The Little Book of Big Deforestation Drivers

GCP
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24 catalysts to reduce tropical deforestation from 'forest risk commodities'

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The Global Canopy Programme is a tropical forest think tank working to demonstrate the scientific, political and business case for safeguarding forests as natural capital that underpins water, food, energy, health and climate security for all.

GCP works through its international networks – of forest communities, science experts, policymakers, and finance and corporate leaders – to gather evidence, spark insight, and catalyse action to halt forest loss and improve human livelihoods dependent on forests.

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We are continually aiming to improve the Little Book of Big Deforestation Drivers and your feedback is welcome.

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History shows us that deforestation is correlated to a country's economic development. Forests are converted to goods such as food, timber, and fuel wood in the early stages of economic growth, and exploited for high value commodities such as minerals, biofuels, and oil and gas in the later stages of development. These actions have led to the loss of 50% of the world's topical forests, impacting the livelihoods of the forest dependent communities, reducing biodiversity, and adding significant amounts of greenhouse gas emissions to the atmosphere.

Indonesia is home to the second largest natural tropical forests on the planet. Wanton destruction of our natural resources has given our country the unflattering distinction of being the world's largest emitter of greenhouse gases from land use activities, deforestation, and forest degradation. President Susilo Bambang Yudhoyono boldly addressed this challenge when he made a commitment to reduce emission by 41 percent with the support of the international community, making Indonesia the first developing country to voluntarily commit to reduce its greenhouse gas emissions significantly.

To this end, Indonesia has entered a partnership with the Government of the Kingdom of Norway for the reduction of emissions from deforestation and forest degradation (REDD+). For Indonesia to realise ambitious national emission reduction targets, and to implement a successful national REDD+ programme, the underlying drivers of deforestation must be addressed. I thank the continued efforts of the UN System, through the United Nations Office for REDD+ Coordination in Indonesia (UNORCID) in facilitating dissemination of vital information in Bahasa Indonesia. Thank you, also, to the Global Canopy Programme for producing the original The Little Book on Big Drivers of Deforestation.

Expanding access to information on the global drivers of deforestation equips Indonesia with powerful knowledge to change the relationship between forests and society. Without sustainable management of the former, the latter cannot survive as we know it. The publication of this book in Bahasa Indonesia increases the understanding of all stakeholders on the drivers of deforestation, and enhances decision maker's ability to implement solutions that address the heart of the complex issue of deforestation.

May this book series continue to inspire Indonesian policy makers and citizens alike to ensure that our nation's future is a sustainable, equitable, and prosperous one.

ANDREW MITCHELL

FOUNDER AND DIRECTOR, GLOBAL CANOPY PROGRAMME

Tropical deforestation has been occurring on an industrial scale for decades, driven initially by demand for timber. However, the impact and complexity of its causes have evolved immensely as forests are increasingly cleared not just for wood, but also for land on which to grow other commodities. Large areas of the Amazon have now been cleared for cattle ranching and soya production, and in Asia, peatland forests are being converted to oil palm plantations. Whilst standing forests appear to be economically valueless, their conversion for agribusiness can deliver astonishingly high returns on investment. Africa is being targeted by investors hungry for cheap land; much of its forest could be felled for agriculture to feed the world's growing populations.

Huge economic benefits have accrued to nations that have deforested, but the benefits have not been evenly spread, and some of the greatest costs have not been counted. These include costs to our food, energy, health and water security. Studies have estimated that the economic value of ecosystem services lost through deforestation could be as high as US$ 2-4 trillion each year.

So what drives this process? The drivers of industrial deforestation act along global supply chains, from small holders and ranchers to food processors, and to consumers in the aisles of supermarkets worldwide. A tsunami of money fuels these supply chains, from the finance chiefs in capital markets to the forest chiefs at the tropical forest frontier. Commodities such as beef, soya and palm oil are traded within seconds on spot markets, in a global business worth US$ 92 billion a year, led by fund managers demanding exacting returns from companies in the supply chains. Far from where the forests once grew, international consumers in search of cheap chicken, leather products, shampoos or chocolates, all of which can contain such 'forest risk commodities', buy these products mostly unaware of the impact their choices are having on the world's forests.

It is not yet clear how the production of these commodities can be uncoupled from deforestation, but there are real signs of progress towards finding an answer. REDD+ has emerged as a possible mechanism to reward countries for reducing emissions from deforestation. The Consumer Goods Forum has set a target of no net deforestation in the supply chains of 400 companies by 2020. CDP's forests program, originally created by GCP as the Forest Footprint Disclosure Project, engaged 800 companies this year.

I hope this book will help accelerate progress, by enabling policy makers and corporate leaders to better understand the complex agents of deforestation, and the range of possible solutions. Ultimately, it is they who must come up with powerful incentives and a new framework for change built not simply on the hope of carbon markets but on a transition to sustainable agriculture and greater environmental security for all. Forests, as natural capital critical for all our futures, are simply too valuable to squander.

CONTENTS

FRAMING THE CHALLENGE

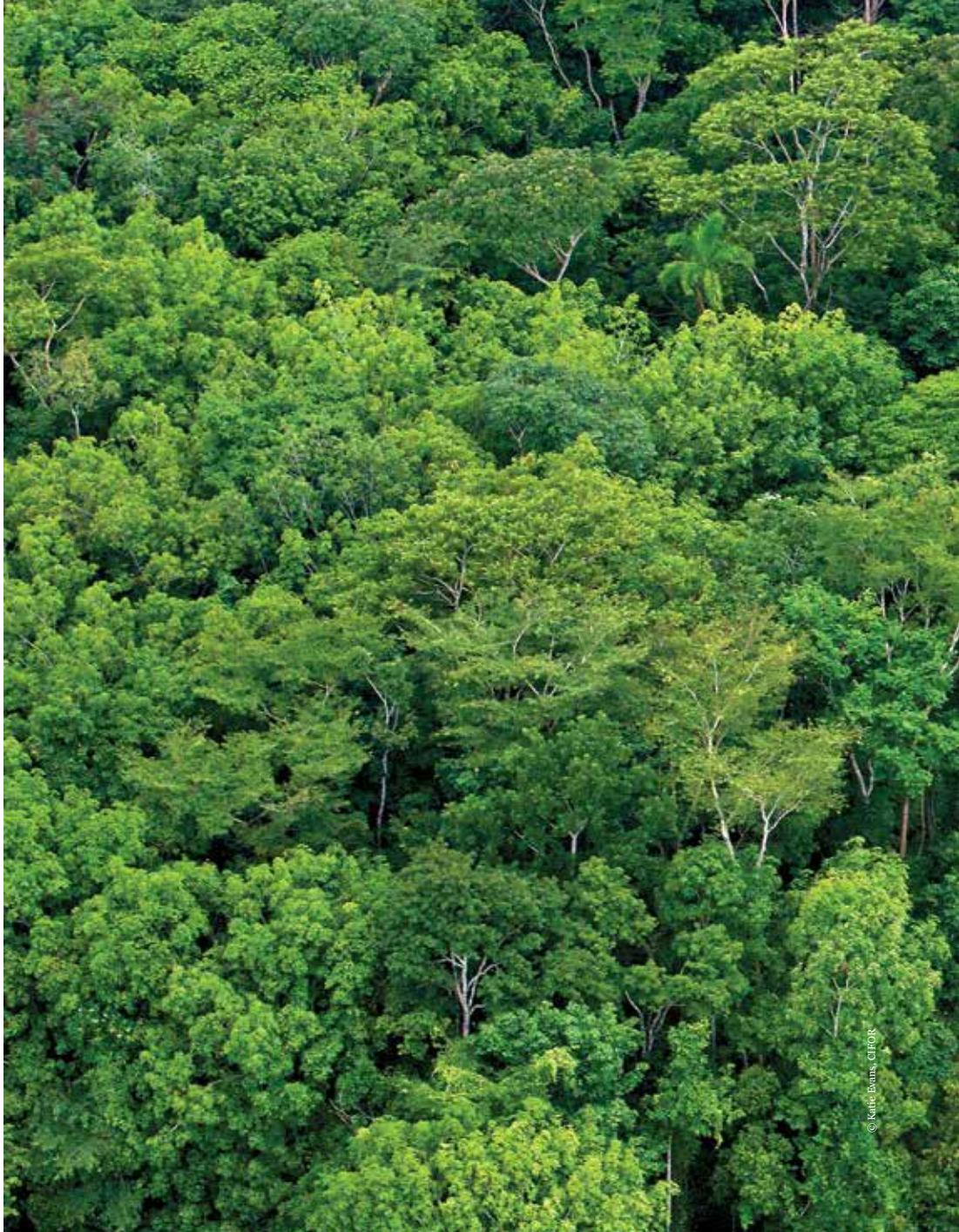
HOW THIS BOOK CAN HELP

Over the last decade the demand for agricultural products for food, feed and fuel and the production of forest risk commodities have been responsible for causing over 50% of deforestation and 60% of forest degradation in tropical and subtropical countries[1], which has major impacts on climate change, the provision of ecosystem services, and the sustainability of long term economic development.

In order to reduce the impact of these 'forest risk' commodities as drivers of deforestation, it is vital that decision makers in the public and private sectors understand the interdependence of the various drivers of deforestation, and the interactions between policies and markets with the agents of land use change in tropical forest countries. This increased level of appreciation for the complexity of the landscape will enable decision makers engaged in the production, trade and regulation of forest risk commodities to identify and implement solutions to tackle this urgent problem.

To address this need, The Little Book of Big Deforestation Drivers outlines the global context to the drivers of deforestation, provides a detailed overview of the most critical forest risk commodity supply chains, and presents a clear and realistic framework of 24 regulatory, market and supply chain catalysts that can act to reduce deforestation caused by these commodities.

The authors do not give preference to any specific catalyst but aim to stimulate dialogue, promote public and private sector collaboration, and contribute to global efforts to reduce deforestation and degradation in tropical forest countries.



TROPICAL FORESTS AND COMMODITY PRODUCTION

This book focuses on forests and forest ecosystems in the tropics and subtropics* – the interdependent web of plant, animal, micro-organism and indigenous people and local communities that co-exist and interact within forested areas in the equatorial tropics.

Tropical forests cover around 7% of global land area but provide habitat for at least half of the earth's terrestrial biodiversity[2]. They are also invaluable to humanity by providing economic goods (such as food, timber and fuelwood), biodiversity, and ecosystem services at local, regional and global scales (see page 22). The largest continuous expanses of tropical forest are found in the Amazon Basin, the Congo Basin and South East Asia.

Up to 50% of the world's tropical forests have been cleared[3], representing one of the most significant anthropogenic land use changes in history. A key driver of this change has been the conversion and exploitation of forests to meet the growing global demand for commodities from forest regions, such as timber and paper, minerals, oil and gas, and food and biofuels. When identifying countries that produce forest risk commodities and the role of commodity drivers in deforestation, and also when applying global trade data to forest risk commodities, this book uses the concept of *forest transition phases* – a sequence of four recurring stages involving forests and their transformations. They summarise the changing historical relationship between forests and societies[4].

The four stages consist of: initially high forest cover coupled with low deforestation rates (pre-transition); accelerating and then high deforestation rates (early transition); a subsequent period of slow-down of deforestation and the start of forest cover stabilisation (late transition); and a final stage of reforestation (post transition)[5]. The focus of this book is on the first three transition phases as this is where most of the deforestation occurs. Countries in transition phase four often have started afforestation or have become commodity and industrial processing countries rather than being involved in the clearing of their own tropical forests.

* This book uses the Food and Agricultural Organisation (FAO) definition of forests – "spanning more than 0.5 hectares with trees higher than five meters and a canopy cover of more than 10%, or trees able to reach these thresholds *in situ*."

FOREST RISK COMMODITIES AND THEIR ROLE IN TROPICAL DEFORESTATION

We define forest risk commodities as globally traded goods and raw materials that originate from tropical forest ecosystems, either directly from within forest areas, or from areas previously under forest cover, whose extraction or production contributes significantly to global tropical deforestation and degradation.

Tropical forests are currently the source of over 5,000 commercially traded commodities[6]. The production and trade of these commodities has provided significant economic benefits to the countries producing them. For example, palm oil is Indonesia's largest agricultural export commodity and has the potential to help millions of people out of poverty[7], and in Brazil soya production has also reduced poverty and lifted median local incomes[8]. However, despite their valuable contributions to economic development, global demand for these commodities is driving the rapid conversion of tropical forests into agricultural land. Forest degradation and deforestation inhibits the provision of vital ecosystem services which underpin the security of food, water, health and livelihoods (see page 22), which ultimately threatens the long-term economic viability of the production and trade in forest risk commodities as a development pathway.

The focus of this book is therefore on those commodities with the highest impacts on tropical forests and the ecosystem services they provide. These are palm oil, soya, beef and leather, pulp and paper, and timber, and their impact – particularly for the agricultural commodities – is mainly through the conversion of forests. In recent decades, more than 80% of new agricultural land came from intact and disturbed forests[9].

The chains that connect the raw commodities to both consumer and industrial end products often involve many actors and are highly complex. As a result, it is usually very difficult for any company or individual to know the origin or impact of the product they are processing, trading, retailing or consuming. This represents reputational, financial and legal risks for companies and investors that – often unknowingly – trade, manufacture or finance products containing these commodities.

Although certification and traceability schemes, such as the Forest Stewardship Council (FSC) and the Roundtable on Sustainable Palm Oil (RSPO), do exist, they currently cover only a small percentage of the total production of forest risk commodities (see page 115).

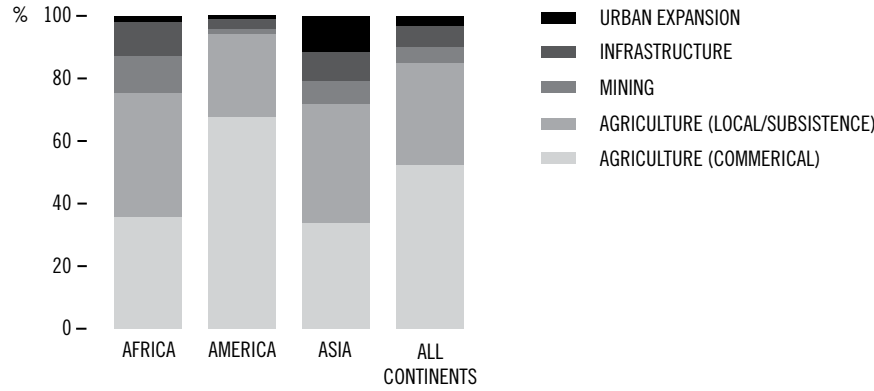
Accountability for ensuring the responsible production and use of forest risk commodities and reducing their impacts on tropical forests is shared by all actors across the supply chains, from commodity producers to processors, commodity traders, manufacturers, retailers and consumers. In addition, the legislators and policy makers who currently provide a policy environment that is conducive to forest conversion, and the financial sector representatives who fund and benefit financially from these commodities, also share this responsibility.

Commercial agriculture is the most important direct driver of deforestation in tropical and subtropical countries, followed by subsistence agriculture. Together they account for 80% of the deforestation, with logging for timber and paper accounting for the majority of forest degradation impacts. Fuelwood collection, charcoal production, uncontrolled fires are also important factors in forest degradation, but are not the focus of this book.

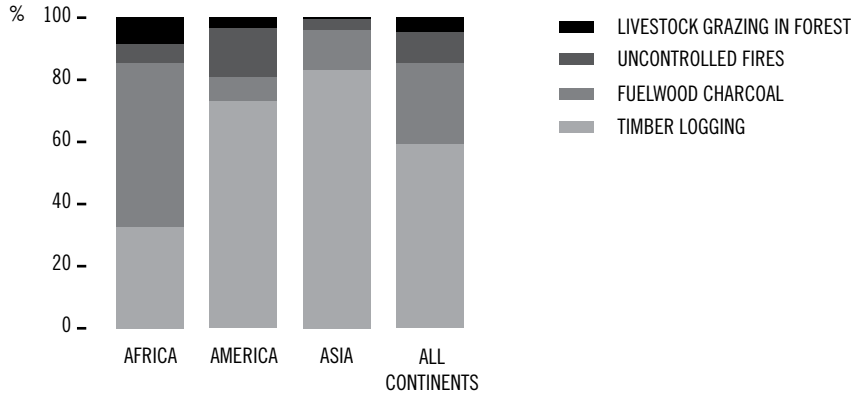
There are, however, significant differences between forest regions. While in Africa and Asia over 30% of deforestation is caused by commercial agriculture, in Latin America this figure increases to nearly 70%. On the other hand, over 80% of forest degradation in Asia and 70% of Latin America is caused by logging, while in Africa the majority of degradation can be attributed to fuelwood collection[10].

PRINCIPAL DRIVERS OF DEFORESTATION AND FOREST DEGRADATION IN TROPICAL AND SUBTROPICAL COUNTRIES 2000-2010[11]

DEFORESTATION



FOREST DEGRADATION



DEFORESTATION TRENDS

In the 1990s the liberalisation of international markets through trade agreements catalysed a surge in global trade, leading to a five-fold increase in the market value of all exports and a four-fold increase in the exports of agricultural products[12]. Research suggests that deforestation is affected by agricultural output prices, hence when trade affects these prices, it will also affect deforestation rates. When trade liberalisation occurs and local agricultural prices increase, deforestation has also been shown to increase and has led to some of the highest deforestation rates on record. Deforestation rates tend to decrease if local prices for agricultural products go down, even when trade liberalisation does occur. However, besides prices, there are significant other factors which affect the role of trade in deforestation. These include conservation policies (although such efforts might be offset by higher deforestation rates elsewhere) and property rights, corruption and resource management regimes[13].

Nevertheless, the demand for a continuous supply of products containing forest risk commodities remains high and is set to rise further. This is increasing conversion pressures on remaining forest areas in traditional commodity producing countries, and also incentivising forest conversion in countries that are not currently major commodity producers and that have relatively intact standing forests. Even though deforestation rates have dropped significantly in some countries that implemented strong conservation policies or commodity-related moratoria, they continue unabated in other countries or are predicted to increase in the future[14,15,16].

The Amazon Basin, the Congo Basin and South East Asia are the regions with the largest remaining intact tropical forests. Together they account for over 1.3 billion hectares, nearly two thirds of which is still considered primary forest. Since the year 2000, however, primary forests have decreased by 40 million hectares[17], an area larger than Germany. These forests also play an important role in the climate change discourse as they store 42% of the carbon contained in all the world's forests despite only making up 33% of the global forest area. Most importantly, these regions also represent the frontier of current and future forest conversion and exploitation for the production of forest risk commodities.

Until recently, the **Amazon Basin** had the highest deforestation rates globally, driven by the conversion of forests into land for cattle ranching and soya expansion[18]. In recent years, deforestation in the Brazilian Amazon has dropped due to an increase in protected areas, policy and law enforcement initiatives, and moratoria agreed by major industry players and civil society in regards to sourcing soya and beef products from recently deforested areas (see page 126). Deforestation rates in other countries that have a share of the Amazon biome, however, have not seen the same decline – as can be seen in Columbia, Peru and Venezuela[19]. The Amazon Basin is also of particular importance as it stores 65% of the carbon contained in the rainforests of all three major tropical forest regions[20].

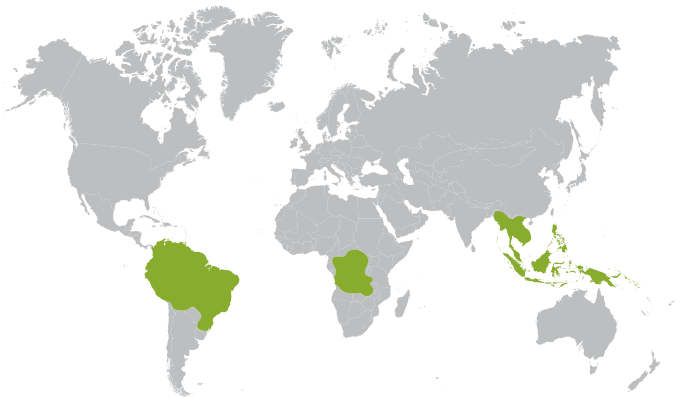
The tropical forests of **South East Asia** are experiencing rapid land use change due to their conversion for cash crop production and the establishment of plantation forests. Over 40% of the forests of this region (and around five times as much as in Thailand or Malaysia) are located in Indonesia, where deforestation occurs at one of the fastest rates anywhere in the world. The island of Sumatra for example, home of many rare and endangered species, has lost 70% of its forest with the establishment of oil palm plantations as a key driver[21]. In May 2011 a moratorium on awarding new licenses to clear or convert natural forests was announced in Indonesia and renewed in May 2013 but it remains to be seen to what extent this will reduce deforestation, as the process for developing the moratorium has been a complicated one and not without flaws and criticism[22]. Deforestation is also particularly rapid in the Mekong region (see page 32) which has lost nearly a third of its forest cover (22% in Cambodia, 24% in Laos and Myanmar, and 43% in Thailand and Vietnam) between 1973 and 2009[23].

As of today the **Congo basin** is still a relatively intact ecosystem compared to most of the Amazon Basin or South East Asia. It contains about 70% of Africa's forest cover[24] and stores around 21% of the total carbon stored in all three tropical forest regions[25]. The Congo Basin has so far escaped the rapid deforestation of the Amazon Basin and South East Asia, which was mostly driven

by a globalised market for agricultural products. For a long time political instability and poor infrastructure kept deforestation at relatively low levels but the demand for commodities and biofuels is putting increasing pressure on African forests. Since 2009, oil palm projects covering 1.6 million hectares have been announced[26], and with 12% of the world's non-cultivated land suitable for cultivation located in countries of the Congo Basin[27], the pressure on the forest is set to increase (see page 28).

The key question when it comes to forest risk commodities is whether it is possible to preserve forests and address poverty for a growing human population within the current agricultural production and trade paradigm (see page 20).

KEY FOREST RISK COMMODITIES FROM TROPICAL FOREST REGIONS



AMAZON BASIN
SOYA
BEEF
TIMBER

CONGO BASIN
TIMBER

SOUTH EAST ASIA
PALM OIL
TIMBER, PULP & PAPER

THE FUTURE OF AGRICULTURE

How to provide diverse, nutritious food to 9 billion people in 2050, preserving forests and ecosystem services, meeting increasing demand in agrofuels and other non-food biomass, providing jobs and incomes to more than one billion workers currently surviving on agriculture? The tradeoffs equation remains puzzling to solve. The Foresight Report of the UK government[i] and the French foresight study "Agrimonde"[ii] attempt to address this complicated problem.

The Foresight Report concludes that a redesign of the whole food system will be necessary to address climate change and achieve sustainability, and that "there will hardly ever be a case to convert forests, especially rainforests to food production."

The two contrasting Agrimonde scenarios show that it is possible to feed the world in 2050 using current available land and resources, but highlight how both the content of our plates and the way in which we produce our food will drive other major issues such as international land use and trade, ecosystem services, rural livelihood and nutrition-related diseases.

The scenario "Agrimonde GO" (AGO) was inspired by the "Global Orchestration" scenario of the Millennium Ecosystem Assessment[iii]: further economic growth and free trade reduce poverty significantly, but more than doubles the demand for animal food products such as beef and dairy by 2050. Consequently the production of plant-based food must increase by 85%, mostly to feed animals with soya bean and maize. Despite a 325% net increase in intercontinental trade, per capita consumption of animal foodstuffs remains very unequal between rich and poor countries. Yields continue to increase too assuming that irrigation, chemical fertilizers, pesticides and biotechnologies will sustain past trends. But due to the large demand for feed, croplands will also have to be extended along with pastures. In AGO, carbon emissions from land use changes are expected to continue, and other emissions such as N_2O, CH_4 and CO_2 from manufacture and use of industrial inputs, husbandry, transport and processing will worsen.

The forward looking "Agrimonde 1" scenario (AG1) imagines a very different future for the world in 2050, that is inspired by agro-ecology or ecological intensification principles[iv]. A key challenge of that world is the development of technologies and markets that enable agriculture to meet growing demands, preserve ecosystems and human health, provide jobs in rural areas and reduce worldwide inequalities. On the supply side, instead of input-dependent and ecologically simplified food production systems that are labour-saving (AGO), AG1 focuses on a mosaic of complex high-productive agro-ecosystems (including agro-forestry) that save capital, inputs and water by exploiting the best local biological synergies[v] amongst numerous plant and animal species, above and below the ground. Such agro-ecosystems call for deep and long-term reforms across the sector. AG1 yields in 2050 are envisioned to be almost the same as those observed in the early 2000s, but able to stock much more carbon and biodiversity on croplands than today. These croplands must expand on a large scale (+0.7% annually between 2003-2050) but without further losses to tropical forests to meet the food demand of 9 billion people. This demand, however, is assumed to be much lower than in AGO by solving simultaneously some important under- and over-nutrition problems: in 2050, the daily per capita availability of food everywhere is envisioned to equal 3000 kcal, with 500 kcal from animal origins (the world average in the early 2000s). Such assumption involves sharp calorie consumption decreases in OECD countries (4000 kcal today of which more than 1000 kcal is from animal foodstuffs) thanks to a drastic reduction in losses throughout the food chain, and a diet more based on plant food rich in proteins, fibres and micronutrients. It also foresees a higher availability of plant and animal foodstuffs in regions such as Sub-Saharan Africa (2400 kcal in 2003 of which 150 kcal from animal foodstuffs). All in all, in AG1, the world production of plant food calories has to increase by only 30% compared to 85% in AGO by 2050 to feed both humans and animals. This scenario is expected to be more virtuous regarding human health (from under-nutrition to overweight, cardiovascular diseases, and cancers) but also resilience (to climatic or economic shocks), conservation (of soil, water and biodiversity) and greenhouse gases emissions, except from intercontinental transports which is set to increase even stronger than in AGO between food surplus regions (OECD, Former Soviet Union, Latin America) and deficit ones (Asia, Africa and Middle East).

In food deficit tropical countries, agro-ecological yields could nevertheless be higher than those assumed in AG1. In recent decades, agricultural R&D has focused on a few monocultures (wheat, rice, maize, soya bean, sugar crops, oil palm), the production of which has increased tremendously to feed humans and animals, albeit with increasing input costs and growing environmental externalities besides the clearing of tropical forests[vi]. Since unit prices have simultaneously declined, only farmers with larger acreages could really boost their labour productivity, often leading the others into a poverty trap, a major current and future concern for most developing countries[vii]. An alternative to the labour-saving, input-dependent and ecologically simplified food production system could include:

- less industrial inputs to lower environmental and production costs;
- more context-specific biological synergies between numerous plant and animal species, above and below ground, to increase both yields and resilience to natural and economic shocks;
- higher price to farmers, which could: i) stimulate the provision of diverse, nutritious food and other goods such as fuels, fibres, drugs and building materials; ii) sustain ecosystem services of local and global importance (safe water, carbon and biodiversity pool, soil fertility, nutrient recycling, pollination, disease and flood control, climate mitigation/adaptation); iii) reverse the current inflation of costly social safety nets in rural and urban areas.

This alternative may start to shed light on difficult questions such as the trade-off between two imperatives: preserving tropical forests and providing global agricultural commodities, food security, as well as revenue and jobs in tropical countries.

Bruno Dorin
CIRAD & CIRED

IMPACTS OF DEFORESTATION

Tropical forests contain over half of the world's terrestrial biodiversity[28]. Indonesia alone, for example, which accounts for just over 1% of the world's land area, is home to 10% of the world's plant species, 12% of mammals, 16% of reptiles and amphibians, and 17% of bird species[29]. Their biodiversity, aside from its intrinsic value, acts as a store of natural capital which provides a wide range of vital ecosystem services. These ecosystem services underpin water, energy, food and health security at local to global scales, and are fundamental for the future prosperity and resilience of societies and economies. Deforestation and forest degradation are threatening the supply of these ecosystem services, with estimates suggesting that 15% of tropical forest species are already extinct, with the remaining 85% coming under increasing threat[30]. Recognition of these values and their incorporation as natural capital alongside financial capital is a major challenge and opportunity for the 21st century economic system. Policy and private sector mechanisms are therefore needed that recognise the interdependencies that connect these ecosystem services, and the likely impacts of deforestation on their continued provision.

WATER SECURITY

Fresh water is an important and increasingly scarce global resource – human populations now use over 50% of the world's readily accessible runoff water[31]. Forests provide critical natural filtration and storage systems that supply an estimated 75% of accessible freshwater globally[32] and the Amazon alone is responsible for 15% of the global water runoff[33]. Forests and forest soils collect and purify vast amounts of water from rainfall during wet seasons and slowly release the water during drier seasons, which helps to regulate cycles of flood and drought[34].

These provisioning, regulating and detoxification services directly provide drinking water to over 60 million indigenous people who live in tropical forests, and at least one-third of the world's large cities depend on protected forest areas for their water supply[35,36]. Furthermore, the recycling of water vapour by forests through evapotranspiration back into air currents helps to maintain rainfall regimes locally and regionally[37,38]. For example, much of the rainfall in the Andes that feeds glaciers and high-altitude populations has been recycled over lowland Amazonian forests[39].

Whilst uncertain, research has suggested that continued deforestation in the Amazon Basin could result in a reduction in precipitation of 12% in the wet season, and 21% in the dry season by 2050[40]. This may impact the provision of clean drinking water and regulation of the spread of water-borne diseases (health security). The economic impact of deforestation on hydropower generation and agricultural production capacity is also important. For example, almost a fifth of the rain that falls on the La Plata Basin[41], a region which generates 70% of the GDP for the five countries that share it[42], originates in the Amazon. In turn, both agriculture and energy generation also impact water security through pollution and flow disruption. In addition, the loss of soil and vegetation moisture associated with deforestation and degradation also increases wider forest vulnerability to fires and subsequent further losses of vegetation and the release of CO_2[43], exacerbating risks to water security.

ENERGY SECURITY

Global energy demand is projected to increase rapidly, and healthy tropical forests can play a vital role in supporting a more stable energy future. At local and regional levels, forests provide fuelwood, a major source of energy (and income) for around 2 billion people[44], particularly in developing countries. In Africa, fuelwood accounts for 90% of primary energy consumption in some regions[45]. Forests are also exploited for charcoal production for industry, a major driver of deforestation in Africa[46].

Tropical forests are also essential to the production of hydroelectricity, through their provision of rainfall, regulation of surface runoff, and reduction of sedimentation in dams and rivers at regional scales. Over 65% of Brazil's electricity supply is generated through hydroelectricity and while only 15% of this is currently produced in Amazonia, thirty new dams are planned in the region by 2020[47]. Major dams are also proposed or under construction in many other tropical forest countries, including Guyana (Amaila Hydropower Project), Democratic Republic of Congo (Grand Inga Hydropower) and in the Lower Mekong (a series of dams are planned in Laos and Cambodia). Deforestation is likely to reduce the forecasted energy production of these developments - evidence indicates that the production capacity of Brazil's new Belo Monte dam in the Amazon could decline to only 25% of the maximum plant output, or to 60% of the industry's own projections, as a result of reductions in rainfall driven by regional deforestation[48]. This will have significant impacts on energy security as well as severe local social and environmental impacts, including likely negative effects on water security.

FOOD SECURITY

Globally, around one billion people are dependent on forests for their basic livelihoods[49], and many more are consumers of food commodities produced in or around forests. While tropical non-timber forest food products, such as bushmeat, nuts and fruits are critical to food security at the local scale, forest risk commodities such as palm oil can be found in half of all packaged food products[50], and soya products can be found in 60% of all processed supermarket foods[51]. A high percentage of these commodities have been grown on land cleared of tropical forests in the last 20 years. Many farmers also depend on forest insects such as bees to pollinate their crops[52] and as much as a third of fish caught each year in South East Asia depend on coastal mangrove forests[53]. Moreover, plant biodiversity within tropical forests also acts as a gene pool reserve for many food products, ensuring the genetic diversity of a large proportion of agricultural crops[54].

Deforestation and forest degradation impact crop yields through reduced precipitation, and increase food insecurity and poverty for those who depend on tropical forest biodiversity for subsistence. However, although agriculture is currently a major driver of deforestation, studies have concluded global food production needs could be met while also reducing deforestation in tropical countries (see page 20)[55,56].

HEALTH SECURITY

Forests are essential contributors to health products locally and globally. Between 75% and 90% of people in developing countries depend on natural products (many from forests) as their main source of medicine[57]. In the late 1990s, ten of the world's 25 top-selling drugs were derived from natural sources[58], and the trade of medicines and plants derived from tropical forests has been valued at US$108 billion per year[59]. However, less than 1% of the plant species in tropical forests have been assessed for their medicinal properties[60]. Some medicinal

plants are threatened by commercialisation, and forest peoples are often considered to be inadequately compensated for their knowledge of medicinal plants[61].

Deforestation is also threatening the discovery of new potential medicines, and disrupting access for local populations – for example in Belem, Brazil, five of the top selling medicinal plant species are commercially logged for other uses[62]. Disease regulation[63] is an important forest ecosystem service, and even small changes in forest cover can be linked to increased incidence of disease, with some heavily deforested areas displaying a 300-fold increase in the risk of malaria infections[64]. The increase in frequency of emerging infectious diseases (EIDs) (e.g. HIV, Ebola, SARS, Dengue) has also been linked to accelerated rates of tropical deforestation and land use change[65]. As incidence rates rise and spread geographically, so does the socio-economic cost to both emerging and developed economies – even with marginal climate change effects, some countries may see their inpatient treatment cost of malaria increase more than 20%[66], with negative follow-on effects on poverty and livelihoods security.

LIVELIHOOD SECURITY

Around 1.6 billion people are partially reliant on forests and forest products[67], with 350 million highly dependent on forest resources for their livelihoods and 60 million indigenous people totally dependent on forests[68]. The value of global trade in forest products is estimated at US$ 270 billion but less than 5% of tropical forests are managed sustainably[69].

The relationship between forests, deforestation and livelihoods is complex. The livelihoods of people dependent on forests can be both threatened by deforestation[70] or, if incomes rise as a result of farming, supported. While the nature of the impact of deforestation on livelihoods depends on interactions between many interconnected factors, and is difficult to predict, its devastating potential effect on rural poverty should be a critical consideration in social and economic planning.

CLIMATE REGULATION SECURITY

Tropical forests play a critical role in regulating the world's climate. They act as 'carbon sinks', sequestering vast quantities of carbon dioxide (CO_2) out of the atmosphere, which is stored in the soil and vegetable matter. Anthropogenic climate change is likely to multiply threats from deforestation to water, energy, food, and health security with high social, environmental and economic costs. Every year tropical forests process six times as much carbon, via photosynthesis and respiration, as humans emit from the use of fossil fuels[71], and tropical forests (established and regrowth) store around 2.8 billion tonnes of carbon annually[72] – the equivalent of two times the annual CO_2 emissions of the U.S.A[73]. Tropical forests also evaporate huge volumes of water that cool the earth's surface and create clouds that reflect sunlight back out to space, contributing to local and global climate regulation[74,75]. In addition they reduce the incidence of flood events at local scales by slowing down the passage of water over the land surface[76].

However, as a result of deforestation and land use change, these climate regulation services are under threat. Deforestation and degradation of tropical forests, including peatland loss, is a major cause of global greenhouse gas emissions, accounting for around 10% of our global annual CO_2 emissions[77]. Land use change in tropical forests is currently leading to net emissions of 1.3 billon tonnes of carbon annually[78]. Climate change is likely to increase the frequency of extreme events such as droughts and floods, impacting water security, with subsequent effects on energy, food and health security. Increasing temperatures coupled with changes in growing season length will also have major impacts on agricultural productivity. When average annual temperatures rise above 30°C, many staple crops, including maize and rice, suffer significantly lower yields while other crops, such as beans, cannot be cultivated[79].

According to the Intergovernmental Panel on Climate Change (IPCC) no other climate mitigation strategy has the potential for a higher and more immediate impact on the global carbon stock than reducing and preventing deforestation[80].

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EMERGING DRIVERS IN AFRICA AND THE MEKONG

THE INDUSTRIALISATION OF AFRICA'S RAINFORESTS

The scramble for Africa's natural resources increasingly extends to forests and land. International tropical timber and palm oil companies, often with Asian roots, are ramping up operations in Africa, home to the second largest area of tropical forest in the world and birthplace of the most common type of oil palm. This is driving the rapid and often secretive allocation of forests and land in countries in West and Central Africa where corruption is widespread, legal frameworks often do not recognize rural populations' rights to land, and environmental laws are weak or poorly enforced.

These issues are playing out dramatically in the small West African country of Liberia, which contains 40% of the remaining Upper Guinean rainforest. Rural Liberians depend heavily on forests and land for subsistence, and one third of the country's population is food insecure[viii]. Despite this, since 2007 the Liberian government has given out licenses for industrial logging and oil palm plantations covering one third of Liberia's land area and 70% of its forests[ix].

The rush to hand out forests and land threatens to undermine Liberia's fragile efforts to improve governance. A recent government audit revealed that laws were routinely ignored in the allocation of forestry and agricultural concessions[x]. In 2012, Global Witness and Liberian NGOs exposed how one type of logging permit was illegally issued on a massive scale in circumvention of laws meant to protect community rights and the environment[xi]. The area under permit – over half controlled by a single Malaysian logging company – would allow 40% of Liberia's rainforests to be cleared.
There are parallels in Central Africa. In the Democratic Republic of the Congo (DRC) in 2012, Global Witness exposed the illegal allocation of logging permits meant for small-scale use by Congolese citizens[xii]. At least 146 permits were handed out in a single province, mainly to foreign industrial logging outfits, often with buyers in China. The breakdown in rule of law is also evident in DRC's large logging concessions, where an independent monitor identified widespread illegal logging over the course of three years[xiii]. Timber from illegal permits in Liberia and DRC has been exported to Europe, India, and China, among other destinations. Ultimately it is used by consumers who ask no questions about the social and environmental impacts of the products they buy.

Across the great rainforests of Liberia and the Congo Basin, poorly regulated industrial logging concessions now cover more than 50 million hectares – an area twice the size of the UK – while palm oil projects are proposed or underway on at least 2.7 million hectares of land and forest[xiv,xv]. If the region's rainforests are to be spared the fate of those in South East Asia, governments will need to look for internal solutions, rather than big external investments in industrial projects, and start by improving governance: tackling corruption, securing land tenure for rural populations, enforcing laws, and holding accountable those who violate them.

THE NEW RUBBER BARONS OF THE MEKONG[xvi]

High prices and soaring demand for natural rubber are increasing demand for land across South East Asia, with devastating social and environmental consequences. This is particularly evident in Cambodia and Laos, which have seen more than 3.7 million hectares of land handed over to companies since 2000, 40% of which is for rubber plantations. International attention has focused on land-grabs for production of food and fuel, but in this region it is the potential gains from rubber production that are driving deforestation and the rush for land.

Natural rubber is native to the Amazon rainforest but today most rubber is produced in South and South East Asia. Surging demand for rubber, particularly from China, has led to predictions of a potential annual global shortfall of 2.5 million tonnes by 2020[xvii].Already, tightening supplies have resulted in a ten-fold increase in natural rubber prices between 2001 and 2011, thus intensifying the demand for land[xviii]. Vietnam is currently the world's third-largest producer of rubber. But with limits on the land available domestically, many Vietnamese companies are turning to neighbouring Cambodia and Laos where the governments are allocating large areas of land and forest for industrial agriculture, ignoring laws designed to protect human rights and the environment. Deforestation rates in both countries are higher than average in the rest of South East Asia. In Cambodia, forest cover fell from 73% of total land mass in the 1990s to 57% by 2010[xix]. Only 3% of the country's forests are still classified as primary[xx].

The Vietnamese rubber barons' drive to open up new frontiers is having devastating impacts on rural populations and forests, with communities affected by rubber plantations facing food and water shortages, and receiving little or no compensation. Indigenous minority peoples' spirit forests and burial grounds have been destroyed[xxi].

Rubber companies have been observed clear-felling intact forest within and beyond their concession boundaries seemingly working with Cambodia's business and political elite to do so. But this isn't just an Asian story. International financial institutions also play a role in funding land grabs and forest destruction[xxii]. And with tyres and tyre products accounting for over half of all the rubber consumed globally, there is a good chance that the rubber grown in Cambodia and Laos can be traced straight back to the cars we drive.

If the rush for rubber continues unregulated and at its current pace, soon there will be no more forests in Cambodia or Laos. Meanwhile, recent political and economic reforms have opened up Myanmar's land and forest resources for exploitation. The government is heavily promoting large-scale rubber plantations and unless it heeds the lessons from Cambodia and Laos, some of Asia's last remaining intact forests will be consigned to history.

Global Witness

THE INTERNATIONAL CONTEXT

Addressing the role of forest risk commodities in driving deforestation is central to the stated objectives of several major public sector multilateral initiatives and international conventions. The following pages summarise the key strategies, decisions and priority indicators of five important agreements that have relevance (either directly or indirectly) to this complex landscape.

UN FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) acknowledges that anthropogenic deforestation and degradation are significant contributors to global greenhouse gas (GHG) emissions, and that forests therefore have a central role in climate change mitigation and adaptation. The UNFCCC directly engages with forests through work programmes on reducing emissions from deforestation and forest degradation (REDD+), land use, land-use change and forestry (LULUCF), and afforestation and reforestation projects under the Clean Development Mechanism (CDM).

Addressing the drivers of forest loss is integral to REDD+. At the thirteenth meeting of the Conference of the Parties (COP13), Parties were encouraged "to explore a range of actions, identify options and undertake efforts, including demonstration activities, to address the drivers of deforestation..."*. Additional decisions at COP16 (2010) and COP17 (2011) reiterated this need, and requested developing countries to address the drivers of deforestation and forest degradation when developing and implementing national REDD+ strategies and action plans**.

The meeting of the Subsidiary Body for Scientific and Technological Advice (SBSTA) in 2013 further recommended a draft decision for adoption by COP19 (2013) which "encourages Parties, organizations and the private sector to take action to reduce the drivers of deforestation and forest degradation***". Although references to the critical importance of the private sector have been welcomed, it is currently unclear whether the UNFCCC will give Parties clear guidance on how to proceed, or if stronger linkages will be made between efforts to establish REDD+ and those to address the agricultural drivers of deforestation.

* Decision 2/CP.13 (2007).
** Decision 1/CP.16(2010) – paragraphs 68,72 and 76.
*** Draft decision 3/CP.19 (2013).

UN CONVENTION ON BIOLOGICAL DIVERSITY (CBD)

The Convention on Biological Biodiversity (CBD) recognises the linkages between biodiversity, ecosystem services and human wellbeing, including in tropical forests, and highlights that the value of biodiversity remains inadequately reflected in broader policies and incentive structures designed to address the drivers of deforestation*,**.

At COP10, Parties agreed to the adoption of a new ten year Strategic Plan for Biodiversity (2011-2020), which will address the underlying drivers of biodiversity loss (including the drivers of deforestation), and provide incentives to protect the benefits provided by well-functioning ecosystems. The goal of the Strategic Plan is to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planets variety of life, and contributing to human well-being, and poverty eradication***". The Strategic Plan includes 20 headline targets organised under five strategic goals, known as the Aichi Biodiversity Targets. While all of the Aichi targets are relevant to efforts to reduce the impact of the global commodity drivers on tropical deforestation, several of the targets are particularly relevant.

Addressing the drivers of deforestation and the achievement of the Forest Cluster Targets (Aichi targets 5, 7, 11 and 15) rely on the attainment of targets 1-4, which fit broadly under Strategic Goal A, to address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society. The Forest Cluster Targets are interlinked and interdependent. Achieving a reduction in habitat loss and degradation, including of forests (target 5) is a prerequisite for achieving sustainable forest management (target 7). While both of these targets contribute to progress made towards increasing the proportion of land under protection for the conservation of biodiversity (target 11), which in turn is affected by the extent of progress in the restoration of forest landscapes (target 15).

* CBD's cross-cutting work on economics, trade and incentive measures seeks to correct the incentives of individuals, governments and companies towards more effective conservation and sustainable use of biodiversity, such as promoting the trade of biodiversity-based goods that are produced in a sustainable manner. It also seeks to ensure the mutual supportiveness of international trade rules and the objectives of the Convention.

** Decision X/2/CP.10.

*** Decision X/2/CP.10 - Strategic Plan For Biodiversity 2011-2020 and the Aichi Biodiversity Targets.

UN CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

Forests are critical in preventing desertification and drought, while dry forests are an important source of ecosystem services in drylands. As such, forests are a core theme within the United Nations Convention to Combat Desertification (UNCCD). The forest-related elements of the ten year Strategic Plan of the UNCCD align with the CBD's Aichi Targets, especially strategic objectives two and three, which respectively aim to improve the condition of affected ecosystems and to generate global benefits, such as through the sustainable management of forests and agricultural systems. There are also synergies between the National Action Programmes of the UNCCD with the National Biodiversity Strategies and Action Plans (NBSAPs) of the CBD, particularly with regards to dry forests and agroforestry.

UN FORUM ON FORESTS (UNFF)

The work of the United Nations Forum on Forests (UNFF) is based on the Rio Declaration, the Forest Principles, Chapter 11 of Agenda 21 and the outcomes of the Intergovernmental Panel on Forests (1995-1997) and Intergovernmental Forum on Forests (1997-2000). The future work of the UNFF is guided by the following four shared Global Objectives on Forests which have particular relevance to addressing the global drivers of deforestation and degradation: (1) reverse the loss of forest cover worldwide through sustainable forest management (SFM); (2) enhance forest-based economic, social and environmental benefits; (3) increase the area of sustainably managed forests, and increase the proportion of products from sustainably managed forests; and (4) reverse the decline in official development assistance for SFM and mobilise new and additional financial resources for SFM.

At the seventh session of the UNFF in 2007 the Forum adopted the Non-Legally Binding Instrument (NBLI) on All Types of Forests. This is an international instrument for sustainable forest management that will facilitate international cooperation and national action to reduce deforestation, prevent forest degradation, promote sustainable livelihoods and reduce poverty for all forest-dependent peoples (UNFF, 2012). UNFF has also facilitated discussions on the future of forests within a green economy as well as opportunities to better reflect the value of forests in sustainable development.

UN GLOBAL COMPACT (UNGC)

Launched in 2000, the UN Global Compact (UNGC) is a policy initiative aimed at encouraging businesses to align their operations with ten 'best practice' principles for human rights, labour, environment and anti-corruption. The UNGC seeks to mainstream these ten principles of business strategy globally and "catalyse business action in support of UN goals and issues, with emphasis on collaboration and collective action". The UNGC environmental principles are that business should support a precautionary approach to environmental challenges (Principle seven); undertake initiatives to promote greater environmental responsibility (Principle eight); and encourage the development and diffusion of environmentally friendly technologies (Principle nine).

As the increasing production of forest risk commodities is a major driver of deforestation and forest degradation, the UNGC can act as a tool to increase support and coordinate public and private sector efforts to reduce the forest footprints of global supply chains. There are currently around 7,000 company signatories to the UNGC, who are expected to communicate progress towards the core principles every two years. Those who fail to do so are expelled from the initiative, with the first half of 2013 seeing 99 companies excluded*.

THE GLOBAL ENVIRONMENT FACILITY (GEF)

Established in 1991, the GEF is the largest funder of environmental projects globally, supporting transformational investments in projects including biodiversity, climate change, and land degradation, among others**. Since its inception, the GEF has provided US$11.5 billion in grants and leveraged $57 billion in co-financing for over 3,215 projects in over 165 countries[81].

In 2013 the GEF-6 Programming Directions*** recognised tackling the drivers of deforestation as a key goal within the strategic priority of *Sustainable Forest Management*[82]. Programme 11 (*Taking Deforestation out of the Supply Chain for Global Commodities of Beef, Soy, Oil Palm, Pulp and Paper to Secure Global Biodiversity Benefits*) specifically aims to support catalytic actions with global, regional and national financial institutions; buyers (e.g. traders, processors, brands, retailers and consumers); and producers to reduce impacts on biodiversity through forest loss.

* 'UN Global Compact Expels 99 Companies in First Half of 2013' www.unglobalcompact.org/news/339-07-01-2013

** Also international waters, persistent organic pollutants, and the ozone layer.

*** Resources for the GEF are replenished every four years when contributing countries pledge resources through a process called the 'GEF Replenishment.' The first meeting of the GEF-6 – the sixth round of replenishment was held in April 2013.

GEF-6 guidance highlights specific actions which could support this programme goal, including financial incentives/disincentives (e.g. preferential access to resources, subsidies and grants, or fines and withholding of benefits), the development of biodiversity friendly value chains and certified products, and legislation that removes subsidies and perverse incentives. Existing initiatives funded by the GEF include the Biodiversity and Agricultural Commodities Program, which is engaging the private sector through commodity round tables (e.g. the Roundtable for Sustainable Palm Oil – RSPO) to support producer certification.

PROGRAMME SYNERGIES

There are clear interdependencies and synergies between these initiatives. Each is closely aligned with the draft outcomes of the GEF-6 Programme 11 – *Taking Deforestation out of the Supply Chain for Global Commodities of Beef, Soy, Oil Palm, Pulp and Paper to Secure Global Biodiversity*. As the financing mechanism for the three Rio Conventions – the CBD, the UNFCCC and the UNCCD – the GEF is in a unique position both to respond to the combined guidance of the Rio Conventions and the UNFF and UNGC, and to catalyse the implementation of actions to address deforestation from forest risk commodity supply chains across their partner countries and organisations.

Collaborative efforts between these initiatives also exist, such as the Collaborative Partnership on Forests*, an initiative of the Secretariats of the Rio Conventions, and the Caring for Climate initiative – a joint UNGC, UN Environment Programme (UNEP) and UNFCCC programme aimed at advancing the role of business in addressing climate change. Of particular relevance to addressing drivers, this initiative is endorsed by 350 companies globally, provides a framework for business leaders to advance practical solutions related to climate change, and encourages the setting of emissions reductions targets, and the disclosure of emissions information.

* The Collaborative Partnership on Forests (CPF) consists of 14 international organisations, bodies and convention secretariats that have substantial programmes on forests. *www.cpfweb.org*

	GEF 6 OUTCOME 11.1 ENABLING ENVIRONMENT CONDUCIVE TO SUPPORTING BIODIVERSITY-FRIENDLY VALUE CHAINS IN COMMODITY PRODUCTION.	GEF 6 OUTCOME 11.2 INCREASE IN AREA OF COMMODITIES PRODUCED USING BIODIVERSITY-FRIENDLY CERTIFIED PRACTICES.	GEF OUTCOME 11.3 DECREASED RATE OF DEFORESTATION BY COMMODITY PRODUCTION.
CBD	Strategic goal a of the cbd strategic plan for biodiversity to address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.	Aichi Targets 5 - a reduction in the loss and degradation of natural habitats; 14 - ensuring the restoration and protection of ecosystems and the associated ecosystem services and; 15 - promoting ecosystem resilience and carbon stock enhancement, and combating desertification.	Aichi Targets 7 and 11 – focusing on the protection and sustainable management of land, including agriculture and forestry.
UNFCCC	UNFCCC measures to encourage participation in implementation of a REDD+ mechanism that supports environmental integrity and the conservation of biodiversity.	UNFCCC provisions for encouraging Parties, organisations and the private sector to take action to reduce the drivers of deforestation and forest degradation.	UNFCCC efforts to reduce emissions from deforestation and degradation.
UNFF	UNFF requirements for enhanced forest-based economic, social and environmental benefits.		UNFF objectives to increase the area of forests under sustainable management and the proportion of forest products derived from sustainably managed forests.
UNGC	UNGC provisions for businesses to take precautionary approaches and greater responsibility when it comes to environmental challenges.	UNGC environmental best practice principles for businesses.	UNGC environmental best practice principles for businesses.
UNCCD	UNCCD Strategic Objectives two and three, which respectively aim to improve the condition of affected ecosystems and to generate global benefits, such as through the sustainable management of forests and agricultural systems.	UNCCD Strategic Objectives two and three, which respectively aim to improve the condition of affected ecosystems and to generate global benefits, such as through the sustainable management of forests and agricultural systems.	UNCCD Strategic Objective two which aims to improve the condition of ecosystems by reducing land degradation.

UNDERLYING CAUSES OF DEFORESTATION

INTRODUCTION

The majority of deforestation and degradation from forest risk commodities is driven by a series of complex interactions with several indirect or underlying economic, demographic, and institutional factors. Therefore, in order to understand the dynamics of the key commodity drivers, it is important to consider them in this broader context. The following chapter briefly outlines the complex linkages and interdependencies between these underlying factors and deforestation, and highlights areas of current debate and consensus.

For example, the building of roads to service expanding towns, or to increase access to markets to reduce poverty in rural areas, can facilitate and drive wood extraction or agricultural expansion. This expansion is in turn often supported by institutional factors (such as limited governance), and socio-economic factors (such as investment from the international finance sector) which may exert influence from outside the region[83].

The dynamics of these underlying causes, and their interactions with the production and trade of forest risk commodities, are also regionally and nationally specific. This contributes to a general difficulty in defining consensus and developing a 'blueprint' policy approach, particularly given the global nature of these commodity supply chains.

While the limited scope of these sections cannot encompass a comprehensive summary of the range of evidence dealing with these fields, some broad messages can be supported which are of critical importance to decision makers seeking to have an impact on reducing tropical deforestation.

POPULATION GROWTH AND DEMAND FOR COMMODITIES

In developing policies to address deforestation from forest risk commodities, policy makers should consider the strong correlations between population increases and commodity demand and deforestation, as well as the complex influences of other demographic, political and socioeconomic factors. By 2050 the human population is predicted to increase by over one third and reach more than 9 billion people. Estimates suggest that in order to meet the demands of growing and increasingly wealthy populations and to accommodate shifts in dietary preferences, food production will have to increase by 70%, and the area of arable land will have to be expanded by 70 million hectares, or about 5%[84] (see page 20).

Specific production increases are projected for cereals (an additional 40% or 900 million tonnes), and meat (an additional 75% or 200 million tonnes)[85,86]. With arable land in short supply, this will no doubt put additional pressure on the world's forests. A net expansion of 120 million hectares of arable land in developing countries (mostly Latin America and sub-Saharan Africa) and a contraction of arable land in favour of other uses in developed countries by 50 million hectares have been forecast[87]. Projections suggest that in order to be able to produce the animal feed that would allow the increase of global meat production, soya bean production would have to increase by 140% by 2050, not including any additional increases for biofuel production[88]. It has been forecast that sugarcane and soya alone will be responsible for a 20 million hectare expansion of agricultural land in Brazil over the next 40 years (more than twice the size of Hungary)[89]. Demand for palm oil production, including for biofuels, is also on the rise and production has been predicted to double or even triple by 2050 – meeting this demand could result in an additional three million hectares of oil palm in Indonesia[90,91]. At the same time, global demand for timber and paper products is also predicted to rise[92], with demand for bioenergy, paper and timber products likely to triple the amount of wood currently being taken from plantations and natural forests by 2050[93].

GOVERNANCE

Many tropical forest countries identify weak governance, inadequate or conflicting policies, and illegal activities related to a lack of enforcement as critical underlying causes of deforestation[94,95]. However, defining 'good' governance is challenging. It encompasses the quality and aims of the decision making process, involves actors and stakeholders beyond both the government and the forest sector, and is contextual, with different nations experiencing unique barriers and opportunities for achieving and defining good governance[96].

Low levels of transparency, accountability, and participation in decision making, low human capacity and poor technical knowledge, and limited resources and coordination in forest management and administration often characterise weak governance. Indicators of such issues often include pervasive corruption, significant conflicts over forest ownership and access rights, and often significant evidence of illegal or unplanned forest conversion[97,98].

Policies that seek to improve forest governance therefore often target improvements in the application of forest laws and capacity for law enforcement, establishing clear and equitable land tenure and use rights, and developing systems for monitoring performance and improving accountability at national and local levels[99,100,101,102]. Critically, even the existence of resources, policies or political will to combat deforestation can be insufficient to combat the economic and political strength of the direct drivers of deforestation when undermined by elements of weak governance[103,104]. For example, the annual loss in revenues and assets due to illegal logging on public lands alone has been estimated to be around US$10-18 billion worldwide[105].

The onus for improved governance that prevents deforestation from forest risk commodities is not only on tropical forest countries. The governments of consumer countries, in most instances, lack regulation which could increase markets for legally sourced or sustainably produced products (for examples see pages 149 and 153). Existing policies in these countries, such as mandated biofuels targets, can even result in increased deforestation in regions that can increase their arable land through deforestation, such as Indonesia[106]. Later chapters outline policies and actions that can catalyse a reduction in deforestation, often through efforts to systematically improve governance.

CLIMATE CHANGE

Although tropical deforestation and degradation generate significant emissions of greenhouse gases, and act as a major contributor to climate change, there is also evidence to suggest that climate change itself may also contribute to driving deforestation and degradation through a number of pathways.

Global temperature rise has been linked with increased water stress and severe drying of soils and vegetation in tropical forests, with associated forest degradation and erosion in some forest areas[107,108]. For example, predictions suggest that a 2°C increase in the Amazon basin could be associated with an 11% reduction in rainfall in the region and increased drought severity and frequency, which could lead to forest dieback[109,110,*]. Forest diebacks could result in standing forests ceasing to absorb carbon and instead starting to emit it[111], and are expected to occur more frequently in coming decades as a result of more regular and severe climate induced droughts[112]. Evidence also suggests that a tipping point may exist at which climate impacts begin to drive deforestation – models indicate that this may occur once 40% of the Amazon has been deforested[113].

However, recent contrasting evidence disputes this hypothesis, and projects a higher degree of resilience of tropical forests. This data indicates that although relatively modest temperature increases of 1°C can alter the species composition of tropical forests and affect rates of forest degradation and regeneration, this may not increase forest die back. A reason for this could be the additional release of CO_2 which can act as a forest fertiliser, increasing tree growth and CO_2 absorption[114].

Regional average temperature increases and changes in precipitation rates are also linked to deforestation and are likely to negatively affect both yields and the area suitable for crop production. This may necessitate a transition of croplands into new forest areas and changing patterns of deforestation[115]. Despite the debate surrounding the mechanisms of climate-induced forest mortality, and uncertainty over the mechanisms of change, there is scientific consensus that reducing deforestation, and the resulting maintenance of existing carbon sinks to support climate regulation, will increase forest resilience to droughts and fires as well as temperature variations[116].

* Defined here as tree mortality noticeably above usual mortality levels.

POVERTY

There are complicated interactions between forests, the political powerlessness of indigenous people and local communities, and the difficulties in alleviating poverty in tropical forest countries[117]. The degree to which deforestation and forest degradation can be causally linked with poverty varies considerably, and depends on both the scale of analysis, and the social, economic and institutional context[118]. While this study does not encompass a comprehensive summary of the range of evidence dealing with these linkages, some broad conclusions can be drawn.

Communities living in areas of high forest cover tend to have high rates of poverty, and relatively high degrees of reliance on forests and forest products for subsistence and livelihoods[119]. However, while some research indicates a link between poverty and higher rates of land use change and deforestation[120], and cautions that policy options that reduce deforestation rates may therefore increase poverty by limiting agricultural outputs[121], other evidence strongly contests this hypothesis. Research demonstrates that forest risk commodities are predominantly feeding better-off consumers in cities in developed and developing countries[122], with deforestation rates increasing with increasing urban growth and agricultural exports, but not with increases in poor rural populations[123]. In addition, studies have also shown that the deforestation attributed to the richest households in forest communities are up to 30% higher than for the poorest households[124], suggesting that poverty alone does not drive deforestation.

Similarly, while the expansion of agriculture can alleviate poverty for poor communities in forest regions, particularly when linked to the smallholder cultivation of forest risk commodities[125,126], the opposite can also be true. For example, forest clearances and subsequent fires in Sumatra have resulted in falling incomes and fewer income opportunities due to forest degradation[127]. There is also strong evidence that in many cases the economic benefits from activities that are linked to deforestation and forest degradation (e.g. clearance for oil palm plantations) tend to be captured by medium to large scale companies, or by elites within communities, reinforcing income inequalities[128,129].

SMALLHOLDERS AND DEFORESTATION

Smallholders, numbering in the millions worldwide, farm on landholdings of anything from less than a hectare in densely populated rural areas of Africa to a hundred hectare plots in government sponsored settlements in the Brazilian Amazon. Most smallholder households have small footprints due to limited access to credit, farm labour, and other capital. As a group they have been labelled as both the culprits and the victims of deforestation, changing depending upon the dominant discourse at the time. Much of the deforestation caused by smallholders is driven by production of staple crops for subsistence or small-scale entry into nearby urban markets. However, they are also intricately linked to the forest-risk commodities outlined in this book, sometimes being displaced by larger players in search of land for commercial agriculture but at other times as important, albeit small-scale, players in the commodity chain.

ROLE AND IMPORTANCE

The relative importance of smallholders as actors of deforestation and degradation varies greatly across continents and countries. While many countries in Latin America and Asia have shown a shift towards increasing dominance of forest risk commodities and export crops[xxiii], deforestation in Africa is still largely driven by smallholder subsistence agriculture and fuelwood harvest[xxiv].

In **sub-Saharan Africa**, although individual families may farm on less than a hectare of land, high population density and limited non-farm economic opportunities for the rural poor has led smallholders to be key drivers of deforestation[xxv]. Although some believed that an increase in oil and mineral production would help decrease pressures on Africa's tropical forests, in many cases, the increase in demand for staple crops and charcoal from urban populations with higher incomes has meant continuation of high deforestation and degradation rates by small farmers, particularly in peri-urban areas and along transportation corridors[xxvi].

In **tropical Asia**, commercial agriculture dominates but approximately 40% of deforestation can be attributed to small-scale subsistence agriculture[xxvii]. Given their roles in other commodity chains (see below), the total footprint of Asian smallholders is even greater.

Latin America sees a wide variety of country contexts. In Brazil, while commercial actors dominate, agrarian reform settlements, which have brought landless farmers to the Amazon starting in the 1970s, were found to be the site of 18% of the Amazon's deforestation up to 2010[xxviii]. In contrast, smallholder subsistence drives much of deforestation in many countries in Central America as well as Colombia and Peru[xxix]. In Peru, for example, 75% of deforestation to 2012 occurred in <0.5 hectare plots and smallholder agriculture is cited as the key driver of deforestation at a national level[xxx].

SMALLHOLDERS, SUBSISTENCE, AND SHIFTING CULTIVATION

The bulk of smallholder deforestation is driven by cultivation of staple crops (e.g. maize, manioc, rice) and small-scale cultivation of cash crops (e.g. coffee, cocoa, cotton). Internal emigration and rural exodus in some regions are leading to growing populations of the urban poor who depend on local smallholders to supply staple foods to growing urban markets. As such, smallholder production is intricately linked to food security for both rural and urban populations. It is important to consider the permanence of the deforestation caused by smallholders as they often undertake shifting cultivation wherein cleared areas are left fallow and forest regrowth occurs quickly, creating a patch-work of forests of different ages in contrast to the expansive clearings for commercial agriculture. In many cases, then, shifting cultivation by smallholders does not lead to permanent forest loss but instead replacement of primary forests with degraded secondary forests[xxxi] such that the actual greenhouse gas emissions from smallholder agriculture may be smaller than imagined[xxxii].

SMALLHOLDERS AND FOREST RISK COMMODITY SUPPLY CHAINS

First and foremost, it must be noted that forest risk commodity production often leads to *displacement* of local peoples, causing smallholders to move further along the agricultural frontier and causing leakage into forest areas. This has been documented with cattle ranchers and soya farmers purchasing conglomerations of lands from smallholders in Brazil[xxxiii] or oil palm plantations encroaching on community lands in Indonesia[xxxiv,xxxv]. Roads built by the timber industry can facilitate movement of smallholders further into the frontier, with logging roads often being a precursor to land invasions and later deforestation by smallholders and large landowner alike[xxxvi].

Smallholders also play an active role in supplying raw materials for many forest risk commodities. While soya requires mechanization and sees very limited participation of smallholders in the supply chain, they play an important role for palm oil, cattle, and timber. In Indonesia, one-third of land under oil palm is cultivated by smallholders[xxxvii]. In other countries, smallholders are showing increasing interest in entry into the palm oil market and some countries are providing economic incentives and technical assistance to facilitate that transition (e.g. Peru). For cattle, many smallholders breed cattle which are later sold to fattening farms which play an integral part in the supply chain[xxxviii]. Smallholders also participate in the timber supply chain: in many cases, they supply local markets or provide raw materials to commercial loggers[xxxix], selling standing trees from their forested lands at low prices[xl] or through more equitable partnerships or grower schemes[xli].

IN SUMMARY

Individual smallholders clear small forest patches principally to meet the immediate needs of their families. Given their numbers, however, as a group they are responsible for a significant proportion of deforestation across the tropics and play important roles in the supply chains for key agricultural commodities. As such, effective and equitable mechanisms to reduce tropical deforestation must consider the implications for smallholders as both actors and potential victims of changes in land use dynamics.

Mary Menton
Global Canopy Programme

INFRASTRUCTURE

Infrastructure developments, such as energy infrastructure and transport networks, can act as indirect drivers of deforestation and can also have significant social impacts, such as the displacement of indigenous peoples and local communities.

The establishment of roads in forest areas tends to have limited impacts on forest cover, but the opening of access to previously inaccessible areas can then facilitate legal and illegal logging, and the conversion of forest to farm land. For example, the construction and paving of the 4,800km Trans-Amazonian highway has been cited by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) as a key factor in deforestation[130]; the 1,400 km long Douala–Bangui Road across the northern Congo Basin was completed in 2003, and has resulted in logging, poaching and forest loss; and the Samling road (named after the Samling Timber Corporation) is opening up Malaysian Borneo to industrial logging[131].

Large-scale dams feature increasingly prominently in energy strategies of countries with tropical forests. In Malaysian Borneo, for example twelve large dams are currently in development[132], raising concerns of significant environmental and social impacts[133]. Large dams in tropical forest areas do not only lead to direct deforestation from flooding valleys but can also exacerbate climate change. Globally, hydro dams are estimated to contribute at least 4% of the total warming impact of humans by emitting millions of tonnes of the greenhouse gas methane[134]. At the same time, increased deforestation from other sources can result in less rainfall and therefore in less energy generation from the dams (see page 22)[135].

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FINANCE

Finance can flow into tropical forest countries from multinational companies, banks, and investors in the private sector, and from governments, publicly-funded financial institutions and development banks in the public sector, ranging from institutions such as the World Bank, to sub-regional and programme-focused funds like the International Fund for Agricultural Development (IFAD).

The range of financial products and investments available, and the geographical scope of the institutions providing them, means that finance has a complex, broad and multi-sectoral effect in many tropical forest regions. While the effect is not fully understood, finance can be economically, socially or environmentally beneficial, e.g. rural credit programmes linked to environmental protection and social development; or it may be damaging to tropical forests. It is the potential negative impacts of finance on deforestation and forest degradation that are briefly discussed here – later sections (from page 129) analyse the capacity of finance to catalyse a reduction in deforestation.

Finance can be directly or indirectly linked to deforestation. Commercial banks*, for example, have been accused of financing companies that are directly involved in activities that lead to deforestation[136]. On the other hand, loans may be provided for the development of large-scale infrastructure projects (e.g. dams or highways – see page 46) which can indirectly facilitate deforestation in new forest areas[137].

Finance from the public sector has also historically played a role in deforestation by incentivising the growth of agricultural production in tropical forest regions. By providing capital for land acquisition and technological improvements, notably biofuels and feedstocks[138], public sector finance has a role in causing land-use change and consequently deforestation[139,140]. In Brazil, for example, the expansion of soya cultivation on pasture land, made possible by investing in mechanised agriculture, has displaced existing cattle production to the forest frontier and has led to increased deforestation levels in the Amazon[141]. Similarly, the availability of rural credit lines for increasing rural agricultural activity in the region has also been attributed to deforestation[142]. This is often a result of the fact that the public sector must trade-off between economic development, social development and environmental stewardship.

* HSBC, for example, was accused of providing loans up to US$25 million (from 2004 until 2012) to Sarawak's largest logging corporations, which have been associated with high levels of deforestation (Global Witness, 2012).

MINING AND DEFORESTATION

The extraction of oil, gas and minerals takes place in some of the most remote and sensitive tropical forest ecosystems around the world, and mining is estimated to cause 7% of total global deforestation in the subtropics[xlii]. Data on the impact of the oil and gas industries on deforestation is lacking, however the direct impacts of mining on forest cover are relatively small compared to the indirect and long term impacts on forest ecosystems caused by associated pollution, infrastructure development and increased human and economic activity in remote forest areas.

More than a quarter of the world's active metal mines can be found within 10km of a protected area[xkuuu] and artisanal and small-scale mining (ASM) commonly operates in protected areas all over the world[xliv]. Concessions also often overlap with indigenous territories[xlv,xlvi]. Nearly 15% (1.08 million km^2) of the Amazon is covered by active and planned oil concessions and about 8% (636,670 km^2) by mineral mining extraction and exploration concessions[xlvii]. Peru sources almost all (92%) of its natural gas from the Amazon[xlviii], where the establishment of infrastructure and pipelines significantly disturbs the landscape and alters drainage systems affecting forest regeneration[xlix].

An important indirect impact of mining is pollution. Highly toxic water is a by-product of oil extraction. Leaks into groundwater systems risk contaminating soils and entire ecosystems, killing off vegetation and reducing re-growth[l]. Mining also requires significant amounts of water and chemicals that are used to separate the mineral from the ore body[li]. In the ASM sector the use of mercury to separate gold is responsible for one third of all the mercury released into the environment globally (727 tonnes annually)[lii,liii], and mercury pollution and waste dumping is also common among large scale mines[liv]. For example, the OK Tedi gold mine in Papua New Guinea has destroyed over 1,600km^2 of forest due to leakage of mercury and mine tailings into river systems. The total forest dieback is expected to reach 3,000 km^2 [lv].

The infrastructure developments that support mineral extraction (e.g. roads, pipelines) also provide migrants and local communities access to new forest areas for illegal logging, expansion of ASM, and agriculture (see page 44). Migration can be rapid and explosive, with significant social and environmental consequences - for example, a village directly upstream from the Amani Nature Reserve in Tanzania expanded from a few hundred ASM miners in 2003 to over 40,000 by 2005[lvi].

The observed price increases for oil and minerals of the last decade are projected to continue[lvii], with the greatest supply of minerals in the future expected to come from developing countries[lviii]. This is likely to put added pressure on tropical forests and new areas such as the Congo basin are also opening up for development.

Anna Bolin
Global Canopy Programme

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FOREST RISK COMMODITY DRIVERS

INTRODUCTION

Demand for and production of the commodities described in this chapter - palm oil, soya, beef/leather, timber and pulp/paper - are responsible for the majority of deforestation and forest degradation in tropical countries. The total export value of these forest risk commodities from tropical forest countries in transition phases one to three (see page 12) reached US$ 134 billion in 2011, which is more than the combined gross domestic product (GDP) of 29% of the world's country economies[143,144].

The last three decades have seen a significant change in the way many of the products that contain forest risk commodities are produced. Market liberalisation in this period, coupled with advances in production technology and information services, as well as improvements in transport logistics and services, have provided the private sector with much greater incentives to fragment production processes and to spread them over a larger number of geographical areas[145]. The associated decline in control by the producers of some consumer goods over raw materials and intermediate products also comes with associated risks and responsibilities, including the necessity to ensure components and ingredients of products come from legal sources and do not contradict corporate sustainable procurement policies.

The mapping of forest risk commodity flows, activities and actors along supply chains can enhance understanding of the various stages of the supply chain and therefore help in identifying effective levers for intervention, by both the private and the public sectors, to reduce deforestation and degradation of tropical forests[146].

In this chapter, each section presents one of the key forest risk commodities, along with a description of the supply chain stages relevant to the commodity, a set of illustrative infographics, a depiction of a simplified supply chain, and a trade flow map showing the export markets of the major tropical and subtropical countries where deforestation for these commodities is occurring. These illustrations are included to demonstrate how global trade in forest risk commodities originates in a small number of forest countries, and to demonstrate the potential risk to the public and private sector of being linked to tropical deforestation through the trade and procurement of these commodities.

METHODOLOGY

TRADE MAPS

The trade maps in this chapter aim to provide an overview of the trade flows of the key forest risk commodities. They have been created using the export values of the commodities, taken from the United Nations Commodity Trade Statistics Database (Comtrade). Due to data limitations for calculating the precise impact each commodity has on deforestation and forest degradation in tropical forest countries, the export and production figures included are representative of entire countries, rather than their forest areas. This is justifiable as global supply chains rarely segregate commodities that originate from within forest areas from those outside.

Major commodity exporting countries have only been included in this analysis where 10% or more of the forest risk commodity production is responsible for deforestation of tropical forests in that country. This percentage has been identified through literature reviews and national government data.

In addition, exporting countries have only been included if they are in forest transition[147] phase one (pre-transition), two (early transition) or three (late transition). Phase four (post- transition) countries have not been included since deforestation rates in these countries are generally low and these countries often serve as a major processing base for forest risk commodities rather than as an exporting country that produces the commodity itself (e.g. China).

INFOGRAPHICS

Domestic production and global consumption data has been generated from the United Nations Food and Agriculture Organisation's statistics database (FAOSTAT[148]) where available. Note that the figures given for domestic consumption are older (2009) than those of the trade data (2011). Commodity specific export data has been generated from Comtrade.

SUPPLY CHAIN STAGES

Supply chains stages vary according to the industry, commodity, and region, but typically include production, processing, distribution, manufacture, retail and consumption. Some large companies also have vertically integrated operations and therefore control multiple stages of the supply chain. In order to help illustrate how the catalysts identified in this book may be applied to these global supply chains, a simple framework comprised of these basic stages is defined and described here. This framework is then used to provide clarity for each of forest risk commodity supply chains discussed later in this chapter.

CONVERSION / PRODUCTION

CONVERSION / PRODUCTION

Production can be defined as the process of transforming a resource or components into a product. Considered in the context of supply chains, production *per se* is only one of a number of stages and generally refers to the creation of raw materials[149], and is typically the stage where the direct impacts on forests occur[150]. In a palm oil supply chain example this would include the clearing and conversion of forested land to establish oil palm plantations.

PROCESSING

PROCESSING

Processing can be characterised as a series of value adding activities to produce a finished product. In this analysis, it encompasses the initial transformative activities. For example, oil palm is processed in mills close to the site of harvest where the fruit is crushed to produce crude palm oil. Further processing activities in the form of refining and fractionation that transform the crude palm oil into numerous derivatives are considered under the Manufacturing stage. The internal capacity of the production country to process the raw material prior to export varies, but initial processing tends to take place in the country of origin due to shifts towards greater investment in domestic processing capacity by forest countries.

TRANSPORT / TRADE / DISTRIBUTION

TRANSPORT / TRADE / DISTRIBUTION

Forest risk commodities are supplied to either domestic or export markets. Factors such as fuel prices, shifts in demand, and global commodity prices define the balance between domestic consumption and export markets.

Transport primarily refers to the international shipping of commodities from the country of origin to manufacturing and end use countries.

Global agricultural **traders** are crucial actors in the commodity supply chains. This sector is characterised by a small number of players that trade the majority of agricultural commodities. In this analysis only traders which take control of physical stocks and are responsible for the transfer of large quantities of commodities and their derivatives from suppliers to buyers internationally are assessed[151]. Traders on financial markets are not included.

Distribution refers to the physical transportation of products from actors such as distributors, importers and exporters, agents, brokers, wholesalers and merchants to manufacturers of the final consumer and industrial products. These actors are typically smaller and more numerous than the big global agricultural traders, and they perform a variety of functions which constitute distribution[152]. In the palm oil supply chain example this stage includes the shipping of crude palm oil to an overseas port by a commodity trader and the subsequent delivery of the product to a refinery.

MANUFACTURING

Manufacturing includes the production of final ingredients for the food, feed and fuel sectors amongst as other, as well the manufacturing of the final goods for consumer or industrial use. In this stage too there is a trend towards increasing market shares among a number of companies that are often active across a number of supply chain stages through vertically integrated business models. In the case of palm oil this may include the refining of the crude palm oil into shortening and its use as an ingredient in the manufacture of a bakery product.

RETAIL / CONSUMPTION

Retailers provide product manufacturers with access to consumers[153]. Recent trends have seen consolidation of the sector and leading consumer brands hold significant influence along their commodity supply chains all the way back to production. The top 15 supermarkets for example account for 30% of all supermarket food sold globally[154]. This section refers to the sale of goods to private consumers but also to users of industrial products.

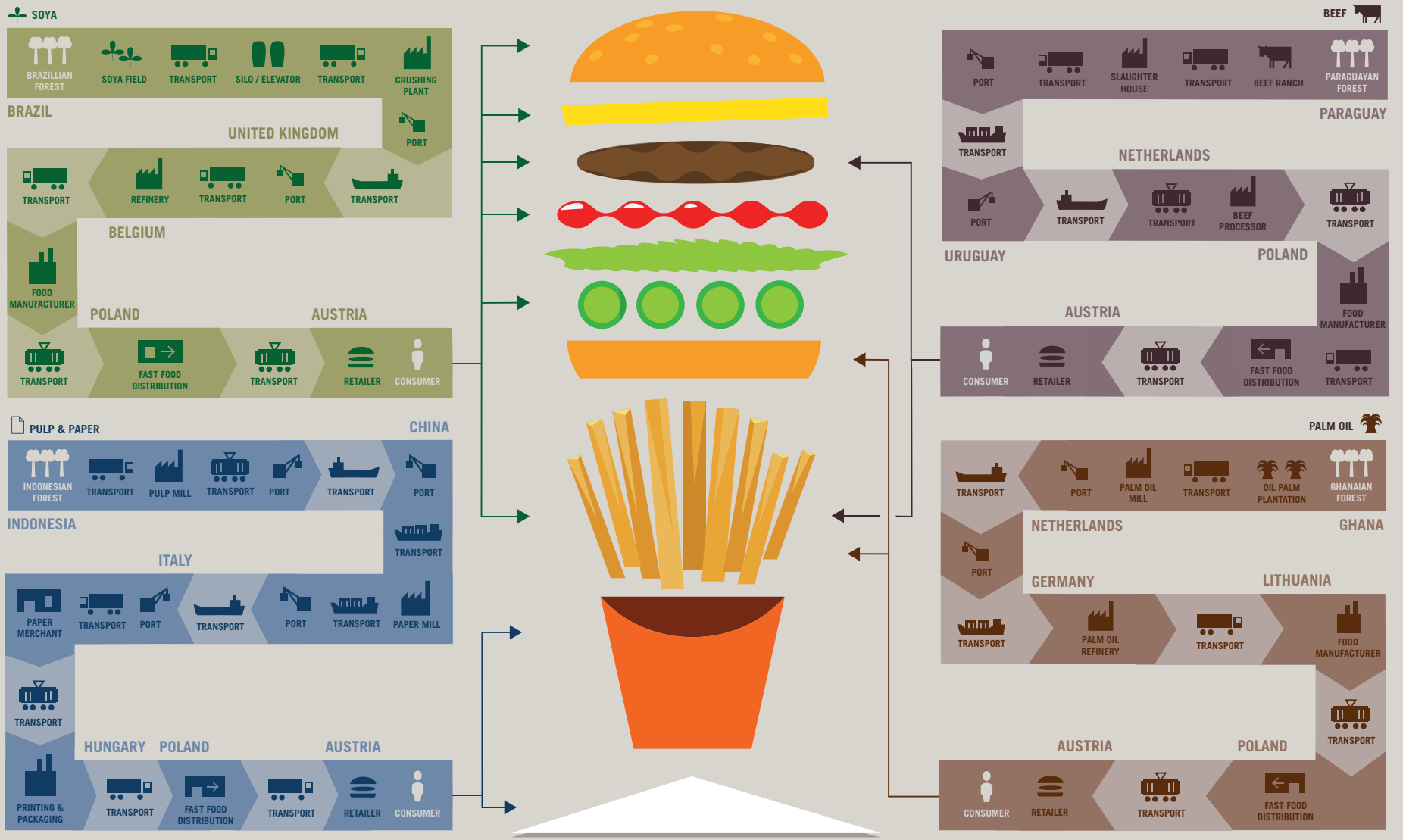
Consumption is the final stage of the supply chain and refers to personal or industrial use of manufactured products that are made from forest risk commodities. In the palm oil example this stage would consist of the purchasing of the finished bakery product by a consumer in a supermarket.

SUPPLY CHAIN GRAPHIC

The graphic overleaf illustrates, through the example of a widely available product, the intricacy of supply chains containing forest risk commodities. In this realistic but non-specific example of a beef burger supply chain, at least 75 stages in various countries have been identified for just a handful of possible ingredients. By necessity the supply chain stages have been simplified and do not represent their true complexity. The exporting and importing countries were selected for illustrative purposes, rather than to describe specific trends or trade relationships of an actual supply chain. However, the supply chain for the same food product in other major forest commodity consumer countries, such as the U.S.A, China or Australia, would look similar to the one depicted here.

FROM FOREST TO FOOD: A SUPPLY CHAIN HYPOTHESIS

THIS GRAPHIC INDICATES THE COMPLEXITY OF HYPOTHETICAL GLOBAL SUPPLY CHAINS THAT COULD LEAD FROM TROPICAL FORESTS TO A FOOD PRODUCT PURCHASED IN AUSTRIA.



SOYA — HAS BEEN USED IN BEEF PATTIES (ALSO THROUGH ANIMAL FEED) AS SOYA PROTEIN OR SOYA FLOUR AND IN THE BUN, SAUCE & CHEESE AS LECITHIN. HAS ALSO BEEN USED IN SAUCES, PICKLES AND FRENCH FRIES AS SOYABEAN OIL.

BEEF — HAS BEEN USED IN PATTIES AS GROUND BEEF AND IN FRENCH FRIES AS COATING OR AS FRYING FAT (TALLOW).

PALM OIL — THE OIL HAS BEEN USED IN THE BUN AND HAS ALSO BEEN USED AS FRYING OIL IN FRENCH FRIES.

PULP & PAPER — HAS BEEN USED IN PACKAGING AND IN NAPKINS.

PALM OIL AND BIOFUELS

INTRODUCTION

The oil palm *Elaeis guineensis* is a tropical species native to West Africa and introduced to South East Asia in 1848[155,156]. It has the highest yield and lowest cost per hectare of any major oilseed and is also the leading edible oil by production volume[157,158]. Palm oil is found in a wide variety of products across a range of industries, including food, animal feed, cosmetics, pharmaceuticals, chemicals, and, increasingly, biofuels. In the past decade, palm oil production has more than doubled and has become a major driver of deforestation particularly in tropical South East Asia[159,160].

Oil palm expansion can contribute to biodiversity loss and forest fires, and have a range of social implications[161]. The climate change implications of conversion of forests to oil palm plantations are especially consequential for plantations established on carbon-rich peatland, which have made palm oil production a major source of global CO_2 emissions in Indonesia[162].

CONVERSION / PRODUCTION

CONVERSION / PRODUCTION

Indonesia and Malaysia account for around 90% of global production and exports[163], which contributes significantly to their economies. Production is also expanding into other areas of the world, including western and central Africa, Latin America and Papua New Guinea[164]. Most of this expansion of the palm oil industry has taken place by bringing more land into production rather than through yield improvements[165] and much of the land-use change associated with the spread of oil palm plantations is characterised by forest loss[166]. From 1990 to 2005, over 50% of oil palm plantation expansion in Indonesia and Malaysia occurred after planned deforestation of lowland tropical forests to allow agricultural development[167].

Smallholders, and large-scale plantation company estates (either privately or government owned), supply mills which are located in close proximity since the oil fruit must be processed within 24 hours of harvesting to avoid spoilage[168]. Smallholders can either be independent, and therefore free to sell to any mill that is willing to buy their products, or become supported smallholders, and be formally linked to specific mills[169]. Oil palm plantations can present an economic opportunity for hundreds of thousands of smallholder farmers, who, together, control a significant share of the area planted with oil palm and account for an estimated 35-45% of the total production in Indonesia and Malaysia[170,171]. When it comes to company owned estates, consolidation is common and recent mergers and acquisitions have resulted in several very large plantation and processing companies such as Sime Darby Berhad and Wilmar International Ltd[172].

PROCESSING

PROCESSING

Oil palm is harvested as fresh fruit bunches (FFB) throughout the year before being transported to mills for processing, where they are crushed to produce crude palm oil (CPO) and crude palm kernel oil (CPKO) which have become key ingredients of many processed food products around the world. Palm kernel meal (PKM) is a by-product of the crushing process and is utilised by the animal feed industry and in electricity generation[173]. Malaysia's industry is characterised by a high internal capacity for refining and processing, while Indonesia has focused on expanding oil palm plantations, and shipping the raw material to foreign processing plants, although investments have been made recently to increase domestic capacity for refinement and around 60% of exports from tropical countries are now made up of refined palm oil and its fractions (see page 64)[174,175,176].

TRANSPORT / TRADE / DISTRIBUTION

TRANSPORT / TRADE / DISTRIBUTION

In 2009, around three quarters of palm oil products produced in Indonesia and Malaysia were exported, with Indonesia replacing Malaysia as the largest palm oil producer in the world in 2005[177,178]. Like other internationally traded agricultural products, palm oil is transported and traded via a range of methods and supply chain stages, from plantations to mills and crushing facilities, to refineries (domestic and foreign), and ultimately to global manufacturers and consumers - making traceability very difficult[179]. International traders have a substantial influence over the global oilseed commodities markets. They influence price, balance supply and demand, and control the movement of palm oil and its derivatives internationally, and a few companies dominate that international trade including Archer Daniels Midland (ADM), Bunge, Cargill and Louis Dreyfus[180]. They often maintain close links with other parts of the supply chain. This is illustrated by the ownership interest of commodity trader Archer

Daniels Midland (ADM) in the Wilmar Group – one of the largest palm oil plantation owners - and by Cargill's direct ownership of plantations and mills in Indonesia[181,182].

MANUFACTURING

MANUFACTURING

The refining of CPO and CKPO consists of neutralisation, bleaching and deodorising. The oil is 'fractionated' to manufacture ingredients such as palm oleine (liquid fraction) and stearin (solid fraction) for use in different end-products, such as edible oils and soaps[183]. Globally, 70% of palm oil is used in processed consumer food products, with the rest supplied for industrial uses including biodiesel[184]. Among the final consumer goods manufacturers that use the largest amount of palm oil products and report their palm oil policies are Unilever, BASF and Nestlé[185]. A number of manufacturers of consumer goods, especially in the EU, are committed to using or phasing in the use of palm oil certified by the Roundtable for Sustainable Palm Oil (RSPO), but the scheme is not without criticism and only half of the globally available certified palm oil is sold internationally[186,187].

RETAIL / CONSUMPTION

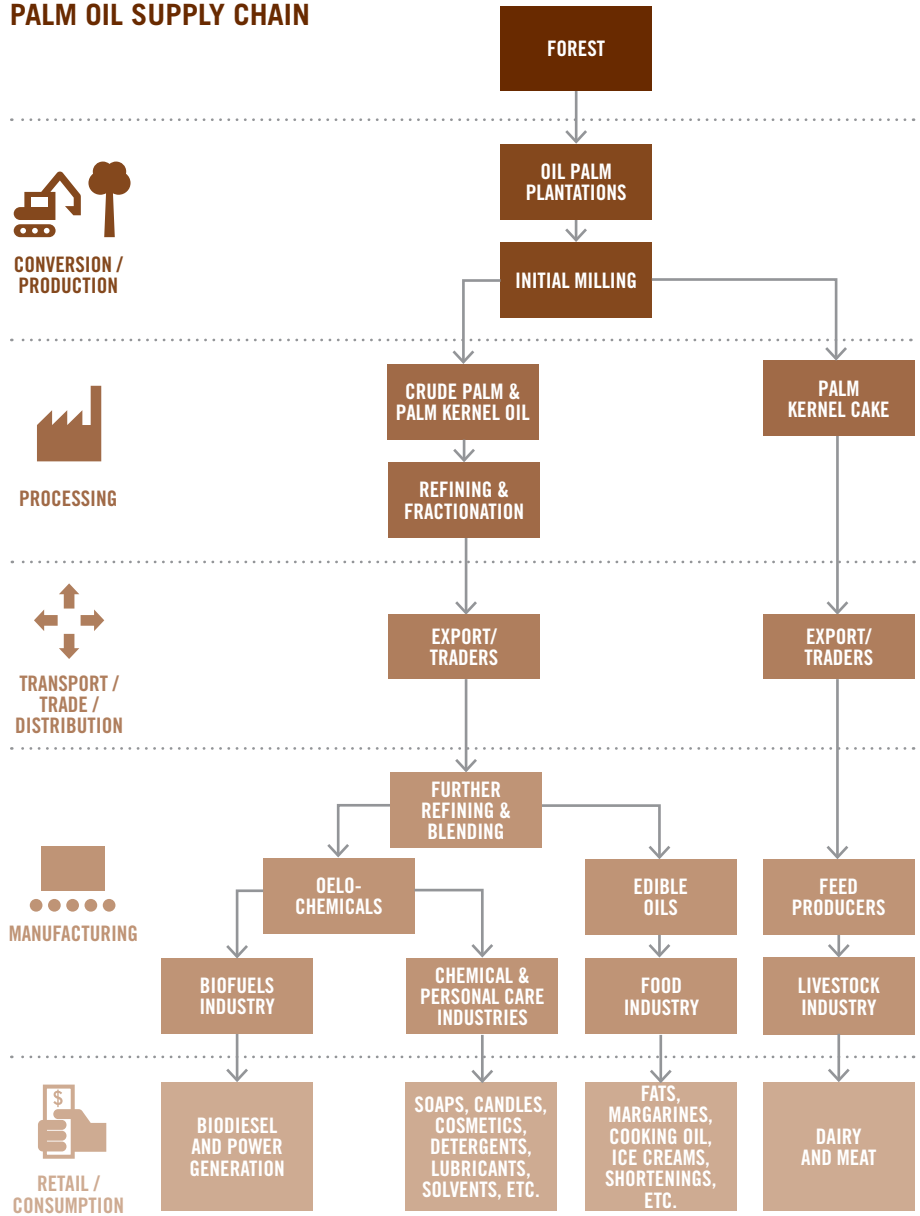
RETAIL / CONSUMPTION

The key importing countries of palm oil products from Indonesia and Malaysia are India and China, who account for just over one third of the exports, with EU countries importing significant amounts[188]. In addition to palm oil and its fractions, consumer countries also import palm oil in finished, processed consumer products. In the UK, for example, it has been estimated that 30-50% of the total palm oil used enters the country in this form. The key consumer food products that contain palm oil include margarines, frying fats, biscuits, snack foods, bakery products and dairy replacers[189]. Global per capita consumption of palm oil has increased from less than 0.5kg in the early 1970s to 2.5kg in 2009[190].

OTHER ISSUES

The biofuels industry is also expanding rapidly, driven by policy mandates and renewable energy goals around the world, and palm oil has been considered for its potential in development of alternative fuel sources in the form of biodiesel. Recently, Indonesia and Malaysia have developed flexible refining capacity for biodiesel production for export in consideration of commodity prices[191].

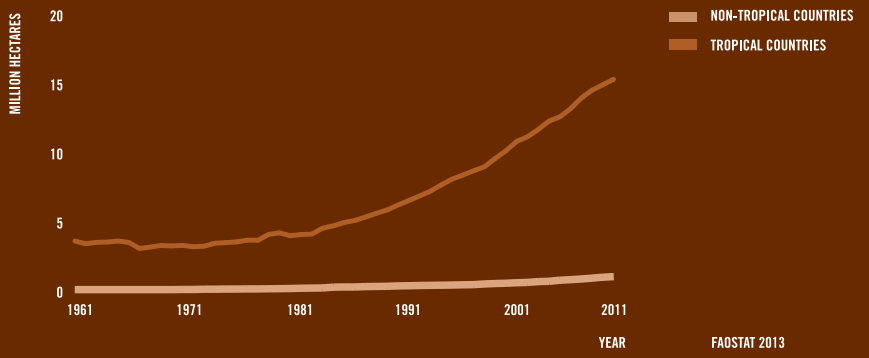
PALM OIL SUPPLY CHAIN



EXPORT VALUE OF PALM OIL PRODUCTS FROM TROPICAL COUNTRIES IN 2011

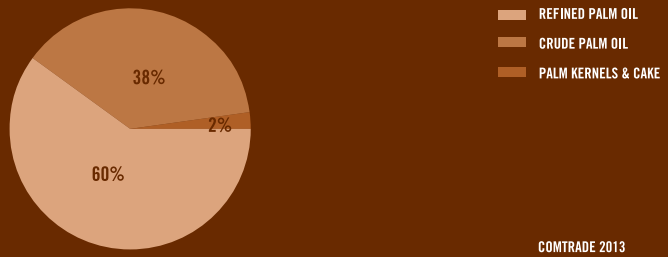
US$40,111,038,755

AREA OF OIL PALM HARVESTED



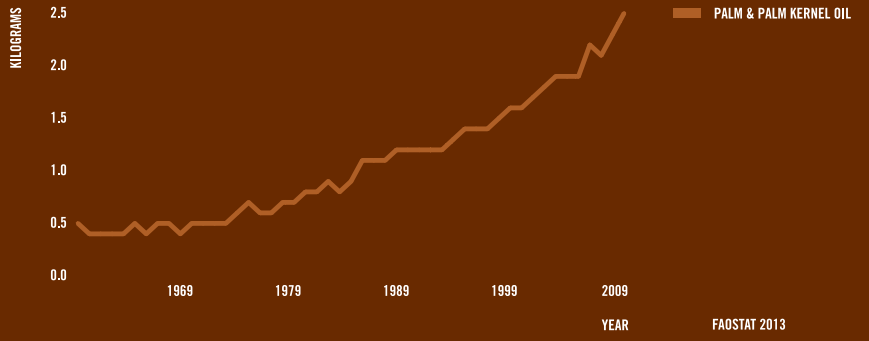
FAOSTAT 2013

PALM OIL PRODUCTS EXPORTS FROM TROPICAL COUNTRIES IN 2011



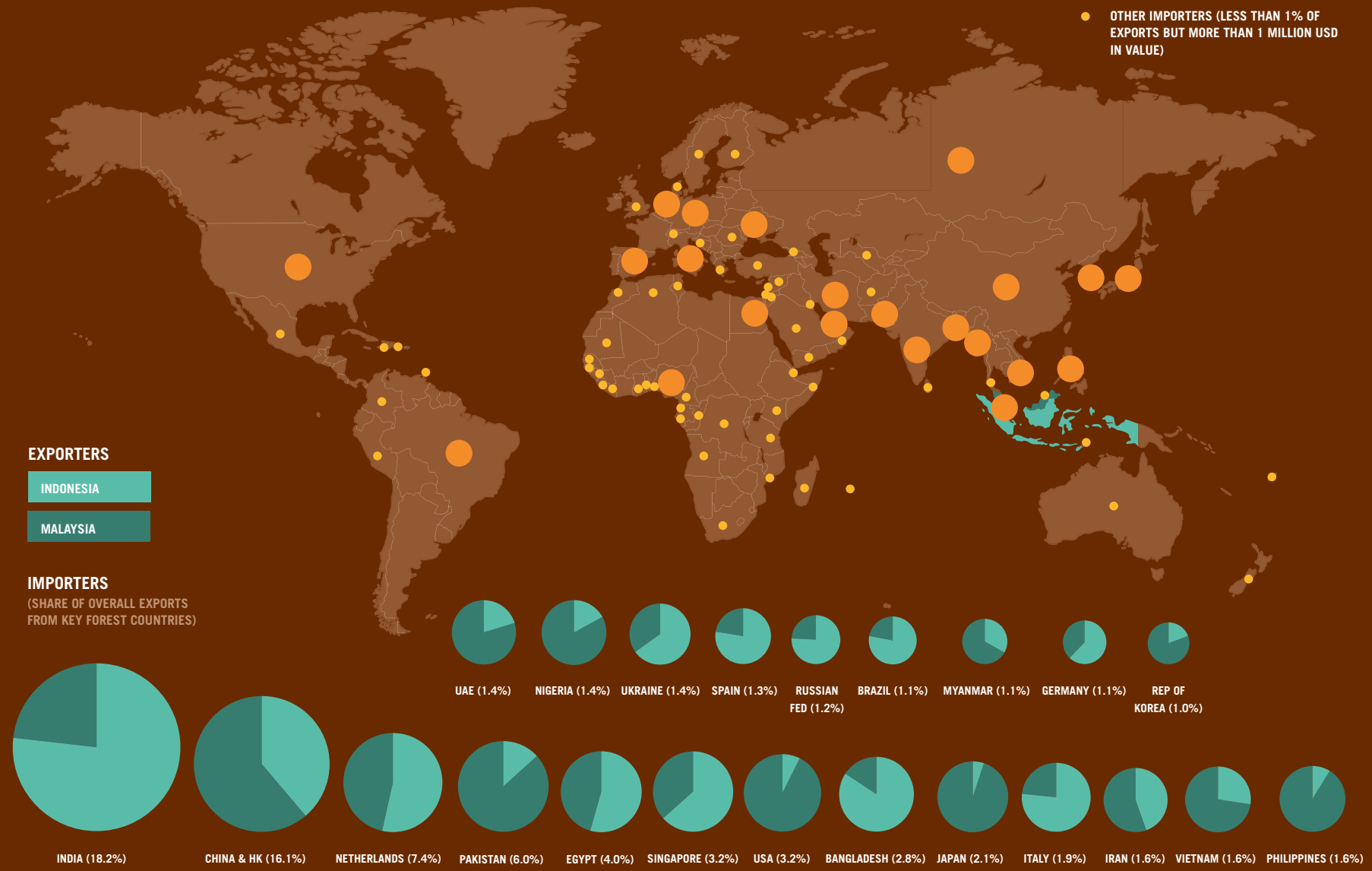
COMTRADE 2013

GLOBAL PER CAPITA CONSUMPTION OF PALM OIL AND PALM KERNEL OIL



FAOSTAT 2013

PALM OIL TRADE
FROM KEY FOREST COUNTRIES IN 2011



SOYA

INTRODUCTION

The soya bean is native to South East Asia and is a hugely versatile commodity, serving as one of the most important global sources of protein and vegetable oil for human consumption. It can be found as an ingredient in numerous processed foods[192], and is marketed in the form of whole soya beans and its two main derivatives, soya bean oil and soya bean meal[193]. Soya bean meal is predominantly used as an ingredient in animal feed for livestock and poultry[194]. Non-food uses of soya are also increasingly common, including paint, ink, wax and soya-based foam and plastic products.

CONVERSION / PRODUCTION

CONVERSION / PRODUCTION

Global production has been rising quickly, driven recently by growing demand in China, and the major soya producing nations are the U.S.A, Brazil and Argentina, which together account for almost 80% of the world's supply[195,196]. It is largely in Brazil and to a lesser extent in Paraguay and Bolivia that soya has been directly associated with the deforestation of tropical forests in the last twenty years.

Soya beans are typically grown on large-scale industrial farms[197], with a much smaller proportion of growers being smallholders, especially compared to the oil palm sector[198]. Harvested soya beans are centrally stored in large silos, where various sources are mixed, which can result in an early loss of the ability to trace products to their origin within this supply chain[199].

During the early 2000s soya bean cultivation in the Amazon underwent a dramatic transformation, driven by low land prices, fertile land and lower labour costs. In Mato Grosso for example, the planted area of soya increased 80 times between the years 1980 and 2004, and was a critical part of the so-called 'arc of deforestation' (alongside Para and Rondonia) in which 85% of all Amazon deforestation from 1996 to 2005 occurred[200,201]. The majority of soya expansion took place on land that was initially cleared to raise cattle, pushing ranchers into forestlands and thereby indirectly driving further deforestation[202], with a smaller area directly cleared to establish soya plantations[203,204]. At its peak, deforestation for soya production in Mato Grosso reached around 18.5% of total national annual deforestation between 2001 and 2005, driven by rising demand for animal feed in Europe and Asia and supported by government interventions[205]. Rising demand also raises concerns for other forests, including the Brazilian Cerrado, and the lowland forested regions of Bolivia[206,207].

A moratorium was put in place in Brazil in 2006, which contributed to an impressive reduction of the deforestation rate (see page 93), and ensured that soya produced in areas deforested after July 2006 could not be commercialised by companies associated with the Brazilian Association of Vegetable Oil Industries (ABIOVE) or the National Association of Cereal Exporters (ANEC). These associations represent approximately 90% of the Brazilian soya market[208]. In Paraguay, which until eight years ago had the second highest deforestation rate in the world largely due to land use change for soya production, there has been a strong political response to the deforestation driven by forest risk commodities. From 2004, a moratorium made it illegal to convert forested land in the Atlantic forests of eastern Paraguay, and reduced deforestation in that region by 90% against a 2002 baseline[209]. In September 2013 the moratorium was extended for another five years[210].

PROCESSING

The crushing of the soya bean to produce soya bean oil and soya bean meal represents the initial stage of processing. Around 67% of the global soya crop is processed into soya bean meal, most of which is further processed into animal feed. Of the 16% of global soya production that is processed to make soya oil[211], an estimated 95% is consumed as edible oil, and the remainder used for industrial products such as soap and biodiesel[212].

PROCESSING

TRANSPORT / TRADE / DISTRIBUTION

Around 34% of soya produced globally is exported and traded internationally[213]. Soya bean trading and processing in all the major exporting countries is dominated by the same large, international commodity trading companies that also dominate the trade of palm oil and include ADM, Bunge, Cargill and Louis Dreyfus[214]. Following harvest, these big traders collect, store and transport soya beans for crushing or export. Soya bean farmers often make forward-sales to the commodity traders in return for seed, fertiliser and agro-chemicals, giving the trader indirect control over production[215].

TRANSPORT / TRADE / DISTRIBUTION

China has emerged as a key actor in the soya industry and serves as the main export destination for Brazil, accounting for almost 67% of the total soya bean export in 2011[216]. Like some countries in South Asia, North Africa and the Middle East with limited internal capacity for expanding production, China has invested heavily in domestic crushing capacity. As a result, their demand for soya bean has grown rapidly over their demand for other soya products. Today China is the world's largest importer of soya bean for its growing livestock industry, and future projections see China increasingly dominating world soya bean imports[217,128].

MANUFACTURING

MANUFACTURING

Soya beans are used in the **manufacture** of a huge variety of products from baked goods and margarines to cosmetics, inks, biodiesel and even building materials such as plywood[219]. There are a few dominant players in the food and cosmetics industries, including Unilever, Procter and Gamble, Kraft and Nestlé[220,221].

RETAIL / CONSUMPTION

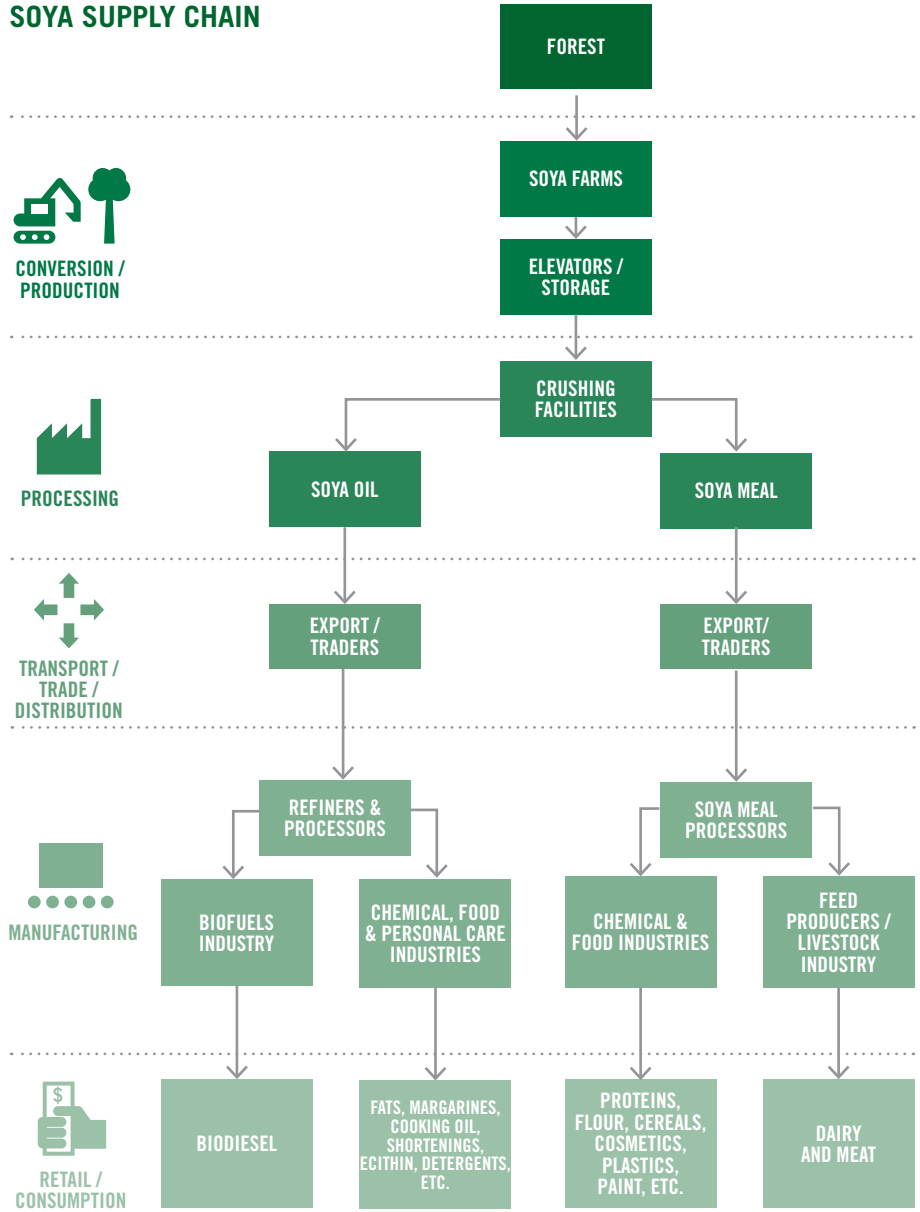
RETAIL / CONSUMPTION

Domestic consumption of soya beans and derivatives within Brazil represents around half of its production, although an increasingly significant proportion of production is exported to meet growing global demand[222]. Growing consumption in Asia, particularly China and India, and increased biodiesel production capacity in Europe have increased global demand for soya bean oil. Europe remains the primary consumer market for soya bean meal, although the market has become stagnant in recent years as a result of a decline in meat consumption. South East Asia is the fastest growing market for soya bean meal to meet demand for animal feed to support increased consumption of meat[223].

OTHER ISSUES

Soya bean oil is the primary feedstock for biodiesel production in Brazil, accounting for 75% of production in 2011[224] and in Mato Grosso biodiesel from soya bean cultivation may be responsible for nearly 6% of direct annual deforestation in the state[225]. Future projections of production of biodiesel feedstocks from developing countries see palm oil and soya bean oil remaining the most important crops, resulting in significant production increases[226].

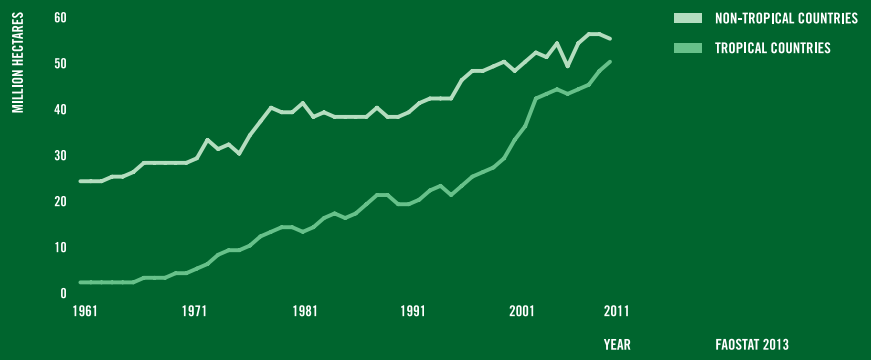
SOYA SUPPLY CHAIN



EXPORT VALUE OF SOYA PRODUCTS FROM TROPICAL COUNTRIES IN 2011

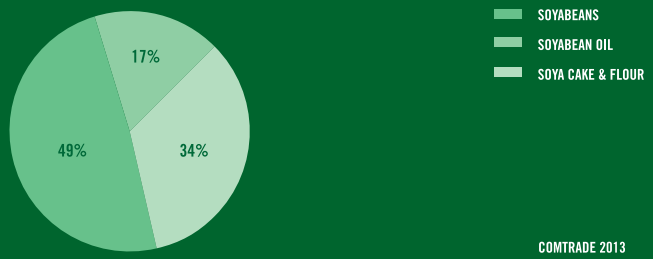
US$48,890,663,330

SOYA AREA HARVESTED



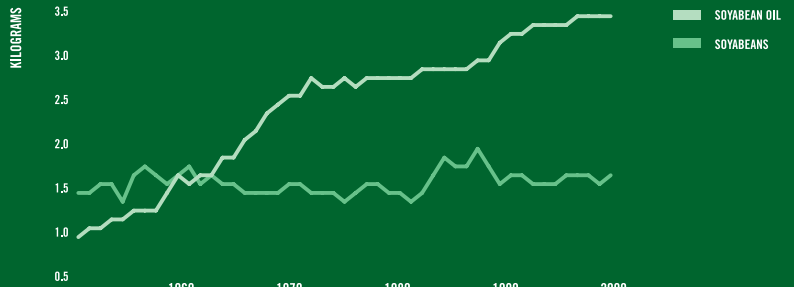
FAOSTAT 2013

SOYABEAN PRODUCT EXPORTS FROM TROPICAL COUNTRIES IN 2011



COMTRADE 2013

GLOBAL PER CAPITA CONSUMPTION OF SOYABEANS AND SOYA OIL



FAOSTAT 2013

SOYA TRADE
FROM KEY FOREST COUNTRIES IN 2011

BEEF AND LEATHER

INTRODUCTION

Around 57 million tons of beef are produced annually around the world, through a wide range of production systems[227]. Since 2003 there have been more cattle in tropical countries than in non-tropical countries[228]. To match the demands for beef from a larger and more affluent global population[229], the global cattle population is set to increase by 70% to 2.6 billion by 2050[230].

CONVERSION / PRODUCTION

CONVERSION / PRODUCTION

Cattle expansion is a key driver of deforestation in a number of tropical countries, primarily in Latin America, but is also a significant contributor to wealth creation and employment[231,232,233]. Brazil now has the largest cattle herd of all the tropical forest countries, while Uruguay has the largest number of cattle per capita[234]. In Brazil, 75% of deforestation has been linked to the cattle industry[235], yet Brazilian production for export is relatively new. From the early 1990s, forest clearing for cattle ranching accelerated, and from 1990 to 2003 the cattle herd in the Amazon grew by 140%[236]. The export value of cattle products from Brazil tripled between 2001 and 2009[237]. Cattle ranching has also been identified as a deforestation driver in the dry forest region of the Argentinean and Paraguayan Chaco[238]. The latter has seen an increase in pasture area of 70% from 1990 to 2008[239].

The cattle sector is also a substantial contributor of greenhouse gas emissions[240], with the full set of emissions from cattle raising responsible for approximately half of all Brazilian emissions[241]. Meat also requires more land and water per unit of nutritional value than other agricultural commodities[242]. For example, one kilogram of beef requires 15,000 litres of water to produce, compared with 600 litres for 1 kilogram of peas[243].

The Argentinian and Brazilian industries are based on year-round grass-fed cattle[244]. However, there is an increasing use of the 'feedlot' system, where cattle are reared intensively, and fed on animal feed that can include soya products, in an effort to increase production efficiency[245,246]. The Brazilian Amazon cattle supply chain, from ranch to slaughter, is complex, with many small calving ranches acting as indirect suppliers, selling to large fattening farms and other types of ranch, who then directly supply slaughterhouses[247]. Cattle may also go through auctions prior to reaching the slaughterhouse[248].

There is also a clandestine market* in Brazil that comprises approximately one quarter of cattle slaughtered. This type of activity is less likely to respond to market signals[249]. In 2009, following NGO reports drawing attention to illegal deforestation on cattle ranches, and legal action by the Public Prosecutor's Office in the Amazon state of Pará, a beef moratorium known as the G4 cattle agreement was put in place in Brazil (see page 92). The largest Brazilian meatpackers agreed to purchase only from ranches in the Brazilian Amazon that had not been connected with deforestation since the date of the agreement[250].

PROCESSING

The majority of cattle reared in the Amazon are slaughtered in the region. Their meat, leather and co-products are then transported across the country and exported globally[251]. Within the Brazilian beef supply chain the meat processing sector is highly consolidated, with three companies – JBS and Marfrig (two of the largest protein producers in the world), and Minerva - accounting for almost 70% of exports, with JBS alone shipping nearly 40% of the beef[252,253,254]. They, as well as other large processors headquartered in Brazil, also operate in other tropical forest countries in Latin America[235].

PROCESSING

The leather industry is a major global industry, with raw hides and processed leather products widely traded and demand growing continuously. Leather is primarily sourced from animals which are reared for the production of meat[256], and the value of cattle hides represents less than 20% of the market value of an animal[257]. The tanning industry involves the processing of raw hide into leather, to be used in the manufacture of a wide range of consumer products. The processing of hides also generates by-products which are utilised by other sectors, such as in fertiliser and animal food production[258].

TRANSPORT / TRADE / DISTRIBUTION

An estimated 80% of Brazilian and Argentinean beef is consumed domestically while in Paraguay and Nicaragua this percentage is much lower at just over 20%[259]. Beef from the slaughterhouse sold on the domestic market generally passes through a wholesaler,

TRANSPORT / TRADE / DISTRIBUTION

* Defined by Walker et al., 2013 as all meat produced at facilities without official inspection codes.

distributor or retailer before reaching the end consumer. The retail sector in Brazil is highly consolidated[260], with three supermarket chains – Wal-Mart, Carrefour and Pão de Açúcar – responsible for a large proportion of beef sold in the country[261].

The Brazilian leather export supply chain is complex, encompassing a wide variety of leather products and types for export[262]. The majority of exports are hides with two thirds of leather products exported to China and Italy[263]. JBS and Euro America Assessoria are the two largest leather exporters in Brazil, accounting for almost half of exports combined[264].

MANUFACTURING

MANUFACTURING

The movement and trade of animal products is highly regulated, far more than for any other forest risk commodity. This has impacts on the manufacturing of products containing beef, and their imports into consumer countries. In some countries such as EU member states such imports have to come from approved overseas establishments[265]. Nevertheless, scandals such as the horsemeat contamination of beef products in Europe highlight the difficulties in tracking products and ingredients along the entire supply chain.

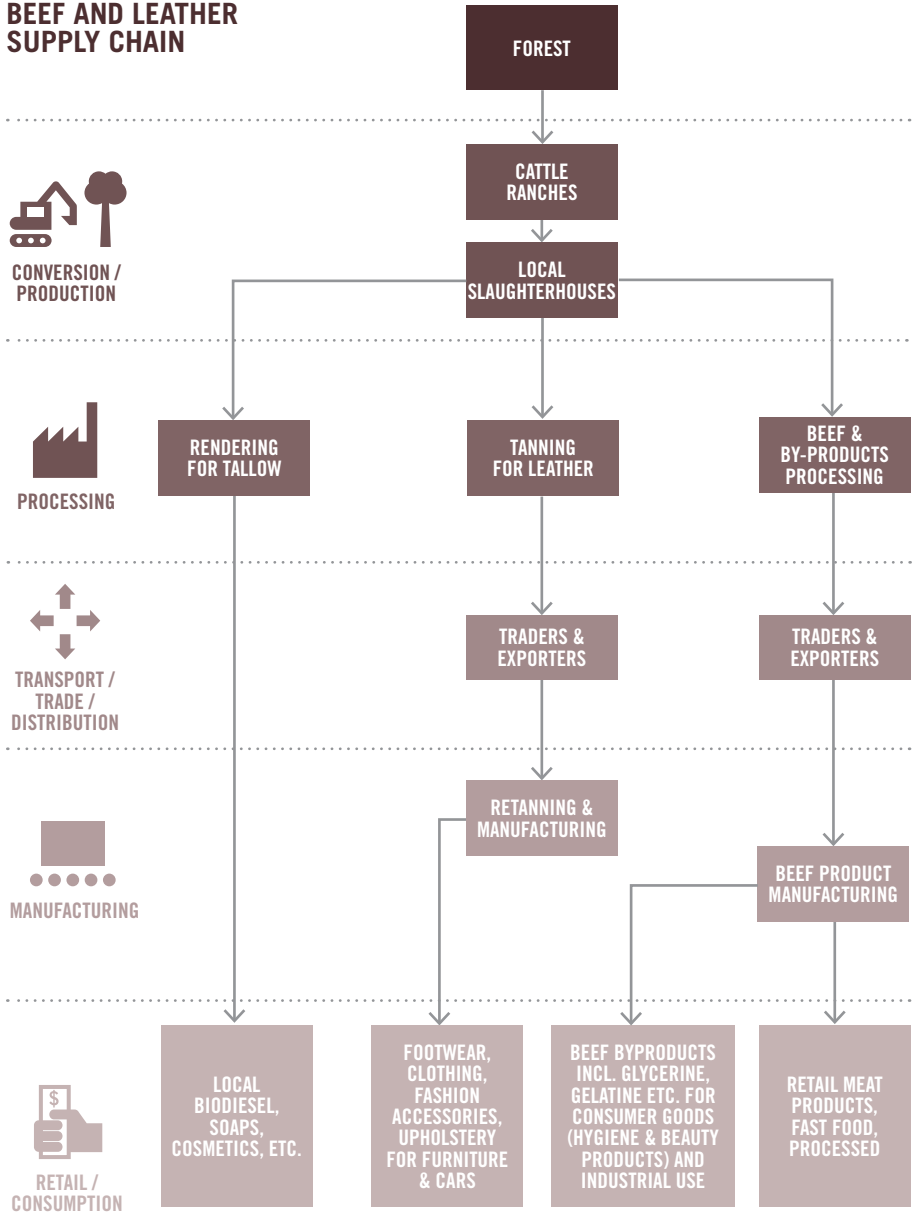
China and Italy are the top global leather product manufacturers[266] but production is increasingly dispersed across many countries and regions, and leather products from Brazil, Argentina, Paraguay and other South American forest countries make their way into major brands sold worldwide via the main processing countries. Footwear accounts for over half of all leather use with the garments, auto and furniture industry also using large amounts of leather[267].

RETAIL / CONSUMPTION

RETAIL / CONSUMPTION

Global per capita consumption of beef now stands at 9.6kg per year[268] and there are many food products around the world that contain beef. In addition to beef and leather there is also demand for other products derived from cattle. These co-products serve a range of different industries, including the cosmetic, food, animal feed, pharmaceutical and other industries, and can be found in numerous products. Animal fat, in particular beef tallow, is widely used for a range of products, especially in the cosmetic and personal care product industries. It is also an important and growing source of biodiesel in Brazil[269].

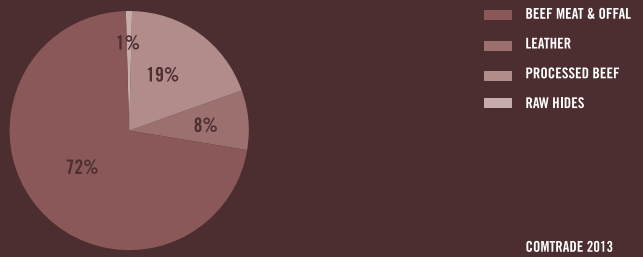
BEEF AND LEATHER SUPPLY CHAIN



EXPORT VALUE OF BEEF & LEATHER PRODUCTS
FROM TROPICAL COUNTRIES IN 2011

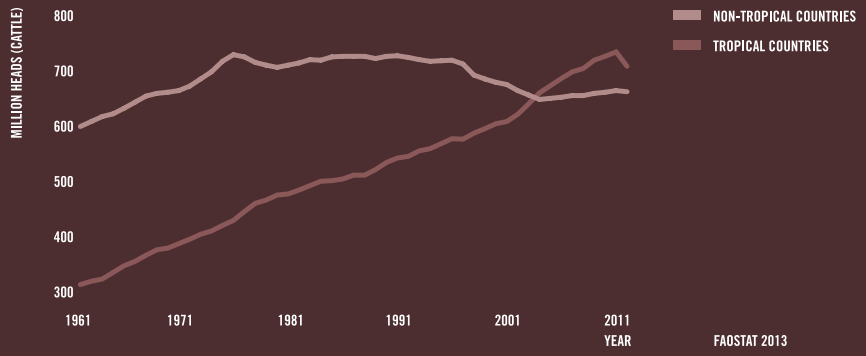
US$10,787,004,970

BEEF & LEATHER PRODUCTS EXPORTS FROM TROPICAL COUNTRIES IN 2011



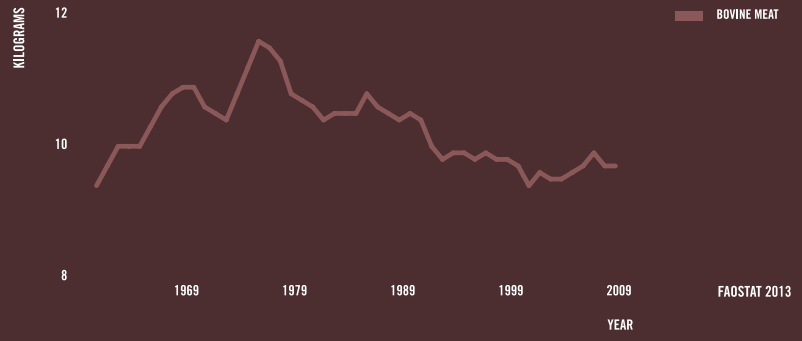
COMTRADE 2013

NUMBER OF CATTLE AND PRODUCTION OF LEATHER (HIDES)



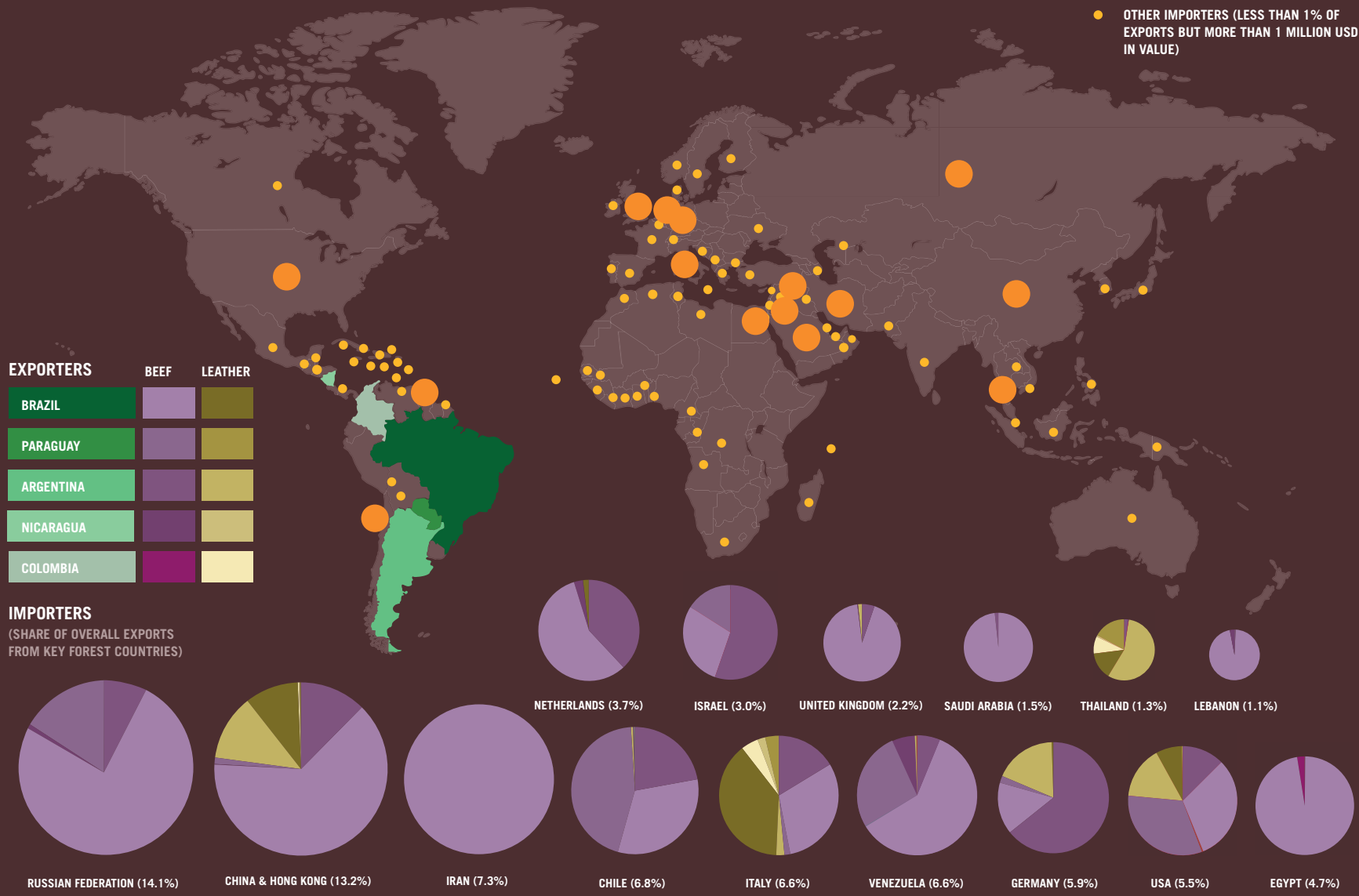
FAOSTAT 2013

GLOBAL PER CAPITA CONSUMPTION OF BOVINE MEAT



FAOSTAT 2013

BEEF & LEATHER TRADE FROM KEY FOREST COUNTRIES IN 2011



TIMBER, PULP AND PAPER

INTRODUCTION

The supply chains for timber, pulp and paper consist of a vast number of operations and operators and are much more complex and fragmented than those of other forest risk commodities[270]. Between 1992 and 2012 the global export value of these products more than doubled from US$104 billion to US$233 billion[271], and global demand for wood products is expected to increase even further, creating added pressure on tropical forests[272]. High demand also drives an illegal market in timber, generating up to an estimated US$15 billion annually in illicit earnings, and with underpayment of royalties and taxes on legally sanctioned logging amounting to an additional US$5 billion[273]. The production and trade of timber products is particularly susceptible to illegality: timber is a fungible product that is easy to launder, originates from sparsely populated areas far from enforcement, and moves within a global supply chain that provides many entry points for corruption[274].

CONVERSION / PRODUCTION

CONVERSION / PRODUCTION

Tropical forest countries only account for a small proportion of the production and trade of global wood products[275]. However, with demand increasing, the pressure on tropical forests in developing nations will continue to rise, exacerbated by lower production costs, and by favourable climates for fast growing trees, incentivising the conversion of natural forests to plantations[276]. Logging as a driver of forest degradation is most significant in Latin America and South East Asia, particularly in Indonesia[277,278], which has some of the highest rates of deforestation in the world. This has been largely driven by forest clearances to provide land for oil palm plantations, which can be financed by the sale of cleared timber[279].

Harvesting of wood involves either indiscriminate or selective felling of trees in a forest or plantation. Unlike in the paper industry, only a small number of tree species are considered economically viable for use by the timber industry. Selective logging entails the removal of particular trees (e.g. high-value species) and the resulting forest degradation can leave the area more susceptible to fires and exploitation by other extractive industries[280].

The area of productive planted forests has expanded considerably in the past two decades[281] but replacing primary forests with monoculture production plantations can be associated with negative environmental impacts, including on CO_2 emissions[282], water resources[283] and biodiversity[284]. In Africa, particularly in the Congo Basin, timber production is also a significant threat to tropical forests, with logging concessions being allocated for large areas of forest[285,286]. In addition, fuelwood collection, particularly in Africa, can be a key driver of forest degradation[287].

The global area of certified forests has been estimated at around 400 million hectares, but in the tropics, the proportion of forests that are certified as being sustainably managed remains very low[288]. 87% of all certified forests are in the northern hemisphere, while only 2% of tropical forests are currently certified[289].

The pulp and paper industry is more consolidated than the timber industry and in Indonesia, where much of the tropical forest deforestation related to the production of pulp and paper is occurring, two companies dominate the sector: Asia Pulp and Paper (APP), a subsidiary of the Indonesian Sinar Mas Group, which also has large palm oil operations, and Singapore-based Asian Pacific Resources International Holdings Limited (APRIL). Together they account for 80% of the pulp production in Indonesia[290].

PROCESSING

Following their removal from the forest, logs are sorted according to potential end uses and usually transported a short distance from the harvest area for processing, either directly to mills or through intermediate storage at terminals[291]. Export of whole logs is becoming less common, with several tropical forest countries having implemented export bans at various times to address illegal logging and to stimulate the local economy[292]. Higher quality logs are generally assigned to sawmills for timber production, while smaller logs are used to make paper, biomass fuel and wood-based panels. Critically, when timber harvests are combined in a sawmill, identity preservation and the traceability of the products can be easily lost[293] - but are easier to maintain than for other forest risk commodities and paper. Exports of unprocessed timber and primary processed timber products are becoming less important in international trade. This reflects a shift towards an increase in the export of higher added value secondary products (e.g. flooring)[294].

PROCESSING

TRANSPORT / TRADE / DISTRIBUTION

TRANSPORT / TRADE / DISTRIBUTION

The timber product supply chain contains multiple-level distribution channels. Products may make their way from sawmills to market via various intermediaries, including wholesalers, retailers, distributors, agents, exporters, and importers[295]. Similarly, paper goes through many trading and production stages including pulp and paper mills, paper merchants, printers, and retailers.

The largest importing country of tropical sawnwood is China, which uses it mostly for furniture manufacturing and home improvement in a market that is also closely tied to Chinese exports. China is also the largest importer of tropical logs[296] and the largest importer of pulp from Indonesia. The major importers of tropical plywood are Japan, South Korea, the U.S.A, Taiwan, and the UK[297]. Processed timber products, and furniture in particular, are shipped from tropical countries to markets in the U.S.A, Japan and the EU[298], which are also the key import markets of paper products. In recent years these imports have levelled out or fallen, partly due to the increasing popularity of electronic alternatives[299]. Demand for these products is now shifting to emerging markets in Asia[300].

MANUFACTURING

MANUFACTURING

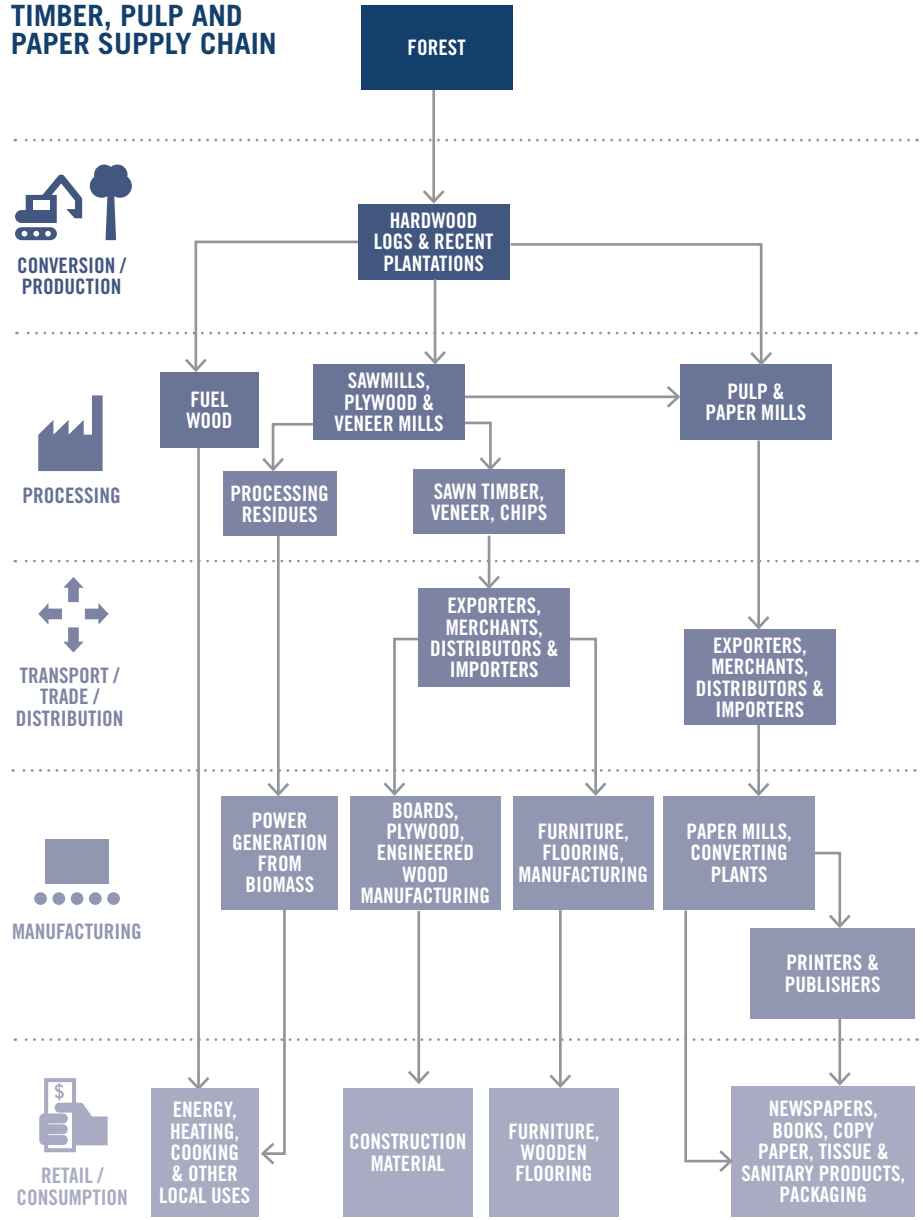
The manufacturing process turns timber into a vast array of products including furniture, flooring, plywood and boards as well as structural timber products and building materials. More than 60% of global trade in secondary processed wood products is made up of furniture and furniture parts[301]. Pulp is largely converted to printing and writing paper, newsprint, tissue, container board, and other paper and paperboard products in more than 4,000 pulp mills globally[302].

RETAIL / CONSUMPTION

RETAIL / CONSUMPTION

Do-It-Yourself (DIY) chains, building material suppliers and furniture retailers represent some of the many points of sale for wood products to the private and professional consumer[303]. Large retail chains command a significant share of national markets and have the ability to exert a great deal of influence over the supply chain structure[304]. Very large amounts of paper products (around US$80 billion worth) are sold as tissue through various retail channels including supermarket chains[305].

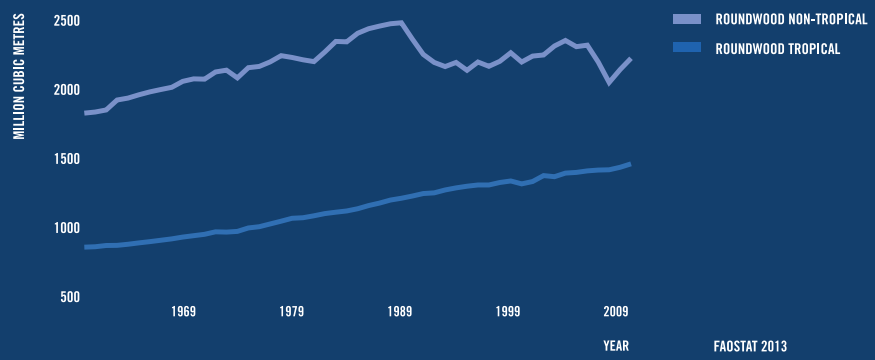
TIMBER, PULP AND PAPER SUPPLY CHAIN



EXPORT VALUE OF TIMBER, PULP & PAPER PRODUCTS
FROM TROPICAL COUNTRIES IN 2011

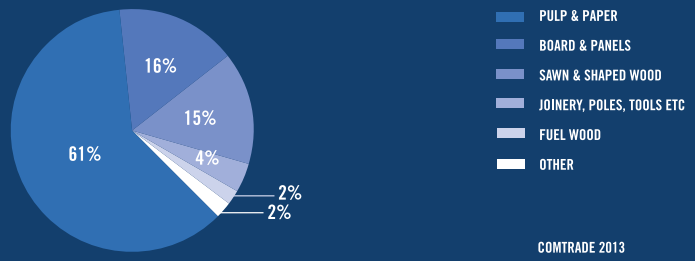
US$34,592,171,583

ROUNDWOOD PRODUCTION



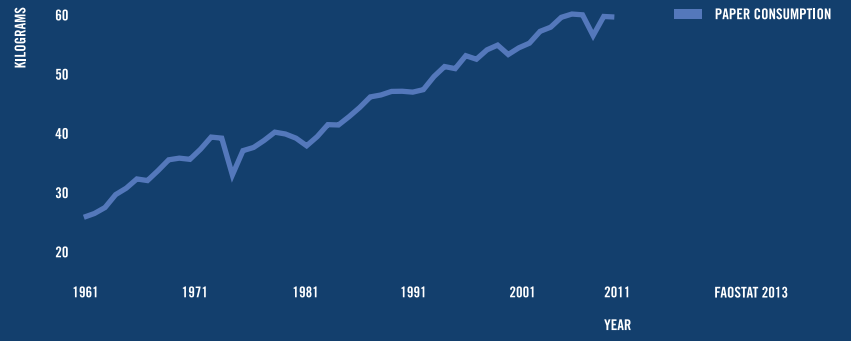
FAOSTAT 2013

WOOD PRODUCTS EXPORTS FROM TROPICAL COUNTRIES IN 2011



COMTRADE 2013

GLOBAL PER CAPITA CONSUMPTION OF PAPER

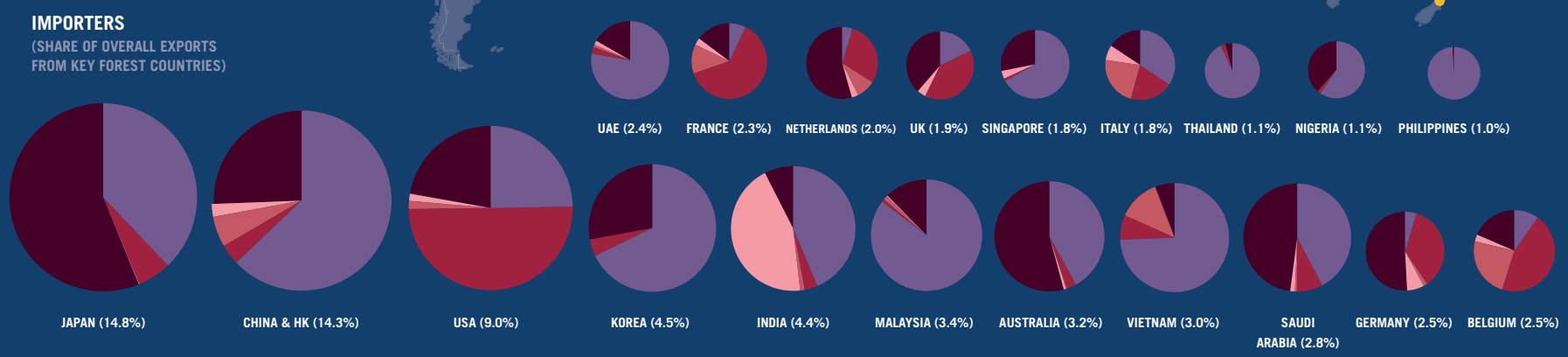


FAOSTAT 2013

TIMBER, PULP & PAPER TRADE FROM KEY FOREST COUNTRIES IN 2011

IMPORTERS

(SHARE OF OVERALL EXPORTS FROM KEY FOREST COUNTRIES)



POLICY SYNERGIES TO ADDRESS DRIVERS OF DEFORESTATION: CASE STUDY FROM THE AMAZON CATTLE INDUSTRY

Growing international demand for the agricultural commodities is increasing pressure on forests throughout the tropics[lix]. Effective policies to prevent deforestation while encouraging improvements in productivity on existing crop and pastureland are a key global need[lx]. Forests cover vast and often remote areas of public and private land, and tenure is often uncertain[lxi]. As long as forests can be cleared without detection and land rights ignored, effective measures to control deforestation are likely to prove elusive.

Brazil has a national deforestation monitoring system, Prodes, which has provided annual deforestation data since 1988[lxii]. A system for registering rural properties was legislated in 2009, the Rural Environmental Registry (CAR), which stores georeferenced private property boundaries and vegetation cover information[lxiii]. If widely adopted by land holders, these systems allow for the identification of whose land is being cleared and could prove a powerful combination to combat deforestation and support transparent, deforestation-free commodity supply chains.

Cattle pasture is found on around three quarters of cleared land in the Brazilian Amazon[lxiv,lxv] and is therefore a priority for tackling deforestation in Brazil. In June 2009, the Federal Prosecutor's office in the Amazon state of Pará filed a lawsuit against slaughterhouses buying from ranches with illegalities and warned supermarkets to stop buying from those slaughterhouses[lxvi]. At the same time, Greenpeace released a widely publicised report linking deforestation to the supply chains of Brazil's largest meatpackers and the end products sold by large supermarkets and leather brands in Brazil and internationally[lxvii]. As a result, Brazilian supermarkets suspended purchases with prosecuted slaughterhouses and many international leather brands adopted "zero deforestation policies". This led meatpackers to sign agreements both with the Federal Prosecutor and with Greenpeace. Meatpackers issued with a lawsuit signed "Terms of Adjustment of Conduct", agreeing to ensure all ranches they buy from are registered with the state CAR. In an October 2009 agreement with Greenpeace, Brazil's four largest meatpackers committed to a phased-in plan to drop all suppliers in the Amazon biome whose ranches have new deforestation or are not registered in a state CAR[lxviii].

The number of properties registered in Pará state have risen to over 70,000[lxix], representing the majority of privately-owned land in the state[lxx]. Since 2009, other states in the Brazilian Amazon have taken similar action and companies throughout beef and leather supply chains have taken steps to support deforestation-free supply chains[lxxi,lxxii]. However, not all slaughterhouses have signed onto TACs, the requirement to purchase from ranches registered in the state CAR applies only to direct supplying ranches, not calving ranches and property numbers in other states' CARs are much lower than in Pará. Land use decisions are influenced by a range of economic, social and political factors, including international market demands and government policies[lxxiii], but the measures in place in Brazil offer an opportunity for several key factors to be addressed simultaneously.

Nathalie Walker
National Wildlife Federation

THE SOYA MORATORIUM

The "Soya Moratorium", launched in 2006, is a fascinating example of the potential for reputational risk to drive collective action among powerful agro-industrial companies that solves an environmental problem. Through the Moratorium, most of Brazil's soya industries agreed to stop buying soya grown on previously-forested lands that were cleared after July 25, 2006. For seven years, the Moratorium has been remarkably successful, contributing to the Brazilian Amazon region's 76% decline in deforestation.

The Moratorium was inspired by the steep spike in deforestation rates in the Brazilian Amazon region in 2003 and 2004, when more than 25,000 square kilometers of forest were cleared each year (compared to an average of 19,500km^2 for 1996-2005) [lxxiv]. This surge in deforestation was the result, in part, of a perfect soya expansion storm in which a weak Brazilian currency that favored soya exports converged with escalating international demand for vegetable protein[lxxv]. Soya fields expanded into the southeastern forests of the Amazon region, especially in the state of Mato Grosso[lxxvi], and led Greenpeace to launch a campaign targeting European restaurants that bought chicken raised on meal containing Amazon soya[lxxvii]. Soya producers and processors operating in the Amazon responded, eager to eliminate Amazon deforesters from their supply chains.

The Moratorium fostered important innovations. A system for monitoring soya fields in Mato Grosso was developed, identifying areas of new soya production that did not meet the Moratorium's cut-off date, and publishing the names of landholders not in compliance. A working group of Brazilian NGOs was established to accompany the process and a strong dialogue developed among civil society and industry actors.

The Moratorium is not a perfect instrument for addressing deforestation, however. It does not address deforestation of the Cerrado woodland vegetation driven by soya expansion, nor does it take into account the indirect effects of soya production on forest clearing for cattle pasture. Cattle pastures suitable for conversion to soya are at a premium, and the sale of these areas has capitalized cattle ranchers to move deeper into the forest[lxxviii]. The Moratorium is also renewed annually, and has almost ended in the past. Part of its fragility is the lack of positive incentives for soya farmers who forgo legal forest clearing on their land.

It is very difficult to assess, with precision, the impact of the Moratorium on Amazon deforestation. The "perfect storm" for soya expansion ended in 2005, and the total area of soya production actually declined in the state as the Moratorium went into effective[lxxix]. When production began to surge again in 2007, rising yields of cattle production allowed beef and soya production to both increase in Mato Grosso while deforestation continued to decline sharply[lxxx,lxxxi]. Other initiatives contributed to the further decline of deforestation, including restrictions on access to farm credit for producers located in high-deforestation municipalities, the Beef Moratorium launched in 2009, and greater law enforcement[lxxxii].

The Soya Moratorium is best viewed as one important element of a medley of interventions that, together, have suppressed deforestation in the Brazilian Amazon.

Daniel Nepstad and Claudia Stickler
Earth Innovation Institute

INTERACTIONS BETWEEN UNDERLYING CAUSES AND FOREST RISK COMMODITY DRIVERS

Deforestation is a complex process which usually cannot be represented by a one dimensional cause and effect relationship. In fact, the underlying causes and the direct commodity drivers of deforestation and forest degradation are closely interlinked and interdependent in a series of interactions of varying complexity. In many cases it is not possible to reliably model the entire system of factors that intervene in the processes of deforestation[306].

Research indicates that in most areas with high deforestation rates there is an interaction between three or four underlying causes of deforestation, which in turn influence two or three direct drivers. For example, in a frequently seen pattern, road construction (which is associated with wood extraction or agricultural expansion) is mostly driven by policy and institutional factors, but also by economic and cultural factors. At the same time, pro-deforestation policies such as incentives for cash crops, low taxation and others that target land use and economic development, also lead to the expansion of commercial crops and pastures in combination with an extended road network[307].

Similarly, it has been predicted that if infrastructure and therefore access to forests is improved within the Congo Basin, a projected regional population growth of 110% (by 2030), combined with rising demand for commodities (including for biofuels), dietary changes in emerging economies, and trade liberalisation will lead to increased deforestation for agriculture[308].

Interactions between direct commodity drivers can also occur, as can be seen with the case of soya and beef in the Amazon basin. The expansion of livestock farming into the Amazon was largely driven by the growth of soya bean production, particularly within the Cerrado region[309]. Furthermore, with the increasing use of intensive cattle rearing techniques (feedlots) in Brazil, soya is now also used as a component of cattle feed, thereby producing an interdependent production loop[310, 311].

CHINA'S ROLE IN THE INTERNATIONAL TRADE OF FOREST RISK COMMODITIES

China is the world's largest importer of forest risk commodities from the tropical forests. It is currently the world's number one importer of industrial roundwood, sawnwood, and pulp and the largest exporter of wood-based panels[lxxxiii]. In 2011, China purchased nearly 50% of the soya, 40% of the leather and 11% of the beef that was exported from Brazil (in value). In addition, over 12% of all palm oil exported from Indonesia and 20% of palm oil exported from Malaysia was shipped to China[lxxxiv]. Large quantities of some of the forest risk commodities, such as leather and timber, are re-exported after processing in China but others, including palm oil, soya and beef, primarily serve the domestic market. Successfully addressing the deforestation driven by the production and trade of these commodities will therefore be extremely difficult without the engagement of China.

KEY FOREST RISK COMMODITY EXPORTS TO CHINA IN MILLION USD (2011)[lxxxv]

Rank indicates China's position amongst destination countries of that commodity.

VALUE	EXPORTER	COMMODITY	RANK
11,753	BRAZIL	SOYA	1
3,829	MALAYSIA	PALM OIL	1
2,430	INDONESIA	PALM OIL	2
804	INDONESIA	PULP	1
535	BRAZIL	BEEF	3
438	INDONESIA	TIMBER/ BOARDS	2
347	BRAZIL	LEATHER/ HIDES	1
272	INDONESIA	PAPER	3
203	ARGENTINA	LEATHER/ HIDES	1
94	CAMEROON	TIMBER/ BOARDS	1
39	GHANA	TIMBER/ BOARDS	3

China's role as the largest importer of illegal timber has been the focus of much debate. In 2011 it imported at least 18.5 million cubic meters of illegal logs and sawn timber from around the world, worth around $3.7 billion (not including processed timber products)[lxxxvi]. In recognition of this problem, the Chinese government developed a "Guide on Sustainable Overseas Forests Management and Utilization by Chinese Enterprises" in collaboration with a group of international NGOs, including the World Wildlife Fund (WWF), The Nature Conservancy (TNC) the International Union for Conservation of Nature and Natural Resources (IUCN), and Forest Trends.

China has also entered into bilateral initiatives with the EU, U.S.A and Indonesia to tackle illegal logging imports and is currently developing and testing the Chinese Timber Legality Verification Scheme[lxxxvii,lxxxviii]. However, more needs to be done to ensure timber for the domestic market, or for timber later re-exported to other markets in Asia or elsewhere, comes from legal sources. China exports vast amounts of wooden furniture to the U.S.A, Japan and Europe[lxxxix], but even where regulations to address the problem exist, it is often difficult to guarantee the legality of the timber used once it has been processed.

There are also significant concerns in regards to the operational practices of some Chinese companies that are directly engaged in forestry operations overseas, and have been implicated in illegal logging exports or highly damaging extraction practices in Indonesia, Myanmar, Papua New Guinea and other forest countries[xc].

There are few Chinese initiatives that address the sustainable production, rather than the illegality, of forest risk commodities. The **pulp and paper** industry provides a crucial opportunity for action in this space, with companies such as Asia Pulp and Paper (APP) and Asia Pacific Resources International Limited (APRIL) operating very large pulp and paper mills in China, some of which have been shown to use Indonesian raw materials to produce a variety of paper products which are then exported globally[xci].

China has also seen an enormous increase in **soya bean** imports and Brazil is a key supplier. Half of all soya exported globally is destined for China and it has been estimated that by 2020 up to 90% of Brazilian soya exports will be shipped to China requiring an increase of about 5 million hectares in land planted with soya[xcii]. Furthermore, Chinese companies are also investing heavily in overseas soya bean production. Reports suggest that state-owned Chongqing Grain Group Co Ltd (CGG), plans to invest up to $2 billion in soya processing plants and plantations in Brazil, with other Chinese companies also reported as investing in the region[xciii,xciv]. Currently the Chinese effort to address sustainable soya is in its infancy, but in 2013 the country hosted the annual meeting of the Round Table on Responsible Soya Association (RTRS).

China is the third largest consumer of **palm oil** globally with most of the products being used for food, especially cooking oil. Chinese companies are making major investments in new palm oil operations overseas, especially in Africa and the Congo Basin[xcv]. As of today there is no demand for certified sustainable palm oil in China[xcvi] and it remains to be seen what the impact on land use change from such investments in Africa will be.

Although China's per capita environmental footprint is still much smaller than that of many other countries[xcvii], the processing and trade of forest risk commodities by Chinese companies, and the import of illegal commodities to the country has major impacts on tropical forests and on climate change. Even though China's involvement in initiatives that address the legality and sustainability of forest risk commodities is laudable, it will be necessary to show the same level of commitment the country has shown when it comes to other issues such as renewable energy generation and transport[xcviii]. Strengthened national regulation, partaking in international efforts, creating markets for certified commodities and implementing tools to ensure supply chain transparency could all be part of the solutions to reduce China's role in the deforestation of tropical forests.

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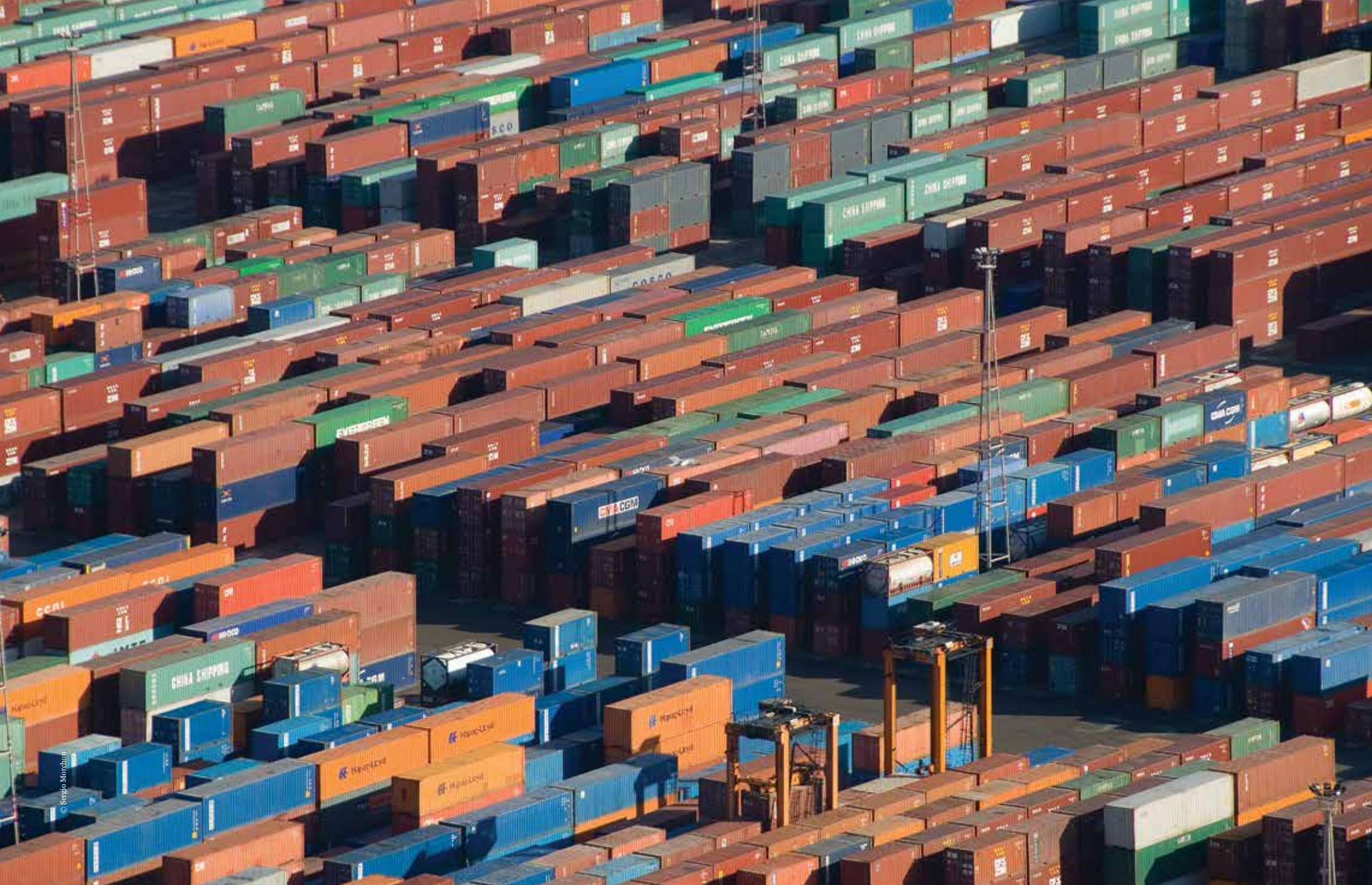
Global Canopy Programme



A FRAMEWORK FOR ANALYSIS

INTRODUCTION

This chapter presents a series of instruments or 'catalysts' that could be implemented to reduce deforestation or forest degradation arising from the production or trade of forest risk commodities. To enhance clarity and ease of analysis, these catalysts can be grouped into three categories according to their main focus and area of impact:

Supply Chain catalysts that influence the operation of supply chains;
Financial catalysts that influence behaviour through price;
Regulatory catalysts that influence behaviour through legality.

Every catalyst is assessed within a framework of five criteria, each represented by a relevant icon, to enable decision makers to rapidly identify and compare the key characteristics and applicability of each instrument. These criteria are:

Stage: This icon describes the stage of the supply chain which the catalyst primarily targets.
Timescale: The estimated time it takes to implement the catalyst.
Implementer: The sector that typically leads in the implementation of the catalyst.
Level: The geographical level at which the catalyst is ordinarily applied.
Resilience: The ability of each implemented catalyst to resist change that could result in the withdrawal or reversal of the catalyst in the future.

For example, a policy maker looking for a rapidly implementable catalyst that addresses commodity production in the supply chain and operates at the local level can use the icons to navigate the chapter and compare and contrast the various options presented. Many of the criteria are interrelated and have co-dependencies, and in some cases catalysts can be considered under more than one category. These variations are described in each catalyst page. It is important to highlight that the aim of the following chapter is not to claim definitive and rigid characteristics for each of the catalysts described. The purpose is to emphasise the key trends and traits that *tend to characterise* the catalyst in question, to assess its interaction with forest risk commodity supply chain stages, and to facilitate action by decision makers.

STAGE

This icon describes the stage of the supply chain which the catalyst primarily targets.

Options: Forest, Conversion/Production, Processing, Transport/Trade/Distribution, Manufacturing, Retail/ Consumption

The catalysts discussed in the following chapter each have differing impacts on particular stages of the supply chain. For example, understanding how different forms of regulation interact with and influence behavioural change at each stage is critical in deciding the feasibility or suitability of implementing a particular catalyst. A summary of a more detailed framework describing the stages of a generalised forest risk commodity supply chain outlined in the previous chapter is presented below.

Stages
1. Conversion/Production: The first stage in the transformation of the forest resource into a commodity.
2. Processing: The processing of a forest risk commodity.
3. Transport/Trade/Distribution: The shipping, trading and circulation of a product or commodity.
4. Manufacturing: The final processing of the commodity to create a consumer or industrial product.
5. Retail/Consumption: The retailing of products through various points of sale and their consumption by consumers or industrial user.

The impacts of catalysts that operate in specific parts of the supply chain are not isolated and can have considerable influence on other parts of the chain in either direction. For example any regulation that limits production of a commodity will trickle down the supply chain to ultimately result in less consumption of that commodity. Conversely, catalysts such as import limitations of forest risk commodities may result in a lack of demand and can therefore impact the production of that commodity. In addition to individual stages, catalysts can also target multiple stages in the supply chain, or can be required to do so in order to be successful.


CONVERSION / PRODUCTION


PROCESSING


TRANSPORT / TRADE / DISTRIBUTION


MANUFACTURING


RETAIL / CONSUMPTION

RESILIENCE

HIGH

MEDIUM

LOW

The ability of each implemented catalyst to resist change that could result in the withdrawal or reversal of the catalyst in the future.

Options: High, Medium, Low

It is important for decision makers to assess the relative resilience of each catalyst when considering the appropriateness of the intervention and to understand the potential trade-offs involved in implementation. This is especially important as the catalysts and/or the associated behavioural changes may be exposed to a variety of political, social and economic challenges after they have been implemented.

Several of the catalysts discussed require a long-term commitment and high level buy-in in order to implement (e.g. international legislation). These catalysts are also often complex, require long timescales to enact (see page 106), and may require engagement from multiple public or private sector stakeholders. As a result, these types of catalysts tend to have a **high** resilience to negative changes or reversal.

However, some catalysts that have been reliant on political capital for their implementation (e.g. national legislation relating to land use change) may be at risk of reversal due to changes in government or in political priorities. In the private sector, investment priorities may also shift in response to changing economic circumstances (such as a recession), which may negatively impact on previous commitments. Catalysts which therefore have a relatively balanced risk of reversal can be said to have a **medium** resilience to change.

In contrast, catalysts which depend for their implementation on a relatively low level of stakeholder commitment or are not supported by legislation (e.g. voluntary moratoria), may be more quickly implemented, but also more easily reversed or diluted with potential negative consequences for deforestation. These catalysts can be considered to have relatively **low** resilience to change.

LEVEL

The geographical level at which the catalyst is ordinarily applied.

Options: Local, National, International

The catalysts discussed in the following chapter tend to be implemented at a particular geographical level. Understanding how each catalyst interacts with and influences behavioural change at these levels can be critical in deciding the feasibility or suitability of implementing a particular catalyst. For example, forms of regulatory catalysts may be implemented nationally, but may influence behavioural changes internationally (e.g. subsidies may lower national production costs, and increase demand for a more sustainable product internationally). The geographical level of implementation can have implications for other key factors, such as the timescale required to initiate a catalyst (see page 106), and the relative resilience of the changes made (see page 104).

LOCAL

NATIONAL

INTERNATIONAL

Catalysts that operate on a **local** (subnational) level tend to be developed and implemented quicker but are more limited in scope, and therefore can often only address the localised drivers of deforestation.

Nationally implemented catalysts impact a much greater area, but can often be more complex to implement, particularly those that target regulatory change in developing countries. However, in the emerging economies of tropical forest countries, such as Brazil or Indonesia, or in the key markets of the EU, India and China, catalysts that target national level change remain very powerful.

Catalysts that operate on an **international** level (such as international agreements or certification) often have global scope and as such have the potential to encompass the major changes needed to address deforestation across several global supply chains. However, they are rarely rapidly implemented and may be difficult to enforce.

TIMESCALE

0-2 YEARS

3-5 YEARS

5+ YEARS

The estimated time it takes to implement the catalyst.

Options: 0-2 years, 3-5 years, 5+ years

It is important for decision makers to assess the time required to implement each catalyst. As well as being a critical factor in evaluating the general applicability of a policy option, the time to initiation also has implications for the overall implementation cost, and is closely linked with the relative resilience (see page 104) of the catalyst. There are also implications for the costs of delaying solutions to deforestation – it is estimated that 10.4 million hectares of tropical forest were permanently destroyed each year in the period from 2000 to 2005[312].

The time required for implementation can depend on a number of factors, such as national or international legal complexity, the level of collaborative partnerships required, or political capital. Catalysts that can be instigated by private sector companies or investors and that operate within existing legal frameworks tend to be relatively rapid to implement. In contrast, actions that require amendments to legal systems, complex political partnerships or international consensus tend to be slower to implement.

Each of the catalysts described in the following chapter is allocated into one or more of the three timescale categories: catalysts that are typically implementable over the short term **(0-2 years)**, catalysts that are typically implementable over the medium term **(3-5 years)**, and catalysts that are typically implementable over the long term **(5+ years)**. It is important to note that these timescales are indicative only and may vary considerably according to national circumstances, resources and capacity.

IMPLEMENTER

PUBLIC

PRIVATE

CIVIL SOCIETY

The sector(s) that typically leads in the implementation of the catalyst.

Options: Public, Private, Civil Society

The catalysts discussed in the following chapter tend to each be implemented by institutions within different sectors. Understanding how these sectors can implement each of the catalysts can give clarity as to the most likely successful pathways for the development of such instruments, as well as help to identify opportunities for new partnerships and collaborative efforts to reduce deforestation.

The **public sector** predominantly establishes regulatory frameworks for the implementation and enforcement of specific catalysts; the **private sector**, which includes both companies and investors, can enact catalysts which tackle deforestation through addressing improvements in production, supply chain efficiency, and through price; and while their role is usually much more indirect, **civil society** can also have direct impacts on a smaller number of catalysts, as has been the case in the development of certification standards, consumer campaigns or even in agreements for voluntary moratoria or protected areas.

In addition there has been a promising rise in the number and type of partnerships established between public sector actors and the private sector, which can reduce deforestation from forest risk commodities. Although these tend to be characterised by public-private partnerships (PPPs) between a government and a private sector entity (e.g. co-investment), there are also cases of partnerships between civil society and the private sector (e.g. certification). These partnerships are often characterised by the sharing of technical knowledge, investment, risk, responsibility or reward, and can range from loose arrangements to formal joint venture companies.

In many cases, catalysts that can be implemented through partnership benefit from increased resilience (see page 104), and may be enacted in a shorter timescale (see page 106) than those implemented independently.

A GUIDE TO ICONS AND CATALYSTS

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

The following pages list 24 catalysts that could be implemented to reduce deforestation or forest degradation arising from the production or trade of forest risk commodities. The characteristics of each criterion described in the previous pages are represented graphically using the icons shown overleaf.

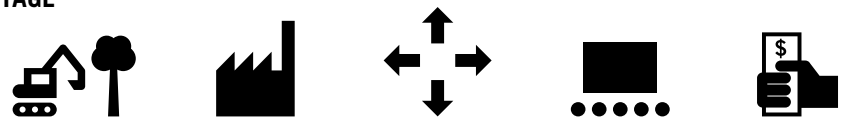
The icons will be presented in an icon bar as shown on the left. Only the icons that apply to a particular catalyst described will be highlighted in colour, while icons that do not apply will be shown in grey.

In the hypothetical example shown on the left, the catalyst targets the supply chain stages of Conversion/Production, and Processing, takes between three and five years to implement, and the major implementers are the public and private sectors (or a partnership between the two). The catalyst is implemented on a national level and is highly resilient to change. The page on the right summarises all icons included in the assessment of the catalysts.

The following pages present a matrix that acts as both a quick reference guide to navigating the catalysts chapter, and as a tool to identify catalysts that have specific characteristics – e.g. all those catalysts which can be implemented by the private sector.

KEY TO ICONS

STAGE



CONVERSION /PRODUCTION | PROCESSING | TRANSPORT / TRADE / DISTRIBUTION | MANUFACTURING | RETAIL / CONSUMPTION

RESILIENCE

HIGH | MEDIUM | LOW

LEVEL

LOCAL | NATIONAL | INTERNATIONAL

TIMESCALE

0-2 YEARS | 3-5 YEARS | 5+ YEARS

IMPLEMENTER

PUBLIC | PRIVATE | CIVIL SOCIETY

		STAGE				
		CONVERSION / PRODUCTION	PROCESSING	TRANSPORT / TRADE / DISTRIBUTION	MANUFACTURING	RETAIL / CONSUMPTION
PAGE	CATALYST					
114	AGRICULTURAL PRODUCTIVITY AND EFFICIENCY	●				
115	CERTIFICATION	●	●	●	●	●
118	CONSUMER MARKET CAMPAIGNS	●	●	●	●	●
119	ENFORCEMENT AND MONITORING	●	●	●	●	●
120	GOVERNMENT PROCUREMENT					●
121	LAND-USE STRATEGIES	●				
123	CODES OF CONDUCT AND STANDARDS	●	●	●	●	●
125	TECHNICAL ASSISTANCE	●	●	●	●	●
126	MORATORIA	●	●	●		
130	ADVANCE MARKET COMMITMENTS	●				
132	CO-INVESTMENT	●	●		●	
133	CONCESSIONAL CREDIT LINES	●	●	●	●	
134	ENVIRONMENTAL LENDING CRITERIA	●	●	●	●	●
135	GUARANTEES	●	●	●		
138	INSURANCE	●	●	●	●	
140	SHAREHOLDER ACTIVISM	●	●	●	●	●
146	CLARIFYING LAND TENURE	●				
147	IMPORT TARIFFS			●		
149	INTERNATIONAL LAW AND BILATERAL AGREEMENTS	●	●	●	●	●
152	NATIONAL LEGISLATION	●	●	●	●	●
154	NATIONAL PLANNING AND COORDINATION	●				
155	REDD+	●				
156	SUBSIDIES	●	●	●	●	●
157	TAX INCENTIVES	●	●		●	

	RESILIENCE			LEVEL			TIMESCALE			IMPLEMENTER		
	HIGH	MEDIUM	LOW	LOCAL	NATIONAL	INTERNATIONAL	0-2 YEARS	3-5 YEARS	5+ YEARS	PUBLIC	PRIVATE	CIVIL SOCIETY
PAGE												
114		●		●	●				●	●	●	●
115		●				●		●		●	●	●
118			●		●	●	●					●
119		●		●	●	●	●	●	●	●	●	●
120		●			●		●			●		
121		●		●	●				●	●	●	●
123			●	●	●	●	●				●	
125			●	●	●		●			●	●	●
126		●		●	●		●			●	●	●
130		●				●		●		●	●	
132		●		●	●	●	●			●	●	
133			●	●	●		●			●	●	
134		●		●	●	●	●			●	●	
135			●	●	●		●			●	●	
138			●	●	●	●	●			●	●	
140		●			●	●	●				●	●
146	●			●	●				●	●		
147	●				●		●			●		
149	●				●	●			●	●		
152	●				●			●	●	●		
154		●		●	●			●		●	●	●
155		●		●	●			●		●	●	●
156		●			●		●			●		
157	●				●			●		●		

SUPPLY CHAIN CATALYSTS

AGRICULTURAL PRODUCTIVITY AND EFFICIENCY

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Achieving increases in agricultural productivity and efficiency to feed a growing population will pose serious challenges in a resource constrained world (see page 21). Outside the use of degraded lands, around which there is considerable debate, the scope for expanding the available land area for production is limited. To prevent expansion into additional forest areas and other natural environments increased production on existing agricultural land is critical[313], but must also be decoupled from the economically and environmentally unsustainable use of water, energy, land and chemicals[314].

Productivity and efficiency improvements will require a combination of public and private sector led approaches, including: better use of existing knowledge and technology; technological innovation; the reduction of waste (estimated at 30-50% of all food grown worldwide[315]); improved governance and the reduction of resource-intensive consumption[316]. These initiatives typically address the production and conversion stages of the supply chain, and can be implemented at local and national scales.

One approach that can play a central role in achieving this is agro-ecology. The principles of agro-ecology are based on the use of agricultural biodiversity to achieve productivity and environmental gains. Data indicates that agro-ecology could "if sufficiently supported...double food production in entire regions within 10 years", and agro-ecological principles have been successfully applied in a number of regions[317]. For example, crop improvements, pest management, and agro-forestry initiatives in Africa, often implemented by the private sector, have on average more than doubled crop yields[318]. However, the public sector also plays a key role in helping to finance the transition costs for such initiatives, and in scaling up such efforts to national levels[319]. Public sector investment is particularly important where there are significant upfront and/or on-going costs to improving efficiency that will not be taken up by the private sector. Collaborative public and private sector actions are therefore critically important.

CERTIFICATION

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Certification is a market-based instrument driven by the private sector and civil society and is typically voluntary*. Products that are certified meet a specific set of environmental or social criteria and have been verified as meeting that standard by an independent third party. Voluntary certification can have impacts on all stages of the supply chain, and may also boost the relative profitability of a product through efficiency gains, improved supply chain management, preferential credit terms, and possibly greater market access and a price premium[320,321]. In general, the most effective standards are those developed through multi-stakeholder processes, such as commodity roundtables. Although they typically take a minimum of three years to develop, the consensus based process ensures that these standards also have a relatively high resilience.

The role of certification schemes as a tool for addressing deforestation in the supply chain is expanding. For example, many international companies have made commitments to source 100% certified commodities through these standards, and major initiatives, such as the Consumer Goods Forum (see page 122), recommends its members make use of multi-stakeholder standards as a step towards achieving their goal of zero net deforestation by 2020[322]. However, to date the demand for certified goods has not always matched the level of production. For example, demand for Certified Sustainable Palm Oil (CSPO) has failed to keep pace with production (market uptake of 52% in 2012)[323], and in 2004 FSC introduced the certification of wood products from (but controlled) mixed sources to deal with supply bottlenecks and high demand[324].

Critically however, information on the direct impacts of certification on reducing tropical deforestation is currently insufficient (see page 116), and the costs of certification tend to be high, falling mainly on the producer[325]. As a result, certification schemes have been criticised for excluding small-scale producers who typically lack the technical knowledge and finance to meet the standards required[326]. Public sector technical assistance and credit (see pages 125 and 133) can be utilised to support smallholders in overcoming these barriers.

* Certification can also be mandatory in type, such as the government-backed Indonesia Sustainable Palm Oil (ISPO) certification programme.

THE IMPACTS OF CERTIFICATION ON DEFORESTATION

International, voluntary standards for agricultural and forest commodities (e.g. palm oil, soya, timber) have been developed through multi-stakeholder processes to reduce the negative environmental and social impacts of commodity production[xcix]. Early approaches, exemplified by the Forest Stewardship Council (FSC) launched in 1993 for wood and paper, assumed that consumers would express a preference for certified, labelled products, and the prospect of a price premium motivated some early certifications. A more recent wave of standards exemplified by the agricultural commodity roundtables, such as the Roundtable on Responsible Palm Oil (RSPO) launched in 2007, uses a "pre-competitive" approach that seeks market transformation — i.e., the exclusion of non-certified producers from supply chains. In this approach, it is assumed that the costs of certification are covered by upward adjustments of commodity prices within transformed markets[c]. In practice, certified producers continue to expect premiums and the markets are not yet transformed.

The pre-competitive approach has enabled a quicker and broader adoption of roundtable standards. For example, RSPO has certified almost twice the share of global production (14%) as the FSC (8% global, and a smaller percentage in the tropics) and in one-quarter the time[ci,cii]. Progress is somewhat slower for the roundtables for soya (RTRS) and sugarcane (Bonsucro)[ciii,civ,cv,cvi]. Important differences influence uptake rates. "Consumer choice" standards, such as FSC, set a higher performance bar at the outset, while roundtables start with a lower bar that rises over time, facilitating broader initial uptake. Also, advantageously, some agricultural commodities (e.g., palm oil and soya) are controlled by a small number of traders and processors relative to the timber industry[cvii,cviii].

The impact of certification on tropical deforestation is significant, but still largely *indirect*. The FSC and commodity roundtables place restrictions on forest conversion[cix,cx], but direct impacts are difficult to measure[cxi,cxii,cxiii]. This is in part because certified producers are still the exception, not the rule. Unruly, tropical forest frontiers, where certification could have its greatest impact on deforestation, are often dominated by informal economies in which law-abiding companies or farmers pose a threat to these economies and the systems of graft that undergird them. In this context, the criterion of legal compliance that is common to all standards can expose certified operations to new risks. The first firms to certify also tend to be those that are already implementing responsible management practices, and for whom the costs, and the positive impacts, of certification are relatively small. Impacts will be easier to measure with increases in certified area and new research. *Indirect* impacts are manifested through greater industry and public awareness of the links between commodity production and deforestation. For example, the Brazilian soya sector embraced the Soya Moratorium (see page 93) in part as a pre-emptive alternative to the Roundtable for Responsible Soya standard and strong European demand for zero-deforestation sources of soya.

Despite these limitations, certification is the main entry point for most farmers, agro-industries and forestry firms into the dialogue on tropical deforestation, and this private sector engagement is very significant. For certification to realize its potential in supporting the transition to rural development models that slow and eventually end deforestation while increasing production, stronger public policy frameworks are needed to create farm- and firm-level incentives for the transition to sustainable production, and to weaken the informal economies that impede certified, legal production. Second, certification systems need to add criteria that recognize progress in lowering deforestation across landscapes and entire jurisdictions. Finally, companies and nations with commitments to buy from certified sources need to increase and implement their commitments.

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Shoana Humphries
Katie McCann
Earth Innovation Institute

CONSUMER MARKET CAMPAIGNS

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Consumer campaigns related to deforestation are led by civil society organisations, and often use investigative research to expose the supply chain links between deforestation activities in tropical countries and well-known brands in consumer countries. In a successful campaign, the reputational risk of being linked to deforestation negatively impacts sales, market shares or stock prices, and pressures brand owners into behavioural changes (i.e. improved raw material sourcing). The threat of contract cancellations and loss of export markets in turn puts pressure on companies in producing countries to take action to reduce deforestation. For example a campaign against Asia Pulp and Paper cost the company tens of millions of dollars in cancelled contracts[327].

Examples of other successful campaigns include the connection of McDonalds' products to soya from the Amazon basin, Nestlé to unsustainable palm oil, and Mattel packaging to tropical forests in Indonesia (all by Greenpeace). In each case, company exposure to the reputational risk of being linked to deforestation resulted in improvements to the relevant supply chains. Although consumer campaigns tend to be short they can directly support longer term policy change across sectors. For example, the voluntary moratoria on soya and cattle expansion in the Amazon were the direct product of consumer campaigns by Greenpeace (see page 92 and 93).

Campaigns are not limited to food manufacturers or suppliers – successful campaigns against Citibank (by Rainforest Action Network) forced them to make fundamental changes to their investment policies. In addition, in 2012 following a Rainforest Foundation campaign, the Norwegian Government Pension Fund sold the stakes it had in 23 palm oil companies which it considered to be producing palm oil unsustainably[328]. Behavioural change at this scale can have wide reaching impacts on other investors - Norway's pension fund is the world's largest sovereign wealth fund, and invests in more than 7,000 companies, with a total value of around 650 billion USD. However, the resilience of consumer campaigns to market and political changes and their long-term effectiveness in creating a permanent reduction in deforestation, rather than a market shift to regions with less awareness and scrutiny, is still to be determined.

ENFORCEMENT AND MONITORING

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

The existence of comprehensive legislative frameworks or strong industry commitments alone is insufficient to ensure that public and private sector actors in commodity supply chains comply with policies or regulations designed to reduce deforestation. Compliance with policies and regulations must be monitored, and where transgressions are discovered, enforced[329].

Although important at the conversion/production stage of the supply chain, enforcement and monitoring initiatives are critical throughout all stages. For example, ensuring that processors or manufacturers adhere to their sustainability commitments, certification schemes meet their own statutes and principles, and procurement policies are being effectively implemented at the retail/consumption stage, are all critical to establishing sustainable supply chains. However, enforcement and monitoring initiatives are particularly important in ensuring compliance in areas not governed by legislation, and where multiple stakeholders are involved (e.g. certification schemes[330] and voluntary industry commitments). Effective enforcement can involve the threat of legal action (e.g. Interpol's Project Leaf*), or the threat of loss of contracts or market share (e.g. the FSC ending its association with APRIL in response to unsustainable deforestation in Indonesia[331]).

Although field based activities continue to be essential in enforcement and monitoring, the use of technology is playing an increasingly important role. This can include the use of near real-time satellite images to identify forest cover change and direct law enforcement efforts[332]. DNA barcoding, fingerprinting and stable isotope research are also being used to track specific timber species and fight illegal and unsustainable logging[333]; and mobile online tools and technology such as radio frequency identification (RFID) allow for novel and transparent supply chain management. The engagement of civil society and the use of private sector expertise are also becoming increasingly important in monitoring and enforcement[334]. This includes, for example, progressive monitoring platforms such as Terra-i and Global Forest Watch (GFW), which use remote sensing satellite images to monitor land-use change. Community Measurement, Reporting and Verification (MRV) projects also play an important role in local monitoring and enforcement for REDD+**.

* Law Enforcement Assistance for Forests (2012) - a partnership between UNEP and Interpol aimed at combatting all aspects of forestry crime worldwide.

** e.g. The use of community teams and smart phone technology to monitor land use change in Guyana related to REDD+ (Global Canopy Programme).

GOVERNMENT PROCUREMENT

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Central, regional and local governments in developed countries are major consumers of products made from forest risk commodities. Government procurement policies specify the exact criteria and specifications which must be met when government agencies purchase products. A number of countries already have government procurement policies which aim to ensure purchased wood products are legally or sustainably sourced (see page 153)[335]. For example, the UK has joined other countries, including the Netherlands, in a commitment to source 100% sustainable palm oil for central government by 2015[336].

Government procurement policies can be established while meeting the principles and guidance of the World Trade Organization (WTO) (see page 148). For example, European Union procurement rules are dependent on national legislation but fit within an overall EU legal framework, which allows significant scope for including environmental and sustainability criteria. Although there have been debates over the legal and economic implications of the interaction between environmental and trade policies, none of the EU procurement policies have ever been challenged[337].

Procurement policy can also be developed and implemented more rapidly than many other policy options. Market impact research of timber policies (in the UK and the Netherlands) has shown a continued increase in certified imports following changes to public policy[338]. Requirements by governments for proof of legality or sustainability prior to purchase can also have significant impacts on the market beyond the direct effect of government purchases. Suppliers which have in place systems for traceability to assure certified legal and/or sustainable products for government contracts are likely to supply other customers using the same supply chains. In this way, government procurement policies can create a knock-on effect, leveraging the market by up to 25% (compared to 10% for direct purchases)[339]. The use of purchasing power as a supply chain control mechanism to tackle illegal and unsustainable production could also be applied to a broader range of forest risk commodities.

LAND-USE STRATEGIES

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

The development of coordinated and coherent national planning processes (see page 154) that contribute to a reduction in deforestation from commodity supply chains are dependent on the implementation of innovative national land-use strategies.

For example, zoning plans can incentivise the intensification of commodity production and reduce expansion into forest areas. In Acre, Brazil, sub-national zoning plans require landowners to maintain a minimum level of forest cover, and adhere to standards for sustainable forestry management, agricultural development and the harvesting of non-timber forest products[340].

Additionally, an estimated 200 million ha of degraded forest or abandoned land in the tropics could be restored for agriculture or forestry[341]. This offers one option for some tropical forest countries to increase agricultural production, without expanding into natural forest areas. For example, to meet Indonesia's palm oil production target of 40 million tonnes by 2020, a collaborative project between the government and WRI has identified and mapped seven million hectares of suitable degraded lands in the provinces of West and Central Kalimantan alone. Technical assistance, public co-investment and access to credit will all be critical to facilitate and promote the uptake of projects in these degraded areas.

Innovative 'land swaps' could also enable existing high intensity agricultural production in carbon rich areas (natural forests and peat land) to be relocated to degraded lands[342]. WRI's project in Indonesia is also trialling an initiative of this kind*. If strong social and environmental safeguards are in place, there may also be opportunities for land 'offsets' to be used to reduce deforestation in natural forests – companies could develop new concessions on degraded lands on the proviso that larger, higher biodiversity or more carbon rich forest areas are paid for and protected by those companies. Land-use strategies are typically expensive and require considerable parallel developments in land-use planning, coordination of legal frameworks and clarifying land tenure rights (see page 146), as well as efficient enforcement and monitoring, in order to be effective. However, once in place, they can have resilient and landscape-scale impacts on reducing deforestation from forest risk commodity supply chains.

* See Project POTICO (Palm Oil, Timber, Carbon Offsets) www.wri.org/project/potico

THE TROPICAL FOREST ALLIANCE 2020

The Tropical Forest Alliance 2020 (TFA 2020) is an innovative public-private partnership with the goal of reducing tropical deforestation associated with key global commodities, such as palm oil, soya, beef, leather and paper and pulp. The initiative was born out of discussions between the U.S. Government and the Consumer Goods Forum (CGF), an industry organisation representing over 400 retailers and manufacturers, and was officially launched at Rio+20 in 2012. CGF member companies have combined sales of EUR 2.5 trillion, and directly employ nearly 10 million people, with a further 90 million related jobs estimated along the value chain. Government partners include the major donor nations of the United States, Netherlands, Norway, and the United Kingdom.

The TFA 2020 has four key stated objectives: improved planning and management related to tropical forest conservation, agricultural land use, and land tenure; to share best practices for tropical forest and ecosystem conservation and commodity production, including working with smallholder farmers and other producers on sustainable agricultural intensification, promoting the use of degraded lands, and reforestation; to provide expertise and knowledge in order to assist with the development of commodity and processed-commodity markets that promote the conservation of tropical forests; and to improve monitoring of tropical deforestation and forest degradation to measure progress.

It is principally the scale and breadth of this public-private initiative which makes TFA 2020 the most promising tool yet to influence global behavioural change to address commodity-driven tropical deforestation in companies and governments globally. However, importantly TFA 2020 is not intended to be a regulatory body, and will not regulate purchases or supply chains, create or endorse specific certification standards or verification services, create any legally binding obligations, or seek to create new or additional definitions for deforestation or sustainability[cxiv]. As a result, the TFA 2020 contributions towards a reduction in deforestation can only be measured in the number of industry regulated initiatives that result in quantifiable changes to business-as-usual activities.

Instead, TFA 2020 requires members to endorse the goals of the Alliance, and to agree to undertake specific actions to address commodity-driven tropical deforestation, while recognizing that actions needed will vary depending on the region, products involved, national conservation laws, farming regulations, and economic development goals.

The challenge for TFA 2020 is to continue to encourage and incentivise the rapid incubation of innovative private sector led approaches that have real-world and large scale impacts, without their non-regulatory focus allowing their members to make but not fulfil commitments, or to limit their contributions to relatively minor actions with limited impact on removing deforestation from commodity supply chains.

Matt Leggett
Global Canopy Programme

CODES OF CONDUCT AND STANDARDS

A number of business-led initiatives to reduce or remove deforestation from forest risk commodity supply chains exist which are voluntary and self-regulated. Their self-regulation in particular distinguishes these kinds of initiatives from tools such as certification (see page 115) and international laws and policies (see page 149). While they may often have involvement from civil society or government, they are typically led either by individual companies, by sectors within a specific industry, or by groups of companies engaged in commodity supply chains.

Relevant sector led initiatives include the Leather Working Group (LWG), which was developed with the aim of improving environmental standards in the leather industry. The LWG Auditing Protocol for tanneries sets a grade for traceability for leather, and leather sourced from the Brazilian Amazon is graded on whether it can be traceable to supplying ranches with no post-2009 deforestation[343], in line with the G4 Cattle Agreement*.

Individual companies have also established comprehensive internal guidelines and standards to limit or remove deforestation from their supply chains. One of the leaders in this space is Nestlé, who have established a 'Commitment on Deforestation and Forest Stewardship'. This sets an internal standard to ensure that all of its raw materials sourced from forested areas have not led to deforestation or the loss of high conservation values. Nestlé is also a member of the Consumer Goods Forum**, an industry organisation that has committed to mobilise resources within their respective member businesses to help achieve zero net deforestation by 2020 (see page 122).

As they are not subject to external regulation, voluntary codes of conduct can have relatively rapid impact throughout the supply chain. As mentioned, civil society can also provide valuable support to such initiatives. For example, Conservation International has produced "Deforestation Guides for Commodity Sourcing" that provide Nestlé with spatial data to help prioritise its sustainable sourcing commitments[344]. Governments also play a key role in providing data, building capacity and encouraging leadership within the business sector to facilitate the replication of such initiatives.

* Following the release of a Greenpeace report in 2009, and legal action by the Public Prosecutor's Office in the Amazon state of Pará, four key meatpackers controlling a third of Amazon slaughter (JBS, Bertín, Marfrig and Minerva), signed the 'G4 Cattle Agreement'. This established a timeline for purchasing only from ranches that can demonstrate zero deforestation.

** The CGF represents over 400 major retailers and manufacturers, many of whom produce or trade products from tropical forest countries.

DISCLOSURE AS A DRIVER OF CORPORATE CHANGE

Corporate disclosure takes two forms: *mandatory*, comprising information which is required to be disclosed by relevant authorities such as the Securities and Exchange Commission (SEC), and *voluntary*, comprising information which is not required by legislation, but which the company provides to stakeholders in the interests of transparency and better communication.

Voluntary disclosure has become more widespread over the past 15 years, with the Global Reporting Initiative (GRI) launched in 1997 to provide a framework in which companies can report environmental, social and governance (ESG) strategies and explain their relevance and materiality. Many companies now produce an annual sustainability report, which details their work on these strategies. 2002 saw the launch of CDP, formerly known as the Carbon Disclosure Project, which originally requested companies to disclose their carbon footprint from their own activities and their supply chains. The request has since been expanded to include water and forest risk commodities such as soya, palm oil, cattle products and timber, and CDP now forms the world's largest database of corporate natural capital usage.

There has been considerable evidence that CDP has driven corporate behavioural change by enabling companies to measure and manage their emissions and consequently to identify hotspots where efficiency can be improved and profits increased. Publicly available scoring has driven disclosing companies to improve their performance relative to their peers, while shareholder activism has put pressure on companies firstly to disclose and then to decrease their emissions.

Within CDP's forests program, there is also considerable evidence of corporate behavioural change, driven partly by an increasing number of signatories filing shareholder resolutions against companies to request them to develop sustainable sourcing policies (especially for timber and palm oil), to set targets for moving to certified sustainable commodities and to disclose their progress publicly. The project also provides individual feedback to disclosing companies on their strengths and weaknesses, together with suggestions for future improvements. The project has been most successful with consumer-facing companies so far, partly due to their awareness of reputational risk and partly due to their more sophisticated and better-resourced sustainability commitments. However, an increasing number of producers and processors are now disclosing to the program and there is likely to be pressure from those companies further down the supply chain for their suppliers to disclose too.

Other disclosure programs in the forests space include a biennial Palm Oil Scorecard by WWF, which ranks companies according to various sustainability criteria based on publicly disclosed information. The RSPO also requires its members to complete a public annual communication of progress.

There is clearly a role, therefore, which disclosure can play in encouraging and monitoring more responsible production and sourcing of commodities by companies. Publicly available responses can be analysed by civil society, who can act as independent verifiers on the ground, while scoring and shareholder pressure can drive performance improvement and publicise best practice.

James Hulse
CDP

TECHNICAL ASSISTANCE

Technical Assistance (TA) is the transfer of knowledge or expertise from one organisation to another, or to specific individuals. The purpose of TA is to increase the efficiency and effectiveness of organisations or individuals in achieving their goals. TA is generally provided by public agencies or (NGOs) to other public agencies, companies or individuals on a local or national level. On a smaller-scale, TA is also provided by the private sector, often in partnership with the public or civil society, and in parts of South America it has played an important role in the development of the soya industry[345]. NGOs also have a role in providing TA to private sector organisations seeking to reduce their exposure to forest risk commodities.

The provision of TA is a key part of the successful implementation of many catalysts for reducing commodity-driven deforestation, including financial incentives (e.g. credit lines), REDD+ and PES, and certification. However, the provision and uptake of TA at scale is often hampered by limited availability of financial assistance (e.g. grants or loans) and on low technical capacity. For example Brazil's Technical Assistance and Rural Extension state public services only reach under a third of farmers[346].

Primarily a supply-side instrument, TA can be an important catalyst to enable producers, especially small-holders, to transition to sustainable commodity production at scale. TA can lower the costs of certification and environmental legislation compliance, improve access to finance, and increase productivity (see page 114), with a recent study suggesting TA could increase agricultural yields two to three fold in parts of Africa[347,348]. TA can also help retailers and traders apply best practise in sourcing sustainable commodities through providing information on certification, public procurement policy, and sustainable products. It can also bring further benefits including improved project governance and transparency. In addition, encouraging and coordinating the delivery of TA through public, private, and civil society partnerships is important to promote sustainable commodity production[349].

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

MORATORIA

STAGE

RESILIENCE

LEVEL

TIMESCALE

0-2 3-5 5+

IMPLEMENTER

A moratorium is a temporary suspension of activities. In the context of this book moratoria are used as policy instruments to temporarily halt illegal or unsustainable activities that lead to deforestation. They can be government implemented and regulatory, or voluntary and established through agreements between private sector companies.

Regulatory moratoria have been widely used by the public sector in many developing countries to tackle deforestation. Current moratoria exist in Indonesia (timber concession[350]), Papua New Guinea (agricultural leases[351]), and Nigeria (logging in Cross River State[352]). Moratoria can allow governments to conduct reviews of legislation, establish monitoring protocols, or improve enforcement, whilst ensuring that no further deforestation occurs.

In contrast, voluntary moratoria tend to be led by the private sector in response to civil society campaigns (see page 118), and are characterised by companies agreeing to time-bound commitments not to buy products arising from deforestation in a specific area (e.g. the Amazon Soya moratorium). Signatories to a moratorium require producers to meet the mandated criteria by threatening loss of contracts and market share. Voluntary moratoria are therefore most easily applied to supply chains with a concentration of a few companies at a single stage with a large market share, and to forest risk commodities with a geographic concentration in their production.

However, by definition moratoria are not resilient policy options to reduce deforestation. While moratoria are often renewed - Paraguay's Atlantic Forest 'Zero Deforestation Law', implemented in 2004 for an initial two years, has been repeatedly renewed and currently extends until December 2018[353] - the priority should be to ensure that these renewals do not take the place of permanent legislative change.

FINANCIAL CATALYSTS

ADVANCE MARKET COMMITMENTS

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

An Advance Market Commitment (AMC) is a financial mechanism that is used by governments or private sector grant-making bodies to provide long-term, predictable finance to the producers of a good. A financial commitment is made by the government or grant-making body to purchase the good in order to stimulate its production in the short term. The aim of an AMC is ultimately to stimulate growth in the market or sector for that good, and it tends to be used where the market for the good is small, weak or non-existent.

For example, the Global Alliance for Vaccination and Immunisation (GAVI) is a public-private partnership which raises funds for the purchase of vaccines to immunise children. By making a financial commitment to purchase vaccines, the GAVI has two effects on the market for vaccines: it creates a clear financial incentive for the manufacturers to increase their production of vaccines; and it can further incentivise others – such as charitable foundations and the private sector – to also make financial commitments to the GAVI.

The AMC model could be applied to the forestry and land-use sector to drive a reduction in deforestation (see page 155). There is currently weak demand for emissions reductions, but Governments may be able to stimulate the market and increase overall demand for verified emissions reductions from REDD+ projects by creating and funding an AMC mechanism. An AMC could create a clear, performance-based financial incentive for forest communities, jurisdictions and countries to enter into long-term, results-based contracts. Moreover, it creates favourable investment conditions for other private and public sector investors who wish to invest in a variety of improved forest and land-use based activities that are linked to REDD+.

EXCHANGE TRADED CONTRACTS

Historically, food was grown for local consumption, but with the advent of mass transport and the increasing urbanisation of many areas of the world, a global food market has been developed. Initially, this comprised 'forward agreements' between a buyer and seller, but this had issues around credit-worthiness and security of delivery. In 1864, the first homogenous contracts were created which defined the quality, quantity and specific details of the product, which enabled these contracts to be traded around the world on commodity exchanges such as the Chicago Board of Trade (CBOT). Nowadays, most food commodities are traded on these exchanges, including forest risk commodities such as soybeans, soybean meal, soybean oil, palm kernel oil, crude palm oil and live cattle.

The commoditisation of food products has had enormous benefits for the world economy, lowering prices and increasing efficiencies. There are however several downsides, one of which is that it is difficult for buyers to source sustainably produced products on the global markets, as there are currently no contracts for certified commodities. Buyers who wish to source certified products therefore need to enter bilateral procurement agreements with traders or producers to ensure that the product meets their standards. These agreements have the same issues as forward contracts, in that they rely on the credit-worthiness of the buyer (especially for multi-year arrangements) and the ability of the supplier to deliver the agreed quantities, which could be affected by weather patterns, diseases, transport problems etc.

There is clearly a role for exchanges to create contracts specifically for certified products, using mainstream certification schemes such as RSPO and RTRS. This would have several benefits: it would make price differences between certified and non-certified products transparent and encourage more uptake of certified commodities as buyers would be able to secure sufficient quantities for their future requirements and outsource the risk of non-delivery to the exchange. It would also create a stronger market for segregated certified products, as chain of custody certification would be needed to verify the commodity, and this would pass demand signals directly through the supply chain.

James Hulse
CDP

CO-INVESTMENT

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Many agricultural and forestry projects in tropical forest countries are perceived to carry high commercial or political risk (see pages 136 and 138). Similarly, where projects include forest conservation or sustainable use objectives, returns on investment are often considered too low. Combined, these factors disincentivise private sector investment in projects that may reduce deforestation compared to business as usual. However, when the project generates public benefits, governments, NGOs or multilateral entities might offer capital, i.e. co-invest.

Co-investment can reduce the risk profile of the project, making it more attractive to the private sector. Public co-investors can help reduce risk by simply taking on some of the capital requirements, providing concessional debt or equity finance, providing a buffer to absorb losses or payments to private investors, or by offering specific expertise, technical assistance and enabling conditions[354,355]. Co-investment can act as a catalyst at various stages of the supply chain, increase project resilience, and be implemented in a relatively short timescale.

The primary means in which co-investment is carried out is by offering credit guarantees (see page 135) and concessional credit (see page 133). Public sector financial institutions can also provide equity co-investment at concessional rates; however, this is less practiced than providing credit guarantees or concessional credit. In Brazil for example, CPFLR Energias Renovaveis S.A., a renewable energy company hoping to generate power from wind, small hydro and biomass, has received an equity investment from the International Finance Corporation (IFC) equivalent to around US$74 million and representing approximately 2.7% of the company's shares. This will be used to help finance the generation of 530 MW of power from renewable energy projects. Through its participation, IFC expects to support fundraising by providing confidence to other potential investors[356].

CONCESSIONAL CREDIT LINES

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

The provision of credit, such as loans, can be conditional on meeting certain environmental standards. These forms of credit can be extended to companies in commodity supply chains that are linked to deforestation through targeted lending programmes. In order to incentivise the uptake of these credit lines, they must be accessible and affordable. Providing concessional loans is one way of achieving this.

Concessional loans are typically provided by public financial institutions on terms that are more generous than loans from private sector financial institutions. Such loans tend to have lower interest rates (i.e. the periodic interest payments are lower), longer maturity periods (i.e. the payback period is longer), or a combination of the two. Structural changes in the commodity supply chains driving deforestation often require large amounts of upfront capital (e.g. implementing traceability systems), which can disincentivise companies from transitioning to more sustainable modes of production. Concessional loans provide an opportunity for companies to make these transitions at an affordable cost, without needing to meet onerous debt repayments. Concessional loans can support transitional change at all stages and at all levels of the supply chain. They are also often coupled with the provision of technical assistance (see page 125).

However, existing concessional credit lines are not always utilised to their full potential. In Brazil, for example, the government has allocated significant amounts of concessional loans for activities such as sustainable cattle intensification and forest restoration, but due to the low capacity of landowners, uptake has been limited[357]. This, however, does not detract from the fact that rural credit as a policy mechanism can contribute to reducing deforestation.

Finally, concessional loans usually fund projects that are struggling to raise finance from traditional market sources. As a result, concessional loans may not be able to leverage significant additional private investments from third parties[358]. For example, the GEF's Earth Fund – a concessional loan provider – did not attract private funding at the expected level or with the expected number of private sector partnerships[359].

ENVIRONMENTAL LENDING CRITERIA

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Although shareholder activism (see page 140) can be an effective tool to drive behavioural change in publicly-listed companies, many companies in the supply chains of forest risk commodities are privately held or effectively under private control despite being publicly-listed. Given the limitations of shareholder influence in some of these circumstances, an alternative method for affecting corporate behaviour can be the inclusion of deforestation specific criteria into lending decisions by private sector and multilateral development banks.

Many banks already have broad environmental criteria – for example the European Bank for Reconstruction and Development (EBRD) has a mandate which commits the Bank 'to finance projects that are environmentally sound and sustainable'[360], while the World Bank Group has a ten year environment strategy promoting development 'that supports growth while focusing more on sustainability and ensuring that the environment is a key enabler for green, more-inclusive growth'[361]. However, very few organisations have specific criteria targeting reductions in deforestation. The introduction of these criteria could promote more sustainable lending practices and make access to finance difficult for companies whose supply chains and projects are linked to deforestation. Rabobank Group, the agribusiness-focused Dutch bank, has one of the leading responsible lending policies. The Group has specific policies on products such as forestry, palm oil and soya, which actively promote certification and engage with companies to address potential risks associated with deforestation, legality, human rights, free, prior and informed consent and sustainable forest management. The Group also requires companies to show progress in addressing these issues in order to receive loans, and advises downstream companies to request certified commodities from their suppliers[362,363].

Policies such as these could be implemented throughout the banking industry relatively quickly and would have a relatively high resilience to risk or future change. While they could specifically target improvements at the conversion/production stage by sending clear messages to producing companies about the expectations from lending institutions, they could also have positive impacts throughout the supply chain.

GUARANTEES

A credit guarantee is a promise by a third party (the *guarantor*), to repay the creditor (in exchange for an up-front *commitment* or *origination fee*), if the organisation that has borrowed money fails to do so (i.e. they *default*). Although guarantees can be applied to a variety of transactions, they usually relate to debt structures of some kind.

Credit guarantees directly reduce the risk for investors, making investments more attractive and therefore making it easier for a project or organisation to access capital. Guarantees are typically offered by publicly-funded organisations to stimulate private sector investment in areas that may serve the public interest but currently experience limited lending. Many countries have made partial credit guarantees "a central part of their strategy to alleviate small to medium size enterprises' (SMEs) financing constraints[364]". Guarantees from multilateral or international financial institutions could be extended to support organisations in the agricultural sector seeking to transition from business as usual (BAU) production to methods with a reduced impact on natural forest cover, or to directly support projects that conserve or protect existing forest cover (e.g. REDD+ – see page 155)[365]. These kinds of projects tend to be exposed to a higher political risk of default, and greater uncertainty due to their reliance on ecosystem service provision.

Guarantees could also be offered in combination with insurance products (see pages 136 and 138) to reduce investor risk. USAID's Development Credit Authority* has been a prime innovator in this space and since 2012 has worked on developing a loan guarantee for REDD+ activities, as well as other carbon market projects. USAID's guarantee covers a broad range of risks in addition to political risk, including those associated with verification, weather, and the production of carbon credits[366]. Partial credit guarantees, such as those from the International Finance Corporation, are another tool which could be utilised to support climate-smart development in tropical forest countries. In order to reduce the costs for project developers and incentivise the uptake of specific kinds of initiatives, the public sector could also offer to subsidise the guarantee premiums in full or in part, which is the case for USAID's guarantee programme.

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

* www.usaid.gov/dca

POLITICAL RISK INSURANCE

Political risk insurance protects the policy-holder against acts of political or social disruption leading to loss of investment value, and covers two broad categories of risk: expropriation and political violence.

Expropriation coverage protects against nationalization, confiscation and creeping expropriations by the government, which results in a loss of the investment. Political risk coverage protects the investor's property against damage (e.g. a carbon-producing forest incurs a politically violent act that destroys the forest).

Political risk insurance can mitigate many aspects of country risk, which is often high in tropical forest countries with investment opportunities in the agro-forestry sectors. But there are two specific risks that concern potential investors in these spaces that can also be minimized with political risk insurance: 1) government repudiation acts; and 2) changes of law. These are of particular importance to projects that operate in innovative ways, or in evolving legal spaces (e.g. forest carbon and payments for ecosystem services).

Both the Overseas Private Investment Corporation (OPIC) and the World Bank Group's Multilateral Investment Guarantee Agency (MIGA) currently offer insurance products that underwrite the risk of developing carbon offset projects. There are several differences between these suppliers. OPIC requires majority US participation in any investment and tends to focus its activities in countries where a strong bilateral relationship exists with the US. MIGA is open to any of its 179 member countries, and is usually competitive in 'riskier' countries where investors are keen to take advantage of the World Bank's deterrence effect. MIGA currently provides up to $220 million in insurance coverage per project, whereas OPIC can provide up to $250 million – with both agencies able to provide additional coverage through reinsurance. There is also a private political risk insurance market, but it is unclear whether carbon offset project developers in particular have utilised this market.

The first REDD+ political risk insurance contract was underwritten by OPIC on an investment made by Terra Global Capital on a forest carbon project in Cambodia in June 2011. In 2012, MIGA provided its first political risk insurance to a carbon offset project in Nicaragua, where EcoPlanet Bamboo (EPB) is reforesting degraded pasture land with *guadua aculeate*, a native bamboo species. MIGA's $27 million guarantee backs the company's investment in the purchase and conversion of degraded land into commercial bamboo plantations for the sale and export of bamboo fibre for the timber manufacturing industry, which in turn reduces pressure on natural forests. In this case, the benefits to EPB were twofold - access to MIGA insurance resulted in a significant reduction in their cost of capital (around 40%), and a reduced risk of expropriation due to the deterrence effect of World Bank involvement.

Insurance costs vary according to the risks of operating in any given country, but project developers must also be in compliance with environmental and anti-corruption policies that are prerequisites for securing MIGA and OPIC insurance, which can represent significant additional costs if project developers have not already met the overlapping social and environmental requirements of carbon standards.

An opportunity exists for public sector bodies to subsidise insurance fees or scaling pricing to reduce the cost of premiums to project developers, which could provide a key opportunity for governments to catalyse sector-wide transition towards projects with a low-impact on natural forest cover. There is also space for donors to target funding towards project developers looking to cover the costs of meeting these criteria, or to underwrite the cost of insurance premiums. Some precedent already exists - OPIC may undertake these evaluations as part of its own due diligence process, and also provides discounted rates for small businesses, while MIGA provides subsidized rates for investments of $10 million or less with an average 25% discount.

In spite of early-mover activity, there remains a relatively low awareness of the availability of political risk insurance for forest carbon projects, and it is hard to say whether the market is likely to see scaled-up adoption. However, the successful application of political risk insurance in forest carbon projects suggests that there is also potential for similar products to be developed that support initiatives that drive a reduction in tropical deforestation. One such product could be modelled after the index-backed agricultural insurance programs offered by the World Bank's Global Index Insurance Facility.

Daphne Yin
Forest Trends' Ecosystem Marketplace

INSURANCE

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

If there is a risk that an event will cause an organisation to lose money (e.g. a natural hazard, or breach of contract etc.), that organisation can take out insurance to protect itself against potential losses. Two types of insurance have specific relevance for forest risk commodity supply chains: commercial insurance, which is provided to businesses and typically covers financial losses that are a result of operational problems, such as droughts or floods; and political risk insurance, which covers financial losses due to political decisions (see page 136). Both are important because both tropical forest countries and activities with sustainable production or use aims are often considered relatively high risk investments[367]. Insurance can catalyse a reduction in deforestation in several ways. Firstly, companies that purchase insurance cover reduce the investment risk of their ventures and therefore increase their organisational access to capital. If these insurance products also have environmental criteria linked to deforestation (particularly achievable in insurance products provided by the public sector), and specifically support activities with low impacts on forests, their availability may incentivise a broader uptake of such activities.

Secondly, when organisations know that potential losses will be compensated, internal investments in technology or improved methods that secure a more sustainable business model (e.g. efficiency improvements that reduce deforestation) are more likely to be made. Data demonstrates that insured farmers invest up to 19% more in their farms and earn 16% more income[368]. Existing insurance initiatives such as the Global Index Insurance Facility (GIIF) could therefore be amended to support a reduction in deforestation. The GIIF develops insurance for farmers based around statistical indices for various parameters, such as crop yield or livestock mortality rates. Deviations from the normal range trigger payments for insured clients. An introduction of 'deforestation' criteria could ensure that farmers that deforest could be excluded from such schemes[369].

The public sector could provide additional support by subsidising the premiums paid to private sector insurers, paying the premiums themselves for activities that meet their own environmental criteria, or establishing publicly funded insurance products that incentivise low-impact agricultural/forestry activities.

NATURAL CAPITAL DECLARATION

Nature underpins global wealth creation. The renewable flow of goods and services provided by the earth's assets buttress our economy and yield benefits for business. But this stock of ecosystems – also known as "natural capital" – is largely invisible in financial or corporate decision-making. As a result, degradation continues largely unabated. Economists estimate that the hidden economic costs of natural capital use for global production and industrial processing total US$7.3 trillion per year. This unallocated risk equates to 13% of global economic output[cxv].

The Natural Capital Declaration (NCD) is a finance sector initiative launched in 2012 to address this challenge. More than 40 CEOs of financial institutions have signed the NCD, committing to integrate natural capital considerations into lending, investment and insurance products, as well as in accounting, disclosure and reporting. Forests are some of the world's richest and most valuable forms of natural capital, and deforestation risk will be among the issues considered under the NCD. Forests pump water, remove CO_2 from the atmosphere, support livelihoods and underpin regional economies. Deforestation provides short-term profits for some, but its costs to the global economy are estimated at between $2-5 trillion per annum. Corporate over-exploitation of forests and other natural capital is driving environmental degradation.

The costs of deforestation and climate change affect companies in various ways, including through volatile commodity prices, rising input costs, business disruption and loss of license to operate. Providers of financial capital are exposed to unanticipated credit risk, stranded assets, volatile cash flows and lower returns across asset classes including fixed income, public and private equity and corporate and project finance.

An investor in London or Mexico could finance a palm-oil development scheme in Indonesia or Africa, resulting in deforestation. The costs of this investment in terms of climate, food, energy and water security are unlikely to be included in the cost of capital, credit ratings, share prices or insurance premiums. However, they will end up on other companies' balance sheets, with knock-on effects on credit risk and portfolio returns. Examples such as these illustrate the need for financial institutions to uncover environmental risks embedded in products and services.

The Natural Capital Declaration aims to work with financial institutions to provide practical guidance to address these risks. Together, the NCD Secretariat, formed of UNEP FI and the Global Canopy Programme, the Steering Committee, and four working groups aim to support the development of methodologies to enable professionals in asset management, corporate finance, treasury, and other departments to integrate natural capital factors in the structuring of new products and the risk management of new and existing products. The working groups aim to:

- Build an understanding of the impacts and dependencies of natural capital relevant to financial institutions' value chains.
- Support the development of methodologies to integrate natural capital considerations into financial products and services.
- Work towards building a global consensus for the integration of natural capital into private sector accounting and decision-making.
- Develop methods to disclose and report on natural capital using an Integrated Reporting approach.

Liesel van Ast
Global Canopy Programme

SHAREHOLDER ACTIVISM

STAGE

RESILIENCE

LEVEL

TIMESCALE

0-2 3-5 5+

IMPLEMENTER

Shareholder activism can be defined broadly as the use of voting rights to influence the management of a company. It can take several forms, including private meetings between shareholders and management to discuss issues of concern, public questions at a company's annual general meeting or investor events, and the filing of shareholder resolutions to request a specific action from the management team. In the U.S.A., the process often begins with a shareholder resolution, followed by a dialogue which may result in the resolution being withdrawn and the requested action taking place. In other regions it is generally more common for private conversations to be the starting point, with shareholder resolutions seen as an instrument of last resort. It is in the U.S.A., therefore, where the most public shareholder activism often takes place.

In the first half of 2013, American shareholders filed nine deforestation-related resolutions, up from six in 2012. Eight of these requested the company to put into place a sustainable palm oil sourcing policy, while one requested a broader policy around commodity-related deforestation[370]. Six of the nine resolutions were addressed by the companies (which included major food producers such as Starbucks and Dunkin' Brands), who agreed to implement the requests[371]. This is clear evidence of the power of activist shareholders to effect rapid and substantive change within multi-national organisations.

Activism may be in form of action by individual shareholders or by a concerted group of investors. The most prominent example of the former was the decision in early 2013 of the Government Pension Fund of Norway, one of the world's largest sovereign wealth funds, to introduce a deforestation policy within its investment funds, which resulted in its divestment from 23 palm oil companies which it considered to be producing palm oil unsustainably[372]. An example of the latter is the Sustainable Palm Oil Investor Working Group within the UN Principles for Responsible Investment (UNPRI) coalition of investors, made up of organisations representing more than US$2 trillion of assets, which is looking at how investors can engage with companies to support the development of a sustainable palm oil industry[373].

SPECULATION ON FOOD COMMODITIES AND THE LINK TO DEFORESTATION

INTRODUCTION

Speculation is the buying and selling of an asset (e.g. such as a forest risk commodity) in order to make a profit from a change in the asset's price. Speculators aim to profit from the changes in the price of the asset between when the asset is bought and when it is re-sold to another market participant[cxvi]. Speculators serve a useful function in the market by contributing to the price discovery of the asset. They buy when the asset is cheap and sell when it is expensive.

SPECULATION USING DERIVATIVES

Speculative activity has possible links to deforestation through the trading of a particular type of financial security known as a *derivative*. A derivative is a contract between a buyer and a seller that allows both of them to mitigate (or hedge) the risk of being unable to buy or sell an asset at a particular price and/or at a particular time in the future.

The value of the derivative contract is derived from the underlying asset. For example, a derivative can allow a producer to guarantee the price of the asset paid by the buyer on a specific date in the future. But to do so, the contract has a price, which is determined, in part, by the value of the asset on the open market.

Using the contract value, derivatives can be bought and sold by various market participants, thus creating a market in these contracts. Some financial markets participants buy and sell the derivatives with no intention of taking delivery of the underlying asset (e.g. corn), but only intend to profit from short-term changes in the contract's value. This is speculative activity, and it can have an effect on the price of the underlying commodity. This is because the relationship between the price of the underlying asset and the value of the derivative contract can work in both directions. The price of the commodity can be increased by changes in the value of the derivative[cxvii], i.e. speculation in derivatives markets can cause an increase in the price of underlying commodities.

THE EVOLUTION OF SPECULATIVE ACTIVITY

There are different types of markets where assets are bought and sold, e.g. financial markets (stocks, bonds, etc.) or commodity markets. Deforestation is driven primarily by agriculture, and since agricultural products are commodities that are sold on the commodity markets, it is these markets that this book is concerned with.

In the past, derivatives of commodities were only allowed to be traded for risk mitigating purposes (known as hedging), traders were required to disclose the holdings of these assets, and risky behaviour was limited (one method of reducing risk taking, amongst other purposes, is something known as setting *position limits*).

In 2000, a particular type of derivative known as an Over-the-Counter (OTC) derivative was exempted from oversight across all markets in the U.S.A, including commodity markets. This stimulated the emergence of unregulated exchanges and the uncontrolled entrance of hedge funds, pension funds and investment banks. Participants were no longer required to hold the underlying asset or limit their positions[cxviii].

Meanwhile, the financial crisis that began in 2008 reduced the appeal of investments in the housing sector; investors sought, and still seek, alternative sources of return. As result of this (and other reasons), commodities have started to be viewed as another asset class for portfolio managers. An illustration of this is the growth in commodity index funds, which give investors the opportunity to invest in food commodities and take positions on the price of food[cxix].

RISING FOOD PRICES AND THE LINK TO DEFORESTATION

There has been a significant rise in food prices in 2007-2008 and 2010. It is argued that these food price spikes are caused, in part, by the increase in the speculative activity of commodity derivative markets. Other causes cited include what are known as *market fundamentals*, e.g. differences between supply and demand for food commodities[cxx,cxxi]. Often, speculators take huge positions on food commodities using derivatives (i.e. make a large bet on the price change), and so can exert pressure on market prices of the underlying food commodities[cxxii,cxxiii].

If prices are increasing, this in turn creates higher returns and incentivises an increase in the production of the food commodity, which often means clearing natural forests to make way for plantations[cxxiv]. Palm oil for instance, experienced a significant price increases in 2008 and 2010, when it climbed above US$ 1,000/tonnes.

There is, however, no conclusive proof that speculation in commodity derivative markets has driven the changes in the price of food commodities, and it cannot be definitively claimed that speculation is a driver of deforestation. Some market participants see the increases of commodity prices as a result of the difference between supply and the increasing demand for food commodities[cxxv,cxxvi]. However, they do acknowledge that excessive speculation on the market can increase volatility and temporarily distort the normal functioning of markets.

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REGULATORY CATALYSTS

CLARIFYING LAND TENURE

STAGE

RESILIENCE

LEVEL

TIMESCALE

0-2 3-5 5+

IMPLEMENTER

Land tenure can be defined as a set of rights that determine the access, use, management, exclusion and alienation (the right to sell or transfer ownership rights) of land and resources[374]. Clear and secure land tenure can have a positive or negative impact on deforestation depending on economic and social circumstances.

For example, secure tenure enables landowners to take into account the potential future values of the land into current decision making. In some cases this can result in more sustainable management of forest resources, but in others can lead to investment in agricultural development, often associated with negative impacts on forest cover[375,376]. Although on balance security of land tenure is associated with a reduction in forest loss[377,378], the determinants of whether improved tenure security has positive or negative impacts on forests are complex and context specific. For example, research demonstrates that in the short term, tenure security has in some cases led to increased competition for land, conflict and rent seeking behaviour[379]. Landowner attitudes, cultural restrictions, existing regulations and available incentives are therefore all critically important factors in determining the ultimate impacts of improved tenure security, and secure tenure alone is insufficient to protect forests.

Instead, clear and secure land tenure is a vital enabling factor for the effective implementation of many other catalysts, exerting a multiplying effect on the impacts and feasibility of establishing REDD+ projects (see page 155) and agricultural productivity initiatives, for example (see page 114). This is principally because clarity and security of land tenure lowers the financial risk of public and private sector investment in land and land-use strategies, and enables longer term strategic planning, and more effective resource management[380].

However, land tenure clarification can be a long and costly process requiring strong political commitment. Once achieved, typically through legislative reform or some other means of clarification, considerable investments in enforcement and monitoring are required to ensure that rights are upheld in practice.

IMPORT TARIFFS

STAGE

RESILIENCE

LEVEL

TIMESCALE

0-2 3-5 5+

IMPLEMENTER

Custom duties on imports are called import tariffs[381]. Applying differential import tariffs as a demand-side measure on forest risk commodities that are produced unsustainably could disincentivise their trade and consumption. This may be achieved by either lowering tariffs on sustainable commodities and/or raising tariffs on unsustainable commodities. While no clear precedent has been set for applying differential import tariffs to commodities, the existence of preferential EU tariffs for imports from certain developing countries and sustainability criteria for biofuels under the EU Renewable Energy Directive* suggests that differential import tariffs are unlikely to trigger a WTO dispute (see page 148)[382,383], provided governments comply with WTO principles when defining sustainable and unsustainable products. Any potential disputes should also be avoidable through the establishment of multilateral or bilateral trade agreements between major producers and importing countries and by restricting trade between those countries to an agreed definition of a sustainable product[384]. These agreements could be potentially modelled along the lines of the 'voluntary partnership agreements' used under FLEGT (see page 150).

A lack of political will could be a barrier to the success and long-term resilience of differential import tariffs in markets where an increase in taxes on unsustainable commodities would be required. As existing EU import duties on forest risk commodities are already very low[385], the greatest scope for impact for tariff reductions on sustainable commodities is in large forest commodity importing markets such as India and China, where tariffs for commodities are higher. However, both countries have a consistent stance of opposing trade-related environmental measures within the WTO[386]. Differentiating between 'sustainable' and 'unsustainable' commodities will also require the full segregation and traceability of forest risk commodities throughout the supply chain. This may need to go beyond existing systems, for example mass balance palm oil (a mix of certified and non-certified palm oil), while currently allowed under RSPO certification, would likely have to be excluded. These factors, along with legislation and improvements in traceability, could restrict the overall size of and producers' access to the sustainable commodities market, and limit its quick implementation.

INTERACTION OF WTO RULES WITH MEASURES TO RESTRICT THE TRADE OF UNSUSTAINABLE COMMODITIES

The legal and economic implications of the interaction between environmental and trade policies have been much debated, in particular since the creation of the World Trade Organisation (WTO) in 1995. Existing multilateral environmental agreements (MEAs), e.g. the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the range of measures adopted by governments in recent years to exclude illegal timber from international trade, demonstrate that environmental policies that affect trade can be implemented without triggering WTO disputes. While governments do have considerable latitude to introduce trade-restrictive measures, they need to be aware of the constraints on their efforts posed by WTO rules.

The WTO agreements set out broad principles to remove barriers to international trade. WTO challenges and disputes revolve around the evolving interpretation of these key principles. In particular, WTO members are not permitted to discriminate between traded 'like products' produced by other WTO members, or between domestic and international 'like products' ('like products' are not described in the WTO agreements, and their definition can be controversial). Restrictions other than duties, taxes or other charges on imports from and exports to other WTO members are forbidden.

However, the WTO agreement provide for exemptions to these principles in specified circumstances, including 'measures necessary to protect human, animal or plant life or health' and 'measures relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption'. In general, trade measures which diverge less from the WTO core principle of non-discrimination in trade are less likely to lead to a dispute. A key issue is whether sustainable and unsustainable commodities can be discriminated between based on their process and production methods, or are in fact 'like products' and thus cannot be discriminated between.

In theory the following measures could be adopted by governments to address commodity-related drivers of deforestation:

1. **Public procurement policies** requiring governments to only purchase sustainable commodities (e.g. the UK government's target of 100% sourcing of certified sustainable palm oil in food and catering supplies by the end of 2015).
2. **Bilateral or multilateral agreements** between importing and exporting countries to restrict trade to an agreed definition of a 'sustainable' product (e.g. the Voluntary Partnership Agreements within the EU's Forest Law Enforcement, Governance and Trade (FLEGT) mechanism, designed to combat the trade in illegal timber).
3. **Differential import tariffs** for sustainable and unsustainable commodities.
4. **Other government regulations**, for example for biofuels, differentiating between commodities on the basis of their environmental impact.

WTO rules are only applicable to national governments and therefore private enterprises have full freedom to control their supply chains. Governments can play an important role in supporting private sector and industry initiatives that promote the production and consumption of sustainable commodities without WTO implications. These include amongst others, voluntary commitments to reduce deforestation (e.g. the Consumer Goods Forum's goal of zero net deforestation by 2020), certification initiatives, and the development and dissemination of best practices.

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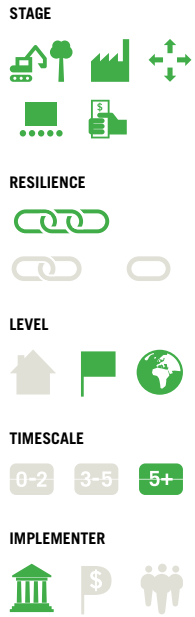
INTERNATIONAL LAW AND BILATERAL AGREEMENTS

International laws and agreements can provide regulatory architecture to guide global efforts to reduce the production or trade in illegal or unsustainably harvested forest commodities at both the demand and supply side of the market. Relevant major multilateral environmental agreements (MEAs), such as the United Nations Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), can be legally binding to Parties that ratify them. Although the UN Framework Convention on Climate Change (UNFCCC) is non-binding, 'protocols' of the treaty such as the Kyoto Protocol, which sets mandatory emissions limits, are legally binding. MEAs are not just a legal tool - typically, ratifying countries are offered clear technical guidance and accompanying financial support to implement actions to achieve the objectives of the treaties (as in the case of REDD+).

Bilateral trade agreements, such as the Voluntary Partnership Arrangements (VPAs) of the EU Forest Law Enforcement Governance and Trade action plan* (FLEGT), present another policy option to address deforestation from forest risk commodities. FLEGT VPAs seek to exclude illegal timber from EU markets while increasing partner country access to EU markets for legal timber (see page 150). The implementation of bilateral agreements is also often linked with the provision of additional Technical Assistance (see page 125) for partner countries. In the case of FLEGT, Technical Assistance has built national capacity, and supported the review or reform of relevant national legislation to reduce deforestation from commodity supply chains, including the development of traceability systems to support the enforcement and monitoring of activities[387].

To date, FLEGT VPAs only tackle illegality within the timber sector. However, options may exist to explore the applicability of VPA type mechanisms within new bilateral agreements to leverage the demand for sustainable forest commodities, such as palm oil and soya[388]. Some consideration has already been given to the feasibility of bilateral agreements in fulfilling the sustainability criteria of the EU Renewable Energy Directive (EU-RED)**,[389]. However, governments should also be aware of the constraints posed by WTO rules, particularly when applying 'sustainability' criterion to forest commodities (see page 148)[390].



* Forest Law Enforcement, Governance and Trade.

** Based on Article 18(4) of the EU-RED.

STRENGTHENING FOREST GOVERNANCE IN TIMBER-EXPORTING COUNTRIES THROUGH FLEGT VPAS

A Voluntary Partnership Agreement, or VPA, is one instrument among many in the EU Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan of 2003, the EU's initiative to address illegal timber and its related trade and promote governance in the forest sector. The EU Timber Regulation, another of such instruments, is introduced on page 153. Others include activities related to public procurement policy, private sector initiatives, financing and investment, existing legislative measures, and conflict timber.

VPAs are bilateral trade agreements between the EU and timber-exporting countries. They are voluntary, but become legally binding once they are agreed. Since 2004, six countries* have concluded a VPA with the EU and seven** are in the process of negotiating one. Many more are considering engaging.

VPAs have proved effective in creating space for improving forest governance. By mandating consensus-building in the country concerned, they have prompted a broad range of stakeholders to come to the table and provided a forum for discussions about forest sector reform.

- In the Republic of the Congo, the VPA process triggered the creation of a civil society platform where there had been no tradition of engagement in forest issues.
- In Cameroon and Ghana, officials overcame initial reluctance to broad stakeholder engagement, and a thriving debate about forest governance among all stakeholders continues as the VPAs are implemented.
- In Indonesia, government officials, leaders in the private sector and a network of local civil society organisations have established a national timber legality verification system they all trust.

VPA Partner Countries have used the negotiation process to catalyse change in tough issues that go beyond the legality of timber exports.

- In Republic of the Congo, the legislature has passed the country's first Indigenous Peoples Law, a requirement before the authorities issue FLEGT licences.
- In Liberia, the VPA has served as a conduit to expose the abuse of private use logging permits, while in Cameroon the government and civil society have developed an anti-corruption plan.
- A recent study by Mary Hobley and Marlene Buchy[cxxvii] has concluded that VPAs can make an important contribution to alleviating poverty, and thus to the development objectives of many timber-producing countries.

Other commodities affecting deforestation where illegal or unsustainable practices pose challenges may look to VPA lessons and experiences in promoting in-country dialogue on challenging issues. Illegal clearing of forests for palm oil and soya production, or for introducing cattle, are all vivid examples, and are discussed in other sections of this book.

Land-use change is expected to continue to escalate as consumers in emerging and developed economies create more demand. Promoting engagement of all stakeholders in transparent, inclusive decision-making processes aimed at improving forest governance and stopping illegal practices is the first step toward a bigger conversation about land-use planning that stops deforestation. VPAs provide a model for how to do this.

EU FLEGT Facility

* Cameroon, Central African Republic, Ghana, Indonesia, Liberia and Republic of Congo.
** Democratic Republic of Congo, Gabon, Guyana, Honduras, Malaysia, Vietnam and Côte d'Ivoire.

NATIONAL LEGISLATION

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

National legislation to reduce deforestation can encompass an extremely wide range of regulations, incentives and policies which can have major impacts on all stages of the supply chains of forest risk commodities. Legislation can operate at all levels, from the 'supply side' (where commodities are grown or sourced), to the 'demand side' (typically in commodity consuming or processing countries). Demand-side legislation often targets the illegal production of commodities. For example, amendments to the US Lacey Act in 2008 made it illegal to trade plants or wildlife products sourced in violation of either American state laws or foreign domestic laws[391,392]. Other countries have similar legislative restrictions, for example Australia's Illegal Logging Prohibition Act (2012), and the EU Timber Regulation (see page 153). Demand-side legislation could also include labelling guidelines or banning the imports of products which do not meet sustainability criteria, however here the potential limiting effect of World Trade Organization principles would have to be considered (see page 148).

In contrast, a reduction in the supply of forest risk commodities can be achieved through a number of measures, such as the establishment of protected areas or extractive reserves[393,394]. Such initiatives are often most effective when enacted in concert with broader reforms. For example, Costa Rica's rapid reduction in deforestation was driven by a ban of land cover change in forests, combined with legal and fiscal incentives for reforestation, and schemes for payments for environmental services (PES)[395].

Brazil's Low Carbon Agriculture Plan aims to limit deforestation and ensure planned agricultural development by denying farmers access to credit until their compliance with the Brazilian Forest Code is proven[396]. Other initiatives, such as Indonesia's Sustainable Palm Oil (ISPO) certification programme, also attempt to establish and enforce national production sustainability standards. Ultimately, the effectiveness and resilience of such legislation is connected with the enforcement and monitoring of compliance (see page 119). As a result, international support may be required in order to establish and implement supply-side legislation, and although resilient to later changes, legislative reform generally requires a medium to long-term timescale to implement.

INTERNATIONAL MARKETS ALIGNING: THE EMERGENCE OF ANTI-ILLEGAL LOGGING LEGISLATION

The recent introduction of the EU Timber Regulation (EUTR, March 2013) follows the amendment to the US Lacey Act (2008). A third law, the Australian Illegal Logging Prohibition Act (2012), will take full effect from November 2014. These laws seek to limit the access of illegally logged timber and timber products to their markets by making it an offence to sell illegally logged wood, and demanding that attention is paid to the risk that timber has been logged illegally.

In order for companies to comply with these laws, gaining access to reliable information about the origin of timber is vital. Currently the information required for companies to assess the risk of illegal timber in their supply chains (i.e. species and country of origin) is not easy to find; no one central source exists. Under the EUTR, if a company suspects they are exposed to a risk of illegal timber they are expected to undertake some risk mitigation measures. These measures can range from commissioning independent verification to collecting evidence about the timber supply source. Deciding which measures are applied is the responsibility of the individual company. Mistakenly many companies are asking suppliers for official "proof of legality" documents, however it is assessment of the validity of these documents as part of due diligence that is required under the EUTR. Requesting additional information from suppliers is an important step, however information requests to suppliers are rarely met with clear answers, which can leave companies to apply their own knowledge and judgement on the information they have to hand.

For those supplying these markets, it is clear that while actions to verify both supply chain controls and forest management practices are no guarantee to the avoidance of illegal timber, they are the best and most logical options.

Ultimately there are differences between the three laws; notably in the form of border controls and enforcement. The US Lacey Act requires a border declaration in many cases whilst the EUTR does not. However under the rules of the EUTR the way that operators assess *risk* of illegality (due diligence) is also subject to scrutiny. Consequentially, a company could be buying entirely legal timber, but if it has not undertaken any sort of risk assessment it still falls foul of the EUTR.

However, the EU, US and Australian laws are aligned in the fundamentals; all consider legality in terms of the laws in the country of harvest, and make it an offence to put illegal timber on the market. They really aim at ensuring buyers know their supply chain, which for any company has to be sound business practice. Will they directly address deforestation? Possibly, where a particular supply is proven to be sourced through illegal conversion, or exceeding cutting rates. However, a greater indirect impact will be achieved when discerning companies undertake due diligence on all forest-impacting commodities, including products such as palm oil and soya – a logical step in knowing your supply chain in a world of resource insecurity, surely?

Rachel Butler
Independent Technical Advisor to the European Timber Trade Federation

NATIONAL PLANNING AND COORDINATION

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Coordinated national planning involves integrating the future resource needs of all relevant government departments and public agencies to achieve economic, environmental and social goals. Often numerous national plans exist that target different priorities, for example biodiversity, energy, and climate change. However, a low technical capacity, poor intergovernmental communication, and limited access to reliable data in many tropical forest countries, combined with overlapping departmental mandates and finite resources, can lead to the formulation of national plans which may propose contrasting development strategies, and that demonstrate conflicting priorities. One of the outcomes of these conflicts can be overlapping and conflicting land use plans, which can disincentivise companies and investors from engagement in the forestry and agricultural sectors, and can represent a significant financial risk. For example, a recent study indicates that 31% of all commercial mining, timber and agricultural concessions (by area) are overlapped in some way by community lands, putting at risk some US$5 billion of implied agriculture production value[397].

In the context of reducing deforestation, coordinated national planning is therefore urgently needed that incorporates input from all relevant government departments (e.g. mining, forestry, agriculture, transport, energy, environment etc.) at both the national and sub-national level, and involves wide stakeholder consultation with civil society, the private sector and the free prior and informed consent (FPIC) of communities. Indonesia's 'One Map' Initiative, for example, seeks to create a single national land use map using a standardised methodology and a single database, in order to radically improve development planning[398]. To reduce the deforestation from forest risk commodity supply chains, this approach could be extended in the forestry and agricultural sectors of many other tropical forest countries to enable commodity production to meet multiple, and potentially conflicting goals (e.g. poverty reduction, emissions reductions, food security, and commodity export targets). For example, in Brazil the agro-ecological zoning of sugarcane, which aims to bring social and economic benefits while minimising environmental impacts, uses ecological criteria to define areas where sugarcane can be cultivated - in this case excluding Amazonia. Producer access to loans is also dependent on compliance with zoning[399].

REDD+

The UNFCCC mechanism to reduce emissions from deforestation and degradation and to enhance forest carbon stocks (REDD+) provides a unique opportunity to reverse the on-going trend of deforestation and degradation of forests and improve sustainable forest management in tropical forest countries. To implement national REDD+ strategies, prioritising actions to address deforestation and forest degradation resulting from agricultural forest commodity supply chains is critically important[400].

Payments for verified emissions reductions from REDD+ may act as an alternative funding source for forest owners seeking economic returns from standing forests, particularly in areas which may be under threat from timber extraction but that have marginal value for agricultural conversion. However, there is debate as to whether estimated returns from REDD+ per hectare, although fluctuating, will ever match the potential profits from palm oil production[401]. Despite this, when other ecosystem services such as the provision of clean water and biodiversity are considered, even relatively low payments from REDD+ can make the establishment of REDD+ projects a viable and attractive alternative to agricultural conversion or timber extraction[402]. REDD+ payments from voluntary carbon projects can also provide on-going revenue streams to establish or maintain protected forest areas and support improved forest management initiatives. Furthermore, public sector international funding for REDD+ readiness activities can support improved enforcement and monitoring, clarified tenure rights, and institutional capacity building. These improvements in turn contribute to public sector efforts that support a transition to the sustainable production of agricultural commodities and the reduction of national greenhouse gas emissions.

REDD+ could therefore be a significant contributor to reducing agricultural expansion into new forest areas, particularly when implemented in conjunction with other financial and institutional catalysts[403]. The potential impacts of REDD+ will be amplified if agreements are made by the UNFCCC that finalise the architecture for a global REDD+ mechanism, anticipated before 2020. In order to be most effective, REDD+ mitigation strategies and agricultural plans should be integrated in landscape scale and 'climate-smart' agricultural development pathways[404].

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

SUBSIDIES

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Subsidies are a form of targeted economic incentive provided by governments - or any public body - that can benefit producers or consumers through the direct transfer of funds, the provision of goods and services (e.g. production inputs), or through foregone revenue (e.g. tax exemptions – see page 157)[405]. The availability and provision of soya, cattle, palm oil, and biofuel subsidies can directly impact the profitability, and therefore the level and intensity, at which these commodities are produced[406].

Governments may provide subsidies to farmers based on the amount of crop they produce, to keep farmers employed and food prices low. Production subsidies could be targeted at companies engaging in low impact agricultural or forestry projects, or redirected away from unsustainable conversion/production and processing activities in the supply chain to incentivise reductions in deforestation. For example, in beef supply chains subsidies could be used to improve productivity on existing pasture land, or to reduce the cost of production on degraded lands, lessening the need to further clear forests. Similarly, subsidies provided to producers engaged in more sustainable production systems (e.g. "green" commodities) could increase returns, and therefore promote such commodities.

Subsidies can also be provided to financial institutions to support either the premium payments for insurance or credit guarantees (see pages 135 and 138), or the interest payments on a loan. The inclusion of 'avoided deforestation' criteria in the allocation of these subsidies could ensure that they are only directed towards projects which have low impacts on tropical forests. The removal of existing subsidies can also have an indirect impact on forest cover. For example, governments could reduce incentives to open new roads that are used to access natural resources. The application of subsidies can also have unintended impacts. For example, in the United States, subsidies for corn bioethanol precipitated a shift of production from soya to corn in many US farms. Yet given the global demand for soya remained high, its production merely shifted to tropical regions, like Brazil, where it has become a key driver of deforestation in the *Cerrado* and Amazon biomes[407].

TAX INCENTIVES

STAGE

RESILIENCE

LEVEL

TIMESCALE

IMPLEMENTER

Environmental taxes are levied with the primary aim of promoting positive environmental behaviour[408], while environmental tax incentives, such as tax credits and tax exemptions, are reductions in the total tax payable to the government in return for improved behaviour[409].

Positive tax incentives are generally granted to either an individual or a business, and for differing purposes. For example, to support growth in the certified timber market, the government may grant tax incentives to landowners that produce certified timber. A positive tax incentive can support both the profitability of a forest commodity supply chain with low impacts on forest cover and/or an organisation's access to capital by reducing the taxes paid for both the physical inputs to (e.g. raw materials, technical assistance, etc.) and the outputs from (e.g. certified timber, carbon emissions reductions etc.) an organisation's activities. This reduces the operating costs of a forest-friendly activity, thus lowering the risk that an activity will be unprofitable. Alternatively, a tax incentive can reduce the taxes paid by investors in the project (e.g. the taxes on interest payments to a creditor offering a loan). This in turn lowers the cost of sourcing capital and reduces the risk of lower than expected returns to the investor. Environmental taxes can also increase the costs of certain products for consumers and retailers to disincentivise demand.

While tax revenue normally feeds into general government funds[410], it can also be earmarked to fund positive environmental actions. For example 3.5% of Costa Rica's fossil fuel tax is earmarked for its Payment for Environmental Services (PSA) scheme which is focused on forest conservation[411]. For environmental taxes to be effective and resilient in reducing deforestation they must be levied as directly as possible on the drivers of deforestation; there must be a cost-effective alternative for industry and consumers (such as sustainable commodity production), requiring investment in innovation (e.g. subsidies, see page 156) and the availability of credit (see page 133) to cover the costs of transition to sustainable supply chains; the tax must be enforced; and efforts must be made to reduce potential leakage through international cooperation and legislation.

GAP ANALYSIS & CONCLUSIONS

SUMMARY

The production and trade of the key forest risk commodities - palm oil, soya, beef and timber, pulp and paper - are the largest global direct drivers of tropical deforestation and degradation. This dramatic loss of forests is threatening global biodiversity and the security of the vital ecosystem services they provide. The direct commodity drivers of deforestation are influenced by complex and context specific interactions with a series of underlying causes, such as global population growth, poor governance, and poverty. In this landscape, climate change acts as both a likely driver of deforestation and a significant threat multiplier to each of the other underlying causes.

CURRENT CHARACTERISTICS & TRENDS

In order to fully understand the dependencies and interactions within and between the underlying causes and the commodity drivers of deforestation, it is necessary to recognise characteristics of the forest risk commodity supply chains involved.

- Forest risk commodity supply chains are highly complex and non-transparent. Before a final product that contains one of these commodities reaches the end consumer, be it a buyer in a supermarket or an industrial user, it has been transformed and transported multiple times, passing through dozens of stages, and often between different countries and continents.

- The majority of the production and associated deforestation from forest risk commodities is currently highly concentrated in a small number of countries in Latin America and South East Asia. However, without urgent intervention, industrial scale production is likely to spread to other regions such as the Congo Basin. A handful of international commodity traders also dominate the global trade of most of the agricultural forest risk commodities. Although processing and manufacturing take place around the globe, the role of China as a hub for processing forest risk commodities is particularly relevant.

- In stark contrast to the highly concentrated nature of the production and trade, the consumer markets for forest risk commodities and the products in which they can be found are truly global. Nevertheless the mature markets of the EU, and the U.S.A., as well as the markets of China and India are likely to be critical when it comes to implementing demand-side solutions to deforestation.

OPPORTUNITIES FOR ACTION

An analysis of the existing catalysts within the framework described in this book also highlights some important opportunities for action:

- A high proportion of the catalysts tackle either the conversion/production or the retail/consumption stages of the supply chains. Very few initiatives focus specifically on promoting sustainability and ensuring transparency either in the processing or trading/distribution stages, or the entirety of the supply chain. This highlights a clear opportunity for a renewed focus on trialling and expanding catalysts that address these ‘shadow’ stages.

- In addition, the catalysts with the highest resilience to change are often those which require the longest time to implement. Particular attention should therefore be paid to increasing the resilience of catalysts that can be implemented quickly (e.g. moratoria), while working towards long-term solutions, for example by ultimately tying these initiatives into longer term legislative reforms.

- Furthermore, there are few existing financial, regulatory or supply chain catalysts that are led and implemented exclusively by the private sector. Within this sector, even fewer of the instruments described rely upon the leadership of investors and financial institutions to effect change. The majority of the catalysts are currently implemented, and to some degree funded, by public sector actors. This represents both a major opportunity for action within the private sector to proactively address the problem, as well as major risk for the long-term sustainability of their business models.

BARRIERS TO EFFECTIVE IMPLEMENTATION

The majority of the 24 catalysts described in this book are already being used by public and private sector actors in some form, and in many cases they are being utilised to specifically address deforestation and forest degradation. The critical question is, therefore, why is the use of these catalysts not already leading to significant gains in reducing global deforestation from forest risk commodity supply chains?

One important reason for this is that the complexity of these supply chains and their interaction with the underlying drivers and the numerous jurisdictions involved has led to fragmented, disjointed and relatively isolated implementation of catalysts. Applied simultaneously and in a well-coordinated fashion, they could act synergistically, generating far greater momentum and leading to transformational change. While there have been success stories that demonstrate the collective power of concerted action to create this 'momentum of change' to tackle deforestation, these instances are relatively few.

One example of synergistic efforts generating such a momentum of change is the consumer campaign highlighting deforestation caused by soya expansion in the Amazon. The campaign led directly to behavioural change in companies engaged in soya supply chains (e.g. McDonalds). This in turn helped to drive a private sector moratorium on soya expansion, which supported round table efforts on soya certification, and was enforced and monitored by technological innovations led by the Brazilian government. It is hoped that these changes will ultimately lead to strong and lasting national legislation that will permanently safeguard the forest frontier from unsustainable soya expansion.

However, the establishment of this critical momentum across a wider range of catalysts is currently hampered by a number of key barriers that apply across all of the catalyst categories (regulatory, supply chain and price related catalysts) and represent the largest obstacles to permanent solutions to tropical deforestation. The following pages briefly summarise these barriers and highlight a series of urgent recommendations for action.

TRANSPARENCY AND INFORMATION

The accessibility, transparency and utility of information are key determinants of effective public and private sector engagement and, ultimately, of the speed, effectiveness and equity of adoption of catalysts to address the drivers of tropical deforestation and degradation. The current lack of transparency and limited availability of comprehensive information related to forest risk commodity supply chains therefore act as a crucial barrier to targeting efforts to reduce deforestation.

Priorities for action

1. There is a pressing need for wider access to real-time or near real-time information related to the interactions between forest risk commodity supply chains and deforestation in tropical forest countries.
2. The development of systems to establish supply chain transparency are critically important to implement a number of catalysts (e.g. differential import tariffs, subsidies, shareholder activism, enforcement and monitoring, and industry standards) and to equitably allocate transition costs and apply incentives (see below). Effective tracking systems, which allow the tracing of forest risk commodities throughout the supply chain and provide transparency from the forest to the final product, are urgently needed.
3. Transparency and disclosure should be incentivised and regulated, and should extend to the finance sector to ensure the accountability of financial institutions and their shareholders in their engagement in forest risk commodity supply chains.

TRANSITION COSTS AND INCENTIVES

The provision of information alone will be insufficient to drive change at the necessary rate and scale. It therefore needs to be complemented by the application of incentives, as well as financing to implement the catalysts described in this book. Meeting these costs and implementing many of the catalysts will likely to require a combination of mechanisms and activities from multiple sectors.

Priorities for action

1. Better information on supply chains will enable the creation of methodologies for calculating the true cost of commodity production, taking into account negative and positive impacts on natural capital and human livelihoods. These methodologies should be developed collaboratively by the private and public sectors, and supported by civil society. The availability of accurate estimates of true costs will enable all stakeholders to reach a more comprehensive understanding of the scale of the problem and rapidly identify and implement economically viable opportunities for improvements.
2. There is currently a limited market for sustainable or certified commodities, and therefore insufficient price signals to promote the sustainable production and trade of forest risk commodities as a competitive alternative to business as usual. The application of catalysts such as differential import tariffs and guarantees could provide such market signals.
3. The public sector, and in particular multilateral institutions, must accept that they will have to bear a large proportion of the costs of supporting transitions to sustainable agricultural commodity production at all stages of the supply chain, which will require a significant increase in financial resources. The provision of this finance must be coupled with legislation and incentives, and be conditional on the behavioural change of private sector companies in reducing deforestation.
4. The introduction of environmental criteria specifically targeting reductions in deforestation into financial products such as concessional credit lines, guarantees and insurance, could support the costs of transition to the sustainable production and trade of forest risk commodities. In order to achieve this, eligibility to access such financial products would have to be linked to compliance with environmental criteria and the use of comprehensive systems for their monitoring and enforcement.

INNOVATION AND RISK-TAKING

For the implementation of the catalysts to be successful and to generate a momentum of change, there must be greater acknowledgement of the need for risk-taking and innovative solutions in each sector. The barriers that relate to insufficient transition costs, incentives, transparency and access to information, are inherently linked to risk and innovation. Even though some risks can be sector-specific, the acceptance of risks has to be shared by all sectors in order for solutions to be successful and drive change in the necessary timeframe.

Priorities for action

1. In order to maximise synergies between catalysts, innovative collaborations among all sectors need to be formed, or strengthened where they already exist. The private sector must show leadership and financial commitment in funding such collaborations and must demonstrate greater acceptance of risk so that these initiatives can lead to tangible outcomes.
2. The role of civil society as a technological innovator is crucial and should be strengthened, which will also contribute to its effectiveness in monitoring and enforcing public and private sector initiatives and commitments.
3. Innovative political solutions, which can demonstrate leadership and more rapidly replicate successful strategies to reduce deforestation (such as bilateral agreements between tropical forest countries), should be explored.
4. Current certification schemes have not been successful at reducing deforestation at a large scale or in rapid timeframes. Certification schemes need to be improved, so as to have more tangible impacts on deforestation rates, and innovative systems that support a market for sustainable production need to be developed.

In summary, a transformational shift is urgently needed that increases collaboration between public, private and civil society actors in forest risk commodity supply chains. It will be necessary to create transparency and traceability mechanisms in supply chains, and in order to find solutions that cover the significant costs of a transition to sustainable production and trade, innovation and the acceptance of the risks that accompany the implementations of solutions to deforestation will be vital.

ANNEXES

ENDNOTES

1. HOSONUMA, N. ET AL. (2012) An assessment of deforestation and forest degradation drivers in developing countries. Environmental Research Letters, 7(4), 044009.

2. DUPUY, B. ET AL. (1999) Tropical forest management techniques: a review of the sustainability of forest management practices in tropical countries. FAO. Forestry Policy and Planning Division. Rome.

3. LEWIS, S.L. (2006) Tropical forests and the changing earth system. Philosophical Transactions of the Royal Society. Vol. 361 no. 1465 195-210.

4. RUDEL, T.K. ET AL.. (2010) Forest transitions: An introduction. Land Use Policy 27 (2010) 95–97.

5. ANGELSEN, A. (2007) Forest Cover Change in Space and Time: Combining the von Thünen and Forest Transition Theories. World Bank Policy Research Working Paper 4117, February 2007. The World Bank.

6. SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY. (2009) Sustainable Forest Management, Biodiversity and Livelihoods: A Good Practice Guide.

7. GOENARDI, D. (2008) Prospective on Indonesian Palm Oil Production, Paper presented on the International Food & Agricultural Trade Policy Council's Spring 2008 Meeting, 12 May 2008, Bogor, Indonesia.

8. WEINHOLD, D. ET AL. (2013) Soybeans, Poverty and Inequality in the Brazilian Amazon. World Development Vol. 52, pp. 132–143.

9. GIBBS, H.K. ET AL. (2010) Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s. PNAS Vol. 107 no. 38.

10. HOSONUMA, N. ET AL. (2012) An assessment of deforestation and forest degradation drivers in developing countries. Environ. Res. Lett. 7 044009.

11. KISSINGER, G. ET AL. (2012) Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers. Lexeme Consulting, Vancouver Canada. Based on: HOSONUMA, N ET AL.. (2012) An assessment of deforestation and forest degradation drivers in developing countries. Environ. Res. Lett. 7 044009.

12. WTO. (2013) Statistics Database. The World Trade Organisation.

13. ROBALINO, J & HERRERA, L.D. (2010) Trade and Deforestation: A literature review.Staff working paper. ERSD. No. 2010-04.

14. INFOAMAZONIA & TERRA-I. (2013) Incremento de 24% en la deforestación de la Amazonía. [Online] Available from: http://www.oeco.org.br/mapas/27291-incremento-de-24-en-la-deforestacion-de-la-amazonia

15. MEGEVAND, C.ET AL. (2013) Deforestation Trends in the Congo Basin: Reconciling Economic Growth and Forest Protection. Washington DC: The World Bank.

16. ASIA-PACIFIC FORESTRY COMMISSION. (2010) Southeast Asian Forests And Forestry to 2020.Subregional Report of the Second Asia-Pacific Forestry Sector Outlook Study. Food and Agriculture Organization. p143ff.

17. FAO & ITTO. (2011) The State of Forests in the Amazon Basin, Congo Basin and Southeast Asia. A report prepared for the Summit of the Three Rainforest Basins Brazzaville, Republic of Congo. 31 May–3 June, 2011.

18. NEPSTAD, D. ET AL. (2009) The End of deforestation in the Brazilian Amazon. Science Vol. 326 4 December 2009.

19. INFOAMAZONIA & TERRA-I. (2013) Incremento de 24% en la deforestación de la Amazonía. [Online] Available from: http://www.oeco.org.br/mapas/27291-incremento-de-24-en-la-deforestacion-de-la-amazonia

20. FAO & ITTO. (2011) The State of Forests in the Amazon Basin, Congo Basin and Southeast Asia. A report prepared for the Summit of the Three Rainforest Basins Brazzaville, Republic of Congo. 31 May–3 June, 2011.

21. MARONGO, B.A. ET AL. (2012) Mapping and monitoring deforestation and forest degradation in Sumatra (Indonesia) using Landsat time series data sets from 1990 to 2010. Environmental Research Letters Volume 7 Number 3.

22. KEMEN, A. (2012) Indonesia's moratorium on new forest concessions: key findings and next steps. World Resources Institute. Working paper.

23. WWF. (2013) Ecosystems in the Greater Mekong: Past trends, current status, possible futures.

24. MEGEVAND, C. ET AL. (2013) Deforestation Trends in the Congo Basin: - Reconciling Economic Growth and Forest Protection. Washington DC: The World Bank.

25. FAO & ITTO. (2011) The State of Forests in the Amazon Basin, Congo Basin and Southeast Asia. A report prepared for the Summit of the Three Rainforest Basins Brazzaville, Republic of Congo. 31 May–3 June, 2011.

26. THE RAINFOREST FOUNDATION UK. (2013) Seeds of Destruction. Expansion of industrial oil palm in the Congo Basin: Potential impacts on forests and people.

27. MEGEVAND, C. ET AL. (2013)Deforestation Trends in the Congo Basin: - Reconciling Economic Growth and Forest Protection. Washington DC: The World Bank.

28. SHVIDENKO, A. ET AL. (2005) Forest and woodland systems. In: HASSAN, R., SCHOLES, R. and ASH, N. (Eds). Ecosystems and Human Well-being: Volume 1: Current State and Trends. Washington, District of Columbia: Island Press.

29. FAO. (2000) Asia and the Pacific National Forestry Programmes Update 34.

30. PIMM, S. & RAVEN P. (2000) Biodiversity: Extinction by numbers. Nature 403, 843-845.

31. POSTEL, S.L. ET AL. (1996) Human appropriation of renewable freshwater. Science 271, 785-788.

32. SHVIDENKO, A. ET AL. (2005) Forest and woodland systems. In: HASSAN, R., SCHOLES, R. and ASH, N. (Eds). Ecosystems and Human Well-being: Volume 1: Current State and Trends. Washington, District of Columbia: Island Press.

33. 6 POSTEL, S.L. ET AL. (1996) Human appropriation of renewable freshwater. Vol 271.No. 5250. 785-788.

34. CHIVIAN, E. (2002) Biodiversity: Its Importance to Human Health. Center for Health and the Global Environment, Harvard Medical School, Cambridge, MA.

35. DUDLEY, N. & STOLTON, S. (eds.) (2003) Running pure: the importance of forest protected areas to drinking water. Gland, Switzerland: WWF/World Bank Alliance for Forest Conservation and Sustainable Use.

36. SHVIDENKO, A. ET AL. (2005) Forest and woodland systems. In: HASSAN, R., SCHOLES, R. and ASH, N. (Eds). Ecosystems and Human Well-being: Volume 1: Current State and Trends. Washington, District of Columbia: Island Press.

37. ARAGÃO, L.E.O.C. (2012) Environmental Science: The rainforest's water pump. Nature. Citing ELTAHIR, E. A. & BRAS, R. L. (1996) Precipitation Recycling. Reviews of Geophysics 34, 367-378.

38. KUMAGAI, T. ET AL. (2004) Water cycling in a Bornean tropical rain forest under current and projected precipitation scenarios. Water Resources Research, Vol. 40, W01104.

39. POVEDA, G. ET AL. (2008) Sobre La Necesidad De Un Programa De Investigacion Para ElSistema Andes-Amazonia. Revista Colombia Amazonica, 1.

40. SPRACKLEN, D.V. ET AL. (2012) Observations of increased tropical rainfall preceded by air passage over forests. Nature. 489. p.282-285.

41. SUDRADJAT, A. ET AL. (2002) Precipitation source/sink connections between the Amazon and La Plata River basins. American Geophysical Union, Fall Meeting 2002, abstract #H11A–0830.

42. WWAP/ (2007) World Water Assessment Programme La Plata Basin Case Study: Final Report, April 2007.

43. SPRACKLEN, D.V. ET AL. (2012) Observations of increased tropical rainfall preceded by air passage over forests. Nature. 489. p.282-285.

44. FAO. (2012) State of the World's Forests. Rome: FAO.

45. FAO. (2010) Forests and energy: regional perspectives: opportunities and challenges for forests and forestry. African Forestry and Wildlife Commission. Sixteenth Session. Near East Forestry Commission, Khartoum, Sudan, 18-21 February 2008.

46. KISSINGER, G. ET AL. (2012) Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers. Lexeme Consulting, Vancouver Canada. Based on: HOSONUMA, N. ET AL. (2012) An assessment of deforestation and forest degradation drivers in developing countries. Environ. Res. Lett. 7 044009.

47. FEARNSIDE, P. (2012) Belo Monte Dam: A spearhead for Brazil's dam-building attack on Amazonia? [Online] Available from: http://www.globalwaterforum.org/2012/03/19/belo-monte-dam-a-spearhead-for-brazils-dam-building-attack-on-amazonia/. Data from: MME/EPE (2011) Brazil, Plano Decenal de Expansão de Energia 2020. Ministério de Minas e Energia. Empresa de Pesquisa Energética. Brasília.

48. STICKLER, C.M. ET AL. (2013) Dependence of hydropower energy generation on forests in the Amazon Basin at local and regional scales. PNAS vol. 110 (23) p. 9601–9606.

49. SUNDERLAND, T. ET AL. (2013) Food security and nutrition: The role of forests. Discussion Paper. Bogor, Indonesia: CIFOR.

50. RSPO. (2008) Promoting the growth and use of sustainable palm oil. Fact Sheets.

51. GILES, J. (2004) Organic food contaminated with GM. News Item. Nature. doi:10.1038/news040202-15 [Online] Available from: http://www.nature.com/news/2004/040206/full/news040202-15.html

52. RICKETTS, T. H., ET AL. (2004) Economic value of tropical forest to coffee production. Proceedings of the National Academy of Sciences of the United States of America, 101, 12579-12582.

53. HILLEL, D. & ROSENZWEIG, C. (2008) Biodiversity and Food Production. In: CHIVIAN, E. & BERNSTEIN, A. (eds.) Sustaining Life: How Human Health Depends On Biodiversity. New York, NY: Oxford University Press.

54. FAO. (2011)Forests for improved nutrition and food security.

55. THE GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming. Final Project Report. London: The Government Office for Science.

56. INRA-CIRAD. (2009) Agrimonde. Scenarios and Challenges for Feeding the World in 2050.

57. UNFF COLLABORATIVE PARTNERSHIP ON FORESTS. (2012) SFM, Food Security and Livelihoods. SFM Fact Sheet 3.

58. HOOD, L. (2010) Biodiversity: Facts and figures. [Online] Available from: http://www.scidev.net/global/biodiversity/feature/biodiversity-facts-and-figures-1.html . Citing UNEP Global Environmental Outlook. 2003.

59. SIMULA, M. (1999) Trade & Environmental Issues In Forest Production. Environment Division Working Paper. Inter-American Development Bank.

60. CONTE, L.A. (1996) Shaman pharmaceuticals' approach to drug development. In: BALICK, M.J. ET AL. (eds.) (1996) Medicinal resources of the Tropical Forest biodiversity and its importance to human health. New York: Columbia University Press.

61. PIERCE COLFER, C.J. ET AL. (2006) Forests and Human Health Assessing the Evidence. CIFOR. Occasional Paper No.45.

62. SHANLEY, P. & LUZ, L. (2003) The impacts of forest degradation on medicinal plant use and implications for health care in Eastern Amazonia . BioScience 53 (6) :573-584.

63. HASSAN, R. ET AL.(eds.) (2005) Ecosystems and Human Wellbeing: Current State & Trends Assessment. Millennium Ecosystem Assessment (MEA), Volume 1. Washington DC: Island Press.

64. FOLEY, J.A. ET AL. (2007) Amazonia revealed: forest degradation and loss of ecosystem goods and services in the Amazon Basin. Frontiers in Ecology and the Environment, 5(1), 25-32.Citing VITTOR, A. ET AL. (2006) The effect of deforestation on the human-biting rate of Anopheles darlingi, the primary vector of falciparum malaria in the Peruvian Amazon. American Journal of Tropical Medicine and Hygiene, 74(1), 3-11.

65. WILCOX, B.A. & ELIIS, B. (2006) Forests and emerging infectious diseases of humans. FAO. Unasylva 224, Vol. 57.

66. EGBENDEWE-MONDZOZO, A. ET AL. (2011) Climate change and vector-borne diseases: an economic impact analysis of malaria in Africa. Int J Environ Res Public Health. Mar; 8(3):913-30.

67. THE WORLD BANK. (2008) Forests sourcebook : practical guidance for sustaining forests in development cooperation.

68. THE WORLD BANK. (2008) Forests sourcebook : practical guidance for sustaining forests in development cooperation.

69. THE WORLD BANK. (2008) Forests sourcebook : practical guidance for sustaining forests in development cooperation.

70. ANGELSEN, A. & WUNDER, S. (2012) Exploring the Forest- Poverty Link – Key concepts, Issues and Research Implications. CIFOR. Occasional Paper No.40.

71. LEWIS, S.L. (2006) Tropical forests and the changing earth system. Philosophical Transactions of the Royal Society B: Biological Sciences,361(1465), 195-210.

72. PAN, Y. ET AL. (2011) A Large and Persistent Carbon Sink in the World's Forests. Science. 333, 988-993.

73. UNITED NATIONS. (2013) Millennium Development goals Indicators. Carbon dioxide emissions (CO2).

74. BETTS, R.A. (2007) Biogeophysical effects of land use on climate: Model simulations of radiative forcing and large-scale temperature change. Agricultural and Forest Meteorology, 142, pp.216-233.

75. BONAN, G. B. (2008) Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests. Science, 320, pp.1444-1449.

76. VAN DIJK, A.I.J.M. & KEENAN, R.J. (2007) Planted forests and water in perspective. Forest Ecology and Management, 251:1-10.

77. IPCC (2013) Intergovernmental Panel on Climate Change. The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

78. PAN, Y. ET AL. (2011) A Large and Persistent Carbon Sink in the World's Forests. Science. 333, 988-993.

79. ERICKSEN, P. ET AL. (2011) Mapping hotspots of climate change and food insecurity in the global tropics. CCAFS Report no. 5. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark.

80. NABUURS, G.J. ET AL. (2007) Forestry. In METZ, B. ET AL. (eds.) Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, U.S.A: Cambridge University Press.

81. GLOBAL ENVIRONMENT FACILITY. (2013) Areas of Work. [Online] Available from: http://www.thegef.org/gef

82. GLOBAL ENVIRONMENT FACILITY. (2013) Draft GEF-6 Programming Directions.

83. GEIST, H.J. & LAMBIN, E.F. (2002) Proximate Causes and Underlying Driving Forces of Tropical Deforestation. BioScience Vol. 52 No. 2.

84. FAO. (2009) How to Feed the Word in 2050. Discussion paper prepared for Expert Forum: 12–13 October 2009, released 23 September 2009.

85. FAO. (2009) How to Feed the Word in 2050. Discussion paper prepared for Expert Forum: 12–13 October 2009, released 23 September 2009.

86. BRUINSMA, J. (2009) The resource outlook to 2050: By how much do land, water and crop yields need to increase by 2050? Paper presented at the FAO Expert Meeting, 24-26 June 2009, Rome on "How to Feed the World in 2050".

87. FAO. (2009) How to Feed the Word in 2050. Discussion paper prepared for Expert Forum: 12–13 October 2009, released 23 September 2009.

88. BRUINSMA, J. (2009) The resource outlook to 2050: By how much do land, water and crop yields need to increase by 2050? Paper presented at the FAO Expert Meeting, 24-26 June 2009, Rome on "How to Feed the World in 2050".

89. KRUSE, J. (2011) Estimating Demand for Agricultural Commodities to 2050. Global Harvest Initiative.

90. KONGSAGER, R. & REENBERG, A. (2012) Contemporary land-use transitions: The global oil palm expansion. GLP Report No. 4. GLP-IPO, Copenhagen.

91. KRUSE, J. (2011) Estimating Demand for Agricultural Commodities to 2050. Global Harvest Initiative.

92. DAMETTE, O. & DELACOTE, P. (2011) Unsustainable timber harvesting, deforestation and the role of certification. Ecological Economics 70 (2011) 1211–1219.

93. TAYLOR, R. (2012) Living Forest Report. WWF – World Wide Fund for Nature.

94. RADEMAEKERS, K. ET AL. (2010) Study on the evolution of some deforestation drivers and their potential impacts on the costs of an avoiding deforestation scheme. Prepared for the European Commission by ECORYS and IIASA. Rotterdam, Netherlands.

95. KISSINGER, G. ET AL. (2012) Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers. Lexeme Consulting, Vancouver Canada.

96. BRITO, B. ET AL. (2009) The Governance of Forests Toolkit (Version1). World Resources Institute.

97. BRITO, B. ET AL. (2009) The Governance of Forests Toolkit (Version1). World Resources Institute.

98. FOOD AND AGRICULTURE ASSOCIATION. (2011) Framework for Assessing and Monitoring Forest Governance. Rome: FAO.

99. SAUNDERS, J. ET AL. (2008) Reduced Emissions from Deforestation and Forest Degradation (REDD) Lessons from a forest governance perspective. Oxford: Proforest.

100. KOYUNCU, C. & YILMAZ, R. (2013) Deforestation, corruption, and private ownership in the forest sector. Quality & Quantity, 47(1), 227-236.

101. ROBINSON, B.E. (2011) Does secure land tenure save forests? A review of the relationship between land tenure and tropicaldeforestation. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Working paper No. 7.

102. ROBINSON, B.E. (2011) Does secure land tenure save forests? A review of the relationship between land tenure and tropicaldeforestation. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Working paper No. 7.

103. MUELLER, B. & ALSTON, L. J. (2007) Legal reserve requirements in Brazilian forests: Path dependent evolution of de facto legislation. ANPEC-Associação Nacional dos Centros de Pósgraduação em Economia [Brazilian Association of Graduate Programs in Economics].

104. KOYUNCU, C. & YILMAZ, R. (2013) Deforestation, corruption, and private ownership in the forest sector. Quality & Quantity, 47(1), 227-236.

105. MEGEVAND, C. ET AL. (2013) Deforestation Trends in the Congo Basin: - Reconciling Economic Growth and Forest Protection. Washington DC: The World Bank.

106. GAO, Y. ET AL. (2011) A global analysis of deforestation due to biofuel development. CIFOR Working paper 68.

107. IPCC. (1995) Intergovernmental Panel on Climate Change. Second Assessment Report.

108. COX, P. ET AL. (2000) Acceleration of global warming due to carbon-cycle feedbacks in a coupled climate model. Nature, 408, 184-187.

109. MARENGO, J.A.ET AL.(2011) Dangerous Climate Change in Brazil. Centro de Ciência do Sistema Terrestre (CCST) of the Instituto Nacional de Pesquisas Espaciais (INPE), Brazil, and the Met Office Hadley Centre, UK.

110. ALLEN, C.D. (2009). Climate-induced forest dieback: an escalating global phenomenon? Unasylva 231/232, Vol. 60.

111. COX, P. ET AL. (2000) Acceleration of global warming due to carbon-cycle feedbacks in a coupled climate model. Nature, 408, 184-187.

112. ANDEREGG, W.R.L. ET AL. (2012) Consequences of widespread tree mortality triggered by drought and temperature stress. Nature Climate Change 3, 30–36.

113. MARENGO, J.A. ET AL.(2011) Dangerous Climate Change in Brazil. Centro de Ciência do Sistema Terrestre (CCST) of the Instituto Nacional de Pesquisas Espaciais (INPE), Brazil, and the Met Office Hadley Centre, UK.

114. COX, P. M. ET AL. (2013) Sensitivity of tropical carbon to climate change constrained by carbon dioxide variability. Nature.

115. ROCHA, J. (2013) Brazil faces drop in crop productivity.

[Online] Available from: http://wwwp.dailyclimate.org/tdc-newsroom/2013/09/brazil-crops-climate

116. IPCC. (1995) Intergovernmental Panel on Climate Change. Second Assessment Report.

117. SUNDERLIN, W.D. ET AL. (2007) Poverty and forests: multi-country analysis of spatial association and proposed policy solutions. Bogor, Indonesia: CIFOR.

118. KERR, S. ET AL. (2004) Effects of poverty on deforestation: Distinguishing behavior from location. FAO. ESA Working Paper No. 04-19.

119. SUNDERLIN, W.D. ET AL. (2007) Poverty and forests: multi-country analysis of spatial association and proposed policy solutions. Bogor, Indonesia: CIFOR.

120. KERR, S. ET AL. (2004) Effects of poverty on deforestation: Distinguishing behavior from location. FAO. ESA Working Paper No. 04-19.

121. HUSSEIN, Z ET AL. (2013) Climate change mitigation policies and poverty in developing countries Environ. Res. Lett. 8. Center for Global Trade Analysis, Purdue University, U.S.A.

122. UNION OF CONCERNED SCIENTISTS (2010) Deforestation Today – It's just business. Briefing 7. Washington D.C.

123. DEFRIES, R.S. ET AL. (2010) Deforestation driven by urban population growth and agricultural trade in the twenty-first century. Nature Geoscience. 3, 178 - 181 (2010). Letters.

124. ANGELSEN, A. (2011) The economic contributions of forests to rural livelihoods: a global analysis. Oral presentation at the PEN Science Workshop: 'Exploring the forest-poverty link: new research findings'. University of East Anglia, Norwich, UK. June 13-14, 2011.

125. SUNDERLIN, W.D. ET AL. (2007) Poverty and forests: multi-country analysis of spatial association and proposed policy solutions. Bogor, Indonesia: CIFOR.

126. PALMER, C. & DI FALCO, S. (2012) Biodiversity, poverty, and development. Oxford Review of Economic Policy, Volume 28, Number 1, 2012, pp. 48–68.

127. CHOKKALINGAM, U. ET AL. (2007) Community fire use, resource change, and livelihood impacts: the downward spiralin the wetlands of southern Sumatra. Mitigation and Adaptation Strategies for Global Change. 12(1): 75–100.

128. IVERSEN, V. ET AL. (2006) High value forests, hidden economies and elite capture: Evidence from forest user groups in Nepal's Terai. Ecological Economics, 58(1), 93-107.

129. DOVE, M. (1994) Marketing the Rainforest – Green Panacea or Red Herring. Asia Pacific East West Centre. No.13. [Online] Available from: http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/3777/api013.pdf?sequence=1

130. AFP. (2012) Brazil sets up special security force to protect Amazon. [Online].

131. LAWRENCE, W.F. ET AL. (2009) Impacts of roads and linear clearings on tropical forests. Trends in Ecology and Evolution Vol.24 No.12.

132. SOVACOO, B. K. & BULAN, L. C. (2012) Energy security and hydropower development in Malaysia: The drivers and challenges facing the Sarawak Corridor of Renewable Energy (SCORE). Renewable Energy, 40(1), 113–129.

133. SOVACOO, B. K. & BULAN, L. C. (2011) Settling the Score: The Implication of the Sarawak Corridor of Renewable Energy (SCORE) in Malaysia. Energy Governance Case Study #04.

134. LIMA, I. ET AL. (2007) Methane Emissions from Large Dams as Renewable Energy Resources: A Developing Nation Perspective. Mitigation and Adaptation Strategies for Global Change. Volume 13, Issue 2, pp 193-206.

135. STICKLER, C.M. ET AL. (2013) Dependence of hydropower energy generation on forests in the Amazon Basin at local and regional scales. PNAS 110(23), 9601-9606.

136. GLOBAL WITNESS. (2012) In the future, there will be no forest left. [Online] Available from: http://www.globalwitness.org/sites/default/files/library/HSBC-logging-briefing-GW.pdf

137. KANNINEN, M., D. ET AL. (2007) Do Trees Grow on Money? Implications of deforestation research for policies to promote REDD. Bogor, Indonesia: CIFOR.

138. PACHECO, P. ET AL. (2011) Avoiding deforestation in the context of biofuel feedstock expansion: an analysis of the effectivenss of market-based instruments. Working Paper 73. Bogor, Indonesia: CIFOR.

139. KANNINEN, M., D. ET AL. (2007) Do Trees Grow on Money? Implications of deforestation research for policies to promote REDD. Bogor, Indonesia: CIFOR.

140. KISSINGER, G. ET AL. (2012) Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers. Lexeme Consulting, Vancouver Canada.

141. ARIMA,E.Y. ET AL. (2010) Statistical confirmation of indirect land use change in the Brazilian Amazon. Enivronment Research Letters, No. 6.

142. ASSUNÇÃO, J. ET AL. (2013) Does Credit Affect Deforestation? Evidence from a rural credit policy in the Brazilian Amazon. CPI Technical Report. Climate Policy Initiative.

143. UN COMTRADE. (2013)[Online] Available from: http://comtrade.un.org

144. UNITED NATIONS. (2013) GDP Breakdown. United Nations Statistics Division.

145. NICITA, E. ET AL. (2013) UNCTAD. Global Supply Chains: Trade and economic policies for developing countries. Policy issues in international trade and commodities. Study series no. 55.

146. SUN, C. ET AL. (2008) Global Forest Product Chains: Identifying challenges and opportunities for China through a global commodity chain sustainability analysis. International Institute for Sustainable Development.

147. HOSONUMA, N. ET AL. (2012) An assessment of deforestation and forest degradation drivers in developing countries. Environmental Research Letters,7(4), 044009.

148. FAOSTAT (2013). The statistics division of the FAO. . [Online] Available from: http://faostat.fao.org

149. KAPLINSKY, R. & MORRIS, M. (2001) A handbook for value chain research (Vol. 113). IDRC.

150. WWF. (2012) The 2050 Criteria: Guide to responsible investment in agricultural, forest, and seafood commodities.

151. ZSL. (2013) Sustainable Palm Oil Platform.[Online] Available from: http://www.sustainablepalmoil.org

152. GUAN, W. (2010) Developments in Distribution Channels - A Case Study of a Timber Product Distribution Channel. Linköping Studies in Science and Technology, Thesis No. 1458, LiU-TEK-LIC 2010:29.

153. LEVY, M. & WEITZ, B. (2008) Retailing Management. 7th Ed. New York: McGraw Hill.

154. USDA. (2012) Global Food Industry. Economic Research Service.

155. SANTOSA, S. J. (2008) Palm oil boom in Indonesia: from plantation to downstream products and biodiesel. CLEAN–Soil, Air, Water, 36 (5-6), 453-465.

156. RSPO. (2013) Factsheet Palm Oil. [Online] Available from: http://www.rspo.org/files/pdf/Factsheet-RSPO-AboutPalmOil.pdf

157. ZIMMER, Y. (2010) Competitiveness of rapeseed, soybeans and palm oil. Journal of Oilseed Brassica, 1(2), 84-90.

158. PRODUCT BOARD MVO. (2010) Fact sheet Palm Oil 2010. [Online] Available from: http://www.mvo.nl/LinkClick.aspx?fileticket=jsFVMZwZzkc%3D

159. FAO. (2011) Southeast Asian forests and forestry to 2020: Subregional report of the second Asia-Pacific forestry sector outlook study. Bangkok: FAO.

160. KONGSAGER, R. & REENBERG, A. (2012) Contemporary land-use transitions: The global oil palm expansion. GLP Report No. 4. Copenhagen: GLP-IPO.

161. SHEIL, D. ET AL. (2009) The impacts and opportunities of oil palm in Southeast Asia: what do we know and what do we need to know? Occasional Paper No. 51. Bogor, Indonesia: CIFOR.

162. CARLSON, K. ET AL. (2012) Carbon emissions from forest conversion by Kalimantan oil palm plantations. Nature Climate Change, 3(3), 283-287.

163. UN COMTRADE. (2013) [Online] Available from: http://comtrade.un.org

164. IFC. (2011) The World Bank Group Framework and IFC strategy for engagement in the palm oil sector: Draft for consultations.

165. KONGSAGER, R. & REENBERG, A. (2012) Contemporary land-use transitions: The global oil palm expansion. GLP Report No. 4. Copenhagen: GLP-IPO.

166. WICKE, B. ET AL. (2011) Exploring land use changes and the role of palm oil production in Indonesia and Malaysia. Land Use Policy, 28(1), 193-206.

167. KOH, L. P. & WILCOVE, D. S. (2008) Is oil palm agriculture really destroying tropical biodiversity?Conservation Letters, 1(2), 60-64.

168. KONGSAGER, R. & REENBERG, A. (2012) Contemporary land-use transitions: The global oil palm expansion. GLP Report No. 4. Copenhagen: GLP-IPO.

169. IFC. (2011) The World Bank Group Framework and IFC strategy for engagement in the palm oil sector: Draft for consultations.

170. RSPO. (2013) Roundtable on Sustainable Palm Oil Website. [Online] Available from: http://www.rspo.org

171. ZSL. (2013) Sustainable Palm Oil Platform. Smallholders. [Online] Available from: http://www.sustainablepalmoil.org/growers-millers/growers/smallholders

172. IFC. (2011) The World Bank Group Framework and IFC strategy for engagement in the palm oil sector: Draft for consultations.

173. PROFOREST. (2011) Mapping and understanding the UK palm oil supply chain. London: Department for Environment, Food and Rural Affairs.

174. SANTOSA, S. J. (2008) Palm oil boom in Indonesia: from

plantation to downstream products and biodiesel. CLEAN–Soil, Air, Water, 36(5-6), 453-465.

175. REUTERS. (2012) Insight: Top palm oil producer Indonesia wants to be more refined. [Online] Available from: http://www.reuters.com/article/2012/07/15/us-indonesia-palm-idUSBRE86E0HV20120715

176. UN COMTRADE. (2013) [Online]Available from: http://comtrade.un.org

177. FAO. (2013) FAOSTAT [Online] Available from: http://faostat.fao.org/

178. USDA. (2008) Oilseeds: World Markets and Trade. [Online] Available from: http://usda01.library.cornell.edu/usda/fas/oilseed-trade//2000s/2008/oilseed-trade-12-11-2008.pdf

179. ZSL. (2013) Sustainable Palm Oil Platform. Smallholders. [Online] Available from: www.sustainablepalmoil.org

180. MURPHY, S. ET AL. (2012) Cereal secrets: the world's largest grain traders and global agriculture. Oxfam.

181. UNITED STATES SECURITIES AND EXCHANGE COMMISSION. (2011) Archer-Daniels-Midland Company. [Online] Available from: http://sec.gov/Archives/edgar/data/7084/000000708411000028/adm10kfy11.htm

182. CARGILL. (2013) Palm oil. [Online] Available from: http://www.cargill.co.id/en/products/palm-oil

183. SANTOSA, S. J. (2008) Palm oil boom in Indonesia: from plantation to downstream products and biodiesel. CLEAN–Soil, Air, Water, 36(5-6), 453-465.

184. MURPHY, S. ET AL. (2012) Cereal secrets: the world's largest grain traders and global agriculture. Oxfam.

185. WWF. (2012) Palm Oil Buyers' Scorecard 2011 - Measuring the Progress of Palm Oil Buyers. [Online] Available from: www.panda.org

186. WWF. (2012) Palm Oil Buyers' Scorecard 2011 - Measuring the Progress of Palm Oil Buyers. [Online] Available from: www.panda.org

187. GREENPEACE. (2013) A dirty business. [Online] Available from: www.greenpeace.org

188. UN COMTRADE. (2013) [Online]Available from: www.comtrade.un.org

189. PROFOREST. (2011) Mapping and understanding the UK palm oil supply chain. London: Department for Environment, Food and Rural Affairs.

190. FAO. (2013) FOSTAT.

191. OECD-FAO. (2012) OECD-FAO Agricultural Outlook 2012. OECD Publishing.

192. WWF. (2002) Corporate actors in the South American soy production chain.

193. WWF. (2012) The 2050 Criteria: Guide to Responsible Investment in Agricultural, Forest, and Seafood Commodities. Washington D.C.: World Wildlife Fund.

194. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

195. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

196. USDA. (2013) Oilseeds: World Markets and Trade. USDA Economic Research Service. [Online] Available from: www.fas.usda.gov/psdonline/circulars/oilseeds.pdf.

197. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

198. MURPHY, S. ET AL. (2012) Cereal secrets: the world's largest grain traders and global agriculture. Oxford: Oxfam.

199. THE DUTCH SOY COALITION. (2008) Soy big business, big responsibility: Addressing the social- and environmental impact of the soy value chain. Amsterdam: Ruparo.

200. WWF. (2004)Mato Grosso a hot spot of soy expansion – and deforestation. WWF Forest Conversion News No. 3.

201. MACEDO, M.N. ET AL. (2012) Decoupling of deforestation and soy production in the southern Amazon during the late 2000s. Proceedings of the National Academy of Sciences, vol. 109, issue 4, pp. 1341-1346.

202. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

203. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

204. BARONA, E. ET AL. (2010) The role of pasture and soybean in deforestation of the Brazilian Amazon. Environmental Research Letters, 5(2), 024002.

205. GARRETT, R. D. ET AL. (2012) Land institutions and supply chain configurations as determinants of soybean planted area and yields in Brazil. Land Use Policy.

206. MÜLLER, R. ET AL. (2012) Proximate causes of deforestation in the Bolivian lowlands: an analysis of spatial dynamics. Regional Environmental Change, 12(3), 445-459.

207. KRUGLIANSKAS, I. (2011) Soy production in South America: key issues and challenges. Proforest. [Online] Available from: www.proforest.net/objects/news-objects/soy-production-in-south-america-key-issues-and-challenges/at_download/file

208. RUDORFF, B. F. ET AL. (2012) Remote Sensing Images to Detect Soy Plantations in the Amazon Biome - The Soy Moratorium Initiative. Sustainability, 4(5), 1074-1088.

209. HUTCHINSON, S. (2011) Making a pact to tackle deforestation in Paraguay. World Wildlife Fund.

210. WWF. (2013) Paraguay extends Zero Deforestation Law to 2018. [Online] Available at: wwf.panda.org

211. VUOHELAINEN, A. (2011) Soy production and trade. Proforest. [Online] Available from: www.proforest.net/objects/news-objects/soy-production-and-trade-vuohelainen

212. MURPHY, S. ET AL. (2012) Cereal secrets: the world's largest grain traders and global agriculture. Oxford: Oxfam.

213. MURPHY, S. ET AL. (2012) Cereal secrets: the world's largest grain traders and global agriculture. Oxford: Oxfam.

214. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

215. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

216. ALICEWEB. (2013) [Online] Available at: www.aliceweb2.mdic.gov.br

217. USDA. (2012) Agricultural Projections to 2021. Outlook No. (OCE-121) 102 pp

218. USDA. (2010) USDA Soybean Baseline, 2010-19. [Online] Available from: www.ers.usda.gov/topics/crops/soybeans-oil-crops/market-outlook/usda-soybean-baseline,-2010-19.aspx#.UehqzI1J4tQ

219. NORTH CAROLINA SOYBEAN PRODUCERS ASSOCIATION. (2013) How soybeans are used. [Online] Available from www.ncsoy.org

220. THE DUTCH SOY COALITION. (2008) Soy big business, big responsibility: Addressing the social- and environmental impact of the soy value chain. Amsterdam: Ruparo.

221. RABOBANK. (2008) The soy supply chain policy: striking a CSR balance in financial decisions. [Online] Available from: www.banktrack.org/manage/ems_files/download/soy_supply_chain_policy/080115_rabobank_soy_supply_chain_policy.pdf

222. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

223. U. S. SOYBEAN EXPORT COUNCIL. (2011) How the Global Oilseed and Grain Trade Works. [Online] Available from: http://www.soyatech.com/userfiles/file/tradeflow_manual(1).pdf

224. PACHECO, P. (2012) Soybean and oil palm expansion in South America: A review of main trends and implications. Working Paper 90. Bogor, Indonesia: CIFOR.

225. GAO, Y. ET AL. (2011) A global analysis of deforestation due to biofuel development. Working Paper 68. Bogor, Indonesia: CIFOR.

226. OECD-FAO. (2011) Agricultural Outlook 2011-2020. Chapter 3: Biofuels. [Online] Available from: www.oecd.org/site/oecd-faoagriculturaloutlook/48178823.pdf.

227. WWF. (2012) The 2050 Criteria: Guide to Responsible Investment in Agricultural, Forest, and Seafood Commodities. Washington D.C.: World Wildlife Fund.

228. FAO. (2013). FAOSTAT.

229. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

230. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

231. ETTER, A. ET AL. (2006) Modelling the conversion of Colombian lowland ecosystems since 1940: Drivers, patterns and rates. Journal of Environmental Management, 79(1), 74-87.

232. PIU, H.C. & MENTON, M. (2013) In press. Contexto de REDD+ en Perú: motores, actores e instituciones.

233. MÜLLER, R. ET AL. (2012) Proximate causes of deforestation in the Bolivian lowlands: an analysis of spatial dynamics. Regional Environmental Change, 12(3), 445-459.

234. GUEVARA, J.C. &GRÜNWALDT, E.G. (2012) Status of beef cattle production in Argentina over the last decade and its prospects. Chapter 6 in Livestock Production, edited by Javed, K. ISBN 978-953-51-0814-6.

235. BUSTAMANTE, M. M. ET AL. (2012) Estimating greenhouse gas emissions from cattle raising in Brazil. Climatic change, 115(3-4), 559-577.

236. BARRETO, P. ET AL. (2005) Cattle ranching and challenges for environmental conservation in the Amazon. Belém,

Brazil: Imazon.

237. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

238. GRAU, R. ET AL. (2008) Balancing food production and nature conservation in the Neotropical dry forests of northern Argentina. Global Change Biology (2008) 14, 985–997.

239. CALDAS, M. (2013) Land-cover change in the Paraguayan Chaco: 2000–2011. Journal of Land Use Science. 10.1080/1747423X.2013.807314.

240. WESTHOEK, H. ET AL. (2011) The Protein Puzzle. The Hague: PBL Netherlands Environmental Assessment Agency.

241. BUSTAMANTE, M. M. ET AL. (2012) Estimating greenhouse gas emissions from cattle raising in Brazil. Climatic change, 115(3-4), 559-577.

242. WIRSENIUS, S. ET AL. (2011) Greenhouse gas taxes on animal food products: rationale, tax scheme and climate mitigation effects .Climatic Change, 108(1-2), 159-184.

243. MEKONNEN, M.M. & HOEKSTRA, A.Y. (2011) The green, blue and grey water footprint of crops and derived crop products, Hydrology and Earth System Sciences, 15(5): 1577-1600.

244. FERRAZ, J. B. S. & FELÍCIO, P. E. D. (2010) Production systems–An example from Brazil. Meat Science, 84(2), 238-243.

245. MILLEN, D. D. ET AL. (2011) Current outlook and future perspectives of beef production in Brazil. Animal Frontiers, 1(2), 46-52.

246. GUEVARA, J.C. & GRÜNWALDT, E.G. (2012) Status of beef cattle production in Argentina over the last decade and its prospects. Chapter 6 in Livestock Production, edited by Javed, K. ISBN 978-953-51-0814-6.

247. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

248. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

249. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

250. BARRIONUEVO, A. (2009) Giants in Cattle Industry Agree to Help Fight Deforestation. The New York Times. [Online] Available from: www.nytimes.com/2009/10/07/world/americas/07deforest.html

251. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

252. FERRAZ, J. B. S. & FELÍCIO, P. E. D. (2010) Production systems–An example from Brazil. Meat Science, 84(2), 238-243.

253. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

254. GIBBS, H. ET AL. (2013) Policy Revolution in the Brazilian Amazon. [Submitted].

255. GUEVARA, J.C. & GRÜNWALDT, E.G. (2012) Status of beef cattle production in Argentina over the last decade and its prospects. Chapter 6 in Livestock Production, edited by Javed, K. ISBN 978-953-51-0814-6.

256. INTERNATIONAL COUNCIL OF TANNERS. (2013) Perspective on Leather. [Online] Available from: www.tannerscouncilict.org/perspective.htm

257. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

258. EENPACT. (2013) Leather Sector Report. The Leather Industry.

259. FAO. (2013) FAOSTAT.

260. SMERALDI, R. & MAY, P. H. (2008) O Reino do Gado: uma nova fase da pecuarização da Amazônia. São Paulo, Brazil: Amigos da Terra-Amazônia Brasileira.

261. GREENPEACE. (2009) Slaughtering the Amazon.

262. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

263. UN COMTRADE. (2013) [Online] Available from: www.comtrade.un.org

264. GIBBS, H. ET AL. (2013) Policy Revolution in the Brazilian Amazon. [Submitted].

265. EUROPEAN COMMISSION. (2013) TRACES.

266. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

267. INTERNATIONAL COUNCIL OF TANNERS. (2013) Perspective on Leather. [Online] Available from: www.tannerscouncilict.org/perspective.htm

268. FAO. (2013) FAOSTAT.

269. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. [Online] Special Issue Vol. 6(3):446-467. Available from: www.tropicalconservationscience.org

270. GUAN, W. (2010) Developments in Distribution Channels - A Case Study of a Timber Product Distribution Channel. Linköping Studies in Science and Technology, Thesis No. 1458, LiU-TEK-LIC 2010:29.

271. FAO. (2013) Faostat.

272. UNEP. (2009) Vital Forest Graphics. Nairobi, Kenya: UNEP.

273. WORLD BANK. (2012) Justice for Forests: Improving Criminal Justice Efforts to Combat Illegal Logging. Washington, D.C: World Bank.

274. BROWN, M.L. (2010). Limiting corrupt incentives in a global REDD regime. Ecology Law Quarterly 37(237):237–266.

275. RUDEL, T. K. ET AL. (2009) Changing drivers of deforestation and new opportunities for conservation. Conservation Biology, 23(6), 1396-1405.

276. UNEP. (2009) Vital Forest Graphics. Nairobi, Kenya: UNEP.

277. FAO. (2009) State of the World's Forests. Rome: FAO.

278. HOSONUMA, N. ET AL. (2012). An assessment of deforestation and forest degradation drivers in developing countries. Environmental Research Letters,7(4), 044009.

279. FISHER, B. ET AL. (2011) The high costs of conserving southeast Asia's lowland rainforests. Frontiers in Ecology and the Environment. 9: 329–334.

280. UNION OF CONCERNED SCIENTISTS (2011) The root of the problem: What's driving tropical deforestation today? [Online] Available from: www.ucsusa.org/assets/documents/global_warming/UCS_RootoftheProblem_DriversofDeforestation_FullReport.pdf

281. ITTO. (2011) Status of tropical forest management 2011. ITTO Technical Series 38.

282. LIAO, C. ET AL. (2010) Ecosystem carbon stock influenced by plantation practice: implications for planting forests as a measure of climate change mitigation. PloS one, 5(5), e10867.

283. KENNAN, R. & VAN DIJK, A. (2010) Planted forests and water. In BAUHUS, P. ET AL.(eds.) Ecosystem goods and services from plantation forests. London, UK: Earthscan Ltd.

284. BROCKERHOFF, E. G. ET AL. (2008) Plantation forests and biodiversity: oxymoron or opportunity? Biodiversity and Conservation, 17(5), 925-951.

285. FISHER, B. (2010) African exception to drivers of deforestation. Nature Geoscience 3: 9-10.

286. NDOYE, O. & TIEGUHONG, J. C. (2004) Forest Resources and Rural Livelihoods: The Conflict Between Timber and Non-timber Forest Products in the Congo Basin. Scandinavian Journal of Forest Research, 19 (Suppl. 4): 1_/9.

287. HOSONUMA, N. ET AL. (2012) An assessment of deforestation and forest degradation drivers in developing countries. Environmental Research Letters,7(4), 044009.

288. FAO. (2009) State of the World's Forests. Rome: FAO.

289. FERNHOLZ, K. (2012) Certified forest products markets, 2011-2012. In: UNECE/FAO Forest Products Annual Market Review, 2011-2012. United Nations. Geneva.

290. GREENPEACE. (2013) Major breakthrough in protection for Indonesia's remaining rainforests. [Online] Available from: www.greenpeace.org/international/en/press/releases/Major-breakthrough-in-protection-for-Indonesias-remaining-rainforests

291. CARLSSON, D. ET AL. (2006) Supply chain management in the pulp and paper industry. Working Paper DT-2006-AM-3. Interuniversity Research Center on Enterprise Networks, Logistics and Transportation (CIRRELT), Université Laval, Québec, Canada.

292. FOREST LEGALITY ALLIANCE. (2012)National export bans and restrictions. [Online] Available from: http://risk.forestlegality.org/files/fla/Export_bans_restrictions_2012_06.pdf

293. AULISI, A. ET AL. (2008) Trees in the greenhouse: Why Climate Change is Transforming the Forest Products Business. Washington, D.C: World Resources Institute.

294. ITTO. (2002) Tropical timber products: Development of further processing in ITTO producer countries. Geneva: ITC/ITTO.

295. GUAN, W. (2010) Developments in Distribution Channels - A Case Study of a Timber Product Distribution Channel. Linköping Studies in Science and Technology, Thesis No. 1458, LiU-TEK-LIC 2010:29.

296. UNECE/FAO. (2011) Forest products annual market review 2010-2011. Geneva Timber and Forest Study Paper 27.

297. ITTO. (2012) Annual Review and Assessment of the World Timber Situation. [Online] Available from: www.itto.int/annual_review

298. ITTO. (2012) Annual Review and Assessment of the World Timber Situation. [Online] Available from: www.itto.int/annual_review

299. UNECE/FAO. (2013) Forest products annual market review 2012-2013. Geneva Timber and Forest Study Paper 33.

300. WRI. (2008) Trees in the greenhouse: Why Climate Change is Transforming the Forest Products Business. [Online] Available from: pdf.wri.org/trees_in_the_greenhouse.pdf

301. ITTO. (2012) Annual Report [Online] Available from: www.itto.int/annual_report

302. IBISWORLD. (2012) Global Paper & Pulp Mills Market Research Report.

303. NORD, T. (2005) Structure and Developments in the solid wood value chain: Dominant saw milling strategies and industrialized housing. Licentiate Thesis, Luleå University of Technology.

304. NORD, T. (2005) Structure and Developments in the solid wood value chain: Dominant saw milling strategies and industrialized housing. Licentiate Thesis, Luleå University of Technology.

305. RISI. (2013) Tissue Retailers and Distributors Insight Forum to focus on retail and distribution channels at Tissue World Americas 2014 in Miami, March 18-21.

306. GEIST, H.J. & LAMBIN, E. (2001) What drives tropical deforestation? A meta-analysis of proximate and underlying causes of deforestation based on subnational case study evidence. Land-Use and Land-Cover Change (LUCC) Project, International Geosphere-Biosphere Programme (IGBP). LUCC Report Series: 4.

307. GEIST, H.J. & LAMBIN, E.F. (2002) Proximate Causes and Underlying Driving Forces of Tropical Deforestation BioScience Vol. 52 No. 2.

308. MARTINET, A. ET AL. (2009) REDD Reference Levels and Drivers of Deforestation in Congo Basin Countries. The World Bank.

309. WWF. (2009) Keeping Amazon forests standing: a matter of values. [Online] Available from: www.wwf.se/source.php/1229304/Keeping%20the%20Amazon%20forests%20standing.pdf

310. DEBLITZ, C. (2010) Feedlots: A new tendency in global beef production? Working Paper 2/2011 updated in July 2012. agri benchmark.

311. SOYBEAN AND CORN ADVISOR, INC. (2011) Feedlots Consuming More Grain Domestically in Mato Grosso.

312. FAO. (2005) Global Forest Resources Assessment. Rome: FAO.

313. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

314. SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK. (2013) Opportunities and Solutions for Sustainable Food Production. Background paper for the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda. [Online] Available from: www.unsdsn.org/files/2013/05/130112-HLP-TG7-Solutions-for-sustainable-food-production.pdf

315. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

316. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

317. DE SCHUTTER, O. (2010) Report submitted by the Special Rapporteur on the right to food, Olivier De Schutter. Human Rights Council, Sixteenth Session. A/HRC/16/49.

318. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

319. DE SCHUTTER, O. (2010) Report submitted by the Special Rapporteur on the right to food, Olivier De Schutter. Human Rights Council, Sixteenth Session. A/HRC/16/49.

320. PFAFF, A ET AL. (2010) Policy impacts on deforestation: lessons learned from past experiences to inform new initiatives. Nicholas Institute for Environmental Policy Solutions, Duke University, NI R 10-02.

321. IIED. (2013) Demand-side interventions to reduce deforestation and forest degradation. Workshop Report 21st February 2013. London.

322. ISEAL ALLIANCE. (2013) Consumer Goods Forum cites FSC and RSPO in net zero deforestation pledge. [Online] Available from: www.isealalliance.org/online-community/news/consumer-goods-forum-cites-fsc-and-rspo-in-net-zero-deforestation-pledge

323. RSPO. (2013) Market data. [Online] Available from: www.rspo.org/en/Market_Data_-_as_at_3rd_August

324. FSC. (2011) FSC evaluation of the impacts and implementation of the Controlled Wood System

325. JAKARTA POST. (2010) Sharing the burden of producing sustainable biofuels. [Online] Available from: www.thejakartapost.com/news/2010/01/12/sharing-burden-producing-sustainable-biofuels.html

326. ISEAL ALLIANCE. (2011) Improving small-scale producer access to certification. [Online] Available from: www.isealalliance.org/online-community/blogs/new-report-improving-small-scale-producer-access-to-certification

327. BUTLER, R. (2013) The beginning of the end of deforestation in Indonesia? Mongabay. [Online] Available from: news.mongabay.com/2013/0205-app-forest-policy.html

328. RAINFOREST FOUNDATION. (2012) The world's biggest sovereign wealth fund joins battle against rainforest destruction. [Online] Available from: http://www.regnskog.no/languages/english/the-worlds-biggest-sovereign-wealth-fund-joins-battle-against-rainforest-destruction

329. MAGRATH, B. & GRANDALSKI, R. (2002) Policies, strategies and technologies for forest resource protection. In: Enters ET AL. (eds). Applying Reduced Impact Logging to Advance Sustainable Forest Management. FAO.

330. BROWN, D. & LUTTRELL, C. (2005) Review of independent forest monitoring. Overseas Development Institute (ODI), Forest Policy and Environment Group. 67p. London: ODI.

331. FSC. (2013) FSC Ends Association with the APRIL Group. [Online] Available from: ic.fsc.org/newsroom.9.454.htm

332. ASSUNÇÃO, J. ET AL. (2013) DETERring Deforestation in the Brazilian Amazon: Environmental Monitoring and Law Enforcement. Climate Policy Initiative.

333. GLOBAL TIMBER TRACKING NETWORK. (2013) Why GTTN. [Online] Available from: www.globaltimbertrackingnetwork.org/about_us/why_gttn.html

334. BROWN, D. ET AL. (2004) Forest Law Enforcement & Governance: The role of independent monitors in the control of forest crime. ODI.

335. BRACK, D. & SAUNDERS, J. (2004) Public Procurement of Timber: EU Member state initiatives for sourcing legal and sustainable timber. Discussion paper for workshop on public procurement of timber. London, UK: Chatham House.

336. DEFRA. (2012) Sustainable production of palm oil: UK statement. [Online] Available from: www.gov.uk/government/uploads/system/uploads/attachment_data/file/69607/uk-statement-palm-oil-20121025.pdf

337. LEGGETT, M. (2013) Drivers of deforestation and WTO rules: Conflicts and Solutions. Oxford: Global Canopy Programme.

338. DE BOER, A. & HENTSCHEL, G. (2011) European Timber Trade Federation Annual Survey: The European Market for Verified Legal and Sustainable Timber (April 2011), p.6.

339. BRACK, D. (2008) Controlling illegal logging using public procurement policy. Energy, Environment and Development Programme. June 2008, EEDP LOG BP 08/02.

340. EDF. (2013) Ready for REDD: Acre's State Programs for Sustainable Development and Deforestation Control. [Online] Available from: www.edf.org/sites/default/files/Acre_Ready_for_REDD_EDF.pdf

341. GLOBAL PARTNERSHIP FOR FOREST LANDSCAPE RESTORATION. (2009) A world of opportunity. Edinburgh, UK.

342. FOREST CARBON PORTAL (2013). Indonesian palm oil industry would support land swaps to protect forest, while expanding production. [Online] Available from: www.forestcarbonportal.com/news/indonesian-palm-oil-industry-would-support-land-swaps-protect-forest-while-expanding-production

343. LEATHER WORKING GROUP. (2013) [Online] Available from: www.leatherworkinggroup.com

344. CONSERVATION INTERNATIONAL. (2013) Deforestation Guides for Commodity Sourcing. [Online] Available from: www.conservation.org/how/science/Pages/deforestation-guides-for-commodity-sourcing.aspx

345. FAO. (2007) Future expansion of soybean 2005-2014 Implications for food security, sustainable rural development and agricultural policies in the countries of Mercosur and Bolivia, Synthesis Document, Policy Assistance Series 3 ISSN 1819-4591, Santiago October 2007.

346. ASBRAER/ABER. (2010) Serviços de ATER para o Brasil contemporâneo: "Contribuição da Extensão Rural Estatal aos candidatos à Presidência da República". Associação Brasileira das Entidades Estaduais de Assistência Técnica e Extensão Rural (ASBRAER) e Academia Brasileira de Extensão Rural (ABER).

347. CLAY, J. ET AL. (2005) Leverage points for encouraging sustainable commodity production. Agricultural commodities, trade and sustainable development. London: International Institute for Environment and Development.

348. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

349. CLAY, J. ET AL. (2005) Leverage points for encouraging sustainable commodity production. Agricultural commodities, trade and sustainable development. London: International Institute for Environment and Development.

350. WRI. (2013) Indonesia Extends its Forest Moratorium: What Comes Next? [Online] Available from: http://insights.wri.org/news/2013/05/indonesia-extends-its-forest-moratorium-what-comes-next

351. POST COURIER. (2013) SABL Inquiry Commission Slammed By PNG Government. [Online] Available from: http://pidp.eastwestcenter.org/pireport/2013/March/03-28-09.htm

352. TROPICAL FOREST GROUP. (2013) Reducing Emissions from Deforestation, Cross River State, Nigeria. [Online] Available from: http://www.tropicalforestgroup.org/logging-moratorium-cross-river-state-nigeria

353. WWF. (2013) Paraguay Extends Zero Deforestation Law to 2018. [Online] Available from: wwf.panda.org/?210224/Paraguay-extends-Zero-Deforestation-Law-to-2018

354. OAKES, N. & LEGGETT, M. (eds.) (2012) The Little Forest Finance Book. Oxford: Global Canopy Programme.

355. FORUM FOR THE FUTURE. (2009) Forest Investment Review. London: Forum for the Future.

356. INTERNATIONAL FINANCE CORPORATION. (2013) IFC Projects Database. [Online] Available from: ifcext.ifc.org/ifcext/spiwebsite1.nsf/651aeb16abd09c1f8525797d006976ba/a8f1bd7744b6da1485257bc800701226?opendocument.

357. TRIVEDI, M. ET AL. (2012) Think PINC: Securing Brazil's food, water and energy with Proactive Investment in Natural Capital. Oxford, UK: Global Canopy Programme.

358. GRIFFITHS, J. (2012) Leveraging private sector finance: how does it work and what are the risks? London: Bretton Woods Project. [Online] Available from: www.brettonwoodsproject.org/doc/private/leveraging.pdf

359. GLOBAL ENVIRONMENT FACILITY. (2011) Review of the Global Environment Facility Earth Fund. Evaluation Report No. 62. [Online] Available from: http://www.thegef.org/gef/sites/thegef.org/files/documents/Earth-Fund_2011.pdf

360. EBRD. (2008) Environmental and Social Policy. [Online] Available from: http://www.ebrd.com/downloads/research/policies/2008policy.pdf

361. WORLD BANK. (2011) 2012 Environment Strategy. [Online] Available from: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/0,,contentMDK:22276657~pagePK:210058~piPK:210062~theSitePK:244381,00.html

362. RABOBANK GROUP. (2013) Sustainable banking policy. [Online] Available from: www.rabobank.com/en/group/sustainability/policies.html

363. RABOBANK GROUP. (2012) Rabobank Brazil - CSR Policy. [Online] Available from: www.rabobank.com.br/en/images/CSR%20Policy%20version.pdf

364. BECK, T. ET AL. (2008) The Typology of Partial Credit Guarantee Funds around the World. Washington, DC: The World Bank.

365. GAINES, A. & GRAYSON, J. (2009) Chapter Four: The potential of risk mitigation mechanisms to facilitate private sector investment in REDD projects. In Forest Investment Review. London: Forum for the Future.

366. YIN, D. (2013) How Forest Carbon Projects Protect Themselves From Political Risk. Ecosystem Marketplace. [Online] Available from: www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=9916&section=news_articles&eod=1

367. OAKES, N. & LEGGETT, M. (eds.) (2012) The Little Forest Finance Book. Oxford: Global Canopy Programme.

368. INTERNATIONAL FINANCE CORPORATION ADVISORY SERVICES. (2013) Global Index Insurance Facility. [Online] Available from: http://www.ifc.org/wps/wcm/connect/b72e85804f36187a88a1ce032730e94e/GIIF_Global_Factsheet_April+12.pdf?MOD=AJPERES.

369. INTERNATIONAL FINANCE CORPORATION ADVISORY SERVICES. (2013) Global Index Insurance Facility. [Online] Available from: http://www.ifc.org/wps/wcm/connect/b72e85804f36187a88a1ce032730e94e/GIIF_Global_Factsheet_April+12.pdf?MOD=AJPERES.

370. CERES. (2013) Shareholder Resolutions – Forests. [Online] Available from:http://www.ceres.org/investor-network/resolutions#!/subject=Forests&year=2013&company=&filer=&sector=&status=&memo=&all=.

371. CERES. (2013) Dunkin' Palm Oil Resolution. [Online] Available from: http://www.ceres.org/investor-network/resolutions/dunkin-palm-oil-resolution-2013

372. RAINFOREST FOUNDATION. (2012) The world's biggest sovereign wealth fund joins battle against rainforest destruction. [Online] Available from: http://www.regnskog.no/languages/english/the-worlds-biggest-sovereign-wealth-fund-joins-battle-against-rainforest-destruction

373. UN PRI. (2013) Institutional investors call on palm oil producers to adhere to RSPO principles as next phase of engagement begins. [Online] Available from: http://www.unpri.org/press/institutional-investors-call-on-palm-oil-producers-to-adhere-to-rspo-principles-as-next-phase-of-engagement-begins

374. SCHLAGER, E. & OSTROM, E. (1992) Property rights regimes and natural resources: a conceptual analysis. Land Economics Vol. 68 (3) pp. 249-262.

375. ROBINSON, B.E (2011) Does secure land tenure save forests? A review of the relationship between land tenure and tropical deforestation. CCAFS Working Paper 7. Copenhagen, Denmark: CCAFS.

376. ANGELSEN, A. (2010) Policies for reduced deforestation and their impact on agricultural production. PNAS, 107 (46), 19639–19644.

377. ROBINSON, B.E (2011) Does secure land tenure save forests? A review of the relationship between land tenure and tropical deforestation. CCAFS Working Paper 7. Copenhagen, Denmark: CCAFS.

378. KISSINGER, G. ET AL. (2012) Drivers of deforestation and forest degradation: a synthesis report for REDD+ policymakers. Vancouver, Canada: Lexeme Consulting.

379. DEACON, ET AL. (2006) Political economy and natural resource use. Economic development and environmental sustainability: new policy options, 122.

380. MUNDEN PROJECT. (2012) The financial risks of insecure land tenure: an investment view. Prepared for the Rights and Resources Initiative. [Online] Available from: www.rightsandresources.org/documents/files/doc_5715.pdf

381. BRACK, D. & BAILEY, R. (2013) Ending global deforestation: policy options for consumer countries. London: Chatham House.

382. BRACK, D. & BAILEY, R. (2013) Ending global deforestation: policy options for consumer countries. London: Chatham House.

383. LEGGETT, M. (2013) Drivers of Deforestation and WTO Rules: Conflicts and Solutions. Oxford : Global Canopy Programme.

384. LEGGETT, M. (2013) Drivers of Deforestation and WTO Rules: Conflicts and Solutions. Oxford: Global Canopy Programme.

385. BRACK, D. (2013) Controlling Imports of Palm Oil: Interaction with WTO Rules. A report commissioned by Global Canopy Programme.

386. BRACK, D. & BAILEY, R. (2013) Ending global deforestation: policy options for consumer countries. London: Chatham House.

387. PURVIS, N. ET AL. (2013) Breaking the link between commodities and climate change. Report prepared by Climate Advisers, Washington D.C. [Online] Available from: http://www.climateadvisers.com/pdf/Breaking.pdf

388. WALKER, N. ET AL. (2013) Demand-side interventions to reduce deforestation and forest degradation. London: International Institute for Environment and Development (IIED).

389. WESTBERG, C.J. & JOHNSON, F. X. (2013) The path not yet taken: Bilateral agreements to promote sustainable biofuels under the EU Renewable Energy Directive. SEI Working Paper No. 2013-02.

390. BRACK, D. (2013) Controlling imports of Palm-Oil: interaction with WTO rules. A report commissioned by Global Canopy Programme.

391. USDA ANIMAL AND PLANT HEALTH INSPECTION SERVICE.(2008) Amendments to the Lacey Act from H.R.2419, Sec. 8204.

392. US DEPARTMENT OF JUSTICE. (2012) Gibson Guitar Corp. Agrees to Resolve Investigation into Lacey Act Violations.

393. CLARK, S. ET AL. (2008) Protected areas: an effective tool to reduce emissions from deforestation and forest degradation in developing countries? Working Paper. Cambridge, U.K : UNEP WorldConservation Monitoring Centre.

394. JOPPA, L.N. ET AL. (2008) On the protection of "protected areas". PNAS May 6, 2008 vol. 105 no. 18 6673-6678.

395. RODRICKS, S. (2010) TEEBCase: Enabling the legal framework for PES, Costa Rica. 2010. [Online] Available from: TEEBweb.org. Mainly based on BENNET, K. & HENNINGER, N. (2009) Payments for Ecosystem Services in Costa Rica and Forest Law No. 7575: Key Lessons for Legislators. World Resources Institute.

396. IPAM. (2012) Brazil's "Low-Carbon Agriculture"Program: Barriers To Implementation. [Online] Available from: http://www.gcftaskforce.org/documents/brazil's_low-carbon_agriculture_program.pdf

397. RRI. (2013) Global Capital, Local Concessions: A Data-Driven Examination of Land Tenure Risk and Industrial Concessions in Emerging Market Economies.

398. DTE. (2012) Indonesia's 'One Map Policy'. [Online] Available from: http://www.downtoearth-indonesia.org/story/indonesia-s-one-map-policy

399. LEOPOLD, A. (2010) TEEBcase: Agroecological Zoning in Brazil incentivises more sustainable agricultural practices.

400. FOREST CARBON PARTNERSHIP FACILITY. (2009) Drivers of deforestation and degradation. Conference presentation, August, 13 – 14, 2009.

401. BUTLER, R ET AL. (2009) REDD in the red: palm oil

could undermine carbon payment schemes. Conservation Letters 1–7.

402. HEIN, L. ET AL. (2012) REDD+ in the context of ecosystem management. Current Opinion in Environmental Sustainability. 4,6: 604–611.

403. ANGELSEN, A. (2010) Policies for reduced deforestation and their impact on agricultural production. Proceedings of the National Academy of Sciences of the United States of America (PNAS). Vol. 107, no. 46 pp. 19639-19644.

404. FAO. (2012) Building Bridges Between REDD+ And Sustainable Agriculture: Addressing Agriculture's Role As A Driver Of Deforestation.

405. BULL, G. Q. ET AL. (2006) Industrial forest plantation subsidies: Impacts and implications'. Forest Policy and Economics 9, pp. 13-31.

406. WOLOSIN, M. ET AL. (2011) A Whole-of-Government Approach to Reduce Tropical Deforestation. Discussion Paper. Climate Advisors. pp. 11-28. [Online] Available from: http://www.climateadvisers.com/pdf/RFF-DP-11-28.pdf

407. WOLOSIN, M. ET AL. (2011) A Whole-of-Government Approach to Reduce Tropical Deforestation. Discussion Paper. Climate Advisors. pp. 11-28. [Online] Available from: http://www.climateadvisers.com/pdf/RFF-DP-11-28.pdf

408. OECD. (2011) Environmental Taxation. A Guide for Policy Makers. [Online] Available from: http://www.oecd.org/env/tools-evaluation/48164926.pdf

409. FULLERTON, D. ET AL. (2010) Environmental taxes. MIRRLEES, J. ET AL. (eds.). Dimensions of Tax Design. The Mirrlees Review. Oxford: Oxford University Press.

410. OECD. (2011) Environmental Taxation. A Guide for Policy Makers. [Online] Available from: www.oecd.org/env/tools-evaluation/48164926.pdf

411. PAGIOLA, S. (2008) Payments for environmental services in Costa Rica. Ecological economics, 65(4), 712-724.

EXTERNAL CONTRIBUTOR ENDNOTES

i. GOVERNMENT OFFICE FOR SCIENCE. (2011) Foresight. The Future of Food and Farming: Challenges and choices for global sustainability. London: The Government Office for Science.

ii. PAILLARD, S. TRÉYER, S. & DORIN, B. (Coord.) (2011) Agrimonde: scenarios and challenges for feeding the world in 2050. Quae, Versailles.

iii. MILLENNIUM ECOSYSTEM ASSESSMENT. (2005) Ecosystems and Human Well-being: Synthesis. Millennium Ecosystem Assessment, World Resources Institute, Washington D.C.

iv. GRIFFON, M. (2013) Qu'est ce que l'agriculture écologiquement intensive ? Quae, Versailles.

v. ALTIERI, M.A (1999) The ecological role of biodiversity in agroecosystems. Agriculture Ecosystems & Environment 74, 19-31.

vi. FOLEY, J.A. ET AL. (2005) Global consequences of land use. Science 309, 570-574.

vii. DORIN, B. ET AL. (2013) A World without Farmers? The Lewis Path Revisited. CIRED Working Paper 47-2013.

viii. THE WORLD BANK. (2013) Country Partnership Strategy, July 2013.

ix. GLOBAL WITNESS. (2013) GIS estimates.

x. LEITI. (2013) LIBERIA EXTRACTIVE INDUSTRIES TRANSPARENCY INITIATIVE (LEITI) Post Award Process Audit Final Report.

xi. GLOBAL WITNESS. (2012) Signing Their Lives Away: Liberia's Private Use Permits and the Destruction of Community-Owned Rainforest.

xii. GLOBAL WITNESS. (2012) The art of logging industrially in the Congo: how loggers are abusing artisanal permits to exploit the Democratic Republic of Congo.

xiii. REM. (2013) Final report. Independent Monitoring of Forest Law Enforcement and Governance (IM-FLEG) in the Democratic Republic of Congo.

xiv. GLOBAL WITNESS. (2013) Estimate for Liberia.

xv. THE RAINFOREST FOUNDATION UK. (2013) Seeds of Destruction. Expansion of industrial oil palm in the Congo Basin: Potential impacts on forests and people.

xvi. This article is based on Global Witness' May 2013 report "Rubber Barons: how Vietnamese companies and international finance are driving a land grabbing crisis in Cambodia and Laos" [Online] Available from: www.globalwitness.org/rubberbarons

xvii. INTERNATIONAL RUBBER STUDY GROUP (IRSG). (2003) The future of tyre and rubber sector of China and consequences for the world rubber industry: a multi-client study. [Online] Available from: www.iisrp.com/Related-linksDoc/IRSGChinaStudy.pdf

xviii. ASSOCIATION OF NATURAL RUBBER PRODUCING COUNTRIES (2008) Quarterly NR Market Review, Kuala Lumpur, Q1 and Q2. [Online] Available from: www.anrpc.org/html/filedownload.aspx?file=QUARTERLY%20NR%20MARKET%20REVIEW/MARKET%20REVIEW%20Q1_Q2%20%202008.PDF
ADNAN, H. (2010) Rubber prices reach new highs. The Star, 26 April 2010, [Online] Available from: http://biz.thestar.com.my/news/story.asp?file=/2010/4/26/business/6120041&sec=business\
INTERNATIONAL RUBBER STUDY GROUP (IRSG) & FAO. (2003) Recent Developments in Natural Rubber Prices. [Online] Available from: http://www.fao.org/docrep/006/Y4344E/y4344e0d.htm; Teo Ser Luck, op.

xix. FAO. (2010) Forest Resources Assessment data for Cambodia.

xx. FAO. (2010) Assessment of land use, forest policy and governance in Cambodia. [Online] Available from: http://www.unredd.net/index.php?option=com_docman&task=doc_download&gid=6040&Itemid=53

xxi. Interviews conducted by Global Witness with villagers in Kratie and Ratanakiri Provinces, Cambodia, 2012-2013.

xxii. GLOBAL WITNESS. (2013) Rubber Barons. [Online] Available from: http://www.globalwitness.org/rubberbarons

xxiii. DEFRIES, R. S. ET AL. (2010) Deforestation driven by urban population growth and agricultural trade in the twenty-first century. Nature Geoscience, 3(3), 178-181.

xxiv. RUDEL, T. K. ET AL. (2009) Changing drivers of deforestation and new opportunities for conservation. Conservation Biology, 23(6), 1396-1405.

xxv. FISHER, B. (2010) African exception to drivers of deforestation. Nature Geoscience, 3(6), 375-376.

xxvi. RUDEL, T. K. (2013) The national determinants of deforestation in sub-Saharan Africa. Philosophical Transactions of the Royal Society B: Biological Sciences,368(1625).

xxvii. KISSINGER, G. ET AL. (2012) Drivers of deforestation and forest degradation: a synthesis report for REDD+ policymakers. Lexeme Consulting, Vancouver, Canada.

xxviii. BRANDÃO, A. ET AL. (2012) Inquérito Civil Público no 1.23.000.002382/2011-17. Belém, Brazil: Imazon.

xxix. KISSINGER, G. ET AL. (2012) Drivers of deforestation and forest degradation: a synthesis report for REDD+ policymakers. Lexeme Consulting, Vancouver, Canada.

xxx. MINAM PERÚ. (2013) Plan de Inversión Forestal (Documento de Trabajo)-Versión 15.03.2013 - Elaborado por el Comité Directivo Nacional del FIP, integrado por el MEF, MINAM, MINAG y CIAM. Lima, Perú : Ministerio del Ambiente.

xxxi. BROWN, D. & SCHRECKENBERG, K. (1998) Shifting cultivators as agents of deforestation: assessing the evidence. Overseas Development Institute.

xxxii. BRUUN, T. B. ET AL. (2009) Environmental consequences of the demise in swidden cultivation in Southeast Asia: Carbon storage and soil quality. Human Ecology, 37(3), 375-388.

xxxiii. LIMA, M. ET AL. (2011) Deforestation and the social impacts of soy for biodiesel: perspectives of farmers in the South Brazilian Amazon. Ecology and Society, 16(4), 4.

xxxiv. RIST, L. ET AL. (2010) The livelihood impacts of oil palm: smallholders in Indonesia. Biodiversity and Conservation, 19(4), 1009-1024.

xxxv. COLCHESTER, M. ET AL. (2006) Promised land: Palm oil and land acquisition in Indonesia: Implications for local communities and indigenous peoples. Bogor: Forest Peoples Programme (FPP), Perkumpulan Sawit Watch (SW).

xxxvi. NEPSTAD, D. ET AL. (2001) Road paving, fire regime feedbacks, and the future of Amazon forests. Forest ecology and management 154.3: 395-407.

xxxvii. RIST, L. ET AL. (2010) The livelihood impacts of oil palm: smallholders in Indonesia. Biodiversity and Conservation, 19(4), 1009-1024.

xxxviii. WALKER, N.F. ET AL. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science. Special Issue Vol. 6(3):446-467.

xxxix. POKORNY, B. ET AL. (2010) A produção familiar como alternativa de um desenvolvimento sustentável para a Amazônia: Lições aprendidas de iniciativas de uso florestal por produtores familiares na Amazônia boliviana, brasileira, equatoriana e peruana. Bogor, Indonésia: CIFOR.

xl. MEDINA, G. ET AL. (2009) Loggers, development agents and the exercise of power in Amazonia. Development and Change, 40(4), 745-767.

xli. MAYERS, J. & VERMEULEN, S. (2002) Company-community forestry partnerships: From raw deals to mutual gains. International Institute for Environment and Development, London.

xlii. HOSONUMA, N ET AL. (2012) An assessment of deforestation and forest degradation drivers in developing countries. Environ. Res. Lett. 7 044009.

xliii. DURAN, A.P. ET AL. (2013) Global spatial coincidence between protected areas and metal mining activities. Biological Conservation, Vol. 160 p. 272-278.

xliv. VILLEGAS, C. ET AL. (2012) Artisanal and small-scale mining in protected areas and critical ecosystems programme: a global solutions study. WWF-World Wide Fund for Nature & Estelle Levin, Ltd.

xlv. FINER, M. & ORTA-MARTINEZ, M. (2010) A second hydrocarbon boom threatens the Peruvian Amazon: trends, projections, and policy implications. Environmental research letters, 5(1), 014012.

xlvi. SWENSON, J.J. ET AL. (2011) Gold mining in the Peruvian Amazon: global prices, deforestation, and mercury imports. PloS one, 6(4), e18875.

xlvii. RAISG. (2012) Amazonía bajó presión. Red Amazónica de Información Socioambiental Georreferenciada; coordinación. general Beto Ricardo (ISA) . São Paulo: Instituto Socioambiental.

xlviii. MINEM PERÚ. (2011) Anuario Estadístico de Hidrocarburos 2010. Lima, Peru: MINEM.

xlix. WWF. (2013) The many faces of the Camisea natural gas project. [Online]. Available from: wwf.panda.org/what_we_do/where_we_work/amazon/problems/other_threats/oil_and_gas_extraction_amazon/camisea_amazon

l. SOSYASUNI. (2013) Forseeable impacts of oil industry activity in Yasuní. [Online] Available from: http://www.sosyasuni.org/en/index.php?option=com_content&task=view&id=39&Itemid=26

li. MEGEVAND, C. ET AL. (2013) Deforestation Trends in the Congo Basin: Reconciling Economic Growth and Forest Protection. Washington DC: The World Bank.

lii. SWENSON, J.J. ET AL. (2011) Gold mining in the Peruvian Amazon: global prices, deforestation, and mercury imports. PloS one, 6 (4), e18875.

liii. UNEP. (2013) Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport. Geneva, Switzerland: UNEP Chemicals Branch.

liv. EARTHWORKS AND MININGWATCH CANADA. (2012) Troubled waters: how mine waste dumping is poisoning our oceans, rivers, and lakes. [Online]. Available from: www.earthworksaction.org/files/publications/Troubled-Waters_FINAL.pdf

lv. MARSHALL, A.R. (2007) Lower Ok Tedi and Middle Fly vegetation dieback monitoring summary report. Ok-Tedi Mining Environment Department. [Online]. Available from: http://www.oktedi.com/attachments/238_070920_FY07%20Dieback%20Monitoring_Marshall_summary.pdf

lvi. MWANYOKA, I. R. (2005) Payment for Water Services as a Mechanism for Watershed Management: The Case of the Sigi River Catchment, Tanga, Tanzania. [Online] Report prepared for WWF Tanzania. Available from: www.cepf.net/Documents/wwf.pse.report.pdf

lvii. UNEP. (2011) Decoupling Natural Resource Use and Environmental Impacts from Economic Growth. [Online] Available from: http://www.unep.org/resourcepanel/decoupling/files/pdf/decoupling_report_english.pdf

lviii. PWC. (2011) Mine 2011 — The game has changed: review of global trends in the mining industry. [Online] Available from: http://www.pwc.com/en_GX/gx/mining/pdf/mine-2011-game-has-changed.pdf

lix. DEFRIES, R. ET AL. (2013) Export-oriented deforestation in Mato Grosso: harbinger or exception for other tropical forests? Phil. Trans. R. Soc. B 368, 20120173.

lx. SEARCHINGER, T. ET AL. (2011) The Food, Forest and Carbon Challenge. National Wildlife Federation.[Online] Available from: www.nwf.org/~/media/PDFs/Global-Warming/Reports/TheFoodForestandCarbonChallenge.ashx .

lxi. GEIST, H. & LAMBIN, E. (2002) Proximate causes and underlying driving forces of tropical deforestation. Bioscience 52, 143–150.

lxii. PRODES. (2013) [Online] Available from: http://www.obt.inpe.br/prodes/index.php

lxiii. PRESIDÊNCIA DA REPÚBLICA. (2009) DECRETO Nº 7.029, DE 10 DE DEZEMBRO DE 2009. [Online] Available from: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/Decreto/D7029impressao.htm .

lxiv. BUSTAMANTE, M. M. ET AL. (2012) Estimating greenhouse gas emissions from cattle raising in Brazil. Climatic Change, DOI: 10.1007/s10584-012-0443-3.

lxv. MACEDO, M. N. ET AL. (2012)Decoupling of deforestation and soy production in the southern Amazon during the late 2000s. Proceedings of the National Academy of Sciences, doi:10.1073/pnas.1111374109.

lxvi. BARRETO, P & SILVA, D. (2010) Will Cattle Ranching Continue to Drive Deforestation in the Brazilian Amazon? Paper presented at the International Conference: Environment and Natural Resources Management in Developing and TransitionEconomies, November 1.

lxvii. GREENPEACE. (2009) Slaughtering the Amazon.

lxviii. GREENPEACE. (2009) Brazil cattle industry giants unite in banning Amazon destruction. [Online] Available from: http://www.greenpeace.org/usa/en/media-center/news-releases/brazil-cattle-industry-giants

lxix. SIMLAM. (2013) Sistema Integrado de Monitoramento e Licenciamento Ambiental. [Online] Available from: http://monitoramento.sema.pa.gov.br/simlam

lxx. GIBBS, H. (2013) University of Wisconsin-Madison, pers comm. 25th July 2013.

lxxi. WALLKER, N.F. (2013) From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science 6:446-467.[Online] Available from: http://tropicalconservationscience.mongabay.com/content/v6/TCS-2013_Vol_6(3)_446-467-Walker_et_al.pdf

lxxii. CONSUMER GOODS FORUM. (2010) Consumer Goods Industry Announces Initiatives on Climate Protection Press Release. [Online] Available from: http://sustainability.mycgforum.com/images/sustainability-pic/Press_Release_-_2010-11-29-ClimateProtection.pdf

lxxiii. BRANDO, P.M. ET AL. (2013) Ecology, economy and management of an agroindustrial frontier landscape in the southeast Amazon. Phil. Trans. R. Soc. B 368, 20120152.

lxxiv. INPE. (2013) Projeto Desmatamento (PRODES): Monitoramento da Floresta Amazonica por Satelite. [Online] Available from: http://www.obt.inpe.br/prodes

lxxv. NEPSTAD, D. C. ET AL. (2006) Globalization of the Amazon soy and beef industries: opportunities for conservation. Conservation Biology 20:1595-1603.

lxxvi. MORTON, D. C. ET AL. (2006) Cropland Expansion Changes Deforestation Dynamics in the Southern Brazilian Amazon. Proceedings of the National Academy of Sciences of the United States of America 103:14637-14641.

lxxvii. GREENPEACE. (2006) Eating Up the Amazon. Greenpeace International.

lxxviii. NEPSTAD, D. C. ET AL. (2006) Globalization of the Amazon soy and beef industries: opportunities for conservation. Conservation Biology 20:1595-1603.

lxxix. NEPSTAD, D. ET AL. (2009) The End of Deforestation in the Brazilian Amazon. Science 326:1350-1351.

lxxx. MACEDO, M. N. ET AL. (2012) Decoupling of deforestation and soy production in the southern Amazon during the late 2000s. Proceedings of the National Academy of Sciences of the United States of America 109:1341-1346.

lxxxi. NEPSTAD, D. C. ET AL. (2013) Responding to climate change and the global land crisis: REDD+, market transformation and low-emissions rural development. Philosophical Transactions of the Royal Society B-Biological Sciences 368.

lxxxii. NEPSTAD, D. C. ET AL. (2011) Systemic Conservation, REDD, and the Future of the Amazon Basin. Conservation Biology 25:1113-1116.

lxxxiii. UNECE. (2009) The importance of china's forest Products markets to the UNECE region. Geneva timber and forest discussion paper 57.

lxxxiv. UN COMTRADE. (2013) [Online] Available from: http://comtrade.un.org

lxxxv. UN COMTRADE. (2013) [Online] Available from: http://comtrade.un.org

lxxxvi. ENVIRONMENTAL INVESTIGATION AGENCY. (2012) Appetite for destruction - China's trade in illegal timber.

lxxxvii. JIANGUAN, F. (2013) China's Effort to Tackle the Trade in Illegal Timber. Presentation - 22nd Illegal Logging Update and Stakeholder Consultation meeting. Chatham House London. Department of Development Planning and Assets Management, State Forestry Administration of China.

lxxxviii. STATE FORESTRY ADMINISTRATION OF CHINA. (2012) China's Forest Resources Management and Forest Products Trade Policies. Presentation - UNFF CLI Vietnam.

lxxxix. UN COMTRADE. (2013) [Online] Available from: http://comtrade.un.org

xc. ENVIRONMENTAL INVESTIGATION AGENCY. (2012) Appetite for Destruction – China's trade in Illegal Timber. New York.

xci. GREENPEACE. (2012) The Ramin Paper Trail Asia Pulp & Paper Under Investigation - Part 2.

xcii. BROWN-LIMA, C. ET AL. (2010) An overview of the Brazil-China soyabean trade and its strategic implications for conservation. The Nature Conservancy.

xciii. CHINA DAILY. (2011) CGG is setting up a soyabean base in Brazil. [Online] Available from: http://www.chinadaily.com.cn/business/2011-11/24/content_14153948.htm

xciv. BLOOMBERG. (2012) Brazil Seen Beating U.S. in Soyabean Trade as China Buys. [Online] Available from: http://www.bloomberg.com/news/2012-10-31/brazil-seen-beating-u-s-in-soyabean-trade-as-china-demand-surges.html

xcv. PUTZEL, L. ET AL. (2011) Chinese trade and investment and the forests of the Congo Basin. Synthesis of scoping studies in Cameroon, Democratic Republic of Congo and Gabon. Working Paper 67. Bogor, Indonesia: CIFOR.

xcvi. NORMAN, B. (2013). GreenPalm: China and India. [Online] Available from: http://www.sustainablepalmoil.org/standards-certfication/certification-schemes/case-studies/greenpalm-kick-starting-sustainability-in-china-and-india

xcvii. GAODI, X. ET AL. (2012) China Ecological Footprint Report. WWF.

xcviii. MCKINSEY & COMPANY. (2009) China's green revolution – Prioritizing technologies to achieve energy and environmental sustainability.

xcix. STEERING COMMITTEE OF THE STATE-OF-KNOWLEDGE ASSESSMENT OF STANDARDS AND CERTIFICATION. (2012) Toward sustainability: the roles and limitations of certification. Washington, DC: RESOLVE, Inc.

c. NEPSTAD, D. ET AL. (2013) Responding to climate change and the global land crisis: REDD+, market transformation and low-emissions rural development. Philosophical Transactions of the Royal Society B-Biological Sciences, 368.

ci. RSPO. (2013) Market data performance 11 June 2013. [Online] Available from: http://www.rspo.org/file/Market-Data-Performance-May2013_11June_LATESTiii.pdf

cii. FSC. (2013) Global FSC certificates: type and distribution. [Online] Available from: https://ic.fsc.org/download.facts-and-figures-august-2013.a-2271.pdf

ciii. WWF. (2012) The 2050 criteria: guide to responsible investment in agricultural, forest, and seafood commodities. Washington, DC: WWF.

civ. BONSUCRO. (2013) Fact sheets. [Online] Available from: http://bonsucro.com/site/fact-sheets

cv. RTRS. (2013) Certified volumes and producers. [Online] Available from: http://www.responsiblesoy.org/index.php?option=com_content&view=article&id=297&Itemid=181&lang=en

cvi. MASCOTENA, A. (2013) Personal communication.

cvii. MASCOTENA, A. (2013) Personal communication.

cviii. GRIMARD, A. (2013) Personal communication.

cix. FSC. (2012) FSC principles and criteria for forest stewardship. Bonn, Germany: FSC International Center.

cx. STICKLER, C. ET AL. (2012) Global rules for sustainable farming. A comparison of social and environmental safeguards for REDD+ and principles and criteria for commodity roundtables. San Francisco, U.S.A: IPAM International Program.

cxi. AULD, G. ET AL. (2008) Certification schemes and the impacts on forests and forestry. Annual Review of Environment and Resources, 33, 187-211.

cxii. DAMETTE, O. & DELACOTE, P. (2011) Unsustainable timber harvesting, deforestation and the role of certification. Ecological Economics, 70, 1211-1219.

cxiii. VISSEREN-HAMAKERS, I.J. & PATTBERG, P. (2013) We can't see the forest for the trees: the environmental impact of global forest certification is unknown. Gaia, 22, 25-28.

cxiv. USAID. (2013) Tropical Forest Alliance 2020. [Online] Available from: http://www.usaid.gov/sites/default/files/documents/1865/TFA2020FACTSHEET.pdf

cxv. TRUCOST PLC. (2013) Natural Capital at Risk: The Top 100 Externalities of Business. [Online] Available from: http://www.teebforbusiness.org/js/plugins/filemanager/files/TEEB_Final_Report_v5.pdf

cxvi. IRWIN, S. H. & SANDERS, D. R. (2010) The Impact of Index and Swap Funds on Commodity Futures Markets. OECD Food, Agriculture and Fisheries Working Papers No. 27.

cxvii. GHOSH, J. (2010) The Unnatural Coupling: Food and Global Finance. Journal of Agrarian Change, Volume 10, pp. 72-86.

cxviii. GHOSH, J. (2010) The Unnatural Coupling: Food and Global Finance. Journal of Agrarian Change, Volume 10, pp. 72-86.

cxix. JONES, T. (2010) The Great Hunger Lottery: How Banking Speculation Causes Food Crises, s.l.: World Develpment Movement.

cxx. SCHAFFNIT-CHATTERJEE,C. (2009) The Global Food Equation: Food security in an environment of increasing scarcity, Frankfurt am Main: Deutsche Bank Research.

cxxi. SCHAFFNIT-CHATTERJEE,C. (2011) Where are the food prices heading? Short-term drivers, trends and implications, Frankfurt am Main: Deutsche Bank Research.

cxxii. JONES, T. (2010) The Great Hunger Lottery: How Banking Speculation Causes Food Crises, s.l.: World Develpment Movement.

cxxiii. IRWIN, S. H. & SANDERS, D. R. (2010) The Impact of Index and Swap Funds on Commodity Futures Markets. OECD Food, Agriculture and Fisheries Working Papers No. 27.

cxxiv. BLOCK, B. (2009) Global Palm Oil Demand Fueling Deforestation. [Online] Available from: http://www.worldwatch.org/node/6059.

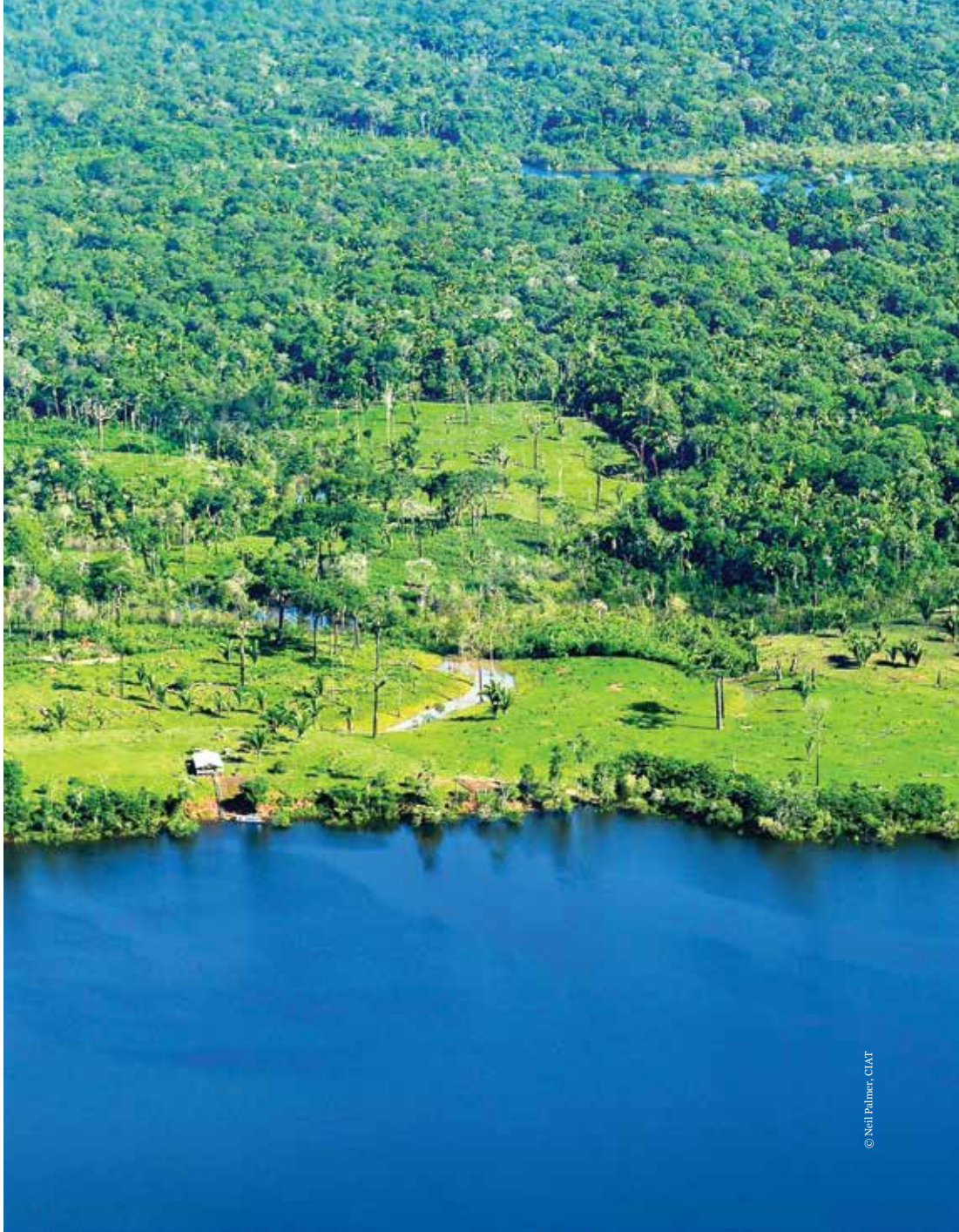
cxxv. SCHAFFNIT-CHATTERJEE,C. (2009) The Global Food Equation: Food security in an environment of increasing scarcity, Frankfurt am Main : Deutsche Bank Research.

cxxvi. SCHAFFNIT-CHATTERJEE,C. (2011) Where are the food prices heading? Short-term drivers, trends and implications, Frankfurt am Main: Deutsche Bank Research.

cxxvii. HOBLEY, M. & BUCHY, M. (2011) FLEGT and poverty alleviation: the role of VPAs. Internal report prepared for the European Forest Institute.

ACRONYMS

AMC	Advanced Market Commitment
BAU	Business-as-usual
CBD	United Nations Convention on Biodiversity
CITES	Conventions on International Trade in Endangered Species
COP	Conference of the Parties
EM	Enforcement and Monitoring
ES	Ecosystem services
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FI	Financial Institutions
FLEGT	Forest Law Enforcement Governance and Trade action plan
FSC	Forest Stewardship Council
GEF	The Global Environment Facility
GHG	Green House Gas Emissions
IFC	International Finance Corporation
MEA	Multilateral Environmental Agreements
NGO	Non Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
OPIC	Overseas Private Investment Corporation
PES	Payment for Ecosystem Services
PPP	Public Private Partnership
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RSPO	Roundtable for Sustainable Palm Oil
RTRS	Round Table on Responsible Soy
SFM	Sustainable Forest Management
TA	Technical Assistance
TFA	Tropical Forest Alliance
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UNGC	UN Global Compact
VPA	Voluntary Partnership Arrangements
WRI	World Resources Institute
WTO	World Trade Organisation



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