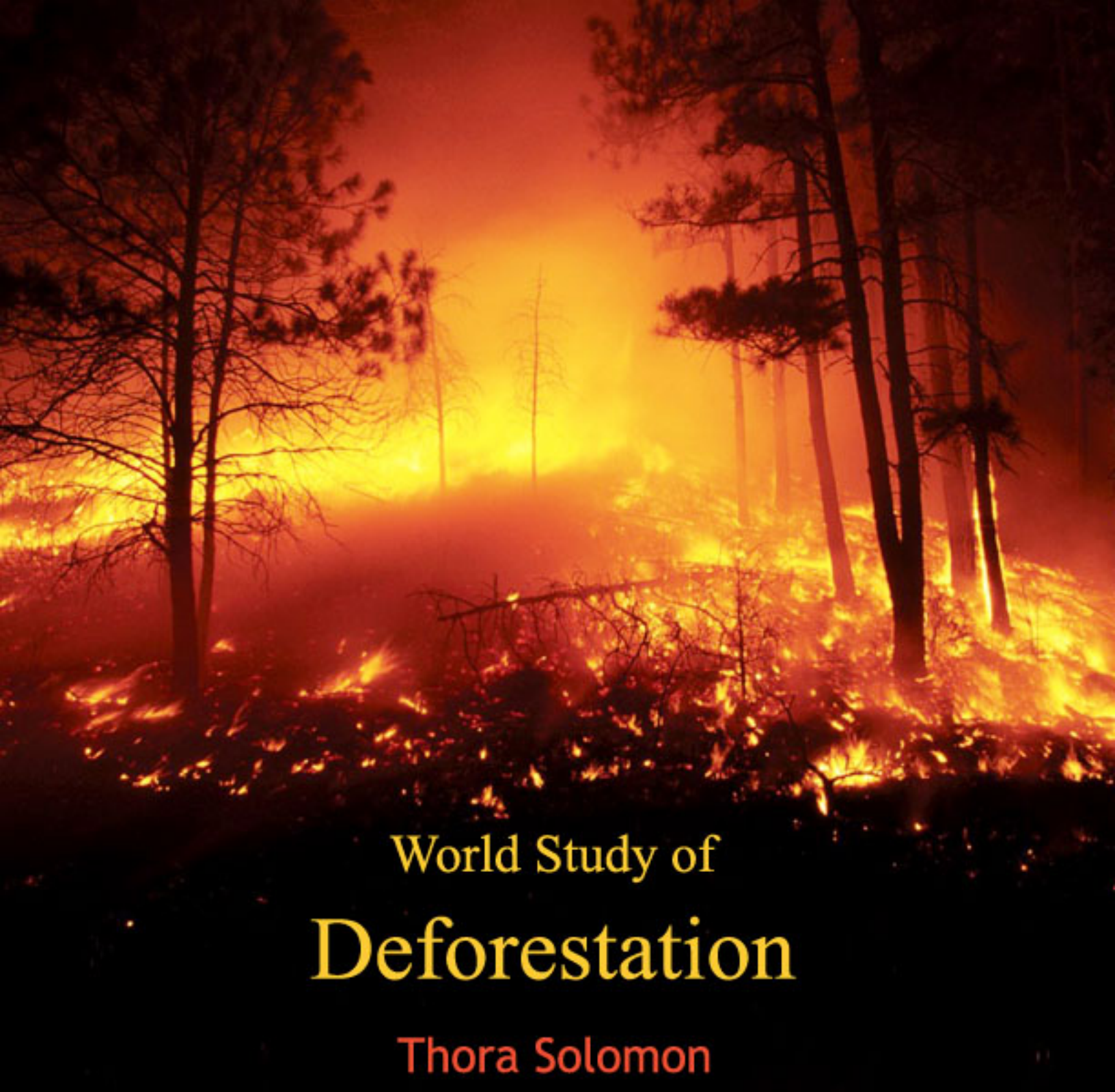

World Study of Deforestation

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Deforestation in Madagascar

Deforestation in **Madagascar** is an ongoing environmental issue.

Deforestation with resulting desertification, water resource degradation and soil loss has affected approximately 94% of Madagascar's previously biologically productive lands. Since the arrival of humans 2000 years ago, Madagascar has lost more than 90% of its original forest. Most of this loss has occurred since independence from the French and is the result of local people using slash-and-burn agricultural practices as they try to subsist. Largely due to deforestation, the country is currently unable to provide adequate food, fresh water and sanitation for its fast growing population.

Primary causes of forest loss include slash-and-burn for agricultural land (a practice known locally as *tavy*) and for pasture, selective logging for precious woods or construction material, the collection of fuel wood (including charcoal production) and forest clearing for mining.

Illegal logging

Illegal logging in **Madagascar** has been a problem for decades and is perpetuated by extreme poverty and government corruption. Often taking the form of selective logging, the trade has been driven by high international demand for expensive, fine-grained lumber such as rosewood and ebony. Historically, logging and exporting in Madagascar have been regulated by the Malagasy government, although the logging of rare hardwoods was explicitly banned from protected areas in 2000. Since then, government orders and memos have intermittently alternated between permitting and banning exports of precious woods. The most commonly cited reason for permitting exports is to salvage valuable wood from cyclone damage, although this reasoning has come under heavy scrutiny. This oscillating availability of Malagasy rosewood and other precious woods has created a market of rising and falling prices, allowing traders or "timber barons" to stockpile illegally sourced logs during periodic bans and then flood the market when the trade windows open and prices are high.

The unsustainable exploitation of these tropical hardwoods, particularly rosewood from the SAVA Region, has escalated significantly since the start of the 2009 Malagasy political crisis. Thousands of poorly paid Malagasy loggers have flooded into the national parks—especially in the northeast—building roads, setting up logging camps and cutting down even the most difficult to reach rosewood trees. Illegal activities are openly

flaunted, armed militia have descended upon local villages and a rosewood mafia easily bribe government officials, buying export permits with ease. These illegal operations are funded in part by advance payments for future shipments (financed by Chinese expatriates and Chinese importers) and by loans from large, international banks. Demand is fueled mostly by a growing Chinese middle class and their desire for exotic imperial-style furniture. European and American demand for high-end musical instruments and furniture have also played a role. However, public scrutiny has put significant pressure on shipping companies involved in the trade and the United States is starting to enforce the Lacey Act by investigating companies with suspected involvement in the illegal trade of Malagasy precious woods.

Rosewood is illegally logged from Masoala and Marojejy national parks, with the heaviest exploitation occurring after the 2009 political crisis.

Logging in Madagascar's tropical rainforests has had many secondary effects, beyond the risk of depletion of rare, endemic trees. Habitat has been disturbed, illegal mining has begun, local people have turned in desperation to the forests for resources and poaching of endangered wildlife has escalated. Lemurs, the most well-known faunal group from the island, have been captured for the exotic pet trade as well as killed for food. Even the most critically endangered species have been targeted, primarily to feed a growing demand for delicacy food in up-scale restaurants. The local villagers have also suffered as tourism has declined sharply or ceased almost entirely. Some have resorted to working as loggers for minimal pay, while others have spoken out against it, often receiving death threats from the rosewood mafia in return.

History

With its dilapidated infrastructure and inadequate health care and education systems, Madagascar is one of the poorest countries in the world. With the lack of jobs being created by the formal economy, a large informal economy has developed to accommodate. One of the most significant components of this economy has been illegal logging, particularly of the valuable, dense, hardwoods known as rosewood and ebony.

Rosewood (of the family Leguminosae) generally has a deep, lustrous red coloration, whereas ebony (of the family Ebenaceae) has a dark, heavy fine wood grain. Malagasy rosewoods include *Dalbergia baronii*, *D. louvelii* and the "palissandre wood" *D. madagascariensis* (which lacks the distinctive red coloration). These rare, endemic species are mainly found in the SAVA Region and the Makira-Masoala Landscape of Madagascar. Although rosewood species from other countries have traditionally been used for high-class musical instruments and furniture, these sources have been depleted, leaving Madagascar as one of the leading sources. Ebony, on the other hand, belongs to the large mostly tropical genus *Diospyros*. The rare, endemic ebony species of Madagascar grow primarily in the northwestern part of Madagascar, but some also grow in Marojejy and Masoala national parks. Both species are slow growing and take as much as 300 years or more to reach maturity.

Rosewood removed from Marojejy National Park by waterway in 2005

The use of these rare hardwoods by local people is limited and sustainable, unlike the unsustainable exploitation from illegal and government-approved logging for international markets. The logging of rosewoods and ebonies in Madagascar can be traced back more than twenty years prior to the 2009 Malagasy political crisis. Until recently, the island's forests had not experienced the levels of intense logging seen in countries like Malaysia or Indonesia due to its smaller trees, challenging terrain and national policies favoring locally controlled, small-scale operations. Forestry laws have been in place since at least the 1960s and commercial logging has been regulated by the state. For decades, artisanal loggers have extracted high-value trees from most remaining forests on the island. Between 1974 and 1980, logging was permitted in the northern section of the Zombitse protected area. In the 1970s, a logging company received permission from the state to selectively harvest precious hardwoods from Ihera Classified Forest, which continued legally until all trees of commercially valuable size had become rare. However, illegal logging began when local leaders manipulated the remaining loggers to continue the extracting on a smaller scale for their own benefit.

The unauthorized logging of these precious woods was banned from sensitive regions (such as national parks) and their adjoining areas in November 2000 with the passing of Order 12704/2000. The law was subsequently amended repeatedly, with orders and memorandums oscillating between permission and bans for the export of logs, semi-finished wood (i.e. planks) and/or finished wood (i.e. furniture) and one, Inter-ministerial Order 16030/2006 (September 2006), reiterating the explicit ban on logging. Conservation groups challenged that none of these held precedence over the original order in 2000, but merely "lend a pretext of legality" to the export of illegally logged precious woods and view all recent logging and exports as criminal offenses. So far, operators have only been fined, wood has rarely been confiscated, exports have been permitted and logging has accelerated, especially near the end of the decade.

Hardwoods are still being harvested from protected areas across the island and exported from most of Madagascar's ports. The most significant activity has been occurring in the SAVA Region and particularly in Masoala National Park and the eastern and northeastern portions of Marojejy National Park—both part of the Rainforests of the Atsinanana, a World Heritage Site. The terrain in both parks is very rugged and with only one park ranger per 100 square kilometers (39 sq mi), it is impossible to fend off the loggers. The parks are being targeted because all the rare rosewoods and ebonies outside of Masoala and Marojejy national parks have already been logged.

Thousands of workers may be involved in the logging and transporting, especially since the 2009 political crisis, yet the logging and export is orchestrated by only a few dozen powerful "Timber Barons," a group of exporters who are some of the wealthiest Malagasy citizens and therefore strongly influence regional and national politics. These include, but are not limited to:

- Jeannot Ranjanoro, president of the National Group of Vanilla Exporters
- Eugene Sam Som Miock, Madagascar's largest lychee exporter
- Jean Paul Rakoto, who has ties to former President Didier Ratsiraka

- Martin Bematana, a former member of parliament
- Christian Claude Bezokiny, owner of the Hôtel Hazavola in Antalaha

These exporters are supplied by a regional network of collectors and subcollectors, which procures the wood and transports it from the protected forests to the nearest major port, all through the paid labor of teams of young local men who receive between 5,000 and 10,000 ariary, or around US$2.50 to $5.00 per day. This income, which is sometimes not paid, is equivalent to less than 2% of the export value of the 200–900 kg (440–2,000 lb) logs they cut and transport. A report by the Environmental Investigation Agency (EIA) and Global Witness estimated that 200 rosewood trees were being cut down a day in 2009. With prices at around $3000 per cubic meter or $11 per kilogram, the wood was worth nearly ten times as much as oak or maple.

The work is done with hand axes and rope, often in remote corners of the forest. The trees are felled and cut into 1–2 metres (3.3–6.6 ft) logs, or *bola-bola* and dragged for miles to the nearest river, where they are tied into bundles and floated downstream on rafts made of four or five lighter logs. From there, they are transported by truck to a nearby port, such as Antalaha and Vohémar. The work is strenuous and very dangerous. Once out of the parks, the logs are transported to open yards or hidden locations in and around Antalaha and Vohémar. Sometimes logs are hidden beneath vanilla or buried under gardens, houses, beaches, or in riverbeds. In October 2009, a cache of rosewood was discovered during a raid of Tiko headquarters, a company owned by former president Marc Ravalomanana.

Local poverty and the extremely high value of rosewood have driven the local people to violate their local taboos, or *fady*, by cutting down these trees they hold to be sacred. The Deputy Director of Prevention at the Independent Anti-Corruption Office (BIANCO) cites the sharp fall of vanilla prices in mid-2008 (the local cash crop fell from $230 per kilo to $25 per kilo between 2003 and 2005.), the cutting of conservation funding following the political coup in January 2009 and an increased interest in rosewood from mostly Chinese buyers as major factors behind the explosive surge in illegal harvesting of rosewoods. He reported that before this, in 2008, the illegal logging and export of rosewood had been halted.

Illegal rosewood stockpiles in and around Antalaha and Vohémar

Stockpile in Antalaha (2005)

Stockpile in Antalaha (2007)

Stockpile in Antalaha (2008)

Stockpile in Antalaha (2009)

Cyclical exports and cyclone damage

Following the bans in 2000 and 2006, exports were restricted to finished or semi-finished products, such as handicrafts. However, exceptions have been made following cyclones that frequently ravage the island's east coast. The export of trees felled by cyclones is permitted, opening a loophole since the government never inventories downed trees. Thus, the timber barons export logs that have been harvested previously, claiming they were a result of storm damage—a technique historically employed by loggers in the United States and elsewhere. The high density of rosewood prevents them from blowing over in cyclones, leading environmental activists to believe the only purpose is to facilitate illegal logging.

Inter-ministerial Order 17939/2004 was passed in September 2004, following Cyclone Gafilo in March, which cleared the way for export of new and existing stocks of rosewood as "salvage." This created anarchy in the national parks in the SAVA Region, with loggers extracting a large amounts of rosewood and ebony, grossly disproportionate to the amount of damage caused by the cyclone. During this time, Marojejy National Park reported that with the granting of export rights, logging in the park had resumed. It wasn't until 2006, with the passing of Inter-ministerial Order 16030/2006, that the export ban

was reinstated, nearly two years after the storm, but not before the exporters lobbied the government for an extension "following the grievances expressed by operators" in October 2005, per Memorandum 923/05. Exports were also authorized following cyclones in 2006 and 2007, encouraging the stockpiling of large quantities of lumber in both legal depots and hidden caches around the ports of Vohémar and Antalaha.

These oscillating bans and authorizations for export have created wave-like market of rising and falling prices for rosewood. During times of stricter control, prices rise considerably while illegally harvested wood is stockpiled in anticipation of future authorizations. When restrictions are removed, large quantities of rosewood are dumped on the market, bringing massive profits for traders before causing a rapid fall in prices. During the intervals between exports, the wood traders, who are also vanilla traders, use the relatively steady income from vanilla exports to fund the extraction of the illegal wood.

Cyclones have precipitated illegal rosewood logging in other ways. When Cyclone Hudah hit the island in April 2000, affecting 50,000 people, it exacerbated local poverty. Its devastating effects, later coupled with the downturn in the vanilla market, drove the local people to increase their slash and burn agriculture (called *tavy*), the use of bushmeat and the logging of precious hardwoods.

Effects of the 2009 political crisis

Stump of illegally logged rosewood from Marojejy National Park, Madagascar

In late January 2009, increasing political protests led by the mayor of Antananarivo Andry Rajoelina destabilized the Malagasy government. With the backing of the military, former President Ravalomanan was removed from office on March 18 and power was handed power over to Rajoelina, making him the President of the High Transitional Authority of Madagascar. This drew sharp criticism from the international community and resulted in a sharp cut in foreign assistance from donor countries. Foreign embassies also discouraged their citizens from visiting the country, causing a sharp drop in ecotourism—a critical part of the economy. Coupled with a recent crash in vanilla prices, this has left an already impoverished Malagasy government and economy in an even more desperate state, especially since communities living within the vicinity of the national parks receive half of the park entrance fees. This set the stage for profitable, illegal activities. To meet the surge in demand for Malagasy rosewood, illegal logging of rosewood surged in the SAVA Region, or northeast corner of the island, including Marojejy and Masoala national parks, starting around the time of the first political protests.

On January 19, just before the beginning of the riots, the export of precious woods, which had been stockpiled for the past two years, was once again allowed. This permitted the sale of 500,000 logs of rosewood, ebony and palissandre, along with many more logs that appeared from hidden caches, thus increasing the pressure for renewed logging. When riots and looting broke out in Antalaha on January 27 and 28, the rosewood mafia recovered an estimated 500 metric tons (500,000 kg) of previously seized logs from the Water and Forests Headquarters. Armed militia backed by foreign profiteers (primarily from China) descended on local villages and began soliciting workers for logging, issuing death threats for villages who opposed them. As a result, the people who had once relied on tourism were left with no other means of support, dividing the community and families. Some turned to the rosewood trade out of desperation, while others who feared prosecution for directly participating in logging instead acted as guides by helping the loggers find the trees.

By March 2009, the national parks of the SAVA Region were swarming with thousands of loggers. This period of intense logging lasted six to eight weeks and park rangers and guides were forced by armed gangs to abandon their posts, resulting in the closure of Marojejy National Park for over a month, from March 20 to May 11. By early April, the roads leading from the parks were streaked with red from rosewood logs that had been dragged across the pavement. In late March, a representative of the Ministry of Environments, Water and Forests for the new government met with NGOs concerned with conservation and declared that stopping illegal logging was a top priority. He proposed the following action plan:

1. Send gendarmerie to the region as reinforcements for forest control
2. Use a radio and print campaign to remind people that logging in protected areas is illegal
3. Ceases export at Vohemar (the primary export location for illegal wood) and assess exports more closely
4. Annul the permissions for export given in January

5. Check the visa status of foreign traders in the regions plagued by illegal logging
6. Replace the head of the Directorate General of Waters and Forests
7. Police the radio calls promoting logging in the parks

However, if any of these actions were taken by the cash-strapped central government, they met only limited success. In fact, all attempts by the transitional authority to implement control over trade have had little effect.

Between March and mid-July, authorities in Masoala National Park found a total of 23 stumps, 2,906 logs, 142 logging camps and over 130 workers within the park. (Few stumps were found because these rare trees are found at low densities—up to 5 trees per hectare, whereas workers, camps and logs can be found concentrated along paths cut into the forest.) With an estimated 100 to 200 rosewood trees cut per day during peak harvesting in Masoala and the Mananara Biosphere Reserve, between 23,325 and 46,650 trees were cut in Marojejy and northern Masoala while 7,500 to 15,550 trees were cut in Makira and southern Masoala during 2009. Within the SAVA Region, 27,000 to 40,000 acres (11,000 to 16,000 ha) were affected.

It is estimated that $460,000 of rosewood and ebony were harvested per day in 2009, yielding 1,137 containers, or more 24,560 tons, of exported wood worth over $200 million for the year. In Vohémar alone, more than 625 containers of precious wood worth approximately $130 million were exported in 2009. In late April alone, 500 containers of wood harvested from protected areas were exported to China.

As of February 2010, there had been no shipments of precious wood since December 3, 2009. An estimated 15,700 tons of wood, valued at over $100 million, exist in stockpiles awaiting the next export window. Meanwhile, stocks continue to increase as logging in restricted areas continues.

The looting of these forests is well organized and well funded, placing it beyond the regulatory abilities and monitoring of park agents. Workers have been recruited by radio advertisements, the cargo boats of nearby Maroantsetra have all been hired out (to the exclusion of conventional shipping), a 6 km (3.7 mi) road has been built into a remote park in the north and a flotilla of small boats has been bypassing ports by landing anywhere on the 5,000 km (3,100 mi) of wild coastline to collect wood. In July 2009, investigation teams observed large-scale transport of rosewood logged from national parks in broad daylight along roads policed by posted gendarmerie around Antalaha, demonstrating that these timber traffickers have bribed not only customs officers but also the local law enforcement. This was after a mid-April attempt by the government to increase law enforcement in the parks and toughen enforcement on the export ban. Illegal activities declined during this time, particularly in areas under closer scrutiny, but also increased activities in remote areas.

Malagasy laborers work to conceal rosewood illegally harvested from Masoala National Park by burying it at a beach near Cap Est

A few other developments around that time hampered the illegal logging. Shortly before the increased enforcement began in April, about 500 workers gathered in Antalaha, threatening to burn the homes of the rosewood collectors due to continued withholding of their salary. By June, thousands of logs from approximately 20,000 trees had been confiscated in the north-eastern ports of Vohémar and Antalaha. However, the economic and political circumstances that were fueling the looting had not changed, allowing illegal logging to continue and driving even the impoverished gangs of Malagasy loggers to accept partial payments for their labor.

Eleven environmental organizations condemned the logging in March and later identified the withholding of international aid due to the political crisis as one of the most significant problems fueling these illegal activities. In particular, frozen funds from World Bank and United States Agency for International Development (USAID) support capacity building for the national parks, the implementation of chain of custody and tracking for logging and general funding of the Ministry of Environment and Forests (MEF). In all 70% of the government's operating budget was funded by foreign aid prior to the political turmoil. Since the funding was cut, the government has been strangled by a severe lack of funds, leaving the MEF, for instance, restricted to 10% of its normal budget. Despite pleas from conservation organizations, aid agencies have stood firm on the withholding of aid, arguing that it is the only way send a clear message to the current government that their actions are illegal and disruptive to business relations as well as to pressure them into holding new elections.

An alternative view turns the connection between illegal logging and the 2009 political crisis around completely. Instead of the crippling of the government sparking the illegal logging, the drive to exploit valuable resources on public land may have helped drive the political upheaval, especially since these illicit activities have been problems for decades. If members of Madagascar's higher echelons cannot benefit from this highly profitable trade, it could encourage political change.

Corruption and violence

Government corruption in Madagascar has been a problem for more than a decade. Transparency International has rated the country between a 1.7 and a 3.4 on its 10-point Corruption Perceptions Index (CPI), with a score less than 3.0 indicating rampant corruption. With the political disturbance in 2009, Madagascar fell from a 3.4 to a 3.0 and suffered a slide in rank from 85 out of 180 countries to a rank of 99.

This downward trend has been demonstrated by the conflicts between various agencies and levels of government. This has allowed wood traders to "shop" for export clearance among the authorities that regulate it. As a result of this bribery to open periodic trade windows, large-scale exports of illegal precious woods clear customs without much difficulty. Because of the incredibly lucrative nature of recent trades, reports have indicated that government officials have significantly increased the price of export certificates to make more money for themselves. This however has not stopped exporters from re-using single-use export certificates for two or three containers of rosewood. Furthermore, some of the certificates and authorizations from various government agencies bear titles found nowhere in any legal text, such as *permis de ramassage* and *permis de carbonisation* ("collection permit" and "carbonization permit" respectively). Such authorizations are not supported by and clearly conflict with Malagasy law.

Even when the government has attempted to enforce its own laws, bribery has influenced the outcome. A good example occurred on April 20, 2009, when the port in Vohémar reopened two days after authorities closed it down due to international protests over uncontrolled illegal logging. On the same day as the re-opening, loggers that had previously been arrested were released. One day prior, on April 19, prominent timber barons allegedly flew to the capital city by private plane and met with a senior government official. Another example is when a Malagasy court acquitted timber barons because "the relevant Forestry Administration official had not properly complied with forest control regulations." In other words, because the Forestry Administration had been bribed, the timber barons were cleared of charges.

In many cases, the actions of the criminal syndicates have been direct or even violent. Radio stations have been used to recruit civilians for logging and on April 20, one person promoted the logging of rosewood "in the name of democracy," spawning the resumption of logging in the region. Park rangers and guides at Marojejy National Park were forced away from their posts at gunpoint resulting in the closing of the park in April and the MEF's regional offices were set on fire and its staff were intimidated. Violent attacks on park staff were documented in August 2009 at Mananara Biosphere Reserve and Masoala

National Park and politicians that have stood up against illegal logging have also faced violent threats or worse. Villagers have lived in fear of the rosewood mafia, silenced and in dire poverty, while people in the coastal city of Sambava demonstrated in strong support of the logging. When remote villagers joined together to protest the destruction of their forests, the armed mafia dispersed them by firing shots over their heads. Throughout the region, local communities that opposed illegal logging lived in fear of retaliation since some informants have received death threats. This has made publicizing the situation very difficult.

At the national level, there seems to be only nominal resolve to halt illegal logging. Even the former administrations and members of parliament have been implicated in illegal logging. Given the lack of government funding, the transitional government appears to have little choice but to take money from one of the only profitable industries in the country. Even if the central government wanted to halt the illegal logging and export, they would be hamstrung by decentralization and a lack of funds, leaving them unable to deal with corrupt provincial bureaucrats.

In some ways, illegal actions need to be permitted to combat them. For example, twice in 2009 ministerial orders permitted the export of rosewood and ebony, but only if traders were willing to pay a fine of 72 million ariary, or $35,500, per container of illegally harvested wood. Malagasy law calls for the confiscation of illegal wood, not fines. Furthermore, these ministerial orders do not hold legal precedence over Malagasy law. However, the money from these fines will be used to fund the task force that will attempt to combat illegal logging.

There are some signs that the situation may be starting to change, as conservation groups and the media spotlight have pressured the government to fire some local officials for participating in illegal exports and send gendarmerie to increase surveillance in part of the SAVA region. They have also promised to more closely monitor the exports that they have temporarily approved.

Role of the international market

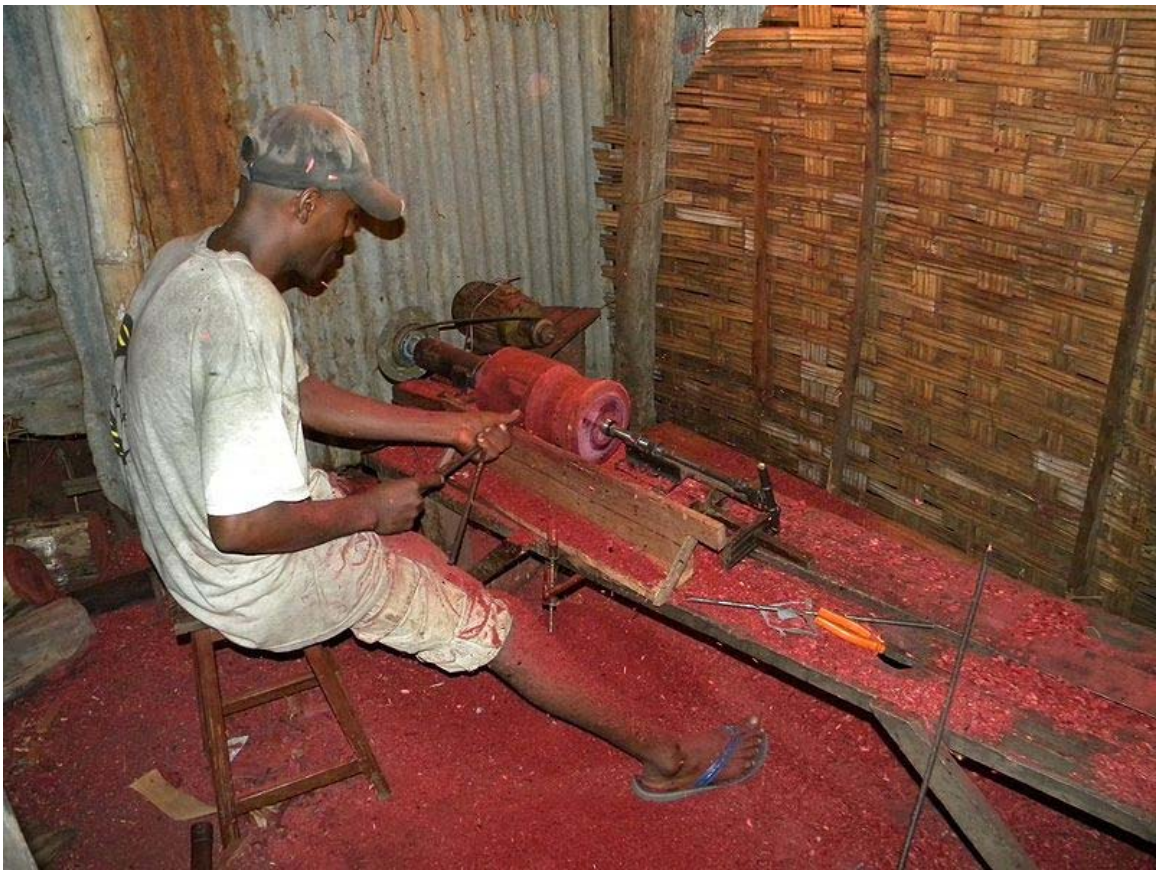
Near the port city of Antalaha, workers process illegally cut rosewood by turning it into planks, which is considered "semi-finished form"

Although timber barons orchestrate the illicit operations, including export, their operations are financed by international sources. This financing comes in the form of down payments of up to half the total sale from foreign buyers and loans from international banks that have branches in Antananarivo. The loans are critical, even in such a profitable industry, because without full payment, most of the capital gets tied up in the stockpiles of logs waiting to be exported.

More than two-thirds (11 out of 15) of the major timber barons have received loans from the Bank of Africa Madagascar while the two most important timber barons have received loans from BFV Société Générale, according to cargo manifests from ports in the SAVA Region. In all, 55% of the loans were made by the Bank of Madagascar, while 45% were made by Société Générale. Local reports have also indicated that Crédit Lyonnais was also involved in giving loans.

Over the course of the political crisis, six nations (in conjunction with the World Bank and three conservation organizations) have called for a stop to this illegal logging in the national parks and other protected areas. Ironically, many of these same governments have either directly or indirectly helped finance these illicit acts through their investments. France, the Netherlands and Morocco, as well as the World Bank, have been

identified has having directly funded these activities. The Bank of Africa is partly owned by France (through the Agence Française du Développement), the World Bank's International Finance Corporation (IFC), Netherlands Development Finance Company (FMO) and Banque Marocaine du Commerce Extérieur (BMCE Bank) in Morocco. Also, Société Générale and Crédit Lyonnais are both partly owned by the French government. Most other western governments are significant shareholders in these banks, thus helping channel foreign investment money into this informal economy. Despite this, these governments and banks have not faced the same level of scrutiny from the public as the shipping companies have. However, as of February 2010, the organized trafficking of illegal wood is being investigated by SAMIFIN (the Malagasy Financial Intelligence Services), which is starting to make these international financial organizations reluctant to participate.



At a rosewood vase factory in Antalaha, an artisan produces an example of "finished form" wood for export

Several international shipping companies have also previously been implicated in the export of illegally harvested wood from Madagascar, although most of them immediately and unequivocally ceased such operations when confronted with the issue. Between January and April 2009, United Africa Feeder Line (UAFL), based in Mauritius, shipped 80% of the exports out of Vohémar and Delmas Shipping, based in France and a subsidiary of CMA CGM, shipped the remaining 20%. According to local sources,

Spanfreight and Safmarine Container Lines N.V. have also been involved in the exports, although the EIA and Global Witness report could not substantiate the claim at the time. Other companies, such as Pacific International Lines (PIL), may also be involved or may become involved, but it is difficult to track since containers are transshipped and effectively laundered, through nearby Réunion or Mauritius. By the end of 2009, only Delmas continued to ship rosewood and other precious woods out of Madagascar, although it was beginning to come under public pressure to stop.

Ultimately demand fuels the market for these precious woods. Most of the blame rests with the Chinese and Westerners, who unknowingly prop up this high-priced market through their demand for high-class furniture and musical instruments made from rosewood or ebony. Therefore the solution lies in public education to help control demand and teach people how their money can indirectly support these illegal activities by providing revenue to companies that directly support them through investment.

China

Rosewood stockpile sits on a beach near Antalaha, awaiting export to China or Europe

China is the largest consumer of tropical woods in the world. As of 2008, it imports 45 million cubic meters of tropical wood per year, a fourfold increase since 1998. Having depleted its own rosewood stands and those of nearby neighbors, such as Burma, Chinese timber importers have focused their attentions on Madagascar. As a result, nearly all of

the rosewood exported from the SAVA Region is shipped to Chinese import companies. Malagasy precious woods are primarily shipped to four cities in China: Hong Kong, Dalian, Shanghai, Ganzhou.

The international demand for Madagascar's precious woods, such as rosewood and ebony, is growing primarily due to a surge in the numbers of Chinese middle class over the last five years. Furniture, such as armories, beds and cabinets, styled after ornate designs from the Ming Dynasty fetch up to $10,000 and traditional Chinese instruments are associated with fine red grain of rosewood and have become a popular way for the Chinese middle class to express their new-found wealth.

In 2009, the vast majority of the illegally obtained rosewood was exported to several Chinese ports. On October 31 alone, 55 containers holding 7,267 logs, weighing 989 tons and valued at $11 million, were shipped to China from Vohémar. It has also been demonstrated that illegal logging is funded with advance payments from Chinese buyers; and that the local rosewood mafia collude with the foreign profiteers, primarily from China. The EIA and Global Witness reported further that logging operations also received significant funds from a network of Chinese importers based in Antananarivo. These importers are part of a recently established expatriate community of Chinese people in Madagascar. Many hold passports due to a questionable practice started by the Prime Minister under former president Marc Ravalomanana, where Chinese immigrants could buy passports for 500,000 ariary or $2,500 per person. According to an October issue of the Madagascar Tribune, these importers operate by selling Chinese household and electronic goods in Madagascar, using artificial customs declarations to under-report both their sales and their revenue and then instead of repatriating the proceeds, they use the money to finance the tropical wood purchases of their compatriots in the SAVA Region.

In addition to the loans from the international banks, this infusion of cash from the new Chinese community is essential to keeping the illegal logging going at times when the wood is blocked from export. According to a local source, boxes of money were unloaded from small planes on November 28, 2009 in Sambava. The money was sent from the bank-like system controlled by the Chinese community in Antananarivo. This infusion of money came in response to two months of blocked rosewood exports at Vohémar, involving 170 containers that required a payment of a $35,500 "fine" per container.

Europe and the United States

Although Chinese demand constitutes the vast majority of the demand for Malagasy rosewood and other precious tropical woods, they are still popular in Europe and North America—particularly rosewood. Between January and April 2009, approximately 1.5% of the wood harvested in the SAVA Region and exported from Vohémar made its way directly to Europe in semi-finished form for the production of musical instruments and craft furniture. The tree species in these shipments consisted mostly of ebony, palissandre, *faho* and *andrapotsy*. In some cases, the wood is shipped to China, where it

is crafted into products that are eventually sold in the United States and Europe as high-end goods. Given the lack of documentation, many importers do not know the species of rosewood used or the country of origin, making it difficult for North American and European companies to filter out illegal products.

Steps are being made to encumber the illegal timber trade by Western countries. In one such instance, federal agents from the United States Fish and Wildlife Service raided Gibson Guitar Corporation's Massman Road manufacturing facility on November 17, 2009 and reportedly confiscated wood, guitars, computers and boxes of files on the grounds of a possible violation of the Lacey Act, which holds U.S. companies to the environmental laws of foreign countries. Reportedly, the company was involved in plans to ship wood from Madagascar to the United States through Germany. Charges have not been filed and Gibson Guitar released a statement that it was cooperating fully with the investigation. The day following the raid, CEO Henry Juszkiewicz took a leave of absence from the board of the Rainforest Alliance. Gibson Guitar holds a chain-of-custody certification from the Rainforest Alliance, however wood from Madagascar is not covered under that certificate.

Another company that has been identified as having ties to the illegal timber trade in Madagascar is Flavour Handling LLC. Reports show that Jeannot Ranjanoro, one of Madagascar's most noteworthy timber traffickers, exports rosewood under this Delaware-based corporation. If the allegations are true, they may come under investigation under the Lacey Act and face prosecution.

International outcry and effects on shipping

Unlike the international banks, shipping companies have been the primary target of the public outcry over the illegal logging and timber trading in Madagascar. Several companies were shown to have been involved in the shipping of rosewood, but most willingly ended their participation when the issue was called to their attention. Delmas, which had been the most prominent transporter of rosewood in 2009, has received the brunt of the attention due to its reluctance to cease its transport of wood. The company originally dismissed criticisms by citing authorizations to export from Madagascar's Minister of Environment and Forests.

Workers load illegally logged rosewood onto a transport vessel bound for the nearest major port

In December 2009, international outcry was generated and channeled through the internet by activist networks, such as Ecological Internet, over a rosewood shipment scheduled for December 21 or 22nd from Vohémar. Both the French government and Delmas were targeted with mass emailing while the French delegation at climate talks in Copenhagen were notified of Delmas' EU FLEGT Action Plan violation, which conflicts with France's position on reducing illegal logging to reduce emissions from deforestation. As a result, the shipment was canceled.

Two weeks after the cancellation, representatives from Andry Rajoelina's government began pressuring Delmas to pick up the shipment, which included more than 200 containers worth $40 million. Threats from Patrick Leloup, an adviser to Rajoelina, were reportedly issued to Delmas stating that their refusal to transport the wood would result in a ban from doing business in Madagascar. Delmas was targeted because it was the only company that had enough empty containers in Vohémar to transport the shipment. Under pressure, Delmas began to show signs that it's position might change.

Despite previous reports of being "enraged" by previous timber exports, Rajoelina may have turned to rosewood exports to fund his financially isolated government. Signing a decree on December 31, 2009, his transitional authority authorized the export of rosewood stocks in Vohémar, with the first pick-up scheduled for January 15, 2010. However, on January 13 Delmas once again refused to ship rosewood in fear of tarnishing its reputation. In March, Delmas succumbed to pressure from the Malagasy

government and resumed rosewood shipments with permission of the French government. However, near the end of March the Malagasy government, in turn, gave in to public pressure and reinstated the ban on rosewood logging and exports for two to five years with decree number 2010-141.

Confiscated logs

The confiscation of illegally harvested woods is called for by Malagasy law in accordance with the Forestry Act. However, confiscations have only happened on a small scale and the wood usually ends up back in the hands of the timber barons. For example, on previous occasions seized wood has been stamped and auctioned off, only to be re-obtained by exporters. Other seized stockpiles have either mysteriously disappeared, or have been stolen back from government headquarters when riots have broken out.

This raises concerns about what effects proper law enforcement would have on the trade, since it may only postpone the problem. Since small-scale auction for international consumption have previously failed, the destruction of seized logs has been discussed in the conservation literature. Although this approach has been taken in Africa to deal with confiscated ivory, the burning of the wood would produce significant pollution and would be dangerous and complicated to control.

Another option involves allowing the local wood crafting community to transform the wood into finished goods, thus bringing money into economically devastated parts of the country. However, the sheer volume of wood currently in stockpiles far exceeds what the local craft community could process, leaving large stocks in storage for decades. Protecting these stored stocks would be problematic at best. Also by promoting the use of these precious woods for crafts, a market is created and people's livelihoods become dependent upon it. Once the confiscated stocks are depleted, once again there will be demand to resume logging.

Another proposed option involves the auctioning of log ownership at their current market value (approximately $1,300) with the money going towards a forest fund. Beneficiaries, selected from those negatively impacted by the logging, would receive operating funds from the sales. Additionally, they would receive engraved logs (*bola-bola*) for display at protected areas, villages and education or health centers as reminders of the destruction that peaked during 2009 and 2010.

Environmental and social impacts

A Malagasy worker extracts a heavy rosewood log from Masoala National Park. The work is very strenuous and pays little, if at all.

Although not as immediately devastating as large-scale clearcutting, the selective logging taking place in Madagascar's protected areas creates secondary effects that can be just as harmful, if not more so, to both the local environment and local communities. These effects include the introduction of invasive species, increased susceptibility to fire due to localized drying, impaired habitat, reduced genetic diversity and biodiversity and collateral damage from dragging the trees out of the forest. In some cases, the disturbances create enough unbalance to cause the forest to die off completely. Human activities also tend to increase, further destroying what remains. Poaching and wildlife trafficking, as well as illegal mining have been documented in newly disturbed areas. Furthermore, local communities can be negatively impacted. Local villagers have been threatened into silence or exploited for cheap, dangerous labor and all of these activities within the forest often violate local taboos.

With decades of illegal logging in Madagascar's protected areas it comes as little surprise that evidence of closely associated activities, such as slash-and-burn agriculture, tree cutting, honey extraction and bushmeat hunting, were discovered in Marojejy National Park by a research team in 2008. With the recent political instability, these transgressions have increased in frequency and severity along with the illegal logging and now threaten the existence of critically endangered lemurs and other species. This has done irreparable damage and jeopardized over thirty years of conservation work.

The sheer size of the areas already affected during 2009 highlight the threats posed by illegal logging in Madagascar, particularly in the SAVA Region. The total areas impacted include between 4,665 and 9,330 hectares (18.0 and 36.0 sq mi) in Marojejy and northern Masoala, 1,500 hectares (5.8 sq mi) in Makira and 5,000 hectares (20 sq mi) in southern Masoala. To make matters worse, extensive forest clearing has been occurring around the parks' rivers. Since it takes four to five lighter trees (such as *Dombeya* species) to create a raft to float the much denser, heavier rosewood logs, loggers cut these lighter trees along the riverside first, causing erosion and silting of the streams and rivers. According to the EIA and Global Witness report, observations suggested at that 200 to 400 lighter trees were being cut per day to transport the rosewood.

Three dead bamboo lemurs (*Hapalemur griseus*), killed for bushmeat in northeast Madagascar. The meat is often consumed by loggers or sold to up-scale restaurants as a delicacy.

Lemurs and other endemic wildlife have become the target for poachers, a problem that has increased significantly since the large-scale illegal logging has commenced. Malagasy reptiles have long been a target of animal traders, but as smuggling of these species has intensified, now lemurs are also being collected and illegally exported for the exotic pet trade.

Initially following the political upheaval, conservation organizations were concerned that lemurs and other wildlife would be hunted for food by the thousands of loggers living and working in the protected areas. This indeed has happened, although the scale of the damage is unknown. However, unlike the bushmeat problems in other tropical countries, the majority of the meat from illegal hunting has not gone to feeding the hungry, impoverished rural populations. Instead, a "luxury market" has developed in the larger towns, including the capital, Antananarivo. Around Makira, lemurs have been tracked using trained dogs, killed, smoked on-site and sold to up-scale restaurants around the region. In August 2009, photos of piles of dead lemurs that had been confiscated from traders and restaurants in Northern Madagascar were published by Conservation International.

The numbers of killed and exported lemurs are unknown, but they include the Indri and the critically endangered Silky Sifaka and Golden-crowned Sifaka. Marojejy alone contains eleven species of lemur, including the Silky Sifaka.

Illegal logging has affected more than just the forests and the wildlife. Communities living around the national parks rely heavily on tourism for economic support since they receive half of the park entrance fees. Some community members also work as guides, porters, shopkeepers, hotel and restaurant personnel, so when tourism declines or ceases, their lives and the local economy they help fuel fall into jeopardy. Other communities receive fewer benefits from tourists, particularly around Masoala and Marojejy National Parks, which are difficult to reach and have minimal infrastructure. However, logging is still physically demanding and dangerous work that offers minimal pay, leaving them few options. Still, much of the logging and lemur hunting at Masoala is done by members of nearby communities. Emigrants coming into the region likewise have limited or no opportunities for earning income, making these illegal activities their only option.

The influx of immigrant loggers introduces new risks for the local communities, such as rural food shortages and increase in crime rate and an increase in the rate of sexually transmitted diseases, such as HIV. Although the increased economic activity introduced by logging might be seen as a benefit, the windfall is mostly seen by the traders and not the rural Malagasy poor, who do the strenuous physical labor for minimal pay. Some locals have abstained from logging from fear of prosecution, while others have turned to logging out of desperation. With armed militia occupying villages and issuing death threats towards people who object to their activities, people live in fear and communities and families have been divided.

Chapter- 2

Deforestation in Indonesia

Deforestation in Riau province, Sumatra, to make place for an oil palm plantation (2007)

Deforestation in Indonesia has had a massive environmental impact on the country, home to some of the most biologically diverse forests in the world, ranking third behind Brazil and the Democratic Republic of Congo. As late as 1900, Indonesia was still a densely forested country with the total forest representing 84 per cent of the total land area. Deforestation intensified in the 1970s and continuously accelerated since than. As a result, the estimated forest cover of 170 million ha around 1900 decreased to 98 million ha by the end of the 20th century, at least half of which is believed to be degraded by human activity. At present rates, tropical rainforests in Indonesia would be logged out in 10 years.

Large areas of forest in Indonesia are being lost as native forest is cleared by large multi-national pulp companies and being replaced by plantations. Forest are often burned by farmers and plantation owners. Another major source of deforestation is the logging industry, driven by demand from China and Japan. Agricultural development and transmigration programs moved large populations into rainforest areas, further increasing deforestation rates.

Logging and the burning of forests to clear land for cultivation has made Indonesia, the world's third largest emitter of greenhouse gases, behind China and the United States. Forest fires often destroy high capacity carbon sinks, including old-growth rainforest and peatlands. In May 2010 Indonesia declared a moratorium on new logging contracts to help combat this.

History

Deforestation for a tobacco plantation in North Sumatra (ca.1900)

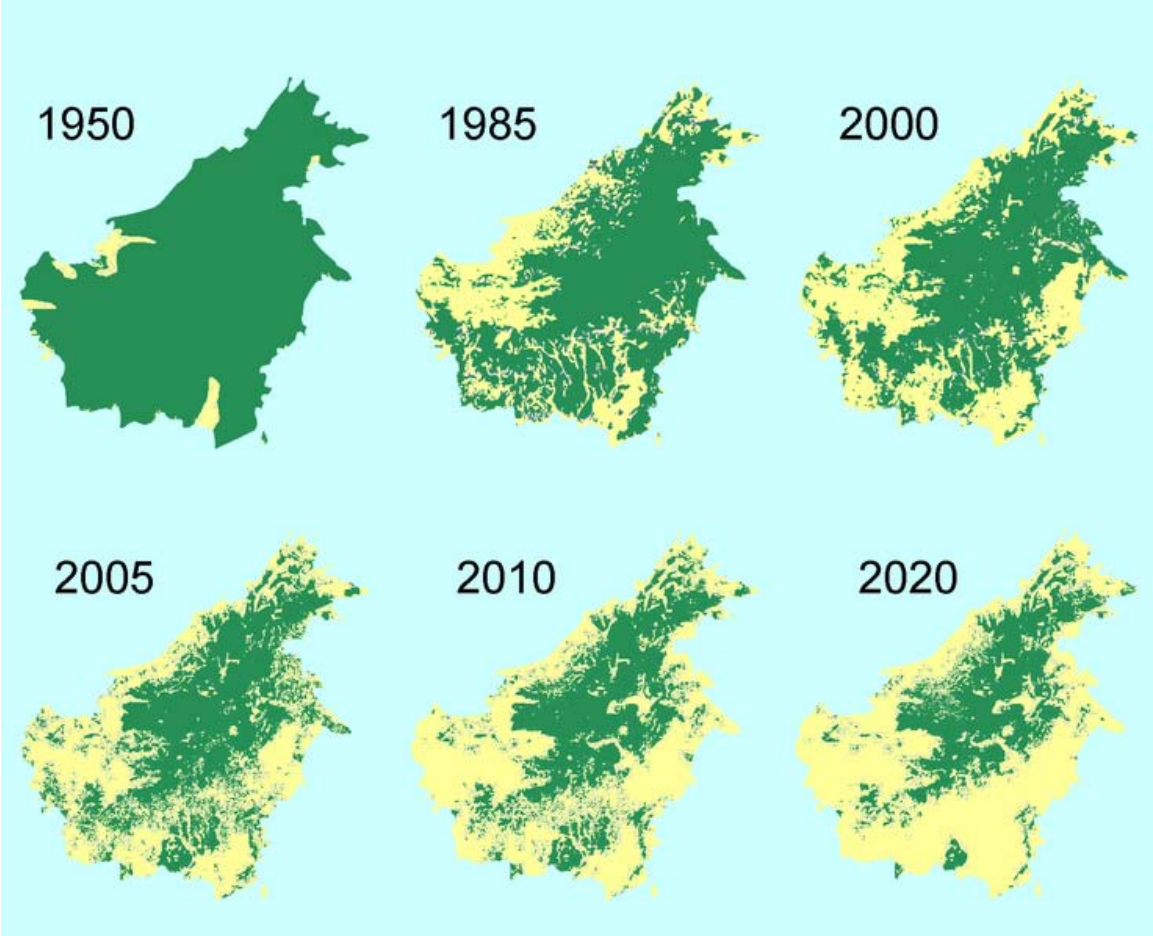
The Indonesian archipelago of about 17,000 islands is home to some of the most biodiverse forests in the world. As of 1900 the total forest represented 84% of the total land area. By 1950 plantations and smallholder plantings of tree crops still only covered a small area. The forest cover by that time is estimated to 145 million ha of primary forest and another 14 million ha of secondary and tidal forest. In the early 1970s Indonesia used

this valuable resource to its economic benefit with the development of the country's wood-processing industries. From the late 1980s to 2000, production capacity has increased nearly 700% in the pulp and paper industries, making Indonesia the world's ninth largest pulp producer and eleventh largest paper producer.

The rate of deforestation continues to increase. The 2009 State Environment Report launched by President Susilo Bambang Yudhoyono revealed that the number of fire hotspots rose to 32,416 in 2009 from only 19,192 in 2008. The Environment Ministry blamed weak law enforcement and a lack of supervision from local authorities for the increase, with land clearance as the primary cause of the fires.

Affected regions

Deforestation of peat swamp forest for oil palm plantation in Indragiri Hulu, Riau Province, Sumatra



Current and projected change of forest cover in Borneo between 1950-2020

Indonesia's lowland tropical forests, the richest in timber resources and biodiversity, are most at risk. By 2000 they have been almost entirely cleared in Sulawesi and predicted to disappear within few years in Sumatra and Kalimantan.

In Sumatra tens of thousands of square kilometres of forest have been cleared often under the command of the central government who comply with multi national companies to remove the forest. In Kalimantan, between 1991 and 1999 large areas of the forest were burned because of uncontrollable fire causing atmospheric pollution across South-East Asia.

Logging

A joint UK-Indonesian study of the timber industry in Indonesia in 1998 suggested that about 40% of throughout was illegal, with a value in excess of $365 million. More recent estimates, comparing legal harvesting against known domestic consumption plus exports, suggest that 88% of logging in the country is illegal in some way. Malaysia is the key transit country for illegal wood products from Indonesia.

Conservation efforts

Efforts to curb global climate change have included measures designed to monitor the progression of deforestation in Indonesia and incentivize national and local governments to halt it. The general term for these sorts of programs is Reducing Emissions from Deforestation and Forest Degradation (REDD). New systems to monitor deforestation are being applied to Indonesia. One such system, the Center for Global Development's Forest Monitoring for Action platform currently displays monthly-updating data on deforestation throughout Indonesia.

On 26 May 2010 Indonesia signed a letter of intent with Norway, to place a two-year moratorium on new logging concessions, part of a deal in which Indonesia will receive up to $US1 billion if it adheres to its commitment. The accord is expected to put curbs on Indonesia's palm oil industry and delay or slow plans for the creation of a huge agricultural estate in Papua province. Funds will initially be devoted to finalizing Indonesia’s climate and forest strategy, building and institutionalizing capacity to monitor, report and verify reduced emissions and putting in place enabling policies and institutional reforms. Norway is going to help Indonesia to set up a system to help reduce corruption so that the deal can be enforced.

Environmental issues in Indonesia

Environmental issues in Indonesia are associated with the country's high population and rapid industrialisation and they are often given a lower priority due to high poverty levels and weak, under-resourced governance. Issues include large-scale deforestation (much of it illegal) and related wildfires causing heavy smog over parts of western Indonesia, Malaysia and Singapore; over-exploitation of marine resources; and environmental problems associated with rapid urbanization and economic development, including air pollution, traffic congestion, garbage management and reliable water and waste water services. Deforestation and the destruction of peatlands make Indonesia the world's third largest emitter of greenhouse gases. Habitat destruction threatens the survival of indigenous and endemic species, including 140 species of mammals identified by the World Conservation Union (IUCN) as threatened and 15 identified as critically endangered, including the Sumatran Orangutan.

History and background

For centuries, the geographical resources of the Indonesian archipelago have been exploited in ways that fall into consistent social and historical patterns. One cultural pattern consists of the formerly Indianized, rice-growing peasants in the valleys and plains of Sumatra, Java and Bali; another cultural complex is composed of the largely Islamic coastal commercial sector; a third, more marginal sector consists of the upland forest farming communities which exist by means of subsistence swidden agriculture. To some degree, these patterns can be linked to the geographical resources themselves, with abundant shoreline, generally calm seas and steady winds favoring the use of sailing vessels and fertile valleys and plains--at least in the Greater Sunda Islands--permitting

irrigated rice farming. The heavily forested, mountainous interior hinders overland communication by road or river, but fosters slash-and-burn agriculture.

Each of these patterns of ecological and economic adaptation experienced tremendous pressures during the 1970s and 1980s, with rising population density, soil erosion, river-bed siltation and water pollution from agricultural pesticides and off-shore oil drilling.

Marine pollution

In the coastal commercial sector, for instance, the livelihood of fishing people and those engaged in allied activities--roughly 5.6 million people--began to be imperiled in the late 1970s by declining fish stocks brought about by the contamination of coastal waters. Fishermen in northern Java experienced marked declines in certain kinds of fish catches and by the mid-1980s saw the virtual disappearance of the terburuk fish in some areas. Effluent from fertilizer plants in Gresik in northern Java polluted ponds and killed milkfish fry and young shrimp. The pollution of the Strait of Malacca between Malaysia and Sumatra from oil leakage from the Japanese supertanker Showa Maru in January 1975 was a major environmental disaster for the fragile Sumatran coastline. The danger of supertanker accidents also increased in the heavily trafficked strait.

The coastal commercial sector suffered from environmental pressures on the mainland, as well. Soil erosion from upland deforestation exacerbated the problem of siltation downstream and into the sea. Silt deposits covered and killed once-lively coral reefs, creating mangrove thickets and making harbor access increasingly difficult, if not impossible, without massive and expensive dredging operations.

Although overfishing by Japanese and American "floating factory" fishing boats was officially restricted in Indonesia in 1982, the scarcity of fish in many formerly productive waters remained a matter of some concern in the early 1990s. As Indonesian fishermen improved their technological capacity to catch fish, they also threatened the total supply.

Deforestation and agricultural pollution

A different, but related, set of environmental pressures arose in the 1970s and 1980s among the rice-growing peasants living in the plains and valleys. Rising population densities and the consequent demand for arable land gave rise to serious soil erosion, deforestation due to the need for firewood and depletion of soil nutrients. Runoff from pesticides polluted water supplies in some areas and poisoned fish ponds. Although national and local governments appeared to be aware of the problem, the need to balance environmental protection with pressing demands of a hungry population and an electorate eager for economic growth did not diminish.

Major problems faced the mountainous interior regions of Kalimantan, Sulawesi and Sumatra. These problems included deforestation, soil erosion, massive forest fires and even desertification resulting from intensive commercial logging--all these threatened to create environmental disasters. In 1983 some 30,000 km² of prime tropical forest worth at

least US$10 billion were destroyed in a fire in Kalimantan Timur Province. The disastrous scale of this fire was made possible by the piles of dead wood left behind by the timber industry. Even discounting the calamitous effects of the fire, in the mid-1980s Indonesia's deforestation rate was the highest in Southeast Asia, at 7,000 km² per year and possibly as much as 10,000 km² per year. Although additional deforestation came about as a result of the government-sponsored Transmigration Program (*transmigrasi*) in uninhabited woodlands, in some cases the effects of this process were mitigated by replacing the original forest cover with plantation trees, such as coffee, rubber, or palm. In many areas of Kalimantan, however, large sections of forest were cleared, with little or no systematic effort at reforestation. Although reforestation laws existed, they were rarely or only selectively enforced, leaving the bare land exposed to heavy rainfall, leaching and erosion. Because commercial logging permits were granted from Jakarta, the local inhabitants of the forests had little say about land use, but in the mid-1980s, the government, through the Department of Forestry, joined with the World Bank to develop a forestry management plan. The efforts resulted in the first forest inventory since colonial times, seminal forestry research, conservation and national parks programs and development of a master plan by the Food and Agriculture Organization (FAO) of the United Nations.

The use of fires to clear land for agriculture has contributed to Indonesia being the world's third largest emitter of greenhouse gases, after China and the United States. Forest fires destroy carbon sinks in old-growth rainforests and peatlands. Efforts to curb carbon emissions, known as Reducing Emissions from Deforestation and Forest Degradation (REDD), include monitoring of the progression of deforestation in Indonesia and measures to increase incentives for national and local governments to halt it. One such monitoring system is the Center for Global Development's Forest Monitoring for Action platform, which currently displays monthly-updating data on deforestation throughout Indonesia.

Natural environmental hazards

Natural hazards include occasional floods, severe droughts, tsunamis, earthquakes, volcanoes, forest fires Human activities can help cause or exacerbate these hazards.

Notable environmental issues

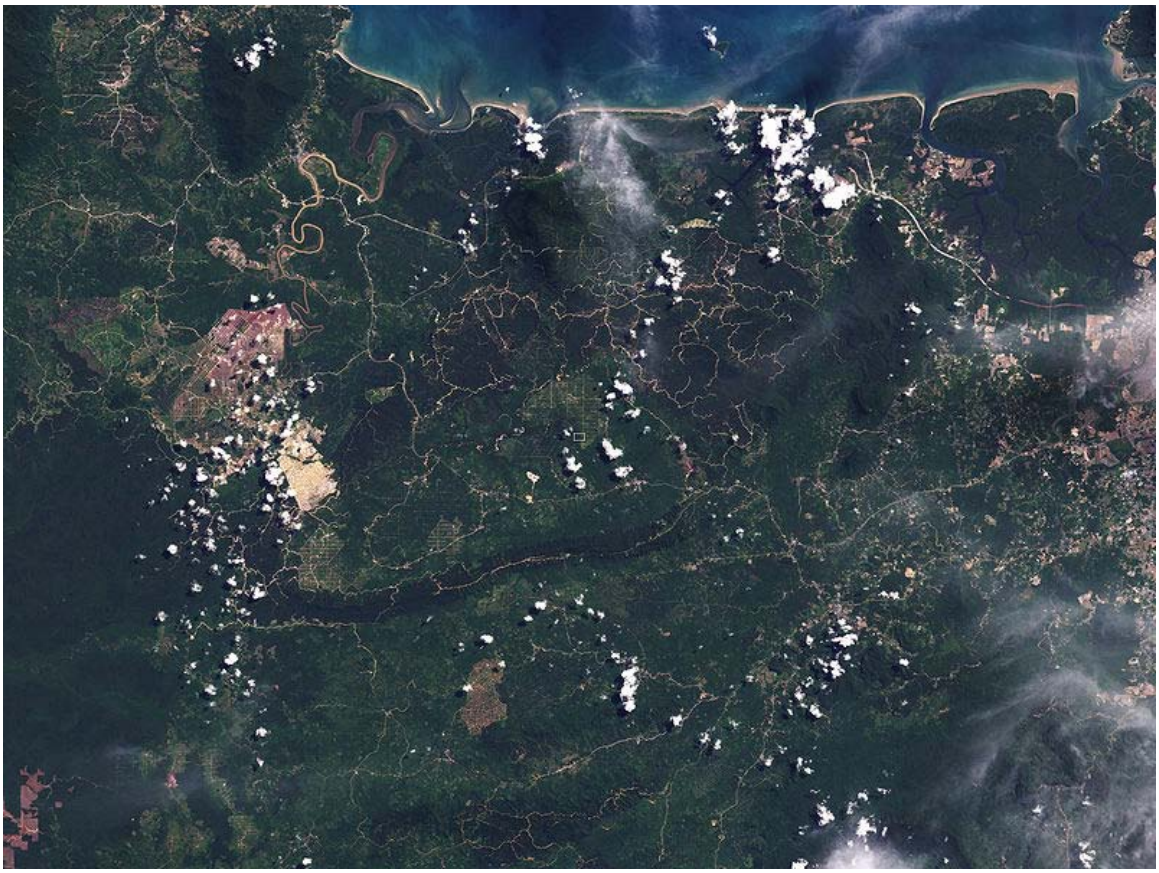
- PT Inti Indorayon Utama, a pulp and paper milling company, has a record of environmental degradation caused by its operation. It has been targeted by local people and environmental groups with a number of people killed as a result.

- Buyat Bay has been used by PT Newmont Minahasa Raya since 1996 as a tailings dumping ground for its gold mining activities.

- Grasberg mine

Chapter- 3

Deforestation in Malaysia



This image reveals the overall extent of land-cover change throughout the region

Deforestation in **Malaysia**

Between 1990 and 2005 Malaysia lost 6.6% of its forest cover, or around 1,486,000 hectares.

Background

Malaysia declared its independence from Britain in 1957 and formed its current state in 1963. Since then, it has seen significant economic growth, a large part of which can be attributed to its forest industry. Malaysia's rapid rate of development has put it far ahead of several of its neighbors, such as Indonesia and Papua New Guinea. This has largely been in part to its abundance of natural resources, which constitutes significant portions of the country's economic sector. Because of this large financial gain from logging, production has been high since initiation and it was not until 1985 that consequences were first realized.

Benefits of Logging

As stated above, Malaysia has received considerable financial gain from its logging industry. One statistic states this benefit is valued at $2,150,000,000 USD. Together with neighboring Indonesia, Malaysia produces 85% of the global supply of palm oil, the chief cause of logging. Additionally, the agriculture sector accounts for 14.5% of the labor force - more than 1 in 7 persons. 56.6% of Malaysia' tropical forests are used for production, leaving the rest for uses such as 'Protection' and 'Conservation'. These statistic clearly show how much both the general population and the Malaysian government is able to benefit from its logging sector, while still leaving untouched nearly half of its abundant forests.

Consequences of Logging

Consequences have been varied across different parts of Malaysia. However, all areas have suffered some effect from deforestation. Three of the most prominent include: 1. Malaysia ranks as the 21st most biodiverse country in the world, with 2,199 endemic species. 18% of these species are listed as 'threatened' and because they are endemic, if Malaysia fails to conserve them, extinction will result. 2. Indigenous peoples in Malaysia have always depended on the rainforest for medicine, shelter, food and other necessities. The destruction of their prime resource is resulting in the destruction of their traditional ways of life. As the forest disappears, so does their culture. 3. Runoff has also increased. Though it would not be immediately suspected that logging deep in the jungle could affect a distant city on the coast, because there is less forested area to soak up rainwater and act as a slow-release reservoir, sudden floods are becoming more and more frequent. 4. And People are dieing from mudslides

Alternative Option

In Malaysia, the World Bank estimates that trees are being cut down at 4 times the sustainable rate. Logging does not have to be as destructive a practice as it currently is in Malaysia. In the past 2 decades, Malaysia has moved towards diversifying its economy, but logging still draws in many because of poor regulation and high profit. The most effect way to combat the negative effects of logging would be tighter regulation that still allows high production of palm oil, but in a more sustainable manner. This way, not only

will the effects be mitigated now, but there will be more forests to log and thus profits to make, in the future.

The Malaysian Nature Society is active in advocating protection of forest.

Current issues

Logging of the following areas are believed to be threatening endangered wildlife:

- Hulu Terengganu Hydroelectric Project
- Bukit Cherakah
- Kelau Forest Reserve
- Pulai River Mangrove Forest
- Sungai Mas Forest
- Gunung Stong Selatan Forest Reserve

Environmental issues in Malaysia

Haze over Kuala Lumpur.

Issues

Endangered species

The IUCN Red List gives 2890 native endangered species.

- Malayan Tiger

Deforestation

Deforestation at the following locations are threatening flora and fauna:

- Hulu Terengganu Hydroelectric Project
- Kelau Dam
- Bukit Cherakah
- Ulu Padas
- Pulai River
- Sungai Mas

Deforestation is taking place for a variety of reasons including:

- Housing development
- Timber plantations
- Oil palm plantations
- Roads
- Dams

Pollution

- Air pollution in Malaysia
- 1997 Southeast Asian haze
- 2005 Malaysian haze
- 2006 Southeast Asian haze

Reclamation

Coastal reclamation is damaging mangroves and turtle nesting sights

Environmental organisations

- Malaysian Nature Society

Chapter- 4

Deforestation in Sri Lanka

NASA satellite view of Sri Lanka revealing sparser areas of forest to the north and east of the island

Deforestation is one of the most serious environmental issues in Sri Lanka. In the 1920s, the island had a 49 percent forest cover but by 2005 this had fallen by approximately 20 percent. Between 1990 and 2000, Sri Lanka lost an average of 26,800 ha of forests per year. This amounts to 1.14 percent of average annual deforestation rate. Between 2000 and 2005 rate accelerated to 1.43% per annum. However with a long history of policy and laws towards environmental protection, deforestation rates of primary cover have actually decreased 35% since the end of the 1990s thanks to a strong history of conservation measures. The problem of deforestation in Sri Lanka is not as significant in the southern mountainous regions as it is in northern Sri Lanka, largely due to the nature of environmental protection.

Causes and effects

A tea plantation revealing the way in which forest cover has been removed

The forests in Sri Lanka have been removed to make way for agricultural land and plantations and to provide fuel and timber. The sale of timber is a part of the national economy to raise revenue. The country is a major producer of tea and the land required for tea plantations is substantial. Population pressure is also a significant factor as is the removal of forested areas to make way for irrigation networks which was major process in the 1980s. Aside from the environmental implications deforestation in Sri Lanka has caused such as flooding, landslides and soil erosion from exposure of the deforested areas it is also the primary threat to the survival of Sri Lanka's biodiversity. Sri Lanka has 751 known species of amphibians, birds, mammals and reptiles of which 21.7% are endemic and over 3314 species of vascular plants, of which 26.9% are endemic.

Response

The government of Sri Lanka and international environmental organisations have made several steps to address the problem over the years, establishing national parks, reserves and sanctuaries, which now cover as much as 15 percent of the island's total area as of 2007. The Sinharaja Forest Reserve, which was established in 1978 to protect the nearly extinct tropical lowland rain forest, was flagged as a World Heritage Site in 1988.

History of environmental law and policy

The Sinharaja Forest Reserve, protecting tropical lowland rain forest in Sri Lanka

The history of environmental policy and law in Sri Lanka however goes back much further in history. In 1848, the Timber Ordinance No.24 was signed for the reservation of forests, largely for timber production. In 1873, Hooker advocated the protection of natural forests above 5000 feet as climatic reserves and in 1938 a law was passed prohibiting the removal of forest above 5000 feet. In 1885 Forest Ordinance No. 10 for the Conservation of forests saw some protection of forests primarily for sustainable wood production but also some protection of wildlife in sanctuaries. This was developed further in 1907 with Forest Ordinance No 16 with some protection of forests and their products in reserved forests and village forests, again for the controlled exploitation of timber.

In 1929 the first authoritative forest policy statement was given in regards to species protection and in 1937 the Fauna and Flora Protection Ordinance No.2 was signed with the protection of wildlife in national reserves. However this was restricted in that in sanctuaries, in that habitats were only protected only on state land, with complete freedom to exploit privately owned land. In 1964 Amendment Act No.44 in 1964 saw the nature reserve and jungle corridor formally recognised as categories of Sri Lanka's protected areas national reserve. In 1970 Amendment Act No.1 saw the creation of an Intermediate zone to provide for controlled hunting and the 1969 UNESCO Biological Programme and 1975 UNESCO Man and Biosphere Programme saw a move towards the

marking of bio-climatic zones in Sri Lanka and new reserves proposed. In 1982 the Mahaweli Environmental Project established a network of protected areas to protect the effects of deforestation on wildlife and the upper catchments of the Mahaweli Ganga river. In 1988 the National Heritage Wilderness Area Act No.3 established a national heritage protection scheme of state land for those forests possessing a unique ecosystem, genetic resources, or outstanding natural features.

A tea plantation in Sri Lanka

In 1990, the National Policy for Wildlife Conservation was approved by the Sri Lankan cabinet with the prime objectives to the sustainability of ecosystems and ecological processes and the preservation of genetic diversity. The government also introduced a logging ban that was implemented in all natural forests in Sri Lanka under the Forestry Sector Development Programme. In 1993 Amendment Act No. 49 also added Refuge, marine reserves and buffer zones as additional formal categories to the definition of the national reserve. Deforestation rates of primary cover have since decreased 35% since the end of the 1990s following the combination of all of these policies and laws and notably the National Forest Policy of 1995 which is explained below.

Sustainable timber farming

One of the main threats to the sustainability of Sri Lanka's forests is government development policies in relation to the demand for timber and fuel and also the need to create plantations to raise revenue. Government policies are focused primarily on timber production and tree plantations. The Sri Lankan government working in conjunction with multi-national institutions have seen a major change in timber harvesting in Sri Lanka for the cause of sustainable development. Commercial plantations have gradually been brought under management system in Sri Lanka to produce wood in an economically efficient and sustainable way. The harvesting, processing and the sale of wood products from state forests is conducted by the State Timber Corporation, which the Sri Lankan government owns. In the 1980s the cause progressed significantly with the Asian Development Bank (ADB) funding the Community Forestry Project (CFP) which concentrated on the development of fuelwood plantations and agroforestry in 5 of the 25 districts of Sri Lanka. Other major sustainable forest plantation projects were also funded by IDA/World Bank, USAID and numerous integrated rural development projects operating in more than 10 districts of Sri Lanka.

Forest enroute from Batalegala to Kadugannawa

In 1995, the Sri Lankan government approved the National Forest Policy, with the specific focus on conservation and sustainability. The National Forest Policy, aside from protecting the environment directly, advocates increased community involvement and unity in forest management, providing leases to the private sector to manage multiple use production forests. The scope of the policy includes the biophysical, environmental,

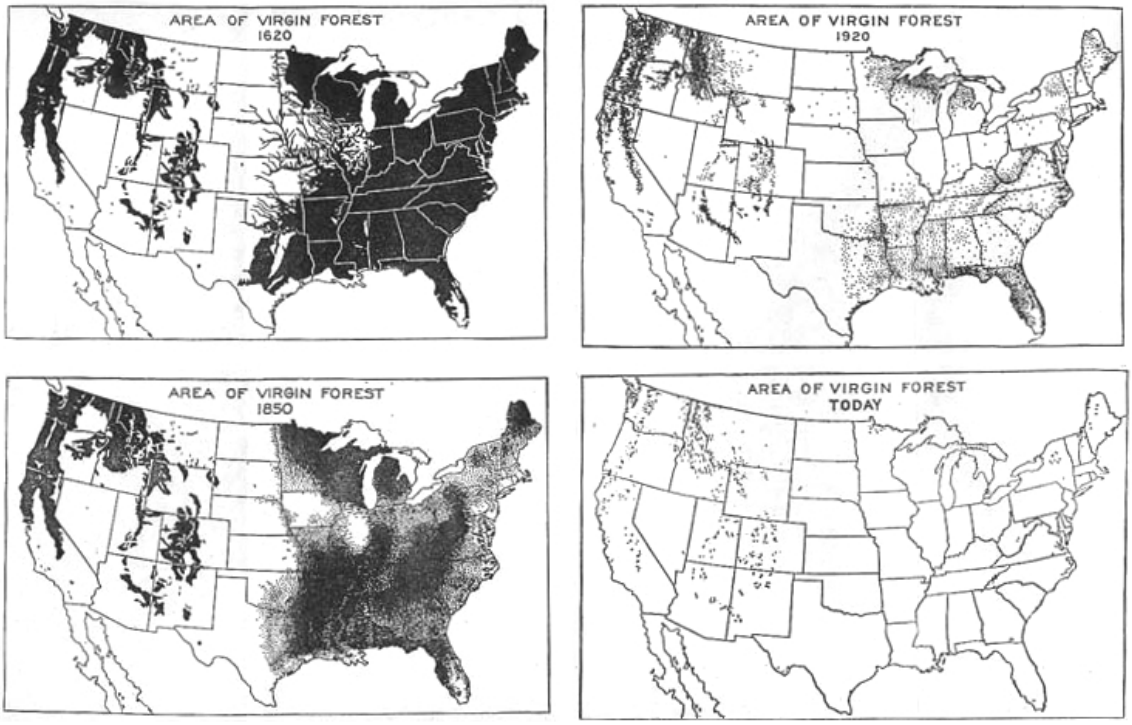
socio- political and economic components of forestry in Sri Lanka. The policy stressed the need to conserve biodiversity, soil and water resources and it emphasizes the central importance of retaining the present natural forest cover in sustaining an ecological balance in the ecosystems of the island. Under the policy, the remaining natural forests are to be used sustainably to provide for the growing demand for bio-energy, wood and non wood forest products. The policy has also identified the need for collaboration to make sustainable forest management a reality and has guided the state sector, farmers, NGOs and small and medium scale commercial entrepreneurs towards community organization in protecting the forests whilst meeting wood, raw material and the bio-energy requirements.

While illegal logging in Sri Lanka is not a major problem as it is in many countries, deforestation has still affected the lives of every day people in some parts of Sri Lanka where removed forests meant that greater time and energy is spent gathering firewood typically by women who have to travel relatively long distances, affecting their health and well-being. Any degradation of the forest resource in Sri Lanka is dynamically related to the increasing demand for timber and fuel wood. Central to the sustainability of the forests of Sri Lanka in the future is the rate of population pressure and economic growth. Not only will a growing population demand more fuel, they will also place a higher demand for housing construction materials with wood. The increase in the demand for logs and poles is estimated from about 2.0 million M3 in 1995 to 2.7 million M3 in

2020 and during this period the requirement of biomass energy will increase from 9.0 to 9.7 million tons. Conflicts may arise between the goals of conservation and the demands for production that such pressures create. While a significant area of land is in practice protected by the central government, the government has often been unable to extend effective and universal control over every square kilometre of its protected areas. Villagers have been known to cut down forest illegally with serious pressure to meet energy needs, particularly in northern Sri Lanka, but overall illegal logging in Sri Lanka is relatively low compared to many countries affected by this environmental problem at the beginning of the 21st century.

Chapter- 5

Deforestation in the United States



Loss of old growth forest in the United States. These maps represent only virgin forest lost. Some regrowth has occurred but not to the age, size or extent of the 1620 level due to population increases and food cultivation.

Deforestation in the **United States** is an ongoing environmental issue that attracts protests from environmentalists. Prior to the arrival of European-Americans about one half of the United States land area was forest, about 4 million square kilometers (1 billion acres) in 1600. Nearly all of this deforestation took place prior to 1910 and the forest resources of the United States have remained relatively constant through the entire 20th century.

The 2005 Food and Agriculture Organization (FAO) *Global Forest Resources Assessment* ranked the United States as seventh highest country losing its old growth forests, a vast majority of which were removed prior to the 20th century.

After European settlement

For the 300 years following the arrival of Europeans, land was cleared, mostly for agriculture, at a rate that matched the rate of population growth. For every person added to the population, one to two hectares of land was cultivated. This trend continued until the 1920s when the amount of crop land stabilized in spite of continued population growth. As abandoned farm land reverted to forest the amount of forest land increased from 1952 reaching a peak in 1963 of 3,080,000 km² (762 million acres). Since 1963 there has been a steady decrease of forest area with the exception of some gains from 1997. Gains in forest land have resulted from conversions from crop land and pastures at a higher rate than loss of forest to development. Because urban development is expected to continue, an estimated 93,000 km² (23 million acres) of forest land is projected be lost by 2050, a 3% reduction from 1997. Other qualitative issues have been identified such as the continued loss of old-growth forest, the increased fragmentation of forest lands and the increased urbanization of forest land.

Current issues

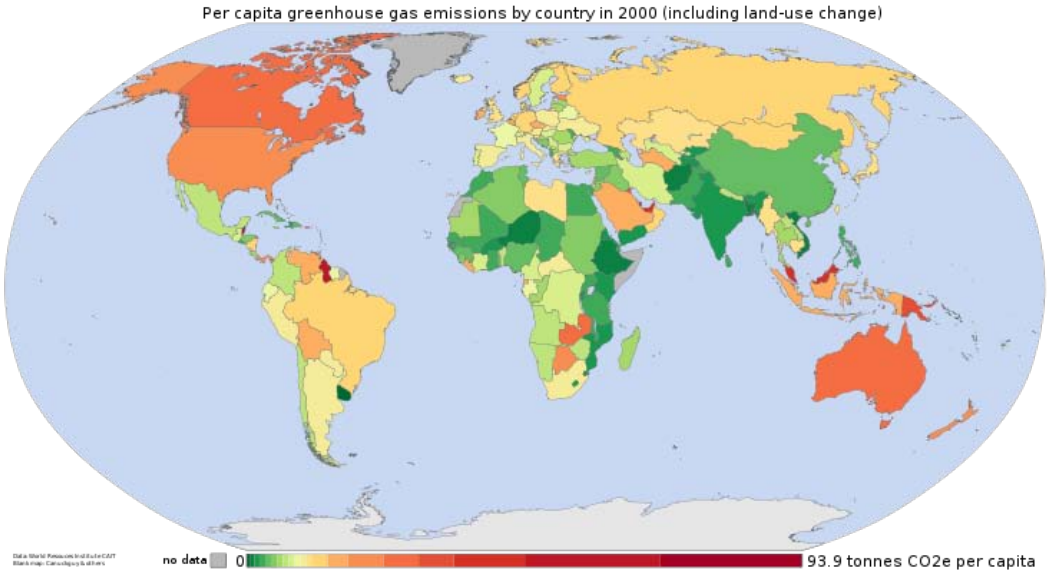
The current environmental issue of deforestation in the United States is one that is affected by many different factors. One such factor is the effect, whether positive or negative, that the logging industry has on forests in the country. Logging in the United States is a hotly debated topic as groups who either support or oppose logging argue over its benefits and negative effects. "This industry comprises the establishments primarily engaged in one or more of the following: (1) cutting timber; (2) cutting and transporting timber; (3) producing wood chips in the field," the definition provided by the U.S. Environmental Protection Agency. "The United States is the world's leading producer and consumer of forest products and accounts for about one-fourth of the world's production and consumption. The United States is also the world's largest producer of softwood and hardwood lumber. In 1996, total annual sales for commercial (nonfederal) timber and nontimber forest products was approximately $3.8 billion." The biggest issue facing deforestation in the United States is illegal logging in forests. The U.S. Forest Service states that illegal logging is the biggest problem with deforestation because it is nearly impossible to monitor and stop. It goes on throughout the U.S. and other countries and often happens when companies disregard their permits and go beyond what they are allowed to harvest. The Forest Service and EPA work together to make sure that the permits for logging companies in the United States are granted in such a way that the forests are kept healthy and sustainable and illegal logging reduces the chances that forests will be kept this way. The United States Forest Service is in favor of logging to a certain extent but there are several groups that oppose logging in the United States. Groups such as NativeForest.org and EarthRoots.org state that logging in the United States and specifically in industrial areas has led to deforestation and near extinction of many animals.

- Logging in the Tongass National Forest in Alaska
- Logging of old growth forests on the West Coast

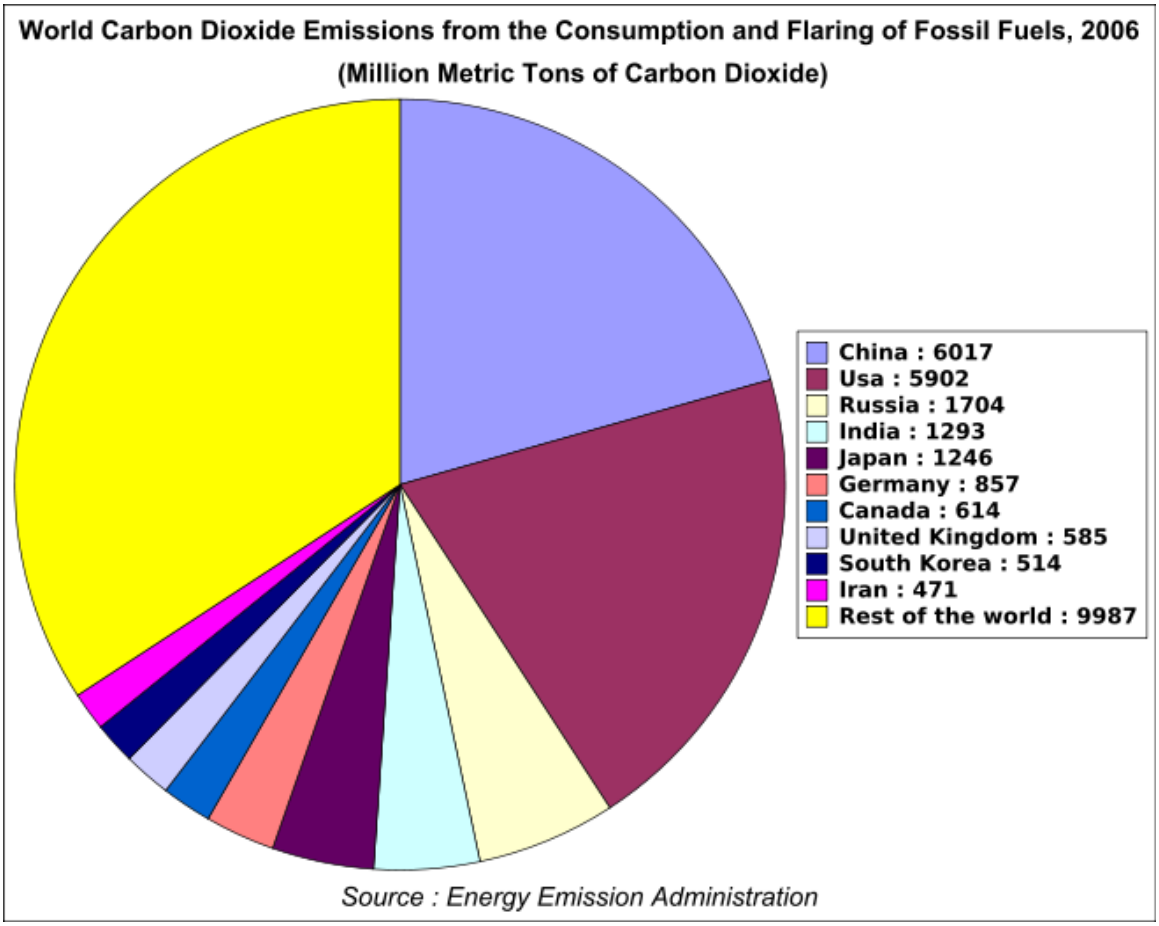
Species extinctions in the Eastern forests

Forest cover in the Eastern United States reached its lowest point in roughly 1872 with about 48 percent compared to the amount of forest cover in 1620. Of the 28 forest bird species with habitat exclusively in that forest, Pimm claims four become extinct either wholly or mostly because of habitat loss, the passenger pigeon, Carolina parakeet, ivory-billed woodpecker and Bachman's Warbler.

Environmental issues in the United States



Per capita anthropogenic greenhouse gas emissions by country for the year 2000 including land-use change



As with many other countries there are a number of **environmental issues** in the **United States**.

Issues

Climate change

The United States is the second largest emitter, after China, of carbon dioxide from the burning of fossil fuels. The energy policy of the United States is widely debated; many call on the country to take a leading role in fighting global warming. The U.S. is one of only two countries that has not signed up to the Kyoto Protocol.

Conservation

Many plant and animal species became extinct soon after first human settlement, including the North American megafauna; others have become nearly extinct since European settlement, among them the American Bison and California Condor.

The last of the passenger pigeons died in 1914 after being the most common bird in North America. They were killed as both a source of food and because they were a threat to

farming. Saving the Bald Eagle, the national bird of the U.S., from extinction was a notable conservation success.

Energy

Satellite image showing the light output at night in the United States

Since about 86% of all types of energy used in the United States are derived from fossil fuel consumption it is closely linked to greenhouse gas emissions and therefore climate change. The energy policy of the United States is determined by federal, state and local public entities, which address issues of energy production, distribution and consumption, such as building codes and gas mileage standards.

Nuclear

The most notable accident involving nuclear power in the United States was the Three Mile Island accident in 1979. Davis-Besse Nuclear Power Station has been the source of two of the top five most dangerous nuclear incidents in the United States since 1979.

Nuclear safety in the United States is governed by federal regulations and continues to be studied by the Nuclear Regulatory Commission (NRC). The safety of nuclear plants and materials controlled by the U.S. government for research and weapons production, as well those powering naval vessels, is not governed by the NRC.

The anti-nuclear movement in the United States consists of more than seventy anti-nuclear groups which have acted to oppose nuclear power and/or nuclear weapons in the USA. The movement has delayed construction or halted commitments to build some new

nuclear plants and has pressured the Nuclear Regulatory Commission to enforce and strengthen the safety regulations for nuclear power plants. Anti-nuclear campaigns that captured national public attention in the 1970s and 1980s involved the Calvert Cliffs Nuclear Power Plant, Seabrook Station Nuclear Power Plant, Diablo Canyon Power Plant, Shoreham Nuclear Power Plant and Three Mile Island.

Pesticides

Pesticide use in the United States is predominately by the agricultural sector. and about a quarter of pesticides used are used in houses, yards, parks, golf courses and swimming pools.

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) was first passed in 1947, giving the United States Department of Agriculture responsibility for regulating pesticides. In 1972, FIFRA underwent a major revision and transferred responsibility of pesticide regulation to the Environmental Protection Agency and shifted emphasis to protection of the environment and public health.

Population

The total U.S. population crossed the 100 million mark around 1915, the 200 million mark in 1967 and the 300 million mark in 2006 (estimated on Tuesday, October 17). The U.S. population more than tripled during the 20th century — a growth rate of about 1.3 percent a year — from about 76 million in 1900 to 281 million in 2000. This is unlike most European countries, especially Germany, Russia, Italy and Greece, whose populations are slowly declining and whose fertility rates are below replacement.

Population growth is fastest among minorities and according to the United States Census Bureau's estimation for 2005, 45% of American children under the age of 5 are minorities. In 2007, the nation’s minority population reached 102.5 million. A year before, the minority population totaled 100.7 million. Hispanic and Latino Americans accounted for almost half (1.4 million) of the national population growth of 2.9 million between July 1, 2005 and July 1, 2006.

Based on a population clock maintained by the U.S. Census Bureau, the current U.S. population, as of 15:00 GMT (EST+5) February 14, 2010 is 308,683,012. A 2004 U.S. Census Bureau report predicted an increase of one third by the year 2050. A subsequent 2008 report projects a population of 439 million, which is a 44% increase from 2008.

Environmental movement

In the United States today, the organized environmental movement is represented by a wide range of organizations sometimes called non-governmental organizations or NGOs. These organizations exist on local national and international scales. Environmental NGOs vary widely in political views and in the amount they seek to influence the government. The environmental movement today consists of both large national groups and also many

smaller local groups with local concerns. Some resemble the old U.S. conservation movement - whose modern expression is the Nature Conservancy, Audubon Society and National Geographic Society - American organizations with a worldwide influence.

Chapter- 6

Deforestation of the Amazon Rainforest

The Amazon River flowing through the rainforest

The main sources of deforestation in the **Amazon Rainforest** are human settlement and development of the land. Between 1991 and 2000, the total area of forest lost in the Amazon Rainforest rose from 415,000 to 587,000 km², more than six times the area of Portugal, 64 percent larger than Germany, 55 percent larger than Japan, 21 percent larger than Sichuan and equal to 84 percent the area of Texas. Most of this lost forest has been replaced with pasture for cattle. In February 2008, the Brazilian government announced that the rate at which the Amazon rainforest was being cut down had been accelerating noticeably during the time of the year that it normally slows. In the last five months of

2007, more than 3,200 sq. kilometers, an area equivalent to the size of the state of Rhode Island, was deforested.

History

Urarina shaman in the Peruvian Amazon, 1988

Prior to the early 1960s, access to the forest's interior was highly restricted and aside from partial clearing along rivers the forest remained basically intact. In many parts of Amazon, the poor soil also made plantation-based agriculture unprofitable. The key turning point in deforestation of the Brazilian Amazon was when colonists established farms within the forest during the 1960s. Their farming system was based on crop cultivation and the slash and burn method. However, the colonists were unable to

successfully manage their fields and the crops due to the loss of soil fertility and weed invasion. In indigenous areas of the Peruvian Amazon, such as the Urarina's Chambira River Basin, the soils are productive for relatively short period of time and indigenous horticulturalists like the Urarina are therefore constantly moving to new areas and clearing more and more land. Amazonian colonization was ruled by cattle raising because ranching required little labor, generated decent profits and awarded social status in the community. Additionally, grass can grow in the poor Amazon soil. However, the results of the farming lead to extensive deforestation and caused extensive environmental damage. An estimated 30% of the deforestation is due to small farmers and the intensity within the area that they inhabit is greater than the area occupied by the medium and large ranchers who possess 89% of the Legal Amazon's private land. This emphasizes the importance of using previously cleared land for agricultural use, rather the typical easiest political path of distributing still-forested areas. In the Brazilian Amazon, the amount of small farmers versus large landholders changes frequently with economic and demographic pressures.

In 2008, Peruvian President Alan García pushed through by executive decree Law 840 (also known as "Ley de la Selva," "the Law of the Jungle" or simply the "Forest Law"), which allowed the sale of uncultivated Amazon land under state ownership to private companies, without term limits on the property rights. While the law was promoted as a "reforestation" measure, critics claimed the privatization measure would in fact encourage further deforestation of the Amazon, while surrendering the nation's rights over natural resources to foreign investors and leaving uncertain the fate of Peru's indigenous people, who do not typically hold formal title to the forestlands on which they subsist. Law 840 met widespread resistance and was eventually repealed by Peru's legislature for being unconstitutional.

Causes

Fires and deforestation in Rondônia

One consequence of forest clearing in the Amazon: thick smoke that hangs over the forest

The annual rate of deforestation in the Amazon region has continued to increase from 1990 to 2003 because of factors at local, national and international levels. 70% of formerly forested land in the Amazon and 91% of land deforested since 1970, is used for livestock pasture. In addition, Brazil is currently the second-largest global producer of soybeans after the United States, mostly for export and biodiesel production and as prices for soybeans rise, the soy farmers are pushing northwards into forested areas of the Amazon. As stated in Brazilian legislation, clearing land for crops or fields is considered an 'effective use' of land and is the beginning towards land ownership. Cleared property is also valued 5–10 times more than forested land and for that reason valuable to the owner whose ultimate objective is resale. The needs of soy farmers have been used to validate many of the controversial transportation projects that are currently developing in the Amazon. The first two highways: the Belém-Brasília (1958) and the Cuiaba-Porto Velho (1968) were the only federal highways in the Legal Amazon to be paved and passable year-round before the late 1990's. These two highways are said to be "at the heart of the 'arc of deforestation'", which at present is the focal point area of deforestation in the Brazilian Amazon. The Belém-Brasilia highway attracted nearly two million settlers in the first twenty years. The success of the Belém-Brasilia highway in opening up the forest was reenacted as paved roads continued to be developed unleashing

the irrepressible spread of settlement. The completions of the roads were followed by a wave of resettlement and the settlers had a significant effect on the forest.

Scientists using NASA satellite data have found that clearing for mechanized cropland has recently become a significant force in Brazilian Amazon deforestation. This change in land use may alter the region's climate. Researchers found that in 2003, the then peak year of deforestation, more than 20 percent of the Mato Grosso state's forests were converted to cropland. This finding suggests that the recent cropland expansion in the region is contributing to further deforestation. In 2005, soybean prices fell by more than 25 percent and some areas of Mato Grosso showed a decrease in large deforestation events, although the central agricultural zone continued to clear forests. However, deforestation rates could return to the high levels seen in 2003 as soybean and other crop prices begin to rebound in international markets. This new driver of forest loss suggests that the rise and fall of prices for other crops, beef and timber may also have a significant impact on future land use in the region, according to the study.

In 1996, the Amazon was reported to have shown a 34% increase in deforestation since 1992. The mean annual deforestation rate from 2000 to 2005 (22,392 km² per year) was 18% higher than in the previous five years (19,018 km² per year). In Brazil, the Instituto Nacional de Pesquisas Espaciais (INPE, or National Institute of Space Research) produces deforestation figures annually. Their deforestation estimates are derived from 100 to 220 images taken during the dry season in the Amazon by the Landsat satellite, also may only consider the loss of the Amazon rainforest biome – not the loss of natural fields or savannah within the rainforest. According to INPE, the original Amazon rainforest biome in Brazil of 4,100,000 km² was reduced to 3,403,000 km² by 2005 – representing a loss of 17.1%.

Period	Estimated remaining forest cover in the Brazilian Amazon (km²)	Annual forest loss (km²)	Percent of 1970 cover remaining	Total forest loss since 1970 (km²)
Pre–1970	4,100,000	—	—	—
1977	3,955,870	21,130	96.5%	144,130
1978–1987	3,744,570	21,130	91.3%	355,430
1988	3,723,520	21,050	90.8%	376,480
1989	3,705,750	17,770	90.4%	394,250
1990	3,692,020	13,730	90.0%	407,980
1991	3,680,990	11,030	89.8%	419,010
1992	3,667,204	13,786	89.4%	432,796
1993	3,652,308	14,896	89.1%	447,692
1994	3,637,412	14,896	88.7%	462,588
1995	3,608,353	29,059	88.0%	491,647
1996	3,590,192	18,161	87.6%	509,808

1997	3,576,965	13,227	87.2%	523,035
1998	3,559,582	17,383	86.8%	540,418
1999	3,542,323	17,259	86.4%	557,677
2000	3,524,097	18,226	86.0%	575,903
2001	3,505,932	18,165	85.5%	594,068
2002	3,484,538	21,394	85.0%	615,462
2003	3,459,291	25,247	84.4%	640,709
2004	3,431,868	27,423	83.7%	668,132
2005	3,413,022	18,846	83.2%	686,978
2006	3,398,913	14,109	82.9%	701,087
2007	3,387,381	11,532	82.6%	712,619
2008	3,375,413	11,968	82.3%	724,587

One of the most important causes of deforestation in the Amazon is the cultivation of agricultural commodities such as soya, which is used mainly to feed animals. McDonald's has denied feeding its chickens with soya from the Amazon rainforest supplied by agricultural giant Cargill; however, not only did evidences prove this to be true, but also pointed out the soya farmers were linked to the use of slave labors, illegal land grabbing and massive deforestation. It has been calculated that McDonald's and its suppliers are responsible for 70,000 km² of the Amazon's deforestation in the last three years. Greenpeace have demanded that fast food companies eliminate soya trade and any meat products that are associated with the Amazon rainforest.

Future

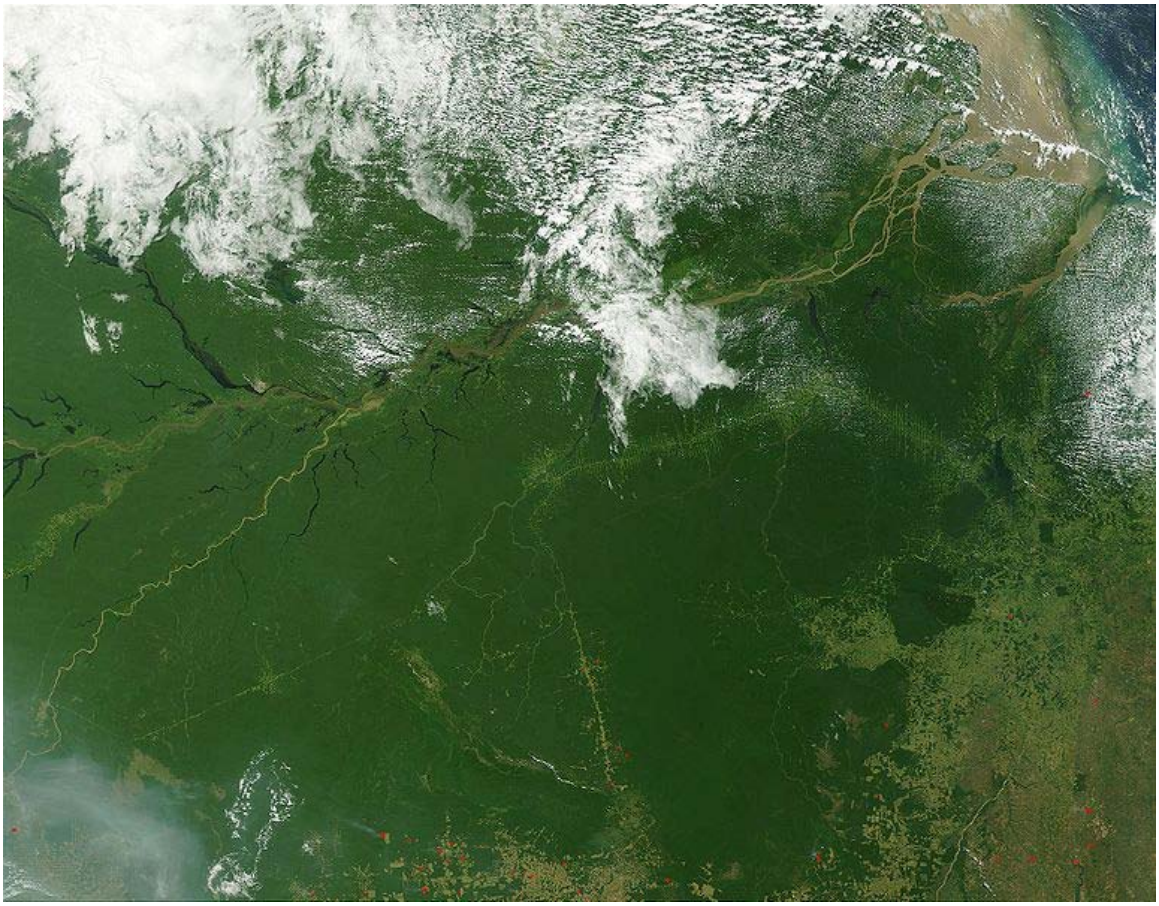
At the current rate, in two decades the Amazon Rainforest will be reduced by 40%.

Norwegian prime minister Jens Stoltenberg announced on September 16, 2008, that the Norwegian Government would donate US$ 1 billion to the newly established Amazon fund. The money from this fund will go to projects aimed at slowing down the deforestation of the Amazon rainforest.

Chapter- 7

Deforestation in Brazil

A NASA satellite observation of deforestation near Rio Branco in Brazil observed July 28, 2000



A satellite image of the Amazon rainforest

Brazil once had the highest deforestation rate in the world and as of 2005 still has the largest area of forest removed annually. Since 1970, over 600,000 square kilometers (232,000 square miles) of Amazon rainforest have been destroyed.

Despite reductions in the rate of deforestation in the last ten years, the Amazon Rainforest will be reduced by 40% by 2030 at the current rate. Between May 2000 and August 2006, Brazil lost nearly 150,000 square kilometers of forest, an area larger than that of Greece.

History

In the 1940s Brazil began a program of national development for the Amazon Basin. President Getúlio Vargas declared emphatically that:

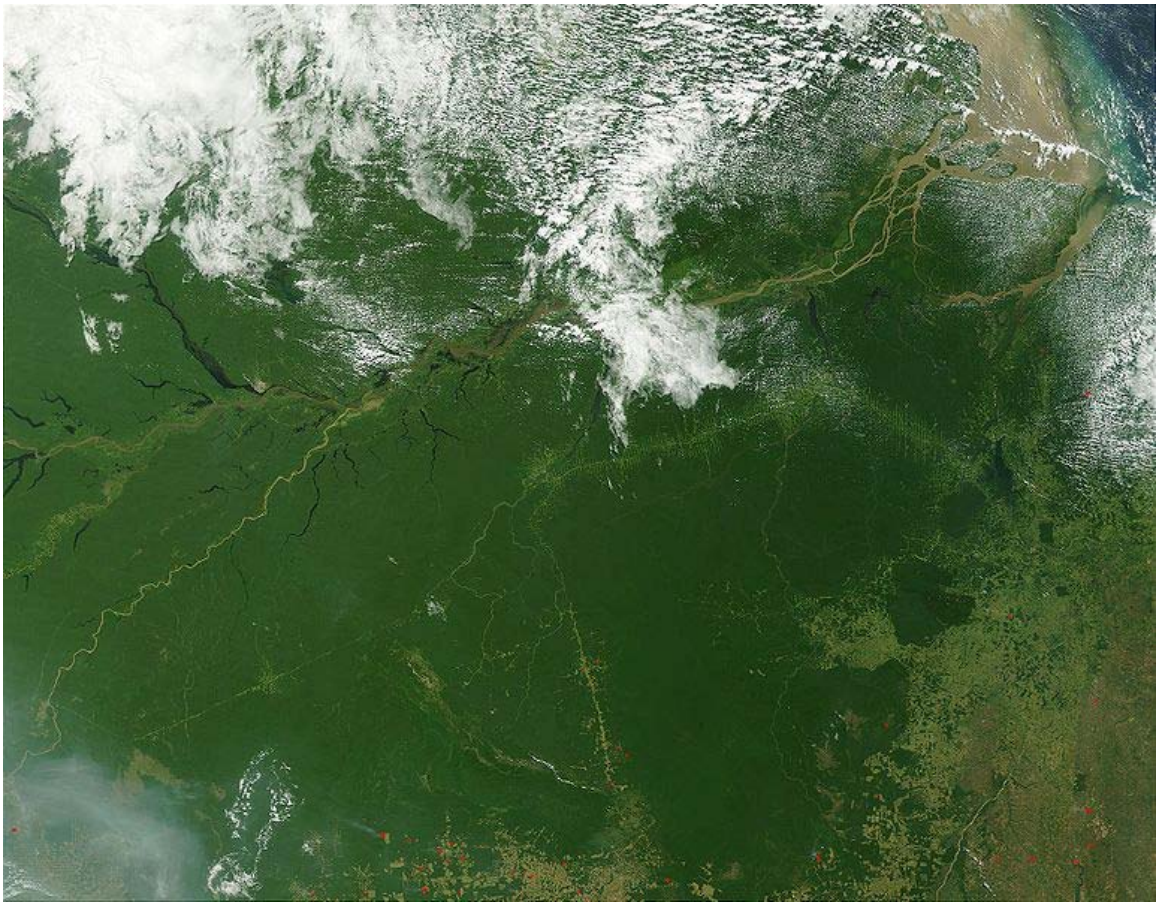
> “The Amazon, under the impact of our will and labor, shall cease to be a simple chapter in the history of the world and made equivalent to other great rivers, shall become a chapter in the history of human civilization. Everything which has up to now been done in Amazonas, whether in”

> agriculture or extractive industry... must be transformed into rational exploitation.
>
> — Getúlio Vargas

Vargas established many government programs to begin developing his vision, including the Superintendency for the Economic Valorization of Amazonia (SPVEA) in 1953, the Superintendency for the Development of Amazonia (SUDAM) in 1966 and the National Institute for Colonization and Agrarian Reform (INCRA) in 1971. It was in the 1960s that deforestation in the Brazilian Amazon became more widespread, chiefly from the removal of forest to make way for cattle ranching to raise national revenue during a period of high world beef prices, to eliminate hunger and to pay off international debt obligations. Extensive transportation projects, such as the Trans-Amazon Highway, were promoted in 1970, meaning that huge areas of forest would be removed for commercial purposes.

Before the 1960s, much of the forest remained intact due to the restrictions in access to the Amazon aside from partial clearing along the river banks. The poor soil also made plantation-based agriculture unprofitable. The key point in deforestation of the Amazon was when the colonists established farms within the forest during the 1960s. Their farming system was based on crop cultivation and the slash and burn method. The colonists were unable to successfully manage their fields and the crops due to the loss of soil fertility and weed invasion. The soils in the Amazon are productive for just a short period of time and so the farmers there must constantly move and clear more and more land.

Slash and burn forest removal in Brazil increased dramatically in the 1970s and 1980s



Large areas of forest are removed to make way for plantations and cattle ranches

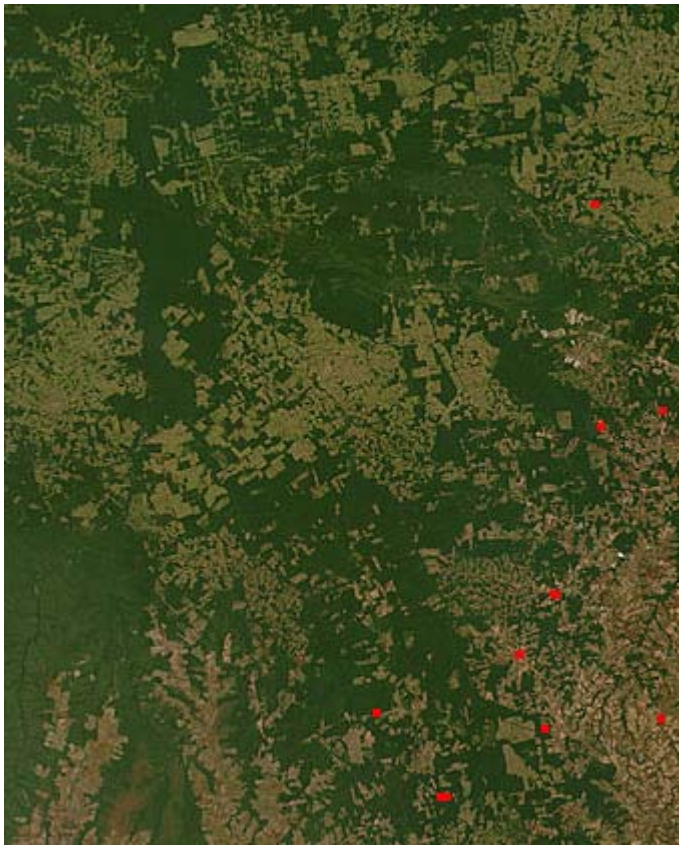
Amazonian colonization was dominated by cattle raising, not only because it was possible to grow grass in the poor soil, but also because ranching required little labor, generated decent profits and awarded social status in the community. However, the results of farming have led to extensive deforestation and have caused extensive environmental damage.

An estimated 30% of the deforestation is due to small farmers and the intensity within the area that they inhabit is greater than the area occupied by the medium and large ranchers who possess 89% of the Legal Amazon's private land. This emphasizes the importance of using previously cleared land for agricultural use, rather the typical easiest political path of distributing still-forested areas. In the Brazilian Amazon, the number of small farmers versus large landholders changes frequently with economic and demographic pressures.

In 1964, a Brazilian land law was passed that supported ownership of the land by the developer: if a person could demonstrate effective cultivation for a year and a day, then that person could claim a right to the land. This act paved the way for clearing enormous areas of forest for cattle production as developers sought to gain a financial profit from land with which they were provided. In the 1970s, with the growth of the Trans Amazonian highway, the National Institute for Colonization and Agrarian Reform

established schemes to attract hundreds of thousands of potential farmers westward into the Amazon and exploit the forest for cattle ranches. Between 1966 and 1975 Amazon land values grew at a rate of 100% per year as the government offered subsidies to reform the land; throughout the 1970s and 1980s, farmers rushed to claim land and quickly convert areas to farming and make a profit due to the improved transportation network and the high prices of beef. The forest was also exploited for timber, which provided Brazil a way of paying off international debt. By the late 1980s, an area the size of England, Scotland and Wales was being removed annually.

Causes



NASA satellite observation of deforestation in the Mato Grosso state of Brazil. The transformation from forest to farm is evident by the paler square shaped areas under development.

Cattle ranching and infrastructure

The annual rate of deforestation in the Amazon region has continued to increase from 1990 to 2003 because of factors at local, national and international levels. 70% of formerly forested land in the Amazon and 91% of land deforested since 1970, is used for livestock pasture. The Brazilian government initially attributed 38% of all forest loss between 1966 and 1975 to large-scale cattle ranching. According to the Center for International Forestry Research (CIFOR), "between 1990 and 2001 the percentage of

Europe's processed meat imports that came from Brazil rose from 40 to 74 percent" and by 2003 "for the first time ever, the growth in Brazilian cattle production, 80 percent of which was in the Amazon was largely export driven."

The removal of forest to make way for cattle ranching was the leading cause of deforestation in the Brazilian Amazon from the mid 1960s. In addition to Vargas's earlier aim for commercial development in the country, the devaluation of the Brazilian real against the dollar had the result of doubling the price of beef in reals and gave ranchers a widespread incentive to increase the size of their cattle ranches and areas under pasture for mass beef production, resulting in large areas of forest removal. Access to clear the forest was facilitated by the land tenure policy in Brazil that meant developers could proceed without restraint and install new cattle ranches which in turn functioned as a qualification for land ownership. The removal of the Amazon forest for cattle farming in Brazil was also seen by developers as an economic investment during periods of high inflation where the appreciation of cattle prices providing a way of outpacing the interest rate earned on money left in the bank. Brazilian beef was more competitive on the world market at a time when extensive improvements in the road network in the Amazonas in the early 1970s through the Trans Amazonian highway and subsequent other new roads gave potential developers access to vast areas of previously inaccessible parts of the forest. This coincided with the reduction of transportation costs through cheaper fuels such as ethanol which lowered the costs of shipping the beef from denser areas of the forest giving ranchers an incentive to maximise profits.

Deforestation in Brazil

In the 1970s, Brazil planned a massive development in its transportation infrastructure with a 2,000-mile (3,200 km) highway that would completely pass through the Amazon forest, which had the effect of increasing the vulnerability of poor farmers by colonizers using the new infrastructure to seek out new areas for commercial development. Studies by the Environmental Defense Fund have revealed areas affected by the road network were eight times more likely to be deforested by cultivators than untouched lands and that

the roads allowed developers to increasingly exploit the forest reserves not only for pastoral production but to export the reserves of wood and use it as fuel and for building. Developers were often given a six month salary and substantial agricultural loans to remove the forest alongside the roads in 250-acre (1.0 km^2) lots into new cattle ranches for production.

The Brazilian government granted land to approximately 150,000 families in the Amazon between 1995 and 1998. Poor farmers were also encouraged by the government through programmes such as the National Institute for Colonization and Agrarian Reform in Brazil (INCRA) to exploit the unclaimed forest land and after a five year period were given the rights to ownership and rights to sell it, giving them a clear purpose to use and reform the land for financial gain. The problem is worsened by the short-term productivity of the soils following forest removal for arable farmers and after only a year or two the fields became infertile and the farmers are forced to exploit new areas of forest to maintain income. In 1995 nearly half, 48% of deforestation in Brazil was attributed to the poorer farmers removing lots under 125 acres (0.51 km^2) in size.

Hydroelectric dams and mining activities

Hydroelectric dam projects in the Amazon have also been responsible for flooding significant areas of the forest. In particular the Balbina dam flooded approximately 2,400 km² (920 square miles) of rainforest on completion and its reservoir itself has been responsible for contributing to global warming by emitting 23,750,000 tons of carbon dioxide and 140,000 tons of methane in only its first three years of operation. Mining has also increased deforestation in the Brazilian Amazon particularly since the 1980s with miners often clearing forest to open the mines, often also using them for building material, collecting wood for fuel and subsistence agriculture.

Soybean production

A soybean field in South America

In addition, Brazil is currently the second-largest global producer of soybeans after the United States, mostly for livestock feed and as prices for soybeans rise, the soy farmers are pushing northwards into forested areas of the Amazon. As stated in Brazilian legislation, clearing land for crops or fields is considered an 'effective use' of land and is the beginning towards land ownership. Cleared property is also valued 5–10 times more than forested land and for that reason valuable to the owner whose ultimate objective is resale. The soy industry is an important exporter for Brazil; therefore, the needs of soy farmers have been used to validate many of the controversial transportation projects that are currently developing in the Amazon.

Cargill, a multinational company which controls the majority of the soya bean trade in Brazil has been criticized along with fast food chains like Mcdonalds by active groups such as Greenpeace for speeding up the process of the deforestation of the Amazon. Cargill is the main supplier of soya beans to large fast food companies such as McDonalds which uses the soya products to feed their cattle and chickens. As fast food chains expand, fast food chains must increase the quantity of their livestock in order to produce more products such as hamburgers and chicken Mcnuggets. In order to meet the large demands of soya, Cargill is forced to expand its soya production by clear cutting parts of the Amazon.

The first two highways: the Rodovia Belém-Brasília (1958) and the Cuiaba-Porto Velho (1968) were the only federal highways in the Legal Amazon to be paved and passable year-round before the late 1990's. These two highways are said to be "at the heart of the 'arc of deforestation'," which at present is the focal point area of deforestation in the Brazilian Amazon. The Belém-Brasilia highway attracted nearly two million settlers in the first twenty years. The success of the Belém-Brasilia highway in opening up the forest was re-enacted as paved roads continued to be developed unleashing the irrepressible spread of settlement. The completions of the roads were followed by a wave of resettlement and the settlers had a significant effect on the forest.

Scientists using NASA satellite data have found that clearing for mechanized cropland has recently become a significant force in Brazilian Amazon deforestation. This change in land use may alter the region's climate and the land's ability to absorb carbon dioxide. Researchers found that in 2003, the peak year of deforestation, more than 20 percent of the Mato Grosso state's forests were converted to cropland. This finding suggests that the recent cropland expansion in the region is contributing to further deforestation. In 2005, soybean prices fell by more than 25 percent and some areas of Mato Grosso showed a decrease in large deforestation events, although the central agricultural zone continued to clear forests. But, deforestation rates could return to the high levels seen in 2003 as soybean and other crop prices begin to rebound in international markets. Brazil has become a leading worldwide producer of grains including soybean, accounting for more than one-third of the country's gross national product. This new driver of forest loss suggests that the rise and fall of prices for other crops, beef and timber may also have a significant impact on future land use in the region, according to the study.

Logging

Logging in Brazil's Amazon is economically motivated. The economic opportunity for developing regions is driven by timber export and demand for charcoal. Charcoal producing ovens use large amounts of timber. In one month, the Brazilian government destroyed 800 illegal ovens in Tailandia. These 800 ovens were estimated to consume about 23,000 trees per month. Logging for timber export is selective, since only a few species, such as mahogany, have commercial value and are harvested. The forest is not completely logged, but still selective logging creates a lot of damage to the forest. For every tree harvested, 5-10 other trees are logged, to transport the logs through the forest. Also, a falling tree takes down a lot of other small trees in the forest. A logged forest contains significantly less species where no selective logging has taken place. A forest disturbed by selective logging is also significantly more vulnerable to fire.

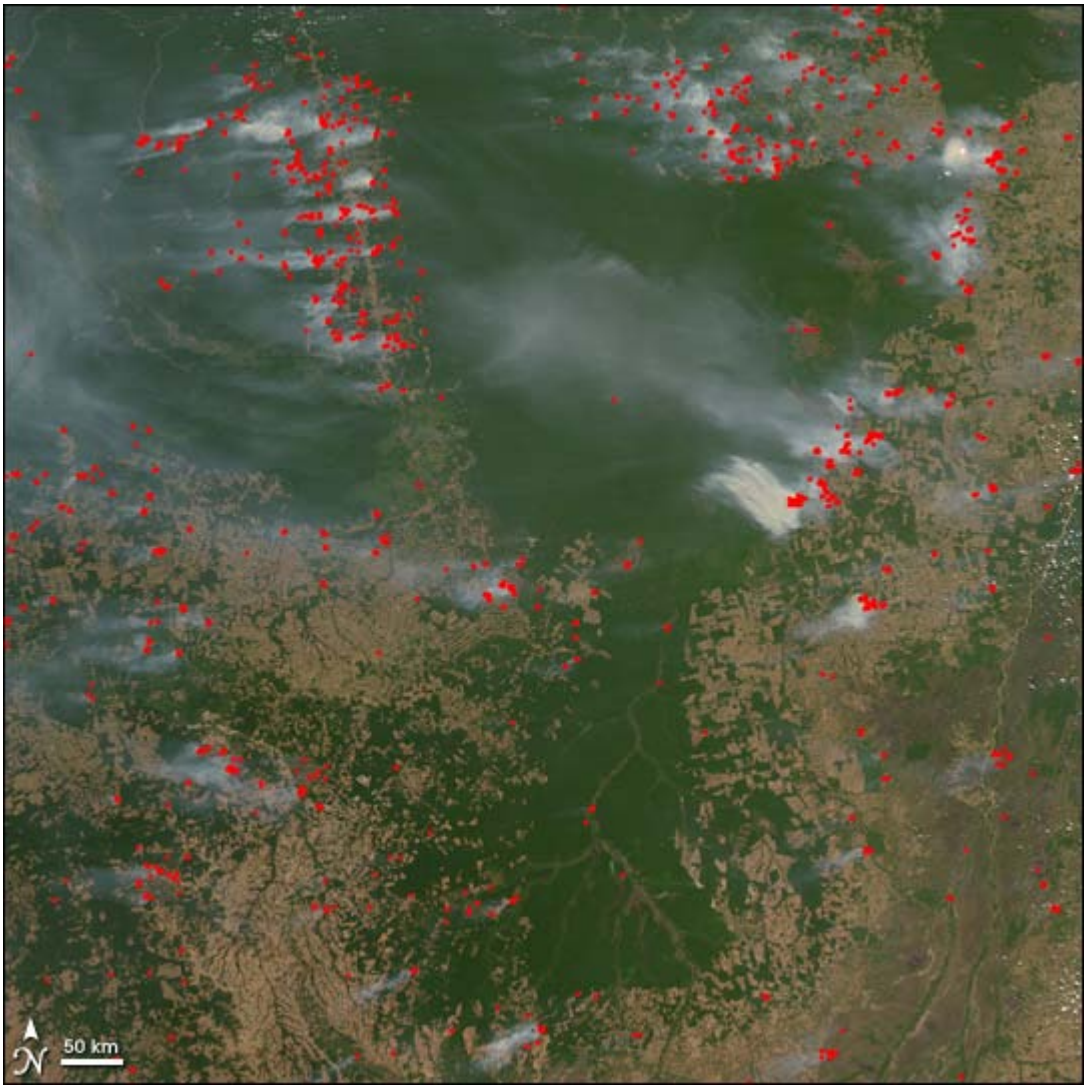
In order to combat this destruction, the Brazilian government has not issued any new permits for logging. Unauthorized harvesting has continued nonetheless. Efforts to prevent cutting down forests are made through payments to land owners. Instead of banning logging all together, the government hopes payments that are comparable to the money the land would earn from timber or farming will dissuade owners from further destruction.

Effects

One of the major concerns arising from deforestation in Brazil is the global effect it produces on climatic change. The rainforests are of vital importance in the carbon dioxide exchange process and are second only to oceans as the most important sink on the planet to absorb increasing atmospheric carbon dioxide resulting from industry.

Burning forest in Brazil

The most recent survey on deforestation and greenhouse gas emissions reports that deforestation in the Brazilian Amazon is responsible for as much as 10% of current greenhouse gas emissions due to the removal of forest which would have otherwise absorbed the emissions having a clear effect on global warming. The problem is made worse by the method of removing the forest where many trees are burned to the ground emitting vast amounts of carbon dioxide into the atmosphere, not only affecting air quality in areas of Brazil but affecting the carbon dioxide levels globally in addition as a result.



NASA satellite observation of forest fires resulting from deforestation on August 27, 2007. The red dots represent areas of fire.

Though the fires are only intended to burn limited areas of forest to make way for allocated agricultural plots, they frequently burn much more extensive areas of land than intended. In 1987 between July and October, about 19,300 square miles (50,000 km²) of rainforest was burned in the states of Pará, Mato Grosso, Rondônia and Acre releasing more than 500 million tons of carbon, 44 million tons of carbon monoxide and millions of tons of nitrogen oxides and poisonous chemicals into the atmosphere. In 2005 the burning of the forests in Brazil created widespread health implications across the Amazon region, including airport closings and hospitalizations from smoke inhalation.

Carbon present in the trees is essential for ecosystem development and plays a key role in the regional climate in Brazil and also globally. Fallen leaves resulting from deforestation leaves behind a mass of dead plant material known as slash, which on decomposition provides a food source for invertebrates which has the indirect effect of increasing

atmospheric carbon dioxide levels through respiration and microbial activity. Simultaneously the organic carbon within the soil structure becomes depleted and the presence of carbon plays a vital role in the functioning of life in any ecosystem.

The Brazilian rainforest is one of the most biologically diverse regions of the world. Over a million species of plants and animals are known to live in the Amazon and many millions of species are unclassified or unknown. With the rapid process of deforestation the habitats of many animals and plants that live in the rainforests are under threat and species may face extinction. The deforestation has the effect of reducing a gene pool amongst species meaning that there is less genetic variation that is needed to adapt to climate change in the future. The Brazilian Amazon is known to possess a vast resource for the treatments of medicines and scientific research into the basin has been conducted to find a cure for major global killers such as AIDS, cancer and other terminal diseases.

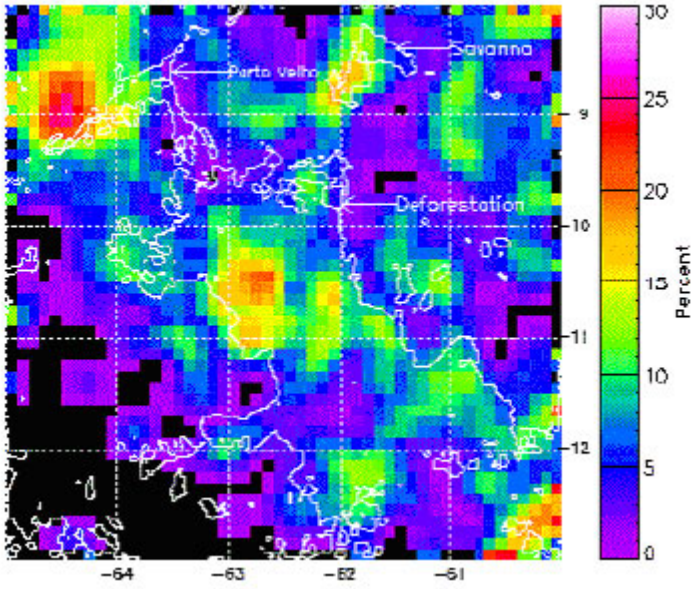
Rainforests are the oldest ecosystems on earth. Rainforest plants and animals continued to evolve, developing into the most diverse and complex ecosystems on earth. Living in limited areas, most of these species are endemic, or found nowhere else in the world. In tropical rainforests, it is estimated that 90% of the species that exist in the ecosystem reside in the canopy. Since the tropical rainforests are estimated to hold 50% of the planet's species, the canopy of rainforests worldwide may hold 45% of life on Earth. The Amazon rainforest borders 8 countries, it has the world's largest river basin and the source of 1/5 of the Earth's river water. It has the world's highest diversity of birds and freshwater fish. The Amazon is home to more species of plants and animals than any other terrestrial ecosystem on the planet—perhaps 30% of the world's species are found there. More than 300 species of mammals are found in the Amazon, the majority of which are bats and rodents. The Amazon basin contains the largest number of freshwater fish species in the world—more than 3,000 species. More than 1500 bird species are also found there. Frogs are overwhelmingly the most abundant amphibians in the rainforest. Interdependence is where all species are to some extent dependent on one another. Biological interdependency takes many forms in the forest, from species relying on other species for pollination and seed dispersal to predator-prey relationships to symbiotic relationships. Each species that disappears from the ecosystem may weaken the survival chances for another, while the loss of a keystone species—an organism that links many other species together—could cause a significant disruption in the functioning of the entire system.

The removal of the forest by developers affects the social and economic lives of the indigenous people who live in the forests whose families have lived their in relative isolation for many centuries. The rainforest is their home and a fundamental source of food, shelter, fuel, nourishment and also their cultural heritage and recreation. Deforestation and removal of the forest specifically for the export of timber also removes a valuable protection of the soils in a dynamic ecosystem and the region prone to desertification and silting on the river banks as rivers become clogged with washed away soils in sparse areas. If too much timber is cut, the soil that once had sufficient cover often gets baked and dried in the sun, becoming subject to erosion and degradation of soil fertility meaning that farmers cannot profit from the land even after removal. According

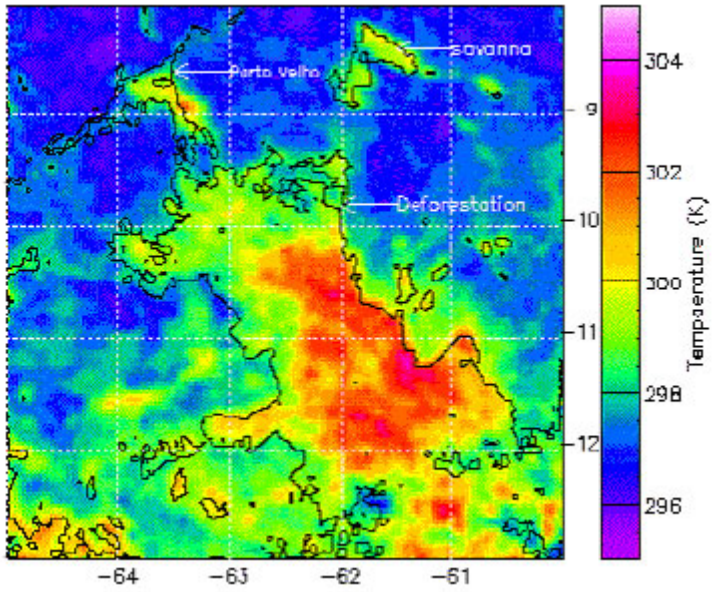
to the United Nations Environmental Programme (UNEP) in 1977, deforestation is a major cause of desertification and in 1980 UNEP estimated that desertification threatened 35 per cent of the world's land surface and 20 per cent of the world's population.

The exploitation of the forests in Brazil for mining activities such as gold mining has also significantly increased the risk of mercury poisoning and contamination of the ecosystem and water. Mercury poisoning can affect the foodchain and impact upon wildlife both on land and in the rivers but can also affect plants and affect the crops of farmers who are also looking to exploit areas of the forests. Pollution may result from mine sludge and affect the functioning of the river system at a time when soils are blown away due to exposure and have a significant impact on aquatic populations further implicated by dam building in the region. Dams build in areas of previously inhabited forest may have a profound impact on migrating fish and ecological life and leave the plains prone to flooding and leaching.

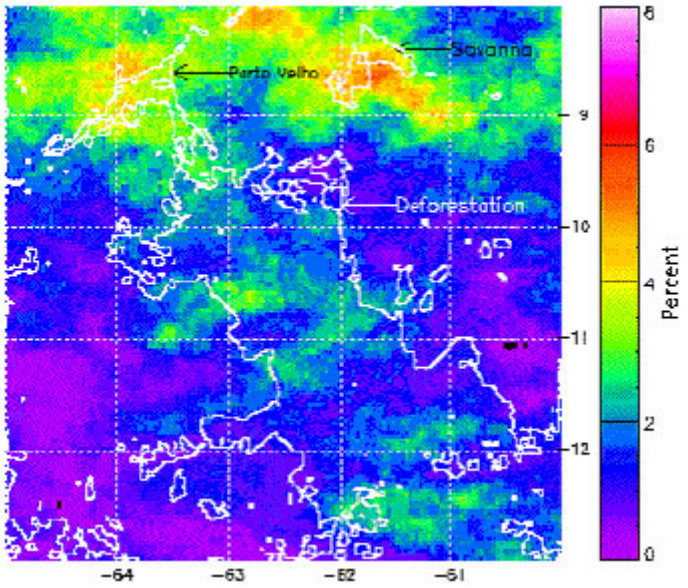
NASA survey



The effect of deforestation on rainfall



The effect of deforestation on increasing land temperature



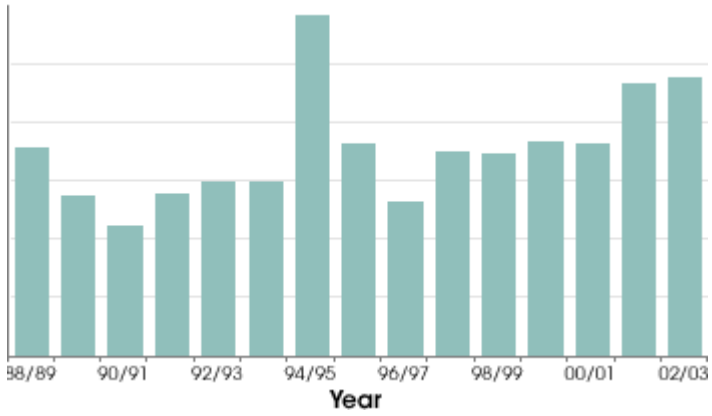
Effect of deforestation on cloud cover

In an American Meteorological Society Journal of Climate, two research meteorologists at NASA's Goddard Space Flight Center Andrew Negri and Robert Adler have analysed the impact of deforestation on climatic patterns in the Amazon using data and observatory readings obtained from NASA's Tropical Rainfall Measuring Mission collected over many years. Working also with the University of Arizona and the North Carolina State University according to Negri "In deforested areas, the land heats up faster and reaches a higher temperature, leading to localized upward motions that enhance the formation of clouds and ultimately produce more rainfall". They also examined cloud

cover in the deforested areas and in comparison with the areas still unaffected by deforestation found a significant increase in cloud cover and rainfall during the August-September wet season where forest had been removed. The height or existence of plants and trees in the forest directly affects the aerodynamics of the atmosphere, affecting precipitation. In addition the Massachusetts Institute of Technology developed a series of detailed computer simulated models of rainfall patterns in the Amazon during the 1990s and concluded that the removal of the forest also leaves the land exposed to the sun naturally increasing the land temperature near the surface, enhancing evaporation and more moisture in the atmosphere.

Measured rates

The zig-zag patterns across the road resulting from deforestation in Brazil can be seen from space



Deforestation chart. The double increase for 1994 and 1995 was attributed to accidental forest burning rather than active logging

Deforestation rates in the Brazilian Amazon have slowed dramatically since peaking in 2004 at 27,423 square kilometers per year. By 2009, deforestation had fallen to around 7,000 square kilometers per year, a decline of nearly 75 percent from 2004, according to Brazil's National Institute for Space Research (*Instituto Nacional de Pesquisas Espaciais*, or INPE), which produces deforestation figures annually. Their deforestation estimates are derived from 100 to 220 images taken during the dry season in the Amazon by the China–Brazil Earth Resources Satellite program (CBERS) and may only consider the loss of the Amazon rainforest biome – not the loss of natural fields or savannah within the rainforest. According to INPE, the original Amazon rainforest biome in Brazil of 4,100,000 km² was reduced to 3,403,000 km² by 2005 – representing a loss of 17.1%.

According to the National Institute for Space Research and the Food and Agriculture Organization (FAO), the estimates of deforestation in Amazon Rainforest are:

Period	Estimated remaining forest cover in the Brazilian Amazon (km²)	Annual forest loss (km²)	Percent of 1970 cover remaining	Total forest loss since 1970 (km²)
Pre–1970	4,100,000	—	—	—
1977	3,955,870	21,130	96.5%	144,130
1978–1987	3,744,570	21,130	91.3%	355,430
1988	3,723,520	21,050	90.8%	376,480
1989	3,705,750	17,770	90.4%	394,250
1990	3,692,020	13,730	90.0%	407,980
1991	3,680,990	11,030	89.8%	419,010
1992	3,667,204	13,786	89.4%	432,796
1993	3,652,308	14,896	89.1%	447,692
1994	3,637,412	14,896	88.7%	462,588

1995	3,608,353	29,059	88.0%	491,647
1996	3,590,192	18,161	87.6%	509,808
1997	3,576,965	13,227	87.2%	523,035
1998	3,559,582	17,383	86.8%	540,418
1999	3,542,323	17,259	86.4%	557,677
2000	3,524,097	18,226	86.0%	575,903
2001	3,505,932	18,165	85.5%	594,068
2002	3,484,538	21,394	85.0%	615,462
2003	3,459,291	25,247	84.4%	640,709
2004	3,431,868	27,423	83.7%	668,132
2005	3,413,022	18,846	83.2%	686,978
2006	3,398,913	14,109	82.9%	701,087
2007	3,387,381	11,532	82.6%	712,619
2008	3,375,413	11,968	82.3%	724,587

Response

By the end of the 1980s, the removal of Brazil's forests had become a serious global issue, not only because of the loss of biodiversity and ecological disruption, but also because of the large amounts of carbon dioxide (CO_2) released from burned forests and the loss of a valuable sink to absorb global CO_2 emissions. At the 1992 UN Framework Convention on Climate Change, deforestation became a key issue addressed at the Summit in Rio de Janeiro. Plans for the Compensated Reduction (CR) of greenhouse gas emissions from tropical forests were set up to give nations like Brazil an incentive to curb their rate of deforestation.

Areas of large scale atmosphere-biosphere experiments in Amazonia aim to monitor and regulate the impact of deforestation on the atmosphere

"We are encouraging the Brazilian government to fully endorse the Compensated Reduction proposal", Paulo Moutinho, Scientist and Coordinator of the Climate Change Program of the Amazon Institute for Environmental Research (IPAM), a NGO research institute in Brazil stated. In Brazil, the cost of reducing deforestation emissions by half will be less than $5 per ton of carbon dioxide, as estimated in an unpublished study of IPAM and the Woods Hole Research Center.

On May 11, 1994, two scientists, Compton Tucker and David Skole, presented the results of a NASA survey at the Subcommittee on Western Hemisphere Affairs of the United States Congress, a formal scientific assessment of deforestation in Brazil aimed at putting to rest the debate on the rate of forest removal and questions on the effectiveness at Brazilian environmental policies. Whilst undertaking a monitoring and complete assessment was very difficult due to the size of the rainforest, they concluded that satellite observations had shown a reduction in the rate of forest removal between 1992 and 1993 and that World Bank estimates of 600,000 square kilometers (12%) cleared by that year appeared to be exaggerated. The NASA assessment concurred with the findings of the Brazilian National Space Research Institute (INPE) with an accurate estimation of 280,000 square kilometers (5%) for the same period. The following year (1995) deforestation nearly doubled; this has been attributed the accidental fire following El Niño-related drought rather than active logging and the following year showed a major decrease from earlier.

In 2002 Brazil ratified the Kyoto agreement as a developing nation in the non-Annex I category of countries. These countries do not have carbon emissions quotas in the agreement as developed nations do. President Luiz Inacio Lula da Silva iterated that it is "Brazil that is in charge of looking after the Amazon." In 2006 Brazil proposed a direct finance route to deal with the Reduced Emissions from Deforestation and Degradation in Developing Countries, or REDD, issue, recognizing that deforestation contributes to 20 percent of the world's greenhouse gas emissions. The competing proposal for the REDD issue is a carbon emission credit system, where reduced deforestation would receive "marketable emissions credits". In effect, developed countries could reduce their carbon emissions and approach their emissions quota by investing in the reforestation of developing rainforest countries. Instead, Brazil's 2006 proposal would draw from a fund based upon donor country contributors.

By 2005 forest removal had fallen to 9,000 km^2 (3,475 square miles) of forest compared to 18,000 km^2 (6,950 square miles) in 2003 and on July 5, 2007, Brazilian president Luiz Inácio Lula da Silva announced at the International Conference on Biofuels in Brussels that more than 20 million hectares of conservation units to protect the forest and more efficient fuel production had allowed the rate of deforestation to fall by 52% in the three years since 2004.

Daniel Nepstad, a Senior Scientist at the Woods Hole Research Center which focuses on tackling deforestation issues in Brazil has demonstrated that Brazil's deforestation rates have been cut nearly in half in recent years through a combination of government intervention and economic trends. Since 2004 the country has established more than 200,000 square kilometres of parks, nature reserves and national forests in the Amazon rainforest. These protected areas, if fully enforced, aim to prevent an estimated one billion tons of carbon from being transferred to the atmosphere through deforestation by the year 2015.

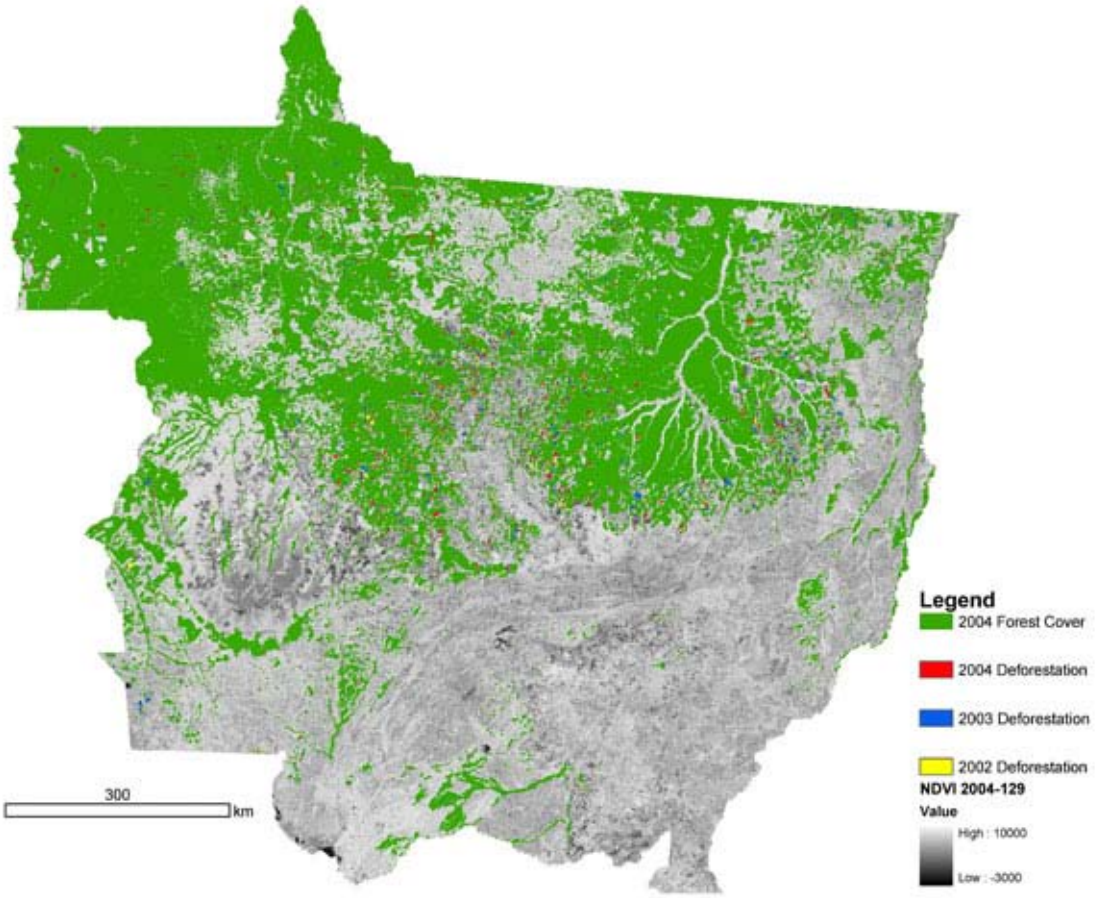
In 2005 Brazilian Environment Minister Marina da Silva announced that 9,000 km^2 (3,475 square miles) of forest had been felled in the previous year, compared with more than 18,000 km^2 (6,950 square miles) in 2003 and 2004. Between 2005 and 2006 there was a 41% drop in deforestation; nonetheless, Brazil still had the largest area of forest removed annually on the planet.

On July 5, 2007 current Brazilian president Luiz Inácio Lula da Silva, spoke at the International Conference on Biofuels in Brussels announcing that the government targets of leaning towards ethanol and biodiesel in fuel production and establishing more than 200,000 square kilometres of conservation units to protect the forest had allowed the rate of deforestation to fall by more than 50% in the three years since 2004.

These methods have also reduced the illegal appropriation of land and logging, encouraging the use of land for sustainable timber harvesting.

Future

Observation on weather patterns above the Amazon taken on board a shuttle in orbit in February 1984. Deforestation in Brazil has and will have a major impact on the climate system and rainfall according to scientists.



A NASA observation of forest cover and deforestation in the state of Mato Grosso for 2004

The improvement of the social and economic conditions of the huge population of poor people in Brazil is the main concern of the government.

It is clear that to diminish deforestation in the Brazilian Amazon would require enormous financial resources to compensate the loggers and given them an economic incentive to pursue other areas of activity. The World Wide Fund for Nature (WWF) has estimated that a total of approximately US$547.2 million (1 billion Brazilian reais) would be required from international sources to compensate the forest developers and establish a highly organized framework to fully implement forest governance and monitoring and the foundation of new protected forest areas in the Amazon for future sustainability. Due to Brazil's need to develop economically and pay off international debt obligations, compensating the loggers over the entirety of the Amazon rainforest would require a heavy amount of funding and increased interaction with the international community and a reform of the world market system if deforestation in the country is to be halted.

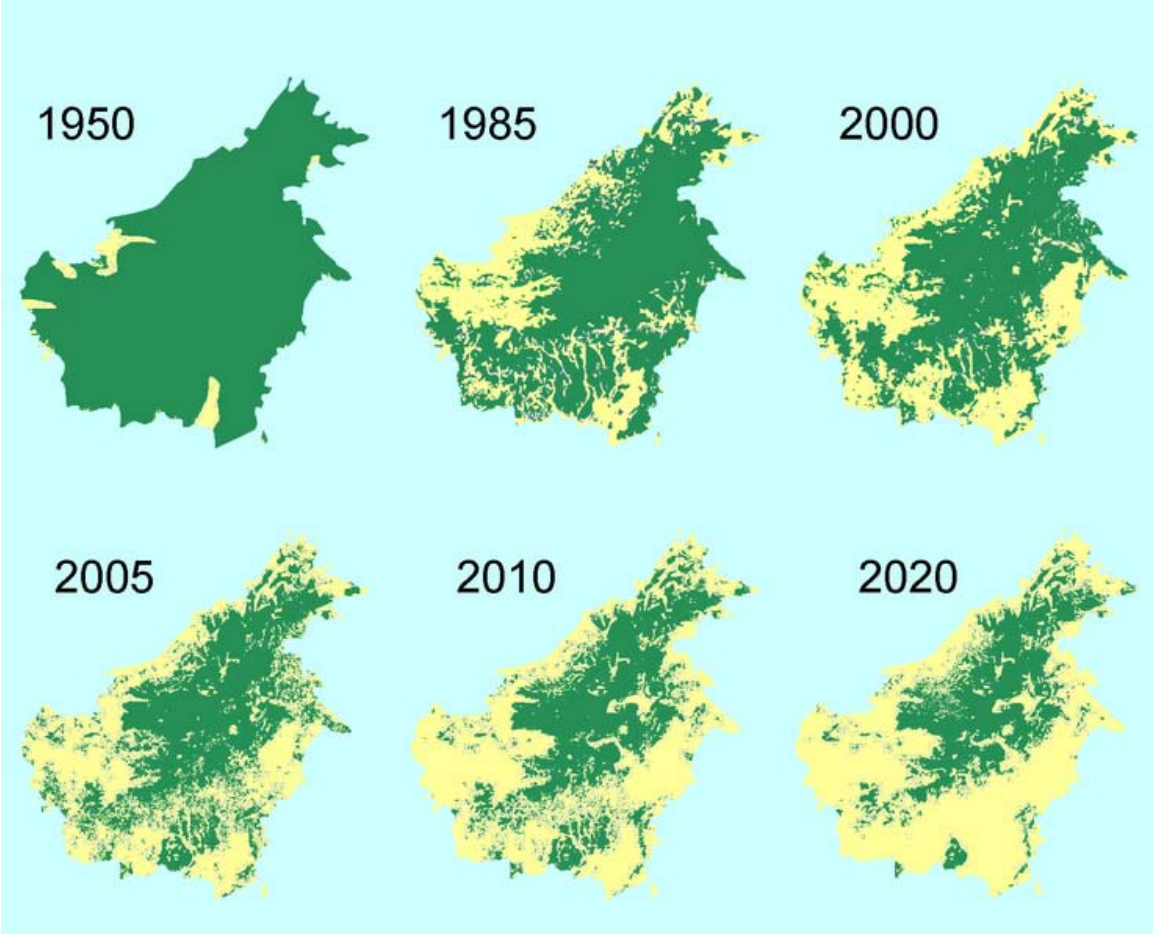
Non-governmental organizations such as WWF have been highly active in the region and WWF Brazil has formed an alliance with some eight other Brazilian NGO'S which aim to

completely halt deforestation in the Amazon by 2015. Working with groups such as Greenpeace and The Nature Conservancy, the proposal, known as the "Agreement on Acknowledging the Value of the Forest and Ending Amazon Deforestation," aims at combining strong public policies with market strategies to achieve annual deforestation reduction targets. The groups aim to establish a wide-ranging commitment between the sectors of the government and society to conserve the rainforest and are aiming for an overall reduction in deforestation of 68,737.8 square kilometres in seven years. Denise Hamú, the CEO of WWF-Brazil has said' "Only through the mobilization of state and federal governments, the private sector and environmental NGOs we can reach significant results for the conservation and promotion of sustainable development in the Amazon".

Toco Toucan. The biodiversity of Brazil's rainforests is under threat

Chapter- 8

Deforestation in Borneo



Map showing the deforestation of Borneo and projected deforestation in 2020

Borneo, the third largest island in the world, divided between Indonesia, Malaysia and Brunei, was once covered with dense rainforests, but along with its tropical lowland and highland forests, there has been extensive deforestation in the past sixty years. In the 1980s and 1990s the forests of Borneo underwent a dramatic transition. They were leveled at a rate unparalleled in human history, burned, logged and cleared and commonly replaced with agricultural land, or palm oil plantations. Half of the annual global tropical timber acquisition currently comes from Borneo. Furthermore, palm oil

plantations are rapidly encroaching on the last remnants of primary rainforest. Much of the forest clearance is illegal.

The World Wildlife Fund divides Borneo into a number of distinct ecoregions including the Borneo lowland rain forests which cover most of the island, with an area of 427,500 square kilometres (165,100 sq mi), the Borneo peat swamp forests, the *Kerangas* or Sundaland heath forests, the Southwest Borneo freshwater swamp forests and the Sunda Shelf mangroves. The Borneo mountain rainforests lie in the central highlands of the island, above the 1,000 metres (3,300 ft) elevation. These areas represent habitat for many endangered species, such as orangutans and elephants.

Malaysian Borneo

Satellite image of rainforest converted to Oil Palm plantations

The Malaysian states of Sarawak and Sabah (East Malaysia), in the north, occupy about 26% of the island. The forested area here shrank rapidly due to heavy logging for the Malaysian plywood industry. Two forestry researchers of Sepilok Research Centre, Sandakan, Sabah in the early '80s identified four fast-growing hardwoods and a breakthrough on seed collection and handling of Acacia mangium and Gmelina arborea, a fast growing tropical trees were planted on huge tract of formerly logged and deforested areas primarily in the northern part of Borneo Island.

The rainforest was also greatly destroyed from the forest fires of 1997 to 1998, which were started by the locals to clear the forests for crops and perpetuated by an

exceptionally dry El Niño season during that period. During the great fire, hotspots could be seen on satellite images and the haze thus created affected the surrounding countries of Brunei, Malaysia, Indonesia and Singapore. In February 2008, the Malaysian government announced the Sarawak Corridor of Renewable Energy plan to harvest the virgin hinterlands of Northern Borneo. Further deforestation and destruction of the biodiversity are anticipated in the wake of logging commissions, hydroelectric dams and other mining of minerals and resources.

Indonesian Borneo

Logging road and impacts in East Kalimantan: logged forest on the left, primary forest on the right

Satellite image of the island of Borneo on August 19, 2002, showing smoke from burning peat swamp forests.

Approximately 73% of the island is Indonesian territory; the Indonesian name for the island, Kalimantan, is used in English to refer to the Indonesian-controlled territory.

In order to combat overpopulation and AIDS in Java, the Indonesian government started a massive transmigration (transmigrasi) of poor farmers and landless peasants into Borneo in the 70's and 80's, to farm the logged areas, albeit with little success as the fertility of the land has been removed with the trees and what soil remains is washed away in tropical downpours.

The Mega Rice Project was initiated in 1996 in the southern sections of Kalimantan. The goal was to turn one million hectares of "unproductive" and sparsely populated peat swamp forest into rice paddies in an effort to allieviate Indonesia's growing food shortage. The government made a large investment in constructing irrigation canals and removing trees. The project did not suceeed and was eventually abandoned after causing considerable damage to the environment.

The peat swamp forest in the south of Kalimantan is an unusual ecology that is home to many unique or rare species such as orangutans, as well as to slow-growing but valuable trees. The peat swamp forest is a dual ecosystem, with diverse tropical trees standing on a 10m - 12m layer of peat -partly decayed and waterlogged plant material - which in turn covers relatively infertile soil. Peat is a major store of carbon. If broken down and burned it contributes to CO_2 emissions, considered a source of global warming.

The water channels and the roads and railways built for legal forestry, opened up the region to illegal forestry. In the MRP area, forest cover dropped from 64.8% in 1991 to 45.7% in 2000 and clearance has continued since then. It appears that almost all the marketable trees have now been removed from the areas covered by the MRP.

It turned out that the channels drained the peat forests rather than irrigating them. Where the forests had often flooded up to 2m deep in the rainy season, now their surface is dry at all times of the year. The government has therefore abandoned the MRP, but the drying peat is vulnerable to fires which continue to break out on a massive scale.

After drainage, fires ravaged the area, destroying remaining forest and wildlife along with new agriculture, filling the air above Borneo and beyond with dense smoke and haze and releasing enormous quantities of CO_2 into the atmosphere. The destruction had a major negative impact on the livelihoods of people in the area. It caused major smog-related health problems amongst half a million people, who suffered from respiratory problems.

Peat forest destruction is causing sulphuric acid pollution of the rivers. In the rainy seasons, the canals are discharging acidic water with a high ratio of pyritic sulphate into rivers up to 150 km upstream from the river mouth. This may be a factor contributing to lower fish catches.

A joint UK-Indonesian study of the timber industry in Indonesia as a whole in 1998 suggested that about 40% of the throughput of timber was illegal, with a value in excess of $365 million. More recent estimates, comparing legal harvesting against known domestic consumption plus exports, suggest that 88% of logging in the country is illegal in some way. Malaysia is the key transit country for illegally logged wood products from Indonesia.

Reforestation

Recently a reforestation project in East Kalimantan has reported some success. The Borneo Orangutan Survival Foundation (BOS), founded by Dr Willie Smits, bought up

nearly 2000 ha of deforested degraded land in Kaltim that had suffered from mechanical logging, drought and severe fires and was covered in alang-alang grass (Imperata cylindrica). The intention was to restore the rainforest and provide a safe haven for rehabilitated orangutans while at the same time providing a source of income for local people. The project was given the name Samboja Lestari, which roughly translates as the "everlasting conservation of Samboja". 1°2′44″S 116°59′15″E / 1.04556°S 116.9875°E. Reforestation and rehabilitation is the core of the project, with hundreds of indigenous species planted. By the middle of 2006 more than 740 different tree species had been planted.

Chapter- 9

Deforestation in Ethiopia

Ethiopian highlands

Deforestation in **Ethiopia** is due to locals clearing forests for their personal needs, such as for fuel, hunting, agriculture, housing development and at times for religious reasons. The main causes of deforestation in Ethiopia are shifting agriculture, livestock production and fuel in drier areas. Deforestation is the process of removing the forest ecosystem by cutting the trees and changing the shape of the land to suit different uses.

Background

Among developing countries, especially in Africa, Ethiopia is exceptionally rich in history, as well as cultural and biological diversity. It is home to one of the earliest ancestors of the human species, around 80 languages are spoken by various ethnic groups and it is home to two globally important biodiversity hotspots. However, this rich cultural and natural heritage is threatened, especially in the form of deforestation.

Ethiopia has the second largest population in Africa and has been hit by famine many times due to rain shortages and a depletion of natural resources. Deforestation may have further lowered the already meagre rainfall. Bercele Bayisa, a 30 year old Ethiopian farmer said "his district was very forested and full of wildlife but, overpopulation cased people to come to this fertile land and clear it to plant crops, cutting all trees to sell as fire wood". Growing populations are increasing deforestation which is leading the country to famine. As the population continues to grow, the needs of the people increase. The country has lost 98% of its forested regions in the last 50 years.

Forests in Ethiopia

Forests in Ethiopia play a big role in protecting erosion, as tree roots protect against washouts. Trees also help to keep water in the soil and reduce global warming by uptake of carbon dioxide. Because there are not enough trees, the Blue Nile is carrying all the soil and nutrients in the water to the neighboring countries of Sudan and Egypt.

Historically, forests have been very important for the livelihoods of the people of Ethiopia. The Ethiopian people used trees for lumber for construction and to fuel their cooking fires. They also made traditional medicines from trees and other forest plants. Forests were also important in Ethiopian religious beliefs; the people believed in holy spirits in the forest that they treat in the same way as human beings. Mitchell Page states that over 6603 plant species live in Ethiopia, of which approximately one fifth are not native to other countries.

At the beginning of the twentieth century around 420,000 square kilometres (35% of Ethiopia's land) was covered by trees but recent research indicates that forest cover is now less than 14.2% due to population growth. Despite the growing need for forested lands, lack of education among locals has led to a continuing decline of forested areas.

Accelerated destruction

Earth trends estimated that in 2000 Ethiopia had 43,440,000 km² of natural forest area, which is 4% of its total land area. Compared to other East African countries Ethiopia's deforestation rate is about average. However, the deforestation rates in East Africa are second highest of the continent. Moreover, it has the smallest fraction of its forest area designated primarily for conservation. Apart from Northern Africa, East African countries show the second highest decline rates of conservation forests in the continent.

In a forest resource assessment of Ethiopia, Reusing found that within 17 years (1973-1990) high-forest cover decreased from 54,410 to 45,055 km² or from 4.75 to 3.93% of the land area. He calculated a deforestation rate of 1,630 km² per year, which means that deforestation at the same rate would leave about 18,975 of the 45,055 km² in 2006. The FAO (2007) estimated a deforestation rate of 1,410 km² per year.

Dereje carried out a study in the coffee forest areas of southwest Ethiopia in order to estimate forest cover change between 1973 and 2005. The study area covered an area of 3,940 km² with 2,808 km² of high-forests (71% of the area) extended over five woredas (Bench, Sheko, Yeki, Guraferda and Godere) in the two regional states of the Gambela and Southern Nations, Nationalities and Peoples Regions. His analysis shows that the forested land declined to 1,907 km², which equals 67% of the forest cover in 1973. Between 2001 and 2005 another 55.4 km² of forest land were allocated for private coffee production and 20 km² for rubber plantations.

Gessesse studied an upland rain forest area of 3,060 km² in the Awasa watershed of the south-central Great Rift Valley, 280 km south of Addis Ababa. He estimated the rate of deforestation between 1972 and 2000 using remote sensing techniques. Furthermore, he could show that within the 28 year period 80% (400 km²) of the 1972 forest cover (489.24 km²) was lost. He describes that within the formerly closed forest, clearings created a speckled pattern of non-connected small forest patches.

Despite the slightly different estimates for deforestation in different regions of Ethiopia, given deforestation rates remain the same, the country will have lost its last tree of high forests within about 27 years. And with it will go the world's only original wild populations of *Coffea arabica*. The economic loss of that genetic resource ranges between 0.4 and 1.5 billion USD/year.

Causes of deforestation

Dereje explains deforestation in the coffee forest area he studied by linking it to historical events in certain time periods. From 1973 – 87 forest cover reduced by 11%. That period was characterized by resettlement and villagization programs and the expansion of state farm programs. Twenty-four percent of forest loss was a result of converting 101.28 square kilometers of high forests into coffee plantations. In later periods forests continued to be converted to agro-forestry systems, agricultural land and settlement areas. The speed and pattern varies depending on the distance to state monitoring and coincides with changes in government.

From the 1950s to 1974 private land ownership was promoted through land grants to civil servants and war veterans. During this period mechanized farming became increasingly attractive. As a result large numbers of rural people were dislocated – also to forest areas. Recently pressure comes from intensive management of forest coffee and semi-forest coffee which drastically changes the structure and functions of the original forests. Improved transport and communication infrastructure and thereby better access to

markets is facilitating deforestation. More forest cover change was detected close to areas with good road networks and around settlements.

Gessesse Dessie and Carl Christiansson identify an entire combination of biophysical and socio-political conditions for forest decline in the Awassa watershed area. Geographic properties, socio-political change, population growth, insecurity of land tenure, agricultural development and the improvement of transport capacities are among the most important. As a result of a political power vacuum during periods of political transition, large forest areas were cut down.

Those proximate reasons are accompanied by underlying causes for deforestation. Faced by food insecurity agricultural land is just more valuable to farmers. Individual farmers do not have many other options than converting forests into agricultural land if they are exposed to severe food insecurity. Their time preference rates are low which means they prefer food today over tomorrow and they definitely can not carry the costs of forest conservation for the larger national or global society.

Deforestation and coffee production

The afromontane rainforests of Southwestern Ethiopia are the world's birthplace of *Coffea arabica* and harbor their last wild populations. The variability in their tolerance towards diseases and drought reflects the high genetic diversity of the wild coffee populations. Their value has been estimated between 0.42 and 1.458 billion US$ a year. Worldwide about 5 billion kg of coffee per year are consumed in the importing countries. Coffee houses have become popular and the specialty coffee market is booming.

Economically valuable forests in Ethiopia, which contain the world's only wild *Coffea arabica* populations are diminishing and, at current deforestation rates, will be completely lost in 27 years. Deforestation in Ethiopia is caused by past governmental and institutional changes, insecurity of land tenure, resettlement programs, population pressure, agricultural and infrastructure developments. Farmers suffer from poverty as well as food insecurity and cannot bear the costs of forest conservation. Ethiopian and international stakeholders are involved in a competitive game for resources, rights and mandates. That hinders collective action and cooperation to prevent deforestation. Apart from appropriate economic incentives, environmental education, public awareness and civil society engagement need to be strengthened and trust needs to be rebuilt between stakeholders. Capacities for conservation must be build by devolving authority. Despite being the birthplace of *Coffea arabica* and the source for one of the world's finest coffees, current commitment of the worldwide coffee industry to conserve the forests is negligible.

Locales of special concern

When the Derg military regime seized power in 1975, socialism was declared the guiding ideology for Ethiopia and all rural and forest land was nationalized. Central and Eastern European experience has taught us that state ownership of land is a disincentive to

manage it productively and sustainably. However, also the current government adopted a constitution in 1995 in which forests (land and other natural resources) are declared exclusively state property. It also says that anybody who is willing to work the land has a right to obtain land without payment. Although this goal can be enforced through land allocation, it almost certainly will conflict with land users' tenure security. This is because the administrative redistribution of land and use rights (in all Regions except Amhara) is contingent on physical residence, the amount of land to be rented out and the prohibition of mortgaging and sale of land. "This leads to confusion and provides scope for bureaucratic discretion."

In 1994 a proclamation made the distinction between public and private ownership of forests, declaring natural forests as state owned and allowing planted forests to be owned privately. The proclamation No. 94/1994 prohibits any person to use or harvest trees, settle, graze, hunt or keep bee hives in the state forest.

With the intention to improve tenure security, the first land certification scheme was initiated 1998 in Tigray and only 80% completed (because of the war with Eritrea). Shortly before the 2005 elections land certification continued also in other regions of Ethiopia. The results showed that certification has indeed improved tenure security and investments into land. However, certification of land rights cannot eliminate systemic uncertainty of the type of problem mentioned earlier in the context of administrative retribution of land. Also, the head of the Ethiopian Forum for Social Studies expressed doubt that "…a piece of paper will bring about (tenure) security because it leaves all other aspects of the (current) land tenure system intact, like interference by the authorities."

In 2000 a new approach to forest ownership and management was initiated with the help of international donor agencies. The so-called co-management approach builds on a contract between the government and communities which rely on forest management for their livelihood. Forest user groups are established and exclusive rights for forest use are granted to the members of the group. The contract confirms the boundaries of the forest, defines ownership and use and other specific conditions. The principal idea behind the co-management approach is that secured rights are a crucial incentive for sustainable management. After initial promising results, the sustainability of that approach still needs to be evaluated.

Deforestation and drought

Horrific famines occurred in Ethiopia during the 1970s and 1980s, especially in the northern part of the country where there was a bad drought. Thousands of people died. Deforestation can exacerbate the problems caused by drought because rains are less likely to soak into the soil and replenish ground water.

Attitudes to deforestation in Ethiopia

It is costly to halt deforestation. Coffee companies have discovered the niche market for forest coffee from Ethiopia and are willing to pay higher prices to the farmer cooperatives in coffee forest areas. Consumers are promised that buying the coffee will improve incomes of farmers and therefore farmers are motivated to manage their coffee forests sustainably. Will farmers act that way? Traditionally farmers have abandoned wild coffee collection when coffee prices were too low. Whether or not higher prices for forest coffee are an incentive either to over-harvest or harvest more sustainably, remains an open question. Currently there is no scientific evidence that higher prices for forest coffee are an incentive for sustainable harvest practices. In fact, even the knowledge about the amount of wild coffee that can be collected in a sustainable way is scarce.

Because of the complex nature of the problem of deforestation, the Ethiopian government alone is not able to prevent deforestation. By now we also know that markets alone are unable to prevent this either. Eventually local stakeholder participation will be required. Much of Ethiopia's national budget is covered by international development aid. Not surprisingly international aid agencies should also play a prominent role in sustainable forest management. The government of Ethiopia has asked several international agencies, like the Japanese ICA, the German Technical Cooperation (GTZ) and FARM-Africa to get involved in Participatory Forest Management. Such projects aim at developing forest management plans and signing contracts between local communities and the government. Different areas of the remaining forests are divided among the foreign aid agencies, where they carry out "their" projects on behalf of the government. What is needed, however, are direct, competent, trustworthy relations between local resource users and the federal authorities: a functioning and effective forestry extension service.

Another problem is that the environmental issues in Ethiopia have no (or a very weak) lobby and the current restrictive socio-political context for public engagement has detrimental effects on environmental education, awareness, advocacy and the building of an engaged and empowered civil society – assets which are necessary to conserve and use Ethiopia's forests in a sustainable way. The recent "School Children Talent Competition Award on Biodiversity Conservation", organized by the Ethiopian Coffee Forest Forum is an excellent example of what is needed.

Government and deforestation

In rural areas, the government realized that if the deforestation continues the overall condition of the country will worsen. Because of that, the government has begun teaching the people about the benefits of forests and encouraging the people to plant more trees and to protect what they have by providing them alternative home and agricultural materials. If any person cuts a tree, he or she needs to plant one to replace it. Basically, the current government and people are working hard together to make their country a better place.

Prohibiting the people to cut trees, especially those who live in rural parts of the country will actually hurt their daily life since it makes meeting their daily needs more difficult. The government is trying to provide them with things such as fuel and electrical machinery so that the demand for forest resources is not as high. The government is also providing land which is flat and has no pre-existing forests to promote agriculture so that deforestation is not necessary for modern agriculture.

There are governmental and nonprofit groups working with the government to protect the land. Organizations such as SOS and Farm Africa are working with the federal government and local governments to create a good system of forest management. The government is also working to relocate people who live in dry regions to places where they can find fertile land for farming, so that they would be able to support themselves without any assistance from the government. With the fund provided by E.C grant (around 2.3 million Euros) people were trained to protect the land from erosion and taught to use water for irrigation, which improved quality of life and the environment. Locals have now come to the realization that trees need legal recognition and must be protected for future generations. One of the methods used to protect trees is to designate certain areas where trees may be chopped down and used and other areas where trees are protected by law.

Environmental issues in Ethiopia

As in many neighboring countries, most **environmental issues in Ethiopia** relate to deforestation and endangered species

Geological issues

The Great Rift Valley is geologically active and susceptible to earthquakes. Hot springs and active volcanoes are found in its extreme east close to the Red Sea. Elsewhere, the land is subject to erosion, overgrazing, deforestation and frequent droughts. Water shortages are common in some areas during the dry season. The causes of degradation are primarily the demand for more land for agriculture, fuel and construction as well as for grazing grounds.

Endangered animals

Ethiopian Wolf

The Ethiopian Wolf is one of the rarest and most endangered of all canid species. The numerous names given to this species reflect previous uncertainties about its taxonomic position. However, the Ethiopian Wolf is now thought to be related to the wolves of the genus *Canis*, rather than the foxes they resemble. Recent DNA evidence even seems to indicate that the Ethiopian Wolf is a descendant of the Gray Wolf. If this lineage is correct, Ethiopian Wolves would be the only genuine wolves in Africa.

Gelada Baboons

Although not listed as endangered, only 50,000-60,000 Geladas are known to exist. Hunting and habitat destruction has forced the Gelada into areas formerly inhabited only by the Olive Baboon; hybridisation between the two species has been observed. In addition, in the southern part of the Amhara Plateau, Gelada males are periodically killed in order to use their manes in a coming-of-age ceremonies. The consequent regular loss of much of the adult male population has disrupted the recovery of this population.

Ethiopian lions

Abyssinian lions are smaller than their east African cousins and the males have distinguishable black manes. Experts say only 1,000 Abyssinian lions (*Panthera leo abyssinica*) remain in Ethiopia. Despite concern amongst conservationists, the 60-year-old Addis Ababa zoo is selling lion cubs to taxidermists because they are unable to feed the cats and lack room to house them.

Muhedin Abdulaziz, the zoo's administrator, said his US $64,000 budget was simply not enough to provide for more than 16 adult lions, which cannot be reintroduced to the wild. "There is a shortage of place and a shortage of budget and when they are over-populated, most of the time we send them to taxidermists," Muhedin said. "It is not really good, but we do this is because of the problems we have," he said.

The culling is done by a veterinarian who kills the cubs with poison. The bodies are sold for about US $175 each to taxidermists who then retail the stuffed lions for US $400. "For the time being our immediate solution is to send them to the taxidermists, but the final and best solution is to extend the zoo into a wider area," Muhedin said.

The director of the wildlife division of Ethiopia's Ministry of Agriculture said he had no idea the lions were being culled.

Chapter- 10

Deforestation in Costa Rica

Costa Rica's tropical landscape

Deforestation is a major threat to biodiversity and ecosystems in Costa Rica. The country has a rich biodiversity with some 12,000 species of plants, 1,239 species of butterflies, 838 species of birds, 440 species of reptiles and amphibians and 232 species of mammals, which have been under threat from deforestation.

Causes and effects

Deforestation in Costa Rica has a serious impact on the environment and therefore may directly or indirectly contribute to flooding, desertification, sedimentation in rivers, loss of wildlife diversity and the obvious sheer loss of timber. Since the end of World War II, approximately 80% of the forests of Costa Rica have disappeared. Approximately 20,000 acres (8,100 ha) of land are deforested annually; in the 1990s the country had one of the worst deforestation rates in Central America. As the population grew, the people of Costa Rica cut down the forests to provide for pastureland for cattle ranching to produce beef for the world market to raise revenue. Since the 1950s, approximately 60% of Costa Rica has been cleared to make room for cattle ranching. The problem was worsened due to the fact that during the 1960s, the United States offered Costa Rican cattle ranchers millions of dollars in loans to produce beef. The deforestation of Costa Rica's tropical rain forests as in other countries is a threat to life worldwide with a profound effect on the global climate. Soil erosion has increased with deforestation with the topsoil washed away from the hills into the streams and out into the oceans, year after year.

Bare land in Guanacasteca

Over half of Costa Rica's existing forest cover today is under the protection of national parks, biological reserves, or wildlife refuges. However, the major problem in regards to deforestation is the privately owned plots which occupy the other half. Lenient laws on

land and amendments to forestry law makes it easy to obtain logging concessions as owners exploit the land to maximise income. As logging companies enter these forests to exploit them, they require access roads to transport the timber. While cattle ranching is by far the primary cause of deforestation in Costa Rica, banana plantations have also significantly contributed to the problem. Lowland rainforest has been most affected where 130,000 acres (530 km^2) of previously forested land (primarily in the Atlantic and Northern regions) have been removed. Such industries have been synonymous with health risks, notably the high levels of toxic pesticides which affected thousands of plantation workers throughout Central America in the 1970s. Pesticides used to grow bananas and other fruits such as mangoes and citrus fruit may enter the hydrological systems and contaminate the water. The removal of the forest to make way for these fruit planatations may also disrupt the nutrient balance in the soil and through monoculture exhaust the soils and render them unsustainable.

Although most of the larger plantations in Costa Rica are owned by large companies, often multinationals, population pressure in Costa Rica has increased the demand for land among farmers who are forced to venture out onto new land to deforest and farm and compete over scraps of land. While certain conservation laws have been passed in Costa Rica, the government lacks the resources to enforce them.

Decline of deforestation 1977-2005

The amount of Costa Rican land deforested annually has declined since 1977:

Year	Forest cleared (ha)
1977	52,000
1983	43,550
1985	42,000
1987	32,000
1991	17,947
1996	18,000
2000	3,033
2005	4,737

Response

The forests of Arenal Volcano National Park

The conservation program in Costa Rica is particularly ambitious and is one of the most developed among tropical rainforest countries.The country has a high level of biodiversity and different eco-zones, even within a small area. For example one of the country's protected areas is a strip of forest which runs for 40 miles (64 km) through nine ecological zones from sea level to 12,500 feet (3,800 m).In 1995, the government introduced further protected areas and a further 13% of the country was put under protection through privately owned preserves, particularly those with high biodiversity.

One of Costa Rica's many national parks to protect biodiversity and habitat loss, Tortuguero National Park

The National Bamboo Project of Costa Rica was founded in 1986 to help decrease deforestation. The scheme aims at reducing deforestation by means of replacing timber with bamboo as a primary building material and providing low cost housing for Costa Rica's rural poor. By cultivating and building with *Guadua* species, indigenous giant bamboos, the National Bamboo Project was able to raise thousands of new homes for the poor, benefit the environment and advance bamboo-based building technology.

In a number of parts of Costa Rica, areas that were bare ten years ago have now been reforested. Many non-government conservation organizations are working in the country to prevent deforestation and further these efforts of preservation and restoration. The country has also significantly taken advantage of ecotourism, taking the initiative to raise revenue through tourism while still protecting the forests. Today, however, while deforestation rates have declined greatly from the 1990s with increased conservation efforts and such schemes, the remaining forests still face threats from illegal logging even in protected areas and land cleared for agriculture and cattle pasture in unprotected areas. Corruption exists in Costa Rica, but this problem is much lower than in many other Latin American countries.

Deforestation in Costa Rica has also been mentioned in a number of cultural (as opposed to scientific) works. For example, the increased rate of deforestation in the 1980s and early 1990s was noted in Michael Crichton's novel *Jurassic Park* (published November, 1990): "most of the deforestation being in the last ten years".

Decentralization efforts

Decentralized decision-making is being practiced in Costa Rica to improve protected area management and biodiversity conservation. Costa Rica stands out among all developing tropical countries for its commitment toward environmental and natural resources issues. The central government has developed a protected area system that has given some kind of protected status to 25% of its national territory. In the mid-nineties the Costa Rican government started to decentralize management and decision-making of all protected areas in the country to promote locally based biodiversity conservation governance. All protected areas were grouped in eleven regionally based administrative units and were labeled as conservation areas. The central government gave each conservation area the authority to exercise significant degrees of autonomy to design and implement policy for the management of the protected areas under their jurisdiction.

Costa Rica is one of the region’s most centralized countries, which has caused forest management to have problems of corruption and lack of efficient controls. An effort has been made in recent years to find different management initiatives that might reduce these problems. Decentralization of the state has been totally excluded from the national political agenda. In recent years, important bills have been formulated to decentralize power to the municipal governments and there is growing awareness of the need to stimulate local participation in natural resource management.

In 1979, Costa Rican forest legislation created tax deduction mechanisms and development funds to jumpstart economic activity linked to reforestation and sustainable forest use. The incentive system introduced the Payment for Environmental Services (PSA) system. The PSA establishes payments to owners of forests and forest plantations in recognition of the service that conserving or appropriately managing the forest offers to society as a whole. According to this law, the services recognized are the mitigation of greenhouse effect gases, the protection of water resources and protection of the biodiversity and scenic beauty. The Ministry of the Environment and Energy (MINAE) administers the PSA system through the National Forestry Financing Fund (FONAFIFO). Funding for the system essentially comes from the transfer of a third of the selective sales tax on fuels and hydrocarbons. One of the main criticisms of the PSA is that the payment allocation has discriminated in practice against small farmers and indigenous peasants, above all those without registered property title deeds. Given that only owners of forested land who can show title are eligible for the benefit, many small farmers and peasants end up excluded.

Because Costa Rica’s forestry sector has made a major effort to certify its activity’s environmental performance, 65,344 ha of forest and forest plantations now use environmental certification schemes of management. Ecotourism is another important

forest-related economic activity. The international promotion of Costa Rica as a “green” tourist spot has made the forest a valuable tourist attraction. During the 2000 tourist season, 70.7% of those who visited the country went to some protected area (national parks, wildlife refuges or others).

Chapter- 11

Deforestation in Other Countries

Deforestation in Thailand

Thailand's borders with Laos and Cambodia are reflected by the brown on the Thai side in this true-colour satellite image, which shows the effects of heavy deforestation in the country.

Between 1945 and 1975 forest cover in Thailand dropped from 61% to 34% of the country's land area. Over the next 11 years Thailand lost close to 28% of all of their remaining forests. This means that they were losing 3.1% of their forest cover each year

over that period. Northern Thailand, the most heavily forested region of the country was not subject to central government and settlement until the second half of the Nineteenth Century. Prior to settlement it was a sparsely populated resource-rich region. When looking at cases of deforestation most people associate the rapid loss of forests with the increasing demand for wood as a resource for industry and development, Thailand presents a somewhat different situation in that deforestation can be tied to political, economic and societal factors. Much of Thailand's recent economic improvement can be attributed to increased agricultural production for export. The country was able to increase production by clearing much of their forests and converting them to cropland.

History of Thai forest management

- In 1897 the Royal Forest Department was established to maintain and control revenue from the teak forests in northern Thailand.
- In 1899 all forests were declared government property and all logging without payment to the Royal Forest Department was prohibited...
- In 1956 The Forest Industry Organization was established to take over government control of industrial uses of Thai forests.
- In 1962 the Thai government began to establish national parks and other forest conservation areas, their management was still under the jurisdiction of the Royal Forest Department. In the sixties there was a large shift in the forest use in Thailand. Deforestation began to increase but not due to the commercial uses in the teak forests in the north but rather the increased export agriculture being done in the south.

- In the late 1960's the Thai government began to grant logging concessions, which required re-planting but were poorly managed.
- A military coup in 1976 led to political instability. The military began to clear forests to suppress rebel forces that had settled in the forests for protection.

- The political instability left the government with little power to protect forests and illegal logging was pursued more heavily by villagers. During the height of illegal logging in Thailand it is estimated that somewhere between 50-75% of timber coming out of Thailand was obtained illegally.

- In the 1980s the government took many steps to limit the speed at which Thailand's forests were disappearing. They set a target for 40% forest cover. To achieve this they initiated tree planting initiatives and leased some degraded forests to third parties to create logging plantations.

- In 1988 a flood in southern Thailand finally set in motion a complete ban on all commercial logging that was put in place in 1989.

Causes of Deforestation in Thailand

Rice paddies and recently cleared forest land in Chiang Mai province

Population Growth

This is most evident in the Northeast region of Thailand. The region is the most densely populated in the nation and has some of the least productive soils for agriculture. As populations increased, the need for food increased and much forest land had to be cleared to increase food production capacity to meet demand.

Agricultural Policy

The Thai government put controls on the price of rice, which encouraged farmers to explore alternative crops. However, the largest impact agricultural policy had on deforestation was the construction of roads following World War 2. These roads were built to help farmers bring food products from rural areas into the more densely populated urban centers. This encouraged farmers to move away from subsistence farming and begin to farm on a larger scale.

Land Ownership Policy

Property rights in Thailand are extremely ambiguous and are often interpreted differently by the various branches of the Thai government. The inability of many Thai citizens to secure property has resulted in them going out into the forests to find space to farm.

Deforestation in Vietnam

According to a 2005 report conducted by the Food and Agriculture Organization of the United Nations (FAO), Vietnam has the second highest rate of deforestation of primary forests in the world, second only to Nigeria.

However, regarding total forest cover, Vietnam has undergone a forest transition: its forest cover has increased since the early 1990s, after decades of deforestation.

As of 2005, 12,931,000 hectares (the equivalent of 39.7% of Vietnam's land cover) was forested, although only 85,000 hectares (0.7% of the land cover) was primary forest, the most biodiverse form of forest.

Vietnam has some 1,534 known species of fauna and 10,500 species of vascular plants, according to the World Conservation Monitoring Centre. 3.4% of Vietnam is protected under IUCN categories I-V.

Deforestation in Haiti

Satellite image depicting the border between Haiti (left) and the Dominican Republic (right), 2002.

Deforestation in Haiti is a severe environmental problem. In 1923, over 60% of Haiti's land was forested; by 2006, less than 2% was.

Deforestation sped up after Hurricane Hazel downed trees throughout the island in 1954. Beginning in about 1954, concessionaires stepped up their logging operations, in response to Port-au-Prince's intensified demand for charcoal, thus accelerating deforestation, which had already become a problem because of environmentally unsound agricultural practices, rapid population growth and increased competition over scarce land. Rather than using techniques which could make forestry more productive for fuel, like coppicing and pollarding, the lack of title on much land results in charcoal burners digging up and using tree root structures. There is also a less discussed problem with feral goats which overgraze and eat seedlings that might otherwise replace ground cover.

The most direct effect of deforestation is soil erosion. An estimated 15,000 acres (61 km^2) of topsoil are washed away each year, with erosion also damaging other productive infrastructure such as dams, irrigation systems, roads and coastal marine ecosystems. Soil erosion also lowers the productivity of the land, worsens droughts and eventually leads to desertification, all of which increase the pressure on the remaining land and trees.

Most of Haiti's governments paid only lip service to the imperative of reforestation. As was the case in other areas of Haitian life, the main impetus to act came from abroad. USAID's Agroforestry Outreach Program, Projè Pyebwa, was the country's major reforestation program in the 1980s. Peasants planted more than 25 million trees under Projè Pyebwa, but as many as seven trees were cut for each new tree planted. Later efforts to save Haiti's trees focused on intensifying reforestation programs, reducing waste in charcoal production, introducing more wood-efficient stoves and importing wood under USAID's Food for Peace program. Because most Haitians still depend on wood and charcoal as their primary fuel source, energy alternatives are needed to save the forests. The 15-year Environment Action Plan, authorized in 1999, proposed to stop deforestation by developing alternative fuel sources. Political instability and lack of funding have limited the impact of this reform effort. However, various grassroots projects have begun planting thousands of trees in an effort to combat deforestation and to reforest the country.

Several agencies and companies that produce solar cookers as an alternative to using wood and charcoal have been working in Haiti to establish solutions to the poverty and fuel issues.

Deforestation in Central America

Central American countries have experienced cycles of deforestation and reforestation since the decline of Maya civilization, influenced by many factors such as population growth and agriculture.

History

The history of most Central American countries involves cycles of deforestation and reforestation. For the Ancient Mayan culture at Copan, Honduras, the process of clearing large amounts of land for their agricultural-based society surpassed the forests' ability to replenish naturally. Besides the clearing of land for farmland, Mayans consumed vast quantities of wood as fuel and building materials, rapidly depleting the natural resources of this area. Eventually, the lack of firewood may have caused health problems among those who were unable to properly cook their food or warm their habitations.

By the fifteenth century, intensive Mayan agriculture had significantly thinned the forests, but had not completely decimated them. Before Europeans arrived, forests covered 500,000 square kilometers – approximately 90% of the region. The arrival of the Spaniards caused a sharp decrease in population resulting from the highly contagious diseases introduced by the conquistadores. This reduction in human pressure gave much of the land that had been cleared for cultivation time to recover. Eventually, the forcing of "Europe's money economy on Latin America" created the demand for the exportation of primary products, which introduced the need for large amounts of cleared agricultural land to produce those products. While the cultivation of some exports such as indigo and cochineal dye worked harmoniously with the surrounding indigenous vegetation, other crops such as sugar required clear-cutting of land and mass quantities of firewood to fuel the refining process, which spurred rapid, destructive deforestation.

From the eighteenth to the twentieth century, mahogany exports for furniture became the major cause of forest exhaustion. The region experienced economic change in the nineteenth century through a "fuller integration in the world capitalist system". This, combined with conflict with Spain, put an even greater emphasis on plantation cropping. Throughout the nineteenth and twentieth centuries, Europe and North America became the chief importers of the regions coffee and banana crops, thus putting increasing demand on the land to produce large quantities of these cash crops and perpetuating the clearing of more forest in an attempt to acquire more exploitable farmland. Most recently, as of the 1960s, cattle ranching has become the primary reason for land clearing. The lean grass-fed cattle produced by Central American ranches (as opposed to grain-fed cattle raised elsewhere) was perfectly suited for American fast-food restaurants and this seemingly bottomless market has created the so-called "hamburger connection" which links "consumer lifestyles in North America with deforestation in Central America". This demonstrates how the developed world has had an indirect influence on the environment and landscape of developing countries.

Logging as a Cause

Logging is another factor that increases deforestation in multiple ways. Though regulated logging is far less detrimental to the forest, uncontrolled logging is prevalent in developing countries due to the demand for timber to house growing populations and the poor economic situation of those making their living from and in the forest itself. Furthermore, all forms of logging necessitate the building of roads, which generates easy

access to those seeking new land to clear for agriculture. The use of wood as the primary fuel for cooking and heating is compounded by developing countries inability to pay high oil prices. As a result, the demand for firewood is "one of the most commonly cited causes of deforestation".

Population Growth as a Cause

As the countries of this region continue to develop, the sheer number of people, as well as trade with developed countries, puts pressure on natural resources by creating many of the situations previously discussed, such as the necessary clearing of land for agriculture and housing. Another study shows that population growth and technological development in Central America (the Mesoamerican biodiversity hotspot) does in fact have a direct impact on the rate of deforestation.

Global Impact

Similarly to the Amazonian rainforest, the Central American forest also "adds to local humidity through transpiration". Without the extra moisture from transpiration, rainfall totals are significantly decreased. Moreover, with less moisture in the air comes the increased susceptibility to fire. These local ramifications are quite serious and affect the quality of life of the surrounding populations, especially the poor, rural peoples who depend on the land for their livelihoods. In addition to the strain on the local environment, the destruction of the rainforests has "a broader impact, affecting global climate and biodiversity".

Efforts to Reverse the Effects

Many countries have undertaken plans to conserve and replenish the forest in response to the recent upsurge in deforestation. For example, in Nicaragua, forest management consists of shifting from timber to non-timber harvesting alongside sustainable logging methods. In Costa Rica, logging roads that had once added to the problem of deforestation are being researched as potential avenues of reforestation. Furthermore, in the mid 1990s, "damage-controlled logging practices" were implemented to prevent rampant illegal logging.

Land clearing in Australia

The distribution of *Banksia* largely coincides with areas of high population density and large tracts of *Banksia* woodland are cleared for urban expansion every year. In this photo, land clearing for housing threatens the *Banksia menziesii* species in Canning Vale, Western Australia.

Land clearing involves the removal of native vegetation and habitats, including the bulldozing of native bushlands, forests, savannah, woodlands and native grasslands and the draining of natural wetlands for replacement with agriculture, urban and other land uses. As much as 70% of Australia's native vegetation has been cleared or modified in the past 200 years, most of which has occurred in the last 50 years.

Prior to European settlement native vegetation covered most of Australia but now only 87% of the country is vegetated by native species. In total 13% of Australia's native vegetation has been lost due to land clearing, with the majority of this being native forests and woodlands.

History

The primary motivator for land clearing in Australia is agricultural profit. The clearing of land allows for increased agricultural production and increase in land values. Land clearing was seen as progressive and there was the general view that land was wasted unless it was developed.

Historically, land clearing has been supported by the Commonwealth and State Governments as an essential part of improved productivity essential for national economic prosperity.a range of institutional incentives for agriculture increased the economic gain from land clearing, with offerings of cheap land along with venture capital in the form of loans or tax concessions. Other incentives included the War Service Land Settlement Scheme, low interest bank loans and financial support programs such as drought relief assistance.

The majority of cleared land in Australia has been developed for cattle, cotton and wheat production. In New South Wales, much of the remaining forest and woodland has been totally cleared, which is due largely to the high productivity of the land for agricultural purposes. Urban development is also the cause of some land clearing, though not a major driver. In The Australian Capital Territory for example, much urban development has occurred on previously cleared agricultural land.

Since the 1980's, the rate of land clearing has declined due to changing attitudes and greater awareness of the damaging effects of clearing. Clearing is now controlled by legislation in Western Australia, South Australia, Victoria, New South Wales and to a lesser degree in Queensland. Land clearing controls differ substantially between jurisdictions and despite growing awareness of the effect of land degradation, controls on clearing have been generally opposed by farmers.

Land clearing destroys plants and local ecosystems and removes the food and habitat on which other native species rely. Clearing allows weeds and invasive animals to spread, affects greenhouse gas emissions and can lead to soil degradation, such as erosion and salinity, which in turn can affect water quality.

The following table shows the Native Vegetation Inventory Assessment (NVIS) of native vegetation by type prior to European settlement and as at 2001-2004.

Vegetation Type	Pre Settlement Total	2005 Total	Percentage Lost
Forest and Woodland	4,101,868	3,184,260	22%
Shrublands	1,470,614	1,411,539	4%
Heath	9,256	8,071	13%
Grassland	1,996,688	1,958,671	2%
Total Native Vegetation	7,578,204	6,562,541	13%

Effects Land Condition As land cover is crucial to land condition, land clearing exerts significant pressure on land condition. Removal of vegetation also leaves soil bare and vulnerable to erosion. Soil stability is essential to avoid land degradation.

Soil erosion is a very significant pressure on land condition because it undermines existing vegetation and habitats and inhibits vegetation and other biota that inhabit the vegetation from re-establishing. Terrestrial vegetation is a source of nutrient replenishment for soils. If vegetation is removed, there is less biological matter available

to break down and replenish the nutrients in the soil. Exposing soil to erosion leads to further nutrient depletion.

Another consequence of land clearing is dryland salinity. Dryland salinity is the movement of salt to the land surface via groundwater. In Australia there are vast amounts of salt stored beneath the land surface. Much of Australian native vegetation has adapted to low rainfall conditions and use deep root systems to take advantage of any available water beneath the surface. In this way, plant roots help to store salt in the earth, by keeping ground water levels low enough so that salt is not pushed to the surface. However, with the removal of plants due to land clearing, the amount of water leaking into the groundwater beneath the root system means that the water table rises to the surface along with salt. Salinity reduces plant productivity and affects the health of rivers and streams.

Biodiversity

The extinction of 20 different mammal, 12 bird and 97 plant species have been partially attributed to land clearing. While land condition is one indicator of the pressure of vegetation removal, the health and resilience of the vegetation that remains is also largely dependent on the size of the fragments and their distance from each other. This is also true for species living within these habitat fragments. The smaller and more isolated the remnants, the greater the threat from external pressures as their boundaries (or edges) are more exposed to disturbances Pressure also increases with the distance to be traversed between fragments.

Climate Change

Land clearing is a major source of Australia's greenhouse gas emissions and contributes to approximately 12 percent of Australia's total emissions in 1998. It has also been found that past clearing of native vegetation contributed to higher temperatures, decreased rainfall and more intense droughts. The removal of vegetation damages the microclimate by removing shade and reducing humidity. It also contributes to global climate change by diminishing the capacity of the world's vegetation to absorb carbon dioxide.

Deforestation in New Zealand

Deforestation in **New Zealand** has been a contentious environmental issue in the past, but native forests, colloquially called "the bush", now have legal protection.

Pre-human forest cover

Since New Zealand was the last major landmass to be settled by humans, anthropological changes are easier to study than in countries with a longer human history. A picture of the vegetation cover has been built up through the use of archeological and fossil remains, especially pollen grains from old forests. Some of the most ancient intact forests in the world are found in New Zealand, examples being on Stewart Island and Ulva Island.

Māori settlement

Prior to the Maori arrival, New Zealand was almost entirely forested, besides high alpine regions and those areas affected by volcanism. Throughout the Maori's exclusive inhabitance, the environment took an expensive toll. Approximately 50% of the original forest cover had been deforested before European contact.

The Māori people began settling the country about 800 years ago and reduced the amount of forest cover with the use of fire. By 1840, when Europeans were a small part of the population, the forest cover had been reduced from 85% down to 56%.

European settlement

When the first Europeans arrived, in 1772, there was still thick, dense forest cover. The Early explorers such as Cook and Banks described the land as "immense woods, lofty trees and the finest timber" Mainly timber was used for repairs to sailing ships until the 19th Century. With the colony of New South Wales rapidly expanding, the need for timber from New Zealand began to rise. Timber exports, mainly kauri, became a major industry for New Zealand. There are records from the 1840s, stating that 50 to 100 ships could be tied to shore in Kaipara Harbor and be filled with lumber from giant floating booms that can hold 10,000 logs at a time. Besides trees as a form of lumber, many pioneers found the kauri trees valuable for the gum it produced to make varnish and linoleum mainly in the north island near Auckland. The colonist used unconventional methods to gather this gum from living trees. Stripping these trees and the ground around them resulted in the destruction of the land, rendering it unusable for agriculture (Wynn pg. 108). With out the trees to hold the soil and debris to the land, water flowed freely causing flooding to be inevitable, which occurred often. As most of New Zealand was covered with thick bush, the slash and burn technique was used often for land set aside for farming in these areas. This practice was not carried out very responsibly due to the complexity of controlling a fire and in turn resulted in enormous amounts of unintentional land catching fire. This led to thousand of acres accidentally burned and destroyed.

After the Treaty of Waitangi was signed in 1840, settlers begin a rapid expansion. Deforestation continued for many uses including clearing land for farming and gardens and wood for construction. An estimated 50,000 acres (200 km^2) land was also lost due to human caused forest fires within only a few days. The rapid levels of deforestation can be seen when looking at sawmill production. There were only six sawmills in 1843, twelve in 1847, fifteen in 1855 and ninety-three in 1868, a growth of more than fifteen times in twelve years. More access to different areas through the newly laid railroad system led to many sawmilling settlements becoming railroad stops. With the production of many more sawmills, job availability increased. These factors helped add to the exponential deforestation rate countrywide. With time, the mills also became more productive and more abundant, perpetuating deforestation.

In the 20th Century the timber had deforested approximately 14 million hectares, or half of the pre-European forest cover.

Recent history

By the 1970s the environmental movement started direct action to protect forests. Notable direct action campaigns were at Pureora Forest with Stephen King and the West Coast with the Native Forest Action Council and Native Forest Action. All native forest logging on public land ended in 2000 when the Labour led government upheld its election promise to stop the logging.

Forest protection

Many legal avenues now exist to protect native forests. The Resource Management Act, a major Act of Parliament that was passed in 1991, affords any natural environment a level of legal protection through the resource consent process. The logging of native trees is governed by a permit system administered by the Ministry of Agriculture and Forestry (MAF) and must be shown to be sustainable.