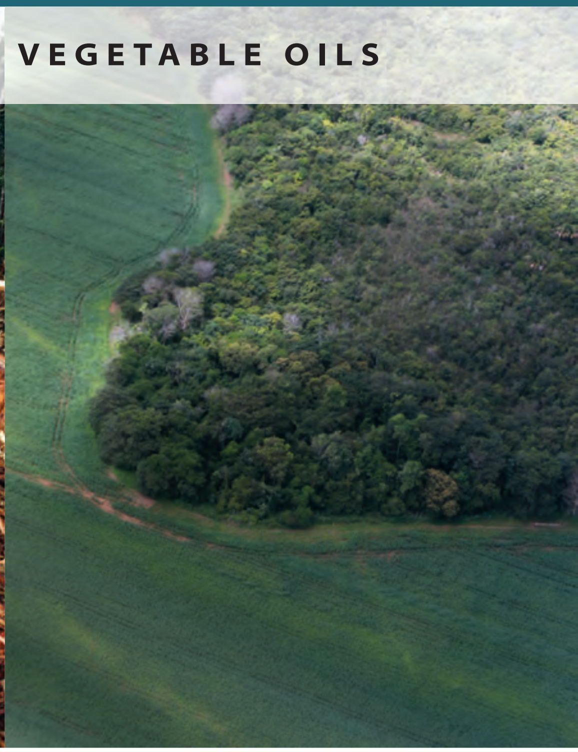



Recipes *for* Success

SOLUTIONS FOR DEFORESTATION-FREE VEGETABLE OILS





A REPORT OF THE **UNION OF CONCERNED SCIENTISTS** AND **CLIMATE ADVISERS**

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SOLUTIONS FOR DEFORESTATION-FREE VEGETABLE OILS

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FEBRUARY 2012

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UCS Publications
2 Brattle Square
Cambridge, MA 02138-3780

Or, email *pubs@ucsusa.org* or call (617) 547-5552.

Design: Penny Michalak
Front cover photos: (palm oil plantation) ©iStockphoto.com/Alice Chong; (oil pouring in pan) ©iStockphoto.com/Ami Parikh; (rain forest) ©iStockphoto.com/Sze Fei Wong; (logs) ©iStockphoto.com/Mayumi Terao; (aerial) ©Rhett Butler/mongabay.com
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Acknowledgments

This report was made possible by generous support from the ClimateWorks Foundation, a member of the Climate and Land Use Alliance.

The authors would like to thank the following experts whose thoughtful and rigorous reviews were essential in shaping this report: Hereward Corley, Jim Lane, Gary List, Alejandro Marangoni, Scott Poynton, Jannick H. Schmidt, Nuša Urbančič, Meine van Noorwijk, and additional reviewers who wished to remain anonymous. We would also like to thank Moray McLeish and Beth Gingold for providing useful background on the current state of degraded land in Indonesia.

In addition to the external reviewers, we would like to thank those at UCS and Climate Advisers, Angela Anderson, Patricia Elias, Jim Kliesch, Kathy Rest, and Michael Wolosin, who took the time to review the report.

We are grateful to Sandi Schwartz for her expert editing work, Bryan Wadsworth and Heather Tuttle at UCS for their help with the production process, and Penny Michalak for her design of the report. Further, Lael Goodman helped innumerably with the minutiae of the report, and we owe her many thanks.

Please note that the reviewers are listed to convey our gratitude for their time and effort, and that the opinions and arguments expressed in this report are solely the responsibility of the authors, not the reviewers.

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Introduction and Summary

Global demand for vegetable oils has recently increased, growing more than 5 percent a year for more than a decade, and is expected to continue to grow at that rate for the next decade (IAPC 2011). This growth rate substantially exceeds the United Nations estimate for global population growth of 1.1 percent through 2020. This impacts not only the global economy, but also the atmosphere and ecosystems. Increasing demand for vegetable oils has traditionally translated into demand for more land to grow oil crops. Over the last decade much of that land has come at the expense of tropical forests, and this is particularly true for palm and soybean oil (Macedo et al. 2012; Wicke et al. 2011; Verchot et al. 2010). This loss of tropical forest means a loss of precious biodiversity and ecosystem services (e.g., water cycle maintenance, potential sources of new medicines) and contributes to global climate change. Tropical deforestation accounts for about 15 percent of annual global carbon emissions (Le Quéré et al. 2009; UCS 2009).

Over the last decade much of the land for vegetable oil production, particularly palm and soybean oil, has come at the expense of tropical forests.

Fats and oils can come primarily from either animal (e.g., tallow, butter) or vegetable sources from oil crops including oil palm, soybeans, rapeseed (also called canola), and others (e.g., olive oil, corn oil). Along with carbohydrates (sugars and starches) and protein, oils and fats are essential to our diet. In addition, vegetable oils are found in thousands of products we use and consume every day, from cookies and cooking oils to shampoo and laundry detergent. Increasingly, they are being used to fuel cars, trucks, and in the future, even airplanes.

Countries around the world produce, consume, import, and export these oils in vast quantities. The recent dynamics of the oilseed market and the demand for vegetable oil have been largely driven by growth in the gross domestic product (GDP) and expanding populations of developing countries, particularly India and China. Government mandates for biodiesel in the European Union, and to a lesser extent in the United States and elsewhere, are also expanding demand for vegetable oil.

In order to help mitigate the worst effects of climate change and to address the growing demands of global consumers for deforestation-free products, businesses today are searching for alternative sources and modes of production of vegetable oil, and there are many ways that companies can ensure their products are deforestation-free.

Producers of vegetable oils grown in tropical locations can still continue to grow these oils while avoiding deforestation. They should pledge to only expand new production onto non-forest lands and work to increase crop yields through a combination of improved breeds and management practices.

Businesses that buy vegetable oils should commit to sourcing only deforestation-free vegetable oils. This can be accomplished by establishing strong relationships with their suppliers to help ensure that any palm or soy oil being sourced is not driving deforestation. Alternatively, businesses can also switch to vegetable oil inputs that do not directly cause deforestation (e.g., corn, sunflower, rapeseed) if they are not able to find deforestation-free sources of soy or palm.

Governments can establish biofuel regulations that support forests and aim to reduce carbon emissions. Additionally, they can utilize policies like agricultural zoning that discourage agricultural development near forests.

Consumers can buy deforestation-free products whenever possible, demanding that more companies make public declarations to go deforestation-free, and then hold them to their word. Further, they can push for biofuels regulations that actually reduce emissions and keep pressures off forests.

This report examines the vegetable oil market and details how businesses can produce and use vegetable oil without causing deforestation.

CHAPTER ONE

Background

MAJOR USES FOR VEGETABLE OIL

Vegetable oils are used in many different products in many different sectors of the economy. The majority of the world's vegetable oil is used in food preparation (75 percent) (FAS 2011a). Around 15 percent of vegetable oil production is used for industrial purposes, in products such as moisturizers and cleaning supplies. An additional 9 percent of vegetable oil production currently goes to biofuel production, while the remaining 1 percent is considered waste.

Vegetable Oils in Foods

Vegetable oils for human consumption are usually separated into three categories: salad and cooking oils, frying oils, and solid fats (Eckel et al. 2007; Schmidt and Weidema 2008). The growing need for cheap cooking oil, particularly in India and China, has led to increased demand for palm oil. Though the majority of vegetable oils are consumed unprocessed, vegetable oils in processed food are an increasingly important share of consumption, particularly in developed countries.

Traditionally, solid fats derived from animals (e.g., butter, tallow, lard) were used in Western countries for cooking and baking. However, in the late 1960s and early 1970s research suggested that dietary cholesterol, which is found in animal fats but not vegetable oils, increased the risk of heart disease (Keys, Anderson, and Grand 1957; Hegsted et al. 1965). Food companies began to replace animal fats with solid fats from tropical oils such as palm and coconut, which do not contain cholesterol. But later research highlighted that saturated fats (which are commonly found in tropical oils) are also linked to cardiovascular disease (Mattson and Grundy 1985; Shepherd et al. 1980; Eckel et al. 2007) and thus the food industry began to again look for a healthier substitute.

Concerns about the health effects of trans fats caused some cities and countries to ban them, helping drive demand for palm oil

Throughout the 1960s, '70s, and '80s, food companies began to replace tropical oils and remaining solid animal fats with solid fats from partially hydrogenated vegetable oils, which are lower in saturated fatty acids. Partially hydrogenated fats seemed to be a good alternative because of their stability, cost, availability, functionality, and their perceived health benefits (Eckel et al. 2007). Partial hydrogenation reduces highly unsaturated fatty acids, which makes the fat more solid at room temperatures and therefore more functional in baked goods and spreads, without dramatically increasing the amount of unhealthy saturated fatty acids. Hydrogenated fats also allow products to have a longer shelf life.

However, the process of hydrogenation of oils creates what are known as *trans* fats. Consumption of these has been linked to substantial risk of coronary heart disease, and possibly diabetes and sudden cardiac death (Mozaffarian et al. 2006; Willett et al. 1993). In 2003, the U.S. Food and Drug Administration mandated that, as of January 1, 2006, all food labels must include *trans* fats as a separate line in the nutrition information so that consumers can make an educated choice about consuming them, in the same way that saturated fat must be included on a similar line on nutrition labels (FDA 2003). Some cities in the United States, such as Philadelphia and New York, have banned *trans* fats in all food service establishments. European countries, including Denmark and Sweden, have also banned *trans* fats (Pérez-Ferrer, Lock, and Rivera 2010; Philadelphia Department of Public Health 2007; New York City Department of Health 2007; Stender and Dyerberg 2004).

Although free of *trans* fats, these tropical oils still have high saturated fat content. So the companies have not removed the risk of cardiovascular disease.

In response to both the consumer demand for *trans* fat-free food and regulations regarding *trans* fat use, many food manufacturers have sought to create "zero *trans* fat" goods. This has pushed many food manufacturers and providers to switch back to using tropical oils like palm oil, because they do not contain any *trans* fats, but still maintain the functional properties desired for different food applications (Hayes and Pronczuk 2010). Although free of *trans* fats, these tropical oils still have high saturated fat content, so the companies have not removed the risk of cardiovascular disease. This return to tropical oils has led to increased demand for palm oil (the cheapest of the tropical oils), and therefore to increased deforestation.

Vegetable Oils in Non-Food Products

About 15 percent of vegetable oils are used to produce useful materials such as soaps and other personal care products, as well as paint and lubricants. As with foods, there are a range of different oils used for these products, and in most cases there are several options for any given application. Many products have historically used petroleum or animal by-products, but with increased prices, the use of vegetable-based products has grown (Hayes et al. 2009). For example, in the past, most soaps were made from substances derived from animal fats, a by-product of livestock slaughter. Because many companies no longer wanted to use animal slaughter by-products in their soaps and shampoos, and because of the greater availability and relatively low price of palm oil, many but not all have switched to vegetable-based oils, including palm (Ogoshi and Miyawaki 1985).

Vegetable oils are found in many cosmetic and cleaning products including soaps, shampoos, shaving creams, household cleaners, and paints.

Vegetable Oils as Fuels

Vegetable oil provides an energy-dense food compared with sugars and starches, and the same high energy density makes it a potential source of fuel for cars, trucks, planes, and ships. Though currently only 9 percent of vegetable oil production goes to biofuel production, that balance could change in the future, driven by the biofuel policies of different countries.

There are two primary means of producing biodiesel today, each of which can use different vegetable oil sources. The low-tech method combines vegetable oil or fat with alcohol and a catalyst to make biodiesel. The properties of the biodiesel are not identical to diesel made from petroleum, and vary depending upon what type of oil or fat is used. For example, at low temperatures biodiesel can start to crystallize, which will clog fuel lines, especially with fuels made from high-melting-point oils or fats. Modern engines and emissions control equipment require strict specifications for the fuel, and generally allow only between 5 and 20 percent biodiesel to be blended with petroleum diesel, depending on the engine type and manufacturer, and further

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Increasingly, vegetable oils are being used to make fuel, like the soybean-based biodiesel sold at this gas station in Washington State.

Today only 9 percent of vegetable oils produced are used to make biofuels; however, government policies around the world could raise that number significantly.

restrict the properties of the biodiesel that can be used. Using the wrong fuel can damage the engine or exhaust systems and will violate the manufacturers' warranty. The biodiesel standard in the European Union is based on the properties of biodiesel made from rapeseed oil and methanol, which makes it difficult for biodiesel made from other vegetable oils to meet the standard. This means that biodiesel produced from other oils is essentially excluded from use in much of the European Union. In the United States and Brazil standards are less tightly specified, and can accommodate soybean and other oils (Elbersen et al. 2010).

A high-tech alternative to the conventional biodiesel process, called hydrotreating, can convert fats or vegetable oils into fuels that are chemically nearly identical to diesel or jet fuel, sometimes called renewable diesel instead of biodiesel. This technology allows the use of almost any source of fat and oil, and makes it possible to produce a fuel that meets the standards for conventional diesel fuel, allowing it to be used in blends of higher than 5 percent in unmodified engines. Several of the largest biodiesel plants in the world use this technology to make diesel fuel, and recently several airlines in the United States and Europe have started flying some routes using 50 percent mixtures of bio-based jet fuel produced from a variety of animal fats and vegetable oils (Mutzabaugh 2011; Lufthansa 2011).

Using french-fry grease and other waste oils to make biodiesel is a way to reuse waste vegetable oil after it has already been used once. But the scale of this resource is small compared with overall diesel use. For example, the United States produces almost 8 billion pounds of waste fats and oils each year, which is enough to make almost 1 billion gallons of biodiesel, if it were all collected and used for fuel (U.S. Census 2011). By contrast the United States consumes about 50 billion gallons of diesel fuel a year, so even if all of the waste fats and oils were used it would account for just about 2 percent of diesel use. Furthermore, in that case the current users of waste fats would likely switch to a low-cost vegetable oil like palm oil (EIA 2011; ACI 2011).

THE GLOBAL MARKET FOR VEGETABLE OILS

Vegetable oil use has grown dramatically as populations and consumption levels around the world have risen. These increases have been driven by growing global consumption and trade of processed goods and biodiesels (Box 1, p. 7). Different oils have been used to a greater or lesser extent over time (see Vegetable Oils in Foods above).

Palm Oil

At 50.6 million metric tons of annual production, palm oil is the leader in global edible-oil production volume (FAS 2011a) (Figure 1). It is produced from the fruit of the African oil palm, *Elaeis guineensis*. Though native to Africa, the oil palm can be grown throughout the humid tropics, primarily between 10 degrees north and south latitudes. It has very high yields compared with other oil crops (3.41 metric tons per hectare [ha] versus 0.68 metric ton for rapeseed and 0.36 metric ton for soy). In addition to the oil from their fruits, oil palms also produce palm kernel oil, which has a much smaller share of the vegetable oil market (33 percent for palm oil, 3.7 percent for palm kernel oil) (FAS 2011a). Palm kernel oil is used mainly in

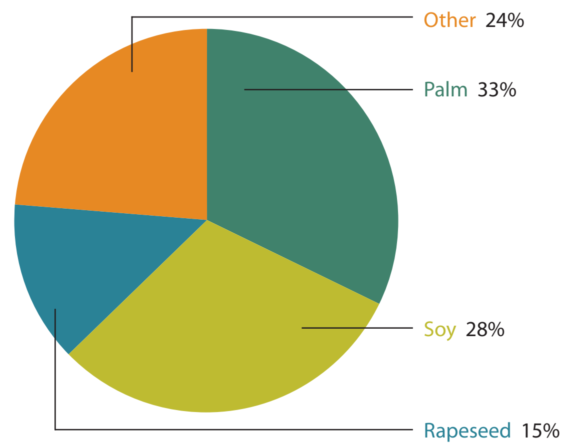
The fruit of the oil palm produces two types of oils: palm oil, from the orange flesh of the fruit, and palm kernel oil, from the white internal kernel.

home and personal care products because of its chemical properties, and is considered a specialty market product.

Palm oil production has rapidly expanded over the last decade. Almost all palm oil currently comes from Indonesia and Malaysia. It is traded throughout the world, but the principal consumers are China, Indonesia, India, and the European Union, each of which imports between 10 and 15 percent of world production. They are followed by the internal consumption of Malaysia (8 percent); the United States only uses a few percent of the world total (Figure 2, p. 6). Palm oil expansion also contributes the most to tropical forest loss and carbon emissions (see Expansion into the Tropics below).

Figure 1. TOTAL VEGETABLE OIL PRODUCTION, 2011–2012 BY SOURCE

Total production of vegetable oil by source. Palm production makes up 33 percent of the market with 50.6 million metric tons, followed by soy (28 percent) with 42.9 million metric tons, then rapeseed oil (15 percent) at 22.8 million metric tons. Source: FAS 2011a.



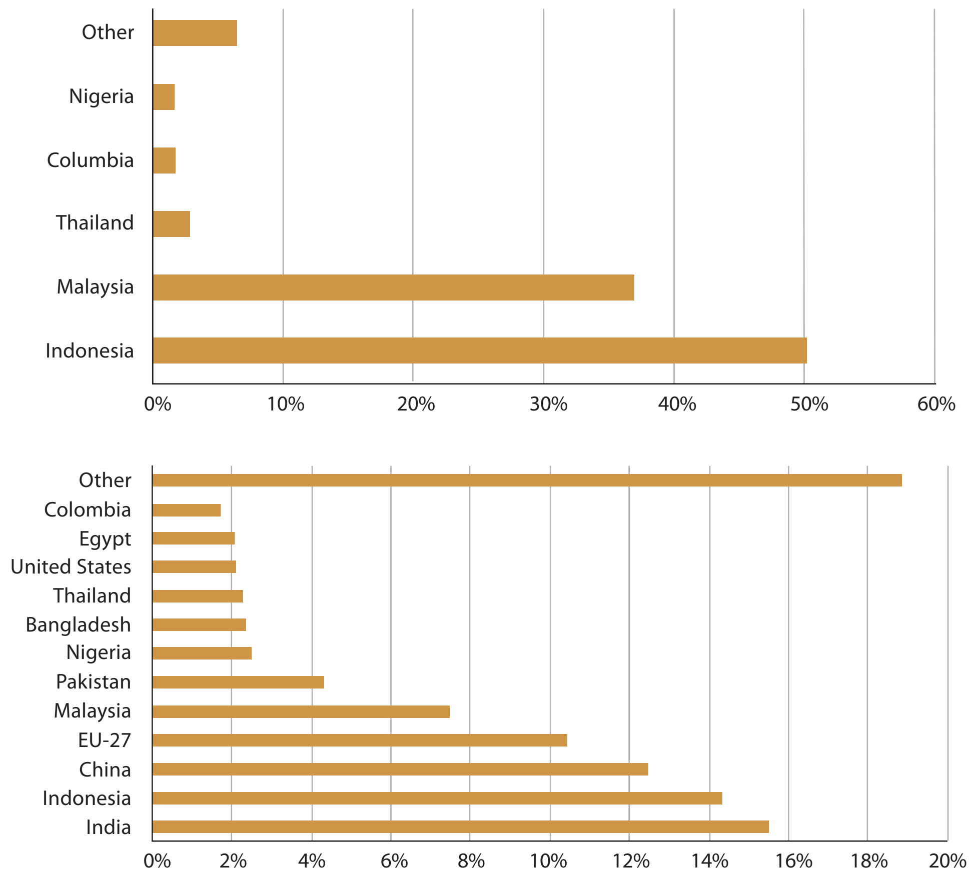
Soybeans

Soy is the next-highest-volume oil, at 43.1 million metric tons of annual production (FAS 2011a) (Figure 1). Unlike palm, soy oil is not the primary product from soybeans. They are grown principally for the livestock feed made from their high-protein meal, and the oil is a by-product. The oil makes up only about 14 percent of the weight of the soybean. Though the oil sells for about three times more per ton than the meal, it only represents a fourth of the soybean's value.

Soybeans produce both a high-protein meal, which is used for animal feed, and soybean oil, which is the second-most-produced vegetable oil.

Figure 2. **PRODUCTION (TOP) AND CONSUMPTION (BOTTOM) OF PALM OIL BY COUNTRY, 2011–2012**

The major producers and consumers of palm oil. Indonesia and Malaysia are the major producers and consumers while China and India are two of the major consumers. Source: FAS 2011a.



Three countries dominate soybean production as well as exports: Brazil (40 percent), the United States (36 percent), and Argentina (10 percent) (FAS 2011a). The main importers, the European Union and China, mostly buy soybeans to make into meal to feed their livestock.

Rapeseed and Other Oils

The third-largest vegetable oil is rapeseed (including canola), with annual production of about 22.7 million metric tons (FAS 2011a) (Figure 1). The major producers are Canada (which has two-thirds of world exports), the European Union, and China, and two-thirds of the global consumption is in the European Union and China. Other oils, such as sunflower, sesame, olive, and corn, make minor contributions to world production and trade.

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Rapeseed oil is the third-most-produced vegetable and does not directly cause tropical deforestation.

Box 1

The Global Vegetable Oil Trade

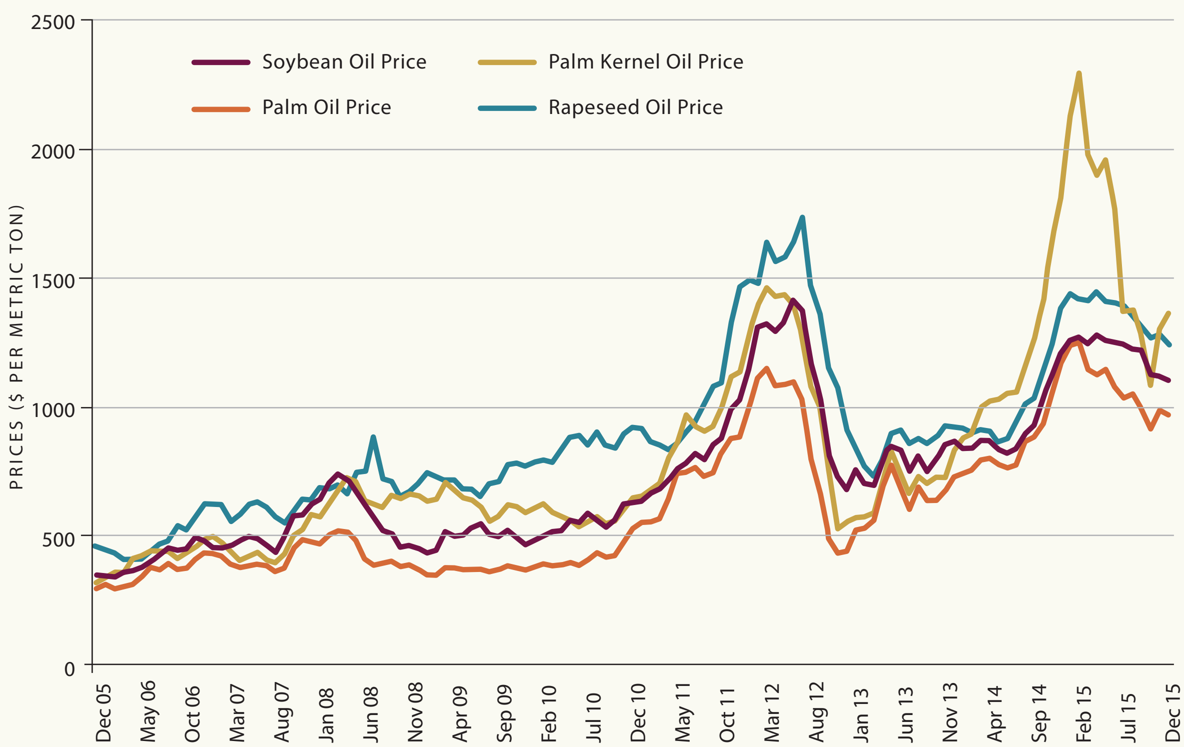
Oilseeds (and the vegetable oils and meal that come from processing oilseeds) are traded around the world in enormous quantities, and the markets for these oils are strongly linked. Because many different oils can be used for the same purpose (e.g., cooking and frying), they are mostly interchangeable, are essentially traded on one market, and the prices of all the vegetable oils tend to go up and down together (Figure 3).

The oilseed trade is highly globalized, with palm oil traveling in enormous tankers from Singapore to Rotterdam, soybeans being shipped hundreds of kilometers down the Amazon or Mississippi Rivers to China, and rapeseed oil going from Canada to southern Africa. This global trade can lead to complicated supply chains and difficulties in tracing products from farm to end user. Changes in the supply and price of one of its components are quickly transmitted through a global web to all the other parts (Schmidt and Weidema 2008).

continued on next page

Figure 3. PRICES OF VEGETABLE OILS

Prices for palm, soy, rapeseed, and palm kernel (PKO) from 2001 to 2011. The prices of all these kinds of oils tend to rise and fall together. Palm oil has been the cheapest of the vegetable oils for more than a decade. Source: Index Mundi 2011.



Box 1, continued

Large agricultural distributors, like Cargill, are responsible for the trading and transportation of vegetable oils in the global market.

Since palm is the cheapest and most productive oil, its production is likely to increase the most as demand for vegetable oils continues to grow.

Overall, palm oil is the largest-traded vegetable oil, accounting for 63 percent of vegetable oil imports, and soybean oil is the second largest (14 percent), followed by sunflower seed oil (8 percent), rapeseed oil (6 percent), and other minor vegetable oils (9 percent). (While sunflower seed oil is actively traded, it is not one of the largest in terms of production, so it is not addressed in depth in this report.) Overall, the three most important producing countries in the global trade in oils are Indonesia (19 percent), Malaysia (about 13 percent), and China (13 percent) (FAS 2011a). Other countries, such as the United States (6 percent of vegetable oil production), the European Union (10 percent), and Brazil (5 percent), are major producers but consume most of their vegetable oil internally, so they make up a smaller part of the total that is traded between countries. However, the United States and Brazil are the principal exporters of raw soybeans, so they too play a major role in the dynamics of the market, as many of the soybeans are converted to oil after import, and any decrease in exports of soybeans pushes up demand for other oils, especially palm.

In recent years, palm oil has tended to have a declining price relative to the others, while still following the same trends of price fluctuations. Between 1995 and 2006 its price dropped from being practically identical to that of rapeseed oil to about 30 percent lower (Schmidt and Weidema 2009). Palm is the largest source of vegetable oil, the fastest growing, and the least expensive, which makes it the "marginal" commodity in the market. Thus, as demand increases for vegetable oils, most of the increased supply comes from palm rather than the alternatives.

EXPANSION INTO THE TROPICS

In the past two decades, two sources of vegetable oil–soy in the Amazon and palm oil in Southeast Asia–have expanded dramatically, and much of this growth has come at the expense of tropical forests (Macedo et al. 2012; Wicke et al. 2011; Verchot et al. 2010; Morton et al. 2006). It is not just the scale of the expansion, but also the pace (with production of both nearly doubling in just a decade) that has put pressure on forests. With demand expected to continue to increase, how production of these oils expands in coming years will be critical to whether tropical deforestation emissions can successfully be reduced (Boucher et al. 2011). Some insights can be derived from the trajectory of the two oils, as soy expansion is now under control in Brazil (Macedo et al. 2012) while palm expansion into forests is expected to continue in Southeast Asia (Harris and Grimland 2011a, 2011b).

Soybeans only became a potential crop for rain forest regions in the 1990s, with the development of new strains that were well adapted to commercial production in the soil and climate conditions of the flat land at the southern edge of the Amazon Basin. Subsidies and new roads that linked the region to ports and thus to international markets made it profitable to clear large tracts of forest with bulldozers and establish farms of thousands of hectares, particularly in Brazilian states such as Mato Grosso (Fearnside 2001).

As this trend became evident and soybeans became the cause of up to a fourth of Amazon deforestation (Morton et al. 2006), environmentalists responded and raised public awareness, putting pressure on the soybean industry (Fearnside 2001; Greenpeace International 2006). Seeing a threat to its rapidly expanding exports, in 2006 the trade association of the Brazilian soybean industry declared a temporary moratorium on buying or exporting soybeans produced on recently deforested land.

The moratorium has been renewed every year since then, and recent analyses using satellite images have shown that it has been very effective (Macedo et al. 2012). Now, only about one-fourth of 1 percent of Brazil's soybean output comes from recently deforested land (Rudorff et al. 2011). There may still be some deforestation impacts: expansion of soybean acreage may be displacing cattle pasture into the Amazon (Barona et al. 2010; Arima et al. 2011), but for the most part soy expansion has been decoupled from forest encroachment (Macedo et al. 2012). The soy moratorium, along with improved enforcement of laws against logging, agricultural zoning, and the incentive created by a $1 billion deforestation reduction partnership sponsored by the government of Norway, has yielded a two-thirds reductions in deforestation in Brazil–at the same time that the country has consistently increased soy (and cattle) production (Figure 4).

Figure 4. **DEFORESTATION AND CATTLE AND SOYBEAN PRODUCTION IN BRAZIL**

Both cattle and soybean production have continue to increase steadily in Brazil in the past several years—even as deforestation rates have dropped to record-low levels. Sources: FAS 2011a, 2011b; INPE 2010b.

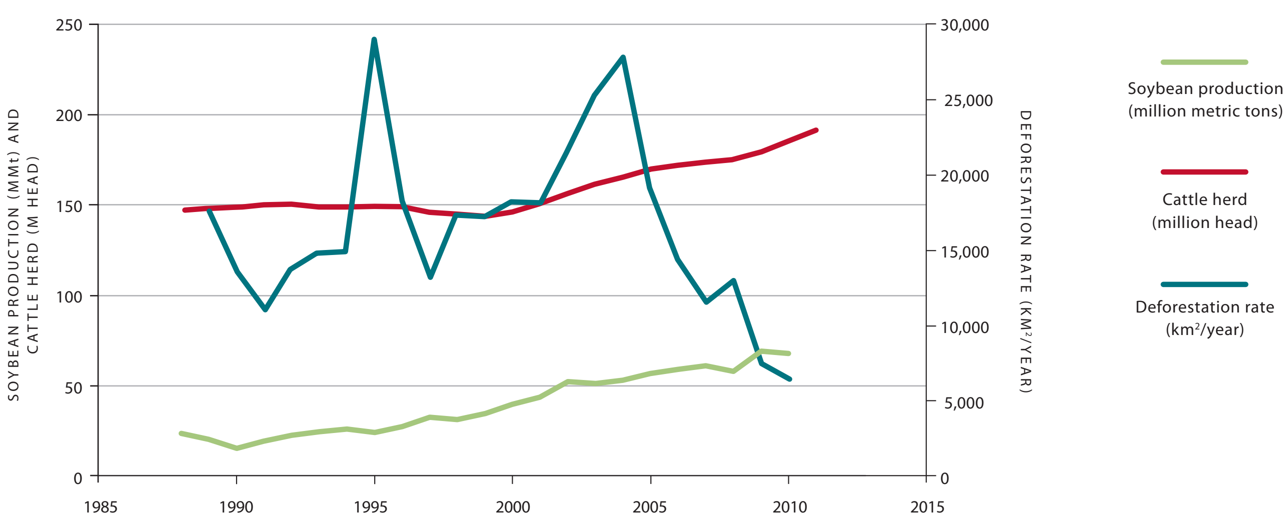
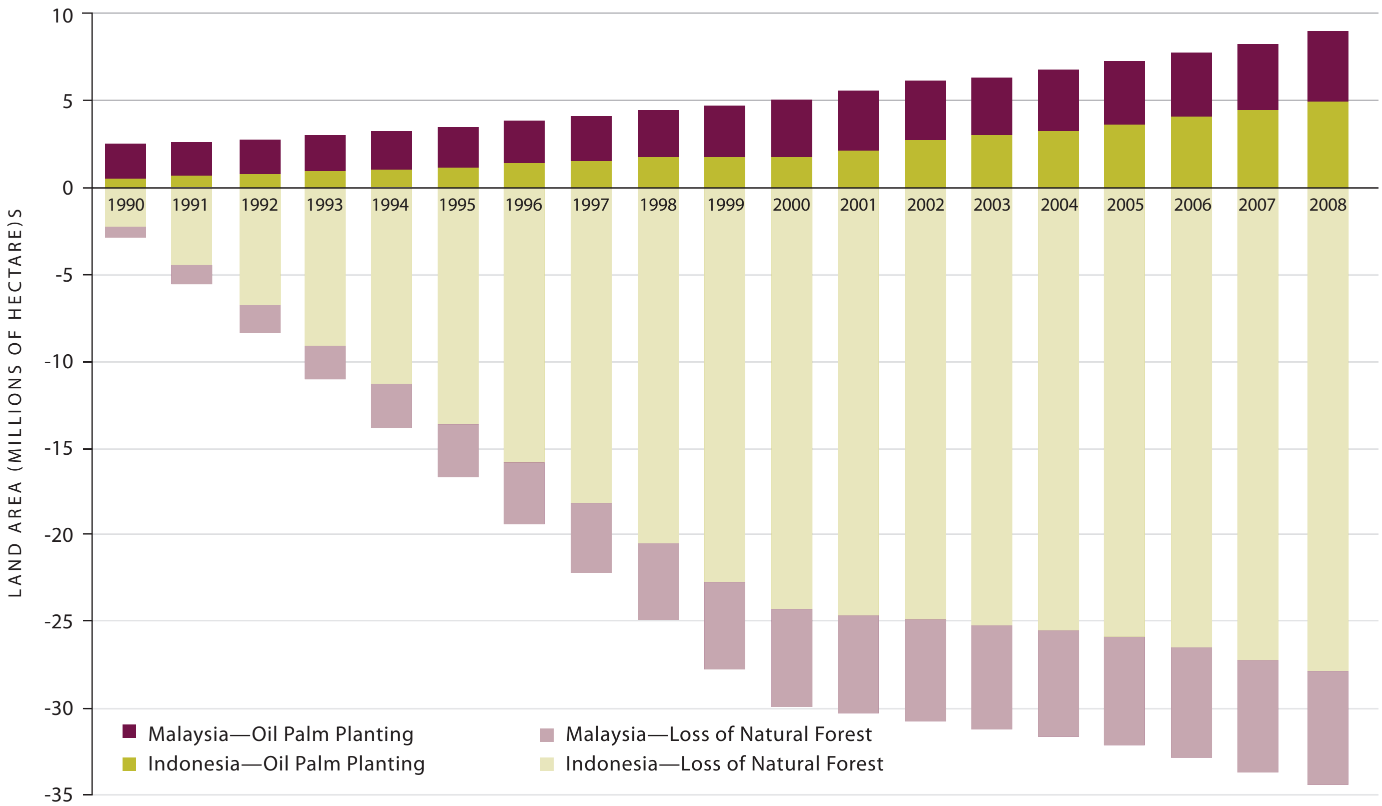


Figure 5. OIL PALM PLANTING AND FOREST LOSS IN INDONESIA AND MALAYSIA, 1990–2008

Deforestation and palm oil expansion continue in Indonesia and Malaysia. Although not all palm oil expansion comes at the expense of forests, land clearing for palm plantations is a major concern for many groups. Source: FAOSTAT, based on figure from mongabay.com.



Palm oil in Southeast Asia showed a similar boom at the expense of tropical rain forests in the 1990s and 2000s. But here responses to reduce deforestation are still in early stages (Koh and Wilcove 2008; Koh, Miettinen, and Ghazoul 2011) (Figure 5). Malaysia was initially the industry leader, and at first much of its new palm oil area came from the conversion of declining rubber plantations (Basiron 2007). But Indonesia, with annual production growth rates of over 10 percent, has overtaken Malaysia in the past decade. Although estimates vary, the Indonesian government plans to establish as much as 18 million additional hectares of palm oil plantation (beyond the 7 million hectares existing in 2008) over the next decade (Verchot et al. 2010).

Only about 10 percent of palm oil plantations in Indonesia and Malaysia established up to 2003 were on peat soils, but these were responsible for over a third of the carbon emissions.

Of particular concern from a climate perspective is expansion into peat forests, which are swamp forests common to Southeast Asia whose soils contain very large amounts of carbon. Only about 10 percent of the plantations in Indonesia and Malaysia established up to 2003 were on peat soils, but these were responsible for over a third of the carbon emissions from palm plantations (Koh, Miettinen, and Ghazoul 2011; Boucher et al. 2011; Saxon and Sheppard 2011). Furthermore, the drained peat soils will continue to emit carbon dioxide for many years into the future as the peat continues to decompose. In May 2011, the Indonesian president signed a two-year moratorium for deforestation on primary forests and peatlands not already under contract to be cleared (Saxon and Sheppard 2011). Although the moratorium is limited in scope and it is too soon to determine whether it has been effective, it is an indication that the Indonesian government considers deforestation an important issue.

In other tropical countries, soy and palm oil have also been expanding, but with much less effect on tropical forests, due either to their smaller size or the fact that the area of expansion is mostly non-forested. For instance, in Argentina, which is the world's third-largest soy producer (about 20 percent of the total), most soybean production takes place in temperate, non-forested regions. However, soybeans have encroached somewhat into forest in its northern provinces. It is also possible that expansion of these and other oils may be indirectly contributing to deforestation by pushing other forms of agriculture, like cattle pasture, onto forested lands. Bolivia and Paraguay have also been losing tropical forest to the growth of soy, and it is likely that losses will continue unless policies like those in Brazil are put in place to stop further expansion into forests.

The story of the expansion of the two largest sources of vegetable oils into the planet's two largest tropical forest countries thus offers contrasting examples of expansion. In Brazil, where consumers and NGOs pressured businesses to make a change, soybean production has all but stopped expanding into forest. In Indonesia, efforts to halt deforestation are still in their early phases, and palm oil expansion continues destroying the forest. Deforestation due to vegetable oil expansion is likely to continue until governments and businesses make commitments to stop clearing forests and to making their products deforestation-free.

In Brazil, where consumers and NGOs pressured businesses to make a change, soybean production has all but stopped expanding into forest.

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Soy expansion was a major driver of deforestation in Brazil for much of the 2000s.

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Previously forested land, like this tract in Indonesia, is cleared for palm oil production.

CHAPTER TWO

Alternatives to Deforestation

Deforestation is not an inevitable result of increased production of vegetable oil. There are a number of steps that growers can take to ensure that their vegetable oils are deforestation-free.

INCREASING YIELDS

One potential strategy for reducing pressure on forests as demand for vegetable oils increases is boosting yields on lands already under cultivation. Some studies have argued that increasing agricultural yields have prevented global cropland area from more than doubling (Burney, Davis, and Lobell 2010), suggesting that yield increases may be a solution. But others have detailed a more complex picture, with yield increases' impact on deforestation varying widely with other factors such as governance, policy, and incentives (Angelsen and Kaimowitz 2001; Ewer 2009 et al.; Rudel et al. 2009). In fact, these economic analyses have shown that the effect may even be the reverse–that increasing yields can make agriculture more profitable and thus promote its expansion into forest–so that higher yields alone may not mean decreased deforestation (Angelsen, Shitindi, and Aarrestad 1999; Gutiérrez-Vélez et al. 2011).

Both the potential and risks of yield improvement are very clear in the vegetable oil sector. Land planted with oil palm produces 5 to 10 times more oil per hectare (including palm kernel oil) than any other vegetable oil crop (3.41 metric tons per hectare for palm oil, compared with just 0.68 metric ton for rapeseed and 0.36 metric ton for soy).* In theory, these greater yields could result in land sparing (i.e., greater yields allow for more production on a smaller amount of land, thus "sparing" the additional land for other uses like conservation). To the extent the world can meet its vegetable oil needs from palm oil, that should mean it needs 5 to 10 times less land than would be required if it relied on other crops, meaning reduced pressure on forests. However, the reality is more complicated. Palm oil's high yields and high profitability are the main factors driving its growth, and deforestation has accompanied that growth. Seen from this perspective, palm oil's high yield–as well as the potential income from timber–is precisely what makes it so economically attractive to growers to cut down forests to expand palm plantations (Fisher et al. 2011). Nonetheless, increasing yields for vegetable oils could lead to global land sparing if combined


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Better management practices, like using legume cover crops, can help improve palm oil yields.

*All figures in this section are the world averages from the UN Food and Agriculture Organization's 2009 FAOSTAT data unless otherwise stated.

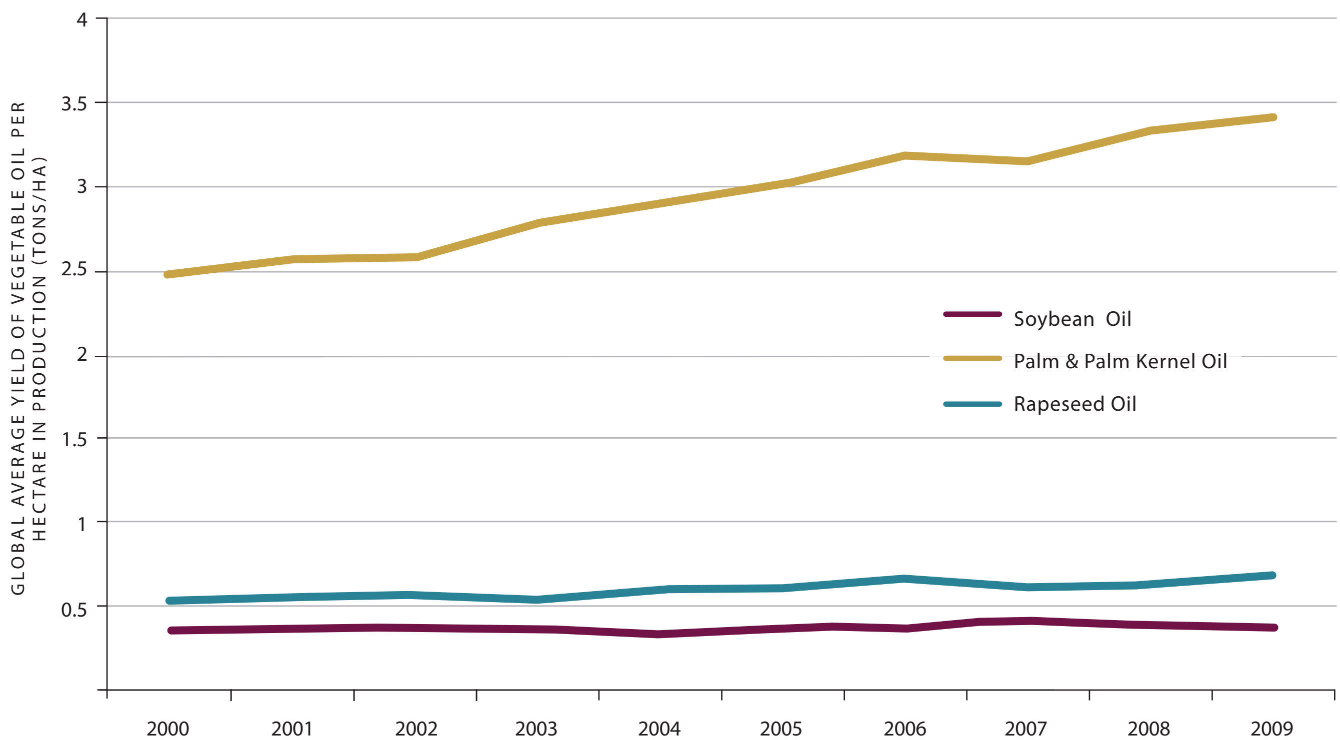
with policy changes and incentives for forest conservation (e.g., zoning regulations, strong land tenure, payment for ecosystem services).

So are yield improvements possible? The answer varies by commodity and geography. The doubling of palm oil fruit production from 2000 to 2009 was not so much due to the increase in yields as to the increase in the area of plantations, which expanded from 10 million to 15 million hectares. While palm oil yields increased 17 percent in the last decade, compared with 30 percent for rapeseed and just 3 percent for soy, this may have more to do with where expansion occurred rather than actual improvements in yield in the same soils (Figure 6). For all commodities, different countries are achieving dramatically different yields based on their level of agricultural technology, governance, education and other factors (i.e. climate, soil type). For rapeseed, yields in the European Union and Canada dramatically exceed those of China and India (Licker et al. 2010). There is a similar pattern for soy, with actual yields close to the current potential in North and South America, but a sizeable yield gap in China and India.

For palm, there seems to be significant potential for improvement. These come in two general forms: breeding/strain improvements and better management practices. Current advanced strains of palm oil in Malaysia, for instance, are achieving yields of 10 metric tons per hectare, compared with the national average of approximately 3.6 metric tons per hectare (Murphy 2007). Using these strains for new production in Malaysia and Indonesia and as additional countries enter the world palm oil market can expand their production while requiring less land. For areas with existing plantations, on the other hand, it is not practical to expect that new high-yielding strains will replace existing ones anytime soon. However, it is possible to achieve significantly higher yields from management practices alone. In Malaysia for instance, it is possible to get yields of six metric tons per hectare through improvement in how the crops are managed and harvested (Murphy 2007). Management practices such as removing rotting trunks of old trees that harbor the bracket fungus *Ganoderma* can reduce transmission of this lethal infection that is one of the main threats to yield. Even without reaching the levels of the most modern

Figure 6. **YIELDS OF PALM, SOY, AND RAPESEED OIL, 2000–2009**

While rapeseed and soybean oil yields remained relatively constant over the past decade, palm oil yields increased by 17 percent. Note that increases in the yield of oil involved both the productivity of the crop and the efficiency with which oil was extracted from it. Source: Calculated from FAOSTAT data.



Even without reaching the levels of the most modern plantations, an average 50 percent yield improvement would produce 18 million more tons of oil without cutting down one additional tree, fully meeting projected near-term needs without deforestation.

plantations, an average 50 percent yield improvement would produce 18 million more tons of oil without cutting down one additional tree, fully meeting projected near-term needs without deforestation (Sheil et al. 2009).

However, as discussed above, there are risks to forests from yield improvements. For instance, because improved yields can boost profitability, they can create a more attractive financial proposition for companies weighing the economic risks and rewards of converting forest into palm oil plantations (Angelsen and Kaimowitz 2001; Ewer 2009; Rudel et al. 2009). As an example, one study in Peru demonstrated that high-yielding producers were more likely to expand onto forestlands than were low-yielding ones (Gutiérrez-Vélez et al. 2011). Despite this complexity, combining yield improvements with forest conservation policies and incentives can produce real reductions in deforestation, such as those achieved by Brazil during the decade of the 2000s. They could also result in economic benefits: e.g., payments to landowners and governments under reduced emissions from deforestation and degradation (REDD+) programs could total $16 billion for Indonesia and Malaysia alone between 2013 and 2020, with significantly higher levels expected beyond then (Deveny, Nackoney, and Purvis 2009).

Technician at a palm oil breeding lab in Malaysia. Using high-yielding breeds can help increase production.

LAND TYPES AND DEFORESTATION-FREE EXPANSION

Despite the potential of yield improvements, vegetable oil production is still expected to grow in part through expansion onto additional lands (FAPRI 2009; Harris and Grimland 2011a, 2011b). Because of palm oil's relatively low cost and high yield, it is likely to form the bulk of expansion, followed by soy and other oils (Schmidt and Wiedema 2008). It has been estimated that the world will need between 6 million and 56 million additional hectares of palm oil to meet future demand, depending on how it is grown and how much demand is met with other vegetable oils (Corley 2009). The low estimate assumes improved yields, increased soy production, and low future demand, while the high estimate assumes current yield, no increase in soy and high demand; both explicitly exclude biodiesel demand (Corley 2009). It is important that this expansion happens with a minimal loss of biodiversity and the carbon stored in ecosystems.

Forests

There are many different types of land onto which vegetable oils can expand, and each type has its own set of advantages and disadvantages. Primary tropical forests are among the most biodiverse and carbon-dense of all ecosystems, and clearing of these forests causes major environmental damage that leads to important business risks. Clearing of Amazonian primary forest for the purpose of soy production, for instance, caused a major consumer backlash against companies involved and led to the eventual soy moratorium on Brazil (see Expansion into the Tropics, above). Likewise, consumer concern about the clearing of forests and peatlands for palm oil plantations is giving palm oil a bad reputation across Europe, North America, and elsewhere (*The Economist* 2010).

Secondary forests are also at risk as vegetable oils expand. Secondary forests are younger than primary forests and tend to be recovering from some sort of disturbance (e.g., selective logging or past agricultural use). While less diverse and carbon-rich than primary forests, secondary forests still have high amounts of biodiversity and carbon (Association for Tropical Biology and Conservation 2011). Often they have high carbon densities (i.e., amount of carbon per hectare), particularly if the previous disturbance was selective logging, in which only a fraction of the trees are removed (Saxon and Sheppard 2011).

Non-Forest Lands

Non-forest lands are often less carbon-rich and biodiverse than forests. They can include intact native ecosystems (e.g., grasslands, savannahs), existing agricultural land, and degraded land. Expansion into non-forest ecosystems poses some of the same challenges around carbon and biodiversity loss as forests, but usually to a lesser degree (Boucher et al. 2011).

Expansion onto existing agricultural land can occur when farmers choose to switch to oil crops from other crops, or when major producers of vegetable oils purchase more agricultural land and convert it to oil crops. This is likely to happen as demand for other crops decrease or as oil crops become more profitable. However, it is important to note that there can be indirect effects from the oil crop expansion: while oil crops may not be expanding directly onto forestland, the crops and livestock they displace may expand into forests (Barona et al. 2010; Arima et al. 2011).

Degraded Land

Several studies point out the advantages (e.g., availability, cost, carbon benefit) of expanding vegetable oil production onto degraded land (Fairhurst and McLaughlin 2009; Fairhurst, McLeish, and Prasodjo 2010; Danielson et al. 2009). According to the United Nations, “degraded land has been defined as land which due to natural processes or human activity no longer is able to sustain properly an economic function and/or the original ecological function” (FAO 2002). This definition leaves a lot of room for interpretation. For instance, degraded land could be previously cleared forestland that has become dominated by an invasive vegetation type such as introduced grasses or ferns, or on which soil has lost much of its productivity and has become

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Non-forest natural ecosystems, like the Cerrado savanna in South America, often have less biodiversity and carbon than tropical forests, but still have environmental value.

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While some lands, like this denuded hillside in Indonesia, are clearly degraded, the term is often used for lands that still have significant ecological value.

It is important to establish a threshold value for biodiversity and carbon densities on degraded land to determine whether expansion is happening in an environmentally responsible way.

incapable of regenerating to forest. Or, it could simply be partially logged forest, which if left undisturbed could revert back to a functioning forest. Given the range of land that can be considered "degraded," it is important to establish a threshold value for biodiversity and carbon densities on degraded land to determine whether expansion is happening in an environmentally responsible way (Fairhurst and McLaughlin 2009; Fairhurst, McLeish, and Prasodjo 2010). High Conservation Value assessments are one way to ensure biodiversity is protected, but this assessment does not include a carbon value.

However, even without a strict threshold for which land is "degraded" or not, there still seems to be ample non-forest land for expansion of vegetable oils. One study, for example, estimates there are between 97 million and 129 million ha of abandoned land (i.e., former crop and pastureland that has been abandoned due to degradation and agriculture reallocation) in the tropics (Campbell et al. 2008). Although not all this land is suitable for vegetable oil production, there seems to be ample abandoned land available to meet even the highest estimate (56 million ha; Corley 2009) of land needed for palm oil plantations.

Expansion of Palm

There is significant potential for expansion of palm oil throughout the tropics. Currently, the majority of palm oil is produced in Malaysia and Indonesia. Palm oil plantations cover 5.3 million ha in Malaysia (Hamzah, Malik, and Joseph 2011) and 7.5 million ha in Indonesia. Much of the future expansion in Malaysia is expected to come from wetlands in Sarawak province on Borneo (Hamzah, Malik, and Joseph 2011; Harris and Grimland 2011b).

Within Indonesia, much of the expansion of palm oil will likely occur on Sumatra, in the Kalimantan region of Borneo, and in Papua province on the island of New Guinea (Gunarso 2011). One study estimates that around 48 percent of new expansion (around 3 million ha) will come from forests in Sumatra and Kalimantan (Harris and Grimland 2011a).

Although, as mentioned above, estimates of degraded land vary (as does the application of the term "degraded"), there appears to be a considerable amount of degraded land in Indonesia that is suitable for palm expansion. Estimates of degraded land in Indonesia range from 6 million ha to 40 million ha (World Resources Institute 2010). According to one study, around 8.4 million ha of degraded land available in Indonesia are dominated by the invasive grass *Imperata cylindrica* (known as Cogon, *alang-alang* or *ilang-ilang*) (Garrity et al. 1997). Although *alang-alang* is hard to clear, it is possible to do so through a combination of methods (mechanical and herbicidal). Establishing palm plantations on *alang-alang* lands is often cheaper than establishing them on forestlands, since clearing the *alang-alang* is less costly than clearing and removing low-value trees. An analysis of an oil palm estate in Kalimantan found that the cost of establishing a plantation on *alang-alang* land was $270 cheaper per hectare than

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Degraded grasslands, such as these in Indonesia, offer a low-carbon, low-biodiversity alternative to forests for palm oil expansion.

establishing it on secondary forest and $960 cheaper per hectare than replacing peatland (Fairhurst and McLaughlin 2009).

A major hurdle for the extensive use of *alang-alang* lands is the issue of ownership. While much of the forestland in Indonesia is owned (at least nominally) by the government, which makes it available for oil palm development at a low price, *alang-alang*-dominated lands are often owned by local peoples, so companies are required to gain rights to the land either through direct purchase or through land swaps. Technically, land developers must get free and informed consent from local and indigenous populations, regardless of land type. However, this step is not always carried out in practice. A further complication is that the initial income from the sale of timber gathered from clearing the forest provides companies with a financial incentive to clear forestland (Fisher et al. 2011).

Palm oil can be grown in most parts of the moist tropics, thus there is significant potential to expand into Africa (where the oil palm tree is native) and tropical Latin America. The governments of Brazil and many African countries have expressed interest in increasing palm oil production. It is important that no matter where palm oil expansion takes place, it be carried out in a way that minimizes forest loss.

Expansion of Soy

The amount of land the United States and China use to produce soybeans is expected to remain fairly constant over the next seven years (IFPRI 2009). However, the leveling-off of soy production over that last decade in the United States has meant that expansion of soy happened mostly in other countries.

Outside the United States, Brazil and Argentina are the next two largest producers of soy. Argentina is expected to see a large expansion, possibly surpassing the United States in terms of production by 2030 (Masuda and Goldsmith 2009). Soy expansion in Argentina currently replaces natural brushland and existing cattle pastures with some expansion into tropical dry forest in the north, and these patterns are expected to continue (Grau, Aide, and Gasparri 2005). While expansion onto native ecosystems should be avoided, dry tropical scrublands are less biologically diverse and carbon-dense than humid forests, and thus may be a better option in situations where yield gains, efficiency improvements, and conservation incentives are not sufficient to stop unnecessary expansion into native ecosystems (Dirzo et al. 2011).

SUBSTITUTING FOR HIGH-DEFORESTATION OILS

The previous two sections demonstrated how vegetable oil production can be expanded without increasing deforestation. However, while the soy industry has dramatically reduced deforestation, the palm oil industry has made relatively little progress. Forest and carbon losses from palm oil expansion remain high, and there is a very limited supply of deforestation-free palm oil available. Currently there is no way to guarantee that the majority of the palm oil supply is deforestation-free.

Until businesses demand improvements in the palm oil industry and increased transparency in the supply chain, corporate and consumer users of vegetable oil who want to ensure that their purchases are not driving deforestation may use other oils as alternatives. Other deforestation-free vegetable

USDA/Scott Bauer

Deforestation-free vegetable oils can be found for a variety of products.

Until businesses demand improvements in the palm oil industry and increased transparency in the supply chain, corporate and consumer users of vegetable oil may use other oils as alternatives.

oils are widely available and easily substitutable as a short-term solution. In the long run, however, without strong government regulations and business practices to protect forests, increasing demand for any vegetable oil could still cause deforestation.

Food Substitutes

Different fats and oils may be substituted for palm oil, depending upon which functional property a food product requires. Products such as spreads (particularly margarine and similar products), dairy products, and confectionary products with melt-away texture require oil that melts at body temperature (Mag 1995). Tropical oils can produce this desired effect, but this may lead to deforestation. The healthiest, deforestation-free substitutes for products like these are vegetable oils derived from corn, soybean, cottonseed, canola, and sunflower, blended and inter-esterified (a process in which the fatty acids in oil are rearranged). Such blends can also be used for cookies, crackers, and pastries, which generally require a fat that is solid during mixing and has a long shelf life (Mag 1995). Animal fats (e.g., butter, lard) could also be used if the product is not intended for vegetarians or vegans, but these also raise health and other ecological issues (Schaefer 2002; de Vries and de Boer 2010).

Producers of commercially fried products such as potato chips, savory snacks, fried meats, french fries, and doughnuts generally require fats or oils with a high smoke point, high levels of oleic acid, and low levels of linoleic and linolenic acid to keep them from turning rancid. To address health concerns, they also look for oils that have no *trans* fatty acids and are low in saturated fat (Mag 1995). In these products, vegetable oils such as corn and cottonseed can be suitable. Several oils with high oleic acid or low linoleic and linolenic acid levels, which make them slower to spoil, have been recently introduced into the market (AAK 2011; Dupont 2010). These options will also work for food-service frying for products such as fried meats, french fries, doughnuts, and onion rings (Mag 1995).

Non-Food Substitutes

Palm oil is an important ingredient in many soaps, shampoos, conditioners, cosmetics, and industrial products (Hayes et al. 2009). The cosmetics industry uses approximately 6 to 7 percent of the global supply of palm oil (Butler 2009).

However, the oleochemicals derived from palm oil can be produced from other deforestation-free fats and oils.

Sodium dodecyl sulfate (SLS) is used to remove oily residues or stains and is found in many products such as floor cleaners, car wash soaps, and engine degreasers. It also has a thickening effect and the ability to create a lather, and is therefore used in many toothpaste, shampoo, shaving foam, and bubble bath formulations. While palm oil is frequently used in the production of SLS, an alternative source is coconut oil (Smulders et al. 2002). However, coconut oil is also a tropical oil, so rapid expansion in its production could have some of the same effects as expansion of palm.

Because of their high smoke points, stearic and palmitic acids are used to make soap and also to produce the pearly effect found in many shampoos, soaps, and other cosmetic products such as shaving cream. Palm-based palmitic acid can be replaced with stearic acid produced from many animal fats and vegetable oils, and is found more abundantly in animal fats as well as in shea and cocoa butter than in most other vegetable oils (Moharram et al. 2006).

Lauric acid is used to produce soap and is also used in other cosmetics, and can be extracted from coconut oil as a replacement for palm kernel oil (Young 1983).

OIL REPLACEMENT BY NEW SOURCES

Some of the current uses of vegetable oil can also be replaced with non-oilseed crops, ranging from the familiar to the high-tech. In the biodiesel sector, government policy can have a major impact on how much biofuel comes from ethanol blended with gasoline versus biodiesel blended with diesel. While most biodiesel comes from vegetable oil, there are also technologies being scaled up to convert sugar or grain directly into diesel fuel replacements, which may be a more efficient way of making biodiesel. The company Solazyme is using algae to convert sugar to biodiesel and jet fuel, chemicals, or consumer products. They have recently performed a demonstration project and were awarded contracts to provide the U.S. Navy with fuel. Another company, Amyris, uses microbes to convert sugar into diesel and jet fuel, as well as cosmetics, lubricants, and other chemicals (Lane 2011; Solazyme 2011; Emerging Markets 2011).

Further in the future there is potential to replace the sugar or grain used in these processes with biomass produced from agricultural waste materials or from non-food crops like switchgrass or miscanthus. Finally, there are startup companies claiming they can produce oil for use as fuel, animal feed, or chemicals from algae or other aquatic organisms, without any use of cropland and with potentially very high yields. These aquaculture approaches have yet to prove that they are cost-effective at large scales, and may also have other resource constraints associated with water and nutrient use, but they suggest that the opportunities for innovation are many (Mata, António, and Caetano 2010). However, their uptake and commercialization will largely depend on cost and policy frameworks for support of biofuels.

Perennial grasses, like miscanthus, have the potential to be used for biofuel production.

CHAPTER THREE

Policies and Solutions

This report identifies ways that businesses can keep using and producing vegetable oils without clearing additional forests. The options include improving crop yields, using non-forest lands in tropical forest countries, and using various deforestation-free vegetable oil alternatives. Businesses and governments can also ensure that their policies, practices, laws, and regulations are designed to keep vegetable oil production deforestation-free.

BIODIESEL MANDATES

Government biofuel mandates are important in creating demand for vegetable oils around the world. Driven by such mandates, biodiesel production increased from 2.3 billion liters in 2004 to 14.7 billion liters in 2008, an annual average growth rate of 50 percent (Figure 7). These policies have been put in place to reduce oil dependence, address climate change, and expand demand for agricultural products. While there is no doubt that biofuel polices are reshaping agricultural demand and having a small impact on fossil fuel use, their impact on the climate is unclear. The global biofuels market is expected to reach 227 billion liters by 2022, raising concerns about the impact on food prices, feedstock production, land conversion, and carbon emissions.

Global biodiesel production increased from 2.3 billion liters in 2004 to 14.7 billion liters in 2008, an annual average growth rate of 50 percent.

Scope of Biodiesel Mandates

While 21 countries have a biodiesel mandate, the combined biodiesel mandate from the EU countries is the largest. In the European Union, biodiesel is the predominant type of biofuel, while ethanol is more significant in the rest of the world. The renewable energy directive of the European Union specifies a 10 percent renewable energy content for the transportation sector by 2020, with 8.8 percent coming from biofuels and the rest from other renewables, such as electrification of the fleet. Seventy-two percent of those biofuels will be biodiesel, according to the plans of the EU countries (IEEP 2011). European Union biofuel mandates are one of the components of the EU's commitment to reduce its emissions 20 percent by 2020. The mandates require both mandatory reductions in climate change compared with fossil fuels and restrictions on the types of land on which biofuels may be grown (CEC 2008). Outside the European Union, mandates in the United States, Brazil, and China also add to global demand.

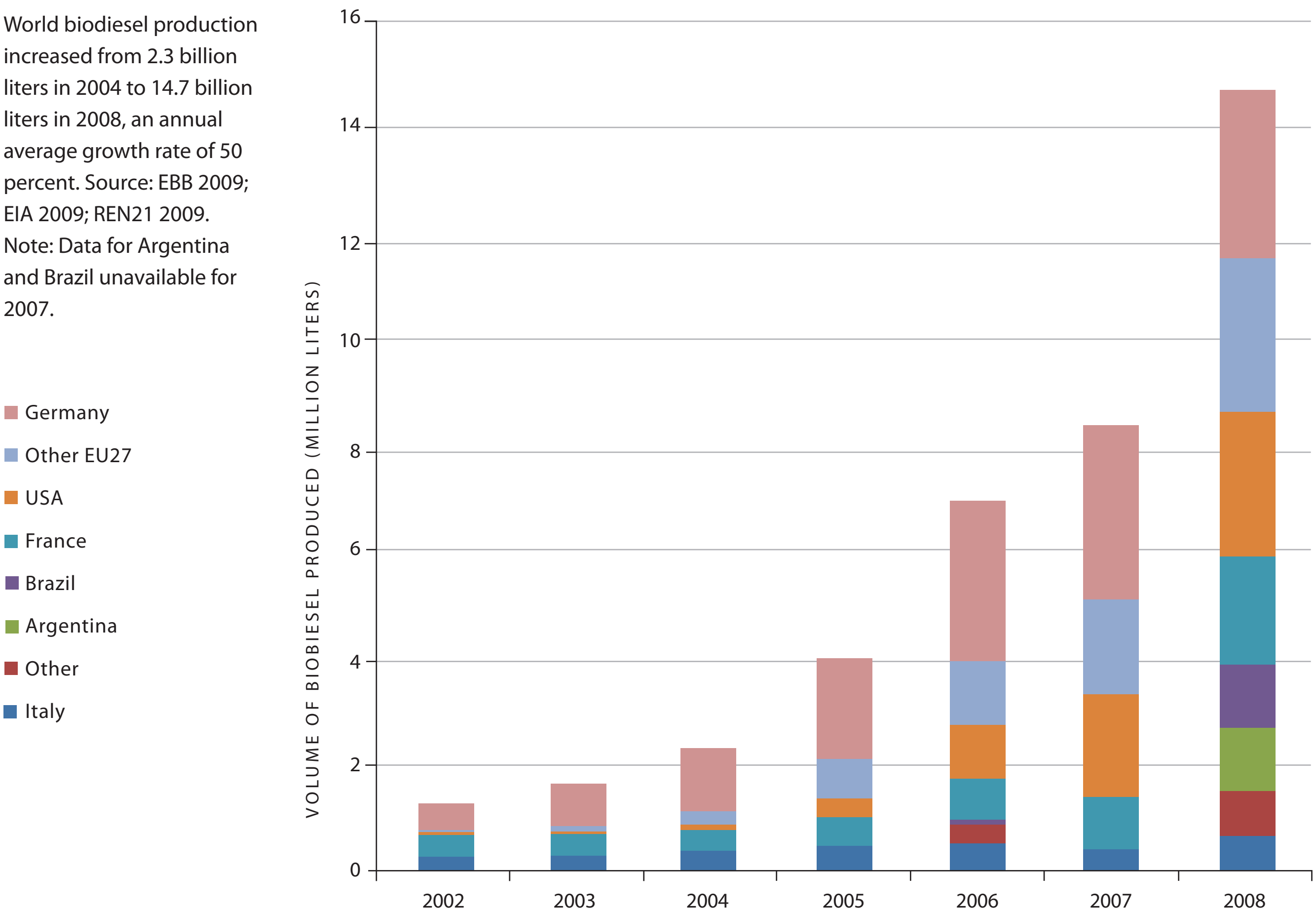
Recent studies of biofuel policies find that expansion of the EU's mandate would lead to a significant increase in the global production of oilseeds. While much of the vegetable oil to produce EU biodiesel is likely to be produced within the European Union (Al-Raffia, Dimaranan, and Laborde 2010; Timilsina et al. 2010; Gohin 2009), the expanded demand for vegetable oil would be felt worldwide, and would also expand production of oilseeds in Brazil and elsewhere (Bouet, Dimaranan, and Valin 2010).

Price Effects of Biodiesel Mandates

The additional demand for crops driven by global biofuels policies has significant implications for global food prices, which in turn may affect food security. According to some economic models, fulfilling mandates already announced by developing and developed countries could increase crop prices by 30 percent in 2020 compared with a scenario with no biofuel mandates (Fischer et al. 2009). However, the impact of biofuels on food prices depends, in part, on which biofuels are produced. Generally, the use of vegetable-oil-based biofuels has the largest impact on food prices, with grain crops (corn and

Figure 7. WORLD BIODIESEL PRODUCTION, 2001–2008

World biodiesel production increased from 2.3 billion liters in 2004 to 14.7 billion liters in 2008, an annual average growth rate of 50 percent. Source: EBB 2009; EIA 2009; REN21 2009. Note: Data for Argentina and Brazil unavailable for 2007.



wheat) having a smaller impact, sugar crops (sugar cane and sugar beets) smaller still, and biomass crops (e.g., switchgrass, miscanthus), which are not widely in use today, expected to have the smallest impact (Fischer et al. 2009; Laborde 2011).

Climate and Land Use Effects of Biodiesel Mandates

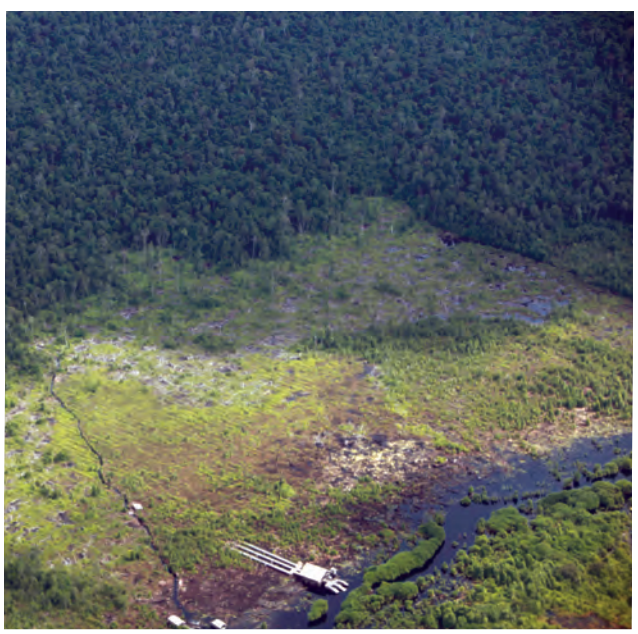
The major driving force behind these biodiesel mandates is the reduction of heat-trapping gases by replacing fossil fuels with low-carbon fuels. However, the expansion of biofuel production can lead to land use changes if forests and grassland are cleared to plant more biofuel crops, which in turn releases carbon emissions. Global biofuels programs will result in increased pressures on land supply and can increase carbon emissions from land use change (Melillo et al. 2009).

Numerous studies have analyzed the impact of carbon emissions resulting from land use change for biodiesel production. While carbon emission impacts vary by scenario, the worst impacts occur when tropical forests are cut down and peatlands are drained to produce a biofuel feedstock such as palm oil. In this case, the potential climate change benefit of producing the biofuel is dwarfed by the additional emissions from deforestation (Page et al. 2011). Depending on the type of forestland cleared, the emissions from clearing the land can be 86 to 600 times as large as the annual emissions savings from replacing fossil fuels with the biofuel (Danielson et al. 2009; Fargione et al. 2008). Furthermore these calculations do not account for other problems caused by deforestation, such as the loss of biodiversity.

When tropical forests are cut down and peatlands are drained to produce a biofuel feedstock such as palm oil, the potential climate change benefit of producing the biofuel is dwarfed by the additional emissions from deforestation and peatland destruction.

Evaluating the magnitude of indirect emissions caused by biofuels expansion requires global agricultural economic models that estimate how producers around the world react to changes in demand and how increased demand for agricultural land influences land use changes. Early estimates of these indirect effects focused on corn ethanol in the United States (Searchinger et al. 2008) and relied on land use trends from the 1990s to estimate where new land for agriculture would be found.

The modeling of indirect land use emissions from biofuels is improving, with more sophisticated treatment of the markets for biofuels and the closely related animal feed market, and more up-to-date and detailed data on changes in land cover around the world (ERS 2011). The most recent analyses suggest that the impact of these indirect emissions for biodiesel is large enough to eliminate most or all of the climate change benefits of using biodiesel in place of fossil diesel (Laborde 2011). To the extent that biodiesel mandates contribute to palm oil expansion into tropical forests, and especially peatlands, these biodiesel mandates will fail to reduce carbon emissions. If vegetable oil expansion can be constrained to non-forested land, the opportunities to produce truly low-carbon biodiesel will greatly expand.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Clearing of carbon-rich peatlands leads to massive carbon emissions, making some palm oil extremely unsustainable.

ROUNDTABLES AND CERTIFICATIONS

Voluntary sustainability certification schemes and roundtables for palm oil, soy, and biofuels (i.e., voluntary organizations of supply chain stakeholders and non-governmental organizations formed to address the social and environmental impacts of their products) can help businesses find standards to achieve their environmental and social goals when using vegetable oils. However, businesses will need to ensure that standards in the roundtables are strong enough to ensure the products they buy are deforestation-free. Or businesses can create their own policies and practices that go above and beyond those of the roundtables. Not all certification schemes have standards that ensure the goods they certify as "sustainable" are deforestation-free.

The Roundtable on Sustainable Palm Oil

The Roundtable on Sustainable Palm Oil (RSPO) is an association that brings together stakeholders from the palm oil industry including oil palm producers, palm oil processors or traders, consumer goods manufacturers, retailers, banks, investors, and environmental, conservation, and social non-government organizations to develop and implement global standards for sustainable palm oil (RSPO 2009). The RSPO offers a voluntary certification scheme for palm oil growers and

While the RSPO standards for certification address many important issues, there are currently no standards to directly address carbon emissions, leaving shallow peat forests and secondary forests (both potentially significant sources of carbon) vulnerable to palm oil expansion.

the palm oil supply chain, resulting in "certified sustainable palm oil." However, while the RSPO standards for certification address many important issues, there are currently no standards to directly address carbon emissions, leaving shallow peat forests and secondary forests (both potentially significant sources of carbon) vulnerable to palm oil expansion (RSPO 2007). Throughout 2012, the RSPO's Executive Board will be considering changes to its standards, which are scheduled to be voted on by RSPO membership in late 2012. This provides an important opportunity for businesses and other stakeholders to weigh in and ensure that the standards are strengthened. The Greenhouse Gas Working Group within the RSPO has made recommendations to the Executive Board that have the potential to address these significant holes in the sustainability standards of the RSPO if implemented correctly (RSPO 2011).

The credibility of roundtables depends on the strength of the standards and transparency through all points in the supply chain, and businesses fulfilling their public commitments to buy certified goods.

Additionally, there are some concerns about RSPO members not complying with the current standards, and there are many disputes ongoing between RSPO members and local communities through the established RSPO grievance procedure. Until the RSPO standards are stronger and properly implemented, it is not enough for a business to use RSPO-certified palm oil and claim it is using deforestation-free oils. The credibility of the RSPO brand depends on the strength of the standards and transparency through all points in the supply chain, and businesses fulfilling their public commitments to buy certified palm oil. Currently, businesses are only purchasing about half the available RSPO-certified palm oil, which is hurting producers who have already invested time and money to become certified. This investment by producers and the large number of businesses that have joined the RSPO represents one of the biggest opportunities to transform the palm oil supply chain. However, businesses and growers must go above and beyond current RSPO standards to achieve deforestation-free palm oil with a small carbon footprint and work within the RSPO to urge the adoption of stronger standards so that forests are protected and carbon emissions are minimized.

The Round Table on Responsible Soy

The Round Table on Responsible Soy Association (RTRS) joins producers, industry, trade, finance, and civil society actors in an initiative that promotes the use and growth of responsible production of soy, through the commitment of the main stakeholders of the soy value chain and through a global standard for responsible production (RTRS 2011). The RTRS standard addresses deforestation and includes guidance to prevent soy cultivation from replacing forests. This has the potential to provide assurances of deforestation-free soy, but businesses should still ensure they are verifying that their supply chain is deforestation-free.

The Roundtable on Sustainable Biofuels

The Roundtable on Sustainable Biofuels (RSB) is an international initiative that brings together farmers, companies, non-governmental organizations, experts, governments, and inter-governmental agencies concerned with ensuring the sustainability of biofuels production and processing. The RSB has developed a certification system for "sustainable biofuels," but it only includes guidance for addressing direct land use change emissions, and leaves the indirect land use change emissions to government mandates (RSB 2010). Much of the deforestation that occurs as a result of biofuel use comes because of indirect land use change, and not all government regulations accurately account for these emissions. Thus, RSB certification alone is not sufficient to ensure that biofuels are not contributing to deforestation.

There are many other sustainability initiatives for vegetable oils that have varying standards. Businesses should set their own policies and practices for deforestation-free vegetable oils and require that growers meet them, rather than simply relying on the standards set by these multi-stakeholder initiatives. While certification standards are important and have very strong potential to shape the market, they need to be strengthened before they can be used as the sole environmental criteria.

Government-Mandated Sustainable Production

Governments in Southeast Asia are also involved in making policies that will require palm oil production in their countries to meet national sustainability standards in order to address growing global demand for better palm oil and to compete with standards like the RSPO's for a share of the sustainable market.

For example, Indonesia has begun work on a national program and certification called Indonesian Sustainable Palm Oil (ISPO). All palm plantations in Indonesia will be required to comply with ISPO standards by 2014 (Yulisman 2011). Furthermore, Indonesia's President Yudhoyono made a commitment to reduce the country's carbon emissions 26 percent or more by 2020, including a two-year moratorium on new concessions for the conversion of primary forests and peatlands (Saxon and Sheppard 2011). ISPO standards should follow the president's commitment, but because the commitment still allows for secondary forests to be cleared for palm oil plantations, ISPO palm oil would not be deforestation-free.

However, the Indonesian government could tighten this standard to meet the growing demand for deforestation-free palm oil.

Additionally, there have been various news reports of the Malaysian government working on a similar scheme for palm oil grown within Malaysia (Koswanage 2011). Government officials have said they are looking into the market demands, and if the market demands no deforestation, they will ensure that they have standards that allow their palm oil to meet that demand. This could be a good opportunity for Malaysia to grab a large share of the emerging deforestation-free palm oil market.

Labeling Regulations

Empowering consumers with the knowledge of what vegetable oils are in the products they purchase can help them make smarter choices and demand information from companies about how and where these oils are grown.

In the United States, food product manufacturers are required to include the types of vegetable oils used by their most common name (e.g., soy, palm, or sunflower oil) following the term “vegetable oil” on packaging (FDA 2011). In non-food items, generally the scientific term for the final refined ingredient is listed, which many consumers cannot easily identify as being a product created from a vegetable oil, and may require customers to contact manufacturers directly to obtain more information.

The European Union passed legislation in July 2011 aimed at providing consumers with clearer information on the content of products. One piece of that law will require the types of vegetable oils to be listed on product labels, similar to the laws in the United States. This will begin to go into effect in 2014 (Europa 2011).

Consumers will be able to use the knowledge that palm oil and other oils are in the products they buy to ask manufacturers to commit to using deforestation-free vegetable oils and/or switch to other vegetable oils that do not have a direct link to forest destruction.

BUSINESSES LEADING THE WAY

In part responding to public campaigns (Box 2), businesses across the globe have started to make commitments to net-zero deforestation supply chains. These businesses are forging the way to a new market by demanding deforestation-free vegetable oils and/or switching away from oils like palm that are associated with deforestation, until changes occur in the way they are grown.

In early 2010 Nestlé, the world’s largest food company, pledged to ensure that its products do not have a deforestation footprint after facing strong consumer pressure.

For example, in early 2010 Nestlé, the world’s largest food company, pledged to ensure that its products do not have a deforestation footprint after facing strong consumer pressure. Specifically, Nestlé has defined specific guidelines for sourcing products that can be associated with deforestation, such as palm oil and soy, timelines and goals for achieving this, and implementation of third-party verification (Nestlé 2011). Nestlé has been able to address one of the major hurdles that companies who want deforestation-free palm oil are facing—traceability—by working with The Forest Trust, a nonprofit organization that helps companies deliver responsible products, to trace its supply chain back to the plantations where the palm oil is grown, and to demand palm oil that meets higher standards. In setting these ambitious goals, Nestlé has set itself apart from many other companies.

Following Nestlé’s lead, the Consumer Goods Forum, a CEO-led organization of more than 650 consumer goods manufacturers and retailers, pledged in late 2010 to mobilize its collective resources to help achieve zero net deforestation by 2020 (CGF 2010). It pledged to develop specific, time-bound, and cost-effective action plans for the different challenges in sourcing commodities like palm oil in a sustainable fashion. The leaders of the Forum’s sustainability program stated that their industry has a responsibility to purchase these commodities in a way that encourages producers not to expand into forested areas (CGF 2010). The Forum is co-chaired by Unilever and Tesco and includes many brands that consumers are familiar with, such as Coca-Cola, General Mills, Johnson & Johnson, Kellogg, Kraft, Kroger, L’Oreal, Nestlé, PepsiCo, Procter & Gamble, Sara Lee, Tesco, and Wal-Mart. The Forum plans to achieve this goal both by individual company initiatives and by working collectively in partnership with governments and NGOs. Many members of the Forum are already moving forward on individual pledges and work toward achieving zero-deforestation supply chains.

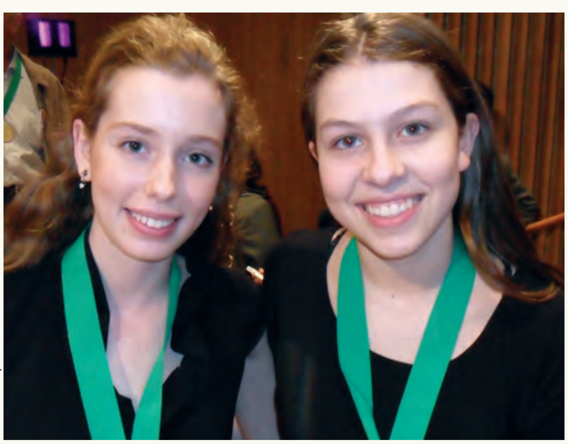
Box 2

Girl Scouts vs. Girl Scouts

When Kellogg's announced in spring 2011 that it was taking steps to address its palm oil in everything from Frosted Flakes to Girl Scout cookies, it represented an enormous achievement for two 15-year-old girls from Michigan.

Madison Vorva and Rhiannon Tomtishen of Ann Arbor, MI, are Girl Scouts who began researching orangutans when they were 11 years old for their Girl Scout Bronze Medal. In their investigation, they discovered that a major threat to the survival of orangutans is the clearing and burning of Southeast Asia's rain forests for palm oil. They were doubly shocked when they found out that palm oil was an ingredient in the Girl Scout cookies that their troop sells to raise money for the organization.

The girls worked on their campaign to make Girl Scout cookies deforestation-free for three years, but were not able to achieve any policy changes within the Girl Scouts USA organization. Seeking help, Madison and Rhiannon reached out to national organizations and received support and media connections to draw national attention to their campaign.



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Madison Vorva (left) and Rhiannon Tomtishen

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Pretty soon, Madison and Rhiannon were on the front page of the *Wall Street Journal*, as well as on National Public Radio, ABC News, *CBS Early Show*, PRI's *The World*, and many other publications large and small across the country and around the world. More than 80,000 people, including many Girl Scouts and Girl Scout alumni, signed online petitions to the Girl Scouts and its suppliers urging the organization to get deforestation out of its cookies. The granddaughter of Girl Scout cookie inventor Ethel Jennings Newton even joined the campaign.

This energy and momentum delivered results: soon Rhiannon and Madison were in New York City meeting with Girl Scouts USA CEO Kathy Cloninger and insisting the company find deforestation-free alternatives. They got a boost when Kellogg's made an announcement in 2011 that it would purchase GreenPalm certificates—certificates companies can buy to help support RSPO-certified sustainable palm oil growers, but do not actually result in any change in the palm oil used in their products—for its entire product line and look to reduce palm oil use overall. Although GreenPalm certificates support RSPO-certified sustainable palm oil production, they do not fully address deforestation. Madison and Rhiannon remain committed to pushing forward with their campaign until Girl Scout cookies are deforestation-free. The girls have provided education and inspiration to people across the United States to stand up for forests and demand deforestation-free goods. In February 2012, the girls' long efforts were recognized when the United Nations Forum on Forests honored them with the first-ever UN Forest Heroes award.

The large demand from Nestlé for deforestation-free palm oil and strong consumer pressure has led to change on the ground as well. Golden Agri-Resources (GAR), the world's second-largest palm oil plantation company, lost several of its major clients including Nestlé and Unilever in 2009 as a result of consumer outrage at accusations that GAR was clearing forests and draining peatlands to grow the palm oil (Unilever 2009). In response, GAR developed a forest conservation policy that aims to ensure it has "no deforestation footprint," and began working with The Forest Trust to ensure it was meeting the standards of Nestlé and other companies (GAR 2011). Because of this commitment, and actions to reach the end goal of a "no-deforestation footprint," both Unilever and Nestlé have again begun purchasing palm oil from GAR (TFT 2011; Unilever 2011). If GAR's progress is verified and it is able to continue down this path and supply deforestation-free palm oil, it will have a market advantage. GAR is on track to being a large-scale example proving that palm oil plantations can adopt higher standards and go deforestation-free.

A RECIPE FOR SUCCESS

Currently the vegetable oil market is in conflict with tropical forests, but this does not have to be the case. Although only two vegetable oils (palm and soy) have directly caused tropical deforestation during the last decade, increased demand for any oil can potentially increase tropical deforestation. As this report has shown, there are many ways to substitute across oil sources. If world demand for vegetable oils goes up, so will world supply–and given the economics, most of the new supply will come from palm oil.

There are, however, ways that companies involved in the vegetable oil supply chain can help ensure their oils are deforestation-free.

Recommendations for Producers

Improve yields. Palm oil producers should improve yields through a combination of using high-performing breeds (for new and expanding production) and better plantation management practices (for all plantations). Soy and rapeseed oil producers, especially those outside of the Americas and Europe, can also improve their yields.

Expand only onto non-forest land. New production should only expand onto low-carbon and low-biodiversity non-forest lands. Plantation developers should work with current landowners (and social NGOs) to acquire the rights to the extensive areas of degraded lands in a way that is fair to local and indigenous populations.

Recommendations for Corporate Buyers

Commit to sourcing and selling deforestation-free products. Whether a company sells vegetable oil directly to consumers, uses them in its products, or is a processor of vegetable oil, it should make a strong and public commitment to using deforestation-free oils. By setting their own practices and joining and helping strengthen the current certification bodies, businesses can signal their strong support for a deforestation-free supply chain.

Establish relationships for suppliers. Companies further up the supply chain should develop strong relationships with their suppliers to help ensure they are meeting their deforestation-free commitment. This includes not only monitoring to ensure that suppliers are meeting standards, but also offering assistance to help meet standards when needed. It is not enough to join a certification body, or establish policies; business must be actively involved to ensure standards are upheld.

Companies that buy vegetable oils can switch to deforestation-free oils. If food and cosmetic manufacturers are not able to find deforestation-free sources of soy or palm oil, they can switch to vegetable oil inputs that do not directly cause deforestation (e.g., corn, sunflower, rapeseed). This will send a clear market signal to producers of vegetable oils that deforestation is no longer an acceptable business practice.

Recommendations for Governments

Establish biofuel regulations that support forests and reduce emissions. Biofuel policies must meet three criteria to be sustainable: they should completely account for the impact of biofuel production on agriculture and forestry, including indirect impacts; they should steer demand toward sustainable sources, using labeling and certification or other mechanisms; and the scale of biofuel policies must be constrained by the scale of the resource, consistent with demand for food and the preservation of forests and protection of the broader environment.

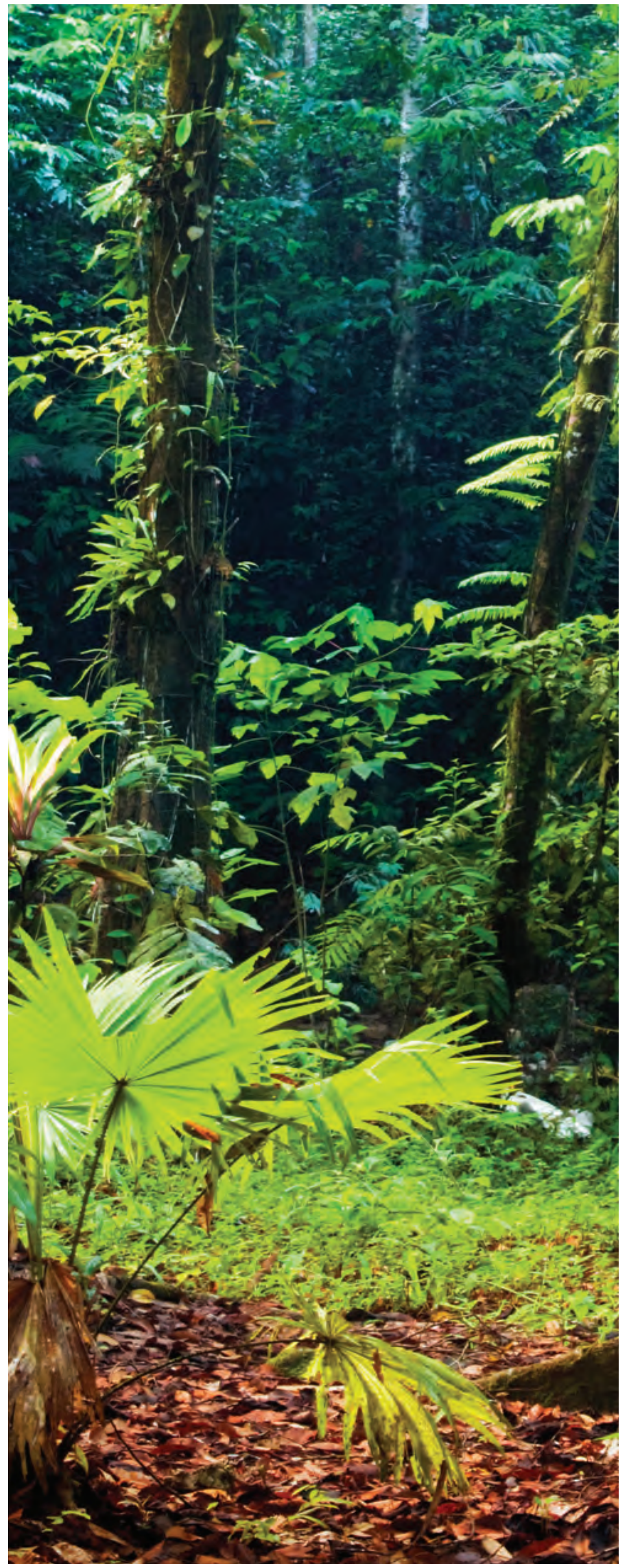
Enforce strong agricultural zoning. Governments can help ensure that companies stay deforestation-free by establishing (and enforcing) strong agricultural zoning laws. Discouraging agricultural development in and near forests, and allowing for the quick, easy, and fair transfer of rights for non-forest lands can help ensure that vegetable oil expansion happens with a minimal loss of forest and carbon.

Recommendations for Consumers

Buy deforestation-free. Whenever possible buy products that are deforestation-free.

Demand deforestation-free. Write to companies or join public campaigns to demand that businesses use and produce deforestation-free vegetable oils. Get companies to make public declarations to go deforestation-free, and then hold them to their word.

Vote deforestation-free. Consumers can tell their elected representative that they want laws and regulations that support deforestation-free development. Push for biofuel regulations that actually reduce emissions and keep pressures off forests. No single option is the complete solution on its own. Every stakeholder along the supply chain must use a combination of these practices and push for strengthened policies to ensure production of deforestation-free vegetable oil. With the right combination, we can meet the future demand for vegetable oils while still protecting the planet's tropical forests.



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Recipes *for* Success

SOLUTIONS FOR DEFORESTATION-FREE VEGETABLE OILS

Vegetable oils are used in thousands of products, ranging from cooking oils and processed foods to shampoos and cleaning products. Increasingly, driven by government mandates for biofuels, they are also used to fuel cars, trucks, and in the future, even airplanes.

The rapid expansion of the vegetable oil market over the last decade has not only affected the global economy, but also the atmosphere and ecosystems. Much of the new production land, particularly for soy and palm oil, has come at the expense of tropical forests. This loss of tropical forest means a loss of precious biodiversity and ecosystem services.

In order to minimize the environmental impacts of their operations and to address the growing demands from global consumers for deforestation-free products, businesses today are searching for alternative sources and modes of production of vegetable oil.

This report is one of a series that examines the vegetable oil, meat, and wood products markets and details how businesses and governments can ensure their products and policies are deforestation-free.

This report is available on the UCS website at *www.ucsusa.org/deforestationfree.*

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