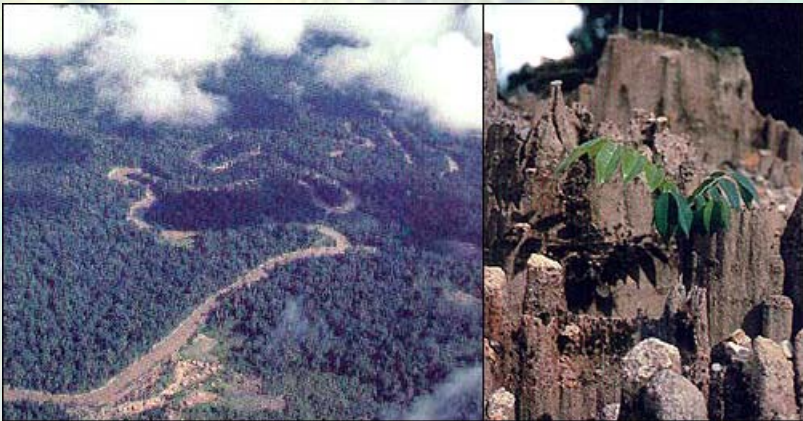


## Holocaust of the Green Cathedral: Tropical Deforestation

### Emerald Deserts and the Five Levels of Wonderland

Tropical rainforests are sometimes called emerald deserts. Because of the relatively high rainfall, their predominantly clay soils are lean in nutrients. Trees and plants send out shallow roots soaking up available nutrients from the forest's waste products - fallen leaves, dead trees and rotting organic matter. These also inhibit nitrogen-producing bacteria through the presence of tannins, reducing nitrogen loss to a minimum. Unlike temperate regions, virtually all the nutrient is thus recycled back into the forest canopy, leaving little in the soils. They are held so tight, it is only with the destruction of the forest itself that the nutrients become released. Stripping away the trees causes the exposed soils to deteriorate rapidly, eroded by the torrential rains that can deluge tropical forests with sometimes over 2.5 centimeters of rain in 30 minutes. A single storm can remove up to 185 metric tons of topsoil from one treeless hectare. After the rains cease, the sun bakes the earth into a hard ochre-colored mass. Such 'laterization' often renders the exposed soil incapable of supporting any kind of vegetation and can be irreversible. Burning is particularly damaging as most of the nutrients are released into the atmosphere. Gradually some research is going into mulching cut material instead (Lean et. al. 65, Ayensu et. al. 106).



Green desert - Amazonian jungle from the air. Eroding soil beside a road in the Amazon (Wallace, Ayensu 209)

There are many kinds of tropical forest, depending on climate, rainfall, the underlying substrate and altitude, varying from the sunken forests of the Amazon wet season to the cloud forests of the high altitudes. What makes all of them interesting is their richness in species compared with the forests of temperate zones. There are often only a few of each species of tree and shrub in any one stand, contrasting with the extensive dominance of a few species in temperate forests. Brazil and Colombia each have around 85,000 plant species, while the US and Europe only 12,000-15,000. They are the most highly developed ecosystems on Earth.

Mature tropical forest has many layers or stories. The uppermost emergent layer

consists of trees 100 feet or more in height. These giants form a broken canopy, rarely touching. They get more sunlight and can tolerate wind. Lower down and more continuous, the main canopy is composed of closely-spaced trees with broad or rounded crowns. Next is a story of smaller trees up to 50 feet which can tolerate dimmer light conditions and receive more moisture. At ground level, the air is very still and the light very dim. Only 2% of the sunlight which reaches the canopy penetrates to the forest floor.



The diversity of tropical forest environments is hinted at by the aerial picture of the winding Amazonian flood plain (previous illustration), the Iguacu Falls bordering Brazil and Argentina (Ayensu 105) and the Cidodja Springs in Java (Ayensu 112).

The forest is a complex and chaotic climax ecosystem. It is continually changing as a result of storms, weather changes and the fall of trees to create fractal windows (p 2) and light patches which allow new individuals to break through the canopy. The Amazon has such high biodiversity partly because it has in historical epochs had significant changes to its climate, retreating into forest islands during drier ice ages and re-enveloping to mix the differentiated species in warmer times. What is different about the current attack on the forests is its massive global extent and massive penetration, dividing even the core sanctuaries into small islands. These effects could combine with resulting climatic changes to make the devastation very serious indeed. Increased incidence of El Niño for example carries the precipitation from the east of the Andes to the west, inhibits the Asian monsoon and causes drought in African forests as well. These combined factors can become devastating.

### **The Demise of the Great Forests**

The world is witnessing an unprecedented destruction of forests worldwide. Forests in Europe suffer from acid rain and vast swathes of Siberia have come under the axe of multinationals since the collapse of the Soviet Union.

However it is in the world's great tropical forests where the destruction is most dangerous and where wholesale felling is having the most devastating effect on biodiversity. As already noted, the tropical forests harbour the greatest biological diversity of any areas of the planet. It is the destruction of these areas which will

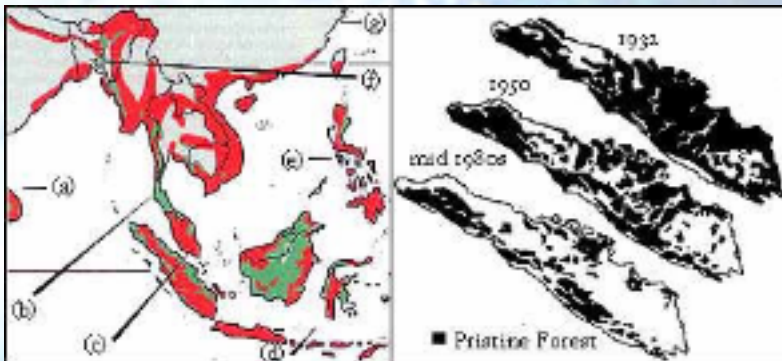
limit humanity's future for possibly millions of years to come.

*"So well does the living forest hold onto the scarce nutrients that nothing can release them, except the destruction of the forest itself" (Carl Jordan - Ayensu 106)*



Amazon 1973, Rainforest clearing, Amazon 1987-8 (Revkin, Porritt 97, Revkin). During burning, the entire planet was obscured and world CO<sub>2</sub> emission increased significantly. In 1997 fires half of Brazil was obscured by smoke. This season's peat bog fires in Indonesia are estimated to have contributed as much CO<sub>2</sub> as the whole of Western Europe.

Over the last half century a tragedy of global dimensions has been unfolding in the world's tropical forests. These unique ecosystems, the richest on earth, are being destroyed at unprecedented rates. All of humanity is affected. Tropical forests regulate water flow and protect watersheds for farmers who grow food for over 1 billion people; they regulate climate and produce oxygen, provide hardwood timber and fuel wood, are home to indigenous people, and harbour untapped genetic resources worth countless billions of dollars (Lean et. al. 65).



Left: South-east Asian Tropical Deforestation is particularly severe, despite the region being the second only to the Amazon for biological diversity: (a) India, Sri Lanka Almost all primary rainforest destroyed. (b) Thailand 45% loss between 1961 and 1985. Will lose 60% by 2000. (c) Malaysia Forest resources exhausted by 2000. (d) Indonesia 620,000 hectares / year. (e) Philippines 55% forest loss 1960 - 1985. (f) Bangladesh All primary rainforest destroyed (Lean 67). Right: Sumatra deforestation. (Groombridge)

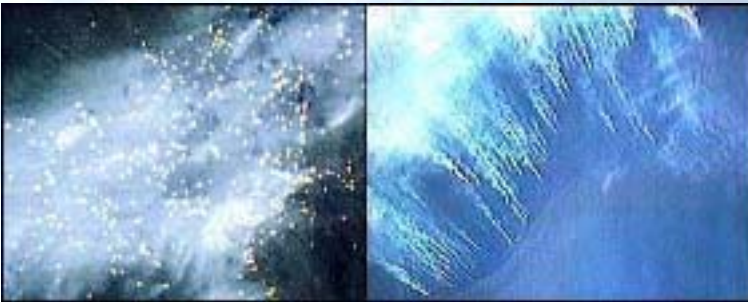
About half of the mature tropical forests, between 750 to 800 million hectares of the original 1.5 to 1.6 billion hectares that once graced the planet have already

been felled. The devastation is already acute in South East Asia, the second of the world's great biodiversity hot spots. Most of what remains is in the Amazon Basin, where the forest covered more than 600 million hectares, an area nearly two thirds the size of the United States.

The forests are being destroyed at an ever-quickening pace. Unless significant measures are taken on a world-wide basis to preserve them, by 2030 there will only be 10% remaining with another 10% in a degraded condition. 80% will have been lost and with them the natural diversity they contain will pass away forever.

### **Rio's Burning Legacy**

Until recently, the best estimates by the Food and Agriculture Organization suggested some 11.4 million hectares of tropical forest were being felled each year, but a World Resources Institute survey, published by the World Resources report in 1990, which for the first time used global satellite observations to build up a global picture revealed that the rate of destruction has increased to between 16.4 and 20.4 million hectares annually, an area about twice the size of Austria. Deforestation shows annual fluctuations, depending on weather and the activities on the ground.. In Brazil; in 1987, a particularly bad year, some 9 million hectares are thought to have been destroyed there, as opposed to almost 5 million hectares in 1988, leading to major hazing of the planet and a significant contribution to world CO2 emissions. These figures represent only those areas that have been permanently cleared for other uses, but many further millions of hectares are severely degraded each year. Individual countries have shown an even more rapid increase in the rate of destruction. In Brazil, the annual clearances rose more than fivefold from the 1980 survey to the 1987 figure (Lean et. al. 65).



Fires in the Amazon - aerial evening view (Sagan) Sulawesi burning. A host of small fires visible from shuttle orbit (National Geographic).

Despite the rhetoric at the Rio Biodiversity Convention in 1992, the rate of deforestation in the Amazon, from satellite surveys show a massive increase. Brazil decreed tough new restrictions whose effect remains to be established in response to satellite information indicating a 34% increase from 11,000 sq. kilometers/year in 1991 to 14,900 between 1992 and 1994. President Cardoso declared a two year suspension on new mahogany and virola harvesting and increased from 50 to 80% the amount of land ranchers and farmers must leave on their property. These restrictions may not work because Brazil's environmental laws are regularly flouted (New Sci. Aug 96).

Burning and logging destroyed more rainforest in Brazil in 1995 than in any previous year, according to figures released in 1997 by their National Space Research Institute. The area lost, 29,059 square kilometers, was almost twice the area deforested in 1994. High rainfall reduced the damage in 1996 to 18,161 square kilometers. The US government's NOAA-12 satellite spotted more than 24,000 fires in the Brazilian Amazon between early August and mid-September 1997, the height of the burning season. This is a 28 per cent increase on the previous year, the satellite's first year on fire watch. The blaze has also spread to neighboring Colombia. The fires, most of which are started by farmers, show up as temperature anomalies at night (New Sci. Oct 97, Jan 98).

In Burma there was a more than sixfold increase, from 105,000 hectares in 1980 to 677,000 in the 1990 report. And in India there is a tenfold difference in the two figures, rising from 147,000 hectares of tropical forest destroyed annually in 1980 to 1.5 million in 1990 (Lean 65).

Many tropical countries, including Indonesia, Thailand, Malaysia, Bangladesh, China, Sri Lanka, Laos, Nigeria, Liberia, Guinea, Ghana and the Cote d'Ivoire have already lost large areas of their rainforest. Eighty per cent of the forests of the Philippines have already been cut down. "In 1960 Central America still had four fifths of its original forest; now it is left with only two fifths of it. Half of the Brazilian state of Rondonia's 24.3 million hectares have been destroyed or severely degraded in recent years. Here, as in rainforests all over the world, indigenous people are being driven from the land they have lived in - and managed sustainably - for thousands of years. Several countries, notably the Philippines, Thailand and India have declared their deforestation a national emergency (Porritt 34). Droughts in West Africa over the past 20 years may have been caused by the destruction of rainforests in countries such as Nigeria, Ghana and Cote d'Ivoire, according to a new study. Further deforestation in the region "could cause the complete collapse of the West African monsoon (NS Jan 97). These effects are becoming global. As the green band around the equator becomes bald, there is an increase in 'shininess' of the Earth's surface, impacting directly on climate (Myers, Porritt 49).



Amazonian fires from the ground (New Scientist Oct, Dec 97)

## Indonesia: The Neighbour from Hell

In 1997, Sumatra and Kalimantan burned. Environmentalists monitoring satellite pictures of the sprawling archipelago said between 500,000 and 600,000 ha [the final count became 5,000,000 ha] was burning or had already been destroyed. The head of the World Wildlife Fund for Nature, Dr. Syed Babar Ali, called it an international catastrophe. This burning is an intentional opportunity coinciding with drought from El Niño. 232 people died when a Garuda flight to Medan crashed in thick smoke (NZ Herald Sep 97).



27-September 1997 Daytime satellite map shows haze and site of fires emphasized at foot of Sumatra (NZ Herald).

The causes of the pollution disaster in South-east Asia are many but the source is greed. For years giant logging companies plundered the forests of Indonesia with impunity, swelling their profits and moving on. In their wake came plantation owners and farmers who wanted to clear the brush to grow lucrative palm oil and other crops. They could have bulldozed the debris, but chose to burn, because it was cheaper and faster. Without the logging companies chopping down the big trees and building the roads, they could never have done it. The timber industry must take a huge share of the blame.

The consequence: hundreds of people reported killed as the fires spread uncontrollably from Borneo and Sumatra, throwing a deadly blanket of smog over 70 million people in six countries: Indonesia, Singapore, Malaysia, Brunei, the Philippines and Thailand. Satellite pictures show the fires have spread to one million hectares

of deep peatlands where they may burn underground for years. The world faces a human and environmental catastrophe that will have a devastating effect on public health and change global climate more than the Mt St Helen's eruption in 1980 or Saddam Hussein's torching of the Kuwaiti oil fields in 1991.

Continuing peat bog fires are believed to be likely to emit as much CO<sub>2</sub> as all of Western Europe over the next year. Some experts say the pollution could bring storms to Europe and the United States this winter. The Indonesian Government also stands accused of greed: granting concessions to timber companies to log one million hectares of forest a year, flouting its own rules on replanting. Allowing plantation owners and farmers to burn forests in breach of its own laws. It seems incredible that this ecological nightmare could start in Indonesia where the rain forests are said to be richer than those in the Amazon. Yet the disaster would not have happened were it not for another crucial factor - El Niño. Crucially, climatologists say, El Niño is occurring more often because of global warming.



Wanton torching in the midst of the Indonesian fires (New Scientist)

### Logging, Multinationals and the Asian Invasion of the Amazon

A major source of deforestation particularly in Asia has been the logging industry, driven spectacularly by Japan, which has almost single-handedly financed the destruction of the great rain forests of South-East Asia, often using prize virgin hard woods for disposable concrete molding in the building industry. Such rape is made easy by the financial inequities between developed and developing nations.

A major new concern is now emerging with the exhaustion of the Asian forests, the convergence of major world and particularly Asian logging companies on the remaining areas of tropical forest, particularly the Amazon. Without international vigilance, there is a real risk that the disaster which has been wreaked on the South-East Asian forests will be repeated even more rapidly on the Amazon by the very same organization seeking further fields for their exploitation.



Worldwide distribution of Tropical Forests shows how little of the world's surface they cover and thus how essential and precious their rich biodiversity resources are (Lean 66) Although the world distribution of temperate forests is more extensive, their species diversity is much smaller. Nevertheless temperate forests are likewise under threat, both from wholesale felling as in Siberia since the opening of Russia to multi-national exploitation and from acid rain and defoliation as in Europe (Lean 82).

Asian logging companies are moving into South America: Guyana, Surinam, and now the big prize, the Amazon rainforest with one-third of the world's existing timber supplies. Large parts of still intact forest in remote areas where government agencies are weak and unmotivated. The forest contains 60 billion cubic meters of timber, said to be worth \$4 trillion. By 2006, Brazil's share of the world market is expected to leap to 20 per cent.

In Guyana, Malaysian companies have obtained government concessions to vast forest areas, and timber production multiplied fivefold between 1991 and 1996, forcing the government to decree a three-year moratorium on new concessions until environmental laws can be tightened. In Brazil, the Asians have begun buying up local timber companies, often keeping their own names. WTK of Malaysia paid \$7 million for Amaplac in January 1997, and also bought 300,000 hectares of forest near the Jurua river, an Amazon tributary, for around \$2.4 million. Total WTK investment in timber is reported to be \$18 million. Samling, another Malaysian giant, is negotiating to buy Amacol. Compensa, a local timber firm, now belongs to China's Tianjin Fortune Timber Company (Guardian Wkly 19 Jan 97).

### Rain Forest Fragmentation and Genetic Genocide



Fragments of rain forest smaller than 100 hectares are useless for species conservation (New Sci. 98)

Forest clearing rapidly reduces continuous stretches of forest to a collection of smaller islands. The forest is reduced from dimension 2 gradually to an archipelago of islands of different sizes with fractal dimension tending to 0. As areas of forest are reduced to ever smaller pockets, the species diversity in each fragment collapses. The effect on particular species is highly selective.

Some species such as frogs which can exist as well in surrounding land may survive, while the vast majority of ranging insect-eating bird species disappear. Some species such as capuchin monkeys army ants and the birds which follow them cannot survive except in a wide contiguous area. Even plots as large as 100 hectares are useless for supporting such species. Many plant species are adapted to growing conditions and methods of dissemination which cease to exist and will slowly die out.

Plants, fungi and animals vanish with the disappearing forests. A 1,000-hectare patch of tropical moist forest contains as many as 1,500 species of flowering plants, up to 750 species of tree, 400 bird species, 150 kinds of butterflies, 100 different types of reptile and 60 species of amphibians; the insects are too numerous to count. Panama has as many plant species as the whole of Europe and in peninsular Malaysia there are more tree species than the whole of the US. Peninsular Malaysia has 7,900 species of flowering plants; the UK, which is twice the size, contains only 1,430. A single volcano in the Philippines, Mount Makiliang, is home to more types of woody plant than the entire United States. A single bush in



Peru may harbour more ant species than the whole British Isles.

### **Finding a Sustainable Way of Forest Management**

In recent years, saving what remains of the world's rainforests has become an international cause. Governments, international organizations and citizens groups are paying it increasing attention. However, despite this the forests are still burning and being felled. Many initiatives have been launched including action plans, and debt-swap deals under which countries protect particular rainforest areas in return for alleviation of some of their foreign debt (Ayensu et al. 117).

No plan to save the rainforests will succeed unless it takes into account the people in the rainforest countries and how they will achieve their livelihood. Third World nations, deep in financial crisis, have little interest in saving the rainforest unless they can be shown that it also makes economic sense.

Traditional non-destructive uses of the rainforest, such as tapping rubber, agroforestry and the collection of products from diverse species for food and medicine can achieve much higher economic returns than logging and particularly cattle ranching. Shifting subsistence agriculture or 'slash and burn' has a mixed record. Often decried for its apparent destructiveness, affecting up to 75,000 square miles annually, traditional slash and burn is better than exotic plantations because it better promotes the regeneration of biodiversity by facilitating diverse regrowth of native species from seed.

Replanting the moist tropics could show some promise of helping to offset some of the effects of global warming, but this requires some commitment to forests which also contribute to biodiversity. Currently trends are in precisely the opposite direction. Indonesia is currently planning to plant 250,000 hectares a year in genetically cloned teak, which would have zero diversity. It remains to be seen where the next round of such genetically-engineered specimens will come from if the basic resource of diversity is discarded for cloned plantations. It would be a better investment for the industrialized nations to fund the planting of genetically diverse forest which could also preserve the heritage of genetic diversity.

There is also an urgent need to head off the need for fuel wood among many less rich populations which causes not only deforestation but erosion and desertification in many parts of the world, by planting sufficient resources of rapidly growing fuel wood species to alleviate the pressure on wilderness and virgin forest.

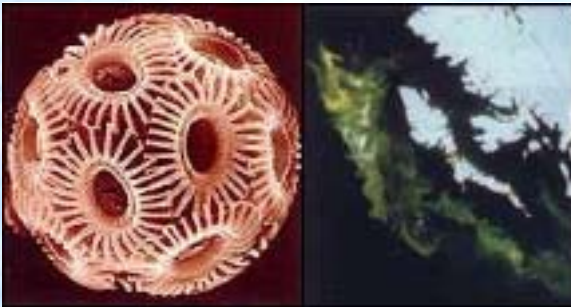
Ultimately it may be possible for man to live with nature in the great rain forests and to do so utilizing the abundance of the forest for a diversity of high value products in addition to immediate sources of sustenance and in turn safeguarding it in its diversity, but only if there is a change of heart and a preparedness to restrain the rapid exploitation that comes with multinational development concessions. We need a fundamental change in attitude from those with the power and the money. Tropical countries have sovereignty over their forest resources and clearly intend to use these resources to their own benefit and as they see that benefit. They do not take kindly to being reminded by outsiders that much of their forested land is a world heritage, especially when that point is most often put forward by the rich nations - most of whose agricultural development has been on previously forested land. Yet all too often this sovereignty is ceded to those very outsid-

ers for short-term gain. We would all be well advised to cooperate in providing the scientific information necessary and adequate international aid to make the preservation of this world genetic heritage possible and learning to make the forest a place where humans can reap the rewards of productivity in diversity.

### **The Eye of Hathor: Climatic Destabilization**

Ancient Egypt provides us with a severe warning for our own time - a chilling saga of what was probably an earlier human-induced environmental crisis, leading to desertification, famine, and its eventual respite in the return of verdant fertility through society re-embracing the fertility principle. Hathor in her angry form as Tefnet sears humanity with her angry sun eye. The people are devastated and many die. Thoth the moon God, who pronounces the logos of wisdom (p 463), is sent to plead with her by the Gods of Egypt, out of concern for the fate of humankind. It is only by embracing her wildness and entreating her to re-assume her verdant form as the goddess of fertility and moisture, dispensing her life-giving waters from her sacred sycamore tree (p 465) that the world is saved and with it, frail humanity.

The Gaia hypothesis is a twentieth-century scientific concept which has also assumed the status of a living myth evoking the spirit of the primal Earth Goddess in the feedback cycles of the atmosphere. It states that the atmosphere of the earth is a feedback system which adapts to external changes in a self-correcting manner through the action of the biota itself. It applies naturally to the photosynthetic oxygen-containing atmosphere and also to ideas about cloud cover formation and several of the natural chemical cycles.



*Emiliana huxleyi* a coccolithophorid. Satellite picture of a 50 km.-wide bloom of coccolithophorid extending some 200 km. along the coast of Scotland (Margulis). The capacity of such biota to play a major role in CO<sub>2</sub> fixation is an illustration of the Gaia hypothesis in action.

On the other hand it is characteristic of many such non-linear feedback systems that if they are pushed too far, bifurcation or catastrophic transition can occur, in which the system undergoes major oscillation and perhaps settles into a new and different stability state, as appears to have happened in previous epochs.

There are a much vaster array of globally deleterious effects that are happening to the Earth this century as a result of human impacts which may involve non-linear feedback or catalytic amplification. One non-linear change of particular