

Corn, Sugar, and Ethanol: How Policy Change Can Foster Sustainable Agriculture and Biofuel Production in Mexico and the United States

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I. Introduction

The ongoing effects of the North American Free Trade Agreement (“NAFTA”), existing agriculture and trade policies, and growing interest and concern over biofuels—and their cumulative effects on world food supplies and the environment—necessitate simultaneous consideration of these issues. With the inevitability of globalization, the connection between social, political, agricultural, and environmental problem are more undeniable. No longer can these issues be adequately explored, much less the associated problems be solved, in a vacuum.

Instead, these policies and problems must be recognized for what they are: multifaceted and interconnected. The broader issues of energy, economics, agriculture, and trade between the United States and Mexico are correlative in nature. Job losses contribute to ever-increasing cross-border migration; subsidies and price support programs inflate commodity prices causing the cost of animal feed and products to rise, while incentivizing overproduction and unsustainable agricultural practices. Recent interest in alternative fuels further obviates the flaws of modern agricultural practices and trade policies, while raising concern over global food security and environmental sustainability; the implementation of NAFTA has caused massive employment losses in the Mexican corn sector and threatens Mexican culture with the demise of traditional maize crops.

While these issues have been previously addressed independently, more recent treatment of this subject matter has begun to realize the mutual influence that social, political, agricultural, environmental and trade issues have upon each other. This article follows in that vain, attempting to emphasize the causal connections and potential solutions

regarding these issues, recommending policy changes which affect each issue independently, offering a modest proposal for implementing progressive policy changes in order to alleviate what many would describe as current agricultural,¹ economic, and environmental crises facing Mexico, the United States, and the world in general. In this case, the culprit—the new global demand for biofuels—may be the very solution.

II. Corn, Sugar, Ethanol, and Trade

A. *The North American Free Trade Agreement*

In 1994, NAFTA established the largest free trade area in the world.² The ambitious undertaking sought to improve trade policy and relations in multiple ways and on a variety of levels.³ The treaty both incorporates and builds upon the prior agreements made by the U.S., Mexico, and Canada pursuant to the General Agreement on Tariffs and Trade (“GATT”).

Proponents of the treaty predicted a mutually beneficial agreement, one that would create jobs, increase efficiency, and lower costs of production.⁴ The agreement was meant to spark the modernization of Mexico,⁵ and as Mexico developed into a First World economic force many predicted cheaper food prices for consumers, more efficient production and manufacturing, and a decrease in Mexican migration to the United States.⁶ NAFTA was to ensure the mutually beneficial integration of the economies of Mexico and the United States.⁷

In negotiating NAFTA, the governments of Mexico and the United States stripped away important restrictive production policies, price controls, and key tariffs on the twin cornerstones of Mexican agriculture and food security—corn and beans.⁸ The devastating results included massive oversupply of grains, rock bottom prices and the loss of many

farmers in Mexico.⁹ As a result, the Mexican agriculture crumbled after NAFTA became effective.¹⁰

Some argue that the current crisis undermining Mexican agriculture results directly from NAFTA.¹¹ Since the opening of the Mexican market to cheap U.S. corn, the price Mexican farmers receive for their corn has plummeted while imports of U.S. corn have skyrocketed.¹² In the Mexican countryside, more than 1.5 million farmers have been driven off their land by heavily subsidized U.S. corn and other agricultural products.¹³ In the last decade, corn imports by Mexico have risen 240%, from 2.7 to 6.1 million metric tons, and the price paid to Mexican farmers has dropped by seventy percent.¹⁴ This trend has left Mexico increasingly dependant on imports of its staple food, and is likely to result in the displacement of fifteen million Mexicans after the remaining tariffs on corn and beans are removed.¹⁵

In the first ten years of the North American Free Trade Agreement, trade increased more than threefold between the two nations, totaling nearly \$300 billion in 2005.¹⁶ The United States was accounting for 85% of total Mexican exports in 2006, including over 80% of all Mexican agricultural exports.¹⁷ In turn, Mexico is the third largest trading partner of the United States and in 2006 became the country's second largest agricultural trading partner.¹⁸ The importance of the economic relationship between the two countries is clear, however, therein lies the problem: both countries are increasingly more dependant on each other, yet competition in vital agricultural sectors creates problems far beyond strict economic figures.

In the United States, the corn crop produces close to \$17 billion in annual sales,¹⁹ with corn exports accounting for 20% of total U.S. exports in 2001,²⁰ and 66% of world exports in 1999.²¹ Nationwide, land in corn production totals more than 28 million hectares, roughly 4% of the total land area of the United States.²² In Mexico, corn production accounts for over two-thirds of the gross agricultural product, covers half of all cultivated land and employs roughly 3 million people.²³ The industry employed three million people totaling 8% of all Mexican labor in 2000.²⁴ Mexico is also the world's second highest annual per capita corn consumer.²⁵

Sugar is the largest remaining sector of Mexican agriculture, and the fifth most important industry in that country.²⁶ The Mexican sugar industry directly employs 300,000 workers, while indirectly supporting another 2.2 million jobs.²⁷ In 2005, nearly one million acres in the United States were planted with sugarcane.²⁸ As of 2004, the value of U.S. sugar crops was \$1.93 billion,²⁹ accounting for 2.4% of total U.S. crop values.³⁰ Unfortunately, the cost of production is much higher than the world average, requiring significant government intervention to sustain the industry.³¹ The delicate state of sugar and corn markets combined with volatile competition between the two countries in those industries inhibit cooperation, contribute significantly to immigration

troubles, and frustrate the goals of NAFTA, advancement in biofuel technology, and ultimately the economic integration demanded by globalization and trade liberalization.³²

B. Subsidies, Overproduction and Dumping

As of 1989, worldwide agricultural subsidies and protectionist trade practices cost consumers \$150 billion, suggesting that a fundamental problem in world agriculture is excessive government intervention.³³ In 2005, it was determined that the U. S. government alone subsidized domestic agricultural industries at an average rate of over forty five billion dollars per year.³⁴ This subsidization contradicts trade policy by impeding the competitive ability of international and domestic farmers and distorting commodity prices.³⁵ These practices ultimately demand that taxpayers support domestic agricultural products while U.S. subsidies make farming unprofitable in other countries.³⁶ Yet, this is not the full extent of the damage done through agricultural subsidies. U.S. market "price supports" ensure a minimum income for American farmers.³⁷ These price supports induce production which exceeds demand, in turn requiring that the surplus is "purchased" by the U.S. government.³⁸ The government then "dumps," or sells the surplus on the world market below world market prices, significantly eroding world prices and the ability of farmers in developing countries to compete.³⁹

The liberalization conferred by NAFTA did not merely open a single commodity market to both countries.⁴⁰ Rather, especially as production of Mexican yellow corn fails to meet domestic demand, the corn trade essentially opened both Mexico's white and yellow corn markets to U.S. exports.⁴¹ Sales of U.S. corn to Mexico increased fifteen-fold between 1993 and 2004,⁴² as NAFTA opened the Mexican markets to tons of cheaper (subsidized) corn, causing the price paid to Mexican corn farmers to fall 70%.⁴³ In 2003, U.S. corn was exported (dumped) at an average price of ten percent below the full cost of production.⁴⁴ U.S. subsidized corn has destroyed the Mexican corn sector, resulting in the displacement of two million Mexican farmers.⁴⁵ Accordingly, the Mexican government has been forced to rely on U.S. yellow corn to keep tortilla prices low. This practice has further plagued the corn industry as Mexican farmers of white corn—from which tortillas are customarily made—are being driven from the market.⁴⁶ The end results of these trade practices are the destruction of the Mexican corn industry.

Same scenario is applicable to U.S. and Mexico's sugar industries. On January 1, 2008, NAFTA became fully effective, lifting tariffs on sugar traded between the U.S. and Mexico.⁴⁷ The removal of trade barriers, once envisioned to level the playing field of the sugar market, has exposed Mexican farmers to unfair competition resulting from the massive subsidization of U.S. sugar.⁴⁸ As a result, the U.S.

faces a potentially overwhelming flood of Mexican sugar into a carefully balanced U.S. market, while Mexico faces pressure from U.S. industries on sugar and corn syrup.⁴⁹ Further, the U.S. government has successfully challenged Mexican non-tariff barriers on sugar, corn, and corn syrup,⁵⁰ demanding importation of cheaper, U.S.-made high fructose corn syrup, further threatening Mexican sugar farmers.⁵¹ In both Mexico and the United States, sugar and sweetener consumption is outpaced by increases in minimum import commitments, and the looming threat of massive imports threatens to destabilize the countries' sugar markets.⁵²

III. Agriculture and Biofuels: Law, Policy, and the Problems They Create

A. U.S. Energy and Agriculture Legislation

Government assistance for ethanol production began in response to the energy crisis of the 1970s,⁵³ beginning with the National Energy Act of 1978 ("NEA").⁵⁴ The Act provided tax exemptions for alcohol/gasoline mixtures as well as investment credits for property devoted to alcohol production.⁵⁵ Additionally, equipment used in ethanol production also qualified for tax incentives.⁵⁶ The NEA also requires the Department of Energy to produce annual studies of alcohol production including quantity sold and gasoline saved, cost of production, selling price, and revenue lost from tax incentives.⁵⁷

In passing the Food Security Act of 1985,⁵⁸ Congress adopted the Conservation Reserve Program ("CRP").⁵⁹ The CRP essentially paid farmers to take highly erodible land out of production, and plant idle land in protective and restorative vegetation.⁶⁰ The program introduced environmental and conservation ideals into U.S. agricultural policy, directly linking conservation benefits to government aid.⁶¹ Despite the good intentions of the CRP and other voluntary preservation programs, long standing support policies which tie support payments to established planting patterns continue to dominate, resulting in agricultural over-production.⁶²

The U.S. Congress updated the Biomass Research and Development Act of 2000,⁶³ when it passed the Energy Policy Act of 2005 ("EPACT").⁶⁴ The EPACT provided substantial funding and incentives for alternative fuels,⁶⁵ while requiring that U.S. fuel include 7.5 billion gallons of alternative fuels, in 2012.⁶⁶ While EPACT had been highly successful in creating incentives for ethanol production, it does little to facilitate an evolution from corn-based ethanol to cellulosic biomass,⁶⁷ which is the most environmentally friendly resource for biofuel production.⁶⁸

The Energy Independence and Security Act of 2007 ("EISA")⁶⁹ dramatically increased mandated alternative fuel standards in the United States, nearly doubling the standard required through 2012, while adding further requirements

through 2022.⁷⁰ Further, EISA requires that new production facilities reduce greenhouse gas emissions by at least 20% in comparison to current facilities.⁷¹ Significantly, EISA mandates that a portion of the alternative fuel requirements be met with cellulosic biofuels,⁷² demanding at least a minimal evolution of biofuel production from current corn-based ethanol to biomass-based fuels. This new EISA mandate raises production of cellulosic fuels to one hundred million gallons per year by 2010, and biomass-based fuels to one billion gallons by 2012.⁷³ Finally, the Act requires labeling of biomass-based fuel at the pump, prohibits oil companies from preventing the installation of renewable fuel pumps, and finances further research and development in the biofuel industry.⁷⁴

B. Corn Ethanol Policy and Problems

EPACT established a requirement that 7.5 billion gallons of renewable fuels be used in the United States by 2012; corn-based ethanol, subsidized at \$0.51 per gallon, will account for most.⁷⁵ Problematically, the recent economic feasibility of corn-ethanol is fantasy. Without subsidizing the production of corn-based ethanol—produced from already-subsidized corn—such production would not be possible in the United States at all.⁷⁶ Yet, EISA now mandates that more than double that amount be produced within the same timeframe.⁷⁷

Meanwhile, it is possible that the increase in Mexican and U.S. corn production devoted to ethanol production will have a larger impact on food security than NAFTA has.⁷⁸ Expected corn use for ethanol production now amounts to nearly one third of U.S. corn production.⁷⁹ In response, the U.S. Department of Agriculture foresees that the additional corn necessary for ethanol production will be diverted from exports, potentially cutting exports to Mexico in half, further exacerbating a food crisis which subsidies first created.⁸⁰ Finally, rapid increase in biofuel production is predicted to raise corn prices as much as 20% by 2010, and 41% by 2020.⁸¹ Yet, subsidization and corn-ethanol policy are only part of a larger problem.

The manner in which the corn ethanol is manufactured in the United States has distinct drawbacks. Production methods are outdated, using only corn kernels, while the remainder of the plant, rich in cellulosic materials (biomass), is discarded as waste byproduct.⁸² Further, experts argue that corn ethanol provides less energy than is required to produce it,⁸³ and even proponents concede that corn is a far less efficient producer of ethanol than other biomass sources.⁸⁴ Clearly, the facts obviate the need for a shift away from corn-based ethanol to a broader variety of raw materials.⁸⁵

Even if the United States and its current ethanol policy could overcome the many concerns, agriculturally, U.S. farmers cannot produce sufficient crops to meet growing ethanol demand. Indeed, if all of the seventy million acres of corn grown in 2006 was used for ethanol, it would displace

only 12% of the U.S. gasoline market.⁸⁶ Moreover, current manufacturing of corn-based ethanol and agricultural practices, designed to produce both food and fuel from U.S. crops, are not environmentally sustainable,⁸⁷ and unless new policies are enacted concerning land use and sustainable bioenergy development, the environmental and economic damage could far exceed the benefits.⁸⁸

C. Agro-Environmental Concerns

1. Modern Agricultural Practices

The environmental concerns regarding current agricultural production and biofuel manufacturing are nearly identical. The current practices of modern agriculture are simply not sustainable, causing environmental damage in multiple ways,⁸⁹ yet current policy reinforces these practices through subsidies and price supports. The practice of mono-crop agriculture today causes soil erosion, soil degradation, and over-fertilization, creating significant pollution problems for both the land and water.⁹⁰ These practices are often irrigation intensive, further straining fresh water supplies.⁹¹ Corn crops specifically require large amount of water, negating the idea of producing corn-based ethanol as a renewable fuel source, as water becomes increasingly scarce.⁹² Plus, the large amounts of pesticides and fertilizers used in modern agriculture lead to water pollution on a massive scale.⁹³ In the United States, agriculture remains the single biggest source of water pollution.⁹⁴

These concerns are well founded as current agricultural practices create a cycle of environmental problems. Ever-worsening soil conditions require more and more fertilizer until the very water required to sustain crops is filled with too many agricultural pollutants to use. Mono-cropping accelerates erosion, contributing to the degradation of top soil and further facilitating the flow of pollutants into fresh water systems. In Mexico, the situation is further compounded by an absence of environmental regulation, and an inability to utilize agricultural side products and waste water.⁹⁵

2. Concerns Regarding Production and Use of Agricultural Biofuel

In addition to concerns raised by mono-crop agriculture in general, biofuel demand contributes to environmental woes. Though many concerns have been raised, water consumption for ethanol production in the United States presents an imminent concern.⁹⁶ Subsidies already contribute to corn production in areas requiring extensive irrigation and water use, and recent demand for biofuels exacerbates the problem. Even more problematic, the petroleum input necessary to produce corn crops, and the atmospheric pollution caused by tillage and other agricultural practices may have an

environmental impact far too great for the biofuel yield to overcome. In other words, the net clean energy yield from corn-ethanol may be outweighed by the energy input required and green-house emissions caused in its production.

D. The Food vs. Fuel Debate

The relationship between biofuels and access to food generates important concerns as the world biofuel market continues to develop. Many argue against the use of agricultural crops for ethanol production, believing that this diverts food which would otherwise feed the world's hungry.⁹⁷ However, studies suggest that U.S. corn does not [directly] feed the hungry of the world.⁹⁸

Instead, half of the U.S. corn supply is used as animal feed,⁹⁹ thus high corn prices inflate the cost of that feed.¹⁰⁰ Higher costs may slow future production as meat, poultry, and dairy producers absorb the rising feed costs.¹⁰¹ The subsequent reduction in supply and increased cost of production will translate in rising food prices¹⁰² and increased food scarcity. Many feel that the effect of increased food prices, coupled with increased demand for biofuel feedstock, will be most detrimental to the world's poor.¹⁰³ As demand for both fuel and food increases, some fear that food prices may increase enough to drive the poorer third of the world into malnourishment.¹⁰⁴ One U.N. expert has gone so far as declaring the use of corn for fuel instead of food "a crime against humanity."¹⁰⁵

Moreover, current subsidy-fueled overproduction cripples the competitive ability of developing countries, undercutting rural farmers, while contributing to poverty, migration, and price distortions in the world market which drive farmers in developing nations out of business.¹⁰⁶ Thus, market-effects of such policies, namely the rise in food prices, contribute to world hunger and poverty, not the diversion of food from the poor. Nonetheless, rising fuel prices, a rising global demand for energy, global warming, and dependency on non-renewable resources are driving a nearly insatiable desire for biofuels,¹⁰⁷ and because society depends on agriculture for a secure and sustainable food supply, the food vs. fuel debate will continue to be a legitimate subject of public policy.¹⁰⁸

E. Mexican Agricultural Issues and Infrastructure Problems on Both Sides of the Border

It is assumed that cheaper labor costs might give Mexico an advantage in producing labor-intensive commodities. However, in agriculture sector, any labor advantage is more than offset by low worker productivity, poor soil conditions and water availability, and the transportation infrastructure in Mexico.¹⁰⁹ Small and midlevel farmers in Mexico cannot reasonably compete with their American counterparts.¹¹⁰ Unlike their U.S. competitors, small grain farmers who do not produce exportable amounts of grain do not receive government

subsidies, in Mexico.¹¹¹ Moreover, total productivity heavily favors the United States (7.5 tons per hectare) over Mexico (1.7 tons per hectare).¹¹² Obviously, Mexican productivity and efficiency must improve for its global competitiveness, and indeed its very vitality.

Additionally, Mexican agricultural resources are scant in comparison to its North American counterparts.¹¹³ In fact, only 12% of Mexico's land is considered arable, with less than 3% of that land being irrigated.¹¹⁴ Agriculturally, the country has been slow to modernize, failing to take advantage of the ethanol movement and other technological advancements such as genetically modified crops.¹¹⁵ Further, state operated granaries and distribution networks are withering, and agriculture cooperatives may be key to the survival of Mexican agriculture.¹¹⁶ Regardless, the future of Mexican agriculture depends on advances in irrigation, agricultural infrastructure, and mechanization, and these advances will likely only result from foreign direct investment.

IV. A Possible Solution?

A. Cooperative Advances in Agriculture and Infrastructure

The devastation of Mexican agriculture post-NAFTA, while problematic, may have been an inevitable development.¹¹⁷ The resulting downfall of the Mexican ejido, while initially displacing Mexican farm workers and further weakening Mexican agricultural production, might be viewed as a market correction demanding efficient production and modernization while providing a better economic quality of life for rural Mexicans.¹¹⁸ However, because the Mexican economy may not be able to survive such a correction, the country might benefit from the help of its Northern neighbor. U.S. assistance should consist of both direct aid and investment in Mexico, and concurrent changes in domestic agricultural practices and subsidization.

Under comparative trade theory, the U.S. should become Mexico's supplier of basic grains, and Mexico should supply most, if not all, of U.S. fruits and vegetables.¹¹⁹ However, special consideration should be given to the socio-economic conditions of the rural Mexican farmer, and Mexican producers of traditional varieties of maize must be protected from market intrusion.¹²⁰ Part of any agreement must be an inherent interest in mutual socio-cultural preservation. In trade, nations must recognize the higher responsibility to protect vulnerable aspects of one another's culture and heritage. As this analysis will demonstrate, the effects of protecting Mexican farmers of white corn will be marginal to U.S. yellow corn farmers as inflated demand for U.S. corn will be eliminated, and any income lost in the Mexican market will be recouped by environmental credits, and the harvesting of biomass for domestic biofuel production.

Notwithstanding the need to protect this sector of Mexican

agriculture, recent land reforms in Mexico has given rise to increased U.S. interest in contract farming and marketing arrangements.¹²¹ Permitting U.S. firms to operate on Mexican agricultural lands, and invest in its development, will likely enhance Mexican agricultural efficiency, productivity, and profitability, while facilitating land ownership for the Mexican farmer. With Mexican sugar production becoming ever-important in the establishment of a North American biofuel industry, FDI from the United States should focus on the supply and development of agricultural technology, the engineering of biofuel production facilities, and the infrastructure necessary to transport ethanol throughout both countries, and to points of export.

B. Revising Government Support and Foreign Direct Investment

1. The Evolution of Agricultural Subsidization

The World Resource Institute determined that the United States paid agricultural producers over \$17 billion in 1993, only \$1.9 billion of which supported conservation programs.¹²² Payments for the Conservation Reserve Program¹²³ constituted 8% of all government subsidization between 1986 and 1995.¹²⁴ Furthermore, the U.S. agricultural subsidy program is projected to distribute approximately \$190 billion in 2012.¹²⁵ Instead of encouraging farmers to grow unprofitable crops through price support, the U.S. would be better served to re-empower the agricultural sector by incentivizing crops in innovative and environmentally sound ways.¹²⁶

"Green payments" were first implemented as part of the Conservation Security Program in the 2002 farm bill, paying farmers to perform environmentally-friendly services on land in production.¹²⁷ Yet thus far, U.S. agricultural policy fails to address the environmental damage done by the industry.¹²⁸ Furthermore, in order to do so, U.S. policy must evolve, expanding and enhancing its land retirement programs and incentivizing sustainable practices in ways other than subsidies.¹²⁹ To accomplish this, coupling of farm support to production levels must cease.¹³⁰

A potential solution may be to link farm support with the reserve program while simultaneously incentivizing the planting of biomass feedstock and ensuring that participating farmers avoid suffering economic loss in not planting corn. Further, conservation program benefits must displace benefits received under commodity programs; this strategy eliminates the ability of a farmer to collect for land under conservation and/or biomass growth while simultaneously over-producing on cropland under cultivation to collect those subsidies tied to production which would defeat the purpose on environmental incentives.

Current subsidization policies undermine environmental goals. Artificially controlled prices inflate demand and reduce investment in more efficient technologies and practices.¹³¹

These policies also distort the market, making corn more valuable than it actually is, further discouraging alternative land uses, frustrating the goal of the CRP, and preventing the economic viability of biomass technologies. Thus, not only must U.S. support policy shift to more “green-oriented” resolutions, it must do so while reducing total subsidy payments. Success in that endeavor would then provide funding for the North American biofuel industry and the accompanying infrastructure needs.

2. Farm Support to Foreign Direct Investment

In 1995, the United States was the biggest foreign investor in Mexico accounting for approximately 65% of total FDI,¹³² suggesting that the United States has a significant influence over the economic future of Mexico. Converting to Mexican-produced sugar-ethanol will likely cause a reduction in U.S. sugar subsidies as the domestic industry would help supply feedstock for the Mexican industry. Expanding the CRP, and the shift to sugar-ethanol and cellulosic biomass would reduce corn crops, which may be significant enough to affect the global price,¹³³ allowing world farmers a competing chance in the world market. Finally, new environmental subsidies which allow farmers to profit from biomass planted on land in the CRP could reduce subsidies paid to corn farmers.

As ethanol production moves to Mexico, corn-ethanol facilities in the United States should begin to convert existing biofuel production facilities to biomass technologies in order to make use of the cellulosic feedstock being grown on reserved land. Having created a market for these materials, U.S. farm supports may now be reduced to the difference between the farmer’s potential profits for harvested corn yields and the value of the biomass harvest. Tax incentives might further compensate sustainable farming practices, further reducing the need for subsidization. Finally, as the policy changes create a surplus of funds previously dedicated to subsidy and support programs, the United States has created the funding for investments in infrastructure and Mexican agriculture, without spending any additional tax dollars than those already earmarked for domestic subsidization alone.

C. A Viable Biofuel Industry for North America

Bioenergy is the major source of energy for the world’s population, making up more than ninety percent of energy consumption in poorer nations.¹³⁴ Bioenergy alleviates reliance on fossil fuels, and may be instrumental in promoting agricultural and environmental sustainability.¹³⁵ Finally, development of biofuels and bioenergy may result in significant development in rural areas and further contribute to the reduction of poverty through job creation.¹³⁶ Mexico’s essential task, given the displacement of agricultural workers, will be to create enough industrial jobs to absorb farm labor

losses;¹³⁷ creating a new biofuel industry may not only fulfill that task, but also correct losses in the agricultural sector by creating more jobs in an expansion of the sugar and sugar-ethanol production industries.

1. A Lesson From Brazil

The rising price of corn—notwithstanding current doubts over agricultural sustainability—necessitates exploration of alternative biofuel resources. Although corn-based ethanol has been profitable, recent corn prices significantly reduce profitability.¹³⁸ Fortunately, the results of Brazil’s sugar-ethanol industry indicate that not only can U.S. mills economically convert to ethanol production from sugar, but that such a conversion may also offer a viable market which mitigates or eliminates competition that threatens the U.S. sugar industries.¹³⁹ This would imply that ethanol production in Mexico would be even more feasible assuming appropriate levels of production and efficiency. Lower costs of production in Mexico and strategic FDI from the United States could make that country the foundation of North American sugar-ethanol production.

Brazil’s success in the multifaceted implementation and development of its biofuel industry merits particular discussion. After extensive government action commenced in the 1970’s, ethanol mandates and tax incentives have made ethanol a political and economic success in Brazil.¹⁴⁰ The government fostered the demand for ethanol by requiring blending with gasoline, subsidizing ethanol use, and financing production facilities.¹⁴¹ Further, the Brazilian government required that towns with over 1,500 residents have an ethanol pump at every gas station.¹⁴² Currently, about 50% of all cars in Brazil are flex-fuel vehicles that run with ethanol mixed fuel.¹⁴³ To ensure ethanol’s future, Brazil has in place an established distribution system and a tax advantage over gasoline.¹⁴⁴

2. An Ethanol Evolution: From Corn to Sugar to Biomass

If the widespread use of biofuel is to become economical and truly environmentally sustainable, current U.S. policies and production methods must change and adapt to the growing body of scientific evidence and social policy which suggests that corn-based ethanol is not the answer.¹⁴⁵ Yet, the U.S. cannot achieve corn-ethanol independence alone,¹⁴⁶ given that U.S. subsidization of sugar has made sugar-ethanol cost prohibitive, driving U.S. ethanol policy to embrace corn.¹⁴⁷

a. Corn

Corn is widely recognized as an inefficient food stock for ethanol production. Even more problematically, U.S. corn-based ethanol currently requires the use of fossil fuels at every stage of production.¹⁴⁸ For this reason, it appears that corn-

ethanol production may use up to 30% more energy than the finished product produces, leaving alone the eroded soil and polluted water.¹⁴⁹ Further, because corn is traditionally used for food and animal feed, producers of retail staples, grains, meats and other animal products are reacting adversely to the rising price of corn.¹⁵⁰ Despite these disadvantages, corn based-ethanol currently accounts for approximately 97% of all ethanol produced in the United States.¹⁵¹ Corn is also vital to the resurgence of agriculture and food security in Mexico, demanding that the industry merely serve as a springboard to further growth in the biofuel sector.

b. Sugar

Producing ethanol from sugar, for many reasons, is simply a better option than current corn-based ethanol production.¹⁵² Sugar is a much more efficient producer of ethanol than corn, and converting surplus sugar production to ethanol does not put undue pressure on a global staple food. Sugar is also the most feasible ethanol feed stock in Mexico, and production facilities can easily be constructed alongside current sugar mills.¹⁵³ Finally, Mexico may hold a comparative advantage in sugar production due to its geographical location which provides for more growing area and longer growing seasons than the United States.

Notwithstanding the advantages of using sugar as a source for ethanol production, it must be acknowledged that without a further evolution to producing cellulosic ethanol, biofuels may not be the best way to reduce greenhouse gas emissions.¹⁵⁴ Current cellulosic biofuel technology makes fuel production from biomass, cost-prohibitive in the short-term. However, as the technology becomes economically viable, and as the North American ethanol industry begins to rely on sugar as its primary resource, surplus farmland—previously planted in corn—should be diverted to biomass through land retirement, subsidization, and the demands of the market. As the production of sugar-ethanol migrates to Mexico, the United States can also transition facilities currently devoted to corn-based ethanol to production of ethanol from biomass or cellulosic materials.¹⁵⁵

c. Biomass

Cellulosic biofuels might be produced from wood, crops or crop residues, or other specialty crops such as switchgrass; Cellulosic materials are generally considered better ethanol feed stocks, can be grown cheaply and efficiently, and do not strain food supplies.¹⁵⁶ Diversification from single crop ethanol sources also avoids problems associated with monoculture production.¹⁵⁷ Furthermore, the use of native species, or climate-tolerant alternatives offer many advantages. Such feed stocks are adaptable to local soil and water conditions, tend to be more blight resistant, and often require less irrigation,

fertilization, tillage, and overall energy input.¹⁵⁸ Finally, use of these non-food crops for energy production avoids adverse effects on local and global food markets,¹⁵⁹ while contributing to the revitalization of farmland.

3. A New Mexican Industry, A New U.S. Supplier, A New Biofuel Market

Potential benefits of a sugar-ethanol industry in Mexico are six-fold. First, the industry creates badly needed jobs in the country, requiring additional farm, industrial, and transport labor. Next, the industry could ensure that U.S. and Mexican sugar farmers have enough demand for their product. Thus, the industry ensures both countries that current and future ethanol mandates can be met and likely exceeded. Fourth, moving away from corn-ethanol eases global pressure on a major food source. Fifth, the creation of a viable biofuel industry benefits both countries in the global market while fostering technological advance in the sector. And finally, this scenario, or one like it, results in the end of competitive, and protectionist trade practices in the corn and sugar industries of both countries.

D. Protecting the Environment and Global Food Security

Agriculture cannot produce the food, much less the fuel, for the world's population if it exhausts or abuses usable soil and water.¹⁶⁰ Furthermore, developing nations often suffer serious environmental consequences resulting from the exploitation of resources and the construction of infrastructure associated with development.¹⁶¹ Consequently, if agriculture is to produce sufficient food and fuel for the world's population, conservation and environmentalism must be at the forefront of any food or fuel policy.

Similar to the problems already plaguing developed countries, water pollution caused from industrial run-off and agro-chemical pollution threatens the water supplies of developing nations.¹⁶² Future environmental concerns for developing nations—in this case Mexico—also include global warming and ozone depletion.¹⁶³ Finally, agricultural development continues to exacerbate deforestation and erosion which contributes to the problems of water pollution and soil degradation.¹⁶⁴

Conversion of biofuel production from corn to sugar begins to ease the pressure on world food supplies, simultaneously presenting the opportunity to initiate environmentally sustainable agricultural practices. United States involvement in Mexican agriculture, stronger regulation and implementation of advanced environmental practices improve the likelihood of achieving environmental stability.¹⁶⁵ However in the United States, policies which link price support and production threaten to undermine the Conservation Reserve Program, and similar endeavors. Without change, the damage to

cultivated land may increase beyond present levels as farmers crop those lands with greater intensity to reap benefits of both environmental and production subsidization payments.¹⁶⁶ To ensure true food security, policies which encourage over-production, essentially wasting the natural resources vital to sustain agriculture, must evolve to recognize environmental sustainability as another hallmark of sound agricultural policy.

V. Policy Recommendations

A. *Agricultural Subsidies: Incentivizing Environmental Sustainability*

1. *Environmental Subsidies, Eco-Penalties, and Tax Incentives*

It is abundantly obvious that U.S. farm support policy must change, at least to incorporate some environmentally-linked subsidization, reduce overall government expenditure on agricultural subsidies, and create funding for the new biofuel industry and related projects. Policy change must begin with decoupling of subsidy payments and levels of production. Instead of the current practice, subsidization should shift away from production, incentivizing conservation and environmentally sustainable practices. These policies should incorporate countervailing measures to prevent collection of environmental subsidies while still over-producing on crop lands in production. Further, implementation of “eco-penalties” checks improper use, over-pollution, and mismanagement of waste water on existing farmlands.

Tax incentives might start by compensating farmers for managing land use and retiring land in production and beginning to incentivize conversion of corn-ethanol production facilities to facilities for cellulosic biomass. Mexico should similarly incentivize the beginning of its sugar-ethanol industry through tax benefits. Both countries might also consider strict soil-conservation controls which would penalize farmers, or states, by withholding environmental support payments for non-compliance or enforcement of environmental policies.¹⁶⁷

2. *“Eco-Retirement” for Highly Erodible and Water-Intensive Land in Production*

Subsidization and tax incentives must be complimented with a mandated prohibition—either permanent or until a predetermined level of sustainable utility is achieved—of monoculture cropping on highly erodible or irrigation-intensive lands. These mandates protect land degradation, loss of top soil, and pollution of ground water and waterways. Regulated land management would contribute greatly to environmental sustainability while providing market-based incentives in planting cellulosic feedstocks and revitalizing topsoil as part of compliance with these mandates. The

obvious starting point for these policy reforms is the existing conservation programs, such as the CRP and similar programs for wetlands, farmland, and protected habitats.

3. *Conversion of U.S. Corn-Ethanol and Funding Cellulosic Biomass Technology*

An evolution in U.S. biofuel policy and production is required in order to sustain domestic agriculture, reduce pressure on a global food staple, progress to more efficient and profitable biofuel production, and ensure that the U.S. biofuel mandates are achieved economically and sustainably. Advancement in this endeavor requires three components: identification of better feed stock, evolution to more efficient methods of production, and economic reward for advancements in technological research.¹⁶⁸

B. *Cooperation in Agriculture*

1. *Establishing a Sugar Cooperative*

Given the problems inherent in Mexican agriculture, revitalization of Mexican agriculture and establishment of the proposed North American biofuel industry demands cooperation between the two nations. Such cooperation should begin at the highest levels of government, yet recognize and encourage the opportunities for private or corporate investment created by the recent changes in Mexican land tenure. The inevitability of current U.S. sugar producers becoming intricately involved in these matters must also be addressed and facilitated.

2. *Protecting Indigenous Culture*

The abundant genetic diversity of Mexican maize crops, and its continued production, is important, not only socio-culturally but also to long-term global food security.¹⁶⁹ “Ecological” tariffs might be imposed, restricting imports which would threaten traditional maize agriculture in Mexico.¹⁷⁰ The more effective, and less controversial, alternative would be “ecological” subsidies.¹⁷¹ Recognizing the value of traditional crops (and the sustenance of indigenous farmers) essentially treats these crops as a class in themselves, not included in the general corn commodity market.

C. *Mexican Policy Changes*

Specifically, Mexico must quickly resolve prohibitions regarding land ownership, restrictions on foreign direct investment, and government monopolization of the economic structure. The Mexican government, through its control of the nation’s economy pursuant to Article 25 and 28 of the Mexican Constitution, undermines investment in the country

at large, stifles an inflow of foreign capital to the agricultural sectors, and prevents the ultimate institutional reform necessary to revitalize failing agricultural industries.¹⁷² The Foreign Investment Law of 1973 must be amended beyond the scope of changes previously incorporated in the 1989 revision.¹⁷³

*D. Establishment of the North American Biofuel Industry:
Brazil Revisited*

Brazil's biofuel success is undeniable, and any policies for a North American biofuel industry should implement the strategies employed by the Brazilian government, at least to some extent. As noted above, the government both incentivized and mandated innovation in biofuel technology, made biofuels widely available—even requiring ethanol pumps at fuel stations—and invested in transport infrastructure. Most importantly, Brazil encourages blending ethanol at high ratios with gasoline.

VI. Conclusion

The problems discussed above, like any potential solutions, are all cyclical and reinforcing in nature. Like many global political and economic issues, each one affects the other. Restoring prosperous farming conditions to Mexico will undoubtedly result in less immigration, as will the creation of industrial and transportation jobs.

Conversion to sugar-based ethanol and the establishment of a Mexican and/or American ethanol industry in Mexico creates new jobs and drives production costs for ethanol down, simultaneously easing the pressure on U.S. corn crops, and reducing demand on a global food staple. Ideally, these changes will also be felt at the pump and in larger petroleum policy. Meanwhile, demand for sugar feedstock should alleviate high costs of farm support for domestic sugar, while providing a resurgent cash crop for Mexico. As demand for U.S. corn falls, farmers may have the opportunity to advance biofuel technology and implement sustainable practices, and with this a cycle of reinforcing solutions become more complete.

Changes in agricultural practices stimulated by concurrent policy change completes the cycle, incentivizing conservative practices, reducing domestic subsidy payments, encouraging the shift in agricultural policy, and funding the new biofuel industry in Mexico. By paying corn farmers to grow biomass feedstock, essentially ensuring payments equal to the value of the corn harvest less profits from the biomass harvest, the U.S. saves money which would otherwise be spent on farm support. With that “saved” money, the environmental and sugar-ethanol movements can be funded, commencing yet another problem-solving cycle, creating economic growth, easing demands on world food supplies, and easing pressure on U.S. farmlands.

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1 While some aspects of agriculture will be addressed generally, the industries most relevant to this note are corn, sugar, biofuel and biofuel byproducts. When referring to “agriculture” this article intends to recognize the affects of broad agricultural policy and modern agricultural practices generally, while emphasizing the corn and sugar sectors which are primary foci of the analysis within this article.

2 North American Free Trade Agreement, U.S.-Can.Mex., Jan. 1, 1994, 32 I.L.M. 289.

3 *Id.* (The Preamble to the agreement includes resolutions by the three countries to “strengthen bonds of friendship,” “contribute to the harmonious development of world trade,” to reduce trade distortions, provide a predictable framework for business and investment, to “build on their respective rights and obligations under the GATT,” to “foster creativity and innovation,” create new job opportunities and improve working conditions, and “promote sustainable development,” among others).

4 Laura Carlsen, *NAFTA Inequality and Immigration*, CIP Americas Policy Program (Washington D.C.: Center for International Policy, October 31, 2007).

5 *Id.*

6 *Id.*

7 *Id.*

8 Alexandria Spieldoch, Speech, “*Biofuels and Tortillas: A U.S.-Mexican Tale of Chances and Challenges*,” Institute for Agriculture and Trade Policy (March 16, 2007).

9 *Id.*

10 *Id.*

11 Mark Muller, et. al., *Food Versus Fuel in the United States: Can Both Win in the Era of Ethanol*, Institute for Agriculture and Trade Policy (September 2007).

12 *Id.* (for the proposition that prices paid to Mexican farmers dropped 70% while U.S. corn imports grew 240%).

13 Garrett Brown, Speech, “*Immigrant Workers Are Our Allies, Not Our Enemies*” (August 15, 2005).

14 *Id.* See also Mark Muller, et al., *Food Versus Fuel in the United States: Can Both Win in the Era of Ethanol*, Institute for Agriculture and Trade Policy (September 2007).

15 *The Mexican Economy, Agriculture and Environment*, Nafta at Ten Series, Public Citizen's Global Trade Watch, available at http://www.citizen.org/documents/NAFTA_10_mexico.pdf.

16 K. Larry Storrs, *Mexico's Importance and Multiple Relationships With the United States*, Congressional Research Service (January 18, 2006) at 2.

17 US-Mexico at a Glance, available at http://www.usembassy-mexico.gov/eng/eataglace_trade.html.

18 *Id.*

19 Frank Ackerman, et al., *Free Trade, Corn, and the Environment: Environmental Impacts of U.S.-Mexico Corn Trade Under NAFTA*, Global Development Institute

(June 2003) at 2.

20 *Id.* at 3

21 *Id.*

22 *Id.*

23 *Id.*

24 *Id.*

25 Frank Ackerman, et al., *Free Trade, Corn, and the Environment: Environmental Impacts of U.S.-Mexico Corn Trade Under NAFTA*, Global Development Institute (June 2003) at 3.

26 Mexico Sugar and Trade, TED Case Study 657 (January 2001), available at <http://www.american.edu/TED/mexico-sugar.htm#r1>.

27 R. Dennis Olson, Commentary, *Farmer Agreement Offers Alternative to NAFTA's Failures*, Institute for Agriculture and Trade Policy (February 4, 2008).

28 Hossein Shapouri and Michael Salassi, Report, U.S. Department of Agriculture, *The Economic Feasibility of Ethanol Production from Sugar in the United States*, (July 2006) at 7. (Hereinafter "Feasibility of Sugar").

29 Stephen Haley, Sugar Backgrounder, USDA Economic Research Service (July 2007) at 2, available at <http://www.ers.usda.gov/publications/sss/Jul07/SSS249/sss249.pdf>.

30 *Id.* at 3.

31 *Id.* at 3.

32 The corn and sugar sectors of both Mexico and the United States, and the recent and looming effects of competition in these markets are well documented, and not fully the fault of NAFTA mandates. It is also important to recognize the economic realities in Mexico unrelated to NAFTA, i.e., the Mexican peso crisis. For a discussion of the so-called "sugar wars" between the United States and Mexico, see Alice Vacek-Aranda, *Sugar Wars: Dispute Settlement Under NAFTA and the WTO as Seen Through the Lens of the HFCS Case and its Effects on U.S.-Mexican Relations*, 12 Tex. Hisp. J.L. & Pol'y 121 (Spring 2006). For insight into the effects of the Mexican economic crisis, see Robert A. Blecker, *NAFTA, the Peso Crisis, and the Contradictions of the Mexican Economic Growth Strategy*, Center for Economic Policy and Analysis (July 1996).

33 Alan Charles Raul and Kevin Brosch, *Global Trade in Agricultural Products*, 510 PLI/Comm 229, 231 (September 18, 1989).

34 Anthony DePalma, *Income Gap Grows, and So Do Protests*, N.Y. Times, July 20, 1996.

35 See Gawain Kripke, *Make Trade Fair*, Dollars and Sense, Nov.-Dec. 2003, at 20.

36 Richard Poole, *Silly Rabbit, Farm Subsidies Don't Help America*, 31 Wm. & Mary Envtl. L. & Pol'y Rev. 183 (Fall, 2006) at 193.

37 William Petit, *The Free Trade Area of the Americas: Is it Setting the Stage for Significant Change in U.S. Agricultural Subsidy Use?*, 37 Tex. Tech L. Rev. 127, 137-38 (Winter 2004).

38 *Id.* at 138.

39 *Id.*

40 Steven Zahniser and William Coyle, *U. S. Mexico Corn Trade During the NAFTA Era: New Twists to an Old Story*, Electronic Outlook Report (May 2004) at 2.

41 *Id.* at 3.

42 Marsha Echols, *Paths to Local Food Security: A Right to Food, A*

Commitment to Trade, 40 Vand. J. Transnat'l L. 1115,1122 (October, 2007).
43 *Id.*

44 See Mark Muller, *supra* note 11.

45 Cliff Bradley, "Saving the Poor and the Planet with Biofuels" (November 2007).

46 Carvana Hicks, *The NAFTA Aftermath: Analyzing a Free Trade Agreement Defectively Designed to Perpetuate Poverty and Deficiency in Rural Mexico*, 13-SUM Currents: Int'l Trade L. J. 49, 51 (Summer, 2004). (Citing Tessie Borden & Sergio Bustos, *Crushed by NAFTA, Mexican Farmers Head North*, at <http://www.azcentral.com/specials/special03/articles/0618nafta-immigration-ON.html> (last visited September 22, 2004)).

47 R. Dennis Olson, Commentary, *Farmer Agreement Offers Alternative to NAFTA's Failures*, Institute for Agriculture and Trade Policy (February 4, 2008).

48 Alice Vacek-Aranda, *Sugar Wars: Dispute Settlement Under NAFTA and the WTO as Seen Through the Lens of the HFCS Case, and its Effects on U.S.-Mexican Relations*, 12 Tex. Hisp. J.L. 121, 129 (Spring, 2006).

49 Donald Mitchell, Working Paper, *Sugar Policies: Opportunity for Change*, The World Bank, (February 2004).

50 R. Dennis Olson, Commentary, *Farmer Agreement Offers Alternative to NAFTA's Failures*, Institute for Agriculture and Trade Policy (February 4, 2008).

51 Mexico Sugar and Trade, TED Case Study 657 (January 2001) available at <http://www.american.edu/TED/mexico-sugar.htm#r1>.

52 Mexico Sugar and Trade, TED Case Study 657 (January 2001) available at <http://www.american.edu/TED/mexico-sugar.htm#r1>.

53 Brian R. Farrell, *Fill'er Up With Corn: The Future of Ethanol Legislation in America*, 23 J. Corp. L. 373, 375 (Winter 1998). (Citing George Anthan, *USDA Study Favorable to Ethanol*, Des Moines Register, May 10, 1996, at 6.

54 Pub. L. No. 95-618, 92 Stat. 3185.

55 Nancy E. Schurtz, *Promoting Alcohol Fuels Production: Tax Expenditures? Direct Expenditures? No Expenditures?*, 36 Sw. L.J. 597, 604 (1982).

56 *Id.* at 608.

57 *Id.* at 609.

58 Pub. L. No. 99-198 (1985).

59 Michael Taylor, *The Emerging Merger of Agricultural and Environmental Policy: Building a New Vision for the Future of American Agriculture*, 20 Va. Envtl. L.J. 169, 178 (2001).

60 *Id.* at 178-79.

61 *Id.* at 179-80.

62 *Id.* at 180-81.

63 James A. Duffield, et al., *Ethanol Policy: Past, Present, and Future*, 53 S.D. L. Rev. 425,435 (2008).

64 Pub. L. No. 109-58, 119 Stat. 594 (2005).

65 Nancy Potter, *How Brazil Achieved Energy Independence and the Lessons the United States Should Learn From Brazil's Experience*, 7 Was. U. Global Stud. L. Rev. 331, 343 (2008). (Citing Samuel W. Bodman, Dep't of Energy, *On the Road to Energy Security: Implementing a Comprehensive Energy Strategy: A Status Report* 11 (2006)).

66 See Duffield, *supra* note 63, at 435.

67 Laura Furrey and R. Lee Gresham, *Construction of a Fool's Paradise: Ethanol Subsidies in America*, 7 Sustainable Dev. L. & Pol'y 26, 27 (Spring

2007) (Citing Jason Grumet, Executive Director, National Commission on Energy policy, Address to the U.S Senate Committee on Commerce, Science and Transportation (Nov. 15, 2005), *available at* <http://www.energycommission.org/site/page/php?testimony=11> (last visited Apr. 6, 2007) for the proposition that virtually all of the EPACT ethanol mandate will be met with corn-ethanol despite credits for cellulosic-ethanol).

68 See Duffield, *supra* note 63, at 435. See Pub. L. No. 109-58, 119 Stat. 594 (2005).

69 Pub. Law 110-140, 121 Stat. 1492 et seq.

70 Phillip L. Fraas, *Biofuel Provisions of the Energy Independence and Security Act of 2007*, 12 No. 3 ABA Agric. Mgmt. Committee Newsl. 19, 20-21 (April 2008). (The Act calls for mandatory output of 9 billion gallons per year by 2008, up from 5.4 billion gallons, and 15.2 billion by 2012, up from 7.5. "From there, the annual standards gradually increase to 36 billion gallons in 2022").

71 *Id.* at 21. (This standard takes into consideration all stages of production, including feedstock generation, conversion/extraction, and use of the finished fuel by the consumer).

72 *Id.*

73 *Id.*

74 *Id.* at 23. (EISA authorizes grant programs for biofuel projects, colleges and universities, and infrastructure development. These appropriations will equal well over \$1 billion per year by 2010).

75 Micheal W. Lore. Subsidies for Corn-Derived Ethanol May Leave Us Thirsty, 8 Sustainable Dev. L. & Pol'y 53 (Fall, 2007). (Citing EPA Fuel and Fuel Additives, Renewable Fuel Standard Program, Aug. 30, 2007, *available at* <http://www.epa.gov/otaq/renewablefuels>).

76 John A. Sautter, et. al., *Construction of a Fool's Paradise: Ethanol Subsidies in America*, 7 Sustainable Dev. L. & Pol'y 26 (Spring, 2007). (Citing Dan Looker, Choices for Ethanol: A Successful Farming Special Report (2006), *available at* http://www.agriculture.com/ag/pdf/Choices_for_Ethanol.pdf (last visited Apr. 7, 2007);, and Global Subsidies Initiative, *Biofuels: At What Cost?*, *available at* http://www.globalsubsidies.org/article.php?3id_article=6&var_mode_calcul (last visited Apr. 6, 2007) (for the proposition that the true cost of ethanol production, considering capital costs averaging \$1.57 per gallon and subsidies translating into over \$1.05 per gallon, would preclude ethanol ventures given profitability concerns.)

77 Public Law 10-140, 121 Stat. 1492 et seq.

78 Marsha A. Echols. *Paths to Local Food Security: A Right to Food, A Commitment to Trade*, 40 Vand. J. Transnat'l L. 1115,1126 (October 2007).

79 Alexandria Spieldoch, Speech, "*Biofuels and Tortillas: A U.S.-Mexican Tale of Chances and Challenges*," Institute for Agriculture and Trade Policy (March 16, 2007).

80 *Id.*

81 C. Ford Runge, *How Biofuels Could Starve the Poor*, Foreign Affairs, Council on Foreign Relations, (May/June 2007).

82 *Id.* (Citing L. Leon Geyer, et al., *Ethanol, Biomass, Biofuels and Energy: A Profile and Overview*, 12 Drake J. Agric. L. 61, 74 (2007)).

83 *Id.* at 519. (Citing generally David Pimentel, *Ethanol Fuels: Energy Balance, Economics, and Environmental Impacts are Negative*, 12 Nat. Res. Research 127, 131 (2003).

84 *Id.* at 519. (Citing Geyer, 12 Drake J. Agric. L. at 71-72).

85 *Id.* at 515.

86 David Tillman, *Corn Can't Solve Our Problems*, The Washington Post, page B-1, (March 25, 2007).

87 *Id.*

88 *Id.*

89 See generally Ackerman, *supra* note 19, at 4. (U.S. agriculture relies heavily on fertilizers, pesticides, and insecticides putting the water supply, natural ecosystem, and human health at risk. Such contaminants have been widely noted as causing oxygen hypoxia in the waters around the world, creating "dead zones" and killing off ocean life).

90 *Benefits and drawbacks of bioenergy must be considered, UN experts say*, UN News Centre, (May 8, 2007), *available at* <http://www.un.org/apps/news/story.asp?NewsID=22480&Cr=energy&Cr1>.

91 Keith Sealing, *Attack of the Balloon People: How America's Food Culture and Agricultural Policies Threaten the Food Security of the Poor, Farmers, and Indigenous Peoples of the World*, 40 Vand. J. Transnat'l L. 1015, 1028 (October 2007) (Citing Richard Manning, *Against the Grain* 98-100, 102, 110 (2004) for the proposition that intensive fertilization results in nitrogen pollution in water systems, American water consumption leads the world and is responsible for declining populations of marine life, and modern agricultural practices have caused the irreplaceable loss of "true" topsoil which takes centuries to form).

92 Mark Murphey, et. al., *A Call to Farms: Diversify the Fuel Supply*, 53 S.D. L. Rev. 515, 523 (2008).

93 *Id.*

94 Christopher Connard, Note, *Sustaining Agriculture: An Examination of Current Legislation Promoting Sustainable Agriculture as an Alternative to Conventional Farming Practices*, 13 Penn St. Envtl. L. Rev. 125, 125 (2004).

95 Mexico Sugar and Trade, TED Case Study 657 (January 2001) *available at* <http://www.american.edu/TED/mexico-sugar.htm#r1>.

96 See Muller, *supra* note 11, at 8. (Corn is a water-intensive crop, and given current subsidy programs is grown in areas which must be irrigated rather than rain-fed).

97 See Muller, *supra* note 11, at 2.

98 *Id.* at 4.

99 *Id.* at 3.

100 See Duffield, *supra* note 63, at 444.

101 *Id.*

102 *Id.* at 444-45.

103 *Id.* at 444-45. (Citing Lester R. Brown, *Supermarkets and Service Stations Now Competing for Grain*, Earth Policy Institute, July 13, 2006, *available at* <http://www.earth-policy.org/Updates/2006/Update55.htm>).

104 David Tillman, *Corn Can't Solve Our Problems*, The Washington Post, page B-1, (March 25, 2007).

105 Joseph Morton, *Despite Critics, Senators Seek More Ethanol*, Omaha World Herald, Nov. 13, 2007.

106 See Muller, *supra* note 11, at 5.

107 Siwa Msangi and Mark Rosengrant, *Agriculture and the Environment: Linkages, Trade-Offs and Opportunities*, 19 GEOIELR 699, 702 (Summer 2007).

108 See Taylor, *supra* note 59, at 174 .

109 See Hicks, *supra* note 46, at 54. (Citing Tessie Borden & Sergio Bustos, *Crushed by NAFTA, Mexican Farmers Head North*, at <http://www.azcentral.com/specials/special03/articles/0618nafta-immigration-ON>).

html (last visited September 22, 2004)).

110 *Id.* (Citing Tessie Borden & Sergio Bustos, Crushed by NAFTA, Mexican Farmers Head North, at <http://www.azcentral.com/specials/special03/articles/0618nafta-immigration-ON.html> (last visited September 22, 2004)).

111 *Id.* (Citing Tessie Borden & Sergio Bustos, Crushed by NAFTA, Mexican Farmers Head North, at <http://www.azcentral.com/specials/special03/articles/0618nafta-immigration-ON.html> (last visited September 22, 2004)).

112 Andy Gutierrez, *Codifying the Past, Erasing the Future: NAFTA and the Zapatista Uprising of 1994*, 14 Hastings W.-N.W.J. Envtl. L. & Pol'y 883, 890-91 (Winter 2008). at 904. (Citing Mexican Agriculture Policies: An Immigration Generator?: Hearings Before the Subcomm. On Employment, Housing, and Aviation of the House Comm. on Government Operations, 103rd Congress, 1st Session 9 (1993) at 62.

113 Thomas E. Cox, *From the U.S. to Mexico: Friendly Advice on Ending the Farm Crisis*, Background No. 753, Heritage Foundation's Reports (February 12, 1990) at 15.

114 U.S. Department of State, Profile: Mexico, available at <http://www.state.gov/r/pa/ei/bgn/35749.htm> (3/7/08).

115 *NAFTA Import Barriers Expire...Another Log on the Immigration Fire* (January 8, 2008), <http://www.mexicopremiere.com/?p=404> (last visited February 1, 2009).

116 *Id.*

117 Ranko Shiraki Oliver. *In the Twelve Years of NAFTA, the Treaty Gave to Me. ... What Exactly?*. 10 Harv. Latino. L. Rev. 53, 131 (Spring, 2007).

118 *Id.* at 131-132.

119 See Gutierrez, *supra* note 112, at 906.

120 This might be accomplished through changing U.S. subsidization and dumping policies regarding yellow corn, the evolution of the biofuel industry to more efficient food stocks which decreases the need for overproduction of U.S. yellow corn, and legislative protection by Mexico, of its traditional maize producers.

121 Bert R. Pena and Amy Henderson. *U.S.-Mexico Agricultural Trade and Investment After NAFTA*, 1 U.S.-Mex. L.J. 259, 260 (1993). at 279.

122 Dana Clark and David Downes, *What Price Biodiversity? Economic Incentives and Biodiversity Conversion in the United States*, 11 J. Envtl. L. & Litig. 9, 41 (1996). (Citing Paul Faeth ed., *Agriculture Policy and Sustainability: Case Studies from India, China, the Philippeans and the United States* 63 (1993)).

123 The CRP began upon the enactment of the Food Security Act of 1985.

124 See Clark, *supra* note 122, at 44.

125 Pablo Ormachea, *Agriculture Subsidies and the Free Trade Area of the Americas*, 13-WTR L. & Bus. Rev. Am. 139, 147 (Winter 2007).

126 See Poole, *supra* note 36 at 185-86.

127 Stacey William Person, *International Trade: Pushing United States Agriculture Toward a Greener Future?*, 17 Geo. Int'l Envtl. L. Rev. 307, 319 (Winter 2005).

128 *Id.* at 325.

129 Proper use of retired lands will achieve the goals of reducing pollution, renewing the soil, preventing erosion and water pollution while supplying farmers with a biofuel crop and the biofuel industry with raw material. See generally, Roger Claasen, et al., *Agri-Environmental Policy at the Crossroads:*

Guideposts on a Changing Landscape, USDA Economic Research Service / AER-794 at 1.

130 Jim Chen, *Get Green or Get Out: Decoupling Environmental From Economic Objectives in Agricultural Regulation*, 48 Okla. L. Rev. 333, 339 (1995).

131 Simon H. Ginsberg, *Economic and Environmental Challenges to Natural Resource Trade*, 10 Emory Int'l L. Rev. 297, 302 (Spring 1996).

132 Jeffrey Garten, *The Changing Face of North America in the Global Economy*, 1-WTR NAFTA: L. & Bus. Rev. Am. 5 (Winter 1995) at 7,8.

133 Stacey William Person, *International Trade: Pushing United States Agriculture Toward a Greener Future?*, 17 Geo. Int'l Envtl. L. Rev. 307, 328 (Winter 2005).

134 Bioenergy (April 2005), http://www.fao.org/sd/dim_en2/en2_050402_en.htm (last visited February 1, 2009).

135 Siwa Msangi and Mark Rosengrant. *Agriculture and the Environment: Linkages, Trade-offs and Opportunities*, 19 Geo. Intn'l Envtl. L. Rev. 699, 703 (Summer, 2007).

136 U.N. Food and Arige. Org., Forestry Dep't, Bioenergy and Millenium Development Goals 2 (2005), available at <http://www.fao.org/docrep/008/j5135e/j5135e01.htm>.

137 See *U.S.-Mexico Agricultural Trade*, *supra* note 121, at 275.

138 *Id.* (This hypothetical assumes that if U.S. mill conversion would be economical, results would be similar in Mexico provided that FDI and agricultural advances positively affect productivity, efficiency and cost of production).

139 *Id.*

140 Kaylan Lytle, *Driving the Market: The Effects on the United States Ethanol Industry if the Foreign Ethanol Tariff is Lifted*, 28 Energy L.J. 693, 694 (2007).

141 *Id.* at 696.

142 *Id.*

143 *Id.*

144 *Id.* at 697.

145 Siwa Msangi and Mark Rosengrant. *Agriculture and the Environment: Linkages, Trade-offs and Opportunities*, 19 Geo. Intn'l Envtl. L. Rev. 699, 703 (Summer, 2007) at 703; Duffield, *supra* note 63, at 441; L. Leon Geyer, *Ethanol, Biomass, Biofuels and Energy: A Profile and Overview*, 12 Drake J. Agric. L 61, 71-72 (Spring 2007); Margaret J. Jennings, *Bioenergy: Fueling the Future?*, 12 Drake J. Agric. L. 205, 215 (Spring 2007).

146 The North American climate restricts the geographic area available in the United States on which sugar may be grown. Also due to climactic restrictions, sugar has a shortened growing season in the U.S. In Mexico, however, sugar maintains a year-round growing season.

147 See Ormachea, *supra* note 125, at 153.

148 Jeffrey A. McNeely, *Biofuels: Green energy or grim reaper?*, BBC News (Sept. 22, 2006), available at <http://news.bbc.co.uk/2/hi/science/nature/5369284.stm>. See also Hosein Shapouri, James A. Duffield & Michael S. Graboski, *Estimating the Net Energy Balance of Corn Ethanol*, U.S. Dept. of Agric. 12 (1995), available at <http://www.ers.usda.gov/publications/aer721/aer721.pdf>. (for the proposition that one gallon of petroleum energy is required to produce 1.24 gallons of corn-based ethanol).

149 *Id.* (See also Sandra Zellmer, *Boom and Bust on the Great Plains: Déjà vu All Over Again*, 41 Creighton L. Rev. 385, 411 (April 2008))("The

environmental coup de grace” is that emissions from the planting and harvesting of corn contribute significantly to global warming).

150 See Tillman, *supra* note 86.

151 See *Feasibility of Sugar*, *supra* note 28, at iii.

152 Although when ethanol production is measured by yield per acre corn is clearly a superior choice, it is the cost of producing that acre of food stock that determines economic feasibility. Other factors to be considered are energy inputs, and environmental issues. When viewed in the totality, sugar, among other feed stocks, are more efficient. See generally, *Feasibility of Sugar*, *supra* note 28.

153 Luis Chavez, et al, *Mexico Bio-Fuels Annual Report 2007*, Global Agriculture Information Network (June 12, 2007). (Importantly, the Mexican climate in sugar-growing regions permit a perpetual annual harvest of sugarcane (and thus sugar-ethanol production), a tropical grass which only grows seasonally in U.S. growing regions).

154 Karl R. Rabago, *A Review of Barriers to Biofuel Market Development in the United States*, 2 *Env'tl & Energy L. & Pol'y J.* 211, 227 (Spring 2008) (Citing Natural Resources Defense Council, Move Over Gasoline: Here Comes Biofuels, at <http://www.nrdc.org/air/transportation/biofuels.asp> (last visited Mar. 10, 2008)).

155 Tom Daschle, et al, *Food for Fuel?*, Foreign Affairs, Council on Foreign Relations (September/October 2007). (“[G]rain-based facilities are a critical platform for the next generation of biofuel technology”). See *Id.* at Part IV.C.

156 Phillip L. Fraas, *Biofuel Provisions of the Energy Dependence and Security Act of 2007*, 12 No. 3 *ABA Agric. Mgmt. Committee Newsl.* 19, 20 (April, 2008).

157 Mark Murphey, et. al., *A Call to Farms: Diversify the Fuel Supply*, 53 *S.D. L. Rev.* 515, 523 (2008).

158 *Id.*

159 *Id.*

160 Drew L. Kershen, *Sustainable and Intensive Agriculture: High Technology and Environmental Benefits*, 16-SPG *Kan. J.L. & Pub. Pol'y* 424 (Spring 2007).

161 Edward D. McCutcheon, *Think Globally, (En)Act Locally: Promoting Effective National Environmental Regulatory Infrastructures in Developing Nations*, 31 *Cornell Int'l L.J.* 295, 402 (1998).

162 *Id.* at 403-04, 406. (Citing World Development Report 1992: Development and the Environment at 46 for the proposition that water pollution is a growing problem in developing countries; Consortium for International Development, Proceedings of the Eighth CID Presidential Symposium, at 7 (Occasional Paper No. CID/01/92, July 25, 1991) for the proposition that toxic chemicals and fertilizers threaten waterways, wildlife, and humans).

163 *Id.* at 404. (See *World Development Report 1992*, at 46; Daniel D. Chiras, Environmental Science—Action for a Sustainable Future 346-49 (1991)).

164 *Id.* at 405. (Citing *Environmental Science*, at 145, 194, 196).

165 See C. Ford Runge, *How Biofuels Could Starve the Poor*, Foreign Affairs, Council on Foreign Relations, (May/June 2007). See also, Mexico Sugar and Trade, TED Case Study 657 (January 2001) available at <http://www.american.edu/TED/mexico-sugar.htm#r1>.

166 *Id.*

167 Sandra Zellmer, *Boom and Bust on the Great Plains: Déjà vu All Over Again*, 41 *Creighton L. Rev.* 385, 419 (April 2008)). (Citing J. William Futrell, *The IUCN Sustainable Soil Project and Enforcement Failures*, 24 *Pace Envtl. L. Rev.* 99, 127 (2007)).

168 Mark Murphey, et. al., *A Call to Farms: Diversify the Fuel Supply*, 53 *S.D. L. Rev.* 515, 523 (2008).at 515.

169 See James K. Boyce, *Ecological Distribution, Agricultural Trade Liberalization, and In Situ Genetic Diversity*, *Journal of Income Distribution*, Political Economy Research Institute, (1996) at 265. (Mexican maize and traditional maize farming techniques are credited with the domestication, genetic biodiversity, and the continued evolution of maize varieties).

170 *Id.* at 279.

171 *Id.*

172 See Cox, *supra* note 113, at 15.

173 *Id.* at 16.

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