The Effects of Brazilian Agricultural Property Policies and International Pressures on the Soybean Industry: Incentives for Amazon Deforestation and How it May be Reduced

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I. INTRODUCTION

In a state-centered, intrinsically focused modern world, the international community is faced with numerous difficulties. Perhaps the most notable issue in the field of international environmental law is the juxtaposition between preserving the global commons and dealing with issues of state sovereignty. The doctrine of state sovereignty provides states with complete control over business, the environment, and resources within their borders.[1] The seminal body of international law, the Stockholm Convention, provides nations "the sovereign right to exploit their own resources pursuant to their own environmental policies."[2] State sovereignty is a barrier the international community must either break through or circumvent to affect positive change on the global environment.[3]

However, the principle that "no state is an island" has never been more apparent. Faced with increasing population, globalization, and looming dangers of climate change, the international community must find ways to work around the obstacles associated with state sovereignty.[4] Due to its extensive biodiversity and importance regarding global climate change, much international attention has been focused on the Amazon region located within Brazil.[5] Brazil, home to over forty percent of the world's remaining tropical rainforests, is presently unable to effectively enforce domestic and international laws, regulations, and environmental policies to halt deforestation.[6]

One of the leading causes of deforestation in the Brazilian Amazon is the increasing demand for soybeans in Europe and Asia.[7] Soybean

1. VED P. NANDA & GEORGE PRING, INTERNATIONAL ENVIRONMENTAL LAW AND POLICY FOR THE 21ST CENTURY 17 (Transnational Publishers, Inc. 2003).
2. Stockholm Declaration of the UN Conference on the Human Environment, principle 21, U.N. Doc. A/CONF.48/14/Rev. 1 at 3 (June 16, 1972).
3. NANDA & PRING, *supra* note 1, at 17–18.
4. *Id*. at 19.
5. *See* Colin Crawford & Guilherme Pignataro, *The Insistent (and Unrelenting) Challenges of Protecting Biodiversity in Brazil: Finding "The Law that Sticks*," 39 U. MIAMI INTER-AM. L. REV. 1, 5 (2007); Randall S. Abate & Todd A. Wright, *A Green Solution to Climate Change: The Hybrid Approach to Crediting Reductions in Tropical Deforestation*, 20 DUKE ENVTL. L. & POL'Y F. 87, 87–88 (2010).
6. Lesley K. McAllister, *Sustainable Consumption Governance in the Amazon*, 38 ENVTL. L. REP. NEWS AND ANALYSIS 10,873, 10,876 (2008).
7. McAllister, *supra* note 6, at 10,873.

cultivation in Brazil began to rise in the 1990s until 2006, when Brazil became the world's largest supplier of soybeans, surpassing the United States.[8] Over the last few decades, the market demand for soybeans as a product for export has incentivized Amazon deforestation, as tropical rainforests are clear-cut for farmland.[9] The rise in soybean prices has allowed soy farmers to purchase large tracts of clear-cut pastureland from cattle ranchers. These cattle ranchers often move deeper into the forests, clear-cutting new land for pastures.[10] Clear-cutting refers to the practice or cutting down all or nearly all the trees in one area in order to develop that land, most often for agriculture.

This practice has a detrimental environmental impact, affecting the entire international community, and is still continuing despite increasing concerns.[11] However, this is happening entirely within Brazil's territorial borders. Brazil's government has enacted regulations to limit the amount of forested land used for agriculture, but there have been significant problems enforcing these regulations. While Brazil is taking some of the necessary steps to curb deforestation, it is not happening at a quick enough pace to satisfy the international community. Thus, the international community is challenged with balancing a respect for Brazilian sovereignty against protecting both the Brazilian and global environment.

This analysis begins in Part II with an overview of the Amazonian environment and the rise of soybeans as a lucrative export product. Part III discusses how Brazilian property law and land use culture has facilitated transformation of land for cultivation and ultimately, deforestation. Part IV discusses international reaction to Brazil's sovereignty over the Amazon, including European import practices such as protectionism, desire for hormone-free products, as well as market incentives for soy raised on land that was not deforested. Finally, Part V offers solutions for working within the current system, aggressively supporting the policies against deforestation while respecting the sovereignty of Brazil.

II. BACKGROUND

While the preservation of every ecosystem is important, much international attention is focused on Brazil's environmental challenges.

8. *Id.* at 10,876.
9. *Id.* at 10,873.
10. *Id.* at 10,876.
11. *See infra* Part II of this writing.

This is perhaps appropriate due to the substantial biodiversity, size, and global importance of Brazil's rainforests. Because of the region's biodiversity and its large and increasing human population, the struggle to preserve this ecosystem has been unique.

A. The Amazon Rainforest

The Amazon basin is approximately three quarters the size of the contiguous United States.[12] Home to approximately ten to twenty percent of the world's known species, the Brazilian Amazon is one of the most bio-diverse ecosystems in the world.[13] Brazil is home to not only the world's largest rainforest system, the Amazon, but also to the second largest, the Atlantic Forest.[14] Besides its massive forest systems, Brazil contains eight percent of the world's fresh water supply.[15] Preserving these forests and ecosystems is critical to global human survival. As discussed below, such a large concentration of vegetation acts as a significant carbon sink and releases a substantial amount of water vapor into the atmosphere.

Aside from the incredible amount of flora and fauna, Brazil is home to the world's fifth largest human population, numbering over 198 million people as of March 2010.[16] Often in developing countries, environmental challenges stem from poverty and the struggle to meet basic human necessities. Brazil is certainly no different. Though blessed with vast resources, Brazil faces issues of widespread poverty. According to the CIA World Factbook, 26% of the population lives below the poverty line.[17] The national per capita gross domestic product ranks 104th in the world and unemployment ranks 72nd.[18] As an advanced developing nation, the Brazilian people have struggled to modernize and increase their economic power. The Brazilian people, in order to accomplish this, have followed the examples of most developed and advanced nations, exploiting their natural resources to stimulate economic growth.

As the fifth largest country in the world, Brazil is home to vast amounts of land with potential agricultural uses.[19] Entrepreneurs, plantation owners, and multinational companies have all played their part in claiming

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12. *The Brazilian Rainforest*, BrazilianRainforest.org, http://www.brazilianrainforest.org/rainforest.htm. (last visited Apr. 1, 2010).
13. Crawford & Pignataro, *supra* note 5, at 10.
14. *Id.* at 10.
15. *Id.*
16. *The World Factbook*, CIA, https://www.cia.gov/library/publications/the-world-factbook/geos/br.html (last visited Apr. 1, 2010).
17. *Supra* note 16.
18. *Supra* note 16.
19. *Supra* note 16.

or purchasing land to develop for agriculture. Unfortunately, much of this agricultural development has taken place in the region known as the "Legal Amazon," or "Amazonia Legal" which encompasses over fifty percent of Brazil's total land mass.[20] The "Legal Amazon" refers to the entire Amazon rainforest as well as the tropical sub-savannahs of Brazil. The Rainforest makes up about 75% of the "Legal Amazon," a substantial portion of Brazil's land mass.[21] The human population of this region has increased from less than five million in 1960 to more than twenty million as of 2001, and the trend suggests that this growth will continue.[22] As a result, the region is being increasingly taxed in order to support this growing population.

B. Land Use and Acquisition in Brazil

One of the many difficulties associated with deforestation is ownership of this expansive area. The largest percentage of this land, roughly 35%, that makes up the "Legal Amazon" was untitled public land as of 2007.[23] That same year, the amount of private lands (24%) surpassed publicly-protected lands (20%).[24] These statistics were compiled after the largest boom in Brazilian agriculture and increases in deforestation. The data from ten to thirty years prior would most probably reveal more untitled land and less publicly-owned and protected land.

Thus, in the 1970s, the Brazilian government took initiative to subsidize agriculture in this area.[25] These government incentives to develop massive amounts of land for agriculture, specifically cattle ranching, began a trend of clear-cutting. While ranching was not particularly profitable until Brazilian beef was widely exported years later, Brazilian property law allowed ranchers who had converted previously forested land into pastureland to gain title to that land.[26] This further provoked deforestation for agriculture. Not only were ranchers producing and selling a product, but their efforts were also earning them title to land as fast as they could clear-cut.

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20. McAllister, *supra* note 6, at 10,874.
21. *Id.* at 10,874.
22. See *id.*
23. *Id.*
24. *Id*.
25. Daniel C. Nepstad et al., *Globalization of the Amazon Soy and Beef Industries: Opportunities for Conservation*, 20:6 CONSERVATION BIOLOGY 1595, 1596 (2006).
26. *Id*. at 1596.

Because much of this land has been unprotected, untitled, or disputed, companies and individuals known as "land grabbers" have capitalized and claimed much of this area as their own. The rise in prices for agricultural products such as beef and soybeans has proven to be what Professor McAllister refers to as a "commodity driver," of Amazonian deforestation.[27] Professor McAllister notes a correlation between the rise in these commodity prices and the rise in deforestation rates in the Amazon.[28] While beef was the major driving force behind deforestation for many years, since the late 1990s soybean cultivation has had an increasingly significant impact on the region, both economically and environmentally.

C. The Rise of Soybeans

Soybeans are not native to Latin America. The plant is native to China and other parts of Asia, and is generally unfit to grow in a climate as warm and humid as the Amazon.[29] For this reason, soybeans were not cultivated in the Amazon until new varieties were developed that could thrive in that type of climate. Since the introduction in the 1990s, soybean cultivation has exploded in the region. The introduction of new varieties coupled with the increase in demand for soybeans led to rapid expansion of Brazil's soy industry. Soybean cultivation grew by fifteen percent every year from 1999 to 2004 in the previously forested Amazon.[30] In 2006, Brazil became the world's largest exporter of soybeans, surpassing the United States.[31]

Soy became a very profitable product in Brazil. First of all, it was grown on land that was very inexpensive to obtain. Second, the demand for high protein animal feed began to rise dramatically. Outbreaks of mad cow disease forced the world to become more conscious of the dangers of mixing rendered animals in livestock feed as a means of providing protein.[32] This led the European Union to ban livestock feed that contained animal proteins in 2001.[33] Soy, however, is a high protein product that can be safely fed to animals without the dangers of mad cow disease. The amino acid composition of soy and other nutritional properties make soy animal feed superior to other plant products.[34] As a result of the animal-based protein feed ban, there was a considerable market

27. McAllister, *supra* note 6, at 10,875.
28. *Id*. at 10,875.
29. Nepstad et al., *supra* note 25, at 1597.
30. McAllister, *supra* note 6, at 10,875.
31. *Id.* at 10,875–76.
32. Nepstad et al., *supra* note 25, at 1597–98.
33. *Id.* at 1598.
34. *See* Nepstad et al., *supra* note 25, at 1598.

demand for a high protein product to be used in the EU as livestock feed. Brazilian soy has since stepped up to fill this void.

D. Soy Farming and its Byproduct: Deforestation

The greatest source of inexpensive and undeveloped land in Brazil is the Amazon. By clear-cutting this land for agriculture, farmers have been able to obtain land without significant expense. Once the land is cleared, it is either converted to pasture or crops are sowed. As the demand for soy grows, so does the demand for land suitable for soybean cultivation.

According to Nepstad et al., rather than engaging in the practice of clear-cutting themselves, most soy farmers are purchasing land from cattle ranchers. The cattle ranchers often use this money to increase the size of their herd. However, they must relocate their operation. There has been a significant trend of cattle ranchers selling their land to soy farmers and then deforesting more land to reestablish their ranch.[35] Thus, soy farmers generally are not directly deforesting land for themselves, but rather incentivizing cattle ranchers to relocate to the forested land within the Amazon. It should also be noted that while many soy farmers are not themselves participating in the clear-cutting of forests, they are often farming on recently deforested land.

Brazil saw rapid growth in deforestation between 2002 and 2004 when market prices for two of its largest exports, beef and soybeans, were the highest.[36] Since that time, deforestation rates have slowed, but are still significant and dangerously high. Nepstad proposes that this is temporary and is caused by the drop in soy and beef prices due to the global economic downturn.[37] If and when these prices rise again, deforestation is expected to increase.

The Brazilian government has made efforts to reduce deforestation in recent decades, however there are a number of obstacles standing in their way. These obstacles include (1) the cultural mindset of a developing nation with an opportunity to improve its station in the world economy, (2) property laws and government incentives encouraging deforestation, and (3) unintended effects of European importers. (See Parts III-V).

35. *See* Nepstad et al., *supra* note 25, at 1598; McAllister, *supra* note 6, at 10,876.
36. *See* Nepstad et al., *supra* note 25, at 1598.
37. *Id*. at 1599.

E. Effects of Amazon Deforestation: Climate Change

Deforestation has a direct effect on global climate change. This is because forests act as "carbon sinks," meaning that they store carbon. During photosynthesis, plants take in carbon dioxide, convert the molecules to carbohydrates, and release oxygen as a byproduct. The carbon atoms that made up the carbon dioxide remain stored in the vegetation, just as the oxygen humans breathe is temporarily stored in the human bloodstream before being utilized. Essentially, plants breathe carbon dioxide and release oxygen, and humans breathe oxygen and release carbon dioxide. The process is mutually beneficial to both flora and fauna in the global commons.

But when trees are cut down or burned, the carbon that is stored within is released into the atmosphere.[38] One square hectare of tropical rainforest, such as Brazil's Amazon, can store 120-400 tons of carbon. When these forests are burned or cleared out for pasturelands, most of that carbon is released into the atmosphere. It is also important to note that many of these soy farms and cattle ranches can be thousands of square hectares or larger.

Tropical deforestation results in a significant amount of carbon emissions, approximately eighteen percent of global carbon emissions annually.[39] Much of the deforestation and resultant carbon emissions have occurred in the Amazon, the largest tropical forest on the planet. According to recent estimates, over the past 240 years, worldwide deforestation has released 121 gigatons of carbon into the atmosphere.[40] Sixty percent of these emissions have come from tropical deforestation in the last fifty years.[41]

This deforestation results in significant amounts of carbon emissions. During this critical environmental era, a source this significant should be given appropriate attention. There is good news however. If this land is given an opportunity to reforest, it may have a carbon sink effect once more. As vegetation ages, it requires more carbohydrates to grow and survive. These plants will utilize more carbon and release more oxygen. This process does require a lot of time, but tropical forests tend to grow back faster than temporal forests due to the heat and rainfall.[42] These

38. Randall S. Abate & Todd A. Wright, *A Green Solution to Climate Change: The Hybrid Approach to Crediting Reductions in Tropical Deforestation*, 20 DUKE ENVTL. L. & POL'Y F. 87, 88 (2010).
39. Abate & Wright, *supra* note 38, at 89.
40. *Id*. at 89.
41. *Id*.
42. Elizabeth Rosenthal, *New Jungles Prompt a Debate on Rain Forests*, N.Y. TIMES, Jan. 30, 2009, at A1, *available at* http://www.nytimes.com/2009/01/30/science/earth/30forest.html?pagewanted=2&_r=1.

secondary forests can begin forming a canopy in as little as twenty years.[43] However, it is unfortunate that the forest preservation efforts have not yet put the international community in a position to be primarily concerned with reforestation. Until deforestation is stopped, or very significantly reduced, it will remain the primary concern.

Not only do the fallen trees and vegetation emit the carbon they store, but their absence also decreases the surrounding forests ability to store carbon.[44] Large, vast forests are an environmental necessity. Other than their essential contribution to the carbon cycle, tropical rainforests release large amounts of water vapor, which acts as a cooling agent.[45] Without release of this water vapor the global climate will continue to warm. As the climate warms, the ecosystem of the tropical rainforest will change as well. Many of the plant species may not be able to adapt to temperature changes. In this manner, deforestation is cyclical. Deforestation causes climate change, which may destroy or degrade forests.[46]

III. BRAZILIAN PROPERTY RIGHTS AND DRIVERS OF DEFORESTATION

This is not to suggest that the Brazilian government is indifferent or believes adverse environmental impacts and climate change are positives. In fact, the government has enacted a tremendous body of environmental legislation in an attempt to combat the overwhelming problems associated with deforestation. The problem with the environmental laws in Brazil and elsewhere, including the United States, is a lack of enforcement.[47] In the last ten years, there has been an increase in enforcement efforts among Brazilian governmental agencies. The problem still persists however, and will continue to persist unless tremendous paradigm shifts take place.

A. Brazilian Property Laws Encouraged Deforestation

As discussed above, Brazil is home to vast tracts of undeveloped land. As a nation still growing and attempting to define itself in the economic world, entrepreneurs, investors, and those simply trying to make a living have focused their attention on the hundreds of square miles of unclaimed

43. Abate & Wright, *supra* note 38.
44. Abate & Wright, *supra* note 38, at 89.
45. *Id.* at 89.
46. *See* McAllister, *supra* note 6, at 10,874.
47. McAllister, *supra* note 6, at 10,876.

and untitled lands that are home to the world's largest tropical forest. Brazilian property laws encourage and continue to enable the development of this land in three ways: (1) by providing title to those who developed the land, (2) incentivizing agricultural development, and (3) by lacking enforcement of land use regulations.

First, Brazil's property laws allow their citizens to gain title to land by showing "productive use" of the land.[48] By clearing a forested area and converting it to pasture, a Brazilian may claim title to that land. In fact, conversion of forest to usable agricultural land is one of the least expensive and easiest ways to gain title to hundreds of acres of land without purchase.[49] Several decades ago, the population of the Amazon was relatively small and a great portion of the forested land was untitled. The practice of deforesting land for agriculture, either for large scale commercial farms or small family operated subsistence farms, was commonplace.[50] This land policy has been in effect for several decades and served to both integrate the Amazon region into Brazil's economy and provide a channel through which indigenous people could gain title to land.

The productive use land titling laws affected the land use culture for decades. According to Flávia Santinoni Vera's analysis of the property rights enumerated in the 1988 Brazilian Constitution, a property owner must satisfy three elements of "the social function of property": (1) rational and adequate use, (2) adequate use of available resources and preservation of the environment, and (3) the social responsibility.[51] While the first element requires an adequate use of the property, the second element requires an adequate use of available resources present on that land. In essence, the Brazilian Constitution requires property owners to use their land and resources productively or risk losing title to squatters or land grabbers. (Colloquially referred to as the "use it or lose it" principle). This suggests that the purchase of land to maintain a privately held forest preserve would not satisfy the first two fundamental elements of property ownership in Brazil.

Furthermore, these regulations facilitated a land use culture concerned with adequate use of land. The "use it or lose it" concept has incentivized land-owners to fully transform their land in order to demonstrate use. This productivity requirement necessitates a minimum output or use of

48. Nepstad et al., *supra* note 25, at 1596.
49. *See id*. at 1596.
50. *See id.*
51. Flávia Santinoni Vera, *The Social Function of Property Rights in Brazil*, ALACDE Ann. Papers, Mar. 2006, at 6, *available at* http://repositories.cdlib.org/bple/alacde/34.

natural resources on the land.[52] Santinoni Vera defines productivity as the value of goods and services produced per unit from the resources of the land.[53] Without meeting the minimum output requirement, title-holders risk losing their claim to squatters or other commercial farmers. Farmers and land owners have responded to this policy, in order to safeguard themselves from losing their land, by deforesting, developing, and using the land for agriculture. In some cases landowners or possessors have resorted to using violence to deter squatters or other land grabbers.

Other than encouraging deforestation and development from the actual land owner or possessor, the land titling system has spawned a breed of "land grabbers."[54] Professor McAllister describes land grabbers as individuals who use fraud or violence to obtain land which they either develop themselves and claim title to through productive use, or sell to large scale farmers.[55] Indigent subsistence farmers that have cleared land in hopes of gaining title are often victims of land grabbers.[56]

Such land grabbing was made possible by the absence of surveys and lack of environmental and ecosystem regulation. When large scale deforestation for agro-industry began, about fifty years ago, much of the Amazon was un-surveyed and unprotected. By clear-cutting and establishing pasture land, developers could demonstrate productive use and gain title. This was often accomplished through the use of forged deeds and claims to title. Unfortunately, this practice has continued despite progressive environmental legislation. Illegitimate ploys to gain large amounts of land are still common place in the Amazon.

Nevertheless, the Brazilian government has taken steps in an attempt to protect this region. For example, the Brazilian forest code requires land owners within the legal Amazon to maintain eighty percent of their forested property as a forested reserve.[57] This regulation, however, has not been widely enforced. If every land owner were to comply with this requirement, a significant amount of deforested land could be reclaimed by the bordering forests and the ecosystem could begin the slow process of recovery. Instead many land owners have fully developed their entire forested property and are not in compliance with this regulation.

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52. *Id.* at 6–7.
53. *Id.* at 7.
54. McAllister, *supra* note 6, at 10,874.
55. *See id.* at 10,874; *see also* Nepstad et al., *supra* note 25, at 1596–99.
56. McAllister, *supra* note 6, at 10,874.
57. McAllister, *supra* note 6, at 10,877.

Brazilian property laws that require and allow title through productive use of the land incentivized deforestation. Furthermore, the rising demand for agricultural exports from the region made gaining title to land for farming essential and profitable. Before recent environmental legislation was enacted, there was little or nothing to stop cattle ranchers and soybean farmers from clear-cutting hundreds of acres of forests bordering their plantations in order to increase their operations. By demonstrating productive use of the land and sometimes through fraud and violence, large scale farmers increased their land holdings in a manner similar to adverse possession.[58]

Brazil's regulatory systems have greatly improved over the past twenty years making this practice more difficult.[59] However the problem still persists. Many cattle ranchers are not concerned with land title. Simply having pasture land for their increasing herds satisfies their needs. Cattle ranchers continue to deforest to increase their pasture lands, thus lowering or eliminating their need to purchase feed for the herd.

These regulations are difficult to enforce, and culture is difficult to change. Even though Brazil's property laws today do not allow for such rampant deforestation in many cases, many Brazilian agricultural entrepreneurs have a Manifest Destiny-like view of the Amazon instilled within them. Deforestation has also proved to be a successful model for many. Some large scale farmers of beef and soy in Brazil are among the world's largest, and Brazil is the world's greatest exporter of both soy and beef. Many have had great success deforesting land for agriculture, and are resistant to change their business model. A lack of regulations means increased profitability and virtually no international liability for large scale farmers in the Amazon. In the same way that big business has been resistant to change in the United States (e.g. resisting Labor Unions, Food and Drug regulations, etc.), multinational agricultural corporations and Brazilian farmers struggling to make a living, are unlikely to voluntarily cease deforestation.

The problem does not lie in cattle farming alone; soybeans have contributed to the issues in their own way. Nepstad argues that the soybean and cattle industries in the Amazon "do not operate independently of one another."[60] The soybean industry has had a significant impact on the cattle industry and vice versa. As soybean prices began to rise, international and domestic farming initiatives sought to satisfy this increased demand by farming in Brazil. The price of soybeans continued

58. *See generally* McAllister, *supra* note 6, at 10,874; *see also* Nepstad et al., *supra* note 25, at 1596–99.
59. McAllister, *supra* note 6, at 10,876.
60. Nepstad et al., *supra* note 25, at 1599.

to rise, in part due to the European Union's ban on animal based protein feed for livestock. This drove the price of farmable land up significantly. Most of the land suitable for farming in the Legal Amazon was being used by cattle ranchers suddenly holding title to vast tracts of valuable land.

Cattle ranchers then found themselves in favorable circumstances. Many sold their land to soybean farmers and moved further into the Amazon, deforested, and reestablished their ranching practice. Titled and untitled lands alike, that were once home to agro-industrial cattle ranches, were sold off to soy farmers.[61] To regain land holdings, cattle farmers must again demonstrate productive use of the new land. In a system where accurate surveying is lacking, a demonstration of productive use by cattle ranchers will significantly help them to retain their land, even if it was illegally deforested. Thus the cattle farmers retreated deeper into the Amazon, clear-cutting and reestablishing their ranches.

B. Farming Subsidies and Incentive Programs Encouraged Deforestation

Brazilian property law is, of course, not the only governmental cause or incentive of deforestation. Over the past half century, the Brazilian government took steps to shield the Amazon region from the influence of the international community and steps they might have taken to protect the region.The Brazilian government provided subsidies for agriculture beginning in the 1960's that continued in the 70's and 80's as a means of stimulating the economy and development.[62] Nepstad describes these programs as "generous fiscal incentives" for agriculture, most notably large scale cattle ranching.[63] Prospectors began to develop the forests as a way of gaining title to the land at a time when prices were escalating. The goal of these programs was to utilize the largest region of the country in promoting the national economy.

At this time, soybeans had not yet been engineered to grow in this type of environment. The international demand for soy products was considerably smaller and concentrated mostly in Asia for human consumption. Rather, cattle farming became the largest agro-industry in Brazil, and was the primary source of the deforestation that has occurred

61. McAllister, *supra* note 6, at 10,876.
62. Nepstad et al., *supra* note 25, at 1596.
63. *Id.* at 1596.

since the incentive programs began in the 1960's.[64] As discussed above, the Brazilian property system facilitated the clear-cutting of forests for cattle grazing land. These government incentives provided capital to enable deforestation and quicker returns on investments for these farmers. Deforestation became a very profitable business. By 1990, fifteen percent of the closed canopy area of the entire Amazon rainforest had been clear-cut, primarily for agriculture.[65]

C. The Impact of the International Community: An Increased Market for Deforestation

In addition to domestic government incentives and property rights, the international market for beef first, and then soybeans, substantially accelerated deforestation. When the government incentive plans began, Brazilian beef was not being exported. In fact, many regions had banned the import of Brazilian beef because of the risk of Foot and Mouth Disease (FMD) and Bovine Spongiform Encephalopathy (Mad Cow Disease).[66] Since then, a large portion of the Amazon has been certified as a non-FMD region.[67] This has enabled Brazilian cattle ranchers to export their beef outside of the borders. As the potential consumer base increased, so did the demand for beef, and the demand for cheap pasture land.

Presently, soybeans are one of the most important export crops in Brazil. Since the European ban on animal based protein was enacted, Brazil's share of the soy market has increased steadily. Brazil now supplies half of the European Union's soy.[68] From the early 1990's until about 2004, the demand for both soybeans and beef grew internationally. Brazilian farmers adapted and made Brazil the largest exporter of soy in 2006.[69] As the demand accelerated, deforestation increased as well. The rate of deforestation peaked in 2004, along with the price for soybeans.[70] Ultimately the market for agricultural products has been the predominant factor for deforestation in Brazil and elsewhere.

64. Nepstad et al., *supra* note 25, at 1596.
65. *Id.* at 1596.
66. Nepstad et al., *supra* note 25, at 1596.
67. *Id.* at 1599.
68. *Id.* at 1598.
69. McAllister, *supra* note 6, at 10,875–76.
70. Nepstad et al., *supra* note 25, at 1599.

D. Halting Deforestation will Require Brazilian Property Reform

Since 2005, both the price of soy in the international market and the deforestation rate in the Amazon have decreased. The Brazilian government has taken credit for the slowed rate of deforestation and points to a number of successful environmental programs. The government prohibited land titling of about eight million square hectares of Amazonian forest land.[71] They also established five million square hectares of new parks and reserves where deforestation is strictly prohibited.[72] These significant achievements by the Brazilian government deserve credit for slowing deforestation in those areas. Another significant step taken was the deployment of several thousand troops to the newly protected areas in an effort to ensure deforestation was not occurring. These steps proved that the Brazilian government was serious about protecting their environment, and have possibly deterred those who continue illegal agricultural practices.

However, several million square hectares of Amazon rainforest remain unprotected. In order to protect this region, Brazil must reform their property laws, especially with regards to untitled public lands. Deforestation is illegal on protected public land, but untitled public lands are often unregulated, unprotected, and open for claiming through productive use. Even with the eighty percent preservation requirement, the ability to acquire large tracts of land remains appealing. Additionally, the lack of surveying and the requirement to show productive use makes the eighty percent forest preservation requirement difficult to identify and enforce for new property owners.

For significant decreases in deforestation to occur, the Brazilian property paradigm must shift to include stronger property rights and more clearly defined public land restrictions. Santinoni Vera discusses the Brazilian theory of property as providing the optimal benefit of property to society.[73] At the time the theory was formed and put into practice, the most productive use of property was exploitation of the resources for financial gain. The ratification of the Brazilian Constitution instilled a "use it or lose it" principle requiring adequate and productive use of the land. This property theory did, in a way, what it was meant to do; it created generations of deforesters who converted what was then viewed as virtually useless forest land to useful pastures, farms, and logging sites.

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71. Nepstad et al., *supra* note 25, at 1599.
72. *Id.* at 1599.
73. *See* Santinoni Vera, *supra* note 51, at 6.

The Brazilian theory of property was meant to give squatters significant rights. This is described as a "cultural understanding."[74] Brazil has succeeded in many ways in their attempts to provide indigenous people with viable options for gaining land for economic benefit. This in part led to the ability of Brazilian citizens to take title to land through use. Indigenous people or squatters could settle the land, develop it, and claim title to the land. This principle was also taken advantage of by large domestic and multinational corporations who either farmed directly or invested in farming the same land available to Brazilian citizens.

Despite its intentions, this system of land titling is detrimental to both the environment of the Amazon region and to the global climate. Strong and clear property rights provide certainty, lower transaction costs, and deter illegal use of another's property.[75] Because much of the Amazon rainforest is un-surveyed and untitled public land, it is in danger of falling subject to productive use titling. While the efforts to preserve the rights of indigenous people are commendable, there should be some limit to who may take advantage of this generous land policy. Otherwise, indigenous people, but more problematically large multinational corporations will continue to deforest and exploit these resources.

According to David Novoa, states with unclear property rights and uncertainty in land ownership have experienced greater deforestation than those states that have strong private and public property institutions.[76] When resources are open and available, large scale consumption tends to take place. Novoa describes this as an instance of the "tragedy of the commons."[77] In Brazil, there has traditionally been open access to resources. Because they are blessed with such vast resources, there has been little effort by industrialists to conserve those resources.

Often times, in those nations with strong property rights limiting access to land, there is a necessity to preserve agricultural land and put it to its best and most efficient use, often due to the scarcity of farmable land.[78] This problem has not yet presented itself in Brazil. Instead the Amazon has been seen by many businessmen as a limitless source of open lands and resources for the taking. States that have established strong property rights and usage laws for both public and private lands have been more capable of dealing with the problem of deforestation

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74. *See* Santinoni Vera, *supra* note 51, at 9.
75. *See id*. at 9.
76. *See generally* David C. Novoa, *Deforestation and Property Rights: A Comparison Between Former British and Spanish Colonies*, 7 ECON. ANALYSIS WORKING PAPERS No. 7 (2008), *available at* http://www.unagaliciamoderna.com/eawp/coldata/upload/Deforestation_property_rights.pdf.
77. *See* Novoa, *supra* note 76, at 2.
78. *Id*.

than those with weaker rights or historically open and unrestricted access to resources.

Novoa argues that the former British colonies have been more able to prevent or slow deforestation than former Spanish colonies because of their strong and clearly defined property rights.[79] Novoa likens Brazil, a former Portuguese colony, and its property rights and systems to the former Spanish colonies.[80] Unlike the former Spanish colonies, the British colonies were not as eager to allow open access to resources. In British colonies such as India, forests were subject to government management and regulation in order to protect timber and other resources from scarcity.[81] While the goal of all imperialists was to maximize the value of the colonies' resources, the British did so by setting up effective regulations, while the Spanish and Portuguese were more focused on discovering gold.[82]

By setting up strong institutions regulating forests, the British shaped the land use culture of their former colonies. After independence, many of these colonies retained the institutional framework regulating forests. The British system made the land that was available for resource consumption more valuable.[83] The situation in Brazil is considerably different. In Brazil land was worth little, because there was so much land not in use, open for the taking. However, under the British example, government management of forest lands would prevent deforestation and drive up the value of land designated as useable.

Perhaps the current Brazilian approach to property enumerated in their Constitution is commendable because it creates opportunities for indigenous populations to utilize land for survival. But it is quite possible that the benefits to the indigenous populations are outweighed by the dangers of massive deforestation. Fortunately, there are ways that Brazil could reform their property laws and policies in a manner beneficial to the environment and the indigenous populations. First, the Brazilian government should abolish land titling practices for profit farmers. The incentives for deforestation are high enough due to external market forces. Continuing to allow the option of titling through productive use of land only encourages further deforestation.

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79. *See id*. at 3.
80. *See* Novoa, *supra* note 76, at 3.
81. *Id.* at 3.
82. *Id*.
83. *Id.*

Second, Brazil should create incentive programs for preserving forested land or returning the aggregated land to a forested state. Brazil has had tremendous success with incentive programs before.[84] The incentive programs enacted in the 1970's and 80's played a large part in catapulting Brazil to the top of the beef market and succeeded in establishing a strong agricultural sector of the Brazilian economy.[85] They accomplished nearly all of the government's goals, including successfully integrating the Amazon region into the national economy. These incentive programs also eventually had a great deal of support from market forces including the demand for soybeans and cattle as exports.

It is possible that incentive programs for halting deforestation may have similar success. In the same way that the government encouraged deforestation for development, they should encourage a halt or reduction of deforestation. While the overwhelming force of the market is supporting deforestation, there have recently been market incentives to decrease deforestation rates in the Amazon.[86] If the government enacted a strong body of enforcement programs, they may be able to capitalize on the growing trend toward sustainability.

IV. EXTERNAL PRESSURES FROM THE INTERNATIONAL COMMUNITY

A. Market Influences

The market has not been immune from the trend towards sustainable consumption of resources. Many large companies, for reasons ranging from commitment to sustainability to market pressures to "go green," have implemented policies to reduce deforestation. Most notably, many of these companies are refusing to purchase soy grown on recently deforested land in the Amazon.[87] Cargill, a large multinational supplier of livestock feeds and a major purchaser of Amazon soy, has implemented a policy that requires its suppliers to either comply with Brazilian Forest Law or demonstrate that they are moving toward compliance.[88]

Furthermore, the soy industry in Brazil has enacted a widespread "soy moratorium."[89] The purchasers of Amazon grown soy have agreed not to purchase soy from land that is recently deforested. This industry movement began with a Greenpeace campaign in Europe pressuring McDonald's to cease the practice of selling chicken raised on soy meal

84. *See* Nepstad et al., *supra* note 25, at 1596.
85. *See id*. at 1596.
86. *See infra* Part IV for a discussion of these market incentives.
87. *See* McAllister, *supra* note 6, at 10,873.
88. *Id.* at 10,873.
89. *Id*. at 10,878.

produced in the deforested Amazon.[90] This moratorium was seemingly effective, as none of the major areas of recent deforestation in the region had been planted with soy from the time it was enacted.[91]

These increasingly responsible market forces provide significant incentive to Brazilian environmental regulation to reform land use policies and the soy industry within Brazil's borders. But despite the increased market responsibility, the main driver of deforestation caused by soy farming still exists. The market demand for soy is too high for Brazilian farmers to ignore. Soy farmers are still purchasing previously deforested land from cattle ranchers, who are moving into the forest interior. These cattle farmers then continue to deforest. It should also be noted that while soy purchasers are no longer buying soy grown on very recently deforested land, much of the Amazon land that is home to soy farms was previously deforested for cattle pasture land.

As it stands, the market is not solving the deforestation problem. However its efforts are a step in a positive direction. Cargill is the United States largest privately held company, and steps by such a heavy hitter in the right direction should signal an increasing trend of corporate responsibility. Cargill's regulation alone required 130,000 hectares to be reforested on soybean farms to comply with Brazilian Forest Law.[92] Even steps moving in this direction would be a significant gain for environmental repair.

However, the conscience of businessmen should not be relied upon to cure environmental problems. Governmental regulations must step in to aid in the interim. There will perhaps come a day when the world, as a market, may be able to refuse products grown on recently deforested land, but this is not yet the case. Even in wealthy developed nations such as the United States, economic downturn has forced many to look for the least costly options. The agriculture industry is no exception. If environmentally unsafe soy meal can be produced for livestock feed at a lesser cost, there is likely to be a demand for it.

Through swift and strict environmental regulations and effective enforcement, the pressures on soybean growers may eventually effectuate sustainable production.[93] While deforestation is an overarching problem threatening all parts of the Amazon, by dedicating the limited resources

90. *Id*. at 10,878.
91. *Id*. at 10,879.
92. McAllister, *supra* note 6, at 10,878.
93. *See generally* McAllister, *supra* note 6.

of Brazil to selective enforcement of the most problematic areas, more will be accomplished with less. These programs will be most effective if the government targets areas closest to the interior of the forest. By targeting their enforcement initially on areas that can be more easily reclaimed by the remaining forest, long range species such as large predators are given an improved chance at survival. Many of these animals have ranges of tens to hundreds of miles.

Selective enforcement of environmental regulations will also be most functional and efficient in areas close to major roads. Large-scale soybean farmers require transportation hubs to move the product out and supplies in. McAllister and Nepstad both identify areas near major roads within the Amazon rainforest as areas susceptible to deforestation for agriculture.[94]

B. European Union Influences

Aside from international market forces influencing the Amazon soy industry, the European Union has had a significant influence. First, the European Union ban on animal based livestock feed created a large demand for soybeans as discussed above. Second, the European Union's distrust of genetically modified foods has elevated the demand for Amazonian soy. Much of the soy grown in Brazil, outside of the legal Amazon, is genetically modified. However the soy grown within the Amazon basin is mostly free of genetic modification.[95]

The European large-scale purchasers either refuse to purchase soy from the South of Brazil or purchase less. The demand for soy is still incredible, so non-modified soy from the Amazon has stepped up to fill this void. The Amazon region is the world's largest producer of non-genetically modified soy. Of the six million tons of soy that the European Union imports from Brazil annually, a majority comes from the Amazon.[96]

The effects of the European Union's practices of importing soy from the Amazon after the industry wide soy moratorium remain to be seen. The practice may have the effect of encouraging farmers to grow soy on land that has not been deforested. This would be a beneficial outcome but may be unlikely. If the largest demand is for soy grown in the Amazon, the Amazon farmers must meet this demand. This demand may be met through fraudulent and illegal means as in the past. This may also encourage the farmers in Southern Brazil to grow non-genetically modified soy in an effort to compete with the Amazonian soy farmers.

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94. McAllister, *supra* note 6, at 10,873–76; Nepstad et al., *supra* note 25, at 1596.
95. McAllister, *supra* note 6, at 10,876; Nepstad et al., *supra* note 25, at 1598.
96. Nepstad et al., *supra* note 25, at 1598.

While there may be sufficient land to supply six million tons of soy to the European Union annually, much of this land in the Amazon is either recently deforested, or was deforested at some point. This does not even include the instances of cattle farmers selling their land to soy farmers and moving in towards the forest, clear-cutting for more land.

Although the situation is uncertain, unstable circumstances are often conducive to increased governmental or international regulation. By stepping in with concentrated and focused efforts to reduce deforestation significantly and to establish effective agricultural regulations that are actually enforced, the international community could capitalize on this uncertainty for the benefit of the global climate. This result is perhaps a best case scenario, but one that has proven true in anecdotal instances.

V. WORKING WITHIN THE SYSTEM, SOLUTIONS THAT RESPECT BRAZILIAN SOVEREIGNTY

To reduce and eventually halt deforestation, there must be a paradigm shift domestically within Brazil and internationally. First, the international community should pressure Brazil to adopt new agricultural policies and property laws that balance the interests at stake. The Brazilian government should no longer incentivize Large-scale cattle ranching. Regarding Brazilian property law, the ability to gain title through productive use should be restricted to Brazilian citizens and not apply to multinational corporations. If possible, it should only apply to indigenous peoples or subsistence farmers. Even if these changes are implemented, the market demand for soy will remain, however the clear advantages of Amazon grown soy will be neutralized.

Second, either through international pressures or market awareness, Brazilian soy farmers outside of the Amazon should produce a non-genetically modified crop. This will allow others regions to supply soy to large European purchasers. While it may be difficult to compete with the low prices of Amazon grown soy, non-genetically modified soy grown outside of the Amazon should be available. Recent soy moratoriums signal a trend toward increased corporate and consumer responsibility. Providing non-GM soy grown outside of the Amazon could prove to be a wise business choice in light of this trend. As awareness of the soy industry practices in the Amazon grows, consumers may find non-GM soy grown outside of the Amazon more desirable.

Third, the international community should implement policies to help combat deforestation. As Abate and Wright noted in their article, *A*

Green Solution to Climate Change, "[a]t present, the market drivers of deforestation are simply more profitable for developing nations."[97] The domestic incentives within Brazil to curb deforestation have been overshadowed by the economic demands of a developing nation facing large-scale poverty and unemployment.[98] Brazil has attempted through agricultural policy not only to integrate the Amazon region into the national economy, but indigenous people as well. These well intentioned efforts have proven to also be detrimental as we learn more about global climate change. Since, within Brazil, deforestation makes more economic sense than conservation, the burden lies on the international community, particularly the developed nations, to provide incentives for conservation.

The trick lies in implementing policies to accomplish this goal successfully. Much of the discussion involving an international plan has focused on providing developing nations with tradable carbon credits for reductions in deforestation rates.[99] These carbon credits could be sold off to the developed nations, where international cap and trade regulations or agreement could potentially require them to seek out carbon credits.[100] This practice would provide a financial incentive to reduce deforestation rates and could help fund conservation projects including enforcement of laws against deforestation.

Like any solution, this one is not without its problems. Scholars and especially critics of such a system are concerned with four issues that may arise as a result of this potential carbon crediting system: monitoring, leakage, additionality, and permanence.[101] Monitoring deforestation is costly. Furthermore effective monitoring is already a large problem in Brazil and a contributing factor to the continued deforestation. See below for a discussion of a potential international monitoring scheme.

Leakage is the term used to describe how market demands for deforestation are affected by halting deforestation in one area.[102] If deforestation were to be halted in the Amazon, the market forces encouraging it would still exist. Therefore, the problem of deforestation would not be solved, but simply moved according to this theory.[103] In Brazil specifically, even if Amazon deforestation is ceased completely, developers may simply relocate to the Atlantic Forest or internationally.

This type of carbon crediting system may take years to implement successfully. While many may have been optimistic that the Copenhagen

97. Abate & Wright, *supra* note 38, at 90.
98. *See id.* at 90.
99. *Id.* at 90.
100. *Id.* at 90.
101. Abate & Wright, *supra* note 38, at 102.
102. *Id.* at 90–91.
103. *Id.* at 103–04.

Summit would result in an explicit crediting system, or at least a firm commitment to implement such a system, this was not the case. The Copenhagen accord did identify the major role that tropical deforestation plays with respect to global climate change,[104] but many were unsatisfied with the lack of a specific plan. The Copenhagen accord also included a pledge of thirty billion dollars from the developed world to reduce tropical deforestation.[105] But with no explicit pledges from member states and no specific instructions for how the money should be spent, the eventual effectiveness of the accord is uncertain.

These concerns indicate that the most ideal solutions would reduce the market demand for deforestation. In Brazil specifically, that would require a significant decrease in the demand for beef or soybeans, or both. This is not very realistic. While the soy market is growing, a considerable amount of land in the Amazon is devoted to cattle ranchers. If the demand for beef were reduced, deforestation would likely be significantly reduced, especially considering the recently enacted soy moratorium prohibiting the purchase of soy grown on land that has been recently deforested. If deforestation for cattle were discontinued or even reduced, the result would be a significant victory for global climate change.

There are some very practical and reasonable solutions that the international community and Brazil may cooperatively implement. The first is a cooperative enforcement effort. As discussed above, Brazilian environmental regulations are a very strict, well-intentioned effort to reduce and halt deforestation. The biggest problem lies in enforcement of the laws or regulations. The government simply does not have the resources to enforce regulations in such an expansive region. Enforcement is troublesome due to the difficulties associated with traveling through the region, sheer manpower, and unfortunately, threats and actual violence by illicit land grabbers.[106]

Enforcement is one area where the international community may have a significant impact in reducing deforestation. Member states could provide resources for enforcement, and even man-power if permitted by Brazilian officials. This is where the tricky issues associated with sovereignty come into play. Brazil is unlikely to agree to anything resembling a military occupation of the region, even if this has proved

104. United Nations Framework Convention on Climate Change, Dec. 7-18, 2009, Copenhagen, Den., Draft decision -/CP.15 (Dec. 18, 2009).
105. *Supra* note 104.
106. *See generally* McAllister, *supra* note 6.

successful in enforcing environmental policies in nations such as Botswana. However, the Brazilian government will likely welcome other forms of international assistance.

For example, new technologies in satellite monitoring may provide a safe and efficient way to monitor deforestation. While Brazil may not have the resources to develop a full-scale satellite monitoring program, international funding could be helpful in this development. Grants from developed nations could be tailored to provide funding specifically for such monitoring programs. Advanced satellite monitoring could not only keep developers honest, but could also assist Brazilian officials in identifying problem areas, protecting national parks, and surveying land. A satellite-imaging program is already in place in the state of Mato Grosso.[107]

Satellite monitoring programs could also allow independent organizations such as NGO's and environmental watchdog groups to assist in monitoring.[108] If the images were available online, these groups could assist Brazilian officials. These groups could also help keep environmental officials honest by ensuring that the policies are in fact being enforced, as concerns of corruption have occasionally been raised.

A potential and partial solution to the problem of carbon emissions as a result of deforestation and soy farming comes in the form of agricultural biosequestration.[109] Current farming techniques tend to release carbon into the atmosphere during tilling and harvesting. However, new no-till farming techniques are currently being developed that could reduce the amount of carbon released from agriculture. If soy could be effectively farmed through such practices, the carbon emissions from the region would be reduced.

The problem of deforestation would still remain. However, if the Brazilian government were to incentivize no-till soy farms and provide disincentives for cattle ranchers, the reformed agricultural practices would result in fewer emissions. A reduction in the demand for cattle ranches would yield more land for soy. This outcome would significantly reduce the amount of land being deforested. No-till soy farms could then have a partially beneficial effect on the environment, because soy plants act as a temporary carbon sink. During harvesting not all of the carbon within the crop is released back into the atmosphere. Soy farms could then act as cyclical carbon sinks. This solution is in no way permanent or complete,

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107. Nepstad et al., *supra* note 25, at 1600.

108. *See id.* at 1600.

109. *See generally* Nicholas Bianco & Alexia Kelley, *The Biosequestration Challenge*, WORLD RESOURCES INSTITUTE, May 19, 2009, *available at* http://www.wri. org/stories/2009/05/biosequestration-challenge (for general reading on biosequestration).

but could provide a temporary improvement or quick fix. Soy, of course, does not sequester nearly the amount of carbon as a primary or secondary tropical forest, so reforestation must be the eventual goal.

The real solution must be a reduction in the market demand for commodities causing Amazon deforestation. In many advanced nations, consumers are eating less beef because of its environmental inefficiencies among other reasons. A reduced demand for beef may reduce the amount of soy needed to sustain European beef operations. This effect could either reduce the amount of soy needed from the Amazon, or otherwise allow the crop to go directly to human consumption. Plants provide the most energy when consumed directly by humans. If humans consumed all of this soy directly, the demand facing the region may go down. However this soy is being primarily used as animal feed.

VI. CONCLUSION

Therefore, Brazilian property law and agricultural incentives should be reformed to encompass the issues facing the Amazon rainforest. These reforms coupled with increased regulatory enforcement could significantly reduce the amount of deforestation for agriculture in the Amazon region. Because of the numerous international implications of continuing deforestation, identifying and implementing solutions should be a global endeavor. The atmosphere is truly a "global commons." The amount of carbon emitted from this region affects every member of the commons. Because of the sheer amount of carbon this region stores, and the danger of its release, reducing and halting deforestation in Brazil's Amazon should be a primary environmental policy focus of the international community. Without achieving some success in the Brazilian Amazon, global climate change will persist as a danger to the commons.