

CRUEL OIL

How Palm Oil Harms Health, Rainforest & Wildlife



Center for Science in the Public Interest

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Center for Science in the Public Interest

1875 Connecticut Avenue, NW, #300 Washington, DC 20009

Tel: 202-332-9110 Email: cspi@cspinet.org

Fax: 202-265-4954 Internet: www.cspinet.org

Contents

<i>Executive Summary</i>	iv
The Palm Oil Problem	1
Palm Oil and Human Health	2
<i>Palm Oil and Heart Disease in Mauritius</i>	3
Palm Oil as Agribusiness	5
The Palm Oil Trade	6
Oil Palm Plantation Agriculture	7
<i>Indonesia's Devastating Forest Loss</i>	8
Plantations Replace Tropical Rainforest	9
Ecological Impacts of Oil Palm Agriculture	11
Vanishing Rainforest, Vanishing Wildlife	11
<i>Why Are Tropical Rainforests Important?</i>	11
Endangered Rainforest Mammals	12
<i>Oil Palm Is Main Threat to Orangutan Survival on Sumatra</i>	14
How Oil Palm Destroys Wildlife	16
<i>Lost Habitat = Lost Animals</i>	17
<i>Elephant Killing in Sumatra</i>	18
<i>Who Set the Wildfires?</i>	19
<i>Corruption in the Oil Palm Business</i>	21
Oil Palm Displaces Indigenous People and Subsistence Farmers	21
<i>Palm versus Soy</i>	22
The Damage Doesn't Stop There	22
<i>Palm Oil-Mill Effluent Kills Aquatic Wildlife</i>	23
Still More Destruction to Come	24
<i>Oil Palm Threatens Papua New Guinea's Wildlife</i>	25
Imminent Wildlife Extinctions in Indonesia and Malaysia	26
<i>More Than Just Elephants and Orangutans</i>	26
The U.S. Market	27
Does It Have to Be This Way?	28
<i>"Sustainable" Palm Oil?</i>	30
Notes	32
Notes to Boxes	39

EXECUTIVE SUMMARY

Palm oil, one of the world's leading agricultural commodities, is widely used as a food ingredient and cooking oil. Unfortunately, not only does palm oil promote heart disease, but the vast plantations that grow oil palm trees have contributed to the destruction of the rainforest and wildlife of Southeast Asia. Those side effects are not broadly recognized—and avoided—by governments, food manufacturers, or consumers.

A new U.S. government regulation requires that, by January 1, 2006, food labels list a product's content of *trans* fat, which comes from partially hydrogenated vegetable oil and is a major cause of heart disease. Many food processors are seeking to eliminate *trans* fat by switching to other oils. Palm oil is one such alternative.

This report describes palm oil's chief environmental and health impacts and encourages food processors, consumers, and government and international agencies to support the use of oils that are better for both human and environmental health.

Palm oil and human health

Palm oil is used around the world in such foods as margarine, shortening, baked goods, and candies. Biomedical research indicates that palm oil, which is high in saturated fat and low in polyunsaturated fat, promotes heart disease. Though less harmful than partially hydrogenated vegetable oil, it is far more conducive to heart disease than such heart-protective liquid oils as olive, soy, and canola. The National Heart, Lung, and Blood Institute, World Health Organization, and other health authorities have urged reduced consumption of oils like palm oil.

Palm oil plantations

Palm oil is forecast to be the world's most produced and internationally traded edible oil by 2012. Malaysia and Indonesia account for 83 percent of production and 89 percent of global exports. Oil palm is grown as an industrial plantation crop, often (especially in Indonesia) on newly cleared rainforest or peat-swamp forests rather than on already degraded land or disused agricultural land. Since the 1970s, the area planted with oil palm in Indonesia has grown over 30-fold to almost 12,000 square miles. In Malaysia, the area devoted to oil palm has increased 12-fold to 13,500 square miles.

Ecological impacts of oil palm

Indonesia and Malaysia have, concomitant with the destruction of enormous tracts of tropical rainforest, some of the world's longest lists of threatened wildlife. Of the more than 400 land mammal species of Indonesia, 15 are critically endangered and another 125 threatened. Of Malaysia's nearly 300 land mammal species, 6 are critically endangered and 41 threatened. The numbers of threatened species climb higher when terrestrial reptiles, amphibians, and birds are included. Moreover, certain animals,

such as the orangutan, are only found in these countries; when their rainforest habitat vanishes, so will they.

Five mammals exemplify the impending disaster: the Sumatran tiger, Sumatran and Bornean orangutans, Asian elephant, and Sumatran rhinoceros. Each of those species is endangered, with the three eponymous Sumatran species critically endangered. They once flourished in precisely those areas where rainforests have since been cleared for oil palm.

Oil palm plantations, along with logging, fires, and other factors, destroy rainforest habitat, hinder migration patterns, and block travel corridors. Roads and plantations fragment the rainforest, facilitate encroaching settlements, and make animals accessible to illegal hunting and poaching. If they enter plantations while searching for food outside the rainforest, animals may be killed by workers. They are also at risk when plantation companies set forest fires to clear land for oil palm; some fires burn out of control, demolishing much larger areas than anticipated.

Plantations also pollute the soil and water with pesticides and untreated palm oil-mill effluent, cause soil erosion and increased sedimentation in rivers, and cause air pollution due to forest fires.

The demand for palm oil is forecast to double by 2020. To achieve that production increase, 1,160 new square miles will have to be planted every year for 20 years. Indonesia has 26,300 square miles more forest land officially allocated for new oil palm plantations; Malaysia has almost 3,000 square miles more. The expected thousands of square miles of new plantings on the islands of Sumatra and Borneo could kill off the remaining orangutans, rhinos, and tigers.

The U.S. market

Because of the impending trans-fat labeling regulation, many food manufacturers are seeking alternatives to partially hydrogenated vegetable oil. If companies replaced the 2.5 billion pounds of partially hydrogenated oil used annually in foods needing a solid fat with palm oil, U.S. palm oil imports would triple over the 2003 level. Such an increase would require about 1,240 square miles of new oil palm plantations—an area that represents rainforest habitat for up to 65 Sumatran rhinos, 54 elephant families, 65 Sumatran tigers, and 2,500 orangutans.

Does it have to be this way?

More healthful substitutes are available for most uses of both partially hydrogenated oil and palm oil, and food manufacturers and consumers should seek those out. Where palm oil's use is unavoidable, the oil should be obtained from environmentally sound sources and used in minimal quantities.

The Palm Oil Problem

The sprawling oil palm plantations in Southeast Asia that produce most of the world's palm oil have had a devastating effect on the rainforest and its wildlife. Palm oil, widely used in processed foods and cooking oils in Asia, Europe, and—to a lesser extent—the United States, also harms human health. Yet those effects are not broadly recognized in the countries that finance, import, and trade in palm oil.

This report attempts to address that knowledge gap by reporting on some of palm oil's chief environmental and health impacts. By so doing, it aims to:

- raise awareness of the ravaging impact of oil palm plantations on the environment and the harmful effects of palm oil on human health
- encourage food processors, consumers, government agencies, and international agencies to support the use of edible oils that are better than palm oil in terms of both human and environmental health

The report provides a brief description of palm oil's promotion of heart disease; an overview of the palm oil trade and oil palm plantations as agribusiness; an assessment of the environmental impacts of oil palm plantations, with a focus on five endangered rainforest animals (the Sumatran tiger, Sumatran rhinoceros, Asian elephant, and Sumatran and Bornean orangutans); a snapshot of the U.S. market for edible oils; and recommendations for alternatives.

Several environmental organizations have published major studies and investigative reports on the palm oil business and the dire condition of Indonesia's forests, and the present report draws on those. *Funding Forest Destruction* looks at Dutch banks' financing of Indonesian plantations;¹ *Oil Palm Plantations and Deforestation in Indonesia* explores the role of Germany—and Europe more broadly—in oil palm agribusiness;² *Greasy Palms* discusses the



Palm oil is used, alone or with other oils, in an increasing number of foods.

Palm oil, while not as harmful as partially hydrogenated soybean oil, is still less healthful than other vegetable oils.

ecological and social impacts of oil palm plantations in Southeast Asia;⁵ and *The State of the Forest: Indonesia* covers deforestation and a broad spectrum of forest issues in Indonesia.⁴

Palm Oil and Human Health

Palm oil is an edible oil derived from the pulp of fruits of the oil palm (*Elaeis guineensis*). Palm oil is used around the world in such foods as margarine, shortening, cooking oil, soups, sauces, crackers and other baked goods, and confectionary products. Indeed, after soybean oil, it is the most widely used oil. It is highly versatile and can be substituted for hard animal fats (butter and lard); for soy, olive, or canola liquid vegetable oils; and for partially hydrogenated vegetable oil, which is a staple of the baking, fast-food, and other industries.

In the United States, palm oil is used primarily in processed foods in which a solid fat is required. In many products, palm oil is used together with soy, canola, or other oil. In some foods, such as Nabisco Golden Oreos, Newman's Own Organics Alphabet Cookies, or Devonsheer Classic Original Water Crackers, palm is the major oil or the only oil.

Currently, the United States is a small market for (mostly Malaysian) palm oil compared to China, India, and the European Union.⁵ However, the palm oil industry expects major increases in sales to American companies as a result of the U.S. Food and Drug Administration's requirement that by January 1, 2006, food labels list the amount of *trans* fat per serving. In 2004, that expectation began to be realized when U.S. companies imported about 50 percent more palm oil than the year before.⁶ The Malaysian palm oil industry—growers, processors, and the government—are aggressively publicizing the virtues of its product compared to partially hydrogenated soybean oil. *Trans* fat, which is created when liquid soybean oil is hydrogenated to create a more solid, stable form, is a potent promoter of heart disease. *Trans* fat raises LDL ("bad") cholesterol in blood as effectively as saturated fat, and it slightly decreases HDL ("good") cholesterol. In addition, *trans* fat appears to increase the risk of diabetes, impair cardiac rhythm, and have other adverse effects.⁷

Commendably, many food processors are seeking alternatives to partially hydrogenated oil so they can eliminate the *trans* fat from their products. Palm oil is highly attractive both because of its taste and cooking properties and because it is about one-third cheaper than soybean oil (partly because oil palm plants yield 10 times more pounds of oil per acre than soybeans).^{8,9} Unfortunately, palm oil, while not as harmful as partially

hydrogenated soybean oil, is still considerably less healthful than other vegetable oils.

The palm oil industry and several scientists (some of whom have been funded by the industry) contend that studies show that palm oil is safe and healthful.^{10,11} They note that palm oil does not contain *trans* fat and state that the oil does not raise blood cholesterol levels. The industry emphasizes that 39 percent of palm oil is oleic acid, the major and healthful fatty acid in olive and canola oil. Moreover, the industry claims, the palmitic acid that constitutes 44 percent of palm oil affects cholesterol levels much like oleic acid.

In contrast to the palm oil industry's contentions, most health authorities—supported by most of the medical research on the health effects of different fats—agree that palm oil promotes heart disease. The research they cite goes back to at least 1970.¹²

Two “meta-analyses”—a research technique that combines similar studies to achieve greater statistical strength—examined the effect of palmitic acid on serum cholesterol. In a 1997 meta-analysis based on 134 human experiments, prominent British medical researchers concluded that palmitic acid raises blood cholesterol levels.¹³ Polyunsaturated fatty acids, such as the linoleic acid in liquid vegetable oils, lower cholesterol levels.

In 2003, scientists in the Netherlands conducted another meta-analysis of clinical studies.¹⁴ In addition to considering effects on total blood cholesterol, those researchers examined what many experts consider to be an important indicator of heart-disease risk: the ratio of total cholesterol to HDL (“good”) cholesterol.¹⁵ The higher the ratio, the greater the risk. Based on 35 medical studies, palmitic acid increases that ratio more than other saturated fatty acids, including lauric acid and myristic acid, which are abundant in palm kernel oil and coconut oil, the other “tropical oils.”¹⁶ (All three of those fatty acids increased LDL cholesterol about equally.¹⁷) The same meta-analysis found that palm oil increases the total:HDL cholesterol ratio more than the average U.S. dietary fat, though less than stick margarine, typical vegetable shortening (made with partially hydrogenated vegetable oil), and

Palm Oil and Heart Disease in Mauritius

Perhaps the most damning indictment of palm oil comes from a natural experiment on the island nation of Mauritius, whose population in the 1980s suffered high rates of heart disease. Health experts theorized that palm oil—whose cost was subsidized by the government—was one of the causes of the heart disease. So in 1987, the government began a health promotion program and switched the subsidy from oil made mostly of palm oil to one made mostly of soy.ⁱ That “governmental action to substitute soybean oil for palm oil as the subsidized, rationed oil resulted in a remarkable reduction in cholesterol levels,” according to K. Srinith Reddy, of the All India Institute of Medical Sciences in New Delhi.ⁱⁱ The World Health Organization reported that changing the cooking oil resulted in a 15 percent decrease in serum cholesterol in the population.ⁱⁱⁱ

“Cut back on foods high in saturated fat or cholesterol, such as meats, butter, dairy products with fat, eggs, shortening, lard, and foods with palm oil or coconut oil.”

— NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

butter. That finding indicates that, in terms of blood cholesterol, palm oil is somewhat more harmful than the average U.S. dietary fat and far more harmful than such liquid oils as olive, soy, and canola. It is worth noting, though, that some of the same and other researchers recognize that under certain experimental conditions palm oil does not appear to have untoward effects on cholesterol.^{18,19}

On the basis of a large body of scientific studies, several authoritative health agencies have evaluated the healthfulness of palmitic acid and palm oil. For instance, the World Health Organization has stated that there is “convincing evidence” that palmitic acid increases the risk of cardiovascular disease. It advises that “intake of foods rich in myristic and palmitic acids should be replaced by fats with a lower content of these particular fatty acids.”²⁰

U.S. health authorities have long encouraged Americans to consume less saturated fat, which is a major constituent of palm and other tropical oils and, of course, is abundant in meat and dairy products as well. The National Heart, Lung, and Blood Institute, part of the National Institutes of Health, in 1997 warned:²¹

Saturated fat raises blood cholesterol the most. Over time, this extra cholesterol can clog your arteries. You are then at risk for having a heart attack or stroke... A high content of saturated fat can be found in some foods that come from plants such as: palm kernel oil, palm oil, coconut oil, cocoa butter.

Similarly, and more recently, the National Institute of Diabetes and Digestive and Kidney Diseases stated: “Cut back on foods high in saturated fat or cholesterol, such as meats, butter, dairy products with fat, eggs, shortening, lard, and foods with palm oil or coconut oil.”²²

Consumers can try to avoid both palm oil and partially hydrogenated vegetable oil by reading labels carefully (though one can’t do that when eating out). But consumers need the food industry’s help. Food processors should use the most healthful oils possible. That means using traditional oils, such as soy, canola, and corn. When those aren’t appropriate, they can use newer, more stable oils, such as high-oleic sunflower or canola oil or low-linolenic soybean oil. *Trans*-free Crisco uses a simple mixture of liquid soy oil and solid fully hydrogenated soy oil (which contains no *trans* fat). For instance, several U.S. brands of cookies, such as Whole Foods’ 365 Sandwich Cremes (canola) and Country Choice Vanilla Sandwich Cremes (high-oleic safflower), are made with those oils.²³ If companies absolutely need, for technical or cost reasons, to use the harder, more saturated fats—such as palm, partially hydrogenated

soy, or butter—they should try to minimize the amount by using less of those fats and mixing them with more-healthy oils.

Ironically, some makers of “health foods” use palm oil. Arrowhead Mills Graham Cracker Pie Crust, Late July Classic Rich and Saltine crackers, Health Valley CarbFit Almond and Peanut Butter Cookies, and Whole Foods’ 365 Organic Water Crackers are all made with palm oil. Some companies try to make a silk purse out of their sow’s ear of an ingredient. The label of Back to Nature Classic Creme Sandwich Cookies emphasizes that its palm oil is “from the fruit of the palm, not the kernel.” (Palm kernel oil may actually be less harmful than palm oil.) Courtney’s Fine English Water Crackers brags about its “organic non-hydrogenated palm fruit oil.” Palm fruit oil sounds better than palm oil, but the word fruit and being organic won’t protect a person’s arteries. Several varieties of Newman’s Own organic cookies, as well as Pop’s Corn microwave popcorn, not only contain palm oil, but the labels deceptively brag that palm oil contains no *trans* fat and is less saturated than coconut or palm kernel oil.²⁴ These statements are literally true, but mislead people into thinking that palm oil is positively healthy. Palm oil is not a health food.

If current trends in palm oil consumption continue, that oil’s global impact on public health will increase greatly. According to medical experts who carried out a major multi-country study sponsored by Columbia University’s development-oriented Earth Institute, the burdens of heart disease—in terms of both health and economics—will fall heavily on people in developing countries.²⁵ Already, heart disease, caused in part by certain cooking oils and fats, kills millions of people a year in China and India.²⁶ Researchers estimate that in 2030 in China, half of the projected 9 million deaths from heart disease will occur among people in their prime working years, age 35 to 64. India and China also happen to be the world’s two biggest importers of palm oil; both more than doubled their imports of palm oil between 1997 and 2001.²⁷ The Columbia University study concludes that without concerted interventions by the public health community, national governments, private enterprise, and ordinary citizens, an international health crisis due to heart disease is looming in China, India, and other developing countries.²⁸ Reducing consumption of palm oil would be one good way to start addressing that crisis.

Palm Oil as Agribusiness

Palm oil is attractive to the food industry because it is cheap and is semi-solid at room temperature; thus, it ordinarily does not need to be



Palm oil is derived from the mesocarp, or pulp, of the oil palm fruit (shown here).

The fruit’s kernel yields palm kernel meal and palm kernel oil.

Photo: Malaysian Palm Oil Association.

Cruel oil

hardened to be useful as a shortening. It can be used as a household cooking oil, but in the United States it is used primarily as an ingredient in commercially processed foods. Chocolate products such as candy bars and cake icing may contain palm oil as a substitute for cocoa butter. Ice cream, margarine, peanut butter, coffee whitener, canned cream soups, sauces, baked goods, trail mix and other snack foods, and microwaveable convenience foods may all contain palm oil. Palm oil also has industrial and chemical uses—for instance, as a mineral oil substitute for producing lubricants, detergents, soaps, and cosmetics including lipstick, makeup remover, body lotion, and sun cream.²⁹



Palm tree, palm fruit.

© Sumatran Orangutan Society (www.orangutans-sos.org).

The oil palm fruit also provides palm kernel oil and palm kernel meal. Those products are derived from the seeds of the fruit rather than from the fleshy pulp. The seeds can be stored for a long period and are easily transported. Palm kernel oil is used in some of the same kinds of foods as palm oil, even though their fatty acid compositions differ considerably. Palm kernel meal is an important ingredient in animal feeds.

The yield of the palm fruit is about 82 percent crude palm oil, 10 percent palm kernel meal, and 8 percent palm kernel oil.

The Palm Oil Trade³⁰

Palm oil is a huge agricultural commodity. By 2012, palm oil is forecast to be the world's most produced, consumed, and internationally traded edible oil.³¹ Global production, consumption, and trade in palm oil have soared since the 1970s. In 2002, palm oil and palm kernel oil accounted for almost 50 percent of total global exports of oils and fats.³² Between 1997 and 2001 alone, global palm oil production grew by 31 percent, consumption by 34 percent, and global exports by 43 percent (from 26.6 billion to 38.7 billion pounds).

The world's biggest importers of palm oil over this period (1997–2001) were India, China, and Pakistan, followed by the Netherlands, the United Kingdom, Egypt, and Germany. U.S. palm oil imports were a much smaller share of the global market during those years. However, in 2001,

the United States was the second largest importer of palm kernel oil. (U.S. palm oil imports could increase sharply over the next few years if food processors use it to replace a significant portion of the partially hydrogenated vegetable oil now used.)

Malaysia and Indonesia dominate global production and export of palm oil. In 2001, those two countries accounted for 83 percent (42.9 billion pounds) of palm oil production and 89 percent (34.5 billion pounds) of global exports (see **table 1**). The remainder of the world's palm oil is produced in other humid tropical countries, such as Cameroon, Nigeria, Colombia, and Papua New Guinea, frequently by companies with large Malaysian investment or ownership.

Left unchecked, the palm oil boom is not about to stop: *Oil World*, a trade publication, forecasts that in 2020 world demand for palm oil will be 89.1 billion pounds—almost double the amount produced in 2001.

Oil Palm Plantation Agriculture

Oil palm is big business. It is industrial agriculture practiced by corporations.³³ Almost all oil palm is grown as an industrial plantation crop in both Malaysia and Indonesia. In Indonesia, half of the plantations are owned by private companies, which are often part of large conglomerates; the remainder are owned either by the state (17 percent) or by smallholders (33 percent).³⁴ Smallholders are farmers who own a few acres each in a section of a large company's plantation. Although they tend their own oil palm trees, they depend on the company for planting, pesticides, fertilizers, sale of the palm fruits (at a price set by the company), and initial processing in the company's on-site mill.

The oil palm industry has expanded because the oil is economical to produce and attractive to food processors.³⁵ Oil palm oil yield is 6 times higher than that of rapeseed (canola) and 10 times higher—and, on some plantations, much more—than that of soy. It has a diversified international market in the food sector and is therefore a big export crop. (For example, in 2002, palm oil generated more than \$2.1 billion³⁶ in export revenues for Indonesia and more than \$3.8 billion for Malaysia.³⁷) Furthermore, it is grown in countries in which labor and plantation production costs are cheap. Those countries are hospitable to the industry for other reasons as well. Especially in Malaysia and Indonesia, which have the lion's share of the global market, national governments have made mammoth tracts of land readily available for companies to establish oil palm plantations.

Table 1
Production and exports of palm oil,
2003 (billions of pounds)

	Production	Exports
Malaysia	28.6	26.5
Indonesia	24.3	17.3
World total	62.1	49.1

Source: *Oil World Annual 2004*.

Indonesia's Devastating Forest Loss^{iv}

Only a century ago, 85 to 90 percent of Indonesia's total land mass was densely covered with tropical rainforest. As recently as 1950, forest still covered 77 percent of the land area. Forest loss started to become a serious concern in the 1970s, when industrial-scale logging concessions were first established. Drastic losses in the 1980s and 1990s left only half of the land forest-covered in 1997. At this rate, virtually all Indonesian lowland tropical forests—which are the richest in plant and animal species—will be gone by 2010. A leading cause of this deforestation has been clearance for oil palm and timber.

The oil palm industry in Malaysia and Indonesia is financed by the state, international private banks, and the international donor community. In the 1960s and 1970s, Indonesia's government, with World Bank assistance, invested heavily in state-run companies.³⁸ The government then facilitated rapid growth of large-scale private plantations in the 1980s and 1990s by means of such measures as cheap credit and access to government-controlled public forest land. In many cases, ancestral tribal lands were expropriated. The private sector is dominated by giant conglomerates which frequently also hold interests in logging, pulp, and paper industries—10 conglomerate groups owned 64 percent of the country's plantation area held privately in 1997. With byzantine networks of hundreds of subsidiaries and affiliates, some of those groups controlled dozens of plantation companies.³⁹

Under the Suharto government, many privately owned Indonesian plantation companies or their parent conglomerates were owned by members of the Suharto family or other powerful government insiders,⁴⁰ although the situation has now changed somewhat.⁴¹ Both state-owned and private companies are granted generous concessions on state-controlled land in Indonesia.

Foreigners have invested heavily in oil palm. In Indonesia, at least 50 foreign—especially Malaysian—firms were involved in the sector in 1998, with \$3 billion in investments.⁴² In 1997, Malaysian companies controlled 71 percent of 93 Indonesian projects covering more than 8,000 square miles and worth \$3.3 billion.⁴³ By 2004, well over 100 Malaysian companies had entered the Indonesian oil palm industry.⁴⁴ Important global corporate consumers of palm oil are Unilever, Procter & Gamble, Cognis, Cargill,⁴⁵ and Archer Daniels Midland (through Wilmar Trading).⁴⁶

The international banking sector is also deeply involved in financing oil palm. A study of Dutch financing of Indonesia's oil palm sector gave detailed examples of 50 different financial connections between 8 major Dutch banks and 19 different client companies in Indonesia.⁴⁷ Those connections—involving equity, insurance, direct participation, identification of new investors, asset sales, and the provision of long-term loans or facilities to obtain loans, etc.—exemplify a much larger web of complex connections.

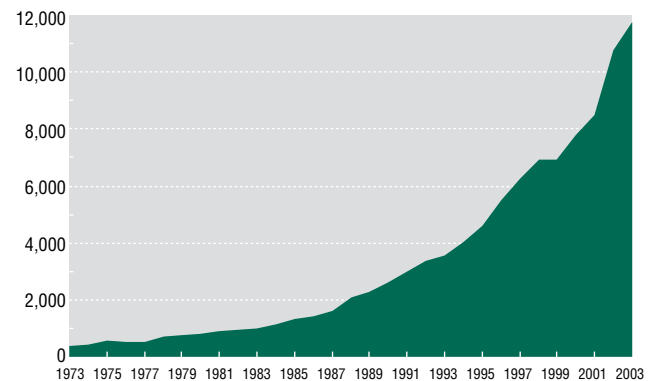
The international donor community has been crucial in financing oil palm projects and facilitating the industry's expansion. World Bank policies and loans facilitated the expansion of the Indonesian oil palm subsector under Suharto, and the Asian Development Bank has been similarly active in funding oil palm projects. Indonesia's group of multilateral and bilateral creditors that constitute the Consultative Group on Indonesia includes the European Union, the United States and Japan, in addition to the World Bank and Asian Development Bank.⁴⁸ Structural adjustment programs supported by the International Monetary Fund and World Bank have also encouraged the expansion of foreign-exchange-earning export crops,⁴⁹ favoring the short-term economic returns from crops at the expense of longer-term returns (for example, from sustainably managed natural forests).

Plantations Replace Tropical Rainforest

Since the 1970s, the areas planted with oil palm have expanded radically in both Malaysia and Indonesia. Palm oil production in Indonesia has grown more than 30-fold since the mid-1960s. From 1973 to 2003, the area covered by plantations increased from fewer than 400 square miles to almost 12,000 square miles (see **figure 1**). In Malaysia, the 1,100 square miles devoted to oil palm in 1973 mushroomed to 13,500 square miles by 2003 (see **figure 2**). That constitutes 11 percent of Malaysia's total land area and 62 percent of all the cultivated agricultural land. The plantations now grow more than 500 million oil palm trees, or 20 trees for every Malaysian.⁵⁰

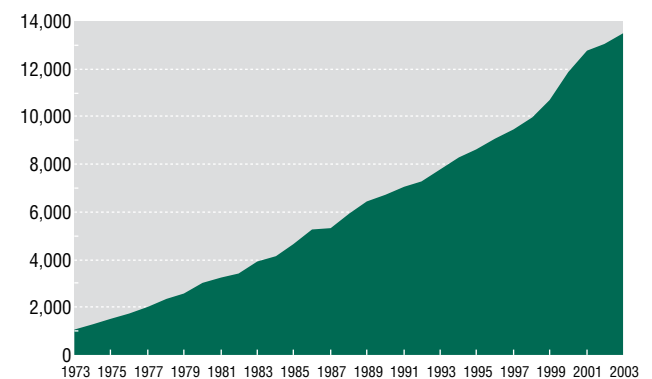
Where has the land for these industrial plantations been found? Many thousands of square miles of tropical rainforest have been cleared for oil palm plantations, though conversion of existing rubber plantations, logging, a soaring population, and other factors account for even larger areas. Although the industry often claims to establish plantations on land already used for agriculture, oil palm has been a major factor in the drastic loss of forest over the past 30 years. Independent studies have used various official data sources to calculate the degree of

Figure 1
Oil palm harvested annually in Indonesia, 1973–2003
(square miles)



Source: FAOSTAT 2004.

Figure 2
Oil palm harvested annually in Malaysia, 1973–2003
(square miles)



Source: FAOSTAT 2004.

deforestation due to oil palm. According to one study, from 1982 to 1999, about 16,000 square miles of Indonesian tropical rainforest was converted to oil palm, timber, coconut, and all other forms of plantation.⁵¹ Of that total, another study estimated that oil palm plantations were responsible for at least 44 percent—about 7,000 square miles—of rainforest loss.⁵² In Malaysia, the government and industry claim that “the Malaysian palm oil industry has been environmentally conscious and eco-friendly since its very beginning.”⁵³ However, others estimate that between 1990 and 2002 in Malaysia, 47 percent of oil palm agriculture (about 5,600 square miles) involved rainforest removal.⁵⁴

In Indonesia and Malaysia, new plantations are often established in newly cleared rainforest and peat-swamp forests (sometimes with an intermediate period of logging), instead of on degraded land or disused agricultural land, such as old rice paddies or old plantations. That’s because it costs much more to rehabilitate disused agricultural land to prepare it for oil palm than it does to clear new land. A further incentive in many cases is that the plantation company can finance its new planting by logging and selling valuable tropical timber trees. Burning of logged-over forests and debris is still a widespread means of clearing land for oil palm plantations, despite the fact that Indonesia made burning illegal after massive plantation-initiated wildfires in 1997–98.⁵⁵ Cash is recouped much faster if a company clears land cheaply by burning after logging and then plants oil palm, rather than waiting years for valuable timber trees to grow again—

unlike timber, agricultural crops are short-term investments that increase cash flow quickly.⁵⁶

In Malaysia, most of the recent expansion of oil palm plantations has been in the states of Sabah and Sarawak on the island of Borneo (see **figure 3**). In Sabah, oil palm plantations accounted for 4,000 square miles in 2002—or 11 percent of the state’s total area, up from just 1 percent in the 1980s. Sarawak had about 1,500 square miles of oil palm in 2004.⁵⁷

Figure 3
Map of Southeast Asia



Note: The island of Borneo is divided into Malaysian states (Sabah and Sarawak), an Indonesian province (Kalimantan), and the independent sultanate of Brunei. The island of New Guinea is divided into the Indonesian province of West Papua (formerly Irian Jaya) and the independent state of Papua New Guinea.

In Indonesia, almost 12,000 square miles of plantations were harvested in 2003.⁵⁸ The island of Sumatra and the Indonesian Kalimantan provinces on Borneo have been the main sites of the oil palm expansion⁵⁹ and are home to 96 percent of all Indonesian oil palm plantations.⁶⁰

Major expansion plans are in the works for oil palm plantations in Indonesia's West Papua province and Papua New Guinea. Those sites are both on the island of New Guinea, which still harbors large forest areas and amazing biological and cultural diversity.

Ecological Impacts of Oil Palm Agriculture

Oil palm has been the direct cause of a host of ecological problems including deforestation; endangered wildlife species; habitat destruction and fragmentation; soil, air, and water pollution and toxic chemical contamination; and last—but certainly not least—social conflict and displacement of local communities.

Vanishing Rainforest, Vanishing Wildlife

Indonesia's and Malaysia's tropical rainforests are some of the most spectacular on Earth and provide sustenance to magnificent wildlife—including the Sumatran tiger, Sumatran rhinoceros, Asian elephant, orangutans, banteng (a wild ox), barking deer, giant flying squirrel, proboscis monkey, gibbons, langurs, and clouded leopard. Yet those animals are under tremendous threat, and many species face the possibility of imminent extinction. A World Bank report states that Indonesia is “almost certainly undergoing a species extinction spasm of planetary proportions.”⁶¹

It is not by chance that Indonesia and Malaysia have, along with the destruction of thousands of square miles of tropical rainforest, some of the world's longest lists of threatened wildlife. In only

Why Are Tropical Rainforests Important?

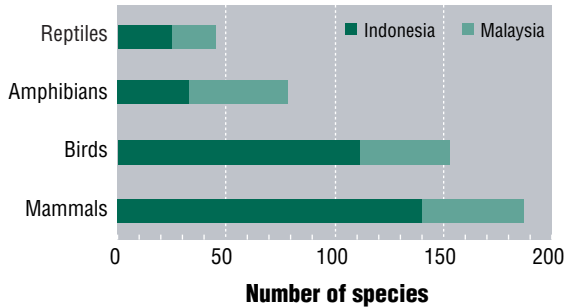
Tropical rainforests are home to 70 percent of the Earth's species of plants and animals. Many tropical rainforests contain over 200 tree species per acre, compared to only a few species in temperate-zone forests. More than 500 million people live in or near tropical rainforests and depend on them for food, shelter, economic needs, and continuation of cultural and spiritual traditions. Most of the indigenous peoples of Borneo and Sumatra are forest-dwellers.

Forests also influence local and global climates. They moderate air temperatures and maintain atmospheric humidity. They absorb atmospheric carbon and replace oxygen in our air. Forests are key to maintaining soil and water resources. They absorb excessive rainfall, and they regulate stream flows by gradually releasing water into streams and rivers, thus reducing flooding and landslides downstream. Trees conserve soil moisture by shading the soil, and their roots reduce soil compaction and help infiltration of water and nutrients.

Cruel oil

12 years, from 1985 to 1997, Indonesia cleared 60 percent of the lowland rainforest of Kalimantan, on the island of Borneo, and Sumatra⁶²—deforestation primarily undertaken to facilitate the planting of oil palm.

Figure 4
Number of threatened terrestrial vertebrate species in Indonesia and Malaysia

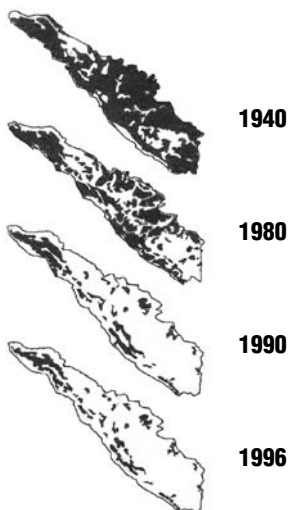


Source: IUCN Red List 2004.

Most Indonesian and Malaysian terrestrial species are forest animals and can survive only in rainforest habitat, not on plantations. Of the more than 400 land mammal species of Indonesia, 140 (32 percent) are threatened,⁶³ according to the Red List of Threatened Species of the World Conservation Union (IUCN). The IUCN Red List is the accepted world standard list of species at risk. Of those 140 species, 15 are critically endangered. Indonesia has 112 threatened terrestrial bird species, mainly rainforest birds. Of Malaysia's nearly 300 land mammal species, 47 (16 percent) are threatened, with 6 critically endangered. Malaysia also has 41 threatened terrestrial bird species.⁶⁴ The numbers of threatened species are still greater when terrestrial reptiles and amphibians are included (see **figure 4**).

Once oil palm has replaced the immense variety of hundreds of species of trees, vines, shrubs, mosses, and other plants found on every acre of lowland rainforest, most animals can no longer live there. An oil palm plantation is, in effect, a “biological desert.” As an industrial plantation crop, oil palm is grown as a monoculture. Most of the other plants found are low-growing ground cover.⁶⁵ Without the rainforest's plenteous variety of fruits, nuts, leaves, roots, nectar, bark, shoots, and other plant materials to eat, most animals cannot survive. And, without plenty of plant-eating prey animals such as deer to hunt, carnivores such as tigers cannot survive either. The plantations provide habitat for only 20 percent or less of the previously resident mammals, reptiles, and birds.^{66,67,68,69}

Figure 5
Loss of primary forest on Sumatra



Note: Shaded areas on maps represent rainforest.

Source: Sumatran Orangutan Society, www.orangutans-sos.org/orangcrisis.htm.

Endangered Rainforest Mammals

The loss of rainforest habitat will swiftly and inevitably lead to the complete disappearance of many unique mammal species. This section presents five animals as examples of the devastation to come: the Sumatran tiger, Sumatran and Bornean orangutans, Asian elephant, and Sumatran rhinoceros. Each of those species is endangered according to the IUCN Red List.⁷⁰ Moreover, the three eponymous Sumatran species are considered critically endangered—a status largely due to loss of habitat (see **figure 5**).⁷¹

Each of the five species discussed here requires connected areas of rainforest to survive. They once flourished in the areas where forests have since been cleared for oil palm—especially the islands of Borneo and Sumatra. On those two islands, 60 percent of rainforest was lost just between 1985 and 1997.⁷² The Sumatran orangutan, Bornean orangutan, and Sumatran tiger exist *only* on the islands of Sumatra or Borneo and nowhere else in the world. The Sumatran rhinoceros has remnant populations on both Sumatra and Borneo, with a small population in Peninsular Malaysia and a few other scattered remnants elsewhere. A significant number of the remaining Asian elephants occur in Sumatra and Borneo; the species is also found in continental Asian countries.

Sumatran tiger.⁷³ The Sumatran tiger (*Panthera tigris sumatrae*) is one of only five remaining tiger subspecies, reduced from eight by recent extinctions. Sumatran tigers live in rainforest. Adults of both sexes are mainly solitary, except for females with cubs. An adult tiger has its own wide-ranging home territory, about 20 to 30 square miles for a female tiger;⁷⁴ a male tiger's home range may be even larger because his overlaps the ranges of several females.

Tigers feed on prey animals that weigh about 100 to 450 pounds, such as deer and wild pigs, which also live in the rainforest. A single adult tiger eats 40 pounds of meat at a sitting and must kill about 75 large prey a year to survive. To support a tiger population, an area of rainforest habitat must be big enough to support a sufficient population of large prey animals.

Population density of Sumatran tigers thus depends on availability of prey. Considering their expansive home ranges, 2,000 to 3,000 square miles of rainforest might be needed for a subpopulation of about 100 tigers. A number of subpopulations, each large enough to be genetically healthy, would be needed to rescue the species from the threat of extinction.

Three tiger subspecies have already become extinct in recent years—including the other two



Sumatran tiger.

Photo courtesy of the Sumatran Tiger Trust Conservation Programme (www.tigertrust.info) and South Lakes Wild Animal Park Limited, Great Britain (www.wildanimalpark.co.uk).



Sumatran orangutan mother and baby.

© Sumatran Orangutan Society (www.orangutans-sos.org).

Indonesian ones, the Javan tiger and Bali tiger. That does not bode well for the Sumatran tiger, which, according to leading experts, had an estimated population of only 250 in the wild.⁷⁵

Orangutan. Orangutans are great apes and are one of humans' closest relatives ("orangutan" means "man of the jungle" in the Malay language). There are two species of orangutan, the Bornean orangutan (*Pongo pygmaeus*) and Sumatran orangutan (*Pongo abelii*). They are the only great apes that exist outside of Africa.

Orangutans live about 45 years in the wild.⁷⁶ Females reach puberty at 10 but do not give birth until they are 15 years old. Pregnancy lasts 8½ months, after which the infant suckles until age three. Even when weaned, the infant is carried by its mother until it is four years old and stays with her until it is seven. Females bear an infant only once every seven to nine years, so a female can produce, at most, four offspring over her lifetime.

Orangutans live in rainforest trees. They search for food during the day and construct nest-platforms of leaves and branches for sleeping. Their diet is largely rainforest fruits, but they also eat leaves, shoots, bark, and other material. Adults are usually solitary, except when females have young.

Oil Palm Is Main Threat to Orangutan Survival on Sumatra

Oil palm plantations have been identified in scientific field studies as the main immediate threat to the continued existence of orangutans. Researchers Carel van Schaik, co-director of the Center for Tropical Conservation at Duke University, and J.M. Yarrow Robertson of the Leuser Development Program and Cambridge University (U.K.), noted:

The major threats to the survival of the Sumatran orangutans are identified as habitat loss, mainly from conversion to oil palm plantations; habitat degradation; and habitat fragmentation.... Habitat loss is caused by forest conversion to permanent agriculture. Habitat degradation is caused mainly by timber extraction. Fragmentation is a byproduct of habitat loss and degradation.^{vi}

Orangutans live in overlapping home ranges of variable size. One square mile of prime habitat in Sumatra can support nine individuals; marginal habitat can support only two individuals.⁷⁷ For each genetically healthy viable subpopulation, at least 500 individuals are needed⁷⁸—because average home-range sizes differ, that means about 385 square miles per subpopulation in Borneo and about 230 square miles in Sumatra.

Both species of orangutan are in crisis and, given current rates of decline, may well become extinct in the wild within 10 years.⁷⁹ More than 50 percent of Sumatran orangutans died in the past 8 years.⁸⁰ In one long-term study in an area that contains the world's largest orangutan

population, the Leuser Ecosystem of northern Sumatra, biologists found a loss of 45 percent of orangutans (5,300 individuals) in just six to seven years beginning in 1993. That precipitous decline was partly due to a wave of forest conversion to oil palm.⁸¹ That study also documented losses during 1998 and 1999 of 1,000 orangutans per year. Further losses will put the orangutan's survival in serious doubt. Sumatra's total estimated remaining 12,000 orangutans survive on 10,000 square miles of already fragmented habitat⁸²—much of which is slated for future conversion to oil palm.

Asian elephant.⁸³ The Asian elephant (*Elephas maximus*) is a separate species from the African elephant. It has smaller ears, and the females do not have tusks. Asian elephants are primarily forest animals because they prefer shade. They live in herds based on family groups of 3 to 40 females (mothers, sisters, daughters) and young, while adult males are usually solitary in their own home ranges. Herds form part of larger related groups in an area (clans).

Elephants feed on twigs, branches, bark, grasses, flowers, and fruit. They will eat cultivated crops, such as bananas and sugar cane, especially if their rainforest foods are destroyed by agriculture. They need large feeding grounds, because each adult eats about 660 pounds of food a day and requires large amounts of water.

The home range of one family of elephants is about 25 to 65 square miles.⁸⁴ A breeding subpopulation of, say, 20 families would thus roam over about 500 to 1,300 square miles. As with the other species discussed here, not one but a large number of breeding subpopulations will be necessary to save the species from extinction.

The Asian elephant is now endangered in the wild. As of 2000, only about 2,800 elephants were estimated to remain in all of Sumatra, 800 in Peninsular Malaysia, and 1,000 in Borneo.



Asian elephant.

© The Elephant Sanctuary, Hohenwald, TN (www.elephants.com).



Sumatran rhinoceros mother and baby.

© David Jenike, Cincinnati Zoo (www.cincinnati-zoo.org).

Sumatran rhinoceros.⁸⁵ The Sumatran rhinoceros (*Dicerorhinus sumatrensis*) is a two-horned, forest-dwelling rhinoceros, the smallest of the living rhino species and the only two-horned Asian species. Often covered with sparse, bristly hair, it is unique among rhinos in appearance and is closely related to the woolly rhinoceros that inhabited Eurasia during the Ice Age.⁸⁶

Sumatran rhinos are mainly solitary, but the young accompany their mothers for about two years. Rhinos eat wild mangoes, figs, bamboo, and other plant material. Each animal may eat over 100 pounds of food daily, so large areas are needed for foraging. Each rhino maintains its own permanent home range of roughly 20 square miles.⁸⁷ Thus, a larger subpopulation of about 100 animals would need about 2,000 square miles.

Most subpopulations of the Sumatran rhino are now isolated and small, composed of fewer than 50 individuals, which may lead to increased inbreeding. At such small sizes, an entire subpopulation could be wiped out by a virus or a natural (or human-made) disaster.

The two biggest threats to the Sumatran rhino are habitat loss and illegal hunting for traditional Asian medicinal products derived from parts of the rhino's body. A huge

demand for rhino horn drives a Far Eastern trade, primarily with China, Taiwan, and South Korea. Forest habitat loss destroys the rhino's travel corridors and thus disrupts its normal social system. Even a small dirt road through the forest shrinks habitat even further because rhinos retreat to the "core" forest interior. While rhinos won't get any closer than a mile or two to a road (see further discussion below, under "Roads and plantations fragment the forest"),⁸⁸ the roads conversely make those remote areas accessible to poachers.

With the world population estimated at fewer than 400 individuals, the Sumatran rhinoceros is now critically endangered.⁸⁹

How Oil Palm Destroys Wildlife

Oil palm plantation companies destroy wildlife both directly and also indirectly by destroying or fragmenting forests.

Industrial plantations destroy large tracts of wildlife habitat.

Sprawling oil palm farms replace the rich rainforest ecosystem with biological desert. In Malaysia, 47 percent of oil palm expansion up to 2002—an area of about 5,600 square miles—involved deforestation.⁹⁰ For Indonesia, an estimated 7,000 square miles of rainforest was destroyed for oil palm,⁹¹ making an approximate total of 12,600 square miles deforested for oil palm in Malaysia and Indonesia together.

Animal populations shrink because the remaining rainforest cannot support all the refugee animals in addition to the normal populations already there. The displaced animals become stressed and may starve, be killed, or die because they cannot find enough food or unoccupied land for home range and feeding grounds. Displaced orangutans, for example, have been observed to cause a “shock wave” of refugee crowding in adjacent forests leading to increased physiological stress and reduced reproduction.⁹²

In central Kalimantan, a large company is clearing 56 square miles of tropical rainforest to create a new palm oil plantation in the Kasongan area. However, there is still a population of wild orangutans living in this forest. Reportedly, during land-clearing activities in this area, an excavator even hit and killed orangutans.⁹³ In another incident in central Kalimantan, the PT Makin Group—one of the biggest oil palm companies in Indonesia—in 1994 began to destroy forest to open up its newly acquired concession of 154 square miles, close to the village of Buntut Bali on the Katingan River.⁹⁴ If just 50 percent of that area is good forest with a fairly healthy population of orangutans, at least 400 to 500 orangutans will be displaced by the destruction.

When shrinking habitats push orangutans nearer to human settlements, they raid fruit orchards and oil palm plantations, and get trapped or shot.⁹⁵ One orangutan can eat as many as 50 young oil palm shoots in one raid, and thus the law provides for “legal killing” in defense of property. Such incidents are commonplace in the Lower Kinabatangan (Malaysia) where oil palm plantations dominate the landscape. Hundreds of orangutans have been shot there over the last decade by farmers and plantation workers protecting their crops. At one time, plantation managers offered a bounty of 20 Malaysian ringgit (about \$7) for each

Lost Habitat = Lost Animals

The roughly 12,600 square miles of rainforest destroyed for oil palm plantations in Indonesia and Malaysia could have supported:

- Bornean and Sumatran orangutans: 30 to 55 viable breeding subpopulations of 500 animals each
- Sumatran rhinoceros: 550–650 rhinos (current remaining population is 400)
- Asian elephant: 200–550 elephant families
- Sumatran tiger: 400–670 tigers (current remaining population is 250)

dead orangutan. In another case, Sukau villagers caught 14 orangutans on their farms; the apes were relocated by government officials and ultimately killed.⁹⁶

Areas of oil palm disrupt animal social systems by hindering migration patterns and blocking travel corridors. A single plantation may cover an enormous area—in Indonesia, an average company manages a plantation area of about 40 to 100 square miles.⁹⁷ Large rainforest animals, such as elephants, tigers, and orangutans, need to be able to move over large distances under forest cover to find water and food; young adults need to leave the family and establish their own territories in order to mate successfully. Plantations block animals because companies do not keep corridors of forest available for animal movement. Further, animals may be killed if they “trespass” onto the plantation or search for food outside the forest. Tigers and plantation workers frequently come into conflict. On Sumatra, forest tigers killed 40 people since 2000, including 18 deaths in 2004. Dwindling habitat was the problem.⁹⁸

In the first six months of 2003, workers caught seven tigers in Riau, Sumatra, alone.⁹⁹ Between 1998 and 2001, at least 64 Sumatran tigers were reportedly killed,¹⁰⁰ a significant portion of the critically endangered population. As for elephants, they may become disturbed and violent when their rainforest trees are destroyed or when they go hungry due to loss of their food sources. In the Sumatran city of Bandar Lampung, the continuing destruction of trees for oil palm plantations drove wild elephants to rampage in residential areas, destroy crops, and kill two people.¹⁰¹ According to local farmers, the elephants lost their habitat to an oil palm plantation.¹⁰²

In Indonesia, as elephants are forced into closer contact with human activities, the number of elephant attacks on people is increasing. According to forest authorities, 16 attacks were reported between 1998 and 2002; in the first three months of 2003, there were 48 such incidents, at least three of them fatal to human victims.¹⁰³ In Sumatra, around South Bukit Barisan National Park, at least 10 people have

Elephant Killing in Sumatra

In November 2004, six wild elephants were poisoned to death in Sumatra after they encroached on an oil palm plantation. The killing of elephants, as well as of endangered tigers, is not unusual on the island, where illegal logging and farming have shrunk those and other animals’ natural habitat and increased their contact with humans.^{vii} The elephants were found dead in Kepenuhan Tengah, a village in Rokan Hulu, Riau. Five were simply poisoned; the sixth was burned after being poisoned. The corpses were found south of the Libo Forest Block, where the concessions of PT Manday Abadi, PT Rokan Permai Timber, and PT Rokan Timber Corporation operate. Workers on an oil palm plantation admitted sickening the elephants with rat poison. According to the Associated Press story in the *Jakarta Post*, one worker said, “The wild elephants have become a big problem for us and we had no other choice than to poison them so we could secure the plantation.” The animals are believed to be from the already critically small elephant group in Riau, the Rambah Hilir elephant group, whose population of 30 to 35 elephants in 2003 is significantly reduced from its level of 100 to 200 in 1995.^{viii}

been killed and 76 others injured in attacks by angry elephants. Overall damage caused by elephants—trampling houses, injuring and killing people, and damaging small- and large-scale plantations—in and around Tesso Nilo National Park, is estimated at around \$1.1 million a year.¹⁰⁴

To protect their crops—and sometimes their lives—farmers often poison elephants. In 2002, the bodies of 17 elephants, which likely had been poisoned, were found near an oil palm plantation on Sumatra.¹⁰⁵

Sometimes, elephants are captured and sent to “training centers” where they will spend the rest of their lives. In Lampung, Sumatra, 40 wild elephants are captured each year.¹⁰⁶ Around Kubu River, Riau, elephants are rarely seen anymore, partly because they have died as a result of habitat loss and partly because they have been relocated to training centers.¹⁰⁷

Fires set by plantation companies destroy huge areas. Plantation companies frequently set fires deliberately to clear forest for oil palm. That practice in itself is bad enough, but sometimes those fires burn out of control and destroy much larger areas of rainforest than originally planned. About 19,300 square miles of Indonesian rainforest burned in 1994, and another 17,800 square miles burned in 1997 and 1998, for a total of roughly 37,000 square miles of rainforest burned in those years alone¹⁰⁸—an area equal in size to the state of Indiana. Additional forest was burned in new wildfires in 2002.¹⁰⁹ Some of these burned areas have since been colonized by small farmers, and some is regenerating as scrubby forest, but little systematic effort has been made either to restore rainforest or establish productive agriculture.¹¹⁰

Animals are burned alive in the flames or are killed as they try to flee. Borneo’s orangutan population was reduced by one-third in just one year, 1997, when almost 8,000 orangutans were either burned to death or were massacred as they tried to escape the fires.¹¹¹ In addition, poachers took advantage of the fires to kill fleeing Sumatran rhinos.¹¹² Those wildfires were started by oil palm plantation companies.¹¹³ In the Wahau River lowlands of Kalimantan, the PT SMART subsidiary company PT Matrasawit illegally burned rainforests to clear land for its oil palm plantation in 1997–98, and one company employee recounted that he personally saw three orangutans dying in the flames.¹¹⁴ PT Matrasawit company was found guilty in court and was fined—\$82.¹¹⁵

Who Set the Wildfires?

The large-scale 1997–98 Southeast Asian wildfires appear to have been set by plantation companies. The Center for International Forestry Research analyzed U.S. National Oceanic and Atmospheric Administration satellite photos of smoking and burning spots and overlaid them with Indonesian land-use maps. That analysis showed that more than 75 percent of the hot-spots recorded in Kalimantan occurred in oil palm plantations and logging concessions.^{ix,x} Also, the Indonesian Ministry of Forestry and Estate Crops published a list of 176 plantation and forestry companies that used illegal burning methods. Of those companies, 133 were oil palm plantation companies.^{xi}

Roads and plantations fragment the forest. Roads bulldozed to provide access to plantations break the remaining rainforest into fragments and open up the surroundings. The roads also provide access for illegal loggers, hunters, and poachers.¹¹⁶ In ecologically sensitive areas, roads invite settlements that further disrupt an already delicate natural balance.¹¹⁷ By 2030, it is estimated that less than 1 percent of orangutan habitat will be unaffected by infrastructure development.¹¹⁸

Forest fragmentation has effects on wildlife populations that are far greater than simply the area of forest lost or the number of trees destroyed by the infrastructure. Fragmentation causes disproportionate habitat loss for such large forest mammals as elephants, tigers, and rhinos, because those animals avoid forest boundaries. A recent scientific study used satellite photos to map deforested areas—generally as a result of agriculture—in Bukit Barisan Selatan National Park in Sumatra.¹¹⁹ Deforestation was then correlated with animals' movement patterns documented by automatic

camera traps on forest trails. The study showed that Sumatran tigers and Sumatran rhinos avoided the forest's edge by staying at least 1.3 miles inside the forest interior core; elephants stayed almost 2 miles away from the edge—even if that edge was just a dirt road. The amount of core forest available to those animals had already decreased dramatically from 1985 to 1999, as the forest became more fragmented by agriculture inside the national park. By 2010, the projected core forest area for tigers and rhinos will be reduced to only 20 percent of remaining forest—and, for elephants, to only 0.5 percent—in the national park.

Displacement of local people and their subsistence forest gardens to make way for oil palm leads to further rainforest fragmentation,

more slash-and-burn agriculture, and more hunting and poaching as new settlement encroaches along the new roads. Local subsistence farmers relocate their gardens in new areas of the forest when they are forced out of their original areas by oil palm. This process creates more forest fragmentation, and thus more edge areas where animals increasingly come into contact with people. More carnivores and other mammals are killed near forest edges compared to other areas as a result of interactions with humans.¹²⁰



Elephant casualty in Riau, Sumatra.

Photo: WWF Indonesia.

Oil palm destroys national parks. In many cases, protected areas are the last strongholds of endangered animals. For example, only about 10 percent of Borneo's critically endangered population of 15,000 orangutans is predicted to survive over the long term. Those few great apes will mainly be found in the protected areas, because most other habitat will be destroyed.¹²¹ However, companies use corrupt means to plant oil palm illegally even in Indonesian national parks. For example, the company Naridi has cleared at least 10 square miles for oil palm plantations inside the Dolok Surunggan Wildlife Reserve in North Sumatra.¹²² In Gunung Leuser National Park, an army-backed foundation colluded with an oil palm factory owned by an army unit commander's family to plant 16 square miles of oil palm in the national park. The project was challenged in court, but the legal process did not stop the project from continuing its activities.¹²³ Gunung Leuser National Park is an important piece of orangutan habitat.

Forest fires set by plantation companies have destroyed parts of many national parks. Such fires affected at least 19 of Indonesia's protected areas, including an internationally registered wetland in Sumatra and a UNESCO Man and the Biosphere Reserve in Kalimantan. Tanjung Putting, the Biosphere Reserve, has the largest protected population of the endangered proboscis monkey. It was severely damaged by fire in 1997 and 1998. In the Kutai National Park of East Kalimantan, formerly an important orangutan preserve, fires irreparably damaged approximately 95 percent of the lowland forest (prime orangutan habitat); 50 to 95 percent of all the rainforest trees were also destroyed.¹²⁴

Regional Indonesian administrations often ignore or circumvent national forestry regulations to open national protected areas to oil palm.¹²⁵ For example, the provincial government of East Kalimantan blocked the decision of the national Ministry of Forests to cancel oil palm concessions held by the Salim Group in the proposed Sebuku-Sembakung National Park, the home of Kalimantan's only population of wild elephants.¹²⁶

Oil Palm Displaces Indigenous People and Subsistence Farmers

Oil palm agriculture can annihilate not just wildlife, but also human communities. Oil palm causes social conflicts, destruction of indigenous

Corruption in the Oil Palm Business

Corruption, collusion, and nepotism—known as KKN practices in Indonesia—are so widespread they are debilitating the country. Indonesia was ranked the 13th-most-corrupt country in the world by Transparency International in 2004 and one of the two most corrupt countries in Asia by Political and Risk Consultancy.^{xii} Indonesia's plantation and forestry sectors are infested with corruption, collusion, and nepotism, according to the Indonesian government's own official investigations.^{xiii} Ultimately, KKN practices underlie the proliferation of oil palm plantations' destruction of prime rainforest habitat for wildlife.^{xiv}

Palm versus Soy

In the U.S. Midwest, corn and soybeans are the two biggest crops. They are used mostly for livestock feed, but also to provide oils for food. Corn and soybean oils, when not partially hydrogenated, are among the most healthful oils available. In recent years, Brazil and several other Latin American countries have become major competitors in the soybean market, exporting soybeans, soy meal, and soy oil to Europe, China, and elsewhere. Unlike in the United States, which long ago replaced its great Midwestern forests, prairies, and Native Americans with large-scale monoculture corn and soybean farms, Brazil is only now replacing its own rich forest, savanna, and jungle habitats with farms, sometimes displacing indigenous communities.

So should food processors use palm oil from southeast Asia or soybean oil from Brazil? From the health perspective, liquid soybean oil is certainly better than palm oil, and palm oil is certainly better than partially hydrogenated soybean oil. From the environmental perspective, pollution or destruction of irreplaceable habitat by soybeans or oil palm is equally tragic. Clearly, governments in both Latin America and Southeast Asia must protect their natural resources. If companies and farmers won't voluntarily adopt sustainable practices, governments must bar farming and illegal logging from sensitive areas, ensure that farmers and loggers abide by specific, enforceable standards, and require that certain ecologically valuable areas be allowed to revert to their natural state.

cultural values, and loss of traditional tribal lands.¹²⁷ For example, an evaluation of the Ophir oil palm project financed by German bilateral aid in western Sumatra showed that, while the project increased the income of a few plantation smallholders, it also had a large negative impact by turning many villagers in the project area into poorly paid wage laborers. The income gap also caused envy and discord within the community. Many villagers were pushed out of their former traditional community farming and garden areas. When forced to give up their gardens to oil palm, poor rural farmers may move into new virgin forest lands or marginal areas to clear more rainforest for subsistence farming.¹²⁸

Tribal peoples' customary land rights are often not recognized by the state or are inadequately addressed when tribal lands are "allocated" by the government to oil palm plantation companies.¹²⁹ In Borneo, many of the indigenous people displaced by oil palm plantations are forest-dwelling Dayak tribes that have lived on their ancestral forest lands for many generations. That is also the case for the indigenous Melanesian tribes of West Papua, the Indonesian province on the island of New Guinea, which was forcibly occupied by Indonesia in the early 1960s.¹³⁰

The Damage Doesn't Stop There

Oil palm plantation agriculture causes other types of serious harm to the environment. Those harms include pollution and contamination of soil and water by the heavy use of pesticides, soil erosion and increased sedimentation in rivers and streams, water pollution from dumping of untreated palm oil-mill effluent, and air pollution from forest fires.

Chemicals.¹³¹ The oil palm industry uses about 25 different herbicides, insecticides, and other pesticides, causing contamination of crops, soils, and groundwater.¹³² One of the most commonly used chemicals is the toxic herbicide paraquat dichloride. The scope of actual harm to soil and water, food safety, and worker health is unknown, because proper

documentation, monitoring, and enforcement are largely lacking. One study of female plantation workers undertaken by nongovernment organizations in Malaysia confirmed widespread pesticide poisonings and problems associated with paraquat.¹³³ Many workers reportedly showed acute symptoms of paraquat poisoning, including nosebleeds, eye irritation, nail loss, and abdominal ulcerations.

Soil erosion and sedimentation in rivers and streams. Land clearance causes topsoil to erode and quadruples sedimentation in watercourses.¹³⁴ Erosion and sedimentation also increase if there are no buffer zones of rainforest left along the banks of rivers and streams and the shores of lakes, as topsoil is carried by rain directly into the water. It is a common—albeit illegal—practice in Indonesia for plantation companies to ignore government regulations and clear rainforest in watercourse buffer zones.¹³⁵

Palm oil-mill effluent. Wastewater effluent from palm oil mills is a mixture of water, crushed shells, and fat residue resulting from initial processing of crude palm oil from fresh palm fruits, which must be crushed within 24 hours of harvest. There is usually one mill for every 15 to 20 square miles of plantation; thus, hundreds of mills operate throughout the countryside of Indonesia and Malaysia.¹³⁶

The production of 13.2 billion pounds of crude palm oil resulted in 33 billion pounds of palm oil effluent in a single year in Indonesia. That amount is equivalent to the domestic sewage produced by 20 million people. Put another way, Indonesia's production of crude palm oil in 1999 generated as much effluent as one-tenth of the country's total population.¹³⁷ Much of that waste is improperly treated or not treated at all.

Plantation companies often dump palm oil-mill effluent directly into water bodies, with sometimes disastrous results. River water turns brown, smelly, and slimy. Fish and other aquatic animals are killed, and local people can no longer use the water for drinking, bathing, or fishing. In one incident in 2003, the *Jakarta Post* reported that palm oil waste dumped by a large Indonesian company, PT London Sumatera, killed thousands of fish and contaminated the Itam River.¹³⁸ In another reported incident in that year, thousands of fish died in the Kuning River in Sumatra due to palm oil effluent.¹³⁹

Palm Oil-Mill Effluent Kills Aquatic Wildlife

Thousands of fish were killed in the Siak River on Sumatra in 2002 as a result of wastewater disposal from palm oil mills and pulp factories. Although the plantation companies and pulp factories decided in 2003 to take steps to stop river pollution, at least 14 facilities still do not meet the new requirements.^{xv} In the Siak River, daily industrial organic pollution violates the water-quality standards set by the Indonesian Ministry of Environment. As a result, the river water has turned black, smells foul, is undrinkable, and reportedly causes skin irritation upon contact. Dead fish float near mills' wastewater outlet pipes.^{xvi}

Compared to Indonesia, Malaysian environmental regulations may be somewhat more strictly enforced, but problems are still widespread.¹⁴⁰

Air pollution. The smoke and haze from forest fires set by Indonesian plantation companies to clear land for oil palm cause serious region-wide air pollution. For example, in 1997–98, such forest fires became wildfires so immense they caused a thick cloud of air pollution across the entire Southeast Asia region. The haze and smog were estimated to have affected the health of 70 million people.¹⁴¹ The Asian Development Bank estimated the overall economic cost of the fire and haze at \$9.3 billion.¹⁴² However, despite Indonesian government decrees outlawing the practice, plantation companies continue to burn extensive areas every year.¹⁴³

Still More Destruction to Come

Unless current trends are stemmed, oil palm plantations will continue to expand rapidly, destroying a great deal of the remaining tropical rainforest and wildlife (see **figure 6**). The demand for palm oil is forecast to double, reaching 40.5 million tons, by 2020.¹⁴⁴ To achieve that production increase of 20 million tons, it will be necessary to plant 1,160 new square miles every year for 20 years.¹⁴⁵

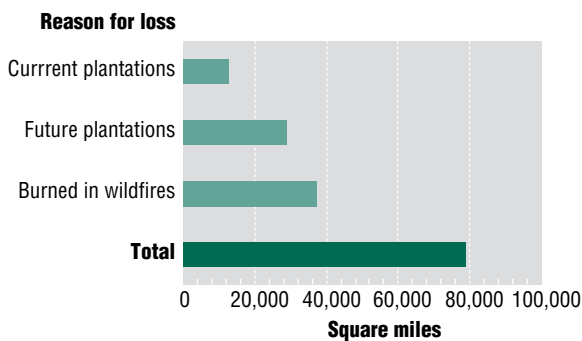
Much of the expansion will take place in Indonesia, since Malaysia has already established palm plantations in much of its former rainforest. According to Indonesia’s agriculture minister, Indonesia is planning to expand oil palm plantations to an additional 26,000 square miles¹⁴⁶—an area larger than the state of West Virginia—largely taken from forests. (By comparison, in 2003, 12,000 square miles of Indonesian plantations were harvested.¹⁴⁷)

The breakdown of Indonesia’s 26,300 square miles of rainforest land officially allocated for new oil palm plantations includes:¹⁴⁸

- Sumatra—15,700 square miles, larger than the state of Maryland.
- Kalimantan—8,000 square miles, larger than the state of Connecticut.
- West Papua—1,100 square miles, half the size of Delaware.
- Sulawesi—1,400 square miles, about the area of Rhode Island.

Maluku, a province on the eastern islands of the Moluccas, is also targeted for plantations.

Figure 6
Rainforest loss in Indonesia and Malaysia due to oil palm



Source: See text.

A recent national development plan in Malaysia calls for about 1,400 square miles of new agriculture, mainly in Sarawak (on the island of Borneo), and 1,300 square miles of new plantations, mostly oil palm, in state-controlled rainforest in Peninsular Malaysia.¹⁴⁹ (By comparison, in 2003, 13,500 square miles of oil palm were harvested in Malaysia.¹⁵⁰)

The total area deforested in Indonesia and Malaysia as a result of oil palm is enormous. As shown in figure 6, 12,600 square miles have been deforested for current plantations,¹⁵¹ at least 37,100 square miles of rainforest were burned in uncontrolled wildfires set by plantation companies during the 1990s (a figure that is probably a gross underestimate),¹⁵² and roughly 29,000 square miles of forest land have already been set aside for future plantations.¹⁵³ Those areas combined will potentially result in roughly 79,000 square miles of forest destroyed because of oil palm. That represents an area the size of Nebraska.

The oil palm industry has also entered other humid tropical areas that have suitable lowlands (where high-diversity tropical forest grows best), such as in Costa Rica, Cameroon, and Colombia. Oil palm plantations are expanding rapidly in the South Pacific as well.

In Papua New Guinea, numerous oil palm projects are being encouraged or endorsed by the government.¹⁵⁴ In the country's West New Britain Province, as in Indonesia, high-conservation-value forest is being permanently lost because oil palm plantations are replacing much of the lowland forest after it has been logged commercially. In West New Britain, companies majority-owned by Malaysians dominate both the logging industry and the oil palm industry—New Britain Palm Oil Limited (which is majority-held by the Kulim Group) is Papua New Guinea's largest oil palm operation.¹⁵⁵ New Britain is a small island, and its lowland forest is rapidly disappearing. According to government forest allocation plans, *all* lowland forest in West New Britain and nearly all in East New Britain has been slated for large-scale industrial logging,^{156,157} after which oil palm plantations may destroy much of this rainforest permanently. That destruction would put many rainforest wildlife species at risk (see box at right).

Oil Palm Threatens Papua New Guinea's Wildlife

Papua New Guinea's dazzling biological diversity includes the world's largest butterfly, the world's longest lizard, rich arrays of birds of paradise and parrots, the world's greatest variety of marsupial forest mammals, and some of the world's most beautiful orchids. Although just a tiny fraction of the world's land mass, it harbors 5 percent of the globe's biodiversity—many of its regions even have their own unique species. Because the island of New Britain has the country's longest list of regionally unique species—12 forest bird species, 7 frog species, 4 forest mammal species, and 2 lizard species—scientists have identified numerous sites of “Very High Priority” conservation value.^{xvii} For example, the bird species that could become endangered or extinct if New Britain's lowland rainforest habitat is lost due to oil palm plantations or other causes include the New Britain buzzard (a hawk), New Britain gray-headed goshawk, New Britain sparrowhawk, pink-legged rail, blue-eyed cockatoo (a species of parrot), New Britain boobook owl, white-mantled kingfisher, and New Britain red-headed honeyeater.^{xviii}

The world's largest butterfly, Queen Alexandra's birdwing (*Ornithoptera alexandrae*), found only in a small area of Oro Province, is considered endangered by the IUCN Red List.^{xix} Recently, traditional landowners in Oro sued the Higaturu Oil Palm Company, whose major shareholder is the bilateral aid arm of the U.K. government (through the Commonwealth Development Corporation). The company operates 39 square miles of oil palm plantations, which local landowners claim have led to river pollution from toxic pesticides and partial destruction of the sole habitat of Queen Alexandra's birdwing.^{xx}

Imminent Wildlife Extinctions in Indonesia and Malaysia

On Sumatra and Borneo, the destruction of roughly an extra 25,000 square miles—about twice the currently farmed area—of rainforest habitat would be ruinous to the remaining elephants, orangutans, rhinos, and tigers.

- The *orangutans* could become extinct in the wild. Remaining Sumatran orangutans, already endangered, survive now in only 10,000 square miles of fragmented rainforest habitat.¹⁵⁸ If, as planned, another 16,000 square miles of Sumatran rainforest are turned into oil palm plantations, these great apes may survive only in zoos.

More Than Just Elephants and Orangutans

The IUCN Red List has recently categorized the maleo megapode (*Macrocephalon maleo*), one of Indonesia's unique and rare forest bird species, as endangered because its population has declined very rapidly over the last five years.^{xxi} The species is found only on the island of Sulawesi and is a member of an unusual family of turkey-sized birds that incubate their eggs inside large mounds of soil and leaf litter material scraped together on the forest floor. According to scientific surveys on Sulawesi, the maleo has become rare or has disappeared completely in over 60 sites where it was once abundant.^{xxii} Habitat loss due to industrial agriculture (specifically oil palm plantations) and severe habitat fragmentation are major reasons for its decline.^{xxiii}

The number of Bornean orangutans declined by 97 percent during the 20th century,¹⁵⁹ leaving the great apes critically endangered. Remaining populations survive in approximately 38,000 square miles of fragmented rainforest habitat.¹⁶⁰ Sarawak and Kalimantan oil palm expansion would consume about 9,400 square miles, approximately one-quarter of orangutan habitat.

- Most of Indonesia's remaining *Asian elephants* are on Sumatra, with a population of about 2,800 animals. Since elephants and orangutans occupy the same habitat, the remaining

10,000 square miles of orangutan habitat is also elephant habitat, which would be wiped out by the destruction of forest for new oil palm plantations. Loss of Sumatra's elephants would be a severe blow for the species as a whole.

- The *Sumatran tiger* would go extinct in the wild. Its rainforest habitat is the same as that of orangutans and elephants, and therefore its last rainforest habitat would be destroyed, too.
- The *Sumatran rhino* would almost certainly go extinct—probably completely, since captive breeding has not been successful.¹⁶¹ Unlike orangutans, it can survive in upland forests and some partially logged areas if it is not hunted, but loss of such massive tracts of remaining rainforest would fragment the forest to such a degree that the already critically small population of rhinos would probably not be able to

maintain an intact social system and normal reproduction (rhinos are found at low densities). Breaking what remains of the rainforest into small, separate fragments would severely decrease core forest areas¹⁶² and expose the last rhinos to poachers.

The U.S. Market

The planned expansion of plantations would make Indonesia the world's largest producer of palm oil. To realize that expansion, investors and markets will be sought to finance new plantations¹⁶³—to finance, in effect, the destruction of additional giant tracts of rainforest in Indonesia and Malaysia, if business continues to expand.

The United States is, as noted previously, a relatively small market in the global palm oil trade, but that could change. The country imported approximately 421 million pounds of palm oil in fiscal year 2003,¹⁶⁴ in addition to approximately 427 million pounds of palm kernel oil, in the first 11 months of the same year.¹⁶⁵ (According to the Foreign Agricultural Service of the U.S. Department of Agriculture, palm oil imports have doubled since 1999.)

U.S. companies use about 8 billion pounds of partially hydrogenated vegetable oils annually. (Of that, 5.5 billion pounds of partially hydrogenated oil is used for frying and other applications in which a liquid oil, such as soy, corn, canola, or sunflower, would generally work. The other 2.5 billion pounds is used in foods that may need a solid fat.) But as food companies are becoming concerned about the impending *trans* fat-labeling requirement, they may switch to palm oil because it does not contain *trans* fat and is inexpensive. Indeed, Lodders Croklaan, a leading palm oil producer (Malaysian-owned, but Dutch-based), is tripling its production capacity in the United States in anticipation of a “big upsurge in the use of palm oil” in 2005.^{166,167}

If U.S. companies replaced 2.5 billion pounds per year of partially hydrogenated oil with palm oil (an unlikely extreme), palm oil imports would triple over the 2003 figures. That would necessitate 1,240 square miles of new oil palm plantations—an area larger than the state of Rhode Island.

Destroying 1,240 square miles of rainforest would have a significant effect on major mammals:

- **Bornean and Sumatran orangutans:** habitat for three to five viable breeding subpopulations of 500 animals each would be lost.

But as food companies are becoming concerned about the impending *trans* fat-labeling requirement, they may switch to palm oil because it does not contain *trans* fat and is inexpensive.

It is certainly possible for the palm oil industry to grow its product in a sustainable manner.

- **Sumatran rhinoceros:** habitat for 54–65 rhinos would be lost.
- **Asian elephant:** habitat for 18–54 elephant families would be lost.
- **Sumatran tiger:** habitat for 40–65 tigers would be lost.

Considering the dangerously low populations of those already endangered species and the fact that destruction of habitat is a major cause of decline, this habitat could make a critical difference and is very much worth fighting for.

Does It Have to Be This Way?

Is the killing or extinction of orangutans, Asian elephants, Sumatran rhinoceroses, Sumatran tigers, and other species a worthwhile trade-off for extra profits for an agribusiness company, a bank, a food manufacturer or restaurant, or even a corrupt official? And are those profits worth the concomitant costs in human health and longevity?

The fact is, palm oil is harmful to health and the environment, and its use should be minimized. When it is necessary for a particular application, it should be obtained from environmentally sound sources only.

Consumers can help reduce the demand for palm oil by avoiding products that contain it (as well as partially hydrogenated and other harmful oils). Clearly, reducing demand would reduce the need to replace rainforests with oil palm plantations.¹⁶⁸ And in answer to human health concerns, an array of other oils—including soy, canola, corn, safflower, and sunflower—can easily be substituted for palm oil in many fried foods. For foods that absolutely require more-solid fats, palm oil (obtained in environmentally sound ways) is preferable to partially hydrogenated oil, but companies should use the smallest amounts possible.

Palm oil certainly will continue to be used, but oil palm plantations do not have to destroy natural forest. It is simply financially expedient for plantation companies to do so. Oil palm can flourish in rehabilitated agricultural land or land that has already been degraded in past decades (of which there is plenty in Indonesia).¹⁶⁹ However, the investment returns do not start as early, and preparing disused agricultural land for plantations is more expensive than selling the timber from forests.¹⁷⁰ So far, easy access to forest land has been one of the factors that plantation companies have used to keep costs down, attract investors, and facilitate the expansion of oil palm plantations.¹⁷¹

One strategy, which companies such as Malaysia's IOI Group are taking, is to breed and grow oil palms that produce several times as much oil on the same amount of land. Another solution would be for governments to require companies to establish their plantations on land that was degraded or cleared years ago, but never planted. Indonesian claims to "actively promote to save the high conservation value [habitat] in and around oil palm plantations including rare and endangered species," according to a spokeswoman for the government's Indonesian Palm Oil Commission.¹⁷² The government has "rules and regulations to protect the rainforest and wildlife." While government officials may be well-intentioned, it is not clear that they have the will or ability to enforce their rules, according to an environmentalist critic.¹⁷³ One strategy for encouraging governments to implement major reforms would be for the international donor community to make development loans—apart from humanitarian aid—contingent on preventing degradation of protected areas¹⁷⁴ and natural forest.

Moreover, it is certainly possible for the palm oil industry to grow its product in a sustainable manner. According to the World Wide Fund for Nature (WWF, known in the United States as World Wildlife Fund), sustainability would involve certain key elements:¹⁷⁵

- no destruction of natural forests
- no burning for land clearing
- watercourse protection by buffer zones of natural vegetation
- integrated pest management to reduce pesticide use
- proper treatment of mill effluent and other wastes
- respect for customary land-use rights of local communities
- transparency in companies' environmental and social policies and practices, with high-level standards of practice and independent monitoring and verification

The Malaysian palm oil industry acknowledges that pressure for agricultural development several decades ago overrode any environmental



Sumatran rhinoceros juvenile.

© David Jenike, Cincinnati Zoo (www.cincinnati-zoo.org).

concerns.¹⁷⁶ But it says that practices have changed and that “Malaysian palm oil is now at the forefront of best practices in sustainable farming and protection of the environment.”¹⁷⁷ It is unclear, though, to what extent those lofty words jibe with reality.

Some companies claim to be developing policies that promote environmentally and socially responsible production of palm oil. The transnational corporation Unilever, which has been a major grower of oil palm and user of palm oil in foods and cosmetics, has been working with WWF on ecological, economic, and social criteria¹⁷⁸ and has published a

set of good-practice guidelines for its plantations.¹⁷⁹ That initiative and the Roundtable on Sustainable Palm Oil (see box) are important steps in the right direction. The goal should be an agreed-upon set of key environmental and social standards, a code of practice, effective regulatory systems, and independent monitoring.

WWF has recommended that finance institutions stop funding the plantation companies (and their parent conglomerates) that are responsible for forest fires, destruction of rainforest, and circumventing of indigenous peoples’ land rights.¹⁸⁰ In the Netherlands, Greenpeace and Friends of the Earth have urged that financiers screen future investments for adverse effects, and several major Dutch banks have agreed to do so.¹⁸¹ As yet, however, there is no

independent third-party verification of environmental or social claims and no guarantee that the activities of a bank and its clients are consistent with the criteria.¹⁸²

WWF further recommends that companies in palm oil-importing countries develop verifiable investment and purchasing policies on the basis of sustainable criteria. Ideally, all companies in the trade chain should know and screen the origin of their raw palm and palm kernel oil.¹⁸³ But because the supply chain is so complex, most companies do not know the origin of the oil they use. For example, crude palm oil from Indonesia is

“Sustainable” Palm Oil?

Some companies, on their own, have begun taking steps toward reducing environmental and social problems. More broadly, certain industry stakeholders (including Loders Croklaan, Unilever, Golden Hope, and the Malaysian Palm Oil Association), in collaboration with WWF and other citizens groups, created the Roundtable on Sustainable Palm Oil, which first met in Malaysia in August 2003, to develop improved standards of practice. A working group is drafting criteria for environmental performance, which will be under discussion in late 2005.^{xxiv} The roundtable is also grappling with the issue of clearing rainforest for plantations (including past forest clearance) and with the question of how to set up a certification system for sustainably produced oil.^{xxv} Another challenge is to agree on a definition of what constitutes “high conservation value” of a forest or other ecosystem. The goals are to identify measurable benchmarks for environmental and social criteria, as well as practical plans and timetables for collecting baseline data, periodically monitoring performance, and correcting deficiencies. All parties hope that a functional, voluntary, self-regulatory system will be developed.

often mixed with oil from other countries in tanks in transit harbors and sent first to oil processors and then to consumer product companies. Yet a German survey found that some companies claimed to know that the palm oil they used did not come from Indonesian plantations.¹⁸⁴ Tracking palm oil from plantation to refinery to food package would be most feasible for large, vertically integrated companies that own the plantations, mills, and refineries.

Active involvement by consumers could help curtail the destruction of rainforests and wildlife. Consumers should note which oil is in the foods and cosmetics they buy. They should avoid partially hydrogenated oils in foods and insist that manufacturers use only palm oil that was produced in an environmentally safe way. Retailers could follow the example of Switzerland's biggest supermarket chain, MIGROS, which became the first European retailer to commit itself to hiring independent auditors to verify annually that its palm oil suppliers are meeting environmental and social criteria.¹⁸⁵



The palm oil industry is one of the forces that is destroying the habitat of rainforest creatures large and small, as well as humans, simply to produce a product that promotes heart disease. Whether human institutions can halt that ecological disaster will be a measure of humankind's stewardship of this planet.



Sumatran orangutan baby.

© Sumatran Orangutan Society (www.orangutans-sos.org).

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