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Africa will import—
not export—wood.



Morning at Seaport, Casablanca, Morocco

Africa will Import, not Export Wood

BACKGROUND AND THESIS

Africa has supplied the world with raw materials for centuries. Along with gold, diamonds, platinum, iron ore, salt, copper, coal, tea, coffee and, more recently, oil and gas, Africa has exported wood and wood products in large quantities, most notably in the form of tropical hardwood logs and pulp. With approximately 180 million hectares (ha) of tropical forests in the Congo Basin (the second largest rainforest in the world after the Amazon) and a globally significant area of arable land—about half of the world’s remaining undeveloped cultivable land—many believe Africa will potentially fill the growing gap between the world’s supply and demand for wood.

However, Global Environment Fund’s (GEF’s) close analysis of data from recent research suggests that Africa will increasingly become a large net importer of wood products, as opposed to a net exporter. Africa is now beginning to experience a wood supply crisis, particularly near population centers close to the coast. In addition to the implications for Africa itself, this development will have significant ramifications for wood markets elsewhere, including trade flows and pricing.

Global Environment Fund (GEF) is a global alternative asset manager with approximately \$1 billion in assets under management. Established in 1990, GEF has grown into one of the world’s most successful investment firms dedicated to the energy, environmental, and natural resources sectors.

GEF’s mission is to be the premier alternative asset management firm in the domain of energy, environment, and natural resources by delivering favorable risk-adjusted investment returns to our investors over multiple vintage years and through varied macroeconomic climates.

GEF was founded on the principle that well-deployed capital can bring significant improvements to the environment and quality of life throughout the world, and GEF’s success is a testament to that vision. GEF and its employees operate according to the highest standards of corporate governance, ethics, and sustainability.



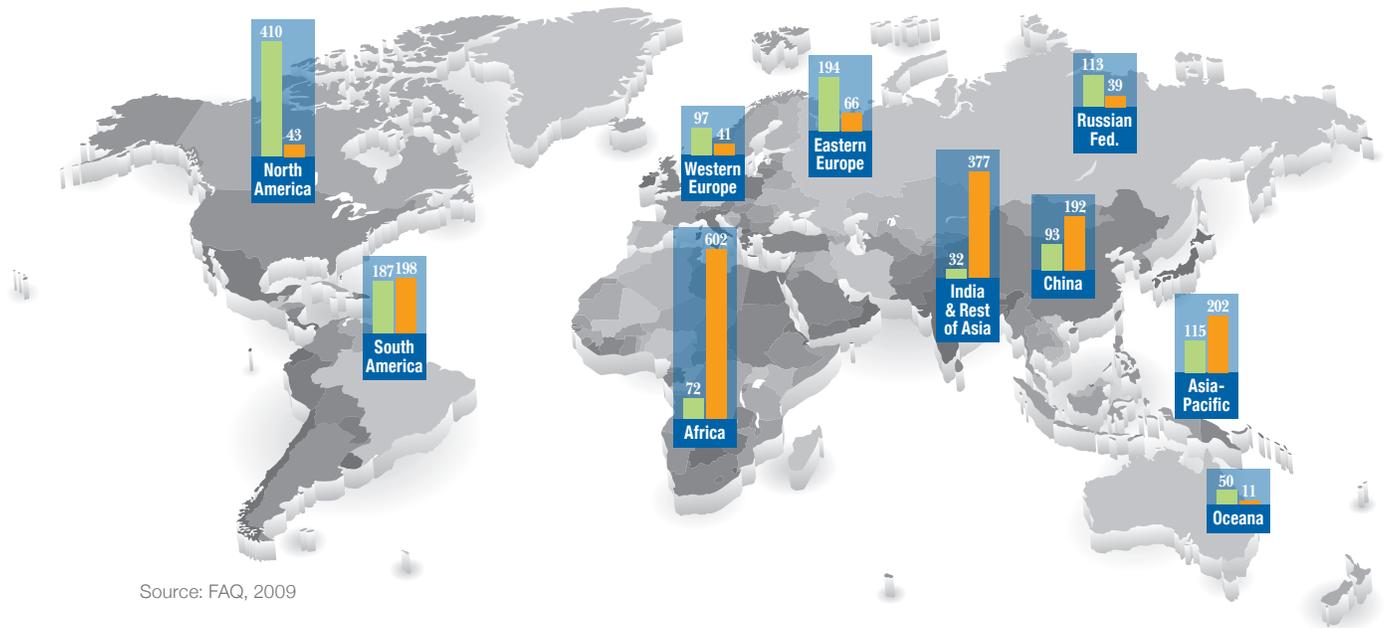
DEMAND

There are two major components to wood consumption in Africa, fuel wood and industrial round wood. Currently, the total consumption of wood in Africa is about 700 million cubic meters (m³) per year—with approximately 75 million m³ consumed for industrial wood products and the remaining 625 million m³ consumed for fuel wood. While demand for industrial wood in Africa is relatively small, making up only 5% of global industrial wood demand, when taken together with the consumption of fuel wood, the continent consumes more wood overall than any other region, including North America. In fact, as the exhibit below demonstrates, Africa accounts for more than one-fifth of the total 3.5 billion m³ annual global demand for wood.

Exhibit 1: Total Global Demand for Industrial and Fuel Wood

(million m³ wood)

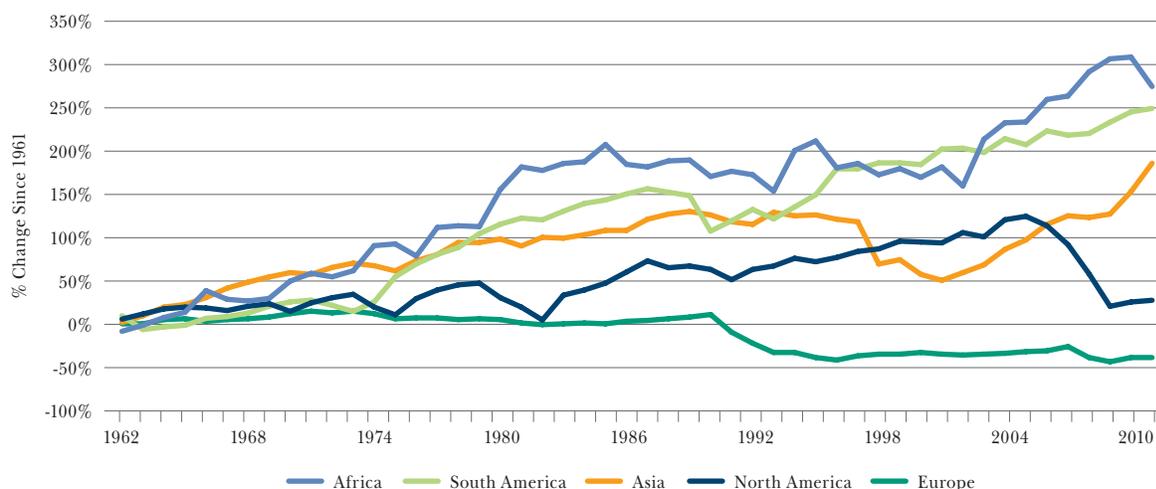
Industrial Wood Fuel Wood



Source: FAO, 2009

DEMAND FOR INDUSTRIAL WOOD: The consumption of sawn wood has grown faster in Africa than in other regions of the world during the past 50 years (as shown below in Exhibit 2). In general, population growth and economic development are the key drivers of wood demand, and since 2000 Africa has been the second fastest growing region in the world after emerging Asia.

Exhibit 2: Change in Global Consumption of Sawn Wood Products Since 1961

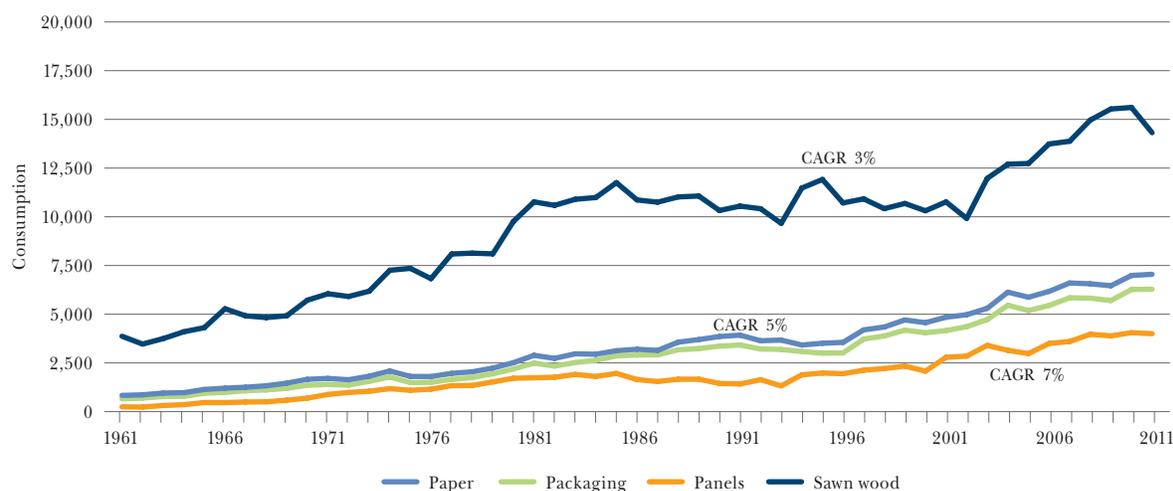


Source: Data from FAO—FORESTAT

Among the different industrial wood products, the growth in demand for paper, packaging and panels in Africa has been even stronger than the demand for sawn wood. African demand for forest products has been particularly robust during the last 12 years when its economies grew at a particularly strong rate.

Exhibit 3: Consumption of Forest Product in Africa (m³) Since 1961

(Sawn wood/Panels 000 m³, Paper/Packaging 000 tons)



Source: Data from FAO—FORESTAT

These population and economic growth rates in Africa are expected to continue for the foreseeable future. A recent global study by the consulting group Indufor projects demand for industrial wood in Africa to grow from 75 million m³ in 2010 to 300 million m³ by 2030, a compounded annual growth rate (CAGR) of 7.1%. In the study, Indufor also calculated a “worst case” scenario of 1.3% CAGR and a more optimistic scenario of CAGR 8.6%.¹ However, the 7.1% CAGR base-case scenario seems more reasonable for the following reasons:

¹ *Strategic Review on the Future of Forest Plantations*, Indufor, Helsinki, Finland, October 4, 2012. Report prepared for Forest Stewardship Council.

- The African middle class is growing rapidly, as Goldman Sachs recently reported on in detail.² This rise in incomes will cause demand for numerous wood products, such as housing and furniture, to take a marked upturn.
- McKinsey has reported that Africa is experiencing high urbanization rates,³ and this in turn will also increase demand for housing, furniture and infrastructure, with wood being an important structural component.
- Economic growth is leading to increased demand for industrial products such as utility poles for power lines, fencing and farm posts; timber to support mining operations; and pallets and crates for the transport of a broad range of agricultural and other products.

Based on our analysis, we expect a continued high growth rate for industrial wood in Africa.⁴

DEMAND FOR FUEL WOOD: According to the International Energy Agency (IEA), some 653 million Africans, or about 80% of all African households, relied on fuel wood as their main source of energy for basic needs such as heating and cooking in 2009. In rural areas, people use mostly small trees and branches for this fuel wood (also known as “green wood”).

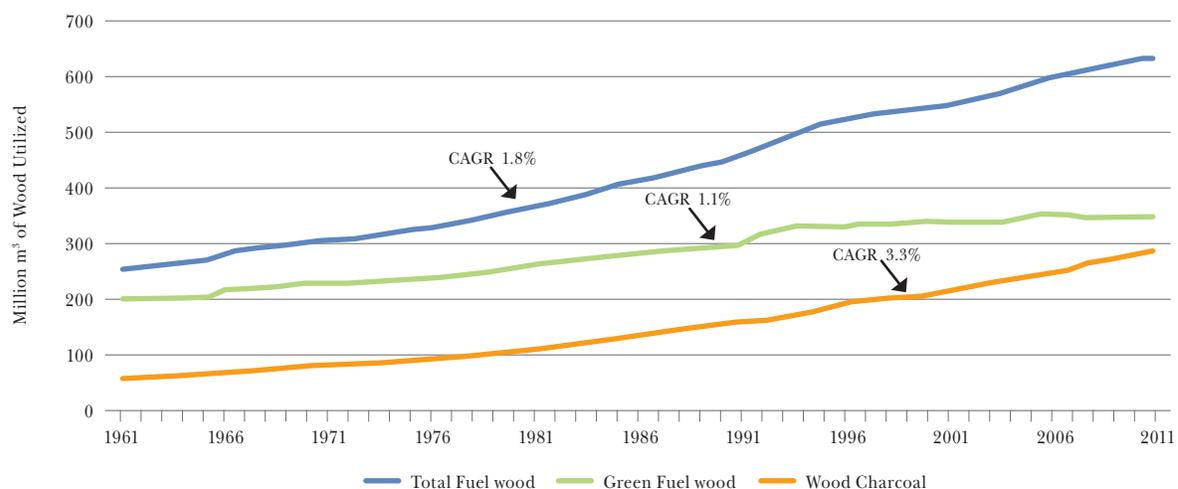
Because charcoal is lighter to transport than fuel wood, while delivering the same caloric benefit, it is often used for energy in urban areas. With Africa experiencing high urbanization rates averaging around 3% to 4% per year, the demand for charcoal is growing accordingly. The manufacturing and transport of charcoal is an enormous, but fragmented and mostly unregulated, business.

Recent studies by the World Bank and the European Union estimate that the charcoal industry makes up 2% to 3% of the GDP in some African countries, including Tanzania and Uganda.⁵ Charcoal is created by putting harvested trees through the process of pyrolysis, which extracts water and certain other organic matter from wood through slow burning. In most cases, the wood is placed in soil-covered mounds to create an anaerobic environment. From start to finish, this process is very energy inefficient—from the unsustainable harvesting of wood in the forest through the value chain to manufacturing, transporting and ultimately cooking a meal in town.

As shown in Exhibit 4, overall fuel wood consumption in Africa has grown steadily with a compounded rate of 1.8% during the past 50 years.

Exhibit 4: Historical Fuel Wood Usage in Sub-Saharan Africa Since 1961

(Charcoal converted at 10 m³ per ton)



Source: FAO—FORESTAT

² O'Neill, Jim. *How Exciting is Africa's Potential*. Goldman Sachs Asset Management. Goldman Sachs, Oct. 4, 2010. Web. Apr. 18, 2011.

³ Collier, Paul. *The case for investing in Africa*. McKinsey. N.p., n.d. Web. May 9, 2011.

⁴ For the purpose of this analysis we have adopted the Indufor medium scenario with a 7.1% CAGR up through 2030.

⁵ *Renewable Energies in Africa*, Joint Research Center, European Commission, 2011.



IEA projects that by 2030, 918 million people in sub-Saharan Africa will rely on biomass energy—equal to one-third of the total global population relying on biomass energy...

Eucalyptus nursery, Mpumalanga, South Africa

Note that charcoal usage in Africa has grown at a CAGR of 3.3% during the last 50 years and is accelerating due to urbanization. In addition, because the conversion of wood to charcoal is so inefficient, a great deal of wood is required, often using 10 tons of wood to create one ton of charcoal.

Millions of families in other parts of the developing world, including India and China, also rely on biomass as their primary energy source. However, while the number of people in developing Asia who rely on biomass is falling, the number in Africa is going up. While the share of households in Africa relying on biomass energy is expected to decline from 80% to 70% by 2030, the overall consumption is expected to rise due to the population growth in Africa. IEA projects that by 2030, 918 million people in sub-Saharan Africa will rely on biomass energy—equal to one-third of the total global population relying on biomass energy, and up from 653 million people in 2009. The table below summarizes these projections.

Exhibit 5: Biomass as a Source of Cooking Fuel Globally

Millions of People Relying on the Traditional Use of Biomass as Their Primary Cooking Fuel

Region	2009 (Actual)			2015	2030	Share of Population on Biomass		
	Rural	Urban	Total	Total	Total	2009	2015	2030
Africa	481	176	657	745	922	67%	65%	61%
Sub-Saharan Africa	477	176	653	741	918	80%	77%	70%
Developing Asia	1,694	243	1,937	1,944	1,769	55%	51%	42%
China	377	47	423	393	280	32%	28%	19%
India	765	90	855	863	780	75%	69%	54%
Other Asia	553	106	659	688	709	63%	60%	52%
Latin America	60	24	85	85	79	18%	17%	14%
Developing Countries*	2,235	444	2,679	2,774	2,770	54%	51%	44%
World**	2,235	444	2,679	2,774	2,770	40%	38%	34%
Africa in % of World	22%	40%	25%	27%	33%			

*Includes Middle East countries.

**Includes OECD and transition economies.

Source: *Energy and Poverty*, Special early excerpt from World Energy Outlook 2010, International Energy Agency.



Eucalyptus sawlogs, Mpumalanga, South Africa



Eucalyptus plantation, Swaziland



Kilombero Valley Teak Company, Morogoro Region, Tanzania

With the continued deforestation and forest degradation in Africa, particularly near population centers, charcoal producers have to move farther and farther from cities and towns to find wood. As a result, the price of charcoal in Africa has increased significantly during the last several years. The Joint Research Center of the EU reported that the charcoal price in Uganda has tripled during the last three years, and the World Bank reports similar price increases in Tanzania.⁶ GEF’s survey of charcoal prices in Ghana and Nigeria has also found prices moving significantly upward.

Factoring the higher growth rate and conversion inefficiency for charcoal, as well as IEA’s projected 1.6% CAGR of the number of Africans relying on biomass energy in Africa, GEF projects the overall rate of consumption of fuel wood in Africa to grow at a CAGR of 1.7%. This is consistent with the overall historical growth rate of 1.8%. In fact, we believe it is a conservative projection for the following reasons:

- The reported charcoal consumption levels used in the FAO numbers—which is based on data collected and reported by individual governments—are likely to be significantly lower than actual charcoal consumption levels. The Joint Research Centre of the United Nations estimated that the actual consumption of charcoal may be as much as four times the reported consumption levels.⁷
- While we have accounted for the low conversion efficiency of charcoal manufacturing, we have used a conservative rate for the penetration level of charcoal relative to the use of green firewood. Beyond the rapidly urbanizing areas, charcoal is also becoming more popular in rural areas of Africa.
- The price elasticity in the demand for fuel wood is low. People need to cook their food, and there are few better alternatives for much of Africa. Thus, the demand for fuel wood is closely related to population growth and demographics, in turn providing good visibility into demand levels for the next decade or two.

Overall, when combining the projected demand for industrial wood and fuel wood in Africa, GEF estimates a growth rate of 2.6% per year from now until 2030, as shown in the following graph. The total consumption of wood is expected to increase from a current level of about 700 million m³ to nearly 1,200 million m³ by 2030.⁸

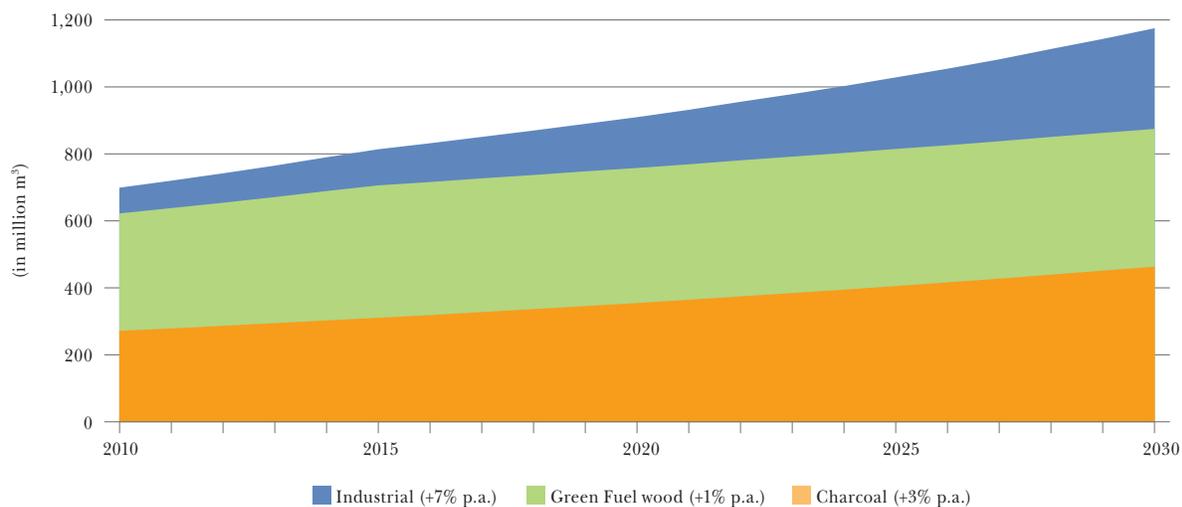
⁶ *Renewable Energies in Africa*, Joint Research Center, European Commission, 2011.

⁷ *Ibid.*

⁸ Note that this is a “steady state” base-case scenario for African demand, without significant new demand from large industrial biomass energy applications and/or exports.

Exhibit 6: African Wood Demand

Estimated Total CAGR = 2.6% p.a.



Source: GEF Analysis.

The demand for charcoal in Africa is growing even faster than the demand for “green fuel wood” due to the steady rate of urbanization taking place across the continent. The total demand for fuel wood is projected to approach 900 million m³ in 2030, with charcoal surpassing green fuel wood as the largest sub-category around 2025.

Growth in overall demand of 2.6% per year might not seem particularly high; however, when viewed in comparison to the stagnant sustainable supply of wood in Africa, an alarming picture emerges.

SUPPLY

Where will all the wood that Africa needs come from? There are three possible sources:

1. Natural forests (sustainably and unsustainably harvested)
2. Forest plantations
3. Net imports

NATURAL FORESTS: Africa has 675 million ha of natural forests, equal to about 17% of total land area. Most of the natural forests in Africa are located in the moist tropical forest regions of the Congo Basin, spanning the Democratic Republic of Congo, Brazzaville Congo, the Central African Republic, Cameroon, Gabon, and Equatorial Guinea.

GEF estimates that about 93.5% of Africa’s wood consumption, or over 650 million m³ per year, is sourced from these natural forests. Practically all the wood used for fuel and about half of the wood used in industry comes from natural forests. The growth rate of African natural forests is just enough to replace what is today harvested by supplying some 675 million m³ per year (about 1.0 m³ per ha per year). However, there is a significant dislocation problem; demand will be in urbanized areas where population is expanding rapidly, while the natural forests are located far from these areas, with most in the far away Congo Basin. In addition, conflicts and a lack of transport infrastructure in the Congo Basin will continue to protect much of its wood from harvesting.

Africa’s rate of deforestation and degradation—currently about 3.5 million ha per year—will likely not be reduced by any significant amount in the next two decades. After “slash and burn” conversion of forests to small-scale agriculture, fuel wood—particularly charcoal manufacturing—is the second largest source of deforestation in Africa. Inevitably, much of the fuel wood will continue to be unsustainably harvested, causing persistent deforestation and forest degradation, especially around coastal urban centers. Deforestation spreads much like growing concentric circles around the cities as they grow and new areas urbanize.

For the purpose of this analysis, we are categorizing 250 million m³ as unsustainably harvested out of the 650 million m³ currently harvested in Africa's natural forests. However, in reality, the amount of unsustainably harvested wood is probably even higher. Regardless of the exact amount, it is clear that rapid urbanization will lead to wood shortages and higher prices of charcoal and other wood products in the near term. Anecdotal evidence has convinced GEF that significant wood shortages will start to appear in many African cities within the next 10 years.

FOREST PLANTATIONS: GEF's analysis shows that the amount of land in forest plantations in Africa is significantly lower even than official estimates would indicate. The FAO estimates that there are more than 12 million ha of total forest plantations in Africa, an amount that includes both industrial plantations and plantations for environmental and protective purposes. However, recent surveys by forest experts indicate that the total amount is far smaller. Industrial forest plantations alone cover only 4 million to 5 million ha, split evenly between private and government ownership.⁹ About 1.3 million ha, or 20% to 25% of this total, representing Africa's highest quality industrial plantations, are located in South Africa.

GEF estimates the total annual production from Africa's plantations to be about 46 million m³, of which approximately 40%, or 18 million m³, is harvested in South Africa.¹⁰ 11 million m³ of wood harvested from South African plantations is processed and exported as pulp and wood chips. The remaining 35 million m³ meets less than one half of the 75 million m³ demand for industrial wood in Africa. Despite relatively low productivity of African forestry plantations¹¹ compared to plantations in other parts of the world, they nonetheless produce about 10 times the sustainable harvest of that derived from natural forests on a per hectare basis. The table below summarizes GEF's estimates.

Exhibit 7: Natural Forest and Plantation Area in Africa

Natural Forests vs. Plantations in Africa

Industrial Plantations (Condition)	Area			Production/Harvesting		
	(1,000 ha)	in %	in %	m³/ha/yr	Mill m³	Output (%)
Good quality	1,384	36.4%	0.2%	14	19	2.8%
Fair quality	1,113	29.3%	0.2%	12	13	1.9%
Poor quality	1,304	34.3%	0.2%	10	13	1.9%
Total Plantations	3,802	100.0%	0.6%	12	46	6.5%
<i>Natural forests*</i>	<i>674,419</i>	<i>—</i>	<i>99.4%</i>	<i>1.0</i>	<i>654</i>	<i>93.5%</i>
<i>Total (Natural & Plantations)</i>	<i>678,221</i>	<i>—</i>	<i>100.0%</i>	<i>1.03</i>	<i>700</i>	<i>100.0%</i>

*Deforestation rate in Africa ~3.5 million ha per year equal to ~0.5%/year.
Source: GEF analysis.

Over the next two decades, the supply gap from industrial plantations in Africa will most likely be larger than in the past. As noted in Exhibit 6, the expected CAGR in demand for industrial wood is about 7% through 2030. In contrast, the CAGR of wood from the establishment of new plantations is expected to be only about 1%, equivalent to about 40,000 to 50,000 ha per year, according to a recent Indufor survey.¹² Why is the establishment rate for new (greenfield) plantations in Africa so low? In short, because such greenfield projects are difficult. There are large, fertile and underdeveloped land areas suitable for forest plantations, but private investors have not committed significant amounts of money to African timberland investments because of real and perceived risks associated with land tenure and sensitivities about communities and conversions.

In the cases where developers have begun greenfield plantations, it will take many years before wood is ready to be harvested. Because of this lag, the supply of plantation-grown wood can be estimated up through the year 2030. While the establishment of greenfield plantations is expected to be only around 1%

⁹ Pöyry (2011), Indufor (2012) and RISI (2012).

¹⁰ The relatively low average productivity from African plantations is due to the fact that about half of the plantations are government owned and generally in poor quality.

¹¹ African plantations have mean annual increments of 10-12 m³/ha/year.

¹² *Strategic Review on the Future of Forest Plantations*, Indufor, Helsinki, Finland, October 4, 2012. Report prepared for Forest Stewardship Council.

GEF expects that the growing supply gap will be met by global wood imports.

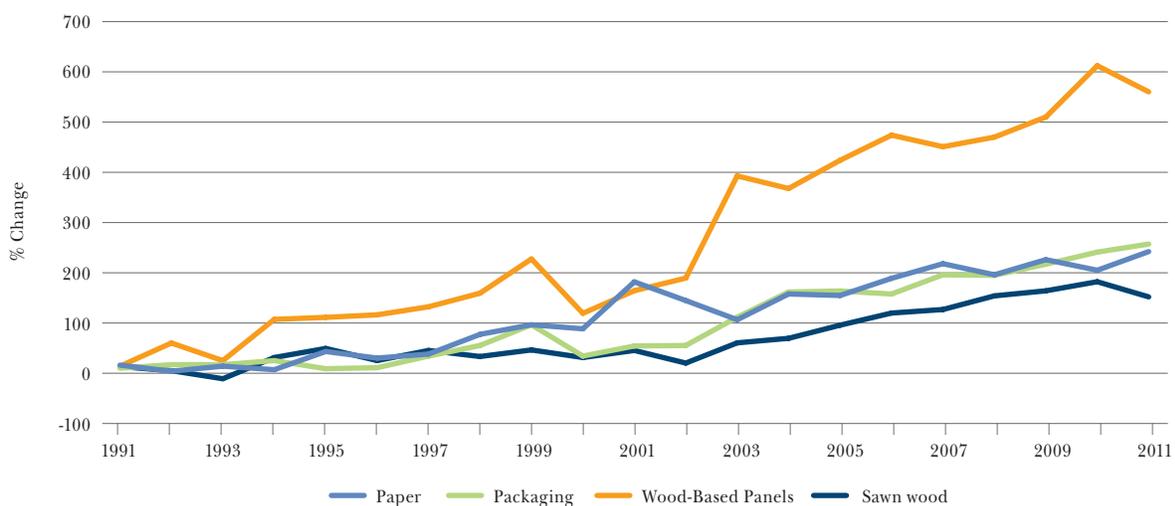
Eucalyptus plantation, Piggs Peak, Swaziland

per year, we have assumed the existing plantations will manage a 2% per year productivity improvement due to better plant material, silviculture practices and forest management in general. As a result, we project Africa to have a 3% overall growth in supply of wood from industrial plantations.

NET IMPORTS: Any demand for wood in Africa not covered by harvests from the African natural forests and forest plantations will have to be imported. Given demand for industrial wood growing from 77 million m³ today to 300 million m³ in 2030, and supply growing from 46 million m³ to 81 million m³ during the same period, forest plantations in Africa will only be able to supply less than 25% of the industrial demand, down from about 50% today. In reality, even 25% might be on the optimistic side since many of the 2 million ha plantations owned by various Africa governments are poorly managed, and may be subjected to deforestation.

GEF expects that the growing supply gap will be met by global wood imports. As shown in Exhibit 8, import levels of forest products into Africa have already been increasing in recent years.

Exhibit 8: Imports of Forest Products into Africa—% Change Since 1961



Source: Data from FAO-FORESTAT



Kilombero Valley Teak Company, Morogoro Region, Tanzania



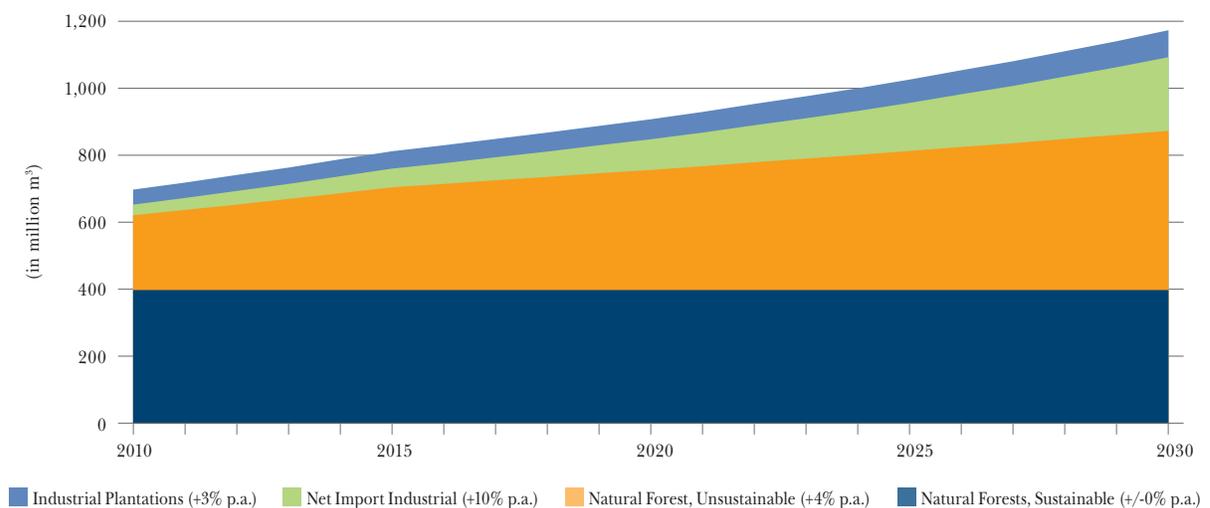
Kilombero Valley Teak Company, Morogoro Region, Tanzania

Recent increases in regional trade suggest that part of the supply of industrial wood will be met by African countries with an abundance of natural forests. However, the steady increase in forest product imports over the past several decades suggests that most of the additional demand for industrial wood will come from overseas imports.

The graph below shows where GEF projects Africa's wood supply will originate from over the period 2010 to 2030. Note that the two sources with the highest growth rates are imports (with a CAGR of 10%) and unsustainable harvesting in the natural forests (with a CAGR of 4%).

Exhibit 9: African Wood Supply Projections

How will the supply gap be filled?



As a result, we see limited opportunity for Africa to significantly increase its supply of wood exports to the Asian economic powers, China and India, or to Europe for pellets and other biomass energy applications over the next two decades. Instead we expect that Africa will increasingly be a net importer of wood products. Africa will continue to supply global markets with high-value African tropical hardwood species and pulp from South Africa, but a portion of that will start to be traded within regions on the African continent. Put simply, Africa will need the wood it can sustainably harvest for its own consumption.



Kilombero Valley Teak Company, Morogoro Region, Tanzania



Pine plantation, Jonkershoek, South Africa

CONCLUSIONS

Although estimations of the demand-supply balance for wood in Africa are hampered by limited and unreliable data, GEF believes that the trajectory of demand and supply that this paper presents is both realistic and striking.

There are several important conclusions and implications:

1. Demand for wood in Africa will continue to grow significantly faster than sustainable supply.
2. Implications:
 - a. Unsustainable harvesting will continue to fill part of the gap (as it has for the past several decades).
 - b. Imports are likely to continue to grow rapidly to fill the remaining gap (as they have for the past several decades).
 - c. Prices for wood and wood products will continue to climb. Ultimately prices will be capped by import parity pricing (as anecdotal evidence has already shown).

While there are certain significant events that could cause large deviations from the demand and supply volumes projected in this paper, it is unlikely that any of the factors could significantly alter the overall demand-supply trajectory for wood in Africa during this decade and the next.¹³

GEF'S POSITIVE VISION FOR AFRICA'S FORESTRY RESOURCES

Amid this somber conclusion, GEF has a positive vision in which Africa better manages its vast, yet declining, forest assets. Instead of the negative developments described here being inevitable, we believe that fundamental, countervailing factors will emerge and start mitigating the wood shortages in the long term.

Most importantly, the prices of wood and wood products will go up across the African continent. While broad-based historical price data are not available, ample anecdotal evidence of rapid price increases in wood products in Africa exists. Higher wood prices will eventually stimulate supply by convincing global timberland investors to invest and the local community to support and participate in this investment. Communities will be incentivized, and in some cases even forced, to find sustainable solutions to fuel wood shortages by establishing their own woodlots as self-sustained firewood resources. Higher prices will also

¹³ Some of the events that could cause significant deviations from the estimates projected in this paper are: 1) Large-scale conversion from use of charcoal in urban areas to cooking with gas, 2) Faster establishment of plantations and/or higher acceleration in the productivity of plantations, 3) Better infrastructure to be able to sustainably harvest more wood in the Congo Basin, and 4) Dramatically lower birth rates and/or higher death rates.



Kilombero Valley Teak Company, Morogoro Region, Tanzania

Pine plantation, Cape Pine, Tsitsikamma, South Africa

improve waste management, forcing more efficient harvesting in the forests and plantations and continuing through the value chain to the end-user, with more efficient cooking stoves as an example. GEF has already experienced a doubling of prices for waste wood over the last four years in Swaziland and South Africa, partially driven by the demand for biomass energy. To some extent, we are already seeing many of these dynamic changes across Africa. Ultimately, both local and international investors will be more likely to invest in new forest plantations, increasing long-run supply.

International and local political pressure on environmental, social and governance matters will all have a positive impact on the sustainably managed African forestry assets. As examples, the increasing demand for Forest Stewardship Council (FSC) certification, traceability of legal wood (Forest Law Enforcement, Government and Trade of FLEGT), sustainable forest management practices, and the ban on export of unprocessed logs will limit access to key global markets, giving sustainable forest management premium market access over competing unsustainably sourced wood.

With the demand-supply crunch and the premium for sustainable wood, GEF believes that timberland ownership based on sustainable forest management practices will yield attractive risk-adjusted returns to investors in the near future. At such time, new investors will be attracted, deploying significant long-term private capital to own, manage and further develop forestry assets in Africa.

Africa represents the last frontier for timberland investors. Only about 1% of global investments in timberland are in Africa, despite the fact that Africa is playing a much larger role in the global wood fiber balance, with 5% of industrial demand and over 20% of total wood consumption. Global timberland investors have expanded in recent years from North America and Europe to New Zealand, Australia, South America, Asia and Eastern Europe. The next and last frontier is Africa.

GEF's positive vision is grounded in the firm's successful experiences managing sustainable timberland plantations and natural forests in Africa, followed by a rapid scaling of the activities for the benefit of all stakeholders. As Jeremy Grantham predicted in April 2011, the world will increasingly face shortages and higher prices for resources such as timber.¹⁴ When it comes to timber, one way or another, the developments in Africa will have a significant impact on the rest of the world.

¹⁴ Jeremy Grantham, *Time to Wake Up: Days of Abundant Resources and Falling Prices Are Over Forever*, GMO Quarterly Letter, GMO, April 2011.

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Pine harvesting operation, Cape Pine, Outeniqua, South Africa



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