Analysing REDD+

Challenges and choices

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Chapter 4

REDD+ and the global economy

Competing forces and policy options

Pablo Pacheco, Louis Putzel, Krystof Obidzinski and George Schoneveld

- Globalisation and market and financial liberalisation have increased the exposure of forests to global trade and investment, which has aggravated the historical trends of deforestation and forest degradation.
- The main forces that compete with REDD+ include a growing integration of food, energy and financial markets, an increasing level and volatility of commodity prices, and a new wave of large-scale investments in agriculture.
- For REDD+ to reduce pressures on forests, while stimulating the transition to more equitable and sustainable development, measures are needed on the supply and demand side to stimulate the adoption of forest-conserving land uses, de-incentivise the conversion of forestlands, and incentivise increased production on non-forestlands.

4.1 Introduction

The challenges of reducing greenhouse gas (GHG) emissions, while feeding a growing population and meeting global demand for fibre and energy, are attracting increasing attention (Kissinger 2011; Wollenberg *et al.* 2011). This chapter presents an overview of current trade and investment-related drivers

of deforestation and forest degradation in the tropics and the ways in which they serve as obstacles to REDD+ implementation, with a closer look at three regions. In addition, we suggest policy options that could help tackle these global drivers by making economic growth more compatible with forest conservation.

The discussion is organised around three questions:

1. What are the main economic drivers and trends shaping deforestation and forest degradation in the tropics that represent major obstacles to REDD+?
2. Which aspects of these economic drivers represent the greatest challenges to reducing deforestation and forest degradation in Indonesia, the Brazilian Amazon and East Africa?
3. What policy approaches would be most effective for reducing the effects of these forces on forests and what are the implications for REDD+?

Deforestation has historically been linked to economic development, population growth and the associated demands for food, fibre and energy. We argue that there are a number of contemporary drivers, strongly related to global markets and investment, that lead to increased competition for land, including forestland in the tropics. These drivers include the increased integration of food, fibre, energy and financial markets; high price volatility and higher commodity prices; and a transnational land rush. They make attempts to reduce carbon emissions through REDD+ more challenging since, directly and indirectly, these drivers stimulate the conversion of forestland to agricultural use and increase logging activities that often lead to forest degradation. Nonetheless, there are important regional variations in how these drivers affect forests, as our assessments from Indonesia, the Brazilian Amazon and East Africa show.

We adopt a broad definition of REDD+ to mean the array of policies that primarily aim to reduce carbon emissions from deforestation and forest degradation and may also include result-based incentives and compensation (see Chapter 1). Many factors affect the implementation of REDD+. In this chapter, we focus on the global economic drivers and trends shaped by markets and public policies – in consumer and producer countries – that bring about changes in land use, thus affecting forest cover and quality. In order to make REDD+ policies more effective, we must consider global economic dynamics and their interactions with political and institutional conditions at the national level. On the supply side, a realignment of market incentives and regulations is needed to reorient economic development in tropical developing countries in order to reconcile food and energy provision with forest conservation, along with policy actions on the demand side.

4.2 Economic drivers and trends competing with REDD+

A number of factors and conditions at different scales influence the dynamics of deforestation and forest degradation. Figure 4.1 shows the main global economic forces and the economic and environmental policies in both consumer and producer countries that shape competition between land uses and have implications for REDD+. These forces represent different economic

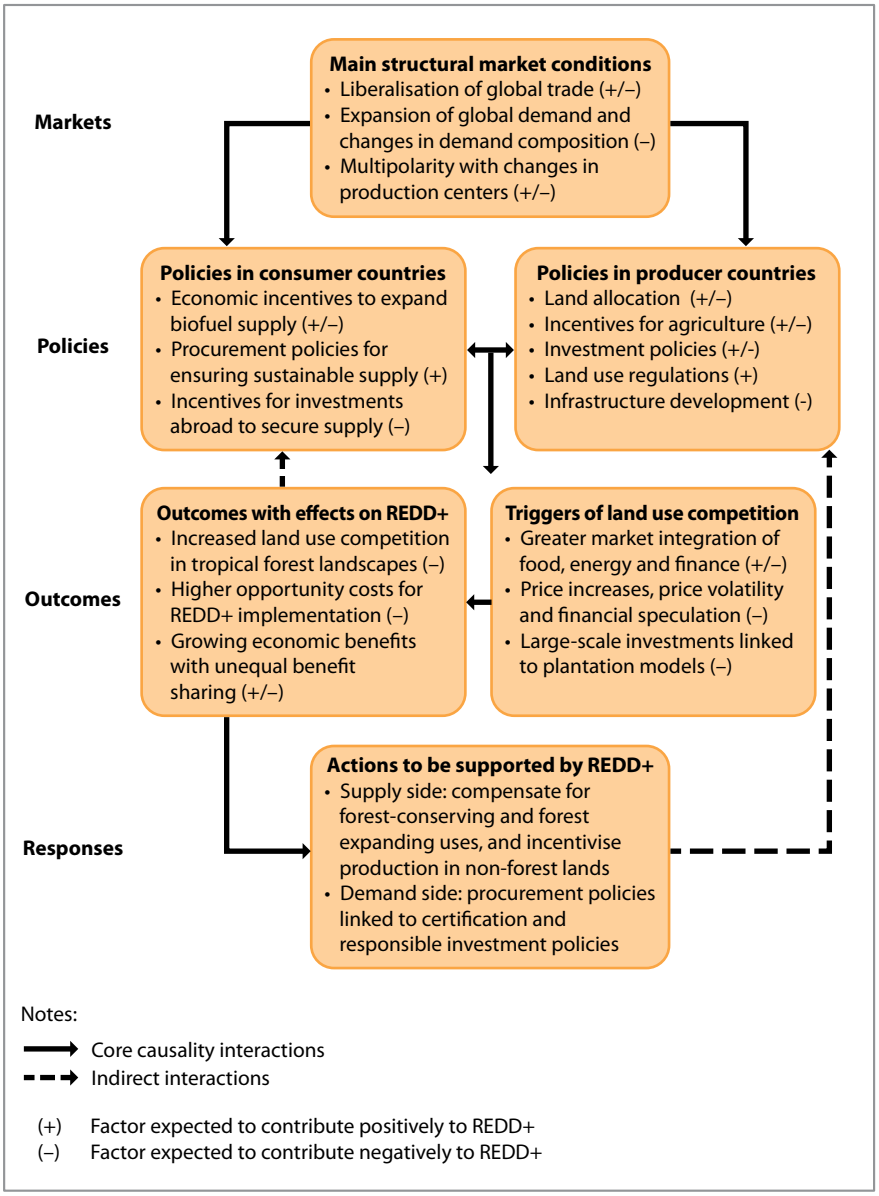

Figure 4.1 Simplified diagram of the global economic forces and policies in consumer and producer countries shaping land use competition with implications for REDD+

interests that contribute to the configuration of the institutional and political arrangements shaping land and forest use, and thus have direct implications for land use opportunity costs. REDD+ policies need to address these forces in order to effectively reduce deforestation and degradation and thus carbon emissions.

Over time, there has been a major growth in the human pressure on forests to meet demands for food and fibre in association with the rise of economies and societies (Lambin *et al.* 2003). While forests covered about 50% of the earth's land area 8000 years ago, today only 30% of land is forested (Ball 2001). In the last three decades, globalisation and market liberalisation have stimulated greater interconnectedness of markets and intensified trade and capital flows, not only between the North and the South, but also among southern countries (Khor 2000). The latter has taken place in the context of a steady expansion of global demand for food, energy and materials associated with increased consumer demand (Tilman *et al.* 2011), largely influenced by emerging economies such as Brazil, Russia, India and China (BRIC). Furthermore, the migration of industrial production to emerging economies (especially in Asia) has increased multipolarity in the global economic system, redirecting global natural resource supply chains (World Bank 2011), which has implications for global land use (Rudel *et al.* 2009).

The impacts of global economic processes on land use change, and thus on forest conversion, are both direct and indirect, and increasingly influenced by regional interdependencies mediated by international trade (Meyfroidt *et al.* 2010, Pfaff and Walker 2010). Higher consumption in some countries may lead to greater land use change in other countries. Land use dynamics are influenced by policy decisions in consumer and producer countries. Boxes 4.1 and 4.2 illustrate the effects of policy decisions in consumer countries, such as the renewable energy policy in the European Union (EU), and the domestic logging ban in China. Examples of policies implemented by producer countries (e.g. land tenure, incentives for agriculture, investment policies and land use regulations) are discussed in detail in Section 4.3.

The structural market trends described above, in their interactions with policies in both consumer and producer countries, have contributed to the emergence of three global trends that constitute the main economic triggers of contemporary land use change:

- A growing *integration of food, fibre and energy markets* causing changes in supply and demand in one market to affect others (Roberts 2008; Naylor 2011)
- Persistent *price volatility* in global food and agricultural markets that occurs within a general trend of increasing prices, which is in part associated with the 'financialisation' of commodity markets (UNCTAD 2009; Falkowski 2011)
- A trend of large-scale *land acquisition*, which is strongly associated with the two preceding trends (HLPE 2011; Anseeuw *et al.* 2012).

Box 4.1 Biofuel markets, the EU Renewable Energy Directive and forests

Francis X. Johnson

The EU Renewable Energy Directive (EU-RED) established targets for 2020, including a target of 10% renewable energy in the transport sector in all Member States (EC 2009). Biofuels used to achieve the target must meet specific sustainability criteria. These include restrictions on the types of land used for production, minimum GHG reduction levels and a prohibition on clearing forests or using lands with high carbon stocks or high biodiversity for biofuel production. Biofuel certification schemes recognised by the EC include provisions to prevent the conversion of such lands into feedstocks for biofuels.

The EU-RED does address deforestation due to direct land use change. However, indirect land use change (iLUC) is not yet explicitly considered. ILUC results from the physical and economic effects of increased demand for land associated with biofuel production. For example, when biofuel feedstocks are grown on agricultural land, food production may be displaced to other parts of the world. The iLUC impacts on GHG emissions resulting from the EU-RED directive are likely to be the most contentious aspect of incentives for biofuel development as part of renewable energy policies. In 2011, the European Commission delayed a decision on whether to address iLUC factors.

Most studies suggest that biofuel development places greater pressures on land as result of iLUC (e.g. Edwards *et al*. 2010). A recent estimate indicates that an additional 5.2 million hectares of cropland will be needed globally by 2020, as compared to a baseline scenario without the EU-RED directive. About 11% of this additional expansion is estimated to take place in open forests and 30% in closed forestlands (Fonseca *et al*. 2010).

Expanding biofuel markets offer economic opportunities for developing countries to export to the EU and to develop their domestic markets. The high productivity of biomass in tropical and subtropical regions can result in lower land use impacts and lower GHG emissions than result from biofuels produced in the EU. Biofuel incentives in developing countries could be linked to REDD+, providing livelihoods for poor rural communities and stabilising the agricultural frontier, while reducing land use change and GHG emissions (Killeen *et al*. 2011). Developing countries may, however, face higher costs in meeting the sustainability criteria, due to the lack of technical, financial and human resources to support certification (Johnson *et al*. 2012).

Box 4.2 China's domestic logging ban and demand for African timber

In 1998, China instituted a domestic logging ban to protect its natural forests (Liu and Diamond 2005; Wang *et al*. 2007; Laurance 2008). Around the same time, the Asian financial crisis resulted in cash shortfalls in Japan and elsewhere and China soon became the world's largest consumer of tropical logs and semi-processed timber. New supply chains were established connecting China to timber supplies in Southeast Asia, Africa and South America. Lower tariffs on imported wood and the revocation of import license requirements facilitated this trend and attracted foreign direct investment, which resulted in increased demand for timber (Lang and Chan 2006).

While China's logging ban reduced domestic production by 30% between 1995 and 2003 (Lang and Chan 2006), it displaced deforestation and logging-related forest disturbance to other countries (Mayer *et al*. 2005). China's increasing demand for logs and sawnwood has been particularly evident in Africa, where it now exceeds that of all developed nations combined. The demand for African timber results not only in higher export volumes, but also in other changes that are likely to cause an intensification of logging. The aggregate figures indicate a shift towards imports of more highly processed wood by developed countries and a continued preference for less processed wood by the Chinese market, although imports of processed wood are increasing.

Between 1991 and 2006, timber exports from Gabon to China increased by over 8000% while exports to France, formerly the largest market, fell by more than half. Gabon's log production increased to an all time high of 2.5 million cubic metres annually (Terheggen 2010). At the same time, the Chinese market demands a greater number of species than do other markets (Putzel 2010; Terheggen 2010; Cerutti *et al*. 2011). This combination of increased volume and greater harvest intensity has several consequences. First, while less selectivity alone might mean a slower expansion of logging, in combination with higher demand it is more likely to result in greater forest degradation. Second, until both exporting and importing countries control illegal logging and timber exports, higher demand for a greater number of species may result in pressure on forests that are not allocated for logging, complicating the implementation of REDD+.

These trends place pressures on land, with impacts on forests through complex interactions. Estimates on how much deforestation for agricultural expansion contributes to global food and energy supply are still controversial. For example, Gibbs *et al*. (2010), using remote sensing analysis across major tropical regions, suggest that about 55% of the 100 million hectares of land converted to agriculture in the 1980s and 1990s were at the expense of

'intact' forests. In turn, Angelsen (2010b), based on data from the Food and Agriculture Organization of the United Nations (FAO), suggests that, at the global level, less than 10% of total crop and livestock production between 1985 and 2004 was on newly deforested lands. Taken together, these estimates suggest that although historically, clearing forests probably accounts for a relatively small portion of the increased global food supply, much of the new agricultural land tends to occur at the expense of forests. Global demand for food and energy is expected to further increase as the world population grows from its current level of 7 billion in 2011 to an estimated 9 billion in 2050 (Royal Society 2012).

4.3 A regional look at the forces shaping land use dynamics

This section examines the trends introduced in Section 4.2 and their implications for deforestation and degradation and REDD+ implementation in three regions: Indonesia in Southeast Asia, the Brazilian Amazon and East Africa. We emphasise the influence that interactions among economic and policy factors and global markets and investments have on increasing or decreasing pressure on forestlands. We also assess the opportunity costs of alternative land uses in these three regions in order to indicate the potential costs of a performance-based compensation system (i.e. a PES-like scheme) under a REDD+ policy framework. Finally, we look at some of the main policy responses adopted by these countries to tackle deforestation.

4.3.1 Forces shaping land use dynamics in Indonesia

In Indonesia, large scale projects in forestry, oil palm and food production are expected to expand to about 17 million hectares in order to meet government targets. An additional 3 million hectares will be required if coal production doubles, as predicted, by 2025 (Bahroeny 2009; Suparno and Afrida 2009; Tragistina 2011). The expected economic gains from these investments are significant. For example, in 2011, export of pulp and paper, crude palm oil and coal represented about US $35 billion (US $4 billion, US $9 billion, and US $22 billion respectively), or about 20% of total export value (COMTRADE 2012).

The growing demand for palm oil (both for food and biofuel) is a key driver of deforestation in Indonesia (Box 4.3), but large-scale land investments also target other commodities, such as timber or coal, under a trend of price increases in the international markets (Inamura *et al.* 2011). In recent years, coal mining has become an important driver of large-scale land acquisition in Indonesia. Coal production has almost quadrupled over the last ten years and the area occupied by mining concessions has expanded rapidly (Ministry of Energy and Mineral Resources 2010; Tragistina 2011). Currently, mining concessions cover about 5 million hectares in Kalimantan and Sumatra;

Box 4.3 Oil palm, food and biofuels in Indonesia

Over the past decade, Indonesia's oil palm sector has experienced tremendous growth. Between 1990 and 2010, the area occupied by plantations increased seven-fold from 1.1 million hectares to 7.8 million hectares (Sheil *et al*. 2009; Direktorat Jenderal Perkebunan 2011). At the end of 2011, Indonesia's production of crude palm oil (CPO) reached 23.6 million tonnes, which accounts for approximately 45% of global output (Slette and Wiyono 2011). Annually, the export of CPO and derivatives generates over US $12 billion in foreign exchange earnings (Bahroeny 2009; World Bank 2010). The oil palm sector is also seen as a potential key to securing Indonesia's energy needs through CPO-based biofuel production and an important source of employment in rural Indonesia.

Anticipating a doubling of global demand for palm oil by 2025, the Indonesian government plans to double its current CPO production of 23 million tonnes over the next decade, through intensification and by developing an additional 4 million hectares of oil palm plantation estates (Bahroeny 2009; Suparno and Afrida 2009; Kongsager and Reenberg 2012). There is concern that new expansion will target the secondary forest zone, which is exempt from the forest conversion moratorium in effect since 2011 (Boucher *et al*. 2011; Colchester and Chao 2011). While new investments are expected to work in partnership with local communities through outgrower schemes, questions remain about their value and effectiveness (McCarthy 2010).

Speculation about the expansion of both oil palm and timber plantations has led to concerns about national food security (Rusastra *et al*. 2008; Basuno and Weinberger 2011). Government planners estimate that over the next two decades at least 2 million hectares of new land will be needed to grow food for Indonesia's growing population (Jakarta Post 2010). Early indications show that food estate investments are targeting significant areas of forested lands (Colchester and Chao 2011). This is likely to weaken the income and food security of forest-dependent people, cause resistance and conflict and contribute to increased levels of GHG emissions in Indonesia.

The negative outcomes of oil palm expansion can be minimised. Government planners need to enforce the forest conversion moratorium and ensure that new oil palm plantations are developed on non-forest lands. The concessions already allocated and found to contain significant forest cover should be subject to legal review. If the legal standing of these concessions is sound, the government should offer land swaps and tax incentives in order to exclude forested lands from them. Similar incentives should be used to support the intensification of production of CPO on existing plantations, rather than promoting their expansion. Wider adoption of Roundtable on Sustainable Palm Oil (RSPO) certification by companies would be particularly helpful, as it includes a carbon stock threshold above which forest clearance is not permitted.

about half of them are located in forestlands. While by law only about 20% of the total concession area, or 1 million hectares, may be cleared to enable the extraction of coal, this limit is rarely respected.

Timber plantations have expanded rapidly as well. In 2006, the government launched a new policy seeking to establish 9 million hectares of new timber plantations by 2016. Although implementation has been slow, due to land allocation problems and limited interest from small holders (Obidzinski and Dermawan 2010), a positive market outlook for pulp is driving further investments. In April 2011, Indonesia's Ministry of Forestry announced large new investments in the pulp and timber plantation sector. The projected investments include seven new pulp mills, with a capacity of nearly 5 million tonnes and nearly 2 million hectares of new timber plantations, at an overall cost of US $14 billion. These investments are likely to result in major carbon emissions (Koran Kaltim 2011). While these targets may be ambitious, the existing pulp and paper mills have continued to expand their capacity and, as of 2010, have relied on natural forests for half of their raw material needs (IWGFF 2010).

The difficulties of making REDD+ economically competitive can be illustrated by comparing it to oil palm plantations. Oil palm is among the fastest expanding commodities in the tropics and, in Indonesia, oil palm estates are growing by about 400 000 hectares *per annum* (Slette and Wiyono 2011). Estimates of the net present value of oil palm plantations vary widely from US $4000 to US $29 000 per hectare (Persson and Azar 2009; World Bank 2010), although most estimates converge in the range of US $6000 – US $9000 per hectare (Butler *et al*. 2009). Keeping the same area forested generates US $614 – US $994 in carbon credits (Butler *et al*. 2009). This disparity roughly doubles if the value of timber cleared in the process of establishing plantations is included in the calculation of foregone benefits (Fisher *et al*. 2011). On a project basis, it is unlikely that carbon payments could compete with the combined benefits from timber and oil palm at their current prices. However, there could be scope for synergy with REDD+. This is particularly the case if growth in the plantation sector is mainly achieved though the intensification of existing plantation areas, if land swaps are used to move some concessions onto non-forest land, and if limits on forest clearance in mining concessions are enforced.

4.3.2 Forces shaping land use dynamics in the Brazilian Amazon

By 2010, the Brazilian Amazon had undergone deforestation equivalent to 75 million hectares, or about 18% of its original forest cover (INPE 2011). Currently, 44.6 million hectares are under pasture (62% of the total deforested area), while 3.5 million hectares constitute annual crops (5%

of the total deforested area), much of which is under soybean production (EMBRAPA/INPE 2011). Since the early 1970s, forest clearing has been related to the expansion of large-scale and extensive cattle ranching (Margulis 2004). In addition, since the early 2000s, there has been an expansion of large-scale and capital intensive agriculture, mainly for soybean production (Nepstad *et al*. 2006). Selective logging has often preceded agriculture over large areas of primary forest (Chomitz *et al*. 2007). Deforestation peaked at 2.7 million hectares per year in 2004, decreasing gradually thereafter to 700 000 hectares in 2010 (INPE 2011). Deforestation in the Brazilian Amazon is related to the integration of the region into the national economy, connecting it more strongly to demand and investment from the southern states, as well as from global markets (Nepstad *et al*. 2006; Walker *et al*. 2009).

Increases in international prices have stimulated the production of beef and soybean (Box 4.4). Other variables, such as exchange rates, have also had an important influence on export dynamics. Richards *et al*. (2012) argue that about a third of current soybean production in South America, including in Brazil, is a response to the devaluation of local currencies in the late 1990s. In contrast, a more recent depreciation of the dollar and appreciation of the Brazilian real may have counteracted a rise in global soybean prices. Thus, deforestation tends to increase and decrease in line with oscillations in international prices and exchange rates (Macedo *et al*. 2012). Government incentives for the expansion of biofuel supplies have also contributed to growth in the market for soybeans produced in Brazil, although still to a proportionately lesser degree (de Andrade and Miccolis 2011). For example, estimates suggest that 13–18% of total deforestation in Mato Grosso is due to soybean production, although less than 6% of this can be attributed to biodiesel, since most soybean is used for other products (Lima *et al*. 2011).

In the late 1990s and early 2000s, the integration of the Brazilian Amazon with national and global markets, at a time of higher prices for agricultural commodities, increased the pressure on forests from the cattle and soy sectors. This forest loss was exacerbated by economic policies promoting agricultural modernisation and agribusiness development (Chomitz *et al*. 2007). Furthermore, the expansion of ranching and commercial agriculture not only stimulated fragmentation of large-scale landholdings, but also contributed to encroachment on public lands by private landholders, who acquired land through semi-legal means, in part driven by speculative purposes (Pacheco and Poccard-Chapuis 2012). In response, the government expanded the area of public forests assigned to various conservation categories, including sustainable development reserves and protected areas (May *et al*. 2011b).

The rate of deforestation has decreased since the mid 2000s. Several factors explain this trend, including the growing enforcement of environmental laws, fluctuating prices of agricultural commodities, the implementation of private

Box 4.4 Beef and soybean in the Brazilian Amazon

Pasture development for beef production in the Amazon was, in the past, strongly related to the dynamics of the local markets. However, it now supplies more distant markets, reaching other regions in Brazil and global markets (da Veiga *et al*. 2004). The expansion of beef production has closely tracked population growth and increasing *per capita* beef consumption. In addition, Brazilian exports of beef have grown from 123 000 tonnes in 1990 to 1.4 million tonnes in 2008 (FAO Statistics 2012). In 2011, two-thirds of the exports went to Russia, Iran, Egypt and China. Although the Amazon region contributed only 15.4% to total beef exports in 2006, this share is increasing rapidly (Pacheco and Poccard-Chapuis 2012). While most beef exports originate in southeast and west-central Brazil, the growth in exports has created a gap in the domestic market, which is filled by beef from the Amazon (Kaimowitz *et al*. 2004). In recent years, there has been an important expansion of slaughterhouses in the Amazon region, due to the arrival of the main corporate actors in the Brazilian beef sector (Smeraldi and May 2009; Pacheco and Poccard-Chapuis 2012).

Soybean production in Brazil grew from 11.5 to 23.3 million hectares between 1990 and 2010. This growth is centred on Mato Grosso on the southwestern border of the Amazon, which had 10.4 million hectares under soy cultivation in 2010, a major portion in the *cerrado* (IBGE 2011). This growth was driven by the availability of cheap land, road expansion and access to new cultivation technologies (Kaimowitz and Smith 2001). The arrival of corporate traders (e.g. Archer Daniels Midland and Louis Dreyfus) and a large-scale Brazilian corporation (Grupo Maggi) have contributed to integrating the region in global markets (Baker 2004). While the domestic market is important in Brazil, a significant and increasing portion of production is devoted to export markets. About 70% of the soybean grain is processed in the country and the rest is exported; 47% of soybean cake and 60% of soybean oil are consumed inside Brazil. In 2011, 67% of Brazil's soybean exports went to China and 69% of soybean cake to the EU (COMTRADE 2012). About 23% of soybean expansion in the period 2001–2004 occurred on cleared forestland, while the remainder was on established pastures (Morton *et al*. 2006). Nonetheless, soy expansion has displaced livestock further to the forest fringes (Barona *et al*. 2010, Arima *et al*. 2011) and expanding demand for biofuels could intensify this effect (Lapola *et al*. 2010).

Pacheco and Poccard-Chapuis (2012) suggest that several policy mechanisms could limit the expansion of extensive cattle ranching and help to close the frontier: i) designating public lands as protected areas and production forest. This has already effectively halted the expansion of extensive ranching into public forestland; ii) land use constraints defined through economic and ecological zoning. This has proven to be an effective deterrent to expansion in recent years; iii) intensification of existing ranching activities, with sufficient economic incentives; and iv) promotion of cattle ranching outside the Amazon biome. This will, however, displace the problem to the *cerrado* ecosystem, which is also under intense pressure from deforestation. These policies could be combined with the certification of beef production systems that comply with environmental regulations and use more sustainable production practices. Policy options i) and ii) also apply to soybean expansion. In addition, the moratorium on soybean production introduced in 2006 has been instrumental in inhibiting the expansion of the soybean frontier into forestlands (Rudorff *et al*. 2011).

initiatives to reduce deforestation (e.g. a soy moratorium in Mato Grosso and a ban by supermarkets in southern Brazil on beef originating on illegally cleared lands) and pressures from social movements (Hecht 2012). A tighter enforcement of Brazilian environmental law between 2005 and 2009 could have helped preserve about half of the forest area that would otherwise have been cleared (Assunção and Gandour 2012).

Analysis of the prospects for REDD+ implementation in the Amazon region suggests that some forest conversion in the Brazilian Amazon – such as lands under extensive cattle ranching – exhibits low per-hectare returns, which could be compensated by carbon offsets. Börner *et al*. (2010) suggest that roughly half of projected forest loss in the period 2009–2018 (55% or 12.5 million hectares) exhibits net returns that could be compensated by payments reflecting the current prices of temporary carbon credits on voluntary markets. The latter does not take into account the fact that productivity and profits from beef production have been growing over time, thus increasing the opportunity costs for land uses that lead to deforestation (Pacheco and Poccard-Chapuis 2012). This is also the case for deforestation prompted by soybean expansion, which is much more profitable than extensive cattle ranching. Despite the low direct pressure from soybean expansion on primary forests, it indirectly leads to some forest conversion (Lapola *et al.* 2010; Arima *et al.* 2011).

A combination of law enforcement and economic incentives are required to effectively 'close the frontier' in the Brazilian Amazon in order to influence the needs and interests of diverse actors, including agro-extractive communities, smallholders and large-scale landholders. No 'one size fits all' approach to REDD+ can deliver both cost effectiveness and equity when disparate actors with different needs shape landscapes in multiple ways (Pacheco *et al*. 2011).

4.3.3 Forces shaping land use dynamics in East Africa

East Africa currently faces one of the highest deforestation rates on the continent, exceeding 1% per year (FAO 2010). Deforestation has been particularly intense in Ethiopia, Kenya and Madagascar. Agricultural expansion, logging, charcoal production and overgrazing in the semi-arid areas are considered to contribute to forest loss (Bishaw 2001; FAO 2003; Olson *et al*. 2004; Tabor *et al*. 2010). In sub-Saharan Africa, increases in production are typically associated with an expansion of the area under cultivation rather than gains in land use efficiency (FAO 2003). According to Chomitz *et al.* (2007), direct conversion of forest area to small-scale permanent agriculture is associated with population increase and accounts for approximately 60% of land use change in Africa. In addition, charcoal production, which accounts for more than 80% of urban household energy consumption, also has impacts on forest degradation (UN DESA 2004).

Global market forces may increase the intensity of land use competition. For example, despite dwindling timber reserves, Tanzania – East Africa's most forested country – reports a rapid rise in timber exports by almost 1300% in the decade 2000–2010, mostly destined for the Indian and Chinese markets (COMTRADE 2012). Milledge *et al*. (2007) estimate that, in the main logging areas of Coastal Tanzania, between 77 and 96% of high value timber species are harvested illegally, primarily as a result of corruption and poor government capacity to enforce forestry laws. Besides growing international demand, greater accessibility as a result of infrastructure development is argued to be a critical enabling factor for illegal harvesting (Tabor *et al*. 2010). Similar trends have been observed in neighbouring Mozambique (MacKenzie 2006).

Additionally, as a result of the recent rush for Africa's land (Box 4.5), large areas of forested and agricultural land risk conversion to plantation monocultures. Due to the availability of cheap, agro-ecologically suitable land, sub-Saharan Africa has become the leading destination for large-scale farmland investments – according to some – accounting for over two-thirds the total global land area acquired for this purpose since the early 2000s (Deininger and Byerlee 2011; HLPE 2011; Anseeuw *et al*. 2012). This is accompanied by an increasing 'financialisation' of global commodity markets and a rise in dedicated farmland investment funds, illustrating the role of financial institutions speculating on high future returns in these sectors (Merian Research and CRBM 2010; Knopfel 2011). Despite potential economic gains for host countries, these investment flows compete directly with conservation. There are indications that commercial plantations on lands acquired for investors in Ethiopia, Kenya, Tanzania and Uganda will expand, to the detriment of forests (WWF 2009; Mortimer 2011).

These types of investments are enabled by a domestic political economy that favours foreign direct investment (FDI). The opportunity costs for REDD+ are high, considering the net present value of crops such as sugarcane and oil palm (Butler *et al*. 2009; Persson and Azar 2010). Furthermore, while FDI flows to the agricultural sector threaten the economic viability of REDD+, high economic dependence on established domestic cash crops, such as coffee, tea, cotton and cloves, will further undermine efforts to curb deforestation. In Ethiopia, Madagascar and Tanzania, for example, the agricultural sector accounts for more than 80% of export earnings. With rapidly rising demand for East African cash crops from large emerging economies and expectations that new agricultural FDI flows will add value by enhancing domestic processing capacity, technology transfers and improving smallholder access to global marketing channels, there may be little long-term political traction for schemes that restrict expansion options.

Box 4.5 Biofuel, food prices and land investments in sub-Saharan Africa

A significant process of large-scale farmland acquisition is underway in sub-Saharan Africa (SSA). Reliable empirical evidence as to its magnitude, distribution and underlying drivers is still scant. To address these knowledge gaps, Schoneveld (2011) verified 353 large-scale farmland projects exceeding 2000 hectares in size and established between 2005 and 2011. The analysis documents plantation agriculture and forestry projects across 32 countries in SSA, covering an area of 18.1 million hectares. A high level of geographic concentration was observed, with just seven countries accounting for almost two-thirds of the total acquired area (Zambia, Ghana, Madagascar, Mozambique, Ethiopia, South Sudan and Liberia). In Ethiopia and Ghana, the threat that these acquisitions will compete with socially and environmentally valuable land uses is particularly high, as 43% (Ethiopia) and 62% (Ghana) of suitable and 'available' land has been transferred to investors since 2005. These threats are facilitated by weak domestic regulatory enforcement of investment and the fact that most of the acquired land originates from the customary land domain.

Sub-Saharan Africa is an attractive investment destination, due to the abundance of agroecologically suitable land and the possibility of leasing land at low rental rates (typically <5% of the rates in other countries with strong plantation agriculture sectors, such as Malaysia and Indonesia). This unprecedented rush for Africa's farmland is also driven by exogenous factors. First, blending mandates in industrialised countries have guaranteed a stable market for biofuel. The resulting economic opportunities have encouraged investors to seek access to vast areas of land for cultivating biofuel feedstocks, such as *Jatropha Curcas L.* and sugarcane. European and North American proponents are responsible for more than 53% of the total area acquired in SSA and 71% of that area was acquired for biofuel feedstock cultivation.

The second main driver is the 2007–2008 increase in international food prices. This created two types of investors: those that are motivated by the profit potential of high food prices and supply constraints and actors, such as parastatals and sovereign wealth funds, that are more closely linked to the policy objective of their governments to reduce national exposure to food price fluctuations. The food projects they lead tend to be initiated by southern countries, whose domestic expansion capacity is especially constrained by the limited availability of suitable land. Southeast Asian oil palm producers and South Asian staple crop producers are therefore particularly prominent. The second largest investor group, Asia, accounts for 21% of the total area acquired, 78% of which is for the cultivation of food crops. These observations highlight how strongly transboundary investment flows are influenced by domestic policies and market conditions. Thus, both supply and demand-side regulations are required.

4.4 Exploring policy options: What implications for REDD+?

The previous two sections suggest that long-term trends in population growth, higher consumer demand and, more recently, major shifts in global production, trade and technology are key to understanding the current dynamics of deforestation and forest degradation in tropical countries. To work effectively, REDD+ needs to tackle the forest-related effects of these trends and address economic drivers and policies in both consumer and producer countries, acknowledging that they manifest themselves differently in different regions. In general, these economic forces have increased pressure on the land to meet the growing demand for food, fibre and energy. This directly and indirectly places pressure on the forest margins, particularly in the tropics. Thus, in order for REDD+ policies to achieve their goals, pathways must be adopted that reduce pressures on forests, but support economic growth.

Because of the financial magnitude and volatile nature of the forces at play, we remain sceptical about the feasibility of overcoming the opportunity costs of REDD+ through financial offsets, such as PES-like schemes or carbon markets alone. There is growing recognition of the importance of regulations and institutions for effective law enforcement, clarification of tenure rights, land use planning and infrastructure development in producer countries.

While market-based approaches may work to some degree in cases where economic activities requiring deforestation bring limited profits, national-level regulatory approaches in producer countries will still be needed to rebalance the economic benefits associated with various land uses. Improved regulations in consumer countries could also complement initiatives from non-state actors, such as voluntary certification, and promote the consumption of commodities from sustainable sources as a way to reduce pressures on the forests. The equity implications of market-based and regulatory initiatives should be examined carefully, whether in producer or consumer countries.

REDD+ policies aim to contribute to a transition towards development that reconciles economic growth and forest conservation, but they face large challenges. To address these, we argue that a combination of state regulations and initiatives by non-state actors is required at both global and national levels. These policy actions need to be implemented on both supply and demand sides, in order to reduce deforestation and forest degradation more effectively. While these actions could be considered as part of REDD+ implementation, it is required to adopt a different paradigm of development, which prioritises low carbon goals based on supporting more sustainable and inclusive business models and policies.

On the supply side, policy actions could include the promotion of land-use optimisation from an economic, social and technological standpoint by: i) providing adequate compensation for forest-conserving and forest-expanding uses; ii) de-incentivising the clearing of forestlands in areas with high ecological value; and iii) incentivising increased production on non-forest lands, including degraded lands, as part of broader processes of agricultural intensification and support for smallholder agriculture. Different policy combinations could be adopted in order to achieve these aims (Angelsen 2010b). On the one hand, the rent from large-scale and extensive agriculture could be reduced by, for example, reforming land tenure or neglecting infrastructure development on new frontier lands. On the other hand, the rent derived from extractive or protective forest activities could be increased, either by supporting existing efforts of local forest users to manage their forests or by promoting markets through PES schemes.

Nonetheless, measures on the supply side only will not be sufficient to address pressures on forests. It is also necessary to address issues on the demand side. A number of policy actions could be widely adopted by major consumer countries, which should also involve emerging economies, given their increasing role in shaping global trade and consumption. Such actions include the adoption of regulations that support sustainable procurement policies, possibly linked to voluntary certification schemes, and accompanied by the removal of barriers that distort global trade. Governments and private actors also need to stimulate private and public financial institutions to adopt responsible investment policies in order to enhance the accountability of investors.

The policy options discussed here imply that REDD+ should be rethought as part of a broader institutional architecture, not only to reduce pressures on forests, but also to promote the development of more sustainable and equitable economies, which are able to combine goals of GHG emission reductions and adequate food and energy supply. Policy actions for enhancing governance and reducing the impacts of trade and investment should address both the supply and demand sides and involve efforts by producer and consumer countries, as well as combined initiatives by state and non-state actors. These efforts must be conceived as part of a broader process of economic transformation, which brings together the objectives of economic growth, poverty alleviation and forest conservation in the context of climate change.