Industry and the Parque Nacional Nevado de Toluca (PNNT): nature of the relationships and challenges for local, national and supranational regulators

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Foreword

This paper is based on research implemented in the framework of research project SELINA (Parque Nacional Nevado de Toluca : a Socio-Environmental Laboratory for policy Innovation in National park management), financed by the French and Mexican agencies for research. This project is implemented in partnership between the Autonomous University of the State of Mexico, ENS Lyon and CIRAD. The preparation of this paper involved field research and a literature review carried out between August 2012 and January 2013. Semi-structured interviews were held with representatives of local government, representatives of the industry and with scientists.

Introduction

This research is a first phase of a planned PhD research aimed at answering the question whether and how NAFTA and its side agreement on environmental cooperation did influence business strategies regarding biodiversity preservation in various industrial districts in Mexico.

The North American Free Trade Agreement (NAFTA) came into force on January 1, 1994. It established a free trade area between Canada, Mexico and the United States. NAFTA has been considered as one of the "greenest" international commercial agreements (Saunders, 1994) since it includes environmental clauses and since a side agreement about environmental cooperation, the North American Agreement on Environmental Cooperation (NAAEC) came into force at the same time.

The impacts of NAFTA at a local level are controversial (Gallagher, 2011) but it seems that several Mexican regions have experienced a change in terms of industrial activity, trough foreign direct investment (Moreno, 2005). The State of Mexico, for example, has received 3.2% of the total amount of the foreign direct investment in Mexico in 2009, and its capital city, Toluca has registered a 280% growth rate of its manufacturing sector between 1990 and 1999 (Gobierno del Estado de Mexico (GEM), 2004).

In 2005, the metropolitan area of Toluca was one of the most populated metropolitan areas in Mexico. Its growth started in the 1960's with the development of the industrial corridor "Toluca-Lerma", resulting from industrial policies trying to locate new industrial activities

outside the capital, which was reaching very high levels of industrial concentration. Toluca has reached its highest growth rate in the 1990-2000 decade, mainly due to its industrial activity (Gobierno del Estado de Mexico, 2009). Intense industrial activity, together with high population density may cause severe environmental issues, especially when it comes to water management (both water supply and waste water disposal).

More than 30% of the infiltrated water available in Toluca Metropolitan area come from the Nevado de Toluca National Park (Parque Nacional del Nevado de Toluca-PNNT) and several rivers providing Toluca's industries with water have their source or the source of one of their affluent located inside the PNNT(Gobierno del Estado de México, 2011). This area has been under protection since 1936, originally to preserve its landscape and its environmental functions, especially its hydrological functions, which benefit the neighbouring city of Toluca and to a lesser extent the city of Mexico. However, the application decree never came into force and since then the PNNT has been theoretically under protection but with strong contradictions, such as the fact that economic activities are permitted inside its territory.

In that context, this working paper will set the basis for a study on the relationship between the industrial sector of the TMA and the PNNT and to assess to what extent international regulations such as NAFTA and its side agreement on environmental cooperation, have influenced the environmental strategy of the industrial sector in the TMA.

Section 1 will focus on the potential relationship between the PNNT and the industrial sector through potential environmental services. Section 2 will present the major local and international environmental rules while Section 3 will introduce the different actors of the industrial sector. Section 4 will assess the environmental impacts of the industrial activity in the TMA.

1. The relationship between the PNNT and the industrial sectors: major environmental services.

Groundwater and surface water

The major environmental service brought by the PNNT to the Toluca Metropolitan Area (TMA) is water. Surface water from the PNNT is directly brought to the municipality of Zinacantepec and the rest of the municipalities of the TMA get surface water from the Cutzamala system which also provides Mexico City with water. However, when it comes to groundwater, more than 30 % of the Toluca Metropolitan Area infiltrated water comes from the PNNT. This directly benefits the industrial sector since many industrial units get their

water through wells and drillings. Those rights to extract water are centralized in the *Registro público de derechos de agua* (public record for water extraction rights) from the National Water Commission (CONAGUA).

Air quality

The second major environmental service brought by the PNNT to Toluca and its metropolitan area is air quality through carbon sequestration. The air is contaminated by various pollutants such as Ozone (O_3), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Particulate Matter (PM_{10}) and Carbon Monoxide (CO). CO emissions come from two different types of sources: fixed source emissions and mobile source emissions. The fixed emissions are the industrial emissions and the mobile source emissions refer to particular vehicles, pickups, buses, and trucks. Since industrial activity is intense and the transport pattern is based on individual vehicles, the PNNT forest area has a crucial function to play in terms of carbon sequestration.
To a lesser extent, the PNNT provide various services such as image. Various companies use a picture of the Nevado de Toluca to promote their products. The majority of them are spring water companies who sell bottled water from the volcano.

2. Major local and international environmental rules

International laws, treaties and regulations

The North American Free Trade Agreement (NAFTA) came into force on January 1st, 1994, in Canada, the United States of America and the Mexican United States. It was welcomed as one of the "greenest" trade agreements since it included innovative provisions regarding environmental protection in the agreement itself but also in a parallel agreement on environmental protection (the North American Agreement on Environmental Cooperation – NAAEC), which created the Commission for Environmental Cooperation (CEC). From the preamble of the agreement, it is stated that NAFTA will be implemented "in a manner consistent with environmental protection and conservation" which "promote sustainable development" (NAFTA Agreement, 1994). Article 104 of NAFTA establishes that in case of any inconsistency between this Agreement and specific trade obligations set out in other environmental treaties ratified by the parties, such obligations should prevail. Those agreements are:

- the *Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);*

- the *Montreal Protocol on Substances that Deplete the Ozone;*
- the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal*
- the *Agreement Between the Government of Canada and the Government of the United States of America Concerning the Transboundary Movement of Hazardous Waste;*
- the *Agreement Between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area.*

Chapter 7 sets up the right for the parties to take sanitary and phytosanitary measures and to establish the level of protection that it considers appropriate as long as these measures don't constitute "a disguised restriction on trade" (Chapter 7, NAFTA, 1994). Article 1114 points out the question of pollution heavens by discouraging the lowering of environmental standards as a method for attracting investment. However, in the case of a dispute, this provision is not accompanied by sanctions (Johnson, 2000).

The North American Agreement on Environmental Cooperation (NAAEC) is centered on the enforcement of environmental regulation through public participation and transparency of information. It gives the opportunity to private individuals or organizations to bring their complaints at the continental level (NAEEC Article 14, 1994). Article 5 sets up the parties commitments regarding the effective enforcement of local environmental regulations. The NAAEC also created the Commission for Environmental Cooperation (CEC). The council, its governing body is composed of the heads of environmental agencies or ministries of the parties. Its aim is to "facilitate collaboration and public participation to foster conservation, protection and enhancement of the North American environment for the benefit of present and future generations, in the context of increasing economic, trade, and social links among Canada, Mexico, and the United States" (CEC, 2013). Technically, the CEC mandate is divided into two kinds of activities. The first is to encourage and control the environmental co-operation between the parties by implementing projects (e.g. concerning Mexico's capacity to manage chemicals and prevent pollution), issuing publications, developing tools and activities on questions such as public participation, pollutants control, investigation and reporting on pollution, capacity building and the relationship between trade and the environment. The second part of CEC mandate is to encourage the enforcement of environmental legislation and the reporting by individuals or private organizations of environmental issues in the member states (Johnson, 2000).

Apart from NAFTA, NAAEC and the international conventions presented in the NAFTA Article 104, Mexico is also a member of:

- the *Vienna Convention for the Protection of the Ozone Layer;*
- the *Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal*;
- the *Stockholm Convention on Persistent Organic Pollutants*;
- the *Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade* ;
- the *United Nations Framework Convention on Climate Change* (UNFCCC);
- The *Kyoto Protocol.*

National and local environmental laws and regulations

When it comes to national environmental legislation, the major Mexican law is the *General* Law of *Ecological Equilibrium and Environmental Protection (Ley General del Equilibrio Ecológico y la Protección al Ambiente*- LGEEPA) which guarantees the right for the citizens to live in an environment adequate for their personal development, health and wellbeing. This law also sets the basis for the environmental policy and the instruments for its application in order to preserve and protect the biodiversity, the environment and the natural resources, and to prevent and control water, soil and air contamination.

The second major law regarding environmental protection is the *General Law* for the *Prevention and Integral Management of* Waste (*Ley General Para La Prevención Y Gestión Integral De Los Residuos)*. When it was enforced in 2003, the major innovation of this law was the fact that is considers waste as a potential source of contamination, but that also has a value that can be employed through recycling, reuse o recovery of the energy contained in it (Armijo de Vega, 2006). The other innovation in this law is the acknowledgement of the presence of an informal sector within the process of gathering and separation of waste.

The *General Law on Climate Change (Ley General De Cambio Climático)* aims at regulating greenhouse gases emissions and taking measures to reduce climate change, all of this strengthening the competitiveness of the economy.

At the state level, the State of Mexico biodiversity code (*Código para la biodiversidad del estado de México*) reaffirms the principles of the LGEEPA in terms of waste management, residual water and citizen participation in environmental matters.

3. The actors

Presentation of the area

According to the 2005 delimitation (INEGI, 2005), the Toluca Metropolitan Area[‡] is composed of 14 municipalities, reaching 1 821 288 inhabitants. The central municipality, Toluca is the most populated, followed by Metepec and Zinacantepec.

Table 1. The Toluca Metropolitan Area

Municipality	Population	Municipality	Population
Almoloya de Juárez	147 362	Otzolotepec	77 903
Calimaya	46 718	Rayón	12 733
Chapultepec	9 580	San Antonio la Isla	21 714
Lerma	133 206	San Mateo Atenco	71 499
Metepec	210 037	Toluca	804 675
Mexicaltzingo	11 637	Xonacatlán	46 259
Ocoyoacac	61 559	Zinacantepec	166 406
		TOTAL	**1 821 288**

Source: INEGI, 2010

Its growth started in the 1960's with the development of the industrial corridor "Toluca-Lerma", resulting from industrial policies of import substitution industrialization trying to locate new industrial activities outside the capital, which was reaching very high levels of industrial concentration. Toluca has reached its highest growth rate in the 1990-2000 decade, mainly due to its industrial activity (Gobierno del Estado de Mexico, 2009). Due to its central location in the Republic and its nearness with the capital, Toluca became one of the most attractive industrial areas in Mexico.

The metropolitan area has now more than 15 industrial parks[§] (private and public), centralized in the municipalities of Toluca and Lerma and which concentrate about 900 industrial establishments.

[‡] See appendix 1 for a map of the metropolitan area
[§] See appendix 2 for the list of the industrial parks

Small, medium and large enterprises

The ZMVT industrial sector is very heterogeneous when it comes to the scale of activities. However, in terms of size, more of the 95% of the establishments are micro and small enterprises.

Table 2. Small, Medium and Large enterprises in the TMA

Size	Number of establishments	%
Micro and Small (0-50)	8921	97,38%
Medium (51-250)	143	1,56%
Large (251 +)	94	1,03%
No esp.	3	0,03%
TOTAL	**9161**	**100,00%**

Source: GEM, 2012

This means the industrial sector is composed of very different actors and that those actors are very hard to identify and locate since the majority of them (micro and small enterprises) are far from industrial parks and industrial organizations and in a very wide range of activities.

Range of activities

The micro and small enterprises represent a very wide range of activities.

Table 3. The micro and small enterprises in the TMA: major subsectors of industrial activity

Code	Subsector	%
339	Miscellaneous Manufacturing	22,5%
316	Leather and Allied Product Manufacturing	15,96%
311	Food Manufacturing	14,06%
332	Fabricated Metal Product Manufacturing	12,63%
327	Nonmetallic Mineral Product Manufacturing	7,88%
337	Furniture and Related Product Manufacturing	7,47%
TOTAL		**81%**

Source: GEM, 2012

The most represented subsector within the micro and small enterprises is the subsector[**] 339: *Miscellaneous Manufacturing*. This gives a clear idea of the level of heterogeneity within the micro and small industrial enterprises. This subsector is composed of a range of different activities such as *Manufacturing of non-electronic medical, dental and laboratory equipment*

[**] According to the 2012 North American Industry Classification System (NAICS). See http://www.census.gov/eos/www/naics/ for more information on this classification system.

and disposable material, and ophthalmic goods manufacturing, *Metalwork and jewelry* or *Candles manufacturing.*

The second most represented subsector within the micro and small enterprises is subsector 316: *Leather and Allied Product Manufacturing*. Those activities are mostly concentrated in one of the municipalities of the metropolitan area: San Mateo Atenco on the west bank of the heavily polluted Rio Lerma.

Then follows the subsectors 311, 322, 327, 337, respectively *Food Manufacturing, Fabricated Metal Product Manufacturing, Nonmetallic Mineral Product Manufacturing,* and *Furniture and Related Product Manufacturing*.

Those four subsectors altogether represent 81% of the micro and small enterprises.

When it comes to medium enterprises, it seems that this group of establishments is in a less concentrated range of activities even though nine subsectors concentrate almost 75% of the total number. The two subsectors with the major number of industrial establishments are subsectors 325 and 311: *Chemical Manufacturing and Food Manufacturing.*

Table 4. Medium Enterprises in the TMA: major subsectors of industrial activity

Code	**Subsector**	**%**
325	Chemical Manufacturing	15,49%
311	Food Manufacturing	14,79%
326	Plastics and Rubber Products Manufacturing	9,86%
332	Fabricated Metal Product Manufacturing	7,04%
336	Transportation Equipment Manufacturing	7,04%
333	Machinery Manufacturing	5,63%
313	Textile Mills	4,93%
322	Paper Manufacturing	4,93%
335	Electrical Equipment, Appliance, and Component Manufacturing	4,93%
TOTAL		**74,64%**

Source: GEM, 2012

Regarding the large enterprises in the TMA, these are concentrated in four subsectors of activity: subsectors 336,311, 315, 325, respectively: Transportation *Equipment Manufacturing, Food Manufacturing, Apparel Manufacturing* and *Chemical Manufacturing*.

Table 4. The large enterprises in the TMA: major subsectors of industrial activity

Code	**Subsector**	**%**
336	Transportation Equipment Manufacturing	16,3%
311	Food Manufacturing	15,22%
315	Apparel Manufacturing	11,96%
325	Chemical Manufacturing	10,87%

313	Textile Mills	8,70%
312	Beverage and Tobacco Product Manufacturing	7,61%
326	Plastics and Rubber Products Manufacturing	5,43%
TOTAL		**76%**

Source: GEM, 2012

This analysis of the industrial sector in the TMA shows the importance of the question of the size of the establishments. Depending on the size, the pattern of the distribution between the different subsectors of activity is different. The question of size also matters in terms of visibility: the large and medium enterprises are much more visible due to the size of their industrial units and location (very often in industrial parks). On the contrary, micro and small enterprises are much less visible even though they represent a very higher share of the total number of industrial establishments. However some subsectors are represented within the three size categories. This is the case of the *Food Manufacturing* which is one of the most represented subsector in the three size categories and of the *Chemical Manufacturing*, present in both the medium and large enterprises.

4. Major potential environmental impacts

The potentially most contaminating industrial activities

Industrial activity can generate pollution, depending on the characteristics of the processes and on the type of the inputs and products. In general, the Mexican National Statistics Institute (INEGI) identified the potentially most contaminating industrial activities (GEM, 2007) according to the fact that they use raw materials that can be considered as "dangerous" since their processing may generate dangerous or toxic residues and since they can harm the environment after leaks or spillages.

Table 5. The potentially most contaminating industrial activities.

Natural soft fibers preparation and spinning	Rubber products manufacturing
Leather and fur tanning and finishing, and manufacturing of leather, fur and allied materials products	Plastic products manufacturing
Wood sawing and preservation	Nonferrous metal industry, except aluminum
Basic chemical products manufacturing	Metal products manufacturing

Textile fibers preparation and spinning, and thread and yarn manufacturing	Electrical Equipment, Appliance, and Component Manufacturing
Pharmaceutical products manufacturing	Transportation Equipment Manufacturing

Data from GEM, 2007

This list shows the potentially most dangerous industrial activities, environmentally speaking. However, to have a clearer idea of the possible relationship between this industrial sector and the PNNT, it is important to separate the environmental impacts according to the major environmental services brought by the PNNT: water and air quality.

Environmental impacts of industrial activity on water

The major problems when it comes to the use of water by the industrial sector are the high level of water consumption, the low level of residual water treatment, the generation of pollutants and the pressure on the availability of the resource due to the high level of sectorial and regional concentration of the water demand (GEM, 2007).

At the state level in 2003, the industrial sector consumed more than 7% of the total of the water consumed in the entity and of this quantity, 11.4% is superficial water and 88.6% is groundwater (GEM, 2003 in GEM, 2007).

The industrial activities demanding major volumes of water and being present in the TMA are the paper industry, the food industry, water purifying and bottling and the beer industry.

In terms of residual water, a few industrial activities concentrate the higher contribution in pollutants and most of them are present in the TMA: the manufacturing of alcoholic beverages, the paper industry, the manufacturing of chemical products, the food industry and the textile industry.

Environmental impacts on air quality

In terms of air quality, in 2000, the industrial sector was responsible for 2.5% of the total air pollution emissions within the metropolitan area.

Table 6. Emissions of pollutants in the TMA, year 2000

	SO2	**HC**	**NOx**	**CO**
Emissions (tons)	10 485	2 341	1 693	275
Emissions per industrial unit (ton/ unit)	75.4	16.8	12.2	1.98

Source: Data from GEM, 2007

If we look closer, it appears that the pollutant with major emissions in the TMA is sulfur dioxide (SO_2; 10 485 tons), followed by hydro carbons (HC; 2 341 tons), mono-nitrogen oxides (NOx; 1 693 tons) and carbon monoxide (CO; 275 tons). When it comes to emissions per

industrial unit, the emissions of SO_2, HC, NOx and CO respectively reached 75.4 tons / unit, 16.8 t/u ,12.2 t/u and 1.98 t/u. Comparing with emissions per unit of those pollutants in other metropolitan areas, the emissions in the TMA are much higher (GEM, 2007).

A study about emissions from the industrial sector in another metropolitan area of the State of Mexico between 2000 and 2004 (GIE-CAM, in GEM, 2007) showed that when it comes to SO2 average emissions per industrial unit in the period, the most polluting subsector is the textile industry (5.44 t/u), followed by the paper industry (4.42 t/u), the electric power generation (3.92 t/u) and the wood industry (2.87 t/u). Regarding the CO average emissions, the subsectors producing the major amount of this pollutant are the electric power generation (509 t/u), the basic metal industry (5.46 t/u), the nonmetallic mineral products manufacturing (4.85 t/u), the paper manufacturing (2.72 t/u) and the chemical industry (2.70 t/u). When it comes to the NOx average emissions, the subsector producing the major amount of emissions is the electric power generation (2825.02 t/u), then follows the nonmetallic mineral products manufacturing (19.48 t/u), the paper manufacturing (5.60 t/u), the basic metal industry (5.26 t/u) and the food industry (3.99 t/u).

Those results, even though concerning another metropolitan area can be used in the TMA to identify the kind of industry in the TMA environmentally speaking. Yet, for SO2, CO and NOx emissions, the most polluting subsectors identified in the study are also present in the TMA.

If we cross the results of the analysis of water and air pollution, we get the potentially "most hazardous" activities in the TMA environmentally speaking. In terms of water consumption, the most demanding industrial activities are the paper industry and the food manufacturing. The activities producing major quantities of residual waters are the paper industry and food manufacturing, but also the chemical and the textile industries. When it comes to air quality, the activities responsible for the higher pollutant emissions are the paper industry (SO2, NOx and CO), the textile industry (SO2), the basic metal industry (CO, NOx), the chemical industry (CO), the nonmetallic mineral products manufacturing (CO, NOx) and the food industry (NOx). In the light of these results, the paper and the food industry are the most "threatening" activities since they have potential environmental impacts on water (both residual and infiltrated) and on air quality. What is crucial here is that the food industry is one of the most important subsectors of the industrial activity in the TMA since it represents 14.06% of the small enterprises, 14.79% of the medium enterprises and 15.22% of the large enterprises. The paper industry represents 4.93% of the medium enterprises and 2.17% of the large enterprises. Those two subsectors, which are potentially dangerous for the environment

and so for the PNNT, are also two important subsectors in the TMA in terms of number of enterprises.

The industrial sector in the TMA has numerous environmental impacts. However, the link with the PNNT is not always clear. When it comes to water, government reports (GEM, 2011) say that more than 30% of the groundwater used in Toluca comes from the PNNT, but this affirmation is not referred to scientific research on that subject. . In terms of air contamination, the industrial sector in the TMA is producing various types of pollutants. As a forest area, the PNNT can sequestrate a significant part the carbon emissions but regarding the other pollutants, there are no data available on acid rains or other environmental link. Nevertheless, these results show that the environmental relationship between the PNNT and the TMA can be direct or indirect: a direct relationship would be the use of ground water (a significant part of it coming from the PNNT) or the carbon sequestration and an indirect link would be for example the emission of pollutants causing acid rains in the PNNT.

5. Conclusions and suggestions for further research

Understanding the industrial sector in the TMA is not an easy task. Yet, some aspects may be visible at first sight, such as big industrial units, but these are not representative of the sector itself since it is a highly heterogeneous sector. More than 95% of the establishments are micro and small enterprises, not following a pattern of territorial concentration and thus are much less visible than it may appear. Moreover, micro and small enterprises usually lack representativeness in industrial organizations which make them quite difficult to reach. In that context, the kind of actors with the major environmental impact are not the biggest actors but small scale actors, being very heterogeneous.

Having said that, assessing the environmental impact of this sector may result easier and much more accurate if we take into account a different typology of the industrial sector, separating it into specific groups according to other criteria: potential environmental impact, similarities in the production process, size… This analysis, together with a more thorough study on the environmental services offered by the PNNT may result more precise and could set the basis for other similar studies in similar areas of the country. Likewise, determining the destination of the final outputs (international, national, local) will give another level of understanding of the question especially to assess the impact of international regulations at the local level.

Mexico is a country with a high level of environmental laws, regulations and agreements but to really assess how they have been influencing the industrial sector at the local level, it is crucial to determine to what extent these regulations are enforced, specifically when taking into account the overwhelming presence of not easily steerable micro and small scale producers.

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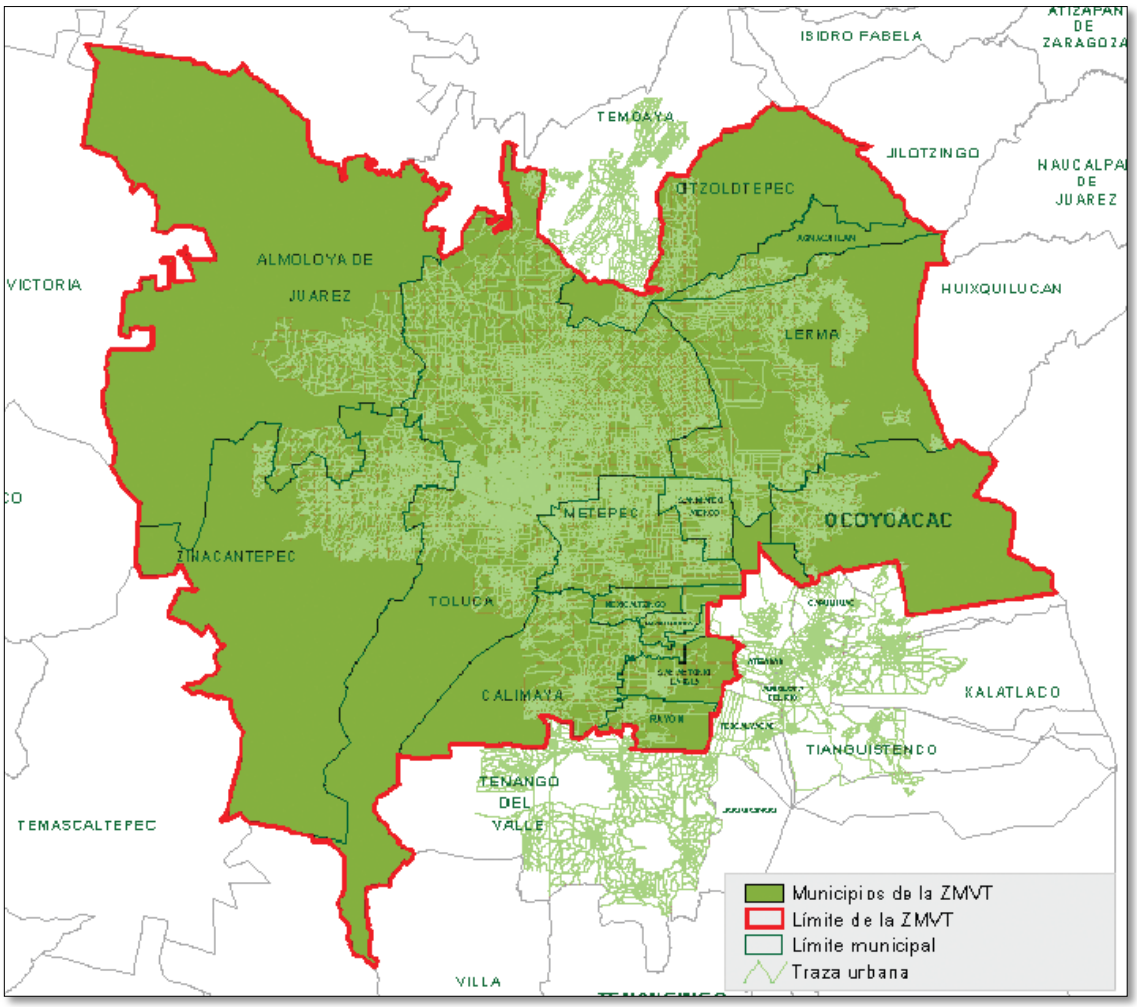
Appendices

Appendix 1. Toluca and its metropolitan area



Source : COESPO, 2009

Appendix 2: Industrial Parks in the Toluca Metropolitan Area.

Industrial Park	Municipality	Number of establishments
Prologis Park Toluca	LERMA	1
Corredor Industrial Lerma	LERMA	361
Parque Industrial Lerma	LERMA	164
Parque Industrial Cerillo II	LERMA	25
Parque Industrial Cerillo I	LERMA	25
Microparque industrial O`DONELL Logistic	LERMA	1
Zona Industrial Ocoyoacac	OCOYOACAC	20
Parque Industrial San Cayetano	TOLUCA	11
Parque Industrial Toluca	TOLUCA	33
Parque Industrial Toluca 2000	TOLUCA	105
Parque Industrial Exportec II	TOLUCA	38
Parque Industrial Exportec I	TOLUCA	18
Zona Industrial Toluca	TOLUCA	25
Parque Industrial el Coecillo	TOLUCA	24
Parque Industrial San Antonio Buenavista	TOLUCA	33
Parque Industrial Vesta Park Toluca	TOLUCA	5
TOTAL		**889**

Source: Fidepar, 2011