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***Best Practice, Malpractice
or Both?
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INTRODUCTION

During the last 35 years international pressure groups have launched attacks on the environmental practices of Latin America's pulp and paper industry. Particularly, Brazilian companies, exporting US\$2,145 million dollars in 1999 (about 4.5% of Brazil's total exports), were accused of reckless environmental practices. Consider the following quote from Fortune Magazine on April 20, 1981:

“After successes in building supertankers that were predicted to fail and dredging the Orinoco River, Daniel K. Ludwig is running into difficulty with Jari, his 4 million acre tree and rice farm in Brazil. After 14 years of pouring money and human suffering into the project, timber production is inconsequential, and pulp capacity is half of what was planned.

The tree that is used is the gmelina, native to Nigeria. Ludwig encountered substantial resistance from ecologists when he began clearing the jungle...”

Fortune; April 20, 1981

Although the Jari project, sold to Brazilian investors in 1982, started with the deforestation of 55,000 ha of virgin forest, by 2001 it had achieved the ISO-14001 environmental certification (Appendix A). Through the years environmentalist pressure was also put on long established pulp and paper companies. For instance, a decade later Aracruz Celulose was subjected to Greenpeace attacks, consider:

“In 1992, with the world's attention drawn on Brazil during the Rio environmental summit, the international activist group Greenpeace co-operated with several non-governmental organisations (NGO's) to publicly lambast Aracruz Celulose. With its

eucalyptus monoculture [Aracruz] destroyed 10,000 hectares of Atlantic rainforest, according to Greenpeace documents. By blockading the company's port with its ship Rainbow Warrior II, Greenpeace held the spotlight on many of the problems that have been blamed on the giant pulp producer."

The Business of Sustainable Forestry, 1998

As it turned out, Aracruz Celulose had not destroyed 10,000 hectares of Atlantic rainforest, instead it had purchased already degraded agricultural land, which was then reforested by the company with Eucalyptus plantations. Aracruz planted a forest where there was none. A summary of the accusations made by Greenpeace in 1992, and Aracruz's counter-arguments are shown in Table 1.

Despite their direct confrontation, Aracruz and Greenpeace co-operated, during the first half of the year 2000, in the joint publication of a textbook for use in Brazilian schools on the protection of Brazilian forests and wildlife. Clearly Aracruz's support helped Greenpeace's educational agenda.

Eventually, Greenpeace pointed its finger to the Brazilian government itself by launching, in 1999, its protection campaign for the Amazons. Greenpeace's General Director met with Brazil's President, Fernando Henrique Cardoso, demanding Government mercy and protection of the Amazonian forest.

Brazil's government was committed to environmental protection since 1965; year in which Brazil's Federal Forestry Law was approved, published, and enforced. Since then, the law demands the preservation, in reservations, of 80% of the land in the Amazon region; 35% of the land in the Cerrados region; and 20% of the land in the rest of Brazil. The Brazilian pulp and paper industry had respected and expanded under this 1965 Law.

Table 1
Aracruz's 1992 Environmental Controversy

NGO's critique	Aracruz's response
Plantation forests are less biologically diverse than natural forests- they eliminate bio-diversity.	Our plantations occupy degraded agricultural land, creating a valuable forest cover for more species.
Eucalyptuses consume substantial amounts of water; much more than native species.	Eucalyptuses do not consume more water than other species of trees if their growth rate is considered.
Tree cloning creates a monoculture that is more vulnerable to disease and pests.	We use over 100 genetic varieties of eucalyptus clones, which we alternate to control pests and diseases.
Aracruz occupies 13,000 hectares of land belonging to indigenous groups.	The land was purchased legally from farmers and indigenous groups.

Source: The Business of Sustainable Forest.

In May of the year 2000, the World Wildlife Fund (WWF) headed a group of NGOs in a heavily advertised campaign aimed at stopping modifications to Brazil's forestry law. This lobbying was successful as reflected in the following news:

"Brazil's congressional leaders last night dropped proposed legislation to increase the area and rate of Amazon forest destruction. Faced with the threat of a presidential veto and widespread opposition from environmentalists, the draft law was killed before it could come to the House floor. After a flood of email and faxed protests, Brazilian President Fernando Henrique Cardoso pledged to veto the measure."

Environment News Service; May 18, 2000

The general public, which increasingly takes sides with NGOs, makes politicians comply with NGO demands as the Brazilian Forestry Law modification shows. Legislators were ready to modify the 1965 Forestry Law, increasing the percentage of legally removable virgin forest area from 20% to 50% in the Amazon. NGO pressure succeeded in stopping the passing of such legislation in the year 2000.

However, in practice, government bureaucracy sometimes acts contrary to the spirit of the law for environmental protection. For example, in the state of Matto Grosso the State concedes vast expanses of virgin forest to cattle ranchers for the expansion of the cattle frontier. Now, some environmentally friendly cattle ranchers set aside, within their concessions, virgin forest reservations for the preservation of nature and wild life. In one case, government officials sued a cattle rancher demanding the devolution of 75% of his land concession (which he set aside as virgin forest reservation) because he was not developing it for cattle ranching. In this region, the 1965 Law called for the preservation of only 20% of the conceded land. This lawsuit has been going on since 1985 and is yet to be settled. As a result of these land development practices, cattle ranchers lead the deforestation of Brazilian virgin forests. Hence, there is plenty of degraded land available for reforestation by Brazilian pulp and paper companies. The P&P industry has no need to fell a virgin forest to build a plantation.

Nevertheless, pressure groups indeed succeed in pushing environmentally friendly legislation or stopping environmentally unfriendly legislation. Constraints to business practices can be effectively pursued through legislation promoted by the political lobby. However, the events described above create the perception that Latin American companies function mainly with environmentally unfriendly business practices. The feeling left is that Latin Americans destroy the few virgin tropical rainforests left in the World. This perception position Latin Americans as the villains in the World's battle for clean air and protection/conservation of wildlife.

LATIN AMERICA'S ENVIRONMENTAL MYTH

Three main messages are at the core of the myth around Latin America's pulp and paper environmental practices. First, Latin America's plantations *destroy virgin rainforests*. Second, Latin America *recklessly* produces and consumes mainly virgin pulp fibre. And third, Latin American plantations *destroy the wilderness'* ecological balance. These "ecological myths", are directed to the unsuspecting general public, governments, and decision makers in multilateral aid agencies. They are responsible for the bad press and ill reputation of Latin America's pulp and paper industry and governments.

First Myth: Latin America's plantations destroy virgin rainforests

The notion that Latin America's 2001 pulp and paper industry destroys virgin rainforest to cultivate its plantations is as remotely true as the notion that Europe's 2001 pulp and paper industry does the same. Sometime during the last 1000 years part of Europe's and Brazil's virgin forests were substituted for arable land, making room for intensive annual agricultural planting and farming. Later on, some Brazilian pulp and paper companies built their plantations on degraded agricultural land, creating a forest, like Aracruz did, where there was none to begin with. This is hardly a practice that destroys virgin rainforest.

Moreover, given the advance of the cattle frontier, finding degraded agricultural land on which to build tree plantations is not difficult in Brazil. Furthermore, it is easier to plant on degraded land than to deforest first a vast expansion and then plant exotic tree species. The economics of a plantation favour the purchase of degraded agricultural land.

Still, some NGO's insist that Brazil's pulp and paper industry looks for and obtains the best arable land; not just degraded land. They search, the argument goes, for agricultural land that best fits the high growth rates required by their exotic tree species. Hence these plantations do not occupy degraded land, instead, some plantations, or parts of them, are on premium agricultural land.

So what? Be it on degraded or prime agricultural land, the fact remains that Brazilian plantations create a forest and habitat for some wild life where there was none before the change of crop. Furthermore, tree plantations should be considered just as any other crop they replace. Thus, plantations don't necessarily destroy virgin rainforests- they create forests where there were none.

NGO accusations raise three interesting questions. First, why is it morally wrong to build a tree plantation on prime agricultural land, and all right to plant some other agricultural crop? It is a fact that agricultural crops and pastures sequester much less carbon than a tree plantation and provide a lot less bio-diversity as well. Second, are European crops as guilty of destroying virgin forests as Brazilian crops? Third, are there double standards in these value judgements?

Furthermore, table 2 shows that most Brazilian pulp and paper companies abide by the country's Forestry Law. Most companies are also certified by the World-wide recognised

Table 2
Pulp & Paper Companies.

Company	Short Fibre Plantation	Long Fibre Plantation	Protected Area	Percentage of Protected Area	Environmental Certifications
Aracruz	139,000 ha		62,000 ha	30% of area	ISO-14001
Cenibra	110,000 ha		70,000 ha	33% of area	ISO-14001
Jari	46,000 ha	9,000 ha	1,558,000 ha	93% of area	ISO-14001 ^o
Bahia Sul	66,000 ha		42,000 ha	36% of area	FSC and ISO-14001
Klabin	207,000 ha*		119,000 ha	34% of area	FSC and ISO-14001
VCP	107,000 ha		35,000 ha	22% of area	ISO-14001

* Includes long fibre plantations

^o To be obtained in 2000.

Source: Company reports: Aracruz, Cenibra, Jari, Bahia Sul, Klabin, VCP.

norms of environmental forestry protection ISO-14001 as well as the norms of the Forest Stewardship Council (FSC).

From this discussion we conclude that Latin America's pulp and paper industry does not destroy virgin rainforest in 2001. Instead, we propose our first alternate hypothesis:

First Alternate Hypothesis

Latin America's pulp and paper industry creates forests where there were none, and prospers under environmentally friendly forestry legislation.

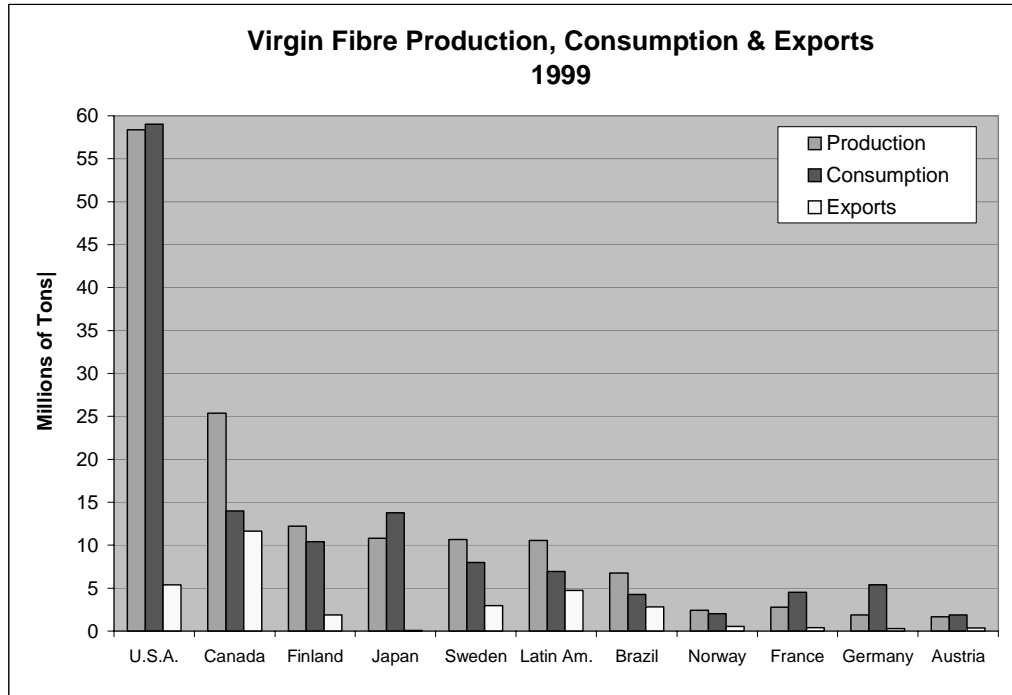
Second Myth: Latin America recklessly produces and consumes virgin pulp fibre

Some environmentalists propose that one way to mitigate the destruction of virgin forests is to reduce the consumption of virgin pulp fibre. This implies recycling more fibre to produce paper. The assumption is that recycled paper is environmentally friendly paper.

Paper recycling has been encouraged in the developed World for economic and environmental reasons. National and Federal governments approved legislation that constraints the consumption of virgin pulp fibre. However, recycling creates a different kind of pollution as it consumes vast quantities of Clorox in the bleaching process. Moreover, not all paper can be recycled. Composite paper, plastic-covered paper, carbon paper, and other kinds are not suitable for recycling.

Well, between 1962 and 1999 the World's virgin pulp fibre consumption increased from 61.5 to 162.8 million tons per year. Country behaviour is illustrated in Figure 1, which compares production, consumption and exports levels of virgin pulp fibre in 1999. Latin America (Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela) produced

Figure 1
Virgin Fibre Production, Apparent Consumption & Exports



Apparent consumption is defined as: Production + Imports – Exports.

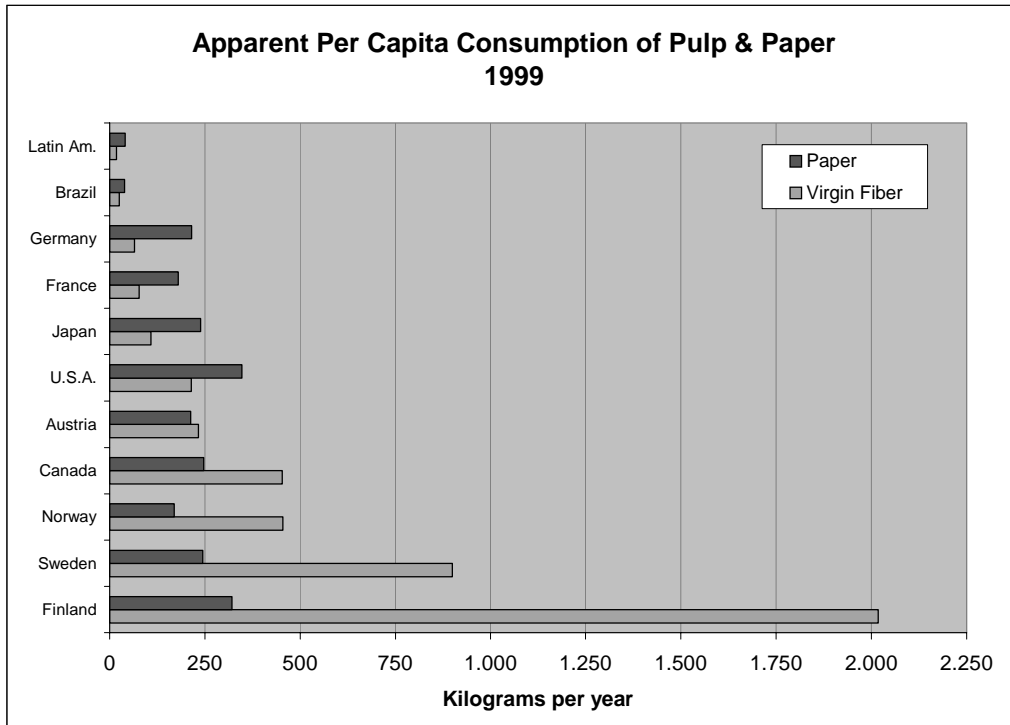
Source: FAO & Pulp & Paper International.

10.5 million tons or 6.5% of the World's production. Brazil accounts for most of Latin America's apparent consumption. The USA and Canada, the World's biggest, produced 58 and 25 million tons respectively in the same year.

Latin America's apparent consumption of virgin pulp fibre- defined as production plus imports minus exports- was 4.3 million tons in 1999 or just 2.6% of World consumption, whereas the USA and Canada consumed 59 and 14 million tons respectively. Japan, Finland, and Sweden consumed 13.7, 10.4 and 8 million tons respectively. So, Latin America, with about 50 times the population of Finland consumed less than half the virgin pulp fibre consumed by Finland. Similar statements can be made about all other fibre producing countries. Therefore, Latin America's virgin pulp fibre consumption pattern is far from being reckless.

Furthermore, figure 2 illustrates apparent per capita consumption of virgin pulp fibre and paper for the most important fibre producing countries and Latin America. Brazil has a slightly higher apparent per capita consumption than Latin America. Finland, with 2,018 kg/year, has by far the highest apparent per capita consumption of virgin pulp fibre. Two other Scandinavian countries, Sweden and Norway, with 900 kg/year and 455 kg/year, are the second and third highest apparent per capita consumers of virgin pulp fibre. Most importantly, Latin America boasts the lowest apparent per capita consumption, 18

Figure 2
Apparent Per capita Consumption of Virgin Pulp & Paper.



Source: FAO & Pulp & Paper International.
 Apparent consumption is defined as: Production + Imports – Exports.

kg/year, of virgin pulp fibre. The same relationships hold for apparent per capita consumption of virgin fibre paper.

Finland's abnormally high apparent per capita consumption of virgin pulp fibre derived from its own paper industry. Finland was the World's second largest paper exporter, for which it imported virgin pulp fibre and exported paper products.

Between 1961 and 1999 the World's paper consumption increased from 77.5 to 310.3 million tons per year. In 1999, 482 million people in the USA, Japan, and Germany consumed about 45% of the World's paper production. Latin America's apparent paper consumption was 15.4 million tons in 1999 or 4.9% of the World's consumption. The USA, Belgium, and Finland had the highest apparent per capita consumption of paper with 347 kg, 344 kg, and 321 kg per year respectively. Latin America's apparent per capita paper consumption was 41 kg/year in 1999- again the lowest in the group.

In a nutshell, an American apparently consumed 8.5 times as much virgin pulp fibre as a Latin American, and a Finn apparently consumed 112 times as much virgin pulp fibre as a Latin American. We can hardly accuse Latin Americans of abusing the consumption of virgin pulp fibre. This raises our second alternate hypothesis:

Second Alternate Hypothesis

Latin Americans have the World's lowest apparent per capita consumption of virgin pulp fibre.

Third Myth: Latin American plantations destroy the wilderness' bio-diversity.

The preferred production system in Latin America's forestry business is the plantation. A plantation cultivates a forest of cloned trees of exotic (non-indigenous) species. In Europe and Canada the predominant production system exploits natural forests. A managed natural forest harvests wood by pruning great expanses of indigenous forests.

Some NGOs argue that plantations do not support indigenous wildlife as natural forests do (Appendix C). Furthermore, they add, plantations have different water consumption and land degradation patterns than natural forests. Of course, NGOs got this right, different forests consume resources differently and create different wildlife habitats. However, it has not been proved that plantations harm the environment more than managed natural forests or degraded land.

Table 3
Plantations Vs Naturally Managed Forests.

Production models	Plantations	Naturally Managed Forests
Geographic Regions	Production system followed by Latin America.	Production system followed by Europe, USA, & Canada.
Environmental Impact	Disturbs native habitat by introducing fast-growth exotic species.	Preserves native habitat by exploiting natural virgin forests- minimal disturbance
Hardwood Yield (m3/ha/year)	Brazil's average yield is 36 m3/ha/year.	Europe's average yield is 9 m3/ha/year.
Area required to produce 500,000 tons of pulp	Brazil requires 66,000 hectares.	Scandinavia requires 800,000 hectares.
Hardwood production cost (US\$/ton)	Brazil's cost was US\$71 in mid 1999.	Europe's* cost was US\$165 in mid 1999.

* Average of Spain, Portugal & Sweden.

Source: Competitiveness in Latin America's Pulp & Paper Industry.

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It is true that a plantation offers lower bio-diversity than a natural forest (Appendix C). It may also be true that Eucalyptuses consume more water than native species, and it is certain that mono-cultures are more vulnerable to disease and pests than virgin forests. However, it does not follow that cultivating Eucalyptus plantations is an environmentally unfriendly forestry practice.

Clearly, it is in the interest of the pulp and paper industry to maintain healthy plantations and use their water resources in the most effective way. Pulp and paper companies do want to use their water resources optimally and also seek to minimise plant diseases and pests. To achieve this, business people seek to cultivate the most water efficient species, to maximise bio-diversity with an alternate mix of more than 100 genetic varieties of Eucalyptuses, and to implement other plantation management practices.

Some comparative facts and statistics between plantations and managed natural forests are useful to clarify this issue. On the input side, one major difference stands out in table 3: to produce 500 thousand tons of pulp per year, European managed-natural forests require 800,000 hectares, whereas Brazilian plantations require only 66,000 hectares of land. Since a Brazilian plantation's land area is 12 times smaller than the European requirement, it disturbs an area 12 times smaller than the area affected by European managed natural forests. Hence, for each 66,000 ha of Brazilian plantation that substitute 800,000 ha of European managed-natural forest, a total of 736,000 ha are truly left untouched- they truly remain in the wilderness.

Furthermore, Aracruz Cellulose uses about 5.6% of its area on infrastructure and roads. Applying this percentage to European managed-natural forests we would end up with some 40,000 hectares for roads and other infrastructure- almost as much as the total area required by a Brazilian plantation to produce the same 500 thousands tons of pulp.

For these two reasons, it is not clear that an European managed-natural forest disturbs the virgin environment less than equivalent Brazilian plantations. Hence, our third alternate hypothesis is that:

Third Alternate Hypothesis

The infrastructure and roads needed to extract the wood (used to produce 500 thousand tons of pulp per year) in an European managed natural forest, and the extraction itself, disturb the wilderness as much as an equivalent production in a Brazilian plantation.

Now, the relatively small area used by a Brazilian plantation to produce the same amount of pulp as an European managed natural forest, demands a much smaller logistic radius to source the wood requirement for a 600 thousand per year pulp plant (minimum economic size). A Brazilian plantation functions with a radius of 28 kilometres whereas a managed natural forest requires a radius of 98 kilometres. This logistic difference is reflected in the lower production costs of Latin American virgin pulp. A plantation's lower logistic costs imply a much lower consumption of diesel and gasoline and hence much lower emission of carbon into the atmosphere (Appendix D).

So, a plantation's logistics injects less carbon into the atmosphere than a managed natural forest, and the plantation also extracts at least seven times more carbon (per hectare) from the atmosphere. Thus our fourth and fifth alternate hypotheses:

Fourth Alternate Hypothesis

The logistic operations of managed natural forests emit much more carbon into the atmosphere than equivalent Brazilian plantations.

Fifth Alternate Hypothesis

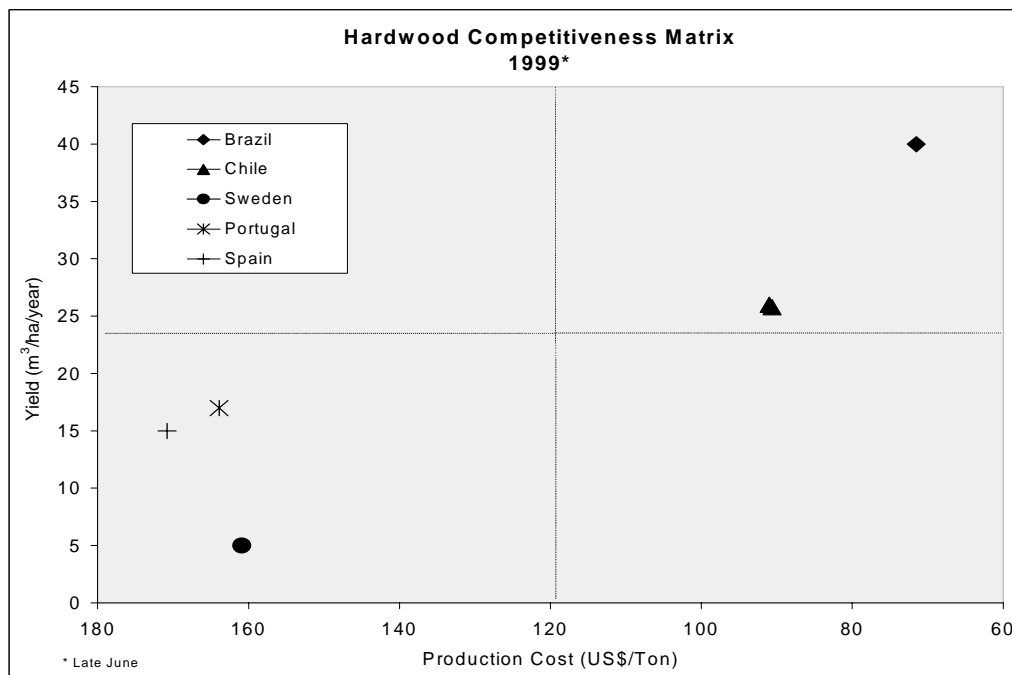
A Brazilian plantation sequesters at least seven times more carbon from the atmosphere than a managed natural forest.

On the output side two main differences stand out in Table 3. First, Brazilian plantations yield four times as much wood (m³/ha/year) as European managed-natural forests; and second, European hardwood production costs are 2.32 times higher than Brazilian costs.

Now, yield measures how effectively each system uses the land, water, and other resources available per hectare. The higher the yield of a given area, the more effective the use of the resources. Hardwood production costs, on the other hand, measure how efficiently these resources are consumed. The lower the production cost per ton of wood, the more efficient the use of the resources. Hence, the lower the unit production costs, the lower the waste of resources. Subsequently, the lower the waste of resources, the lower the pollution. Minimisation of waste is an ecologically friendly business objective.

The forestry business requires the production of as much wood (pulp) as possible out of the land and water available, and at the minimum possible cost. This economic goal is best achieved when a company's forestry practices seek efficient use of the land, water,

Figure 3
Hardwood Production Costs.



Source: Competitiveness in Latin America's Pulp & Paper Industry.
Werner Ketelhöhn and Bernal Allen at INCAE.

fertilisers, pesticides, and the minimisation of plantation roads for wood extraction and transportation- that is, when their forestry practices are environmentally friendly. The forestry production system with the maximum yield and the minimum unit cost should have the most environmentally-friendly forestry practice- because the system uses resources in the most effective and efficient way.

Since Brazilian plantations are four times more effective and 2.32 times more efficient than European managed-natural forests it follows that they are much more environmentally friendly than European managed-natural forests. The most effective and efficient production system provides a benchmark for environmentally friendly forest exploitation. Hence, our sixth alternate hypothesis is that:

Sixth Alternate Hypothesis

Brazilian plantations are at least two times more environmentally friendly than European managed-natural forests.

Our competitiveness matrix, shown in Figure 3, illustrates that Latin America has the World's most environmentally friendly P&P industry because it is the most effective and efficient in the World. The yield, on the vertical axis, also stands for extraction of atmospheric carbon from the atmosphere as it is converted into hardwood- the higher the yield the higher the extraction of atmospheric carbon per hectare. Production cost per ton of hardwood, on the horizontal axis, also stands for resources consumed in the production of a ton of hardwood- the lower the production costs per ton, the fewer the resources consumed per ton of hardwood.

So, our competitiveness matrix also reflects the pulp and paper industry's environmental practices in several countries. Brazil and Chile boast the most environmentally friendly practices in the pulp and paper industry, since they are the most effective in the use of resources and do so in the most efficient way. Hence our seventh alternate hypothesis:

Seventh Alternate Hypothesis

In the year 2000, Latin America's pulp and paper industry had the World's most environmentally friendly business practice.

CONCLUSIONS

The first conclusion that follows from the above is that plantations are at least as environmentally friendly alternatives to virgin pulp fibre production as managed natural forests. At least in Brazil and Chile, plantations should continue to be encouraged and exploited for virgin pulp fibre production.

NGOs should direct their attention to Scandinavian countries, Canada and Indonesia and use Brazil's pulp and paper industry as the best practice to beat. In particular, Finland,

Sweden and Norway must be concerned with their high apparent per capita consumption of virgin pulp fibre. The best solution is to reduce European and USA paper consumption. Indeed, we need to make advances towards the paperless society!

There are three myths about the environmental behaviour of Latin America's pulp and paper industry: first, Latin America's plantations *destroy virgin rainforests*; second, Latin America *recklessly* produces and consumes virgin pulp fibre; and third, Latin American plantations *destroy the wilderness*' ecological balance. Instead of these three wrong myths, we propose seven alternate hypotheses.

Seven Alternate Hypotheses

First:

Latin America's pulp and paper industry creates forests where there were none, and prospers under environmentally friendly forestry legislation.

Second:

Latin Americans have the World's lowest apparent per capita consumption of virgin pulp fibre.

Third:

The infrastructure and roads needed to extract the wood (used to produce 500 thousand tons of pulp per year) in an European managed-natural forest, and the extraction itself, disturb the wilderness as much as an equivalent production in a Brazilian plantation.

Fourth

The logistic operations of managed natural forests emit much more carbon into the atmosphere as equivalent Brazilian plantations.

Fifth

A Brazilian plantation sequesters at least seven times more carbon from the atmosphere than a managed natural forest.

Sixth:

Brazilian plantations are at least two times more environmentally friendly than European managed forests.

Seventh:

In the year 2000, Latin America's pulp and paper industry had the World's most environmentally friendly business practice.

Appendix A

ISO-14001: Effective Since 1996

The ISO-14001 environmental management standards enables a company to integrate quality management systems within their business operations without relying solely on external laws for achieving environmental protection.

Five areas are addressed by the ISO-14001 standard:

1. Environmental Management Systems,
2. Environmental Performance Evaluations,
3. Environmental Auditing,
4. Life cycle Assessment, and
5. Environmental Labelling

There are three components to an environmental management system (EMS): a written program; education and training; and knowledge of local and federal environmental regulations. Environmental performance evaluations (EPE) measure the impact a business is having on the environment. An environmental audit (EA) is similar to a medical examination, it consists of a routine evaluation of a company's environmental controls. Life cycle assessments (LCA) are geared towards substituting less harmful products and minimisation of the waste stream. Environmentally friendly products (EL) have an advantage over their "non-friendly" competition.

Appendix B

Forest Stewardship Council (FSC)

The FSC principles and criteria apply to all tropical, temperate, and boreal forests. There are ten principles of equal importance. They address ecological, social, and economic aspects of forest management.

Major failure in any individual principle will normally disqualify a candidate from certification or will lead to de-certification. FSC intends to complement, not supplant, other initiatives that support responsible forest management worldwide. In order to qualify a company must:

1. Meet all applicable laws,
2. Have legally established rights to harvest,
3. Respect indigenous rights,
4. Maintain community well being,
5. Conserve economic resources,
6. Protect biological diversity,
7. Have a written management plan,
8. Engage in regular monitoring,
9. Maintain high conservation value forests, and
10. Manage plantations to alleviate pressures on natural forests.

Appendix C Biodiversity

It has been estimated that Latin America had, in the year 2000, about 40% of the world's remaining tropical rainforests and Brazil 80% of Latin America's tree plantations

Since there were more indigenous species in LA's natural forest than in their plantations, there is no doubt that indigenous bio-diversity is maximised in Latin America's natural forests. However, plantations established in agricultural land do provide a new source of habitat to local wild life and greatly increase the bio-diversity of the land. Plantations provide more habitats above and below the ground than agricultural (degraded or not) and pastures land. Plantations also provide a habitat for vertebrae animals.

Biological diversity provides a natural barrier against insect attacks on trees in the form of biological control agents, such as birds, insects, and micro-organisms that are natural enemies to the pest. Plantations also maintain soil bio-diversity. There is more microbial and micro-arthropod activity in the soil under plantation trees than in cleared soil or unplanted land. Plantations can renew and maintain stream bio-diversity because they control runoff and help to stabilise stream flow. Finally, plantations have the potential to control rising saline groundwater and thus control stream salinisation.

Eucalyptus, for instance, contributes to intense deposition of organic matter on the soil- through leaves, bark, and roots- estimated at seven tons per hectare per year. This helps recover soil fertility levels. A continued presence (30 years) of under-storey of native vegetation in Brazilian Eucalyptus plantations, contradict the theory that eucalyptus plantations impoverish the soil.

So, increasing a plantation's bio-diversity makes business sense. Plantation management increases bio-diversity in several ways:

By planting several species in a mosaic of mono-cultures, instead of a single culture, a variety of habitats are created. For instance, Aracruz's mosaic averages 15 hectares each. To date, over 100 different hybrid clones have been planted, specifically adapted to local climate and soil conditions.

Bio-diversity is greater when remnant native vegetation is retained within a plantation. Embedding plantation mono-cultures in a matrix of natural forest creates islands of natural forests for indigenous wildlife.

Fostering diverse under-storeys beneath the canopy of plantations increases the habitat for local species.

Allowing the under-storey trees to grow up and join the canopy of the plantation trees creates a mixed forest.

Finally, an increase in area of tree plantations not only increases the bio-diversity of cleared land, but also reduces the pressure put on natural forests, thus protecting natural habitats.

Appendix D

Carbon Sequestration

As forests grow and increase their bio-mass, they absorb carbon from the atmosphere and store it in plant tissue. This process is known as carbon sequestration because it slows the rate at which carbon dioxide accumulates in the atmosphere. Carbon sequestration mitigates global warming.

In a tropical forest, healthy growing trees absorb more carbon dioxide during daytime (photosynthesis) than they emit at night through respiration. So, forests with net growth are capable of net absorption of CO₂ whereas mature forests with little growth are unable to absorb additional CO₂. An undisturbed tropical forest exhibits net growth for about 100 years. After that it exhibits CO₂ equilibrium (emissions equal absorption). In the long run, due to tree over-maturity it will become a net CO₂ emitter. So, preservation of natural forests does not lead to CO₂ sequestration. Forest management is needed to maximise CO₂ sequestration in natural forests.

Notice that the fastest rate of carbon sequestration occurs during the growth phase of a tree i.e. its first ten to fifteen years of life. Afterwards, as the growth rate diminishes, so does its carbon sequestration. In the Scandinavian countries and Canada the average growth is 5 m³/ha/year. In tropical countries the rate of growth is much higher up to 36 m³/ha/year. A yield of 36 m³/ha/year means sequestering 9 tCe of CO₂/ha/year.

Plantations in the tropics are harvested every 8 years, producing as much as 3600 m³/ha of wood over a period of 100 years. This is equivalent to seven times the CO₂ that would be sequestered by the same area of natural forest established at the same time. So, plantations sequester at least seven times more carbon than managed natural forests.

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Often, the argument against more environmentally friendly ones is they don't work as well " but that myth died with the success of Seventh Generation. Now, even brands like Clorox have created greener versions of their products to meet demand for environmentally friendly cleaning options.

6. Patagonia. A 2015 New Yorker profile called Patagonia's corporate strategy 'anti-growth', a tongue-in-cheek nod to the retailer's crusade against conspicuous and superfluous consumption. Being environmentally friendly means having a lifestyle that helps the Earth more than you hurt it, and speaking up when you see the world around you being harmed. Conserving water, driving less often, gardening, and sticking up for animals are all good ways to start helping. See Step 1 to learn more ways to make caring for the environment part of your daily life.

Steps.

To be environmentally friendly, save water by taking shorter showers and turning off the water as you brush your teeth or scrub a sink full of dishes. You can also keep the water supply cleaner by swapping out hazardous household cleaners with greener options, like baking soda and vinegar. An environmental audit can help you: assess the nature and extent of harm to the environment caused your business. assess how you can manage or improve the condition of the environment. prioritise what you need to do to reduce your environmental impact. show your business's accountability to government, customers and shareholders.

Buy green goods " talk to your supplier about using environmentally friendly products or materials. Search for a list of recyclers as well as recycling options for around 90 different materials on the Business Recycling website.

Manage hazardous waste. Environmental waste is the best proxy for identifying and eliminating economic waste. That's the secret of these companies. However, there is a considerable gap between leading edge companies and the rest of the pack when it comes to the adoption of lean and green ideas. There are far too many companies still delaying creating a lean and green business system, arguing that it will cost money or require hefty capital investments. They remain stuck in the "environment is cost" mentality. Being environmentally friendly does not have to cost money. In fact going beyond compliance saves cost at the Environment friendly processes, or environmental-friendly processes (also referred to as eco-friendly, nature-friendly, and green), are sustainability and marketing terms referring to goods and services, laws, guidelines and policies that claim reduced, minimal, or no harm upon ecosystems or the environment. Companies use these ambiguous terms to promote goods and services, sometimes with additional, more specific certifications, such as ecolabels. Their overuse can be referred to as greenwashing. To