American Importation of Brazilian Ethanol: Methods sensitive to economic, ecological, and social issues

Abstract

The United States is already the leading importer of Brazilian ethanol, with increased importation possible in the near future. Should the US open its economy to Brazilian ethanol, and what would be the most efficient methods that remain sensitive to environmental and social issues? Brazil's Forestry Code (Codigo Floresta) is a set of laws mandating conservation areas for approximately 25% of all agricultural land, which may be essential to ecological health, but also cost-prohibitive for smaller producers. I perform a cost-benefit analysis of these areas, Legal Reserves (RL's in Portuguese) composing a mandated 20% of each agricultural plot, and Areas of Permanent Preservation (APP's), which are buffer zones along waterways composing approximately 5% more territory on each parcel of agricultural land. Some agricultural activity is allowed within the RL's, providing a potential revenue stream, though initial research suggests these areas will not be cost-effective in the near- or middle-term. To provide producers with economic incentive to comply with Brazilian law, I suggest the United States should lower our import tariff by an amount that accounts for the increased cost of production for those producers who maintain RL's and APP's. Empirical, quantitative data on land use and production costs will be complemented with interviews of landowners, agricultural laborers, government officials, and other stakeholders in order to provide a more complete assessment of the potential benefits and barriers to implementation of these policies.

I. Problem Statement

A. Introduction

The United States must use increasing amounts of renewable fuels, up to 36 billion gallons (B gals) in 2022 (EERE, 2007). Currently, these mandate are filled almost exclusively with domestic corn ethanol, resulting in food security and environmental threat that have many people questioning any increases in its production. Brazilian sugarcane, until 2005 the world's main source for ethanol, is much more efficient in terms of energy and land use (Macedo et al., 2008). Brazilian ethnaol too, however, comes with its own negative aspects, including labor problems as well as threatening two of the world's leading biodiversity hotspots (Rodrigues et al., 2009). The Brazilian Codigo Florestal (Forest Code or CF) is existing legislation that has the potential both to protect ecological health, and to diversify and increase demand for agricultural labor. Lack of enforcement and economic incentives has led to less than 7% of producers in Sao Paulo, the state producing 60% of Brazil's sugarcane, to comply with CF laws (Bacha, 2005). To examine the economic barriers to compliance with this law, I ask what is the increase in price per gallon of ethanol for producers in Sao Paulo who comply with the Forest Code?

In addition to the economic barriers, initial research indicates that the labor market is also problematic for producers attempting to comply with the law. The Forest Code mandates that producers set aside 20% of their land in a forest reserve (Reserva Legal, Legal Reserves, or RL), and establish buffer zones, accounting for approximately 5% of each plot, along waterways (Areas de Preservacao Permanente, Areas of Permanent Preservation, or APP's). On Legal Reserves wood and fruit collection are allowed so long as the forest remains largely intact, providing potential revenue streams that can defray the costs of lost sugarcane harvests. A lack of skilled labor and administrative costs of registering and employing workers, however, inhibit diversification of agricultural activities, and thus, efficient comliance with the Forest Code. Therefore, after the initial cost benefit analysis of compliance, I aks how labor market conditions can be improved to allow efficient implementation of Legal Reserves and Areas of Permanent Preservation to increase employment in Sao Paulo and to ensure the availability of soil and water resources for generations to come?

Brazil, until 2005 the world's leading producer of ethanol, is no exception to environmental problems, containing the fourth highest priority conservation hotspot, the Atlantic Rainforest, in São Paulo, the state producing 60% of Brazil's sugarcane and most of its ethanol (Smeets et al., 2008). Unfortunately, as of 1998, less than 10% of Brazilian landowners registered Legal Reserves. In São Paulo, the numbers are even worse, with only 6.4% registering RL's, down from 18.2% in 1972, with no signs of the situation improving (Bacha, 2005). Though the environmental, social, and even long term economic benefits of these set-asides may outweigh their costs, the difficulty of enforcing these laws in Brazil's sprawling agricultural land, combined with the potentially devastating initial costs, especially to smaller producers, make this set of legislation practically unfeasible without some sort of economic incentive and compensation (Rodrigues et al., 2009; Turner et al., 2003).

Empirical evidence from existing APP's and RL's (Rodrigues et al., 2009), including some in cane land that has been reconverted to forest (Momoli, 2006), shows their effectiveness in increasing ecological resilience and biodiversity, and decreasing erosion and damage to water quality by agricultural activities. I hypothesize that their implementation in concordance with Brazilian law will provide long-term economic, environmental, and social benefits that justify their implementation, but that in the near- and middle-term, producers would have to be compensated economically in order to overcome the economic costs of implementation. Further benefits could include expansion and diversification of the types of labor demanded that would make these measure the boon to rural development often touted (Goldemberg, 2006) but seldom realized in the biofuels boom of the last several years.

This research proposal continues with details regarding transportation fuels and their consumption in the US, and then a discussion of Brazilian sugarcane and ethanol production as they relate to this research. This is followed by the general significance of Legal Reserves and Areas of Permanent Preservation in the context of agricultural economics and ecology, especially as they relate to development in rural Brazil, and then a discussion of the contributions to the academic literature made by this research. This is followed by a preliminary methodology for the cost-benefit analysis and the qualitative component that is to complement it.

B. Transportation fuels and their demand in the United States

Agricultural production and ecological health are not mutually exclusive, but today’s dominant production methods are indeed detrimental to ecosystem and consequently human health. Increasing demand for agricultural products, including both food and fuel, has induced the replacement of vast tracts of forest with monocultural landscapes, exacerbating enviromental problems caused by industrial agriculture. Concurrently, the United States must find a way to fulfill the Renewable Fuel Standards (RFS) the government signed into law the Energy Independence and Security Act. The current dominant means to satisfy this requirement is with corn ethanol that threatens food security, especially for the poor (Runge and Senauer, 2007), and whose production is harmful to soil and water resources (Donner, 2007). Due to the reliance on petro-chemicals and other petroleum inputs, corn ethanol production may also do little to decrease US dependence on oil (Eaves and Eaves, 2007). Brazilian ethanol, on the other hand, may present a more efficient means of satisfying a portion of the US RFS mandates, so I begin with the broad question of if it is possible for the US to import Brazilian ethanol in ways that are more environmentally responsible.

Current technology, available land and environmental impacts of feedstock production, as well as competition with food production represent formidable limiting factors in the effort to increase domestic biofuels production and reduce U.S. dependency on petroleum. There is considerable potential for cellulosic ethanol, which may require less land and pose less competition for the food supply (Khanna, 2008), but the energetic and economic inputs currently outweigh the outputs (Raguskas, 2008). Countless other measures and alternative sources of energy provide hope for a greener future, but the most efficient biofuels production technology available today remains Brazilian sugarcane ethanol (Martines-Filho, 2007; Goldeberg, 2006). This reality has induced some American policy makers to consider reducing or eliminating a tariff of \$0.54 gal^{-1} on imported ethanol.

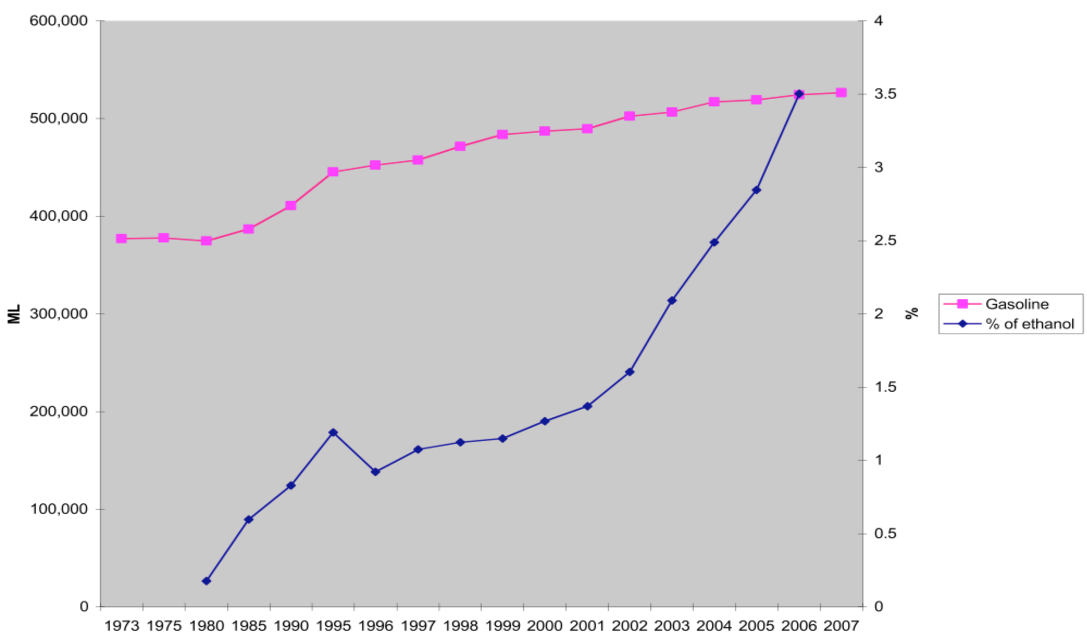

Figure 1. Historical US Gasoline and Ethanol Consumption

Gasoline data were calculated using average petroleum for transportation consumption day^{-1} in barrels, times 365 days $year^{-1}$ (366 for 1980, '96, 2000, and '04), 42 gallons $barrel^{-1}$, and 3.7854 L $gallon^{-1}$. Gasoline data were taken from the US DOE, EIA statistics webpage found at http://www.eia.doe.gov/emeu/mer/wni.html. Gasoline is defined as finished motor gasoline. Beginning in 1993, also includes ethanol blended into motor gasoline.
Ethanol data come from Renewable Fuels Assoc. webpage, available at: http://www.ethanolrfa.org/industry/statistics/#A

As American consumption of transportation fuels continues to climb, so too, once again, does the price of oil. Petroleum lies entrenched in a variety of problematic issues discussed at the top levels of government, from supplies under so called "peak oil" conditions, to fossil fuel's possible links to climate change and the threats to national security posed by their importation from despotic regimes. These problems led to the passage of the Energy Independence and Security Act in December of 2007. Included in this act is not only an increase in the Renewable Fuel Standards (RFS) mandates to use of 36 billion gallons of renewable fuels by 2022, but also a requirement that 60% of these come from "advanced biofuels," defined as "fuels that cut greenhouse gas emissions by at least 50%" (EERE). The likely candidates for these advanced biofuels are certain types of biodiesel and cellulosic ethanol from wood wastes and grasses still under development, but as the technology to produce cellulosic ethanol is not yet energy or cost efficient (Raguskas et al, 2006), methods for meeting these standards remain uncertain. Analysis of Brazilian ethanol production, on the other hand, indicates it is able to meet this requisite level of GHG emissions reductions (de Oliveira et al, 2005). Part of the motivation for the RFS, indicated in the name of the Act that increased them, is to achieve energy independence, an admirable goal for the world's largest energy consumer. Brazilian ethanol would not achieve this mandate, but as Brazil is and almost always has been an ally to the U.S., many American policy makers, including senators Gregg (R NH), Feinstein (D CA), and even the most recent Republican candidate for president, senator John McCain (R AZ), favor Brazil as an energy source over regimes in the Middle East or Venezuela. Furthermore, it is important to note that the EISA specifically calls for the "use" of these alternative fuels, and not the domestic production, leaving the door open to importation of Brazilian ethanol. These and other factors contribute to a changing climate in the discussion regarding transportation fuels in the United States.

Biofuels have been touted as an effective response to supply of petroleum and some of the environmental problems created by its extraction and use. It can reduce greenhouse gas emissions (GHG's) associated with transportation fuels as it is made with plants that sequester as much carbon during their lifespan as they emit during combustion (Tillman and Lehman, 2006). If the life cycle analysis (LCA) were limited in its scope to these factors, this may be true, but GHG's also depends on use of chemicals such as pesticides and fertilizers, and which land is used and from what use it is being converted (Searchinger et al., 2008). While the specifics behind the study of climate change are largely beyond the focus of this investigation, since climate change is a major motivation for biofuels, it is important to include a brief discussion of how the elements in this research project relate to climate change.

Table 1: Sugarcane, Land Productivity, and export scenario

Production	**units**	**1980**	**2002**	**2006**	**2022**
Brazilian Sugarcane	tn ha^{-1}	70	82.4	87.1	95
	L tn^{-1}	n/a	86	86.3	92.3
	L ha^{-1}	n/a	7086.4	7516.7	8768.5
US Corn	L ha^{-1}	n/a	n/a	4060.9	5202.7
US Consumption					(estimated)
Gasoline for transport.	ML	374797	502658	524535	681372
Ethanol	ML	662	8063	18378	136274
% from Ethanol		0.18	1.60	3.50	20.0

Sugarcane production data come from Macedo et al (2008); corn production data come from Gallagher et al (2006). Estimated ethanol consumption is according to requirements defined by the Energy Independence and Security Act of 2007. Liters of ethanol needed for 2020 is based on EISA projection of 36 B gals.

Adding to the advantage of cane- over corn-based ethanol is its relatively minor reliance on fertilizers and other, energy intensive inputs. The total energy ratio of outputs to inputs is considerably higher for Brazilian ethanol, at 3.14-3.87:1, versus American corn ethanol, at 1.03-1.12 (de Oliveira et al, 2005). Fertilizers are key, energy intensive inputs (included in these ratios), and nitrogen cycling is also pivotal in the discussion regarding American corn production—which requires twice the nitrogen fertilizer as Brazilian sugarcane (Smeets et al, 2008)—since nitrogen fertilizer is the source of significant pollution in the Mississippi River Basin and Gulf of Mexico, endangering human as well as economic health (Donner, 2008). These inputs and their impacts combine to serve as counter-arguments to those promoting corn-based ethanol as a substitute for imported petroleum: the immense amounts of fossil fuels needed in fertilizer production, distribution, and application can, some say, preclude the ability of ethanol to relieve us to any significant degree of our dependence on petroleum (Eaves and Eaves, 2007). Cane in Sao Paulo, unlike U.S. corn, is not nearly as reliant on irrigation, placing less strain on water supplies or the energy to pump it (Smeets et al., 2008). Finally, sugarcane is not as central to the global food system as corn, its diversion from food to fuel causing less of an impact on food prices (Goldemberg, 2004).

Table 2. Brazil and Sao Paulo: Agricultural Land Use

Year	**1970**	**1985**	**1995**	**2006**
Brazil				
Farming	33983796	52147708	41794455	76697324
%	13.81	16.28	13.32	21.98
Pasture	154138529	179188431	177700472	172333073
%	62.7	55.9	56.6	49.4
Forest	57881182	88983599	94293598	99887620
%	23.5	27.8	30.1	28.6
Total	**246003507**	**320319738**	**313788525**	**348918017**
Sao Paulo				
Farming	4735925	6524801	5256168	7454683
%	25.4	34.8	32.3	40.6
Pasture	11463383	9926490	9062254	8594106
%	61.5	52.9	55.7	46.8
Forest	2426910	2311967	1949379	2321255
%	13	12.3	12	12.6
Total	**18626218**	**18763258**	**16267801**	**18370044**
People Employed	1420040	1357113	914954	873087

Figures from 2006 Agricultural Census.

C. Brazilian ethanol

There are compelling justifications why, if anyone is going to produce ethanol, it should be Brazil. The country's land mass, roughly equivalent to the continental United States, consists of 32% arable land, 22% of which is dedicated to farming, 49% to pasture land, and 29% to agro-forestry (see Table 2). With the Tropic of Capricorn running through the southern third of the country, through the state of Sao Paulo, almost all of

Brazil enjoys a 365 day growing season each year. The soils in Sao Paulo offer fertility with little demand for chemical fertilizers (Goldemberg et al., 2008), and as home to South America's largest city and just a few hours drive from Rio de Janeiro, it boasts enormous markets close at hand as well as the infrastructure to aid in efficient production and worldwide distribution (Goldemberg, 2006).

This production also benefits from over three decades dedicated to refinements in the ethanol supply lines. Begun as a response to the oil and currency crises of the 1970's, the industry initially received significant government subsidies to cane producers and ethanol refineries, called *usinas*, and later to automakers. These interventions succeeded not only in producing ethanol, but also in boosting sugar prices and creating a vehicle fleet of cars that run on pure ethanol. Together these helped to increase demand for both cane producers and ethanol refineries so that today both operate profitably on the free market (Goldemberg, 2006). Further research and development in the auto industry has recently led to "flex-fuel vehicles" capable of running on any mixture of ethanol and gasoline, allowing consumers to respond freely to market conditions, another enormous boon given last year's meteoric rise in oil prices.

Clearly the Brazilian ethanol industry has both a vast head start and an enormous advantage in terms of natural resource endowments over its more recently initiated and invigorated American counterpart. As seen in Table 1, Brazilian production is nearly twice as efficient in terms of liters of ethanol per hectare. Still, there is the fear that exportation of Brazilian ethanol could turn its rural areas into a 'Green Desert,' with endless expanses of sugarcane nearly devoid of employment opportunities or the biodiversity to support a healthy economy and ecosystem that will provide these resources for future generations. The Codigo Florestal presents an opportunity to expand cane production in ways that both protect the environment and create jobs. A concurrent issue in Brazilian cane production shows how effective market conditions can be in influencing producers' methods.

This issue, fraught with implications and contradictions, is the practice of burning cane fields immediately prior to manual harvesting. The incremental ban on cane burning, recently rewritten, presents a double-edged sword for people in Sao Paulo. On the positive side, LCA shows that there are economic benefits from replacing manual harvesting, which necessitates burning, with mechanized harvesting, which also reduces costs of production (Veira, 2003). On the other hand, it reduces the need for labor by as much as 100,000 jobs in the agricultural sector that, in 2006, employed 1.2 million seasonal sugarcane workers (Azanha, 2007), and has experienced decreasing labor in the agricultural sector for the past two decades (Table 2). This reduction in jobs, too, can be seen in two lights as people do earn wages from harvesting sugarcane, but some studies report cane labor as nearing slave conditions (Sparovek, 2007). It is clear that burning cane has serious climate change implications (Smeets et al, 2008), as well as creating tangible health problems in rural populations. Arbex et al (2007) found high positive correlation between crop burning and respiratory illness-related admissions to hospitals close to fields on days when crops were burned. This complex problem, and the apparent resolution currently underway, provide an excellent example parallel to the policy changes proposed here.

As proponents of bans on cane burning and the move to mechanization touted improved air quality and working conditions, other factors have induced producers to be ahead of the scheduled ban as of the end of 2008. As the Brazilian Real strengthened against the US Dollar over the past few years, coupled with increasing cane production during the biofuels boom, tractor manufactures such as Caterpillar and Case International have established factories in Sao Paulo State. These factors, as well as increased value of trash, or bagasse, which can be used for electricity generation when it is not burned for manual harvest, combine with increasing costs of agricultural labor to produce economic incentives that have motivated more producers to make the move to mechanized cane harvest, in effect making the burning legislation a moot point (Azanha, 2007). This example provides further justification for market-based economic incentives to encourage producers to compy with Brazil’s agro-forestry laws mandating RL’s and APP’s.

D. Problem Statement Conclusions

Clearly, biofuels represent critical matters of immediate importance, and two of the leading players at the center of these issues are the United States and Brazil. Even in these two countries, with their vast natural resources, however, there exist clear constraints. Still, Brazilian biofuels backers continue to make claims that Brazilian ethanol could replace 10% of the world's gasoline consumption, using only 3% of the world's agricultural land (Goldemberg, 2006). Another researcher goes so far as to contend that Biofuels will account for 30% of the global energy supply—not just transport fuel supply!—by 2020, compared with only 2% today (Martines-Filho, 2006). But rather than anticipate the demands and reactions of all or many of the world's countries, I take two countries, one my own--the world's major consumer of energy--and one in which I lived for several years. The US and Brazil are the largest biofuels producers, providing ideal case studies for empirical historical, and realistic theoretical projections of the potential for and potential impacts of biofuels production.

II. General Significance

The significance of biofuels to the pressing issues of deforestation and energy security should be clear from the previous discussion. It is significant because it is an economic issue, an ecological issue, and a human health issue. Taken as a whole, this becomes a general policy problem of the utmost importance. In terms of the general significance it may be helpful first to consider deforestation and energy security in terms of two of their parts: ecology and economics. This is certainly an ecological issue since, without a healthy ecosystem, it becomes difficult if not impossible to sustain a healthy agricultural system, economy, or perhaps any human system. The impacts of sugarcane production have been studied in terms of forestry (Rodrigues, 2009), water quality (Moreira, 2006; Smeets, 2008), air quality (Arbex et al, 2007), and soil quality (Filoso et al, 2003; Ruschel and Vose, 1982). For the purposes of my research, these studies and other studies will be relied upon to provide the scientific foundation for investigating their implications for human health, and can shed light on the interviews I will conduct on site in Sao Paulo. These ecological aspects provide clear integration with economic issues such as tradeoffs between revenue gained from cane production with reduced revenues generated by agroforestry allowed on RL's and no clear revenue streams provided by APP's. These are also not far removed from wages paid to agricultural laborers and changing land prices that affect the sustainability of rural culture in Brazil.

The importance of economic issues--the allocation of scarce resources in the face of unlimited wants--is not to be understated in this study. Biofuels may indeed bring revitalization of rural economies, as has been suggested (Daschle, 2007; Goldemberg, 2006). But it is also equally possible that an overly exuberant move toward biofuels production, given finite agricultural land, could exacerbate the problems outlined in the first section of this paper. Due to the interconnected nature of economics, ecology, and development, it is essential to deal with them simultaneously. Fortunately, or at least hopefully, a CBA involving all three areas is feasible within the sufficiently narrow scope of Sao Paulo's Legal Reserves and Areas of Permanent Preservation.

A more specific question I wish to pose is, who would gain, and who might suffer, from trade in Brazilian ethanol production? Biofuels supporters often tout the potential benefit to the rural poor that may come from boosting demand, and hence prices and production in crops such as corn and cane (Daschle, 2007; Goldemberg 2006). But in the U.S., and even more so in Brazil, agricultural land lies in the hands of fewer and fewer large landholders (Smeets et al, 2008). The various methods employed in agriculture are also essential in determining the effects on these communities.

Brazil sits with Mexico as one of the two Western countries with the widest disparity in people's incomes, with the shrinking of agrarian lifestyles listed as a major factor in the rush of poor rural laborers towards Brazil's already overcrowded cities (Smeets et al, 2008). If biofuels are to be successful exports from Brazil, they will have to achieve this success with more than just the few, already wealthy landowners. This discussion of development will involve both economic and ecological aspects as it has been noted that the desperately poor are both prone to making decisions for any possible economic gain, regardless of the longer-term ecological costs, and are also those who first and most severely fall victim to the ills of economic downturns and ecological damage (Aggarwal, 2006). Unable to ride out the rougher economic cycles felt less by those with a decent savings account, and first to become sick by tainted water that cannot be avoided by buying the blue plastic bottles at the local supermarket, the poor are the ones at the center of the biofuels issue, even if they are often overlooked.

III. Preliminary Methodology

A. Quantitative Research: Comparisons of cost-benefit analysis of sugarcane farms in Sao Paulo state under different production regimes both with and without Legal Reserves and Areas of Permanent Preservation

We begin with three theoretical farms of 100 ha each, with production costs and revenues projected over a thirty year horizon using empirical data

Farm 1 begins and continues with 75 ha in cane, 20 ha RL, 5 ha in APP

Farm 2 begins with 100 ha in cane, moves forward under two scenarios:

scenario a. stays in 100 ha of cane

scenario b. moves in year 1 to convert 20 ha to RL and 5 ha to APP

Farm 3 begins with 100 ha of pasture

scenario a. moves in year 1 to 100 ha of cane

scenario b. moves in year 1 to 75 ha of cane, 20 in RL, 5 in APP

During the first phase of work occurring over the next several months, the CBA will be limited to comparing the production costs and revenues for cane production in the scenarios for the three farms described above. The results here will be carried out to find the differences in production cost per gallon ethanol, with a reduction of the tariff 10% beyond the increased cost to comply with the Forest Code in order to provide economic incentive to producers to maintain forest land reserves and along riparian corridors.

Thirty year scenarios will be run with costs and revenues discounted to present value.

Costs include:

- All farms: Production costs of sugarcane per hectare (from Khanna, Lasco, and Barton, 2009)
- Farms 1, 2b, 3b: Maintenance costs of RL and APP (Rodrigues et al, 2009)
- Farm 2b: Conversion costs from cane to RL and APP (Rodrigues et al, 2009)
- Farm 3a: Conversion costs from pasture to sugarcane (Rodrigues et al, 2009)
- Farm 3b: Conversion costs from pasture to RL and APP (Rodrigues et al, 2009)

B. Qualitative Research:

Two sites for interviews have already been identified and visited, including consulting with landowners and managers regarding the questions outlined above. These are Usina Sta. Helena, an ethanol and sugar refinery owned operated by Cosan, Brazil's largest refinery company, and Fazenda Ambiental Fortaleza, an independent, family owned farm of approximately 1000 ha producing sugarcane, coffee, and bananas. These provide an excellent contrast as different types of producers. Other producers will also be sought in the Sao Paulo state.

Interviews with stakeholders (example questions)

1. Land owners
    a. What benefits do you see to RL's and APP's?
    b. What problems/obstacles do you see in them?
    c. On land producing predominantly sugarcane, would you be willing to pursue production of agro-forestry items (wood, fruit, etc)? Why or why not?
    d. Would expansion of cane production and exportation of ethanol be positive or negative? What methods would influence this toward the more positive?
2. Ag. laborers
    a. Where are you from, and where do you work?
    b. Do you migrate during the course of a typical year? Where? How?
    c. What practical job skills do you have?
    d. What access do you have to training?
    e. Would expansion of cane production and exportation of ethanol be positive or negative? What methods would influence this toward the more positive?
3. Government officials
    a. What are the new enforcement mechanisms that have been used to certify labor?
    b. Are they available for enforcement of RL's and APP's? Why or why not?
    c. Would the Brazilian gov't be willing or able to provide other incentives to ag. producers and/or to refineries to comply with the forestry laws?

d. Would expansion of cane production and exportation of ethanol be positive or negative? What methods would influence this toward the more positive?

The quantitative and qualitative will be discussed in separate sections in the thesis, but will also be brought together in appropriate sub-sections, and will be used in tandem in places where one can help to shed light on the other.

C. Data Sources

In addition to the data already secured from the above sources, several other sources are available. Brazilian government agencies such as IBGE (Brazilian Institute for Geography and Statistics), the Brazilian Ministry of Agriculture, and IBAMA (Brazilian Institute of Environment and Renewable Natural Resources) will be used for collecting data on general Brazilian infrastructure and agricultural production. UNICA (Sugarcane Industry Association) provides further data regarding cane and ethanol production.

Agricultural laborers will be the focus of the surveys and interviews, with attention also paid to managers, landowners, and other stakeholders in food and agriculture, and in rural development. People in the ethanol industry will also be included in the research as sugar and ethanol refineries have been shown to be effective in enforcing the regulations supported by those to whom they export, mainly Europe in regards to improving labor conditions (Smeets et al, 2008).

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