

**Trade Liberalization and the Environment:
A Study of NAFTA's Impact in El Paso, Texas and Juarez, Mexico**

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ABSTRACT

This thesis seeks to promote a clearer understanding of relationships between trade liberalization and environmental quality in a free trade zone along an international border, between countries unevenly matched in development and infrastructure. Specifically, it examines whether theories of environmental degradation provide appropriate models for explaining the impact of NAFTA on the environment in the Paso del Norte. The relationship between trade liberalization and environmental quality is examined through an analysis of environmental indicators in the decade preceding and following NAFTA. Finally, the role of environmental governance is addressed, especially the intricacies involved in multi-jurisdictional governance of the environment. The research indicates that trade liberalization is not necessarily environmentally harmful. The data suggest that NAFTA had little to no direct negative impact on the region's environmental condition, but they also do not provide evidence that NAFTA improved the environment. One factor that could have helped to limit its effects may be local, interstate, and international initiatives that improved the health of the ecosystem along the border before NAFTA was even conceived. Another factor is the environmental governance in place before and after NAFTA. Thus, it may be beneficial for trade liberalization agreements to address environmental concerns as integral parts of the negotiations, and to set requirements for meeting infrastructure demands, as the agreements are implemented. Furthermore, it is important that international environmental institutions established to monitor environmental cooperation be more closely associated with the trade cooperation organizations and be given the authority needed to complete their directives more effectively.

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Chapter 1

Introduction

The growing global trend toward trade blocs and general trade liberalization has the potential to affect not only the socio-economic well-being of the nations in the trade bloc, but also the environmental quality enjoyed by all states involved in the agreements; that such a trade-environment relationship exists is well-established and widely accepted (Baylis and Smith 2005; Callan 2004; MacArthur 2001; Todaro and Smith 2002). Such relationships are especially visible in trade liberalization agreements among countries with a marked developmental imbalance. The North American Free Trade Agreement (NAFTA) therefore provides an excellent case for examining the effects of trade liberalization on environmental quality, given the imbalance between Mexico and the other two partners in the agreement.

This thesis seeks to promote a clearer understanding of relationships between trade liberalization and environmental quality in a free trade zone along an international border, between two countries that are unevenly matched in terms of development and infrastructure. Specifically, it seeks to determine whether environmental conditions in the Paso del Norte region on the U.S./Mexico border have declined in the wake of the NAFTA trade liberalization regime, as many scholars and politicians predicted, and, if so, to identify factors that may have contributed to or prevented that decline. Although this thesis reports on academic research, the intended audience is the policy makers, enforcement officials, and environmental professionals who are responsible for environmental stewardship in the Paso del Norte and similar regions worldwide, and who are positioned to act upon the findings of this research project in future negotiations involving trade and the environment.

Beginning with a brief overview of the historical background and debates surrounding NAFTA, this thesis then discusses opposing theories of the relationship between trade and the environment. I develop my argument regarding trade liberalization and environmental quality through an analysis of environmental indicators in the ten years preceding and following NAFTA. I assess trends in the data in order to evaluate which of the theories, if any, provides an accurate model of the impact of trade liberalization on the environment. Finally, I address the role of environmental governance in this relationship, especially the intricacies involved in multi-jurisdictional governance of the environment.

The debate over NAFTA brought international attention to environmental conditions along the U.S. Mexico border, which caused the region's governments to pay attention to potential environmental impacts resulting from trade liberalization and facilitated cooperation between the two countries at all levels of government. One of the more important findings of this research is that the multi-jurisdictional governance has required innovative methods for cooperation between the levels of government and between the different countries at all levels of government. Of these methods for cooperation, the ones that most successfully impact the environment in the region are negotiated at the local level and involve actors from the business and private sectors.

Historical Background

Stephen Mumme (2003) has provided insight into the political developments that paved the way for NAFTA and the North American Agreement on Environmental Cooperation (NAAEC). The same political developments that promoted the need for scholarly research into the environment in the border region also resulted in the eventual development of the NAFTA environmental side accord.

In 1965, the U.S. and Mexico adopted the maquiladora program, which marked the beginning of serious efforts to integrate the economies of the two countries within 100 miles of the border. This marked the beginning of bi-national economic integration within the border region. In 1969, the U.S. adopted the National Environmental Policy Act, which in its simplicity paved the way for the establishment of the Environmental Protection Agency later that year and established the foundation for nearly all domestic environmental legislation (Alm 1988). By the middle of the 1970's there was "deep global concern with the quality of the human environment" (Mumme 2003, 594). This concern over the environment, coupled with the increased economic cooperation along the border, created an atmosphere in which the environmental problems faced by the border region began to be noticed. Previously, literature on border issues had been focused on water resources; during this period of environmental enlightenment the focus on border environmental issues broadened.

The foundation for action on environmental concerns along the border was facilitated in 1975 when U.S. President Gerald Ford extended the Public Works and Economic Development Act of 1965 to include the four U.S. border states (Blase 2000). This set the stage for increased cooperation and dialogue among the states along the border. There were two outcomes of this increased cooperation. First was the formation of the Southwest Border Regional Commission (SWBRC), which was administered by the department of commerce, a presidential appointee, and a rotation of the governors of the Border States (Blase 2000). Second, this legislation allowed for the development of the Border Governors' Convention (BGC). This ongoing annual event has brought together the governors of the border states from both countries to meet with each other and discuss matters that affect both sides of the border. While this had originally turned heads in the capitals of both countries, it evolved into a forum that facilitated the

integration of environmental cooperation with economic integration that was negotiated at the state level as opposed to the federal level (Blase 2000). This was an important development in the political climate of the 1980's. Through the BGC, U.S. border states had effectively taken initiative to address border issues independently of the Federal Government. In 1980, they agreed to expand this cooperation to their Mexican Counterparts.

While the governors on both sides of the border went into the 1980 meeting with the approval of their federal governments, some of the topics of discussion prompted criticism from federal representatives that were in attendance. For instance, the U.S. special ambassador-at-large to Mexico, Robert Kreuger, criticized the governors for discussing issues such as drug control, immigration, and the environment which he opined should be discussed at the Federal level only. The U.S. governors responded by arguing that the situation on the border was too important and complex to delegate to federal authorities who were less familiar with the problems and potential solutions (Blase 2000). The governors argued that they had the right to discuss issues that fell under federal jurisdiction and then lobby their respective federal governments to act on policies agreed to at the state level (Blase 2000). This approach is an accepted practice in the post-NAFTA political environment, with individual states maintaining trade offices in foreign countries (Blase 2000).

The next significant development in the politics of environmental and economic cooperation along the border was the La Paz Agreement. This was perhaps the most important development in economic and environmental cooperation aside from NAFTA. This agreement, which was entered into force in 1984, cited the 1972 Declaration of the United Nations Conference on the Human Environment as the impetus for its negotiation. The conference called

on nations to “collaborate to resolve environmental problems of common concern” (State 1983, Preamble).

The La Paz agreement laid the foundation for all subsequent environmental cooperation until the NAAEC, which did not replace the La Paz Agreement, but rather served as a supplemental agreement. According to the La Paz Agreement, the parties are “to prevent, reduce, and eliminate sources of pollution in their respective territory which affect the border area of the other.” The agreement establishes the border region as 100 miles on either side of the physical border (this was later amended to include 300 miles), and establishes federal agencies as national coordinators in each country (State 1983). Additionally, the JACIAQ was formed as an amendment to the La Paz Agreement in March of 1996 to address air quality concerns in the Paso del Norte Region. This organization has met with considerable success as it seeks to improve the air quality in the region through cooperation and mediation with and between various levels of environmental/trade governance in the region.

It is under the auspices of the La Paz agreement that the first serious efforts at environmental monitoring, cooperation, and improvement began in the Paso Del Norte. However, it was not until the debate over NAFTA erupted that the border environment became a central theme for discussions between Mexico and the U.S (Sanchez 2002).

NAFTA and NAAEC

In December of 1993, the United States, Mexico, and Canada entered into the North American Free Trade Agreement (NAFTA). Implemented in 1994, this agreement established a trade bloc that was set apart from most other international trade agreements by the unprecedented concern of the lawmakers for environmental issues in the negotiation of the agreement (Fletcher and Tiemann 1994). The preamble includes acknowledgement that the member countries

“resolve to strengthen the development and enforcement of environmental laws and regulations” (NAFTA 1992, Preamble). The environmental provisions in NAFTA, “lay out mechanisms for environmental regulation” and, much like the provisions for trade and labor, “call for harmonization [of national policies] without uniformity” (Kingsolver 2001, 78). These provisions notwithstanding, NAFTA met with a great deal of resistance among labor and environmental advocates.

U.S. President Clinton refused to ratify NAFTA until an acceptable side agreement on environmental issues was established, resulting in the negotiation and signing of the North American Agreement on Environmental Cooperation (NAAEC) in September of 1993. The NAAEC is a tri-national agreement that is intended to offer modest environmental protections to the participants in NAFTA, to facilitate environmental hearings and arbitration of disputes, and to provide for limited environmental oversight. Within the NAAEC, oversight is provided by the Commission for Environmental Cooperation (CEC), which is comprised of a governing council composed of cabinet level representatives from the countries, a central Secretariat responsible for technical, administrative, and operational activities, and a Joint Public Advisory Committee (JPAC) composed of five members of the public from each country who provide technical, scientific, and other information to the secretariat (CEC 2002). The NAAEC required a four-year independent review of the CEC that was to be an examination of the effectiveness and operation of the commission.

Subsequent to the passage of the NAAEC, the United States and Mexico entered into an amendment agreement establishing the Border Environment Cooperation Commission (BECC) and the North American Development Bank (NADBank). The purpose of the BECC is “to help preserve, protect and enhance the environment of the border region” and to “cooperate as

appropriate with the North American Development Bank and other institutions and organizations. The NADBank itself provides financing for environmental infrastructure development in the border region.

Even the NAAEC side agreement and the subsequent amendment did not quell the fears of NAFTA opponents. The environment, along with labor, remained a heated subject. Environmental groups went on the offensive, and some even turned on each other, making claims and counter claims regarding the impacts that NAFTA would have on the environment (Rosenbaum 2005). Among the many concerns was the fear that NAFTA “posed a potential threat to U.S. domestic environmental laws and regulations” because of provisions prohibiting member countries from enforcing environmental laws in ways that restrict trade (Magraw and Charnovitz 1994, 1). These predictions are consistent with the logic of the race to the bottom hypothesis, which suggests that NAFTA will result in competition for industries and jobs, and as a result the U.S. and Mexico will engage in competitive reductions in environmental (and labor) standards and enforcement (Daly 1993) A similar fear was that North American companies would be attracted to regions with lax environmental controls or enforcement concentrating pollution into smaller areas, creating pollution havens (Cole and Ensign 2005)

The Ongoing Debate

The debate over NAFTA’s environmental effects reflects a larger debate over the environmental implications of global trade liberalization (Antle and Heidebrink, 1995; Barbier, 2000; Callan, 2004; Cole and Ensign, 2005; Finus, 2002; Grossman and Kreuger, 1991; Harrington, 1998). Antle and Heidebrink (1995) summed up the situation by saying that: “Vigorous public debate has arisen between individuals who maintain that environmental degradation is a necessary outcome of economic growth and those who believe that economic

growth and environmental quality go hand in hand” (604). Take, for example, Elizabeth Cole and Prescott Ensign (2005), who claim in their article in the *International Trade Journal* that they observed “a trend of US foreign direct investment into Mexico in industries characterized as lower polluting” (1-2). In contrast, Murat Isik (2005) argued in the same year: “There is well-documented relative growth of pollution-intensive industries in developing countries. Geographic variation in environmental regulations can induce migration of industries across state or national boundaries to ‘pollution havens’, where compliance costs associated with environmental regulations are lower” (436).

In addition to the different perspectives that social scientists bring to the table, the uncertain nature of the predictive power of the research tools available to environmental scientists makes for an enduring environmental policy debate. Furthermore stakeholders use the data from social and environmental science inquiries to predict different outcomes of both trade policies and the methods used to achieve environmental goals (Callan 2004; Susskind, Jain and Martyniuk 2001).

Focusing In

One way in which to circumvent the difficulties of assessing the environmental impacts of the NAFTA institution as a whole is to focus on particular geographic regions and on specific types of impacts relevant to those regions. The U.S./Mexico border provides a rich site of inquiry because of the intensity of NAFTA’s economic impact on the region, and its history of environmental problems, rapid population growth, and multi-jurisdictional environmental enforcement. The independent review committee (IRC) appointed by the CEC for the 4-year review initially argued that using the environment along the U.S./Mexico border as a measure for the effectiveness of the CEC was inappropriate (Bendesky, Bramble and Owen 1998), because of

the extent of problems in the region and the budgetary constraints of the CEC that limited their ability to become effective there. However, the most recent comprehensive review of NAFTA's impact on the environment, published in 1999 by the CEC, highlights the US/Mexico border region "as a critical area for consideration as a separate geographic entity along with the three NAFTA countries"(CEC 1999, 45).

The Paso del Norte

The Paso del Norte is comprised of the states of Chihuahua (Mexico), Texas, and New Mexico. One of the fastest-growing metropolitan areas along the border, "The Paso del Norte is a binational, tristate airshed affected by complex terrain, varying emission standards, and multijurisdictional control" (EPA 2004, 1). The region spans a large valley created by the Rio Grande/Rio Bravo (Rio Grande) from the Elephant Butte Reservoir in New Mexico south across the border into southern Chihuahua. This large area consists of three cities and numerous satellite communities that, in addition to having common histories and cultures, share three aquifers as well as the Elephant Butte Reservoir (McHugh 2005).

The sister cities of El Paso and Juarez form the metroplex at the heart of this region and have inherited both the name and the responsibility it implies—the Passage to the North. El Paso and Juarez combine geographically to create the largest border metroplex with contiguous boundaries in North America, with a population of approximately 2 million people in the El Paso/Juarez metropolitan area (Nuñez and Forster 2005). The population of El Paso, which is one-third of the two million, is expected to grow by 18,000 people per year over the next decade. Meanwhile, Ciudad Juarez is expected to grow by 40,000 people per year, with the primary cause of the population increase being internal migration due to the rapid industrialization experienced along the border over the past thirty years. (Frumkin, Hernandez-Avila et al. 1995;

Simmons and Vinas 1996; Coronado and Vargas 2001; Blackman, Blatz et al. 2003; Forster and Hamlyn 2005; Manley 2005; Pena, Fuentes et al. 2005). The area experienced an annual population growth rate of 3.7 % between 1990-2000 (Coronado and Vargas 2001).

Nuñez and Forster (2005) attribute this rapid population growth, and the resulting urbanization, to rapid growth in the maquiladora¹ industry. They observed an interdependence between growth in the maquiladora industry and population growth in the region, indicating a “positive feedback loop” (Nuñez and Forster 2005, 352). Their research also indicated that the number of maquiladoras in the region increased sharply after NAFTA. This claim is consistent with the findings of many other researchers (Frumkin, Hernandez-Avila et al. 1995; Simmons and Vinas 1996; Coronado and Vargas 2001; Blackman, Blatz et al. 2003; Forster and Hamlyn 2005; Manley 2005; Pena, Fuentes et al. 2005).

David Simcox of the Center for Immigration Studies described El Paso as a city experiencing “growth without prosperity, citing “abundant low-wage labor with low expectations” as a major detriment to income growth in the region. He explains that the condition of the workforce, which outpaced national trends in both job creation and labor force growth, created a cycle of attracting low-wage jobs.

The concentrated population, ease of transfer of goods across the border, and location along U.S. Interstate-10 made the region a strategic position for the manufacture of industrial goods prior to and after NAFTA. Mexico has hosted American companies since 1964, when the Mexican government established the maquiladora program in response to the displacement of

¹ Maquiladoras are “foreign-owned assembly plants in Mexico. Companies import machinery and materials duty free and export finished products around the world. When these products are sold back to U.S. markets, they are only taxed on the value added in the manufacturing process (assuming all capital inputs have been imported from the US)” (Corpwatch.org, 1999, Gruben, 1998).

Mexican migrant workers due to the U.S. elimination of the Braceros program (a program in which Mexican labor was imported to work on U.S. farms and ranches) and a U.S. policy for increasing foreign direct investment in Mexico (Gruben 1998; PBS). Since the creation of the program, many U.S. companies have taken advantage of the reduced costs of doing business in Mexico by opening maquiladoras. Unfortunately, one of the major cost-reducing incentives for moving operations to Mexico is the relaxed environmental regulations and enforcement (Barbier 2000; Callan 2004; Cole and Ensign 2005). The proposal of NAFTA generated fear among environmental advocates that environmental problems caused by the maquiladoras would be exacerbated. These arguments set the stage for the environmental debate over NAFTA.

The Project

Focusing on the geographic microcosm of the Paso del Norte, this thesis seeks to provide a focused assessment of the environmental impacts of trade liberalization. More specifically, I will examine whether theories of environmental degradation provide appropriate models for explaining the impact of NAFTA on the environment in the Paso del Norte. I seek to contribute to the literature through a broader overview of environmental evidence than is commonly used in academic studies of trade impacts. Loosely following a combination of the methods prescribed by the Commission for Environmental Cooperation (CEC 1999) and the Organization for Economic Cooperation and Development (Tarasofsky 1999), I will develop a broad historical overview of the environmental conditions in the Paso del Norte and examine whether those conditions have improved or worsened since the implementation of NAFTA.

My project has three primary goals:

- to briefly document the environmental conditions in the Paso del Norte before and after the enactment of NAFTA.

- to discuss these conditions in the context of theories that describe the relationship between trade liberalization and the environment as they apply to the Paso del Norte
- to identify policies and institutions that have played a significant role in determining the impact of NAFTA on the environmental situation in the region
- To explore the implications of this analysis for our theoretical and empirical understanding of the relationship between trade and environment relationship more generally.

It is important to note that the goal is not to determine whether NAFTA *improved* environmental conditions in the region, since establishing a cause and effect relationship is virtually impossible given the complexity of the situation, the number of variables, and the lack of comprehensive data. Rather, the central research question that drives the project is as follows: Do environmental degradation theories accurately describe the process by which NAFTA impacted the environment in the Paso del Norte?

Chapter 2 provides an overview of competing theories for understanding the relationship between trade and the environment, while Chapter 3 discusses various methods for environmental assessment and focuses on the methodology employed in this project. Chapter 4 presents an analysis of the environmental conditions in the Paso del Norte before and after NAFTA and discusses those conditions in relation to the theories introduced in Chapter 2. Chapter 5 focuses on the role played by environmental governance in the region. Finally, Chapter 6 summarizes the findings of the project and identifies future research priorities.

Chapter 2

Trade and the Environment: Theories for Understanding

The literature surrounding the debate over the relationship between the environment and international trade ranges across a broad spectrum of disciplines and schools of thought. I will focus on selected hypotheses that are commonly debated as having significant promise for explaining that relationship.

This chapter begins with an introduction to theoretical approaches for understanding the relationships among trade, economic development, and the environment. Following this introduction is a more in-depth discussion the Race to the Bottom and Pollution Haven theories. This will set the stage for the opposing theoretical perspective of environmental transition theory which posits a multi-staged process in which trade liberalization leads to environmental improvement on a global scale. The final section will include a brief introduction to the environmental Kuznet's curve.

The Trade and Environment Relationship

While the existence of a relationship between trade and the environment is commonly accepted (Antle and Heidebrink 1995; Barbier 2000; Wheeler 2000; MacArthur 2001; Frankel and Rose 2002; Todaro and Smith 2002; Vaughan 2003; Callan 2004; Fredriksson and Millimet 2004; Baylis and Smith 2005; Cole and Ensign 2005) understanding the nature and scope of the relationship is difficult. The most prominent explanations of the relationship between trade and the environment are best summarized by the opposing views taken by Daly and Bhagwati in their now famous debate in the *Scientific American* (Bhagwati 1993; Daly 1993; Gallagher 2004). Daly argues that “free international trade encourages industries to shift their production activities to the countries that have the lowest standards of [pollution abatement, health and safety

standards, etc.]” (Daly 1993). On the other hand, Bhagwati suggests that trade liberalization will lead to environmental degradation in its earliest stages, and then improve as income increases past a turning point (1993).

Pollution Havens and the Race to the Bottom

The Malthusian Trap is an early identification of the relationship between population growth and the carrying capacity of the environment. In spite of its focus on food supply and population, it serves as a building block for hypotheses that make the assumption that the environment is linked to development and trade. Malthus argued that as the human population grew it would meet the earth’s carrying capacity and no longer be able to produce enough food, thus causing starvation and famine to become a natural check on the human population (Tregarthen and Rittenberg 2000). Carrying capacity-based theories of the relationship between trade and the environment suggest that trade liberalization and the subsequent economic growth and competition will create an atmosphere in which states compete for industries by reducing environmental standards in an effort to support continued growth. They further argue that in the short-run poorer countries will become pollution havens—experiencing the worst of the environmental degradation for the benefit of the richer countries. These theories suggest that trade liberalization and economic development will cause a downward spiral that will result in severe environmental degradation in all countries (Grossman and Krueger 1991; Daly 1993; Magraw and Charnovitz 1994; Shafik 1994; Grossman and Krueger 1995; Frankel and Rose 2002; Vaughan 2003; Fredriksson and Millimet 2004; Mann 2004; Cole and Ensign 2005).

Daly’s argument follows the logic of the Pollution Haven and Race to the Bottom theories (Gallagher 2004). These theories suggest that as trade liberalization spreads to less developed countries, global pollution levels will increase due to two interdependent forces

(primarily affecting the poorest populations in both the more and less developed states): a lack of universal environmental standards between trading partners, and inter-state competition for industrial relocation. First, pollution will increase in the less developed countries (that have, or adopt, lower environmental standards), as they attract higher polluting industries that are seeking to reduce production costs by avoiding the pollution abatement and employee/public health standards in place in developed countries. Second, pollution will rise as developed nations reduce their environmental standards in order to retain, or regain, comparative advantages in production (Wheeler 2000). The result is a reciprocal relationship ending with countries eliminating environmental regulation in favor of free market competition.

According to Daly (1993), NAFTA is an example of trade liberalization that would lead to pollution havens and a race to the bottom. Indeed, in spite of attempts to address environmental issues within the agreement, and the enactment of the North American Agreement on Environmental Cooperation (NAAEC), NAFTA was still the object of criticism even after its implementation. In March of 1994, just three months after the start of NAFTA, Daniel Magraw and Steve Charnovitz identified three environmental risks associated with the adoption of NAFTA. First, they were concerned that the agreement would cause a convergence of environmental laws to the lowest common denominator, and that the internationally negotiated standards would prevent federal, state, and local governments from adopting stricter regulations. Second, they worried that industries would be attracted to locales with low environmental protection standards or weak enforcement. Third, they feared that, as evidenced by previous trade agreements, the dispute settlement procedures of NAFTA would be “inherently biased against the environment” (Magraw and Charnovitz 1994, 2).

Subsequent research, utilizing both quantitative and qualitative methods for analysis, has not produced significant evidence that Magraw and Charnovitz's fears will be realized—at least on an economy-wide scale. In fact, there is significant evidence that rejects the Pollution Haven and Race to the Bottom hypotheses on such a scale (Barrett 1994; Clapp 2002; Cole and Ensign 2005; Drezner 2000; Fredriksson and Millimet 2004; Gallagher 2004; Isik 2005; Magraw and Charnovitz 1994; Vaughan 2003; Wheeler 2000). For example, Daniel Drezner (2000) observed that the evidence from trade liberalization has not supported the race to the bottom but rather supports the notion that it has brought about improvements in environmental regulations, especially in developing countries. This view is supported by Elizabeth Cole and Prescott Ensign (2005), who find that the United States' foreign direct investment (FDI) into Mexico has been in less polluting industries, and suggests that the Mexican pre-NAFTA restrictions on FDI promoted industries that were more polluting.

David Wheeler of the World Bank Development Research Group argues there are two reasons there will not be an environmental race to the bottom. He asserts that, first, “communities in developing countries are neither passive agents nor focused exclusively on material gain,” and second, both “consumers and investors assign significant value to environmental performance and, if they are well-informed, their market decisions will provide powerful incentives to reduce pollution” (Wheeler 2000). Wheeler uses suspended particulate matter measures for Mexico City, Mexico; Cubatao, Brazil; aggregated data for Chinese cities; and a group of large U.S. cities to test the race to the bottom. His analysis of the data prompts him to conclude: “The race to the bottom model's assumptions must be flawed, since its predictions are inconsistent with urban air pollution trends in three of the developing world's major industrial powers” (Wheeler 2000, 6)

It is important to note that the methods, scope, and values involved in the examination of these theories have been as widely debated as their theoretical implications (Strohm 2002). For instance, Laura Strohm (2002) and Jennifer Clapp (2002) agree that, while there is strong evidence that rejects these theories, the methods and data used to support these studies have been inadequate; they both argue that nature's assimilative capacity can be sold as a commodity under free trade, and as such, international transfers of waste (hazardous, bio-hazardous, and non-hazardous) should be considered as factors in examinations of these theories. For example, while Wheeler (2000) concluded that underlying assumptions of the Race to the Bottom hypothesis must be flawed, it may be that the scope of his research (e.g. in terms of environmental indicators) or the availability of sufficient time series data is inadequate to support the hypothesis.

In summary, while the Pollution Haven and Race to the Bottom hypotheses have not been strongly supported by empirical evidence, improvements in monitoring and transparency may allow researchers to identify sufficient supporting evidence in particular pollutants, resource consumption, or sectors. Additionally, focusing on a specific geographic region and particular indicators within that region may reveal trends not seen on an aggregate scale.

Environmental Transition

In contrast to Daly and others who espouse carrying capacity and related theories, Bhagwati envisions a more positive outcome for the environment with the spread of trade liberalization. His argument centers upon the Environmental Transition theory proposed by John Antle and Gregg Heidebrink (1995). They follow the logic of Vernon Ruttan, who, in his 1971 Presidential Address to the American Agricultural Economics Association, hypothesized that, in spite of "environmental degradation at low income levels," as income increases, so too does the

“demand for environmental assimilation of residuals” and “demand for environmental amenities (e.g. freedom from pollution and congestion)” (Antle and Heidebrink 1995; Ruttan 1971, 709). Antle and Heidebrink argue that exhausting the environmental capital stock is not economically rational for any market, and thus the market will adopt practices that will prevent such a scenario². The result of this assumption is that as the market grows, it will naturally begin to preserve the environmental stock. This relationship is best described by the inverted-U that occurs as certain environmental indicators are graphed against national income—called the environmental Kuznet’s curve.

The Kuznet’s Curve is an economic theory originally used to explain the relationship between economic development and income disparity. The environmental Kuznet’s curve manifests in the earliest stages of trade liberalization. According to the curve, environmental degradation increases as countries increase trade activities; however, over time, environmental conditions will improve. The causes of this improvement have been widely debated in the literature. Some argue that the improvement is due to changes in scale, composition, and technique effects (Gallagher 2004; Grossman and Krueger 1995; Shafik 1994; Torras and Boyce 1998). According to Kevin Gallagher (2004), scale effects are changes in the size of productive capacity. Composition or product effects are the result of changes in the nature of the output (CEC 1996). For instance, moving from a primarily manufacturing output to a service output would logically cause a decrease in pollution and raw materials consumed. Technique effects are the result of changes in manufacturing methods and technologies. As countries integrate

² I would like to add that in order for this outcome to be effectively achieved, the competing firms within the market would need to enter into some form of collusion (supply and price), which is prohibited (at least in the US) by current anti-trust regulations, and would be discouraged across national boundaries—the best solution for this problem is a combination of federal and international regulation and inter-firm cooperation.

economically, relocating firms bring with them pollution abatement technologies and methods, which at times actually improve the productive efficiency of the firm, which leads to a reduction in pollution per unit of production.

While these effects can be the source of environmental improvements in the wake of trade liberalization, they can just as easily remain the detriments to the environment that cause the initial growth in degradation indicated by the positive slope of the environmental Kuznet's curve (See appendix 1 for a visual depiction of the environmental Kuznet's curve.)

Frankel and Rose (2002) make some very important observations about the environmental Kuznet's curve, and as such, about the environmental transition theory itself. First, they discuss a number of "fairly well established" causal economic relationships, the first of which is the most important to this thesis. There is theoretical and empirical evidence that suggests a positive relationship between trade liberalization and growth in income. Second, they note that output has a positive effect on pollution through the scale of production, as discussed above. Finally, they make the link between this increase in pollution due to scale effects, and income. However, while they make this causal link with the environmental Kuznet's curve, they go a step further than Antle and Heidebrink by suggesting that much of the environmental degradation that stems from growth (fueled by trade liberalization) is external to the product's market. Therefore, "there must also be effective government regulation, which usually requires a democratic system to translate the popular will into action." (Frankel and Rose 2002) In short, a policy response and enforcement are required to bring the environmental transition theory to fruition.

While the environmental transition literature demonstrates that there are some environmental indicators that have traditionally improved in the wake of trade liberalization,

there remain particular externalities relating to select contributors to environmental degradation in North America for which the market is incapable of correcting, relegating responsibility for mitigation of these types of market distortions to the public domain. This market failure brings to light the importance of environmental and trade regulatory institutions at all levels of government—including inter-governmental cooperation—and suggests that environmental conditions should be considered an integral part of the economy...as more than the source of natural capital stock.

Conclusion

Efforts to test the Pollution Haven, Race to the Bottom, and Environmental Transition hypotheses have brought to light some of the problems with the methods used for environmental assessment: To be effective they require consistent time series data at different levels of analysis (national, regional, state, and local), which are often not available. Additionally, establishing a causal relationship that would support or reject such theories is particularly difficult given the complexity of the situation even within one geographic region. However, in the case of theories such as Race to the Bottom and Pollution Haven, it may be possible to reject the theory on the basis of a lack of observable environmental degradation.

The next chapter will provide an explanation of the methods employed in this thesis in order to evaluate the ecological health in the Paso del Norte and relate that assessment to the impacts of trade liberalization.

Chapter 3

Environmental Assessment: Methods for Understanding

The methods used for environmental assessment and for assessing the relationship between trade and the environment have evolved and improved greatly over the past century. However, there is no generally accepted procedure for the assessment of links between macro-economic policy (i.e. trade liberalization) and environmental quality. I regard the recommendations of the Organization for Economic Cooperation and Development (OECD) and the Commission on Environmental Cooperation (CEC) as first steps in the development of commonly accepted methodologies that will lend the assessment process “effectiveness and legitimacy” (Markandya 2000, 101).

Within these pages, I will not only discuss recommended methods for assessing the relationship between trade liberalization and the environment that have been developed through the international cooperation of scholars, scientists, environmental protection professionals, and environmental activists, but I will also relate these methodologies to the approach used in this thesis. By combining strengths of different methodologies, I hope to overcome some of the shortcomings inherent in research on this topic.

I divide this chapter into sections based upon divergences in the environment-trade debate as discussed by Laura Strohm (2002), who identifies three fissures along which the pollution haven debate diverges: values, scope, and methodology. I extend these divergences to the overall debate over environment and trade relationships. These three points represent decision nodes in the research design process.

Values

While researchers rarely discuss values in assessments of environmental impacts of trade, they are nonetheless important. Values represent, or construct, the perspective from which a problem can be understood, and serve as the starting point for my discussion of methodology. Values play a significant role in the debate over the relationship between the environment and trade. Indeed, the OECD acknowledged that early in the Methodologies workshop all in attendance agreed that “no assessment is a purely technical exercise; there will always be an element of policy assumptions and value judgments. This was considered legitimate as long as these are transparent” (Tarasofsky 1999, p. 12) In order to ensure “transparency” of values in this thesis, I explain below the assumptions upon which my research is based.

My interest is in describing the environmental situation from the perspective of the environment—not the economy. This perspective is typically referred to as an ecocentric perspective. It holds that the environment holds intrinsic value outside of any value that humans ascribe to it (Snauwert 1996). Accordingly, I will not measure environmental quality by setting benchmarks, measuring its ability to assimilate pollution or applying any other standard of measurement established to serve anthropocentric goals. Instead, I intend only to observe trends in environmental change in the Paso del Norte without placing any human valuation on nature.

Some argue that trade liberalization may be the only method for reigning in some of the world’s largest polluters—countries whose environmental practices may only be checked by international law and governance strengthened by growth in international cooperation and trade. In employing an ecocentric approach, I assess the extent to which trade liberalization promotes the establishment of international standards for environmental protection which respect nature’s intrinsic value and seek the preservation of the global ecosystem in at least its current state.

It is from this ecocentric viewpoint that I draw the fundamental assumption related to value judgments on which this thesis is based. Less pollution, less deforestation, and a deceleration of global climate change are better than the alternatives, even if that means restriction of the supply of environmental capital for human consumption

The underlying ecocentric assumptions of this thesis provide a clear starting point for assessing global and local ecosystems largely neglected in economic decision-making. The values-based assumptions do not require a total revision of the various forms of inquiry used to investigate the impact of trade liberalization policies on the environment. Rather, they require strict application of “analytical framework[s] [that are commonly accepted as avenues for discovery, and] can be applied through various methodologies” (CEC 1999, 6).

Scope

The scope of this project is intended to allow for the analysis of the environment and trade relationship in the context of NAFTA, while remaining focused enough to allow the findings to address policy and governance issues at a regional level. However, this does not greatly limit the generalizability of the findings, as will be discussed below. There are three distinct components that this thesis is concerned with: geographic, temporal, and environmental.

Geographic Scope

The geographic scope of my research has two aspects: the actual geographic location chosen and the level of analysis that concerns this thesis. The Paso del Norte is the collective name for the sister cities of El Paso and Juarez that is sometimes extended northward to include the City of Las Cruces. In this thesis, I exclude Las Cruces because it is approximately forty-five miles northwest of the western border of the City of El Paso, and tall mountains with unpredictable winds stand between the two communities; this creates a natural barrier that dilutes

any environmental impacts from Las Cruces. Additionally, my interest is in isolating the ambient environmental conditions on the border between El Paso and Juarez. Where appropriate, I will discuss any impact that Las Cruces may have on the region, but its environmental situation will not be discussed in any detail.

The Paso del Norte is bordered by mountains to the north and west. Juarez lies to the south and spreads east. The satellite images in Appendices 1 and 2 demonstrate the united geography of the region and give a visual representation of the inter-connectedness of the sister cities. The two cities share common air, water (ground and surface), and the same ecological region, the Chihuahuan Desert. This common environment allows for flexibility in data retrieval, enabling me to circumvent the shortage of historical data for much of Mexico. The region also provides a community in which a common history, culture, and worldview (Brown 1997) provide a small-scale model for international cooperation.

The Paso del Norte region is, based on my own experience while living there, integrated socially, culturally, and economically. This history of integration pre-dates the NAFTA, the La Paz Agreement, and even the state of Texas (Brown 1997). The high level of integration and inter-dependence has flourished since the La Paz agreement and even more so since NAFTA. Thus, the region provides a unique lens through which to view the relationship between environmental quality and trade liberalization.

Temporal Scope

It is difficult to assess the environmental condition of a region over a short time period. For instance, if one limited assessment of the levels of ozone in the Paso del Norte to 1993-1995, one could come to the conclusion that NAFTA, which began in 1994, caused an increase in pollution that began with its anticipation. While this may appear to be an accurate statement, it

is actually misleading. In spite of a spike in levels of ozone, the overall trend of ozone levels surrounding NAFTA in the Paso del Norte has remained relatively consistently downward sloping, and for the most part below the average of the entire country.

The question then becomes, “How long is long enough?” Analyzing changes in air pollutants ten years prior to 1994, and ten years after 1994 provides a baseline for my analysis that demonstrates how the environment was changing before NAFTA (Tarasofsky 1999), and allows me to better judge how NAFTA has affected the environment in the region. In addition to focusing on this twenty-one year period, I will also discuss the findings in the CEC report on the North American Symposium on Understanding the Linkages Between Trade and the Environment in which Fredriksson and Millimet (2004) trace SO₂ emissions as far back as 1940.

Environmental Scope

The potential environmental scope of this study was constrained by the availability of historical data. There have been two major publications that prescribe methodologies for trade liberalization assessment, both published in 1999. I will begin with the OECD report on the workshop on methodology for environmental assessment of trade liberalization. The result of this workshop, attended by national and international trade officials, academics from around the world, environmental scientists, environmental activists, and economists, was a consensus “that more work on developing and improving data and methodologies is needed” (Tarasofsky 1999, 11). While the report did not suggest specific indicators to be used in environmental assessment, Richard Tarasofsky, the rapporteur for the OECD Methodology Workshop suggested that “it is important to find ways to link the macro and micro levels of analysis”(Tarasofsky 1999, 14). The sister cities in the Paso del Norte help to establish this link by allowing me to confine my

study to a definable geographic region that experiences the best and worst that NAFTA has to offer.

The second report on methodologies was the result of a much more involved multi-phase project conducted by the CEC. The resulting Analytic Framework for Assessing the Environmental Effects of the North American Free Trade Agreement provides the backbone for the methodology in this thesis. While I do not have the resources to complete every phase of their prescribed assessment, I have used it as a guide for my research. The report suggests that indicators should be chosen that provide a view of the pressures put upon the environment by trade liberalization and that will capture the “ambient environment of an entire ecosystem” (CEC 1999, 78). For air quality, the CEC suggests measuring a number of indicators; including criteria air pollutants and volatile organic compounds (VOC’s). For water, they suggest using measures of the quality of drinking water, uses of freshwater by source and sector, concentrations of lead and other surface water pollutants, fish capture rates, and sewage connection rates (CEC 1999). The land indicators include intensity of agricultural pesticide use, nitrogen from agricultural and livestock ranching activities, area of forested land (or other natural habitat), intensity of forest use, and recycling rates. The CEC’s fourth set of indicators is intended to measure bio-diversity, represented by the number of threatened or extinct species in the region, the number of wetlands, and the preservation of natural habitat.

Methodology

Strohm (2002), Clapp (2002), Cole and Ensign (2005), Antle and Heidebrink (1995), the CEC (1999), the OECD (1999), and the Texas Natural Resource Conservation Commission (2002), among numerous others, all cite a lack of data as a limiting factor to environmental assessment. My own experience gathering data for this thesis revealed serious inconsistencies in

the collection and/or reporting of environmental indicators. Furthermore, with the exception of air quality data, the availability of consistent time-series indicators that would provide a more comprehensive picture of environmental changes over the period under investigation was extremely limited.

Since data for most variables of environmental degradation were incomplete or unavailable, this thesis employs a combination of quantitative and qualitative methods in order to assess the environmental impact of NAFTA on the Paso del Norte. The quantitative methodology used is a form of quasi-experimentation called time series evaluation (Babbie 2004), while the qualitative aspect is closer to variable-oriented analysis of the environment in the Paso del Norte (Babbie 2004). In other words, I analyze the findings of published research regarding each variable in order to develop a better understanding of the environmental conditions and changes in the region since NAFTA. This reliance on secondary data limits my analysis to factors that have already been investigated by other academics, governmental agencies, and non-governmental organizations.

Air

The U.S. Environmental Protection Agency (EPA) has been collecting and archiving air quality monitoring data for long enough to provide a 21 year window surrounding NAFTA. This thesis focuses on six criteria air pollutants as primary indicators of environmental quality: Lead, PM10, Sulfur Dioxide, Carbon Monoxide Nitrogen Dioxide, and Ozone. The quantitative analysis focuses on data provided by the EPA through its AirData web driven database. The AirData web-interface database allows queries by geographic scale (in this case the city of El Paso), pollutant (in this case all criteria pollutants), and year. When queried, the database returns information on each monitoring station within the selected geographic scale. Part of this

information is an “annual summary arithmetic mean” for each pollutant monitored at each station. I sorted the queries by pollutant and then averaged these results by year, providing the aggregated data for El Paso. I followed the same process for the national criteria air pollutants. The significant difference is that I averaged the annual averages for all pollutants observed at stations in all states for each year. This quantitative analysis will be supplemented by a discussion of the 2004 North American Power Plant Air Emissions report drafted by the CEC, and reports from various local agencies and citizen groups.

Water

The EPA has long been monitoring water quality. I worked by email with personnel at the EPA and the Texas Natural Resource Commission in an attempt to get actual monitored water values for the time period under investigation in this thesis; but was unable to acquire the data. In fact, the EPA was unable to confirm whether or not they have water data going back to 1984. In light of the current unavailability of water quality data, this indicator will be discussed using reports from other researchers and agencies. However, water quality and availability is a topic that has been long debated in this arid desert region.

Land

Serious limitations in the availability of land data for the Paso del Norte prevent analysis of many variables. For instance, soil quality data are not widely available through any public agency. Therefore measuring the intensity of agricultural pesticide use and nitrogen from agricultural and livestock ranching activities over the time period needed to assess any impacts NAFTA may have had in the region is not possible. The area of natural habitat in the region will be discussed in the context of urban sprawl. Solid Waste in the region has been cited as the most serious detriment to the environment (Strohm 2002). However, agricultural and urbanization

impacts will also be considered in this section. Fortunately, fortunately, I have been able to identify research outside of the social science discipline that will allow me to provide a brief summary of the current and, in some cases, historical situation.

Biota

The El Paso-Juarez region is in the Chihuahuan Desert eco-region. While this eco-region is affected by habitat loss and deforestation immediately surrounding the Paso del Norte, gauging exactly how much development in the Paso del Norte contributes to species loss and deforestation in the entirety of the Chihuahuan Desert is not feasible. This complicates the analysis because data is not available for the Paso del Norte alone. Thus a direct picture of the environment in the Paso del Norte will be limited. However, observing changes in the other three main categories of variables (air, water, and land) should provide a general idea as to how the flora and fauna are faring in the region. For instance, indications of heavy metals in surface waters could indicate a loss, or threat of loss, of bio-diversity in the Rio Grande.

Furthermore, while there are no data available for population, rates of urbanization, or job growth for Ciudad Juarez, there are a number of researchers who have identified rapid population growth (attributed to internal migration) as a serious detriment to the environment and human health in the city (Frumkin, Hernandez-Avila et al. 1995; Coronado and Vargas 2001; Blackman, Blatz et al. 2003; Forster and Hamlyn 2005; Manley 2005). For Instance, Pena, Fuentes, and Forster (2005) identify the maquiladora industry (the result of trade liberalization efforts in the 1960's) as a driver of population growth and urban sprawl. They view the process of urbanization as a "negative sum game where gains of land in one sector are the losses of land in another." Following this logic, it becomes feasible to consider urbanization as a threat to bio-

diversity and discuss this topic within that context, as gains in urban development and industrial parks equate the loss of natural habitat.

Conclusion

This thesis follows the logic of established methods for observing changes over time, and uses indicators that are commonly accepted as indicators for environmental change to build a holistic picture of how the environment has changed since the adoption of NAFTA. The next chapter will discuss observed environmental changes and how they may be connected to NAFTA. It will also relate these changes to the environmental transition, pollution haven, and race to the bottom hypotheses presented in Chapter 2.

Chapter 4

The State of the Environment in the Paso del Norte

Following the assumption that less environmental degradation is better, this chapter seeks to identify the condition of the environment in the Paso del Norte prior to NAFTA and to assess its condition since NAFTA. Time series data is largely unavailable for the Paso del Norte as a whole; furthermore, much of the data that is available has been collected in ways that render it incompatible for comparison across the border. However, as previously discussed, the region's geographic features and U.S. Environmental Protection Agency (USEPA) air monitoring efforts allow for an analysis of air quality before and after NAFTA. Although comparable data are not available for water, land, and biota, the chapter begins with a discussion of these indicators in order to demonstrate the environmental conditions in the region and establish the complexity of the situation.

Water Quality

Assessments and reports of water quality in the Paso del Norte fall into two essential categories: water usage/availability and water pollution.

Water Usage and Availability

Schmandt, *et al.* point out that “the Paso del Norte is home to some of the fastest growing communities in the world” (1999, p. 14). This rapid population growth in an arid landscape places increasing stress on the environment—especially on water resources. The Paso del Norte sits over two aquifers: the Mesilla and Hueco (pronounced like Waco, TX.). The map in Appendix 2 shows these aquifers and their locations in relation to the cities of the Paso del Norte. The Hueco aquifer is 9,000 feet deep, and holds 9 million acre feet of freshwater and 3.4 million

acre feet of saline water. It recharges at a rate of 6,000 acre feet per year but is drained by 51,000 acre feet per year by El Paso and 115,000 acre feet per year by Juarez (Schmandt, Stolp, Ward *et al.* 1999). The second aquifer, the Mesilla, is 2,000 feet deep, contains 54 million acre feet of freshwater (560,000 in El Paso County), and recharges at a rate of 18,000 acre feet per year; it is drawn by 23,000 acre feet per year in Texas, and 107,000 acre feet per year by New Mexico. Juarez does not use the Mesilla aquifer due to poor ground water quality and distance from municipal centers (Schmandt, Stolp, Ward *et al.* 1999).

There are essentially two factors that plague these aquifers. The first is that consumption rates far outpace the rates of recharge (Wark, 1992). This is in no small part due to explosive population growth linked to the urbanization and industrialization of the Paso del Norte. (Frumkin, Hernandez-Avila *et al.* 1995; Simmons and Vinas 1996; Coronado and Vargas 2001; Blackman, Blatz *et al.* 2003; Forster and Hamlyn 2005; Manley 2005; Pena, Fuentes *et al.* 2005) The second issue is that the Hueco aquifer is recharging with increasing salinity levels in wells that experience “significant long-term drawdowns” (Schmandt, Stolp, Ward *et al.*, 1999, 26), causing some wells to go temporarily dry.

In response to diminishing supplies of water from the aquifers, the Rio Grande alluvium has been drilled for its source of ground water. However, research shows that this water is contaminated by heavy metals, arsenic, and other dissolved solids (Rios-Arana, Walsh and Gardea-Torresday 2003; Schmandt, Stolp, Ward *et al.* 1999). These are serious and seemingly unavoidable problems.

Essentially, the ground water in the region is drying up. To make things worse, the Hueco aquifer is a cone of depression³. In essence, it is fed by surface water from the Rio Grande and surrounding areas; draining the aquifers in the region will deplete the surface water as it is drawn into the diminishing aquifers. This will have an exceedingly detrimental effect on the eco-system of the region (Hunt 2004).

The question remains, however, how much of this effect is the result of NAFTA. Population growth in the region increased at approximately the same rate from 1950 until 1990, when there was an increase in population growth rates (Abel and Phillips 2000). It is likely that the increases in population growth rates were due to increased economic growth in Juarez, as the number of maquiladoras in Juarez grew from 240 to 290 by 1990, creating approximately 30,000 new jobs in the same period (EDCJ 2006). Unfortunately, water usage by sector data is unavailable for Ciudad Juarez, making it impossible to attribute increased use exclusively to either population growth or industrial expansion.

Additionally, the groundwater problem pre-dates NAFTA by at least a decade. As early as 1980, El Paso approached the state of New Mexico to request the right to drill water wells into the aquifer that supplies Las Cruces and the surrounding agricultural communities. When New Mexico declined the request, El Paso sued New Mexico, and the debate is ongoing (Bixby 1999). It is therefore quite likely that El Paso would have faced water problems without NAFTA; however, it is also undeniable that increased economic growth beginning in the early 1990's has significantly increased pressure on the Paso del Norte water system.

³ A cone of depression is a characteristic of the Rio Grande Basin. The surface water levels are dependent upon ground water levels. Decreasing ground water means that less water will remain on the surface.

The well documented link between urbanization/rapid population growth and trade liberalization (Frumkin, Hernandez-Avila et al. 1995; Simmons and Vinas 1996; Coronado and Vargas 2001; Blackman, Blatz et al. 2003; Forster and Hamlyn 2005; Manley 2005; Pena, Fuentes et al. 2005), confirms that international trade has impacted the region. Yet, given the agreements that pre-date NAFTA, such as the Braceros program and La Paz agreement, NAFTA alone cannot be held responsible for this growth. Instead, it is more likely that the region is experiencing a more integrated, self-perpetuating, growth situation in which growth in labor intensive, low wage industrial/services sector industries occurs amidst explosive growth in the urban population, which in turn causes increased economic activity, attracting additional low-wage industries seeking to minimize labor costs (Simcox 1993).

Continued economic growth, along with projections of population doubling by 2020 (Forster and Hamlyn 2005), indicates that the region is facing serious water usage and availability issues. Even estimates that consider technological advances in water conservation (indicated by decreases in per capita usage) indicate that these improvements will not be sufficient to preserve the aquifers for any length of time (Forster and Hamlyn 2005).

Water Pollution

The most intensive study of surface water in the Paso del Norte, published in 2003, indicates that the surface water in the region suffers from “numerous chemical pollutants that exceed federal, and/or state standards for aquatic or human health” (Rios-Arana, Walsh and Gardea-Torresday 2003, 957). These contaminants include cadmium, zinc, lead, nickel, copper, and arsenic, and can be found in both the water and sediment (Rios-Arana, Walsh and Gardea-Torresday 2003). The section of the Rio Grande between Juarez and El Paso is not safe for use as a recreational resource, and will not support much wildlife.

Furthermore, these surface water problems are exacerbated by untreated sewage flows into the river from Mexico. Raw sewage from Ciudad Juarez flows in an open canal for several miles before merging with river water diverted into irrigation canals. This contaminated water is then distributed to fertilize crops in the region (Schmandt, Stolp, Ward *et al.* 1999). The untreated sewage flows pose serious health risks for the human population, let alone the non-human population of the ecosystem. High levels of fecal coliform, dissolved oxygen, nitrates (which return to the river through a process of agricultural irrigation on both sides of the border), and salinity cause the one source of surface water for the Paso del Norte to be largely unusable for supporting life, human or otherwise (Rios-Arana, Walsh and Gardea-Torresday 2003).

While much of the degradation of water resources is due to mining, smelting, and agricultural processes which predate NAFTA, population increases are not only exacerbating the current water issues, but also introducing new issues such as significant increases in raw sewage in the region. (Abel and Phillips 2000; Bixby 1999; Brown 1997; CEC 1999; Forster and Hamlyn 2005; Lehman 2001; Rios-Arana, Walsh and Gardea-Torresday 2003; Schmandt, Stolp, Ward *et al.* 1999).

Fortunately, the NADBank and BECC are working in cooperation with Ciudad Juarez to improve wastewater treatment, and the city of El Paso is working on desalination plants so that the high salinity water in the Hueco basin can be used in some applications, as well as installing recharge wells that currently pump 23 acre feet per day back into the Hueco aquifer. Municipal demands for water are forcing the communities in the Paso del Norte to re-allocate water that was once reserved for agriculture for use by municipal sources. While this reduces the amount of agriculture in the region and thus levels of certain contaminants, it also reduces the recharge rates of the aquifers due to increased industrial and municipal consumption (Schmandt, Stolp et

al. 1999; Forster and Hamlyn 2005). It is unlikely that toxics like arsenic, lead, or zinc, among others will dissipate in the region especially since the river and aquifer are so intimately related. If the flow of the water in the Rio Grande slows or diminishes due to agricultural irrigation in the Paso del Norte, then some of the pollutants accumulated in its waters would be deposited in the in the region.

Such transient pollution makes it difficult to assess what the region would be like if NAFTA had never happened. More localized problems existed long before NAFTA. Consider, for example, the case of ASARCO, a copper smelting plant that was notorious for its emissions of lead, arsenic, and cadmium by the ton. ASARCO's 100 year history of high levels of these toxic emissions makes measurement of changes in toxicity levels in water and sediments difficult (Snell 2006).

While the environmental attention that NAFTA brought to the border may influence future toxic releases from plants like this one, current levels of these toxic emissions cannot be assigned to NAFTA, or, for that matter, to trade liberalization more generally. The institutions that NAFTA brought about are slow in their process of enacting environmental change. Perhaps another ten years will reveal changes that currently are not apparent or cannot yet be judged due to a lack of time-series data.

Land

Pena, Fuentes, and Forster (2005) suggest that the city of Juarez "grew in an unstructured pattern of urban sprawl between 1970 and 2000" (2005, p. 329); it grew from a population of ~567,000 in 1980 to almost 800,000 in 1990. This urban sprawl is contributing to the overall degradation of the Chihuahuan Desert, as lands that were inadequate for farming, and thus remained natural habitat, become part of the urban landscape of the region. As the satellite

picture in Appendix 3 indicates, Juarez has grown along the southern side of the mountain to its west. In the mid 1990's that side of the mountain was still natural habitat.

Urban sprawl is not the only factor affecting the surface environment in the Paso del Norte. The region is burdened with contaminants from mining, smelting, and agricultural activities, as well as solid and hazardous waste (Blackman and Palma 2002; Clapp 2002; Pena Fuentes and Forster 2005; Strohm 2002). However, it appears that agriculture and mining are being displaced by urban sprawl, and that this will gradually improve soil conditions over time. Unfortunately, the conditions that are conducive to environmental improvement can quickly be cancelled out by increases in solid and hazardous waste disposal. The border region suffers from a high incidence of illegal dumping of hazardous wastes, directly into the Rio Grande, onto the soil in the rural areas surrounding Juarez, and in existing landfills (Frumkin, Hernandez-Avila and Torres 1995). These toxic releases pose a serious threat to the ecosystem and biodiversity in the area surrounding the Paso del Norte and downstream on the Rio Grande.

The extremely limited availability of historic data on both legal and illegal hazardous waste dumps and other toxic releases makes it difficult to assess how NAFTA has affected soil quality in the Paso del Norte. However, once again, the rapid population growth and increase in economic activity experienced in the first decade of NAFTA will only exacerbate existing problems with solid and human waste. The persistence of these problems suggests that waste management in the Paso del Norte will become one of the top policy priorities in NAFTA's second decade.

Biota

The CEC recommends measuring bio-diversity, or levels of biota, by the number of threatened or extinct species in the region, the number of wetlands, and the preservation of

natural habitat. However, data for these variables are unavailable for the Paso del Norte. The Paso del Norte is an arid desert region with one source of surface water: the Rio Grande. As the analysis of water conditions in the region would suggest, the only wetland in the Paso del Norte is plagued by severe changes in flow due to seasonal use by agricultural activities and storage in upstream dams. These factors cause it to become a subsurface river between the two cities at certain times of the year (Rios-Arana, Walsh and Gardea-Torresday 2003). These conditions combine to create an environment within which bio-diversity is endangered.

According to the World Wildlife Fund, which has compiled a database of species of fauna sorted by eco-region, the Chihuahuan Desert eco-region is home to over 650 species of animals. Of those species, 115 are considered lower risk, 17 are vulnerable, 12 are near threatened, 3 are endangered, and 1 is critical. This represents the entirety of the Chihuahuan Desert, which spans a large portion of the southwest U.S. and northern Mexico (WWF 2006). While these figures provide a perspective into the bio-diversity of the region, they lack two important components. First, the WWF Wildfinder database does not list species that have already gone extinct in the region or how long the species have been in each risk category, and second, there is no way of telling which of these species was indigenous to the basin in which El Paso-Juarez sits (WWF 2006). However, these omissions notwithstanding, the data suggest that there are likely a number of species in the Paso Del Norte categorized as being at some degree of risk.

There are many factors that contribute to bio-diversity loss in the Paso del Norte. The persistence of these factors throughout the last century makes it difficult to assess how much of an effect NAFTA has had on bio-diversity. Nonetheless, the increased population in the region has resulted in a loss of habitat to support bio-diversity in the region.

Air Quality

As the previous discussion suggests, the Paso del Norte suffers from many environmental problems that existed well before the passage of NAFTA. While the rapid population growth and urban sprawl that often accompany trade liberalization certainly exacerbate degradation of water, land, and biota, data are not available to establish strong links with NAFTA. Because the USEPA has been closely monitoring air quality in the region for decades, far more data is available.

The Paso del Norte is ringed with mountains, which creates a common air basin (Stern 2001). There have been improvements in policy coordination among the jurisdictions in the area since the La Paz agreement in 1984, which established mechanisms for international environmental cooperation along the U.S.-Mexico border. In fact, USEPA data indicate that the U.S.-Mexico border has actually outperformed aggregate air quality indicators for the U.S. since the 1950's, demonstrating that environmental conditions have been improving in the region since long before NAFTA (Fredriksson and Millimet 2004). However, the City of El Paso is still an EPA non-attainment zone for Particulate Matter and Carbon Monoxide (Nuñez and Forster 2005), and many air quality problems persist.

In 1992, the ASARCO smelting plant expanded its operations, and in spite of its promises to “install top-drawer pollution-control technology” the plant still emits 100 times the cadmium, five times the lead, twice the arsenic, and three times the sulfur dioxide as a similar plant expanded in Galveston, TX the same year (Snell 2006, 48). As recently as 2001, the Juarez brick manufacturing industry was cited as one of the worst sources of pollution in the region. This was despite efforts taken by the Paso del Norte Air Quality task force⁴ that resulted in 80% of the

⁴ The Paso del Norte Air Quality Task force is a group of citizens that joined forces in 1993 to lobby for improvements in air quality in the region. Their successes include the development of the International Air Quality

brick-makers switching to natural gas and sawdust as cleaner and more efficient alternatives to old tires to fuel their kilns, leaving 80 brick-making facilities in Juarez still using higher polluting and toxic fuels. While these brick-making enterprises pre-date NAFTA, they offer a glimpse into the importance of efforts to control air pollution (Liverman, Varady et al. 1999; Stern 2001).

Through an extensive study of the region, Blackman, Blatz, and Evans (2003) determined that emissions in the Paso del Norte range across a typical spectrum for a modern city. The sources that are responsible for the largest portion of air pollutants in the Paso del Norte, ranked in order by total emissions, are transportation (88%), unpaved roads (5%), services (4%), wind (2%) and industry (1%). The criteria air pollutants are Particulate Matter 10 (PM10), Carbon Monoxide (CO), and Sulfur Dioxide (SO₂), Ozone (O₃), Nitrogen Dioxide (NO₂), and Lead (Pb).

PM10 emissions from unpaved roads (65%) and wind (31%) skew the aggregated results above due to the high percentage of emissions in one category. CO and NO₂ are primarily emitted by the transportation sector (99%, and 92% respectively), followed far behind by industrial emissions (5% for NO₂) (Blackman, Blatz and Evans 2003). The CEC found that 55% of all Sulfur Dioxide (SO₂) emissions in Mexico, and 69% in the United States are the result of electrical generation (Miller and Atten 2004). They suggest the lower rates in Mexico are due to less reliance on coal-powered generation plants and greater reliance upon oil and natural gas to produce electricity, a balance that could change with fluctuations in oil and gas prices.

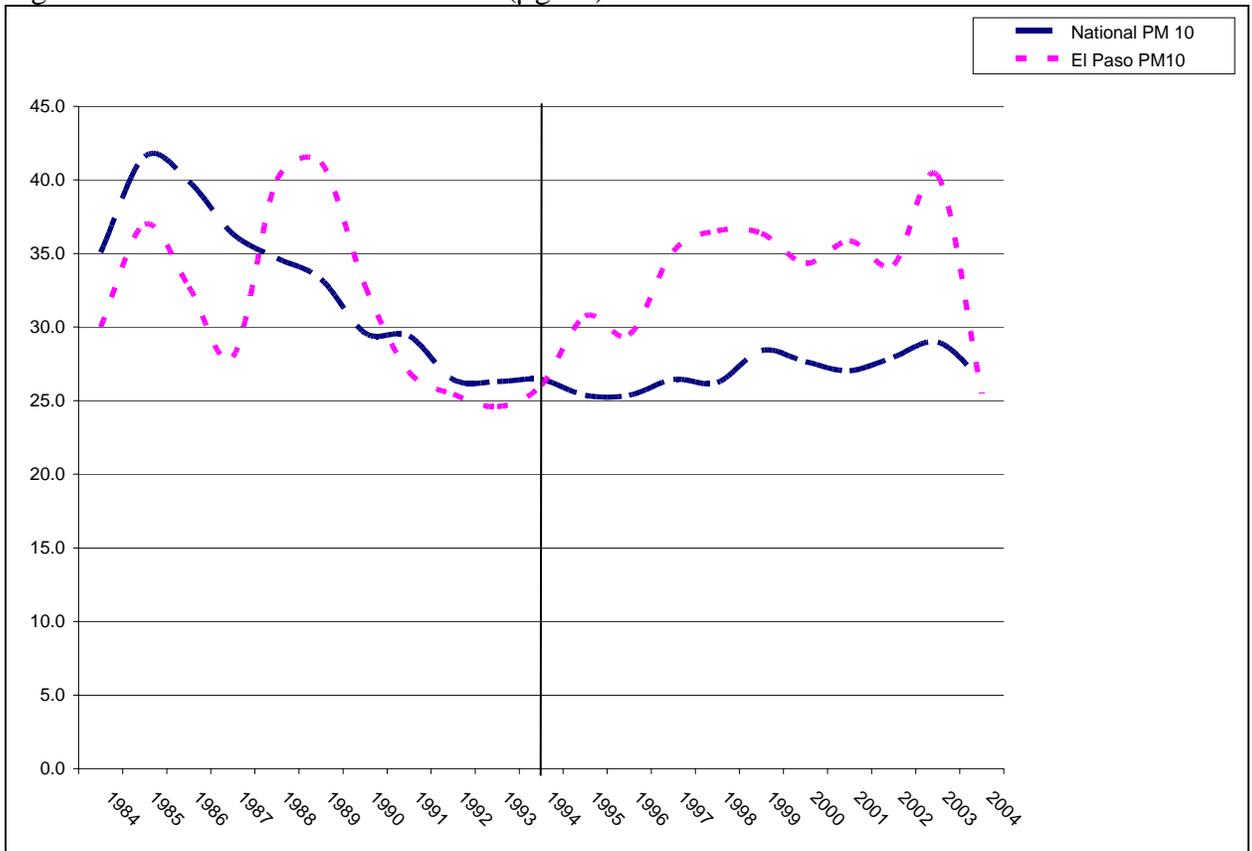
Particulate Matter 10

Particulate Matters (PM10 and PM2.5) are the most challenging air pollutant to address in the Paso del Norte, because the primary contributors to high levels of this pollutant are wind,

Management District that covers the entire Paso del Norte, and a very successful program to inform the wives of brick-makers of the risks that the air pollution posed to them and their children.

and unpaved roads. Wind, of course, is a force of nature, and as such cannot be effectively regulated and controlled; however, given the climate and geography of the region, wind plays a large role in air quality. Additionally, particulate matter can originate from both point and non-point sources, such as quarries, cement factories, power plants, and vehicular traffic (combustion emissions and surface dust) (EPA 2006). These pollutants, although at times composed of little more than desert sand and dust, pose serious human health risks and are also the most difficult to regulate in the region. However, recent efforts to implement strategies for sustainable development in the region have resulted in projects such as the one that grinds up tires from a huge abandoned tire dump in Juarez for use as supplemental paving material, thus reducing two forms of pollution at once: PM10 from unpaved roads, and the soil and water pollution risks posed by the abandoned tire dump (EPA 2006; EPA 2007). I was unable to determine how much of the rubber had been used for paving of roads, but a total of ~4,500,000 tires have been removed from the dump, which represents 16% of its original size. The potential for this project to improve air quality conditions in the Paso del Norte is significant because it is estimated that 75% of the Paso del Norte's Pm10 emissions are from Juarez, and the primary contributor to these emissions in Juarez is unpaved roads(Rincon, Anderson et al. 2005). While the EPA currently monitors PM10 and PM2.5, data for PM2.5 were not available before 1999, making it inadequate for analysis in this thesis. However, figure 1 demonstrates the trend in PM10 levels in El Paso for the period between 1984 and 2004.

Figure 1: Particulate Matter 10 Levels ($\mu\text{g}/\text{m}^3$)



Source: U.S. EPA AIRData (El Paso data was unavailable for 1984. The value of 30 was inserted as a placeholder for the graph. This value does not represent any valid entry for the data and is meant only as a starting point for the graph).

Figure 1 illustrates a possible relationship between trade and the environment, and may provide support for the pollution haven theory. First, note that there is an increase in PM10 levels after NAFTA. The fact that the nation as a whole did not experience a similar increase suggests that NAFTA-stimulated activities that focus effects on the border, such as increased vehicular traffic carrying workers, goods, and consumers across borders, increased wait times to navigate customs, and urbanization, led to an increase in PM10 emissions in El Paso.

While the increase PM10 levels may be attributable to urban sprawl and the related increase in commute times on both sides of the border, there is no doubt that NAFTA has greatly increased commercial traffic in the region and that commercial traffic contributes substantially to

the increase in airborne pollutants in the region. Additionally, there is evidence that the population growth and urban sprawl itself is likely to be due in part to NAFTA (EPA 2006).

Traffic counts indicate that there are approximately 3 million vehicular trips per day within a 5 Km² grid of the Juarez/El Paso border. With about 60% of the private/commuter vehicles being older models without emissions controls, and only 10 to 15% of vehicular traffic in Juarez meeting U.S. emissions standards, the potential for air pollution increases as a result of NAFTA related activity (and related traffic) seems to be an a reasonable explanation (Applegate, Cray et al. 1988; Simmons and Vinas 1996). Additionally, commercial cross-border traffic has increased by 170% since NAFTA (Schneider 2000; Gilyard 2002). This increase represents 86% of cross-border cargo moving by truck (Schneider 2000). Some trucks will cross the border multiple times per day (Battelle 2002), running between maquiladoras on the Mexican side of the border and the component supply/finished product distribution sites on the U.S. side of the border

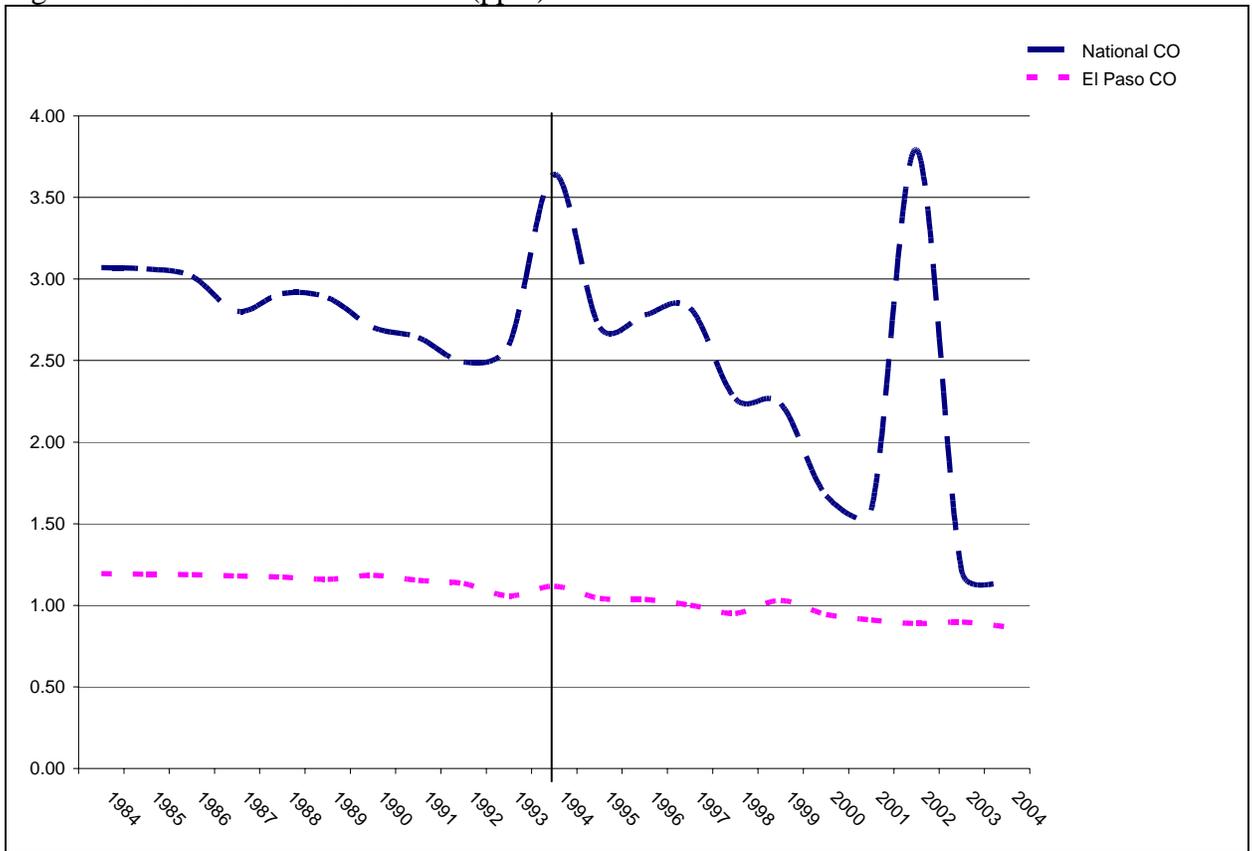
The significant decrease in PM₁₀ levels for 2004 may be due to the fact that there were significantly fewer observations available for the year, an inconsistency that could have resulted in an inaccurate measurement of levels due to the possible exclusion of sites located closer to point sources. For instance, Garcia, *et al.* (2004) found that PM in the Paso del Norte were primarily inorganic and included both fugitive dust from the surrounding desert and unpaved roads and also anthropogenic emissions. The anthropogenic emissions included trace minerals that were concentrated more heavily around the two copper Smelters in the region. Since not all air monitoring sites were included for 2004, evaluation of the reported variable as a sharp decline in ozone levels is not possible. However, the value is included for the sake of temporal and visual consistency between the charts.

Carbon Monoxide

The second criteria pollutant addressed is Carbon Monoxide (CO). CO results when the carbon in fuel is not burned off. Vehicular and other exhaust gasses from internal combustion engines account for 79% of all CO emissions in the U.S. The EPA estimates that 85-95% of all CO emissions in cities are the result of vehicular exhaust. Figure 2 demonstrates how CO levels have changed over the 21 year surrounding NAFTA. As the graph indicates, the U.S experienced considerably more substantial peaks than the Paso del Norte region did. The CO levels in the Pas del Norte have declined consistently, with only a very slight increase 1982 and another in 1998.

In contrast to the data for PM10, the CO data do not offer any support for environmental degradation—or carrying capacity-based—theories. Additionally, while CO levels exhibit a minimal increase immediately following the passage of NAFTA, the data likewise do not support the Environmental Transition theory, since the general trend of emissions is essentially the same before and after the enactment of NAFTA.

Figure 2: Carbon Monoxide Levels (ppm)



Source: U.S. EPA AIRData

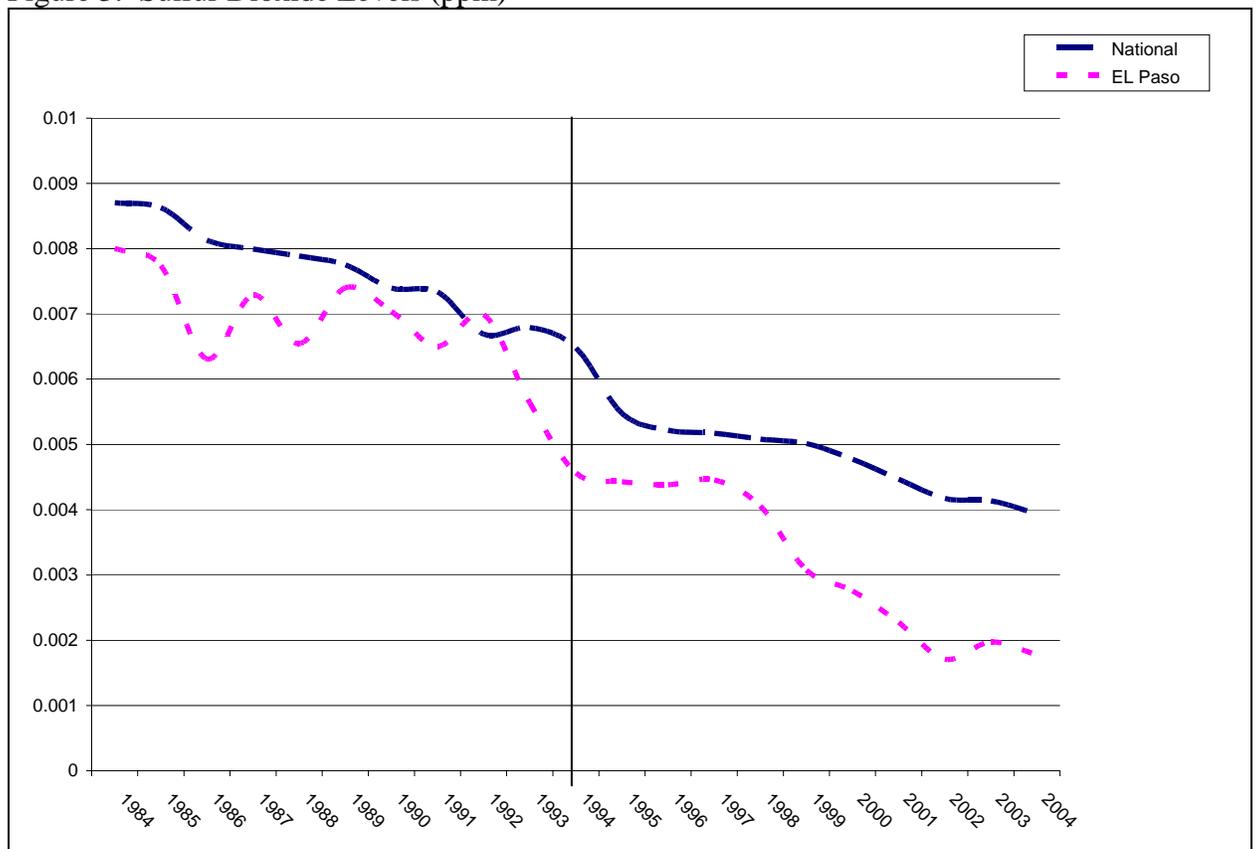
Sulfur Dioxide

Sulfur Dioxide pollution is primarily caused by the burning of coal and oil for electric power generation and industrial manufacturing processes that process raw materials like metal ore, coal, or crude oil (EPA 2007). Fredricksson and Millimet (2004) were able to trace long-run historical averages for Sulfur Dioxide (SO₂). They also separated the data by interior U.S. and U.S-Mexico Border States. While their results capture influences from regions like San Diego and Nogales rather than from the Paso del Norte exclusively, they provide an excellent baseline for comparison of historical air pollution levels along the border. The pattern for per capita SO₂ emissions in the region has been that of a general decline since peaking in the 1940's. The trend exhibits another peak in the late sixties to early seventies. These peaks, however, coincide with

peaks in the interior states and the Canadian border. More recently, the SO₂ levels have continued to decline in the Paso del Norte, as shown in Figure 3. Once again, the Paso del Norte has outperformed the U.S. in restricting SO₂ emissions in every year except 1992. The SO₂ declined more rapidly in the years immediately preceding NAFTA, and then essentially leveled off until 1997, when it began to decline again.

The pattern of SO₂ emissions again counters environmental degradation theories. Instead, the data offer evidence for the Environmental Transition theory, in that the graph demonstrates a leveling off immediately following NAFTA, breaking a fairly consistent pattern of decline. In keeping with the latter theory, the decline in SO₂ levels resumes in ~1998.

Figure 3: Sulfur Dioxide Levels (ppm)



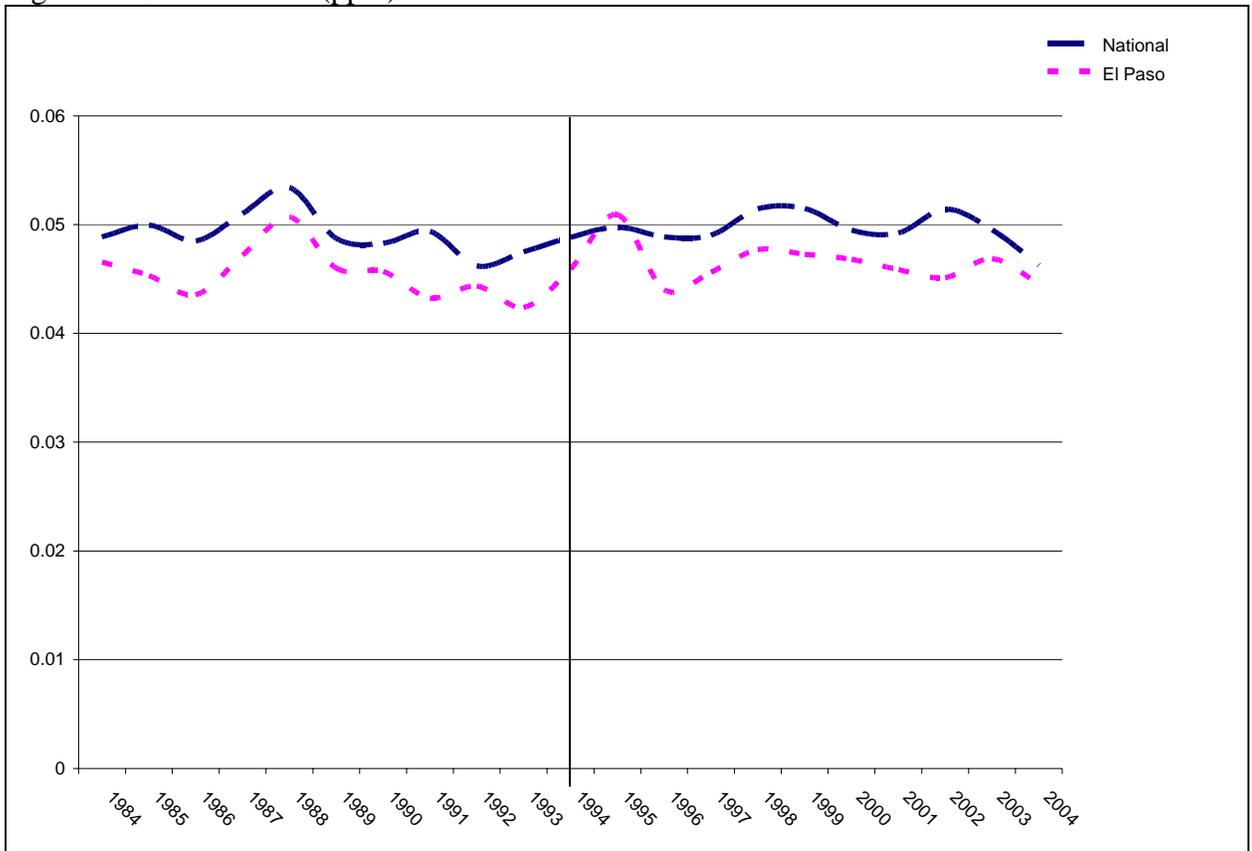
Source: U.S. EPA AIRData

Ozone

Ozone (O₃) is not a pollutant that is typically emitted directly into the air, instead it is formed at ground level by a process in which sunlight, Nitrogen Oxides, and Volatile Organic Compounds interact. The primary causes of ground-level Ozone are emissions from motor vehicle exhaust, industrial processes, gasoline vapors, and chemical solvents (EPA 2007). The Paso Del Norte is particularly prone to the harmful buildup of O₃ due to its warm weather, length of daytime hours, and geographic situation.

Ozone levels, as shown in Figure 4, peaked twice in the period graphed: 1987 and 1994. The first peak is paralleled by a national peak and pre-dated NAFTA. The second peak may be attributed to increased traffic in the region that resulted from NAFTA (Bowman 2003; TDOT 2006). Unfortunately, the region has not experienced any real improvements in O₃ levels over the period under investigation in this thesis. While there have been fluctuations, including the increase that occurred just before the implementation of NAFTA, the trend that this particular pollutant has followed has been generally flat. In short, the trend offers no evidence of a Race to the Bottom or Pollution Haven related to NAFTA. Additionally, although there is a peak in O₃ levels immediately following NAFTA, the trend over subsequent years does not appear to support the Environmental Transition theory, as increase slightly and then remain relatively constant.

Figure 4: Ozone Levels (ppm)



Source: U.S. EPA AIRData

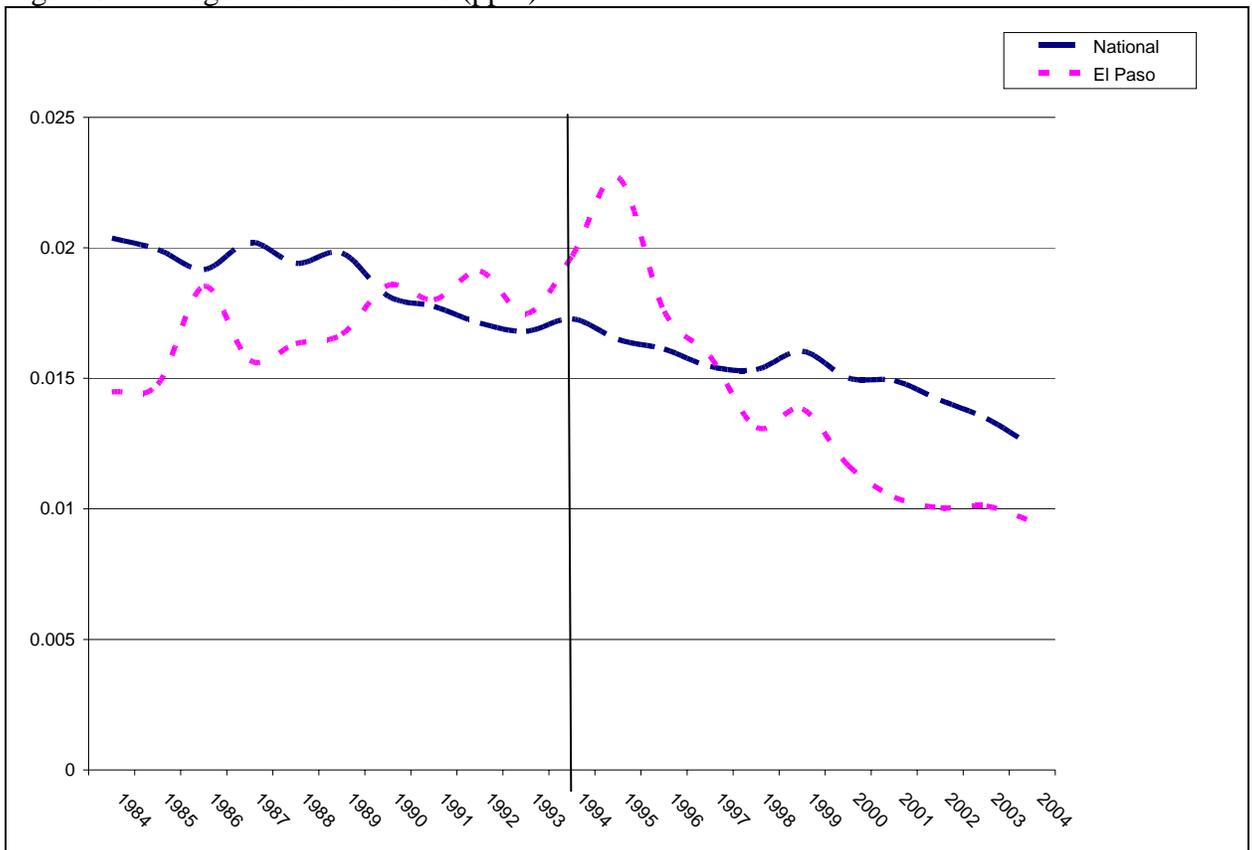
Nitrogen Dioxide

Nitrogen Dioxide (NO₂) exhibits a more pronounced environmental transition than any of the other variables. Nitrogen Dioxide (NO₂) is emitted in combustion processes, including motor vehicles, kiln-fires, electric power generation, and other sources, both residential and industrial, that burn fuel in the region (EPA 2007). As Figure 5 demonstrates, NO₂ in the region has declined considerably after a significant jump in 1995, which indicates that NAFTA may have had a short-term negative effect on pollution. By 2000, the NO₂ levels had dropped to the lowest value observed in this time-series, and have held steady or continued to decline despite increases in population growth. This pattern is most likely related to improvements in air quality

regulations in the region, enforcement, and public awareness that will be discussed in the next chapter.

Unfortunately, vehicular traffic, both private and commercial, poses a threat to the continuation of this downward trend in emissions levels. The El Paso Metropolitan Planning Organization counted approximately 200,000 vehicles registered in El Paso and another 360,000 vehicles registered in Juarez, estimating an average of 40,000 vehicles crossing the border in the center of the city per day (Nunez and Forster 2005). The vehicles in Juarez tend to be older and produce more emissions than those in the U.S. (Simmons and Vinas 1996). As early as 1996 vehicles waiting to cross the border were cited as the primary cause of the Paso Del Norte's air pollution.

Figure 5: Nitrogen Dioxide Levels (ppm)



Source: U.S. EPA AIRData

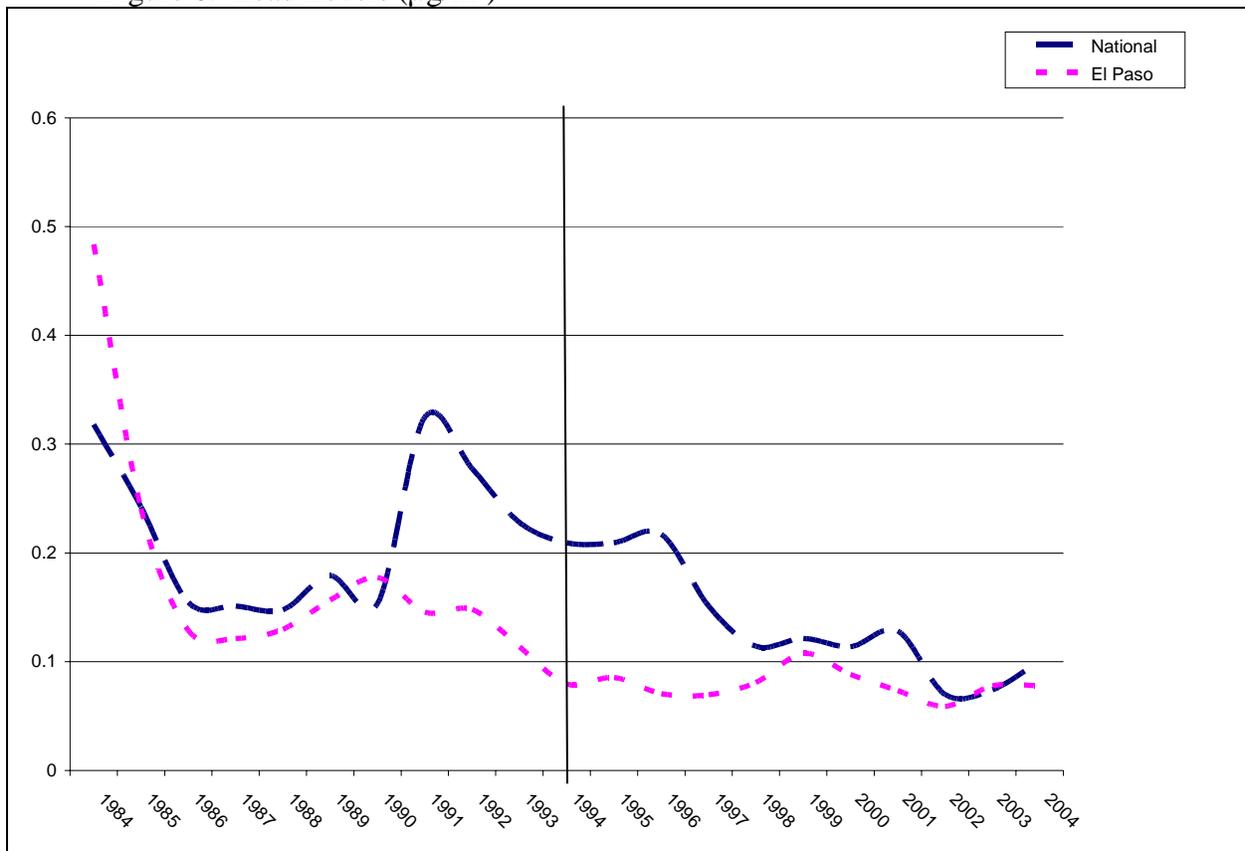
Lead

The final pollutant examined was lead. According to the EPA (2007), the primary sources of lead in the environment, other than those naturally occurring, are vehicular emissions and industrial operations.

In 1887, Robert S. Towne founded the El Paso Lead Smelter. In 1899, the lead smelter became part of the American Smelting and Refining Company (ASARCO) and continued to smelter lead until 1985 (ASARCO 2007). The El Paso ASARCO plant, which was placed on care and maintenance status in 1999 (ASARCO 2007), has a history of emitting lead in large quantities (Snell 2006). However, there is no way to confidently identify a point-source for lead contaminants in the region, especially considering that Juarez still maintains usage of leaded gasoline (Garcia, Li et al. 2004).

In spite of the inability to identify the source, and thus a definitive link between NAFTA and lead pollution, it is possible to discuss the trends that have preceded and followed NAFTA. The dramatic drop in lead levels, both in the Paso del Norte and the U.S., between 1984 and 1987, suggests that it was national policy that affected this pollutant more than international trade. However, as Figure 6 demonstrates, from 1990 until ~1997, the two trend lines diverged, with Lead emissions substantially lower in the Paso del Norte. Subsequently, Lead levels in the Paso del Norte increased, while national levels decreased, to a point at which the lines converge between 2002 and 2003. While the pattern of Lead emissions is not consistent, the Paso del Norte levels have for the most part remained at or below U.S. aggregate levels since 1990, indicating that NAFTA did not exacerbate lead emissions, and once again suggesting that environmental degradation theories are inaccurate descriptions for the environmental situation in the region.

Figure 6: Lead Levels ($\mu\text{g}/\text{m}^3$)



Source: U.S. EPA AIRData

Conclusion

The air quality indicators, along with the other environmental factors, suggest that trade liberalization has undoubtedly had an impact on the environment in the Paso del Norte. However, it cannot be said that there has been a race to the bottom in which the environment suffers as environmental policies, procedures, and enforcement converge into the lowest common denominator. First, the environmental problems in the region predate NAFTA by decades. Second, so many aspects of both economic development and nature itself (e.g. the wind) affect the region, it is impossible to determine whether any negative environmental changes are causally linked to NAFTA or simply the result of economic growth more generally. And, third, the data series for five of the six air quality indicators illustrate no significant change

in emissions that can be linked to NAFTA. In short, my analysis suggests that environmental degradation models such as the Race to the Bottom and Pollution Haven theories do not accurately describe NAFTA's environmental impact on the Paso del Norte.

The increasing levels of PM10, as well as the short-run peaks in other air pollutants, can be linked to private and commercial vehicular traffic. It may be that NAFTA policies, while attending to many potential impacts, did not sufficiently address issues of urban infrastructure and traffic congestion. However, it is equally likely that these problems are the result of non-trade related urban growth, considering that many of the pollution problems witnessed in the region are also visible in other desert cities of the U.S. Southwest.

Chapter 5: Environmental Governance

As Chapter 4 suggests, the environmental conditions in the Paso del Norte have almost certainly been impacted by NAFTA and preceding agreements. However, the overall impact does not appear to have been negative, as many opponents of NAFTA predicted. Although some researchers attribute the population growth and related urbanization in the region to job growth in the maquiladora industry, and this growth to NAFTA, making a direct causal link between any negative environmental changes and NAFTA is not possible. This leaves open the possibility that any negative effects of NAFTA in the Paso del Norte were either mitigated or masked by environmental cooperation accompanying previous trade liberalization efforts or through policy and governance relating to NAFTA and its side agreements. Of course, the possibility also exists that conditions in the region would have worsened due to population growth and urbanization without the impact of NAFTA and its side agreements.

At the same time, the data do not provide strong support for the Environmental Transition theory, which predicts a brief period of environmental degradation followed by improvement. Only two of the six indicators follow this pattern. With the exception of PM10 emissions, which have worsened, the remaining indicators show no improvement following NAFTA.

The data may indicate that trade liberalization regimes, such as NAFTA, may only be effective at improving environmental conditions if they are matched with equally strong environmental policies and governance. Growth in demand for a cleaner environment is not a guarantee that the relationship identified by the Environmental Transition theory is inevitable (Antle and Heidebrink 1995), and it “should not be taken as justification for complacency about environmental problems...” (Antle and Heidebrink 1995, 620). Indeed, Grossman and Krueger

warn that greater prosperity prompts citizens to demand that more attention be paid to non-economic aspects of their living conditions and that an “induced policy response” is necessary to meet these demands (1995, 372). They cite an Organization for Economic Cooperation and Development publication, *The State of the Environment Report* (1991), which finds that “the strongest link between income and pollution in fact is via an induced policy response” (Grossman and Krueger 1995, 372). The role of policy and governance in the Paso del Norte is the focus of this chapter.

Sustainable Development and Governance

Any discussion of contemporary environmental governance in North America should begin with an explanation of sustainable development. Sustainable development is a theory of economic development in which the environmental capital stock remains constant or rises over time (Cooper and Vargas 2004). In essence, this means that the air quality, land quality, water quality, and levels of biodiversity of a region remain static or improve over time (Todaro and Smith 2002). While this is an accurate description of the common understanding of sustainable development, it does not capture the intricacies of sustainable development in practice. There are at least two different forms of sustainable development: strong and weak.

Strong sustainable development means that there is a real policy and practice commitment to preserving the environmental stock independent of human-made forms of capital, while weak sustainable development indicates a situation in which the policies and practices reflect a commitment to preserve combined assets of environmental and human made capital supplementing the shortages in natural stock with human-made capital (Wackernagel, Monfreda et al. 2004). Simply put, strong sustainability begins from the assumption that natural capital is finite and irreplaceable, while weak sustainability assumes that human technology can be used to

substitute for lost environmental stock. For the purpose of this thesis, and in keeping with the value judgment that less environmental degradation is better, I use the term sustainable development in the “strong” context.

If sustainability is the goal, then governance must be the means. Although the notion of incorporating mechanisms for trade restrictions into a trade liberalization agreement may sound counter-intuitive, it is, in reality, a logical solution to a growing problem. For instance, Edith Brown Weiss observed that “the resolution of environment and trade issues requires a framework in which environmental concerns are given billing comparable to those of trade, and both are viewed in the integrating context of environmentally sustainable development and economic growth.” (Weiss 1992, 728)

The Paso del Norte and Governance

Environmental governance for the Paso Del Norte has been a challenge due to its multiple enforcement authorities and historical lack of data collection. However, three NAFTA-related institutions have played a primary role in the Paso del Norte: the CEC, the NADBank, and the BECC. In addition, JACIAQ has experienced significant success in helping to alleviate environmental degradation in the region. Their activities in transportation issues have allowed them to focus attention on the environmental impact of this sector since NAFTA.

The CEC

As part of the CEC’s NAFTA Effects Project, a review of the environmental potential for NAFTA institutions was conducted in 1997. This study concluded that “NAFTA’s institutions will play an important role in determining the environmental impact of the NAFTA regime in the future and in strengthening the ways its effects might be rendered more beneficial” (CEC 1997,

15). This report also indicated that by 1997 the majority of NAFTA institutions with environmental responsibilities had been acting on their environmental mandates.

While the CEC was given no enforcement authority, it has the authority (if a citizen submission meets a number of requirements) to request a response from a party to the treaty that is not adequately enforcing environmental regulations. Furthermore, depending on the decision of the CEC council, the CEC secretariat may also prepare a factual record of the incident(s). If the council so decides, this factual record can then be made public (State 1993). Considering that the CEC Council is comprised of cabinet-level representatives of each country, this puts significant authority in the hands of the environmental officials of the countries under scrutiny. However, the council may authorize the Secretariat to prepare a factual record, and elect to make the record public only with a 2/3 vote, indicating that the council representatives serve as watchdogs on each other.

Beyond the citizen submission aspect, the CEC serves the function of interpreting and implementing the NAAEC, serving as a forum for discussion of environmental matters, and developing recommendations regarding numerous aspects of the environment/trade relationship, including methods for pollution prevention and techniques and methodologies for data gathering and analysis. Thus, the CEC has a wide range of responsibilities and only limited authority with which to achieve the expectations placed upon it.

Although the CEC mandate was vague and provided no enforcement authority, the CEC has played a significant role in environmental governance in the Paso del Norte. The 2005-2006 Report of the Executive Director (2006) demonstrates a continued commitment to protecting environmental quality by the CEC. For instance, working with Mexican officials, the CEC has facilitated the publication of the first *Registro de Emisiones y Transferencia de Contaminantes*

(RETC), which is an assessment of transfers and releases of toxic materials in Mexico and sets the stage for a comprehensive, continent-wide assessment of releases and transfers of toxic chemicals.

Additionally, in the same fiscal year (June 2005-June 2006), the CEC reported that it had other significant successes in environmental improvements, including reporting on the impact of the environment on the health of children in North America. Through its competitive supply chain initiative, the CEC helped to reduce energy and materials consumption and led to a savings of nearly \$1 million (U.S.) by four multinational corporations and 28 medium to small size suppliers in Mexico. The CEC has expanded the North American Environmental Atlas, made progress in the implementation of its Strategic Plan for the Conservation of Biodiversity, enjoyed continued success in its Sound Management of Chemicals initiative (SMOC), and published the 11th factual record while developing four others and reviewing 11 citizen submissions (CEC 2006).

Despite being created by an international agreement with no weight of the law behind it, and despite its multinational constituency, the CEC has asserted authority and worked to improve environmental conditions in North America. Without the CEC, the environmental conditions in the Paso del Norte may have been impacted much differently by trade liberalization.

The BECC and NADBank

Like the CEC, the BECC and NADBank experienced challenges with expectations and outcomes. The sibling organizations promised to be the vanguards of sustainable development and possibly to improve the collection of environmental indicators in the Paso del Norte. A partner of the North American Development Bank (NADBank), the BECC helps U.S. and Mexican “border states and communities coordinate, design and mobilize financing for

environmental infrastructure projects, and to certify projects for financing, while the NADBank evaluates the feasibility of projects certified by the BECC, and provides financing as appropriate” (Tiemann 2000).

The 1994 Congressional Research Service (CRS) report indicated a need for “approximately \$8 billion over the next decade just to address needs for drinking water, sewage treatment, and solid waste infrastructure projects along the border” (Fletcher and Tiemann 1994, p. 11). The 2000 update to the report noted that the Border Environmental Cooperation Commission (BECC) “had certified 33 wastewater, water supply and solid waste projects” (Tiemann 2000, 4). By 2004, the NADBank had authorized \$662.4 million in grants and loans “to partially finance 80 infrastructure projects estimated to cost a total of 2.26 billion” (Tiemann 2004, p. 4). However, the CRS notes that the NADBank had only fully disbursed nine loans and that the USEPA provided most infrastructure funding for NADBank projects due to their low activity levels. In light of this development, there have been calls on both sides of the border to dissolve the NADBank. In fact, members of the House of Representatives from border states issued a letter to John Snow, the U.S. Secretary of Treasury and a member of the Board of the NADBank, criticizing the Treasury Department for conducting secret negotiations with members of the Mexican government over the dissolution of the NADBank without congressional consultation (Ortiz, Hinojosa et al. 2006).

The representatives criticized John Snow for the two-year period in which the Board did not meet, citing this as a failure of the organization to adhere to its charter and suggesting that this “prevented the distribution of \$80 million dollars in below market rate loans” (Ortiz, Hinojosa et al. 2006). While the representatives criticized Snow over these two points, they argued against the dissolution of the NADBank, citing changes made through congressional

legislation that was intended to enable increased funding activity by the NADBank, and finally urging Snow to change his department's focus from dissolution of the NADBank to improving it.

Initially, the NADBank only had authorization to provide loans at current commercial loan market-rates. These rates prevented lower-income communities along the border from seeking assistance through the program. The NADBank is now authorized to make more grants and to set interest rates on these grants below the current market rates for commercial loans. It is encouraged to continue focusing on infrastructure improvements and water conservation, and to finance projects in support of clean energy and energy conservation (Tiemann 2004). These initiatives may improve environmental conditions in the Paso del Norte.

The JACIAQ

The Joint Advisory Committee for the Improvement of Air Quality (JACIAQ): Paso del Norte is responsible to the Texas Air Control Board (TACB). While the other organizations in the region have met with successes in preventing and mitigating environmental degradation, it is the JACIAQ that has the most impressive track record in the Paso del Norte. These efforts are the result of a binational, local approach to environmental management. The Paso del Norte's role as a major port of entry between a more and a less developed country means that the environmental issues faced in the region may be best addressed at the local level rather than federal (JACIAQ 2007).

The successes of this regional approach to environmental quality include projects and recommendations that have been implemented with great success. First, the JACIAQ recommended that Juarez begin distributing seasonally appropriate gasoline to help reduce vehicular emissions; this measure was implemented in 1997. Additionally, the JACIAQ has developed an Air Pollution Research Information Clearinghouse that serves as a research library

for publications and organizations that are involved with air quality. The JACIAQ has also developed an air quality plan in cooperation with officials in Juarez, Mexico that is aimed at reducing emissions in the Paso del Norte. The local governance offered by JACIAQ seems to be the most effective approach to environmental regulation in the region.

Conclusion

While it is not possible to say that any of the actions taken by the intuitions discussed above have been responsible for changes in the environmental indicators discussed in this thesis, the fact that regional traffic and population have increased significantly while traffic related emissions have remained flat, excluding PM-10, which is a pollutant compounded by non-human sources, it seems that efforts to prevent the situation from worsening have met with marginal success. The preceding discussion demonstrates the challenges and successes of environmental governance in the Paso del Norte and demonstrates the potential importance of environmental policy and governance in areas that are undergoing trade liberalization. The environmental transition in which environmental conditions improve following trade agreements may only manifest in conditions supported by such governance. Additionally, such organizations demonstrate that while many of the institutions established at the federal level are inadequate for improving environmental quality at the regional level, regional entities such as the JACIAQ hold significant promise for such achievements.

Chapter 6

Conclusions and Future Research Priorities

A focused assessment of the environmental conditions in the Paso del Norte before and after NAFTA has demonstrated that, while it is likely that NAFTA has had an impact, theories of environmental degradation do not appear to be appropriate models of the effects of trade liberalization in this region. Likewise, the Environmental Transition theory also does not seem to be a good fit across all environmental indicators.

While neither set of theories is entirely supported by the data, two inferences can be made about the impact of NAFTA on the environment in the Paso del Norte. First, the rapid population growth that reportedly increased exponentially with the anticipation of NAFTA and the industrialization of Juarez has had significant effects on the environment. However, if NAFTA had this effect, it more than likely accelerated an ongoing process rather than creating a new one. Second, environmental quality in the Paso del Norte may actually have benefited from NAFTA through increased attention to the environment caused by the debate over NAFTA and how it would impact North America.

The rapid population growth experienced in the first decade of NAFTA, in all likelihood, caught the Paso del Norte off-guard. The city of Juarez lacked (and still lacks) the infrastructure to support an additional million people, causing environmental degradation through accumulation of human and solid wastes, water shortages, and inadequate public transportation, all of which contributed to urban sprawl. These impacts were not limited to Juarez; El Paso shares in these experiences and also contributes to the problems. The shared aquifer means that the additional strain on water supplies from population growth will impact both countries, decreasing the supply of surface water and restricting the availability of water for the irrigation

of crops. While this may actually have a positive effect on water and soil quality levels as agriculture is abandoned in the region, the dumping of wastewater into the Rio Grande will continue to threaten the health of the residents and the ecosystem in the region.

Thus, while there may be environmental benefits gained from certain forms of trade liberalization, there are also new or accelerated problems introduced under these regimes. With regard to these aspects, the provisions provided by NAFTA and the NAAEC failed to protect the environment by failing to anticipate the rapid population growth and related impacts. Clearly, additional policies and enforcement are necessary to address these growing environmental problems.

Fortunately, organizations such as the JACIAQ are working to meet these needs in the region through local bi-national cooperation. In fact, the regional governance provided by the JACIAQ has proved to be one of the most effective approaches to securing environmental protection. This is most likely due to three factors: the diverse makeup of the committee, the local nature of the organization, and the authority granted by the La Paz Agreement. The JACIAQ is comprised of members from bi-national private citizenry, industry, non-governmental and public health organizations, and local, state, and federal government, which encourages cooperation among parties who might otherwise have conflicting interests. Additionally, the community-based nature of the JACIAQ grants it a grassroots perspective that is typically not possible for a federal agency. Finally, the JACIAQ was created through an amendment to a federally negotiated international trade agreement, giving it an uncommon level of authority. This combination of characteristics is a powerful one that has proved very effective in the Paso del Norte.

The environmental problems also require a policy response that is somehow protected from nationalist and/or protectionist influence. To achieve this policy response, international secretariats and other international organizations (i.e. the World Trade Organization, World Bank, Organization for Economic Cooperation and Development, United Nations) will need to broaden their avenues for cooperation and integrate considerations of the environmental impact of their decisions into policy-making, dispute, and enforcement systems. Additionally, these international organizations must work to support the efforts of local and regional groups.

Governance as a Solution

Overall, my research suggested that the impact of NAFTA in the Paso del Norte was limited in scope. One factor that could have helped to limit these effects may be local, interstate, and international initiatives that improved the health of the ecosystem along the border before NAFTA was even conceived. Another factor is the environmental governance in place before and after NAFTA. Additionally, the debate over NAFTA brought considerable international attention to the region and prompted local and regional officials to pay more attention to potential environmental impacts while at the same time providing them with the leverage needed to implement environmental policies and to facilitate bottom up communication between local officials and civil society with federal and international governing bodies. Perhaps this is a solution for pushing reluctant countries into promoting sustainable development. While the notion of an environmental form of the GATT agreement sounds like a promising venture, recent experience with the Kyoto protocol may demonstrate the difficulty in achieving environmental governance.

In fact, research conducted by the Christian Science Monitor in 2004 revealed that the U.S., China, and India are building a proposed 850 new coal-fired plants that will discharge an

extra 2.7 billion tons of carbon dioxide into the atmosphere by 2012—equaling 5 times the amount of emissions reduction promised by 2012 with the Kyoto Protocol (Clayton 2004). This seems to indicate that effective international environmental agreements are difficult, if not impossible, to develop, especially if the largest economies are the largest contributors to the environmental degradation and refuse to participate (Speth 2004).

The United States dependence upon coal-fired electricity generation is an artifact of historical, political, and technological influences, and represents a market distortion promulgated by public policy and sectoral lobbying. This fact is important because it highlights the need for strong international environmental institutions with the ability to influence powerful economies, while also demonstrating the difficulty in establishing international environmental standards, goals, and enforcement authority. For example, had the Kyoto protocol been developed in conjunction and on equal footing with trade liberalization between member countries, then enforcement authority would have been greatly improved and incentive to participate would have been increased.

In this vein of thinking, Weiss (1992) suggests a rethinking of the way in which the environment is framed within trade liberalization. She suggests that instead of framing the environment in accordance with trade laws and goals, there should be an effort to make international trade law fit environmental goals of sustainability. In other words, trade policies should be developed to support environmental goals rather than the other way around.

Reconciliation of these goals will take far more research and far more comprehensive data sets on which to base to governance and enforcement. In order for international standards and governance to be developed and effective, transparency needs to be improved. The lack of consistent data for this thesis has demonstrated how difficult it is to develop an understanding of

the relationship between trade and the environment. Without effective monitoring and evaluation of the situation, there can be no effective management.

Future Research Priorities

Future research would benefit from a more comprehensive approach that incorporates both qualitative and quantitative data from a range of sources. It should seek citizen input to promote a deeper understanding of the historical environmental conditions in the Paso del Norte. This should be tempered with available quantitative data for reference and fact-checking purposes and could also incorporate data related to health issues linked to environmental degradation. Additionally, greater consistency in the data sets available from both sides of the border would result in a richer, and possibly more precise, portrayal of the environmental conditions in the region. For example, sectoral data collected by local level environmental agencies and independent organizations such as the JACIAQ, on both sides of the border would strengthen any analysis of environmental impacts; water usage, emissions, and volume of production by sector would be invaluable for understanding NAFTA's impact in the Paso del Norte. While this data may exist, it is not readily available.

As a future research priority, the development of a methodology for comprehensively measuring the environment as an eco-system rather than a group of discrete indicators would be very beneficial. For instance, the ecological footprint work being done by Wackernagel and his associates at the Global Footprint Network shows considerable promise (Wackernagel, Monfreda, Moran *et al.* 2004). The ecological footprint method for assessing human impact on a broader range of ecological aspects introduces a measure that is not based solely upon economic and monetary valuations, but also captures value added to natural capital. Currently the ecological footprint is used primarily for national accounting. Further development of the model

to measure the environmental conditions of and impacts on a city, or a region like the Paso del Norte, could be used in comparison with local or regional income measures, sectoral growth, and measures of trade flows to better predict the outcomes of trade liberalization for the environment. This would provide more accurate estimations of whether an environmental transition, a race to the bottom, or a pollution haven situation may develop. Ultimately, this could serve as a more accurate model for use in environmental policy assessments.

Conclusion

This thesis suggests that trade liberalization does not necessarily have to be environmentally harmful. If the limited data that are available provide an accurate picture, they suggest that NAFTA had little to no direct negative impact on the region's environmental condition. However, the findings presented do not provide evidence that NAFTA improved the environment in the region. Given the rapid urban population growth associated with trade liberalization and industrialization, as described in this research, any positive environmental effects of liberalization can only be achieved through the anticipation of, and preparation for, those impacts. This suggests that future trade liberalization policies need to be accompanied by development plans that anticipate infrastructure and capacity demands resulting from urbanization of border regions.

While sufficient data are not currently available, Mexico has made improvements in collection and reporting of environmental data. Unfortunately, Mexico's inability, or reluctance, to collect, and report firm/local production/environmental data inhibits effective assessment of the environmental conditions immediately surrounding Juarez Maquiladoras and other production or waste management locations. This transparency is an imperative component of successful analysis of the relationship between trade and the environment.

While identifying specific effects that NAFTA had on the environment in the Paso del Norte was hindered by data availability, it is still possible to assert that international trade liberalization opens a new avenue for international cooperation in the development of global environmental standards. Neglecting this opportunity could prove to be disastrous. In the future, it may be beneficial for trade liberalization agreements to address environmental concerns as integral parts of the negotiations, and to set requirements for meeting infrastructure demands, as the agreements are implemented. Furthermore, it is important that international environmental institutions that are established to monitor environmental cooperation in the agreements be more closely associated with the trade cooperation organizations and be given the authority needed to complete their directives more effectively.

NAFTA provides a case of trade liberalization between developed and less developed countries with common borders, while the Paso del Norte offers a focused view of how these policies affect environment on both sides of the border. At the same time, however, the findings discussed here can be generalized to other trade liberalization agreements and other geographic regions. For instance, there is ongoing comparative research that investigates similarities between the challenges faced by the Paso del Norte and those faced by the Hong Kong-Guangdong region (Stern 2001; Hopkinson and Stern 2003). Although there are currently a limited number of geographical regions experiencing trade liberalization between countries with significant income disparities, the trend of globalization suggests that this situation will become increasingly common. This trend will make it increasingly imperative that we understand the relationship between trade liberalization and the environment.

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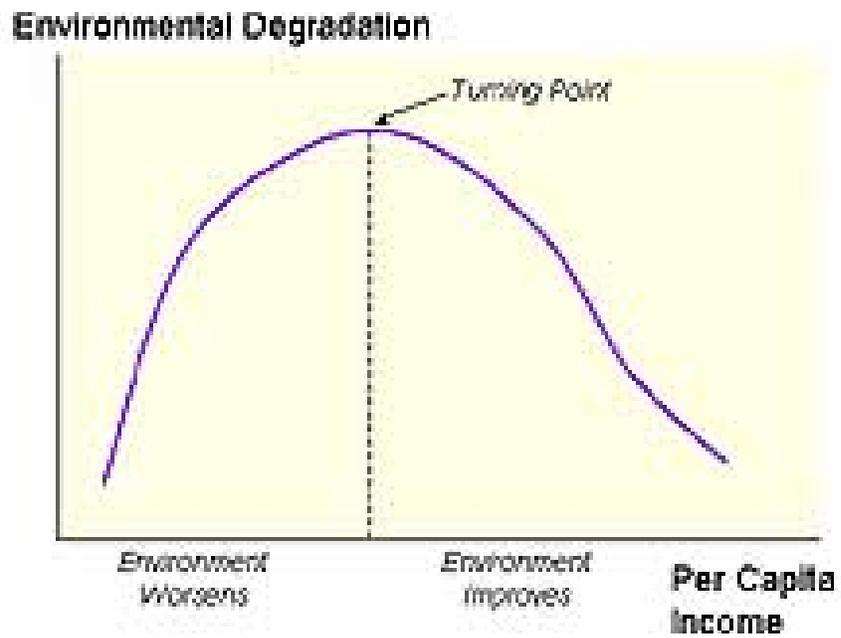
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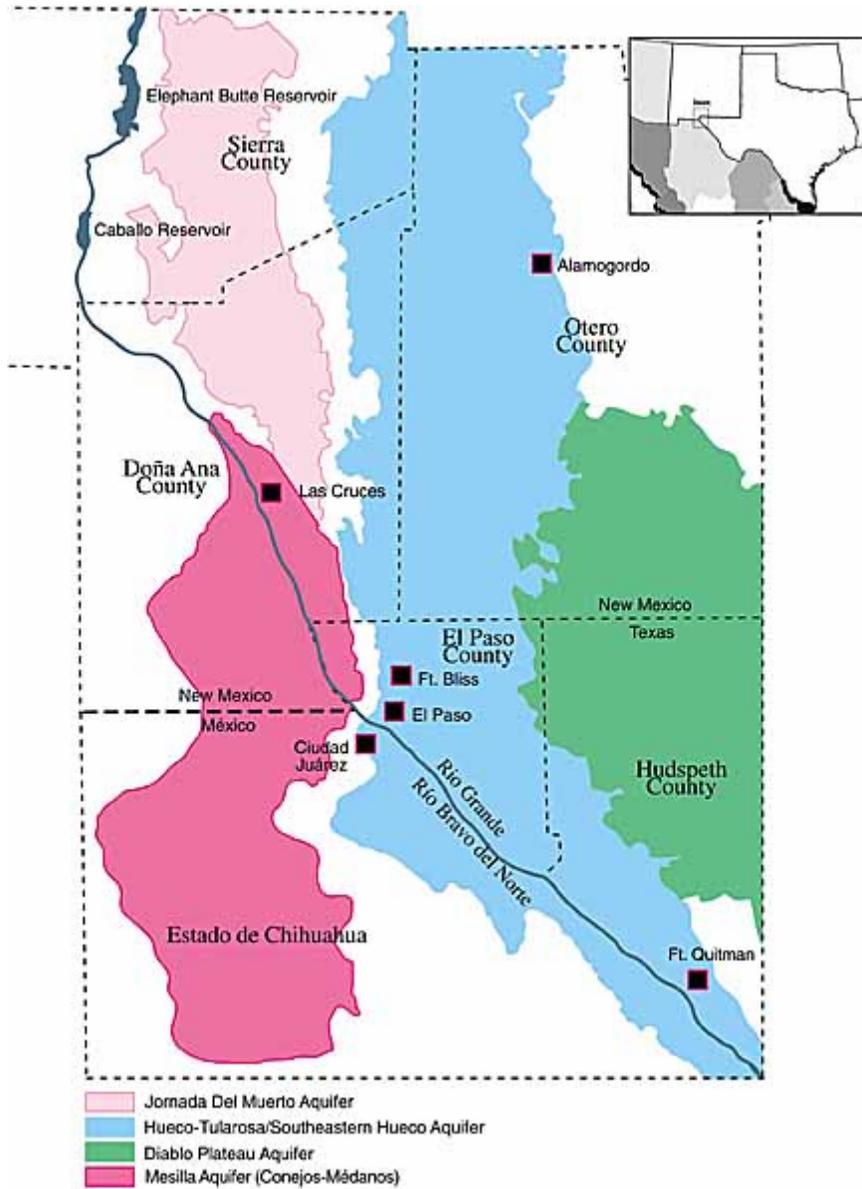
Appendix 1: Environmental Kuznet's Curve

The environmental Kuznets curve



Source: *A better Earth*: <http://www.abetterearth.org/article.php/892.html>

Appendix 2: El Paso-Juarez Aquifer Map



Source: Paso Del Norte Water Task Force:
<http://www.sharedwater.org/en/images/pdnmap.png>

Appendix 3: Satellite Image El Paso-Juarez



Source: Intute GESource Worldguide:
http://www.gesource.ac.uk/worldguide/html/image_1893.html