratory drilling has been completed and the pits have been abandoned, exploratory wells can continue to be sources of contamination. Unless they are properly plugged, abandoned wells, even "dry" wells, can ooze or even spray contaminating fluids to the surface or into freshwater aquifers. These fluids can include injected wastes, petroleum, formation water, and chemically treated waters which are injected later for the enhanced recovery of petroleum. Wells that pass through an injection zone are of special concern because they can be exposed to elevated reservoir pressures. In the United States, the Environmental Protection Agency (EPA) has documented numerous cases of environmental and crop damage caused by the migration of injected fluids through improperly plugged and abandoned wells in producing areas. The lack of information about proper well closure in Ecuador suggests that closure probably does not occur.

58. This involves establishing a flow line for the oil between the reservoir and the surface. Methods vary, but typically a well casing is installed and perforated, chemicals are injected, and production from the well is tested.

59. Some wells have small on-site separation facilities.

Separated oil is then sent out from the separation facility through a pipeline.

Each of the environmental problems associated with exploratory drilling is repeated many times over during production, as new lands are cleared and more wells are drilled. In addition, a variety of chemicals, some of them extremely hazardous, are used in well development and completion. Once production begins, enormous quantities of toxic wastes are generated on an ongoing basis at the wells and separation facilities. At the separation facilities alone, over 4.3 million gallons of liquid wastes are generated every day and discharged without treatment into unlined production pits in a toxic soup known as produced water.

Roughly fifty-three million cubic feet of waste gas from the separation process are burned daily without any air pollution controls.⁶⁰ Routine maintenance activities at the more than three hundred producing wells discharge an estimated five million gallons of untreated toxic wastes⁶¹ into the environment every year, often via unlined open pits at the well sites.

Poor maintenance and operational sloppiness cause even more pollution in production areas of the *Oriente*. For example, hazardous chemicals, which sometimes must be injected into wells for maintenance purposes, can commonly be seen leaking from storage drums and valves, forming standing puddles near the wells. Leaks from wells and flow lines are routine, typically as a result of bad welds or valves that have not been properly closed. Spills from tanks are also common, and can be caused by accidents, carelessness, or lack of maintenance. Spills from flow lines alone dump an estimated 17,000 to 21,000 gallons of oil into the *Oriente*

60. Calculation based on PRODUCCIONES DE PETRÓLEO, *supra* note 3, at 3; 1990 Interviews with Fernando Reyes, *supra* note 30.

61. The total considers only wastes from regular maintenance activities called "workovers" that, according to DINAMA, are carried out roughly every six months at each producing well and generate some 8400 gallons of waste each time they are undertaken. 1989 Interview with Fernando Reyes, *supra* note 52. Typically, the workover is a procedure to eliminate calcium carbonate that forms at the face of the well and retards the flow of petroleum into the well. Methods vary, but the first procedure is usually to "acidize," or chemically treat the oil-bearing formation by injecting a mixture of strong acids, diesel or aviation fuel, and other chemical additives into the formation under pressure. The acid etches the rock, enlarging the pore spaces and passages that the oil passes through to enter the well. Wastes, a mixture of formation water, petroleum, fuel, acids, and other chemicals, are evacuated from the hole. If acidizing does not restore the flow of petroleum, the formation may subsequently be fractured. To fracture a formation, sand in a high viscosity fluid is typically pumped into the hole at high pressure, cracking the formation. When the pumping stops, the pressure drops and the formation contracts. Sand remains in the formation, increasing its permeability, while the fluid is forced into the hole. The fluid, along with petroleum and formation water, is then evacuated from the hole as a waste.

roughly every 2 weeks.⁶² These and other spills are not contained or cleaned up.

The process of separating petroleum from natural gas and formation water takes place in several stages. Typically, the mixture is first pumped through flow lines from a number of wells into a large pipe, or manifold, at a central separation facility. Chemicals then are injected into the manifold to break the oil-water emulsion, retard the formation of foam, and protect the tanks and pipelines from corrosion.⁶³ According to DINAMA technical staff, approximately 3000 gallons of production chemicals are used in the *Oriente* every day,⁶⁴ and they enter the environment untreated as part of the produced water waste stream.

From the manifold, the mixture passes into a separator. Gas, which is lighter than oil and water, rises. Only twelve to fifteen percent of this gas is refined at the Shushufindi gas plant; most of the remainder is burned as waste.⁶⁵ About 235,600 million cubic feet of gas have been burned in the *Oriente* since oil production began in 1972.⁶⁶ Oil companies continue to burn roughly fifty-three million cubic feet of gas every day, despite the fact that Ecuador's imports of liquified petroleum gas (LPG) grew by roughly forty percent between 1988 and 1989.⁶⁷ The gas is burned without any temperature or emissions controls, causing con-

62. *Id.* This does not include spills from the transnational and secondary pipeline systems, which are discussed in the next section. DINAMA expects spills from tanks and flow lines to become even more frequent as equipment deteriorates from age, poor maintenance, and corrosion, especially in the Texaco-Petroecuador concession where it was reportedly designed for a 20 year period of use, to coincide with the 1972-1992 contract between Texaco and the government of Ecuador.

63. Other production chemicals that can be used in the separation process or for well maintenance include biocides, fungicides, coagulants, cleaners, dispersants, paraffin control agents, and descalers. Many of these chemicals are extremely toxic.

64. 1989 Interview with Fernando Reyes, *supra* note 52.

65. An exception is at the Petroecuador camp of Bermejo, where gas is 80% carbon dioxide. As a result, it is not very combustible and is released directly into the air. According to the Ministry of Energy and Mines, 25,000 cubic feet of carbon dioxide is released into the atmosphere every day at Bermejo. PRODUCCIONES DE PETRÓLEO, *supra* note 3, at 3. DINAMA estimates total carbon dioxide emissions from Bermejo since extraction began in 1982 at 31,300 million cubic feet. 1990 Interviews with Fernando Reyes, *supra* note 30. Carbon dioxide is well known as a major contributor to the greenhouse effect. In addition, high levels of hydrogen sulfide and carbon dioxide emissions at Bermejo have been linked to cases of anemia among well-fed residents of the camp.

66. Calculation based on PRODUCCIONES DE PETRÓLEO, *supra* note 3; 1990 Interviews with Fernando Reyes, *supra* note 30.

67. Calculation based on PRODUCCIONES DE PETRÓLEO, *supra* note 3; 1990 Interviews with Fernando Reyes, *supra* note 30. Imports of LPG rose from 10.81 million cubic feet in 1988 to 14.85 million cubic feet in 1989. Remaining reserves are estimated at 262,000 million cubic feet. 1990 Interviews with Fernando Reyes, *supra* note 30.

taminants to pollute the air.⁶⁸

As gas rises in the separator, produced water, which still contains oil in emulsion, sinks to the bottom and is discharged into production pits as waste. Petroleum that has separated from the gas and produced water passes from the separator to a wash tank. Typically, the wash tank is filled with produced water to a depth of eight to ten feet, and petroleum enters the tank above the water. Gas separates from the oil, rises to the top of the tank, and is released and burned. Simultaneously, more produced water with oil in emulsion separates from the petroleum and settles below it. These oily water wastes are routinely drained from the bottom of the tank, typically into a production pit.

Petroleum passes from the wash tank into a stabilization or surge tank, where further separation takes place. A valve allows gas to escape into the atmosphere, and oily water wastes are periodically drained into a production pit. The petroleum is then transferred to a pump station or pipeline tank,⁶⁹ and from there most of it is pumped, via the secondary pipeline system, to Lago Agrio. At Lago Agrio, the crude oil, which now contains less than 0.1 percent water, enters SOTE, the Trans-Ecuadorian Pipeline.⁷⁰

Produced water wastes, also known as toxic brine, are a noxious brew of oil, formation water, and chemicals that have been injected down into a well or used in the separation process.⁷¹ More than nineteen billion gallons of toxic brine have been dumped without treatment into the waters and soils of the *Oriente* since oil production began in 1972.⁷² The

68. DINAMA has proposed reinjecting the waste gas into formation reservoirs for later use, as is done routinely on the North Slope of Alaska. It is not known whether any of the petroleum companies have evaluated the feasibility and environmental impacts of this proposal.

69. Every pump station contains pipeline tanks, which, like the surge and wash tanks, are periodically drained of oily water wastes.

70. Some crude oil is refined at Lago Agrio and Shushufindi. Gas that is not burned or emitted as waste is refined at a gas plant in Shushufindi. Refineries and gas plants are well-known for the contamination they generate, even under the best operating conditions and the most comprehensive regulatory schemes. In Ecuador, environmental regulations and controls are virtually nonexistent and, according to Texaco workers and DINAMA, operating conditions and maintenance are poor. Very little information about the environmental impacts of these facilities is available in Ecuador. Nevertheless, they are known sources of air, water, and soil contamination from spills, operational discharges, and emissions. Pollutants include petroleum and chemical additives such as lead, corrosion inhibitors, bactericides, foam retarders, emulsion-breakers, and descalers.

71. Produced water can also include injected waters, such as chemically treated waters that are used for enhanced recovery.

72. Calculation based on PRODUCCIONES DE PETRÓLEO, *supra* note 3. The calculation uses total to December 1989 plus daily discharges through October 1990.

formation water, which typically comes from geological strata thousands of feet below the surface of the earth, is very hot and very toxic. Its average temperature is 130 degrees Fahrenheit, but the temperature can range from 90 to 168 degrees Fahrenheit. Formation water contains hydrocarbons and heavy metals, as well as levels of salts that are toxic to plant and animal life. Total salts average between 70,000 and 110,000 parts per million (ppm), but can reach as high as 200,000 ppm, a level nearly 6 times saltier than sea water.⁷³ The amount of petroleum in *Oriente* produced water ranges from 500 to 5000 ppm.⁷⁴ As a result, roughly 2100 to 4200 gallons of oil are discharged every day by oil companies as part of the daily 4.368 million gallon toxic brine waste stream,⁷⁵ and an estimated 19 million gallons have been dumped into the environment with those wastes since production began in 1972.⁷⁶ Oil is very toxic. Data show that petroleum products can harm aquatic life at concentrations as low as one to one hundred parts per billion (ppb).⁷⁷ Produced water can also contain sulfates, bicarbonates, hydrogen sulfide, carbon dioxide, cyanide, and heavy metals such as arsenic, cadmium, chromium, lead, mercury, vanadium, and zinc.⁷⁸

In the *Oriente*, virtually all of the produced water wastes, along with spilled oil and chemicals, and wastes from well drilling and maintenance, enter the environment untreated. Most of these wastes initially are

73. Sea water typically contains approximately 35,000 ppm chlorides. No river life can survive at sea water levels. The highest levels of chlorides found in uncontaminated *Oriente* river waters are six to seven ppm.

74. 1990 Interviews with Fernando Reyes, *supra* note 30.

75. PRODUCCIONES DE PETRÓLEO, *supra* note 3.

76. 1990 Interviews with Fernando Reyes, *supra* note 30; PRODUCCIONES DE PETRÓLEO, *supra* note 3. The estimate by the Ministry of Energy and Mines of daily oil discharges assumes average concentrations of 500 and 1000 ppm petroleum in produced water. DINAMA technical staff believe that the 1000 ppm number is a more realistic average, and assume that level in their cumulative estimate. According to DINAMA technical staff, significant amounts of petroleum could be recovered for sale from produced water wastes by use of advanced technology.

77. U.S. ENVIRONMENTAL PROTECTION AGENCY, PB No. 263943, QUALITY CRITERIA FOR WATER: OIL AND GREASE (1976).

78. Although no data is available in Ecuador, concerns have recently been raised in other parts of the world about radioactivity in produced water. Radioactive material can be leached into formation water from uranium and thorium deposits deep underground. In the United States, studies by the Louisiana Department of Environmental Quality show that produced water often contains levels of radioactivity that are higher than what could legally be discharged from a nuclear power plant. In addition to making the waste stream radioactive, radioactivity can become trapped in "scale" that is caked inside those pipes, causing those pipes to become radioactive. Natural Resources Defense Council, Fact Sheet, Offshore Oil and Gas Activities: Environment Concerns 3 (available from the Natural Resources Defense Council, 122 East 42nd St., N.Y., N.Y. 10068; phone: (212) 949-0049).

dumped into open pits, hundreds of which dot the region, typically with one or two at each producing well and separation station. The pits are filled with toxic wastes and are almost always topped by a thick layer of petroleum. Rainwater freely enters the pits, swelling the contents and becoming contaminated as it mixes with the wastes. Liquid wastes or thick, oozing petroleum are discharged on an ongoing basis from small pipes that drain most of the pits, accumulating in low areas or flowing down gullies into nearby streams or rivers. Other wastes spill over the sides of the pits or burst through collapsed walls of poorly constructed pits. Large artificial lakes of spilled petroleum are common near the pits. Wastes that remain in the pits or on nearby soil can seep into the ground and contaminate groundwater.

Streams in producing areas regularly run black with oil. Even when these waters look clear, they can be severely contaminated by prior spills or chronic discharges. When stirred, some sediments release so much oil that it is visible to the human eye as globs of crude or as a sheen that settles on the surface of the water.

In a limited water sampling program, the national oil company found highly elevated levels of oil and grease in all of the thirty-six stream and river sites it sampled. It also found a pronounced deficit of dissolved oxygen in the great majority of sampled waters, and concluded that oil development had caused serious deterioration of both land and aquatic ecosystems.⁷⁹ DINAMA technical staff have reported that small rivers and streams receiving ongoing discharges of produced water now support almost no life. Only microorganisms that have adapted to the heat and contamination survive. Before oil production began, these waters supported a splendid diversity of aquatic life; now some of those species may be extinct.⁸⁰

These findings are echoed by residents throughout oil producing areas. Both colonists and indigenous people report that many local streams and rivers, once rich in fish, now support little or no aquatic life. Cattle have died, their stomachs destroyed by drinking from contaminated streams and rivers.⁸¹ These are typically the same waters people use for

79. CEPE, ANÁLISIS DE LA CONTAMINACIÓN AMBIENTAL EN LOS CAMPOS PETROLEROS LIBERTADOR Y BERMEJO 53-62, 134-51 (1987) [hereinafter ANÁLISIS DE LA CONTAMINACIÓN AMBIENTAL]. The study did not analyze surface water samples for heavy metals, salts, or specific hydrocarbons, and sediments and ground waters were not sampled. The study which also found high levels of malaria was conducted in the Petroecuador concession and has not been released to the public.

80. 1989 Interview with Fernando Reyes, *supra* note 52.

81. According to DINAMA technical staff, salts, bound with other contaminants, settle along the banks of these waters, and the cattle are attracted by the salts. Wildlife can also be

drinking, cooking, and bathing. Colonists report that bathing in these waters causes skin rashes, especially after heavy rains, which accelerate the flow of wastes from nearby pits into the streams.

Oil slicks in pits, and spills in slow-moving waters, are often set on fire and burn for hours, generating dense plumes of black smoke.⁸² Colonists call the rains that follow these burns "black rain," and report that they leave a blanket of ash on crops, animals, water, and clothing, and cause skin problems among children.

Burning oil and gas pollutes the air with oxides of nitrogen, sulfur, and carbon, as well as heavy metals, hydrocarbons, and carbon particulate (soot).⁸³ Many of these emissions are toxic. Nitrogen oxides can react with sunlight to form ozone, a human respiratory irritant. In addition, nitrogen oxides and sulfur dioxide are precursors of acid rain.⁸⁴ Additional air pollution is generated at pits and oil spills by hydrocarbons that volatilize from standing oil slicks. Most of these volatile organic compounds (VOCs) are very toxic and promote ozone formation.⁸⁵ Although quantitative data on air emissions from oil operations is not available in Ecuador—at least to the public—an internal study by the national oil company found that levels of air pollution in its concession are "alarming."⁸⁶ In the Texaco concession, workers have reported respiratory problems and other work-related health problems.⁸⁷

attracted to these salts. Other wildlife, especially waterfowl and insects, are killed in production areas when they are attracted to the waste pits. In addition to immediate lethal impacts, ongoing discharges of produced water into relatively small bodies of water can create a chlorinity gradient that operates as an invisible barrier, preventing the normal migration of fish and other aquatic life between upstream and downstream waters. The result is biological isolation, which could affect reproductive patterns and the distribution of aquatic species. Produced water wastes also strain aquatic ecosystems by reducing levels of dissolved oxygen in receiving waters.

82. Witnesses report that in some producing areas, fires in streams are common.

83. Even gas flares typically emit black smoke, indicating the presence of soot. According to DINAMA technical staff, gas burning is inefficient and pollution levels can increase over time as liquid hydrocarbons become mixed in with the gas wastes. Often, this oil is sprayed from the burner rather than burned. 1989 Interview with Fernando Reyes, *supra* note 52. Burnings also attract insects, and mats of dead insects, often inches thick, can be found at the bases of gas flares.

84. Acid deposition by acid rain, fog, dust, or snow is associated with acidification of waters in ponds, lakes, and streams, and can result in the disappearance of animal and plant life from those waters. Acidic precipitation is also believed to have the potential to leach nutrient elements from sensitive soils and harm terrestrial plant life. In addition, it can cause respiratory disease in humans as well as corrosion of machinery and buildings.

85. In addition to human health effects, ozone and other volatiles such as methane are known contributors to the greenhouse effect.

86. ANÁLISIS DE LA CONTAMINACIÓN AMBIENTAL, *supra* note 79.

87. Pump stations are also sources of air pollution, both from fuel burning engines and the venting of VOCs from crude oil storage tanks. Although no emissions data is available in

Many roads in oil producing areas of the *Oriente* are regularly sprayed with heavy crude for road maintenance and dust control. The crude comes from waste pits, and turns the roads into sources of air and water pollution. The smell of petroleum is pervasive. These roads are heavily used by pedestrians, and pass through local boom towns. Indigenous people who walk on them without shoes have reported rashes on their feet. The oil coated roads are also dangerous to motorists, as they become extremely slippery when wet.

Secondary oil recovery operations in the *Oriente* involve pumping river water that has been treated with biocides, flocculents, corrosion inhibitors, oxygen capturers, foam retardants, and descalers, into oil bearing formations to increase pressure on the oil and force it into the wells. In the formations, the recovery water picks up additional contaminants, which can include heavy metals and toxic levels of salts. After two to five years, the toxic recovery water begins to be extracted with the oil, increasing the ratio of waste water to oil. DINAMA believes that this toxic water is now being extracted at Shushufindi, where it is discharged without treatment into the environment.⁸⁸ Although no chemical data is available from the site, Texaco employees have reported that recovery water that was spilled even before being pumped through the formation has killed a number of cattle, pigs, and other animals that drank it.

In addition to generating toxic wastes, widespread secondary recovery operations can overuse freshwater resources in a nonrenewable way. Roughly five million gallons of fresh water are used every day in the *Oriente* for enhanced recovery, and the aggregate impacts of decreased flow volumes and increased toxic waste discharges have not yet been evaluated.

C. Transportation of Oil

1. Oil Spills

Oil spills from the Trans-Ecuadorian Pipeline (SOTE) and smaller secondary pipelines have had far-reaching and devastating impacts in the

Ecuador, an emissions inventory in Alaska found that eight (out of a total of eleven) pump stations along the Trans-Alaska Pipeline ranked among the top twenty-two sources of toxic air pollution in the state. Significant toxic emissions included heavy metals, formaldehyde, and polycyclic aromatic hydrocarbons (PAH) from the turbine pumps, and benzene, toluene, and xylene from the tank topping units. In addition to their other hazards, many of these pollutants are carcinogenic.

88. DINAMA expects extraction of recovery water to begin at Sacha within a year. This is known as the breakthrough point. After the breakthrough point, increasingly large amounts of chemicals must be added to the water that is pumped into the formation.

Oriente. The Ecuadorian government has recorded approximately 30 major spills from SOTE alone, mostly within the Amazon watershed, with an estimated loss of 16.8 million gallons of oil.⁸⁹ By comparison, the Exxon Valdez spilled approximately 10.8 million gallons into Alaska's Prince William Sound.⁹⁰

In the *Oriente*, no equipment is available to mitigate or clean up oil spills.⁹¹ Spill response is limited to locating the damaged area of the pipeline, turning off the flow of oil into that portion of the line, waiting for the oil in the line to spill out, and then repairing the damage. Because valves along pipelines are designed for pumping purposes only, not for safety shut-offs, the nearest valve to a spill can be tens of kilometers away. Oil can spill for days before the breached line is evacuated.

The *Oriente* pipeline system is particularly vulnerable to spills. Pipelines in the region are predominantly above ground and cross a myriad of rivers and streams. Because the region is geologically active and deforestation in some areas is extensive, SOTE and the secondary pipelines are vulnerable to rupture by rivers swollen with rains and heavy runoff, and landslides. In addition, because SOTE crosses a major Andean fault, it is vulnerable to volcanic activity and earthquakes. Spills from this area enter the Amazon watershed, and their impacts can extend for hundreds of miles.

In March 1987 a major earthquake shattered a portion of SOTE,⁹² spewing millions of gallons of oil into the watersheds of the Quijos, Coca, Aguarico, and Napo rivers.⁹³ The spill caused major fish kills, and destroyed plant and animal life for hundreds of miles. The affected waterways still have not recovered their biodiversity.⁹⁴ In May 1989 a

89. Major oil spills can be expected to increase in frequency in the *Oriente* as SOTE and the secondary pipeline system continue to age. Eighteen years of abrasion and corrosion are thinning the walls of the pipelines. Already, SOTE is vulnerable to landslides. DINAMA technical staff are concerned that the entire system could collapse sometime this decade.

90. See, e.g., L.A. Times, Apr. 11, 1991, at A3, col. 2; Boston Globe, Apr. 10, 1991, at 16; Chi. Tribune, Apr. 5, 1991, at C10.

91. Even if oil spill response equipment was to be purchased, and contingency plans developed, recent experience in the United States demonstrates that accidents can nonetheless have devastating consequences. The most detailed instructions can be disregarded and "available" equipment can be unavailable for days. Once available, equipment can be ineffective.

92. DIGEMA, CEPAL/PNUMA, Estudio de Impacto Ambiental 42 (1989) (documento preliminar) [hereinafter DIGEMA, Estudio de Impacto Ambiental].

93. Estimates range from 400,000 barrels total recorded by the Ministry of Energy and Mines, Boletín de Prensa, DIGEMA, *supra* note 2, at 1, to 5,900,000 gallons reported by the World Bank. The lower number was used by the Ministry to calculate the total amount of oil that was spilled from SOTE between the time it began operations in 1972 through May 1989. As a result, the 16.8 million gallon estimate may be low, even for major recorded spills.

94. Boletín de Prensa, DIGEMA, *supra* note 2, at 2.

landslide at Papallacta destroyed forty meters of SOTE.⁹⁵ Two hundred and ten thousand gallons of oil spilled into the Papallacta River, and subsequently caused the Napo, a major tributary of the Amazon River, to run black with petroleum as it flowed into Peru, hundreds of miles away.⁹⁶ The impacts of *Oriente* spills on ecosystems in Peru and Brazil have not been evaluated.

Spills from the secondary pipeline system can be equally serious. A May 1989 spill at San Carlos, where the secondary pipeline crosses under the Napo River, dumped at least 294,000 gallons of oil into the river.⁹⁷ Normally, the line is buried in the riverbed, but the cresting river had scoured the bed, leaving the pipeline exposed to the force of the water. Eight years ago, the pipeline broke at the same place for the same reason, but this time the spill coincided with heavy flooding along the Napo. Quichua who live in the area reported "petroleum floods" along the Napo River for hundreds of kilometers, especially in low areas. A thick cap of petroleum coated the waters, which remained at flood levels for two days. When the floods receded, petroleum stains remained on soils and plants until subsequent rains finally washed them away. Within two weeks, crops in fields that had been flooded began to die. According to FCUNAE, the local indigenous federation, roughly 560 families in 31 communities lost crops to the flood. Although the full extent of the damages will not be known for some time, hundreds of hectares of subsistence and cash crops were destroyed: *platanos*, coffee, *chonta*, *cacao*, corn, guava, and papaya. In addition, entire fields of yucca were destroyed.⁹⁸ Over a year later, in June 1990 some Quichua reported that crops planted in fields affected by the previous year's "petroleum flood" were not doing well.

Oil pollution is very toxic and can be fatal to marine larvae in concentrations as low as 0.1 ppm. Petroleum products can harm aquatic life in concentrations as low as one to one hundred ppb. Tolerance to oil pollution varies among different species and can depend on the chemical composition of the oil. Plankton, and the eggs and juvenile of many aquatic species appear to be especially vulnerable to oil and other types of pollution. Because plankton are the foundation of the aquatic food

95. 1989 Interview with Fernando Reyes, *supra* note 52.

96. *Id.*; various interviews with residents along the Napo River.

97. 1989 Interview with Fernando Reyes, *supra* note 52; various interviews with residents along the Napo River.

98. Yucca, or manioc, is the main staple food of the Quichua. It is a hearty crop that has traditionally survived prepetroleum flood waters of the same magnitude as the petroleum flood. To plant and harvest yucca of the same quality as the yucca that was destroyed takes nine or ten months.

chain, any impact on them can have serious ecological implications. Other species known by scientists to be especially sensitive to oil pollution include filter-feeding species, species that hunt using chemoreception, and sea turtles. The most vulnerable aquatic habitats are low-energy systems like sheltered marshes and lakes, where oil and other pollutants can accumulate and persist for years.

Bioaccumulation of petroleum in the food chain can cause serious human health problems. Scientific data has shown that edible marine organisms can incorporate cancer-causing polycyclic aromatic hydrocarbons, such as 3,4-benzopyrene, in their tissues. In addition, a variety of organics and heavy metals are known to bioaccumulate in fish that live in polluted waters, making them dangerous for human consumption.

In addition to being toxic, oil can smother burrowing aquatic organisms and certain filter feeding species. Oil can become incorporated into sediments and subsequently enter the food chain or recontaminate the water column. In sediments below the aerobic surface layer, bacterial degradation is slow, and the oil can remain unchanged and toxic for long periods. Oil-laden sediments can even spread to areas that were not initially contaminated by the spill. Oil that persists in sediments can have long-term effects on benthic communities, and can cause the demise of certain important sensitive species.⁹⁹

Oil can cause major fish kills by robbing waters of oxygen. It can also kill fish by coating their gills, thus preventing respiration. Birds that dive for their food or feed on the water's surface can ingest petroleum if they are exposed to an oil slick. Although oil ingestion during eating or preening may not be fatal right away, chronic ingestion can have long-term physiological effects. As liver function increases to detoxify the ingested oil, overall resistance is lowered, and the bird may be unable to survive additional stresses. Waterfowl that become coated with oil can drown as they lose their buoyancy, die from exposure because their feathers no longer insulate them, or starve or be killed by predators because they lack mobility.

Oil polluted waters can be especially dangerous to aquatic birds while they are nesting. Adult birds that pick up oil while foraging typically carry it to their eggs when they return to their nests. Laboratory research shows that concentrations of oil as low as twenty ppb can cause

99. Impacts that have been reported in the scientific literature include deformed and inactive flatfish larvae at concentrations of 10 ppb and delayed or inhibited cellular division of algae at concentrations of 0.1 to 100 ppb. U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 77.

high mortality in seabird eggs during the early stages of development (one to ten days).

2. Road Construction in Primary Forests

In order to lay pipelines and service producing oil fields, oil companies build networks of roads into the rain forests. Road construction by oil companies is the primary engine of deforestation in the *Oriente*, as colonists, land speculators, loggers, ranchers, and agri-industry follow the roads into the forests, without regard for indigenous land claims or protected areas. The U.S. Agency for International Development estimates that more than 500 kilometers of roads built by the oil industry in the *Oriente* have resulted in the colonization of some one million hectares of rain forest.¹⁰⁰ Typically, two to twelve kilometers into the forest along both sides of a new road are colonized, meaning that each kilometer of new road built by the oil industry in the *Oriente* can be expected to result in the colonization of between four hundred and twenty-four hundred hectares of rain forests. Colonization and land trafficking problems in the *Oriente* are exacerbated by the Ecuadorian government's failure to give indigenous people legal title to their traditional lands.

As colonists clear the forests for pasture and cash crops such as coffee, *naranjilla*, and *cacao*, underlying soils erode and contaminate nearby streams and rivers. The agricultural techniques used by the colonists rapidly deplete the generally poor tropical forest soils, forcing settlers to farm new lands or look for seasonal wage labor. Initially, colonization of the *Oriente* produced a relatively equal distribution of land among the settlers. Now, some colonized lands have been abandoned by early settlers and concentrated in the hands of fewer, larger property owners, who primarily devote their holdings to African palm oil and beef cattle,¹⁰¹ with devastating impacts on the land and the people.¹⁰² Most *Oriente* colonists remain poor. As they and others force indigenous people from their traditional hunting and fishing grounds and degrade the forest resources on which those people depend, indigenous people also

100. Data from the most recent census in 1982 shows that as of that year, 47% of the *Oriente's* population had been born outside of the region. Seventy percent of those immigrants arrived after 1972, when oil extraction began. The World Bank, Ecuador, *supra* note 13.

101. *Id.*

102. The environmental impacts of ranching in rain forests are well-known. Monoculture African palm oil plantations in the *Oriente* not only lead to rapid deterioration of soils, but also use large amounts of pesticides and herbicides, generating toxic runoff that reportedly enters the environment untreated. On-site palm oil extraction also generates huge quantities of organic wastes that pollute local rivers. African palm oil cultivation and production activities require a large unskilled seasonal work force.

can become "poor"—unable to find fish, game, fruits, nuts, other foods, medicines, and materials that they need for domestic and religious purposes.

In addition to providing key infrastructure for deforestation, road construction itself can harm the people and the land. As with drilling platforms and seismic trails, new roads commonly pass through indigenous gardens, destroying valuable subsistence and commercial crops and resources in their wake. Road construction can destabilize soils in the hilly *Oriente*, leading to landslides. To control them, the road-cut is typically widened, or the tops and sides of hills are shaved off to decrease the slope of exposed lands. These soils are then usually dumped in the nearest low-lying area. Erosion and sedimentation in nearby surface waters can be severe, increasing turbidity and destroying the habitat of benthic organisms.

Disregard for natural drainage patterns during road construction can also have serious consequences. In addition to its major rivers, the *Oriente* is traversed by winding streams and small rivers. In many places where roads cross those waterways, the roads act like dams. Forests on the upstream side of the road dams become flooded with stagnant, silty water, creating the type of habitat known to attract malaria-carrying mosquitos, and the forests die. On the downstream side of the dams, forests often dry out, and waterways can suffer from seriously diminished flow. Waters also can be dammed when soils that are moved during road or platform construction are carelessly dumped, or when culverts that underlie roads are poorly designed or become clogged with debris because they are poorly maintained. In addition to destroying habitats, these dams can operate as partial or complete barriers to migration of fish and other aquatic life, affecting reproductive patterns and species distribution.

Roads also create barriers to the migration of animals, especially birds and animals that live in the forest canopy. As a result, road construction can affect the distribution and reproductive patterns of those species. Networks of roads could reduce the size of accessible habitats for larger animals, perhaps to less than what is needed to support a population. When in use, noise and vibration from roads can cause certain animals to avoid the area, further reducing their available habitats.

Road construction uses large amounts of sand, gravel, and wood.¹⁰³

103. Either huge tree trunks or planks of wood underlie the entire road. Although the use of synthetic geotextiles or geogrid can decrease the amounts of materials needed, Conoco, for example, will still reportedly need 3000 cubic meters of sand and gravel for each kilometer of

The wood is usually logged from surrounding forests, sand is mined at the road site, and gravel is hauled in from rivers as close to the site as possible. The impacts of these excavations on the land and people vary, depending on location, type of river, and equipment maintenance. Occidental Petroleum recently destroyed a Quichua home and garden, and widened a fifty meter stretch of river by roughly five meters in order to mine sand to build a short road to an exploratory well.

D. Effects on the People

Petroleum development is fueling what could become the final conquest of Amazonia. The oil boom accelerates the destruction of *Oriente* cultures and undercuts traditional indigenous economies and land rights. Without control over their lands, indigenous people will not be able to adapt in their own ways to a changing world. Loss of land and oil pollution also threaten the health and, in some cases, the physical survival of these people. At the same time, colonists in oil producing areas face deepening poverty and a public health crisis.

In oil production areas, indigenous Cofan, Secoya, and Siona have been pushed into small pockets of land that are entirely surrounded by outsiders. These lands cover only a fraction of their traditional lands, straining the subsistence base of the people and severely limiting their range for hunting, fishing, gathering, and gardening activities. Important resources in the forests that remain have also been destroyed or degraded by pollution from nearby oil facilities. Already, Cofan are no longer able to support themselves from their traditional lands, and some groups recently migrated into new areas. Others have traveled to nearby boom towns to sell crafts to tourists, and a few have turned to prostitution. Some reportedly sell wildlife products. Some Quichua and Huaorani have also lost lands and resources in oil producing areas.

Oil companies have often collaborated with missionaries to pacify indigenous people and make their lands hospitable to oil company activities. Gifts of food, candies, and other consumer items that members of a community cannot themselves produce create relationships of dependency and new needs for cash income. Unequal access to cash and external goods can generate tensions and divisions within families and communities, and disrupt the traditional balance of power, status, and rights.

Missionaries preach to indigenous people that they are backward

the 125-kilometer road it plans to build. Conoco plans to use expensive geogrid for its road construction activities, which it says will allow it to build its road network without wood.

savages, that their cultures are "primitive and sinful," and that they must change, modernize, abandon their traditions, and embrace the ways of the "civilized" culture.¹⁰⁴ Missionaries also have typically controlled air transportation, modern communications, and the best hospitals in the *Oriente*. They make these services costly and conditional, using them to manipulate the people and deepen their dependency. For example, the evangelical mission Alas de Socorro recently refused to fly a Huaorani woman with a dying baby to a hospital because her village had participated in the last congress of CONFENIAE, where the mission had been criticized.¹⁰⁵

Similar work was recently carried out by anthropologist Julio Enrique Vela, of the national oil company's Bureau of Ethnic Affairs. Vela visited indigenous communities throughout the *Oriente*, organizing conferences and promising roads, hospitals, community centers, outboard motors, fuel, and other material gifts. These gifts were reportedly to be financed by oil companies and were conditioned on disassociation from indigenous organizations. At least some of Vela's visits were designed to "neutralize"¹⁰⁶ the efforts of CONFENIAE and its member federations. These organizations have begun to challenge the current practices of the petroleum industry in indigenous lands, in an effort to protect the health and welfare of indigenous people, and maintain and develop their cultures and traditions.¹⁰⁷

The traditional economies of indigenous communities, as well as their cultural and spiritual lives, are further undermined by the pollution, deforestation, destruction of family gardens, and desecration of sacred areas that accompany oil development in their lands. As natural resources are degraded, the quality of life of indigenous people can deteriorate because greater efforts are needed to meet the daily needs of survival. Traditional subsistence activities can become more difficult and time-

104. Mission head Daniel Rogers's comments on the issue of bilingual education illustrate the mission's attitude toward the Huaorani: "Bilingual education is communist. The Huaorani need to learn Spanish, not their own language. What is the use? Their culture is primitive and sinful, why on earth does the government want it to be taught in the classroom? The teacher must be an example to follow, a model for the community. How can there be Huaorani teachers? They are not civilized and educated enough for the task." L. Rival, *Learning How to Live in the Manmade World: The Huaorani of Ecuador* 11 (Quito 1990) (draft manuscript).

105. *Id.* at 10.

106. J.E. Vela, *Informe de Labores* 3 (Jan. 1989) (transmittal letter to UNOCAL).

107. In addition to working with Vela and missionaries, some oil companies also seek direct contacts with indigenous communities, especially the Huaorani. Petro-Canada, for example, kept clothing, food, and Coca-Cola on hand to give to Huaorani who live in its concession. Other gifts include sugar, machetes, chain saws, and fuel.

consuming, if, for example, hunters must travel longer distances to find game because noisy helicopters and chain saws have scared the animals away, or because a nearby garden has been destroyed to build a drilling platform. In some cases, these traditional activities are abandoned to plant new cash crops or to seek wage labor, frequently far from home. With each step into the wage economy, subsistence activities are neglected and a spiral of economic dependency begins or quickens. Community life also can be destabilized as some members refuse to help with traditional communal activities that do not pay wages and others are away from home in search of work.

According to regional medical personnel, the health and nutrition of indigenous people decline as they are integrated into a predominantly cash economy. As they abandon traditional subsistence activities, they change their diet, typically substituting carbohydrates for fish and wild-life proteins. The result can be malnutrition and lowered resistance to disease. Additional health problems can be triggered by new diseases introduced into indigenous communities, for which the people have no medicines or immunities.

Despite these accelerating threats and changes, indigenous cultures remain strong, and most of the people are healthy. They do not have much money, but they are not poor. They have land, and they know how to use the resources of the forest in a sustainable way. However, as oil development proceeds, indigenous people could become as poor and marginalized as the colonists who live in oil production areas.

Colonists in oil production areas face a growing public health crisis and deepening poverty as pollution from oil operations contaminates water supplies, destroys fisheries, and kills crops and livestock. Children play on well platforms stained with oil, and cattle, often coated with oil, graze alongside waste pits. According to the Association of Health Promoters of Sucumbios, a Lago Agrio-based organization of colonists who work with their neighbors throughout the province, malnutrition rates in oil producing areas far exceed the national average.¹⁰⁸

108. In a recent study, the health workers found malnutrition rates of 65-70% among primary school children, ages 6-12. The malnutrition rate among younger children is even higher. In the most severely contaminated communities, such as Shuara, malnutrition rates reach as high as 98%. By contrast, in the Siona community of Puerto Bolivar, located just outside Cuyabeno Wildlife Reserve, the health workers did not find a single case of malnutrition. Meeting with Association of Health Promoters of Sucumbios and Northeast Committee on Human Rights, Lago Agrio, Ecuador, July 23, 1990. (The Siona in Puerto Bolivar subsequently reported severe diarrhea among children as a result of drinking waters that were contaminated by a November 1989 oil spill in Cuyabeno Wildlife Reserve).

The health workers attribute the high malnutrition rates in their communities to oil pro-

Just as petroleum development has proceeded in virtual disregard of ancient populations, it has also failed to consider local and regional development needs. Public services, even in urban centers, are "calamitous."¹⁰⁹ Despite years of double digit population growth in oil boom towns, little has been invested in public infrastructure and services.¹¹⁰ Urban centers and settlers' homes in oil producing areas are visibly impoverished and lack basic services. In Shushufindi, for example, a boom town that is home to rich oil fields and oil and gas refineries, there are no public sewers and only 0.2 percent of the homes are served by public electricity and water systems; 61.6 percent of the homes rely primarily on fuel wood for their energy needs.¹¹¹

Coca, a major city in Napo province, has no public electricity before 8 a.m. or after 10 p.m., and between these hours, blackouts are common. The streets in Coca are not paved, and there is no central plaza or other center of community life. Prices for food and other necessities are higher than in other parts of the country because most items are imported. Local urban economies depend on the oil industry, and, if current trends continue, will "bust" once the oil reserves have been depleted, further deepening the poverty of those people.¹¹²

duction pollution in local streams, which has killed the fish that once served as a major source of protein. In addition, both the health workers and local residents report frequent skin problems from bathing in contaminated waters, as well as a variety of other health problems, including respiratory diseases, cancers, and birth defects which they suspect have been caused by oil pollution. *Id.*

DINAMA has also reported serious problems of malnutrition in both Sucumbios and Napo, the other oil producing province of the *Oriente*. It has predicted that protein deficiencies, nutritional anemias, and deficiencies of Vitamin A, thiamine, and riboflavin will cause problems such as mental and motivational retardation. The infant mortality rate for Napo and Sucumbios exceeds the national average, and a review of the principal causes of death indicates that the quality of life for most residents is very low. DIGEMA, *Estudio de Impacto Ambiental*, *supra* note 92, at 172-77.

109. The World Bank, Ecuador, *supra* note 13.

110. The population growth figures are based on the most recent census in 1982. The World Bank has questioned whether investment in public infrastructure in oil boom towns would be "rational" in the long term, because the sustainability of local economies is doubtful. It has concluded that "perhaps the most important short-term measure to preserve sustainable options for the region's development is to promote a [new] regional petroleum development policy that is consistent with a national natural resource management policy." *Id.*

111. DIGEMA, *Estudio de Impacto Ambiental*, *supra* note 92.

112. A 1985 report by J. Fabian Sandoval Moreano, former head of the environmental assessment unit at the national oil company, CEPE, and currently a consultant for Petroecuador, found that oil development has not benefited the region or its settlers:

Petroleum development has created a group of "artificial" population centers characterized by distorted economic and cultural consumer patterns, near-total dependence on basic supplies imported into the region, and a high incidence of social problems, together with a general cultural deterioration. . . . The petroleum regions have not

Oil development generates relatively few stable jobs for residents of the *Oriente*, and most materials and skilled or semiskilled labor are imported into the region. Oil workers live almost exclusively in company camps. They leave their families behind and return to their homes outside of the region during regular periods of rest from work.¹¹³

These oil company camps are islands of prosperity in a sea of poverty, with air conditioners, hot showers, twenty-four hour electricity, video movies, good food, and potable water, luxuries unknown in the surrounding communities.¹¹⁴ Expatriate oil workers report that "money is no object,"¹¹⁵ and "millions of dollars are wasted,"¹¹⁶ as they use helicopters to fly to Quito or deep into the forests to go fishing or crocodile hunting.

Social and environmental problems in the *Oriente* will become even more severe as migrant populations continue to grow rapidly. The World Bank has predicted that if current population and land use trends continue, "and the fragility of the Amazon Region's natural resources is not properly recognized,"¹¹⁷ several adverse impacts can be expected. Those impacts include "irreversible loss of the region's renewable and nonrenewable resources and of their potential to produce regional and national economic benefits," and "diminishing returns of economic activities over time as the fragile resource base is depleted."¹¹⁸ In addition, conflicts between indigenous and colonist populations can be expected. Eventually, "reverse migration" will occur "as people must abandon the then resource-poor Amazon region, contributing to even greater pres-

developed an integral and self-sufficient development structure, based on their own resources. . . . There is no relationship between regional development and regional possession of natural resources. . . . Hydrocarbon-related activities have augmented the unequal development of the country, resulting in conditions of stagnation and deterioration in precisely those regions and areas where hydrocarbon reserves are located, and facilitating the ostentatious rise of other regions where political and economic power in Ecuador is concentrated.

Sandoval Moreano, *Petróleo y Desarrollo Regional*, *supra* note 38, at 82, 85 (translated by the author).

113. According to the World Bank, "from the perspective of employment generation within the region, the petroleum industry is basically an economic enclave." The World Bank, *Ecuador*, *supra* note 13.

114. Oil workers report that Unocal budgeted between 2.5 and 3 million dollars to build a new base camp, with ornamental gardens and lawns, squash courts, satellite dish television reception, sauna, jacuzzi, and a swimming pool.

115. Interview with Mike Cox, at "Eif Camp" near Coca, Ecuador (July 8, 1989).

116. *Id.*

117. The World Bank, *Ecuador*, *supra* note 13.

118. *Id.*

tures in non-Amazon regions."¹¹⁹

E. Oil Development in Protected Lands: A Growing Controversy

1. Cuyabeno—Industrial Corridor in a Wildlife Reserve

The Cuyabeno Wildlife Reserve spans 254,760 hectares in the northern *Oriente*, traditional lands of the Siona and Secoya. Designated as a protected area in 1979 the lands and lakes of Cuyabeno include spectacular flooded forests, or *varzea*, and harbor an extraordinary diversity of plant and animal species, including endangered black caimans, manatees, and harpy eagles. The lake region of Cuyabeno in the eastern portion of the reserve is home to some eighty Siona, who depend on the biological richness of the area to live. Nearby Siona and Secoya, who live just outside the reserve, also depend on the lakes and forests of Cuyabeno for subsistence hunting, fishing, gathering, and gardening. A few families have also come to depend, to varying degrees, on cash income from some of the tourists who visit the lakes.

Cuyabeno has been heralded in the international tropical forest literature as a "model modern tropical reserve,"¹²⁰ one that goes "beyond the traditional goals of protecting species and preserving wildlife habitat" to "also serve human beings."¹²¹ On paper, the reserve may embrace these laudable goals, but in practice, it embraces the oil industry.¹²² Oil development inside the reserve has completely devastated tens of thousands of hectares of rain forest, and it continues to threaten the entire reserve and all of the people who live, hunt, fish, farm, and gather within its borders.

Currently, Petroecuador, Petroecuador-Texaco, and Clyde Petroleum operate oil production facilities in the western and central reserve, but recently, exploratory activities by Petroecuador have also penetrated the lake region. In addition, Occidental Petroleum's concession includes some lands in the southern portion of the reserve. Visitors who travel along the oil roads to get to Cuyabeno typically cannot tell when they enter the reserve, and most colonists did not know either, at the time they arrived. Over 1000 families have colonized roughly one-third of the reserve along the oil roads, destroying forests and displacing indigenous people from their traditional lands. The government still allows colonists to enter Cuyabeno and to clear new lands; indeed, it aggressively pro-

119. *Id.*

120. J. GRADWOHL & R. GREENBERG, *SAVING THE TROPICAL FORESTS* 85-88 (1988).

121. Nations, *Protecting Tropical Forests*, in *TROPICAL FORESTS* 108-11 (1989).

122. One article even states that a Siona park guard "monitors the [national oil] company's actions to avoid oil spills and to protect the reserve's fragile ecosystems." *Id.*

motes colonization of the *Oriente* generally, but it has refused to grant land titles inside the reserve because colonization in protected areas is "illegal." As a result, colonists live with great frustration and uncertainty, and their precarious situation is sharpened by the pollution that saturates the area. Some colonists have left Cuyabeno, in search of clean water and land ownership. In addition to heavy colonization, illegal logging in the reserve has been so severe along oil roads and nearby rivers that, in January 1990 the superintendent of Cuyabeno requested permanent assistance from the Armed Forces and National Police to protect the reserve from loggers.

Pollution problems in Cuyabeno are not limited to its industrial zone. The lakes, some eight to fifteen kilometers away from the nearest wells and separation facilities, are a sink for oil production wastes that are routinely dumped from those facilities by Petroecuador.¹²³ In addition to chronic pollution, six oil spills have contaminated the lakes since 1984. The most recent spill, in November 1989, caught the nation's eye and sparked the first spill "cleanup" program in the history of the oil boom. A flurry of stories appeared in the national press a few months after the spill, and Petroecuador responded by promising to investigate whether a spill had occurred. Witnesses reported huge oil slicks that covered waters in the upper lakes and a myriad of channels and streams, and the death of countless fish, birds, and other wildlife. Public outrage was unprecedented, and some five months after the spill, the press reported that a "group of specialists"¹²⁴ had begun cleanup activities in the lakes and streams of Cuyabeno, using "specialized equipment"¹²⁵ to collect oil from the surface of the waters. The cleanup experts would reportedly work with indigenous residents to locate all of the spill areas, and the public was assured that "contaminating effects are relatively controllable in the short term."¹²⁶ After work began, the press periodically reported on the progress of the cleanup, declaring specified areas to be "completely clean from oil slicks," thanks to the "special equipment."¹²⁷

Accounts of the cleanup by residents and eyewitnesses, which did not appear in the newspapers, are vastly different. Eyewitness accounts assert that a handful of Siona and colonists were paid a few dollars a day

123. Wastes and spills from other wells and separation stations in the reserve find their way into the Cuyabeno River, which flows into the Aguarico, then the Napo, and finally the Amazon River.

124. *Comenzó Limpieza de Cuyabeno*, El Comercio (Quito), Apr. 28, 1990.

125. *Id.*

126. *Id.*

127. *Concluye Limpieza de Cuyabeno*, Hoy, June 4, 1990.

to use their bare hands to scoop petroleum from the surface of contaminated waters into large plastic bags. The bags were then buried near the lakes in shallow unlined holes in the ground.¹²⁸ From there, the oil can be expected to recontaminate the flooded forests and lakes of Cuyabeno, as toxic leachate migrates through groundwater and into surface waters, or as buried wastes find their way to the surface and spill into the environment. Even before the holes were filled and covered, bags broke and oil spilled out. Workers also used machetes to cut branches and leaves that were stained with oil. They complained about headaches, skin rashes, and respiratory problems, but were not given any medication or protective clothing; they were only given gasoline to clean their hands at the end of the day. The Siona also reported that children in a village in the spill area got diarrhea from drinking contaminated water.

Oil can persist in sediments for long periods of time, damaging benthic communities and lowering the bioproductivity of affected aquatic ecosystems. Contaminated sediments can repeatedly recontaminate the water column, and pollutants can enter the food chain. The recent spill in Cuyabeno almost certainly caused severe contamination of sediments throughout the spill area, as huge oil slicks covered waters for five to nine months. The oil company's "cleanup" program did not sample or remedy sediments, but Eduardo Asanza, a biologist who lives in the reserve, collected samples of sediments for chemical analysis in areas where cleanup activities had been completed. He is still waiting for the results of the analyses, but reports that some of the sediments were so contaminated that he could see crude oil in the samples.¹²⁹

2. Conoco, the Huaorani, and Yasuni National Park

Presently, Conoco is planning to build a 125 kilometer road, 120 wells, and other facilities to extract oil from a 200,000 hectare concession, known as Block 16, located within Huaorani territory and partially within Yasuni National Park. Conoco is also negotiating with the Ecuadorian government for petroleum development rights in an adjacent rain forest concession in Yasuni National Park, known as Block 22. Although Conoco has stated that its Yasuni development will not follow

128. By one estimate, some 44,000 gallons of oil were buried in each of several shallow, unlined landfills. Interview with Eduardo Asanza, Cuyabeno Wildlife Reserve (July 25, 1990).

129. Upstream of the lakes, in small rivers and streams that drain the industrial zone of Cuyabeno, petroleum can persist in sediments even after the large oil slicks have moved downstream. One recent slick was caused by the discharge from a pit at a single producing well. In some areas the waters appeared to be clear, but when sediments were randomly stirred or otherwise disturbed, sheens of petroleum appeared on the surface, and in some cases, small globs of crude oil rose up through the water, and formed an oily film on the surface.

the example of Cuyabeno, many indigenous and environmental groups in Ecuador and other countries are concerned that Conoco's proposed activities will threaten the survival of the Huaorani, their environment, and "protected" natural areas like Yasuni National Park. Many see Conoco's development plans for Blocks 16 and 22 as the most urgent and perilous threat to the land and the people of the *Oriente*, and they are appealing to Conoco, and even to Conoco's parent company, Du Pont, to cancel those plans.¹³⁰

The Huaorani are nomadic hunters and gatherers. They cultivate small gardens, which are dispersed in the rain forests around semisedentary villages that serve as their base camps. The Huaorani number only about 1580,¹³¹ and the forest is their home.¹³² In Ecuador, the Huaorani are better known as Aucas, a Quichua term that means "savages," and is considered by the Huaorani to be deeply insulting. Huaorani, their name for themselves, means "the people"; they refer to outsiders as *cowode*, which, in their language, means "nonhuman cannibal."

The first peaceful contacts between the Huaorani and *cowode* took place in 1958. The *cowode* were fundamentalist missionaries from the U.S.-based Summer Institute of Linguistics/Wycliffe Bible Translator, Inc. (SIL) and Christian Missions in Many Lands. Most Huaorani, however, had no peaceful contacts with outsiders until the early 1970s, when SIL missionaries established contact and convinced them to leave their homelands to join previously evangelized Huaorani groups living in the western edge of traditional Huaorani lands. Oil exploration activities were underway in the areas that the newly contacted bands had lived in, and several oil workers and Huaorani had been killed there.¹³³

130. A new coalition of twelve environmental groups in Ecuador, *Campaña Amazonía: Por la Vida* has made opposition to Conoco's proposed development plans its top priority. *Campaña* also seeks to make protected natural areas off-limits to oil and mineral development and has called for a 10 year moratorium on oil development in all Huaorani lands. The 10 year period would give the Huaorani time to form their own organization. It would allow them to complete the demarcation of their lands, so that outsiders will know when they are entering Huaorani territory. Finally, it would give the oil industry and independent experts time to conduct environmental studies that could allow interested parties to evaluate the potential impacts of oil development in the area, consider available development alternatives, and design appropriate mitigating measures. CONFENIAE also opposes oil development in Huaorani lands at this time, because those activities threaten the survival of the Huaorani, and the Huaorani have not consented to those activities.

131. Petition Submitted to the Inter-American Commission on Human Rights Organization of American States by Confederación de Nacionalidades Indígenas de la Amazonia Ecuatoriana (CONFENIAE) on Behalf of the Huaorani People Against Ecuador, at 7 n.6 (June 1, 1990) (citing personal communication with L. Rival, Anthropologist (1990)).

132. L. Rival, *supra* note 104, at 12.

133. *Id.* at 2.

Foreign oil companies, such as Texaco, Shell, and Gulf, collaborated with SIL to "pacify" both the Huaorani and other *Oriente* people. A study by the national oil company described this collaboration as "a hybrid process of religious interests mixed with oil company ambitions, that assured an effective cultural-religious subjugation in order to dominate indigenous peoples and use their labor and explore the riches of their lands."¹³⁴ This "policy of ethnocide" sought to force indigenous people to abandon their lands and subsistence economy and "immerse them in a situation of misery in which [the SIL] could easily create the new ropes of dependency."¹³⁵

Today, most Huaorani live in the western edge of their traditional lands, an area of 66,570 hectares that was legalized by the government in 1983 as a Huaorani Protectorate. Ten small bands still live outside of the protectorate, and one of these, the Tagaeri, has not yet been peacefully contacted by outsiders. In 1989 two large groups left the protectorate, after twenty years of life with the missionaries, to return to the land of their ancestors.¹³⁶

Huaorani ancestral lands span roughly two million hectares. For years, CONFENIAE worked to secure government recognition of Huaorani land rights outside of the small, and by Huaorani standards, overpopulated protectorate. Indigenous people from all over Amazonia came together to physically demarcate Huaorani lands. In expeditions organized by CONFENIAE, they cleared a trail and planted trees that are native to the area but are distinguishable from surrounding forests.¹³⁷ On April 3, 1990, the Ecuadorian government granted the Huaorani legal title to an additional 612,560 hectares of their traditional lands.

Under Ecuadorian law, however, no land titles are truly secure, because all subsurface minerals are deemed property of the national government. Within Huaorani territory, the Ecuadorian government has granted a number of new concessions to foreign oil companies, including Conoco, Petro-Canada, Elf Aquitaine, and Petrobras.¹³⁸ Conoco has dis-

134. Sandoval Moreano, *Pueblos Indígenas*, *supra* note 23 (translated by the author).

135. *Id.* at 10.

136. L. Rival, *supra* note 104, at 2. One group was led by Dayuno, and the other by Babe. Both groups now live in different areas of the oil concession controlled by Petro-Canada.

137. That demarcation has not yet been completed.

138. Those concessions are known as blocks 16, 9, 14, and 17, respectively. The area refers only to Huaorani territories that have been legalized by the Ecuadorian government. Titled lands exclude a large area of traditional Huaorani lands, including some lands in the heart of traditional Huaorani territory. Those lands are located in the Petroecuador-Texaco concession, and were excluded because the area has been heavily colonized along oil roads built by Texaco.

covered commercial quantities of oil in its concession, and is seeking to extract them, while the other foreign companies continue to explore.

Oil production activities in the new concessions could seriously threaten the cultural and even physical survival of the Huaorani. In recognition of this, CONFENIAE and a growing number of national and international environmental and human rights organizations are calling for a moratorium on oil development in Huaorani lands until the Huaorani consent to and participate in those activities.¹³⁹ Of all the indigenous people of the *Oriente*, only the Huaorani have not united to form a federation. Although "contacted" Huaorani recently began to organize themselves, holding their first assembly in March 1990, their contacts with the outside world have been limited, and they are not yet prepared to meet the challenges that would accompany oil production in their lands.

Oil production would suddenly and dramatically change the natural and social environment of the Huaorani. Because they know very little about how the encroaching world operates, they cannot be expected to be able to guide their own destiny in it. In addition, oil production would seriously threaten Huaorani survival by destroying and degrading resources that they need to live. Huaorani lands that have been used by the Petroecuador-Texaco consortium for oil production activities are so degraded by pollution, colonization, and deforestation that the Huaorani can no longer live there.

The importance to the Huaorani and other indigenous people of land rights and rain forest conservation cannot be overemphasized. The survival of Huaorani forests has helped the people to maintain, to varying degrees, their traditional egalitarianism and self-sufficiency through decades of contact and change. Gifts from missionaries to favored individuals, subsequent gifts from tourists and oil companies, and temporary jobs for Huaorani men in seismic crews, have introduced rank and dependency into Huaorani communities by providing individuals with unequal access to goods that the community cannot produce. So far, however, these limited goods have not replaced the subsistence activities

139. Some oil workers contend that acceptance by the Huaorani of oil company gifts such as sugar, clothing, rubber boots, chain saws, and food means that they have agreed to oil development in their lands. CONFENIAE and environmentalists, however, insist that Huaorani consent must be based on meaningful consultation and an understanding of oil development including the full range of possible social, economic, and environmental impacts, and what it means to their future. By this standard, acceptance of gifts by the Huaorani described by anthropologist Laura Rival as "hunting and gathering in the oil camps" — does not constitute consent. L. Rival, *supra* note 104, at 1.

of most Huaorani, and they have equal access to the resources of the forest.

The Huaorani who live in Conoco's concession depend on the resources of the forest to live, and have not consented to Conoco's production plans in an informed and meaningful way. Conoco's proposed activities threaten to trigger epidemics of diseases to which the Huaorani have no resistance, expose the Huaorani to malaria, destroy through pollution and colonization the resources that they need to live, and create or accelerate a spiral of economic, medical, and cultural dependence on outsiders. Colonists and land speculators who follow Conoco's roads into the forest could drive Huaorani from their lands, and violence could result.

Blocks 16 and 22 are entirely within a 679,730 hectare area of low-land tropical rain forest that was designated as Yasuni National Park in 1979.¹⁴⁰ An area of exceptional biological diversity, Yasuni is home to at least 4000 to 5000 species of flowering plants, many of them unknown to science. More than 600 species of birds have been identified in Yasuni by scientists, over 4 times the number found in Ecuador's Galapagos Islands. Five hundred species of fish and one hundred twenty species of mammals have been identified. Ongoing studies of reptiles and amphibians are expected to catalog approximately 100 species of each, the highest numbers in the world for a comparable area. Yasuni is home to harpy eagles, jaguars, manatees, freshwater dolphins, giant armadillos, giant otters, anteaters, and other threatened and endangered rain forest species. It has been designated as a Biosphere Reserve, under UNESCO's Man and the Biosphere Program, and as a world center for plant diversity and endemism under the Joint IUCN-WWF Plants Conservation Programme and the IUCN Threatened Plants Unit.

Although the park was created to preserve the rich flora and fauna of the region, a draft management plan made public in 1989 zones over half of the park for "industrial use," including oil and mining operations.¹⁴¹ The draft plan has sparked considerable controversy in Ecuador, and one environmental law group, Corporación de Defensa de la Vida (CORDAVI), filed a lawsuit with the Tribunal of Constitutional

140. Other foreign oil companies with concessions in Yasuni include Elf Aquitaine (Block 14), Petrobras (Block 17), and Occidental Petroleum (Block 15). These companies are currently exploring for oil.

141. F. Coello & J. Nations, Plan Preliminar de Manejo del Parque Nacional Yasuni "Reserva de la Biosfera" (Quito 1989). The draft plan was prepared by the Nature Conservancy and the Department of Natural Areas of the National Forestry Directorate, within the Ministry of Agriculture and Livestock, and was funded by Conoco.

Guarantees challenging the legality of oil development activities in national parks.¹⁴²

In October 1990 the tribunal issued a decision directing the government not to award oil development concessions in protected natural areas in the future. The government was also directed to take all necessary steps to protect the environment and ensure that the constitutional "right to an environment free from contamination" was respected.¹⁴³ One week later, however, the tribunal reversed itself in a vague decision that directs the government to safeguard the constitutional right to a pollution-free environment and protect the natural world during oil development activities, but does not mention national parks or other protected areas.¹⁴⁴ CORDAVI was not officially notified of the reversal, nor was it even aware that the tribunal was reconsidering its earlier decision.

In April 1990 prior to the decisions by the tribunal, the government changed the boundaries of Yasuni to exclude the oil fields that Conoco propose to develop.¹⁴⁵ Lands excluded from Yasuni were included in the new lands titled to the Huaorani, but with the provision that the Huaorani cannot "impede or obstruct" oil or mining activities in those lands.¹⁴⁶ A number of ecologists reacted with outrage to this announcement. For other Ecuadorians, outrage was tempered by the new land title, and by their belief that national parks like Yasuni can seriously threaten indigenous people's rights to land and self-determination, if they are managed by outside bureaucrats and conservationists. Already, the draft management for Yasuni had designated the sacred lakes of the

142. In June 1990 CONFENIAE and the Sierra Club Legal Defense Fund filed a petition with the Inter-American Commission on Human Rights, an organ of the Organization of American States, on behalf of the Huaorani, charging the government of Ecuador with endangering the lives and culture of the Huaorani by encouraging oil development in Huaorani lands. The petition challenges Conoco's proposed development activities for Block 16, and the government's failure to take meaningful measures to protect the Huaorani's rights to life, security, health and well-being, and other physical and cultural rights protected by the American Convention on Human Rights, Nov. 22, 1969, *reprinted in* 9 I.L.M. 673 (1970), ratified by Ecuador on December 8, 1977, and the American Declaration of Rights and Duties of Man, May 2, 1948, *reprinted in* BASIC DOCUMENTS PERTAINING TO HUMAN RIGHTS IN THE INTER-AMERICAN SYSTEM, OEA/ser. L./V./II.71, doc. 6, rev. 1 (1988).

143. Tribunal de Garantías Constitucionales, Casillero Judicial No. 1285, Oct. 23, 1990.

144. Tribunal de Garantías Constitucionales, Casillero Judicial No. 1285, Oct. 31, 1990.

145. The portion of Conoco's concession that it does not propose to develop remains within the park, and additional lands to the south have been included so that the total area of the park remains essentially unchanged.

146. INSTITUTO ECUATORIANO DE REFORMA AGRARIA Y COLONIZACION, PROVIDENCIA No. 900001772, FOLIO No. 1290, 7C REGISTRO GENERAL DE TIERRAS DEL IERAC, (Apr. 3, 1990).

Huaorani as a "tourist zone."¹⁴⁷

Conoco has repeatedly stated that it will not follow the pattern established by Texaco and the first generation of oil companies in the *Oriente*, and claims that it can develop Blocks 16 and 22 in a manner that will not adversely affect the Huaorani or the environment. Nonetheless, Conoco would be the first oil company to open up Huaorani territory and a national park to commercial oil activities. Other companies could use Conoco's road to exploit concessions deeper in the forest. Moreover, Conoco's actions in the field to date have not differed significantly from those of other oil companies in the *Oriente*. Conoco has been cited by the government for illegally discharging drilling wastes into the environment and contaminating a nearby brook, although, according to Conoco, a fine was never collected. Conoco has also failed to provide requested information about its activities in the field. Despite repeated requests, it has not publicly identified the quantities and chemical composition of drilling muds and other wastes that were abandoned in on-site, unlined waste pits, or discharged directly into the environment during exploratory drilling activities.

Although Conoco did finally comply with the Ministry of Energy and Mines' directive to prepare an environmental impact statement (EIS) for its proposed activities in Block 16,¹⁴⁸ it did not agree to postpone those activities pending approval of the EIS. Moreover, the EIS is seriously flawed. It consists primarily of partial lists of plant and animal species, and offers only a very general discussion of some of the most obvious potential environmental impacts. Conoco's conclusions that most environmental impacts will be of low or moderate severity and will be reversible are not supported by the data or by any analysis. Endangered species, critical feeding and nursing grounds, and low energy aquatic systems that could be particularly vulnerable to pollution are not identified. There is no hydrogeological data, and considerations of water quality are limited to cursory discussions of turbidity, biological oxygen demand, and contamination of the water column by oil and grease. Neither potential contamination of sediments and groundwaters nor potential contamination of any media by drilling muds, toxic brine, heavy

147. F. Coello & J. Nations, *supra* note 141.

148. CONOCO, DECLARACIÓN DE EFECTOS AMBIENTALES (Quito 1990) [hereinafter CONOCO, DECLARACIÓN]; CONOCO, ESTUDIO DE EVALUACIÓN AMBIENTAL, BLOQUE 16, REGIÓN AMAZÓNICA ECUATORIANA, CONOCO LTD., FASE DIAGNÓSTICO, PRIMERA PARTE (Quito 1990) [hereinafter CONOCO, EVALUACIÓN I]; CONOCO, ESTUDIO DE EVALUACIÓN AMBIENTAL, BLOQUE 16, REGIÓN AMAZÓNICA ECUATORIANA, CONOCO LTD., FASE DIAGNÓSTICO, SEGUNDA PARTE (Quito 1990) [hereinafter CONOCO, EVALUACIÓN II].

metals, and particularly toxic hydrocarbons such as benzene, toluene, and naphthalene are evaluated. Chemical additives and hazardous materials that will be used in the production process are not identified or evaluated, and spills, and other accident scenarios are not developed or considered.

The management plan that accompanies Conoco's EIS does not include an oil spill contingency plan or specific measures to prevent colonization, logging, or speculation along the road that Conoco proposes to build.¹⁴⁹ Like the EIS, it is vague and conclusory.¹⁵⁰

Although Conoco admits that burning waste gas will generate carbon dioxide, heavy metals, and oxides of sulfur and nitrogen, the possible impacts of these and other air pollutants are not identified or evaluated, possible emission levels are not quantified, and pollution control alternatives are not considered.¹⁵¹ There is no evaluation of the environmental impacts of proposals, made by Conoco in publicly available documents, to incinerate other, possibly hazardous wastes; to use mud-coated drilling wastes as fill for road and platform construction; and to dispose of oily

149. Instead, the plan identifies some major components that should be included in a contingency plan, and calls for a study and legislative reforms to develop measures to prevent colonization along the proposed Conoco road. CONOCO, ESTUDIO DE EVALUACIÓN AMBIENTAL, BLOQUE 16, REGIÓN AMAZÓNICA ECUATORIANA, CONOCO LTD., PLAN DE MANEJO AMBIENTAL (Quito 1990).

150. The plan states, for example, that liquid wastes can be discharged following treatment to comply with discharge standards — a puzzling claim in view of the facts that no discharge standards are currently applied to oil operations in Ecuador, and that Conoco has stated orally that it will dispose of all liquid production wastes by underground injection. According to Conoco's production proposal to Petroecuador, reinjection is an economic measure that is expected to save them the costs of secondary recovery. Reinjection is a common waste management practice for toxic brine in the United States. While it could potentially be an improvement in the current environmental "state of the art" in Amazonian Ecuador, experience in the United States shows that injection wells can become fountains of contamination — both in freshwater aquifers and above ground in soils and waters — if they are not properly designed, installed, operated, and monitored. Serious pollution problems have been documented in many states where underground injection is practiced. In addition to known contamination problems, the critical question of long-term confinement of injected wastes in injection zones remains unanswered. Very little is known about the ultimate behavior of injected materials. Once injected, wastes are irretrievably removed from control and management, and their subsurface migration to ground or surface waters cannot be accurately monitored. Two recent reviews of U.S. EPA Underground Injection Control regulations for injection of oil and gas wastes concluded that those regulations are inadequate to protect the environment. Those reviews were conducted by the EPA and the U.S. General Accounting Office. U.S. ENVIRONMENTAL PROTECTION AGENCY, MID-COURSE EVALUATION OF THE CLASS II UNDERGROUND INJECTION CONTROL PROGRAM: FINAL REPORT OF THE MID-COURSE EVALUATION WORKGROUP (Aug. 22, 1989); U.S. GENERAL ACCOUNTING OFFICE, GAO/RCED-89-97, UNDERGROUND WASTE DISPOSAL (1989).

151. Emissions from proposed incineration of other wastes are not even mentioned.

tank and vessel bottom wastes by land farming¹⁵² and direct application to road surfaces. The EIS also fails to evaluate a no-action alternative, aggregate impacts, and precedent-setting impacts.¹⁵³ This latter omission is particularly significant in view of Conoco's current efforts to get oil development rights for Block 22.

The EIS ignores sociocultural impacts on local development and the Quichua indigenous communities through which Conoco's road will pass. Despite admissions that oil development in Block 16 will destabilize Huaorani society and intensify the "acculturation, detribalization, marginalization, and dependence"¹⁵⁴ of the Huaorani, the severity of those impacts is summarily dismissed. Conoco's consultant, James Yost, an anthropologist-evangelist who formerly worked with the Huaorani for the SIL, has warned against severe impacts on the Huaorani, and predicted that if the Huaorani are forcibly integrated into the national culture and deprived of their traditional subsistence, they will be trampled and "fall to the bottom of the social heap."¹⁵⁵

Despite the gravity of these potential impacts, Conoco claims that the Huaorani have consented to its proposed activities. This "consent," however, is not based on a meaningful understanding by the Huaorani of the changes that could accompany oil production in their lands, and it has been disputed by Rival, an anthropologist who has done recent field work with the Huaorani.

Conoco's claim is based on a 1990 visit by James Yost and Douglas McMeekin to Block 16. In a report on that trip, Yost maintains that "roads are almost universally viewed as acceptable, but only if colonization is not allowed to proceed along them and only if hunting, fishing, and any other kind of surface extractive activities are not allowed."¹⁵⁶ The basis of his finding of "almost universal" consensus, however, is unclear because, according to Rival, he and McMeekin visited only one of three groups of Yasuni Huaorani. Rival subsequently visited all three Huaorani groups, and spoke with all but three of the adults in those groups. She learned that there is strong opposition among the Huaorani

152. Land farming, which typically consists of mixing wastes with soils to dilute them, has also been proposed for contaminated soils from oil spills, but is not considered in the EIS.

153. The EIS also fails to evaluate the relative impacts of alternative development scenarios. Evaluations of alternatives are limited to engineering rather than environmental considerations of selected activities such as slanted drilling and well completion.

154. Conoco, *Declaración*, *supra* note 148.

155. J. Yost, *Assessment of the Impact of Road Construction and Oil Extraction Upon the Waorani Living on the Yasuni 8* (Apr. 1989) (paper prepared for CONOCO Ecuador Ltd.).

156. J. Yost, *Reaction of the Waorani to Potential Road Construction and Oil Extraction 10* (Nov. 1989) (report written for Conoco Ecuador Ltd.) [hereinafter J. Yost, *Reaction*].

to Conoco's proposed road and oil development, and concluded that "[Yost] is not correct when he says that the Yasuni Huaorani want the CONOCO road to be built."¹⁵⁷ Subsequently, in February 1991 the president of the emerging Huaorani organization issued a written statement complaining about McMeekin's follow-up activities on behalf of the "petroleum companies that [seek to] manipulate [us] with gifts and offers of public works for the communities so that we will allow the [oil] companies to work [in our lands]."¹⁵⁸

Even on its surface, Yost's report is troubling in several important respects. Informed consent requires considerable understanding of the full range of risks and impacts that could accompany oil production activities, but the evidence that Yost musters in support of Conoco demonstrates how little the Huaorani understand about oil production and the changes it can bring. According to Yost, the Huaorani he interviewed like petroleum development because they enjoy watching the *cowode* (outsiders) and want access to outside goods and money. Their understanding of the impacts of road construction is that it will enable them to travel to Coca more rapidly.¹⁵⁹

IV. NONCOMPLIANCE WITH THE LAW

A. Environmental Controls

Oil development in the *Oriente* has proceeded with virtually no environmental or public health controls. The Ecuadorian government has

157. Letter from L. Rival to B. Parker of Sierra Club Legal Defense Fund (May 16, 1990).

158. Organización de Nacionalidad Huaorani de la Amazonía Ecuatoriana (ONHAE), Denuncia en VI Congreso de CONFERENIAE, Unión Base, Ecuador (Feb. 5, 1991).

159. J. Yost, Reaction, *supra* note 156, at 2. It is difficult to imagine how the Huaorani could understand Conoco's plans more deeply than Yost indicates, given the huge cultural gulf between them and the encroaching world. The Yasuni Huaorani have had peaceful contacts with outsiders for less than twenty years. L. Rival, *supra* note 104, at 2. During that time they have, for the most part, remained isolated except for contact with missionaries, some tourists, and oil exploration workers. Yost admits that Huaorani impressions of oil development are based exclusively on the temporary presence of company contractors during exploratory activities. Although he reports that the Huaorani insist that they will not allow the *cowode* to live in their territory, in large measure because of the diseases they can bring, he assumes that the only objectionable *cowode* are colonists. He does not address the question of how the Huaorani will react to the influx of between 90 and 300 Conoco, and subsequently Petroecuador, employees. He also does not discuss how the Huaorani will react to the unprecedented destruction of large tracts of forest by Conoco to build facilities or conduct long-term production activities in Huaorani lands. In addition, he assumes that production activities will not generate contamination or otherwise degrade the resource base of the Huaorani, that there will be no oil spills, that colonization can be prevented, and that Conoco will be able to control the activities of its agents and employees by banning hunting, fishing, alcohol, and prostitution with Huaorani women.

shown little or no willingness to establish meaningful environmental regulation over the nation's most powerful industry, despite provisions in the law which, on their face, prohibit contamination and adverse social and economic impacts on local communities.

The Constitution of Ecuador guarantees the right to an environment free of contamination, and directs the government to protect that right and promote conservation, even at the price of restricting other (unspecified) rights and liberties.¹⁶⁰ The legal decree authorizing Texaco's contract with the government of Ecuador requires Texaco to adopt appropriate measures to protect plant and animal life and other natural resources, and to prevent contamination of air, soil, and water.¹⁶¹ Similarly, the law of hydrocarbons requires Petroecuador and foreign oil companies to develop "plans, programs and projects" to protect natural resources and prevent adverse social and economic impacts on local communities.¹⁶² For the most part, however, these and other applicable laws and regulations lack specific environmental standards and meaningful oversight and enforcement mechanisms. Compliance remains virtually unmonitored and the law unenforced.

160. CONSTITUCIÓN POLÍTICA DE LA REPÚBLICA DEL ECUADOR tit. II, § 1, art. 19, para. 2, provides:

On the rights of the individual . . . the State guarantees . . .

2. The right to live in an environment free of contamination. It is the duty of the State to ensure that this right is not infringed upon and to promote the preservation of the natural world. The law will establish restrictions on the exercise of selected rights or liberties in order to protect the environment.

(Translated by the author).

161. Decreto Supremo No. 925, ch. IX, cls. 46, 46.1 ("The contractors [Texaco and Gulf] shall adopt suitable measures to protect the flora, fauna, and other natural resources and to prevent contamination of water, air, and soil under the control of pertinent organs of the State.") (translated by the author).

162. By law, these plans should be submitted to the government for its approval. Ley de Hidrocarburos (Law of Hydrocarbons), ch. III, art. 31 (1990) provides:

art. 31: Petroecuador and its contractors or associates in exploring and exploiting hydrocarbons, in refining, transporting and marketing, are required, as applicable, to [comply with] the following . . .

s) To present for its approval to the Ministry of *Ramos*, the plans, programs, and projects, together with their respective financing, so that exploration and exploitation activities do not have adverse social or economic impacts on local populations and do not have adverse impacts on local renewable and nonrenewable resources . . .

In addition, the Ecuadorian Law of Forestry and Conservation of Natural Areas and Wildlife, which governs Yasuni National Park, Cuyabeno Wildlife Reserve, and other protected areas, provides:

Title II, Chapter 1, art. 71: "The heritage of natural areas of the State must be preserved in an unaltered state."

Title II, Chapter III, art. 76: The wild flora and fauna are the dominion of the State. Their conservation, protection and administration lie under the jurisdiction of the

It was not until 1984 that an environmental bureau, the Dirección General de Medio Ambiente (DIGEMA), was created within the Ministry of Energy and Mines.¹⁶³ However, DIGEMA has been seriously hamstrung by a lack of political support from ministry officials and a corresponding lack of resources, technical equipment, and enforcement authority. In addition, DIGEMA has been excluded from preexploration and preproduction contract negotiations between Ecuadorian officials and foreign oil companies. In 1988 in an attempt to get a seat at the table during the planning stages of oil development activities, DIGEMA notified oil companies operating in Ecuador that they were required by law to submit environmental impact statements (EIS) for approval before initiating any new exploratory or production activities. However, to date, not a single company has fully complied with this requirement.¹⁶⁴

In an apparent attempt to upgrade its limited environmental efforts, the Ministry of Energy and Mines established a new environmental department, the Subsecretaría de Medio Ambiente (SMA) in 1990. DIGEMA was elevated to this department and renamed DINAMA, Dirección Nacional de Medio Ambiente. Despite this reorganization, which is largely cosmetic, the ministry's environmental efforts remain

Ministry of Agriculture and Livestock, which shall exercise the following functions to that effect: . . .

b) Prevent and control soil and water contamination, as well as environmental degradation;

c) Protect and prevent the elimination of wild plant and animal species that are threatened or in the process of extinction; . . .

Title II, Chapter III, art. 78: "Regardless of the purpose, it is prohibited to occupy the lands of the heritage of natural areas of the State, or to alter or damage the demarcation of management areas or to cause deterioration of natural resources therein."

Likewise, it is prohibited to contaminate the soil, water, or air, as well as to threaten land-, water-, and air-dwelling wildlife in the management areas. *Ley Forestal y de Conservación de Areas Naturales y Vida Silvestre*, tit. II, ch. 1, art. 71, ch. 3, arts. 76, 78 (1990) (translated by the author).

163. At that time, oil development was directed by the national oil company, CEPE, within the Ministry of Energy and Mines. CEPE was created in 1972. In September 1989 it was expanded and reorganized as Petroecuador and subsidiaries. Petroecuador's eight member Board of Directors includes a presidential appointee, the joint commander of the Armed Forces, the chief executive of the (national) Central Bank, the general secretary of planning of CONADE (the national development planning agency), the ministers of Energy and Mines, Finances and Public Credit, and Industry, Commerce, Integration and Fishing, and a representative of the company's workers. DIGEMA's marginal status was codified in the law that established Petroecuador, which gives no authority to the bureau in the reorganized national petroleum industry.

164. Conoco recently submitted an EIS to DIGEMA's successor agency, DINAMA, for planned production activities in Block 16, but did not agree to postpone the start of construction activities pending approval of the agency. The EIS, discussed above, is seriously flawed.

weak, and morale within DINAMA is at an all-time low. Only four full-time technical staff based in Quito oversee oil activities nationwide.¹⁶⁵ There is no staff devoted to full-time oversight or field work.

At the time of the reorganization, DIGEMA technical staff had completed two years of work on a draft of the first comprehensive environmental regulations for Ecuador's petroleum industry. The regulations were designed to improve regulations adopted in 1988, which apply only to development in national parks and other protected natural areas. DINAMA had distributed the proposed regulations to the oil companies for their comments, and planned to use workshops and other means to solicit public comments before presenting the final regulations to Ecuador's president for his signature or to the national congress for legislative action. The existing regulations had been promulgated as an interministerial agreement between the Ministry of Agriculture and Livestock, which manages protected areas, and the Ministry of Energy and Mines.¹⁶⁶

DINAMA's efforts were cut off by SMA. Instead, a set of voluntary guidelines for the oil industry was developed and substituted for the regulations. The guidelines were negotiated by SMA, the oil companies, and Fundación Natura, a leading Ecuadorian environmental group. Other nongovernmental groups and the general public were not invited to participate or advised that the negotiations were underway.

In August 1990 the guidelines were adopted in what the participants called a "gentlemen's agreement."¹⁶⁷ The signers included SMA, Petroecuador, and the foreign oil companies operating in Ecuador. Fundación Natura signed as a witness to the agreement.

According to the gentlemen's agreement, the signers will abide by the guidelines for a two year period.¹⁶⁸ During that period, a commission consisting of Natura and the parties to the agreement is charged with determining whether industry is complying with the guidelines and

165. In addition to those in the *Oriente*, oil development activities are underway in the coastal region of Ecuador.

166. Regulations for the Prevention, Control and Rehabilitation of the Environment During Exploration and Exploitation of Hydrocarbons in National Parks or their Equivalents, Acuerdo No. 1743 (Aug. 4 1988). Some Ecuadorian lawyers question the legality of these regulations as incompatible with the Ecuadorian Law of Forestry and Conservation of Natural Areas and Wildlife. The regulations are very general, and, according to sources inside DINAMA, have not been monitored or enforced.

167. Ministerio de Energía y Minas, Acta de Compromiso Para Observar las Disposiciones de Manejo Ambiental para las Actividades Hidrocarburíferas (Aug. 15, 1990).

168. *Id.* para. 2.

with revising the guidelines.¹⁶⁹ The gentlemen's agreement is silent on how the commission will function, how it will determine when a violation has taken place, what the consequences of a violation will be, and whether the commission's decisions must be unanimous. The agreement provides that at the end of the two year period, SMA will revise the guidelines and issue them as regulations pursuant to a ministerial agreement.¹⁷⁰

In contrast to the gentlemen's agreement, the draft regulations would have provided for detailed reporting, inspections, enforcement, and fines for violations.¹⁷¹ The draft regulations also would have required DINAMA to review and approve site-specific environmental controls, and included a number of specific protective measures that were omitted from the guidelines. For example, the regulations would have encouraged the reinjection of natural gas into underground formations for later use instead of the current practice of burning gas as a waste. The regulations would have required the use of water-based drilling muds rather than more toxic oil-based muds, and would have prohibited the discharge of untreated wastes from cleaning vehicles and containers that have been used for toxic substances.

Petroecuador has recently asserted a new commitment to environmental protection, but at the same time it continues to deny that oil development causes adverse impacts on the land and the people of the *Oriente*. It has its own, very small environmental office in Quito, and no staff assigned to the field. Two new production facilities that came on line in 1990 operate like the existing facilities, with no environmental controls or monitoring.

Under pressure from the World Bank, Petroecuador is currently preparing environmental guidelines for oil operations. Still, many Ecuadorians are skeptical about Petroecuador's willingness either to modify its own operations or to require foreign oil companies to implement environmental controls. In 1987 the World Bank loaned eight million dollars to Petroecuador's predecessor company, CEPE, primarily to support emergency repairs to the Trans-Ecuadorian Pipeline in the wake of a major earthquake. A condition of the loan, however, required that ten percent of the monies be used to prepare an environmental assessment and management plan for the pipeline and other facilities. After a two year delay, Petroecuador contracted with Ambientec, a Colombian

169. *Id.* para. 3.

170. *Id.*

171. Reglamento Ambiental para la Actividad Hidrocarburífera en el Territorio Nacional, ch. 1 (draft).

consulting firm, to do the work. Ambientec began work in January 1990 and presented its draft plan to Petroecuador at the end of 1990.

Despite growing national and international interest in the progress of the study, which began in January 1990 and was financed with public monies from the World Bank, detailed information, including written work summaries prepared by Ambientec for Petroecuador, continue to be withheld from the public. So far, the bank has been unwilling to facilitate the release of this information, insisting that it is the property of the Ecuadorian government. At the same time, it has indicated that it expects the Ambientec study to serve as most of the environmental assessment required by bank policy for an upcoming 100 million dollar loan to Petroecuador.

The loan could total 450 million dollars with cofinancing, and will be used to support exploratory activities, development of new oil fields, secondary recovery from existing fields, expansion of the Trans-Ecuadorian Pipeline, and environmental studies.¹⁷² In response to the planned loan, a newly formed coalition of thirteen Ecuadorian nongovernmental organizations issued a document in January 1990 elaborating thirteen conditions that must be met before the loan is approved.¹⁷³ They demanded that the government of Ecuador stop all oil development in national parks and other protected areas,¹⁷⁴ and in Huaorani territory without the informed consent of the Huaorani.¹⁷⁵ They also demanded rigorous environmental studies of all planned oil development activities, stringent environmental controls, cleanups of damaged areas,¹⁷⁶ and respect for the land and self-determination rights of Amazonian indigenous peoples.¹⁷⁷

The loan is currently stalled because of a domestic pricing dispute between the bank and the government of Ecuador. In preparing the loan, the bank has insisted that the government of Ecuador raise the domestic price of gasoline. Over the last year the government has complied, and the price of gasoline in Ecuador has risen steadily. At the same time, however, the local currency, the *sucre*, has been steadily devalued, based on an agreement with the International Monetary Fund.

172. The World Bank, Monthly Operational Summary of Bank and IDA Proposed Projects (Oct. 1, 1990).

173. Campaña: Amazonía por la Vida, Conditions Demanded of the Government of Ecuador and the World Bank by Ecuadorian Nongovernmental Organizations (NGOs) (Jan. 27, 1990).

174. *Id.* para. 10, at 3.

175. *Id.* para. 8, at 2.

176. *Id.* para. 1(a)-(b), at 1.

177. *Id.* paras. 4-6, at 2.

As a result, the gasoline price increases, when measured in dollars, have not met bank targets. The bank continues to insist on further increases, and, because of the recent surge in international oil prices, the domestic price level that the bank will require has risen even higher. At home, however, the government faces stiff political opposition to higher prices.

V. CONCLUSION

A. The Tip of the Iceberg

The environmental and sociocultural impacts of oil development in the *Oriente* that have been identified so far are probably just the tip of the iceberg. Scientists, with their limited understanding of tropical ecosystems, can only detect the most obvious and acute impacts. Moreover, the scale of oil operations could increase substantially, further jeopardizing both protected natural areas and indigenous peoples in the *Oriente*.

The little that scientists know about rain forest ecology suggests that rain forest pollution could generate environmental impacts on a scale unknown in temperate regions. A significant portion of rain forest plant life is made up of epiphytes, such as bromeliads and orchids. These plants live predominately in the canopy and draw nutrients directly from rain-water through aerial roots or pores in their leaves. Many rain forest trees also have aerial roots and draw nutrients in the same way. These plants could be especially vulnerable to air pollution.¹⁷⁸ In addition, the nature of the vapor cycle, by which one-half to three-quarters of the rainfall in tropical rain forests is generated by transpiration and evaporation from nearby forests, means that airborne pollutants could be returned to the forest in the water cycle rather than dispersed.

Soils in tropical rain forests are typically thin and poor in nutrients, and trees are shallow-rooted so that they can intercept decaying organic matter. This rapid and efficient process of nutrient recycling depends on mycorrhizal fungi that have a symbiotic relationship with the tree roots. This relationship could be seriously affected by pollutants or changes in the soil pH. The forests' vulnerability could be further exacerbated because there is relatively little soil available to buffer contaminants. As with airborne contaminants in the water cycle, soil contaminants could become trapped in this efficient and rapid nutrient cycle.

The diversity and complex interdependencies of tropical rain forest species mean that if just one or two species is impacted, a chain reaction

178. The marked sensitivity of lichens, the epiphytes of temperate forests, to air pollution and particularly sulfur dioxide, is well-documented. Negative impacts can occur at low concentrations and from short-term exposures.

of impacts could be triggered, affecting not only species higher in the food chain but also those that depend on the affected species for pollination or dispersal of seeds, habitat, defense against predators, and nutrient scavenging or uptake.

B. Toward Compliance with the Law

Environmental enforcement policy in Ecuador, which allows the oil industry to set its own standards and police itself, has resulted in widespread noncompliance with environmental laws and serious violations of the constitutional right of Ecuadorians to a clean and healthy environment. Recent developments, such as the gentlemen's agreement, perpetuate this policy and are unlikely to lead to compliance with the law. Implementation of environmental laws would require strong governmental regulation, with public participation in permitting, oversight, and enforcement, as well as accountability of oil companies for any damage they cause.

At existing production, transportation, and refining facilities, the government should require oil companies to revamp their operations to prevent further contamination and ensure maximum recovery of already-tapped reserves. The government should also require oil companies to remedy contamination at these facilities and at abandoned exploratory well sites. Environmental audits and detailed chemical sampling are needed to guide cleanup efforts, to provide a reliable accounting of the composition and quantity of all waste streams and emissions, and to develop waste handling and other operational procedures to protect human health and the environment. These procedures should include emission and effluent controls and standards, monitoring and reporting requirements, and worker safety and training programs. In addition, potential oil spill and other accident scenarios should be evaluated, and prevention measures and emergency response plans should be developed and implemented. Audit results and chemical data should be available to the public and evaluated, along with proposed cleanup and control measures and standards and accident prevention and response plans, in public hearings in affected communities.

For each active facility, the government should determine whether adequate measures are available to protect human health and the environment from continued operations. These determinations should be supported by the hearing record. Upon a finding that adequate measures are available, the government should issue a permit which conditions continued operations on the implementation of those measures. Permits should specify cleanup, control, accident prevention, and response meas-

ures, and require long-term compliance with discharge and emission standards. Permits should also specify strict timetables for compliance, monitoring and reporting requirements, and substantial penalties for violations. Monitoring and other compliance reports should be available to the public. In cases of noncompliance, private citizens should have standing to sue violator oil companies for penalties, attorneys' fees, and costs,¹⁷⁹ and to enjoin compliance with permit conditions.¹⁸⁰

For new facilities, the government should establish a rigorous permitting process which ensures that development decisions in the *Oriente* are based on consideration of potential environmental and sociocultural impacts and a meaningful evaluation of alternative development scenarios. In contrast to the current practice of negotiating development decisions behind closed doors and withholding important environmental information from the public, the permitting process should ensure that affected parties have access to relevant information and have the right to participate in the decision-making process. In addition, it should be administered by an independent environmental agency of the government with legal authority to grant or deny permit applications by oil companies and enforce permit conditions and applicable environmental laws. Permits should specify control measures, discharge and emission standards, monitoring and reporting requirements, and accident prevention and response measures. Citizens should have standing to enforce permit conditions by suing violators for penalties, attorneys' fees and costs, and for court orders enjoining compliance with permit conditions.¹⁸¹

New activities that would require a permit include undertaking seismic studies, drilling exploratory wells, building roads, pipelines, or production facilities (including new investments in enhanced recovery), soliciting bids for petroleum development rights in new areas, and any other activity that may have a significant impact on the environment or

179. A useful model in U.S. law is the citizen's suit provision in section 505 of the Clean Water Act, 33 U.S.C. § 1365 (1977). This provision allows citizens to sue companies in federal court for violations of discharge permits issued under the Act, and is widely credited as an effective deterrent against water polluters.

180. In cases of multiple or repeated permit violations, the court should have authority to order oil companies to suspend operations, pending compliance with permit conditions. Operations should also be suspended at facilities where the government determines that adequate measures are not available to protect human health and the environment, and operator- or industry-financed cleanups should be undertaken at those facilities.

181. In order to serve as an effective deterrent against permit violations, penalties for violations should be substantial, and should be levied for each day of each violation. The monies that are collected could be earmarked to finance cleanup and control activities at selected facilities and to replace lost revenues that result from decisions to decrease production, in order to husband remaining oil reserves and to forgo production in designated new areas.

on the social, cultural, or economic life of local residents. To obtain a permit, the oil company applicant would be required to submit detailed plans and specifications and prepare an EIS for the proposed activity. By law, the government would be prohibited from issuing a permit in the absence of an adequate EIS. The EIS should evaluate the full range of environmental, public health, sociocultural, and economic impacts that could result, either directly or indirectly, from the proposed activity, including aggregate, cumulative, and precedent-setting impacts. The socio-cultural assessment should include an evaluation of potential impacts on the land, self-determination, subsistence, cultural and spiritual rights, and interests of indigenous populations. The EIS should also evaluate measures that could be taken to mitigate adverse impacts and alternative development scenarios, including a no-action alternative and alternatives to petroleum development that would maintain and enhance long-term natural resource productivity. By law, the public would have adequate time to review and comment on the draft EIS and the right to a public hearing to evaluate the adequacy of the study. Although the government would make the determination of adequacy, it must be supported by the record and would be subject to judicial review.

In addition to governmental regulation with clear standards and lines of authority and public participation in permitting, oversight, and enforcement, oil companies should be held accountable for any damage they cause. In cases involving foreign oil companies, injured parties should have recourse to courts in the home countries of those companies, where corporate decisions are typically made and standards of corporate accountability are well-established in the law.¹⁸² Because tort law in Ecuador has not yet been developed, and the government has been unwilling or unable to regulate the environmental and human consequences of oil development, tort liability at home would be an effective constraint on misconduct by foreign oil companies. Without accountability at home, foreign oil companies can be expected to continue to adhere to a double standard in the *Oriente*. Ecuadorians would continue to be denied not only their constitutional right to a safe and healthy environment, but also their day in court.

The measures outlined above, if properly implemented, could be important first steps toward compliance with Ecuadorian environmental law. Their success, however, depends on several factors. First, the independence of the judiciary in Ecuador must be assured. Without an independent judiciary, laws that provide for citizen enforcement, judicial

182. Liability for damages should be applied both prospectively and retroactively.

review, and redress for damages will be meaningless. Although the independence of the judiciary is beyond the scope of this Article, it is clear that, for all practical purposes, the judiciary has not yet become an effective constraint on oil industry conduct in Ecuador.

Second, a strong regulatory agency must be developed within the government to administer the permit process and promulgate and enforce clear environmental standards. To be an effective environmental regulator, the agency should be independent of Petroecuador and governmental ministries charged with developing natural resources and promoting economic development. The agency will need clear legal authority over the oil companies, including Petroecuador, to enforce environmental laws, as well as adequate resources and a serious commitment by the national government to environmental protection.

Third, meaningful public participation in decision-making, oversight, and enforcement must be assured. In addition to public access to environmental information, public consultation when regulatory determinations are made, judicial review, and citizen enforcement, affected communities will need access to legal and technical assistance. In some areas, such as Huaorani territory, local populations may be unable to participate in decision-making and oversight because of vast cultural differences between the people and the oil industry. In those areas, there should be a moratorium on petroleum development until meaningful participation is possible. Outsiders who claim to represent the interests of groups like the Huaorani should be consulted when appropriate, but their participation should not be accepted as a substitute for the direct participation of local populations and their representatives.

Finally, successful implementation of environmental laws in the *Oriente* will require legal recognition and protection of indigenous land rights. In addition, measures must be taken to protect the human rights of indigenous populations to self-determination, to their means of subsistence, and to their right to maintain and develop their own cultures in a multicultural society. An analysis of indigenous land claims and human rights law, which raises questions about the rights of indigenous populations to control surface and subsurface resource development in their lands, is beyond the scope of this Article. Nonetheless, the destruction and risks that accompany petroleum development in the *Oriente* indicate that, as a minimum, certain areas should be off-limits to the oil industry, based on the needs and traditions of local populations. These protected natural areas should be selected and managed by indigenous people and could include sacred areas, critical watersheds, and important resource extraction areas.

