Narco Violence in Mexico:
A Spatial Analysis of Drug-Related Bloodshed

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EXECUTIVE SUMMARY

Drug-related violence in Mexico has increased exponentially in the last five years, killing more than 40,000 people. Even though the country has been a producer of marijuana and opium poppy for nearly a century, over the last decade it has also become the main route for smuggling cocaine onto American soil. In the last few years, meanwhile, Mexico has also transformed into a major producer of synthetic drugs, including methamphetamine. All of these factors have combined to make the country the perfect one-stop shop for American consumers, who constitute the largest market for narcotics in the world.

The main production areas for marijuana and opium, located along Mexico’s Pacific Coast, have historically been more violent than the rest of the country. But the introduction of cocaine and synthetic drugs has altered the patterns of violence and coincided with the rise of a rash of new and ruthless drug gangs that have begun battling traditional Mexican cartels for a share of the smuggling business. Into this already volatile mix came a major crackdown on drug production and smuggling launched in December 2006 by President Felipe Calderon. Given the new, and ever-shifting reality, what parts of the country are now hardest-hit by drug violence? What do these areas have in common? Why have seemingly similar regions suffered different patterns of violence?

Traditionally, zones along Mexico’s northern border have been the most-coveted by drug gangs looking to establish their headquarters and dominate corridors for moving narcotics into the U.S. Killings there are constant. But proximity to American territory is no longer the only determining factor. Any city that is a hub for smuggling and/or producing drugs now suffers more murders and violence than others. Many of these also are in areas with low population density, and high or very high levels of marginalization, or concentrations of people with low incomes and limited access to basic services.

This study focuses on the period between January 2007 and December 2010, when the largest number and most-gruesome drug-related killings were committed. Time series analysis of crime data sheds light on the spatial trends these killings have followed by determining the drug-related homicide rate for each municipality, each year. The results cast doubt on the overall intentional homicide figures that Mexico reports to United Nations Office on Drugs and Crime, of about 11 per 100,000 people each year between 2001 and 2007, and under 22 per 100,000 people during the subsequent three, drug-war torn, years. Querying spatial data using Boolean algebra also shows that the areas which have become producers of and/or smuggling corridors for two and three different types of drugs have expanded greatly over the four years in question; and that drug-related killings are highly spatially correlated to these areas.
INTRODUCTION

Organized crime is violent by definition (Geis, 1966). Criminal syndicates pursuing profit through illegal means often face threats from new competitors who look to rip away segments of their business and steal their profits. Intimidation and violence against rivals, coupled with a demand for unwavering loyalty from members of one’s own gang, are the typical responses of threatened organizations attempting to preserve the status quo and retain control over illicit operations (Conklin 2007: 316). As with other types of crime, organized crime has a spatial component as well (Rossmo, 2000; Chainey 2005). It is committed in a certain area, and the offenders generally occupy a distinctive geographical zone (Herbert, 1976) where they enforce rules that carry punishments if they are not followed. Mexican drug organizations have certainly been territorial since the beginnings of drug cultivation in Mexico almost a century ago. But violence generally remained clustered in certain areas where production and smuggling were most pervasive (Astorga 2005) (Map 1.1). Even though these main producer areas have spread out in the last two decades, they remain concentrated in the same region: the Pacific Coast along the Sierra Madre Mountains. They also tend to share the same characteristics: The heaviest production areas are located in regions with low population density (Map 1.2) and high levels of marginalization (Map 1.3), defined as regions where poverty is concentrated and people have limited access to basic services and social benefits.

It was when Mexico began becoming the main drug supplier for the United States that violence levels increased sharply. An unprecedented wave of brutality that began spiking in 2000 has only gotten worse each year since, killing more than 40,000 people in the last five years, and claiming 15,273 victims in 2010 alone (Chart 1), according to official Mexican government figures.

Chart 1. Standardized Drug-Related Killings 2007-2010
It is no coincidence that drug violence has exploded as Mexico has undergone a political transformation. The turn of the century coincided with the collapse of the single-party regime that ruled the country for 71 straight years, propelling opposition governor Vicente Fox to the presidency in 2000. That prompted the emergence of new political powerbrokers and a series of fresh strategies against drug producers and smugglers, many of whom had been openly protected by the old regime.

The powerful illicit narcotics trade of today’s Mexico didn’t happen by accident. The country’s close proximity to the United States, the world’s economic powerhouse and also the largest global market for illegal drugs, pushed Mexican syndicates toward developing drug-trafficking prowess. But the shift in the country’s drug smuggling hierarchy after Fox took power was also heavily influenced by a larger, international reorganization of the illegal narcotics market — a reorganization that was decades in the making. Mexico had long produced drugs like marijuana and opium poppy, but its kingpins gained stature in the late-1980s and early 1990s, when they began smuggling cocaine (Chart 2). Then, unexpected help came from Washington. A U.S.-led crackdown on Caribbean smuggling routes that had moved cocaine from the jungles of South America to Miami via tropical islands forced gangs to alter how they smuggled cocaine into the U.S., pushing the flow of illegal narcotics toward Central and South America. American authorities also helped bring down the Cali and Medellin Cartels in Colombia, leaving a power vacuum that Mexican-based drug gangs had little trouble filling (Cook, 2007: 1).

**Chart 2.** Marijuana and Opium Poppy Eradications and Cocaine Seizures in 1987-2010.

By the early 2000s, cocaine was flowing north through Mexican territory as seamlessly as native drugs like heroin and opium poppy always had, and Mexican trafficking groups had supplanted all others around the hemisphere as the top source of illegal drugs reaching the United States (INCS 2008, 2009).
As the country’s influence on the world of smuggling grew, however, Mexican criminal syndicates became still more rich and powerful by moving increasingly into making and smuggling highly profitable synthetic drugs.¹ They embraced a wider range of activities and became far more complex and professionally organized, adapting to a market that was booming and thus attracted new competitors.

Violence began to rise under Fox when his new government dismantled much of the symbolic relationship that saw the previous administration protect drug smuggling in many parts of the country in exchange for bribes. Fox’s successor, Felipe Calderon, then declared an all-out war on drugs in December 2006. That caused killings not only to skyrocket but also became more brutal — featuring beheadings, victims dumped in mass graves, and corpses hung from crowded highway overpasses or tossed into rush hour traffic (Chart 3). The bloodshed also seeped into new parts of Mexico that had been previously largely spared by drug violence.

Chart 3. Drug-Related Killings (By Type of Killing) 2007-2010

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¹ Personal interviews with Mexico’s former deputy attorney general for drug crimes, Jose Luis Santiago Vasconcelos, between 2002 and 2006, when the author of this paper was a reporter, first with the Spanish News Agency EFE, and then for Britain’s Reuters news service.
Map 1.1 Main Drug Areas
HYPOTHESIS & RESEARCH QUESTIONS

The central hypothesis of this study is that there is a relationship between areas that are drug hubs — that is municipalities that produce and/or smuggle at least two types of drugs — and the amount of killings taking place there. Killings spread out across the country as new municipalities become drug hubs over time. The main research questions can be summarized as following:

• Which Mexican regions have been hit hardest by drug-related killings? Are there areas especially affected other than those clustered along the U.S.-Mexico border? Have these patterns changed over time?
• What is the nature of the relationship between these killings and the production and/or smuggling areas?

METHODOLOGY

The methodology for the project had three main steps: Data Collection, Maps Elaboration and Analysis. (But the Analysis section will follow the Findings section)

1. DATA COLLECTION
   A. Attribute Data:
      • Drug-related killings (Mexico’s Presidency): TotDrug_Kills, Executions, GangFights. Available online at [http://www.presidencia.gob.mx/base-de-datos-de-fallecimientos/](http://www.presidencia.gob.mx/base-de-datos-de-fallecimientos/)
      • Narcotics eradictions and seizures (Mexico’s Ministry of Defense): Marij_Seizures, Opium_Seizures, Coca_Seizures, Labs_Seizures. Free Information Act Request (FOIA) by the author of this paper.
      • Marginalization (SEDESOL, Mexico’s Secretary of Social Development). Available online at [http://sppe-svr.sedesol.gob.mx/zap/](http://sppe-svr.sedesol.gob.mx/zap/)
   B. Spatial Data:
      • Muni_States (INEGI): polygon with Mexico’s municipalities
      • States (INEGI): polygon with Mexico’s states. These first two shapefiles are available online at [http://www.inegi.org.mx/geo/contenidos/geoestadistica/M_Geoestadistico.aspx](http://www.inegi.org.mx/geo/contenidos/geoestadistica/M_Geoestadistico.aspx)
      • Carretera (INEGI): shapefile with roads in Mexico.
      • Main Cities (INEGI): selection of cities extracted from the shapefile localidadUrbana, with Mexico’s cities. These two shapefiles are available online at [http://www.inegi.org.mx/geo/contenidos/topografia/InfoEscala.aspx](http://www.inegi.org.mx/geo/contenidos/topografia/InfoEscala.aspx)
2. MAP ELABORATION
A. To determine the areas under study and their main characteristics.

Tracking correlations between demographic data and the main drug-smuggling and production areas of Mexico can help us better understand the dynamics drug-related violence have followed over time. Due to the lack of demographic data disaggregated to the municipal level, population density and marginalization were selected as main descriptors. Marginalization is defined by SEDESOL as an index that integrates poverty levels, access to education and health benefits, as well as the level of development of basic and productive infrastructure in the country’s different municipalities. Population and marginalization data were in table Excel and dbf format, respectively. They were joined to polygon data for municipalities available at INEGI. The spatial data has the projected coordinate system North American Lambert Conformal Conic. For Population, the data was symbolized by manually setting six classes (< 25, 50, 100, 300, 1,000 and > 1,000) to take into account the variability in size between municipalities. Marginalization, meanwhile, was symbolized with different colors for the fields High and Very High.

Given that data on drugs and homicides was disaggregated only to the municipal level and exact geographic coordinates for every event do not exist, this study opted to work mainly with polygons. The tables with information on homicides and drugs were joined to the spatial data available for municipalities. The final data layers used to locate each year’s homicide’s areas were obtained after querying the data to get only the municipalities which had had at least one drug-related homicide every year (2007, 2008, 2009 and 2010), because including municipalities with no crime could bias the results.

B. To establish the project time span and the variability of the variables under study between 2007 and 2010 (Time Series Analysis).

Drug production areas are determined by certain physical characteristics like soil type, altitude, and climate, and thus are not very likely to totally change locations from one year to another, but rather expand to new, better and/or safer places. Taking this caveat into consideration, the study determined the main producers for the total four-year period by querying the data to select only the municipalities where drug eradications of marijuana and opium poppy of at least 10 hectares had occurred each year, between 2007 and 2010. The process followed to establish the main cocaine smugglers was different. Considering that cocaine started being heavily smuggled through Mexico only in the late 1990s, and cocaine seizures greatly shift year after year, just those municipalities where at least 10 kilograms of cocaine were seized at least one of the four years under study were selected. For synthetic drugs labs, which have been developed still more recently, the count followed municipalities where at least one lab was seized in one of the four years between 2007 and 2010. The data selected by using these queries was then exported and converted into new shapefiles, which were used for drawing the maps.

The Digital Elevation Model (DEM) was symbolized with an elevation scale color and hillshade effects, leaving four categories labeled for better interpretation of the scale. The areas of drug-related killings for each year of the period being studied were determined by establishing the homicide rate per 100,000 people. The symbology was set to Graduated Colors, the Value to the annual total killings for each year, and then normalized by population. The data for every year was greatly skewed, favoring the use of manually established classification intervals, which were set to five different
categories. The same symbology was applied to every year, in order to make comparisons of the distribution patterns which homicides followed in the last four years.

C. To determine the relationship between areas which were drug hubs and the killings distribution for every year.

To accomplish this goal, data on drugs was queried to calculate the many possible combinations of two and three different drugs for production and/or smuggling. Using factorials, the combinations were determined as 6 for the former \( ^4C_2 = 6 \) and 4 for the latter \( ^4C_3 = 4 \). After determining the combinations for every series, an algorithm was created — by using Boolean algebra — to detect by iteration those municipalities that fulfilled the requirements for every combination. To complete the process, drug-related killings were converted to a point shapefile by using the Feature to Point tool on Features, in the Data Management Tools of the ArcToolbox. Then, municipalities with at least one homicide for each of the years, were selected by querying the data. The resulting selection (for each year) was exported and transformed into a new shapefile with the killings for the respective year. Then every year was queried to show only municipalities with more than 10 killings. (See extended description of the methods in the Appendix).

Using shapefiles with the main cities and highways in Mexico also helped with the analysis. The layer for the main cities was obtained from a larger shapefile with cities (localidadUrbana.shp) from the INEGI. The main cities were selected considering two factors: if they were capitals of the Mexican states; and if the municipality where the cities are located had been hardest hit by killings, or were significant producers and/or smuggler of drugs. Then the selection was exported to create the new layer which was used to symbolize the main cities. The highways were simply queried by using a definition query to select the ones with more than 4 lanes. No names for highways were provided in INEGI’s attribute table.

**FINDINGS**

Reference/Descriptive maps

1. Map Series: Main Characteristics of Drug Areas
   - Map 1.1 Main Drug Areas
   - Map 1.2 Population Density and Index Map
   - Map 1.3 Marginalization Distribution

2. Map Series: Distribution of Drug-Related Homicides
   - Map 2.1 Mexico’s Drug-related Homicides Distribution 2007
   - Map 2.2 Mexico’s Drug-related Homicides Distribution 2008
   - Map 2.3 Mexico’s Drug-related Homicides Distribution 2009
   - Map 2.4 Mexico’s Drug-related Homicides Distribution 2010

Analytical Maps

3. Map Series: Relationship Between Drug-Related Killings and Drug Hubs
   - Map 3.1 Drug-related Killings and Drug Hubs 2007
   - Map 3.2 Drug-related Killings and Drug Hubs 2008
   - Map 3.3 Drug-related Killings and Drug Hubs 2009
   - Map 3.4 Drug-related Killings and Drug Hubs 2010
Map 2.1: Mexico's Drug-related Homicides Distribution 2007

Drug-Related Killings Distribution in 2007

Total Drug Killings Rate
(for 100,000 people)
- < 5
- 5.1 - 10
- 10.1 - 25
- 25.1 - 40
- 40.1 - 777
- No Killings

Mexico's Outline
Main Cities

Projected Coordinate System:
North America Lambert Conformal Conic

Sources: Mexico's Presidency,
Mexico's Institute of Statistics and Geography (INEGI).
Map 2.3 Mexico’s Drug-related Homicides Distribution 2009
Map 2.4 Mexico’s Drug-related Homicides Distribution 2010
Map 3.1 Drug-related Killings and Drug Hubs 2007
Map 3.2 Drug-related Killings and Drug Hubs 2008
Map 3.4 Drug-related Killings and Drug Hubs 2010
ANALYSIS

Reference/Descriptive Maps

1. Map Series: Main Characteristics of Drug Areas
   The series of descriptive maps illustrate Mexico’s main illegal drug production areas for the native drugs of marijuana and opium poppy, as well as synthetic drugs. The first map also shows the main smuggling points for cocaine. The series shows a relationship between areas with high marginalization levels and generally low population density, and areas that are the main drug producers.
   The main areas for marijuana, opium poppy and synthetic drugs are located along the Sierra Madre Mountains, particularly on the Pacific Coast; while cocaine shipments have been detected on both the Caribbean and the Pacific Coasts, as well as even more often in areas bordering the United States and near major ports and highways.

2. Map Series: Distribution of Drug-Related Homicides
   This series shows a progression, both in killings rates and in their spread over the Pacific Coast and along the border with the U.S. By 2007, the situation seemed more under control, with drug-related killings limited to certain areas including the border cities of Tijuana and Juarez, and the coastal region of Guerrero state and the areas surrounding Culiacan, the capital of Sinaloa state. Only a few municipalities had a drug-related homicide rate of more than 40.1 per 100,000 people, which is fairly large in comparison to international figures and the rate reported by Mexico to the United Nations Office on Drugs and Crime (UNODC), which for 2007 was 8.1 per 100,000 for the whole country (UNODC 2011).
   The situation got worse in 2008, with drug-related killings expanding, especially to the north in the state of Chihuahua, and also showing an increase in the border area of Tamaulipas, on the Gulf Coast. Things did not improve the following year. Worse still, the drug-related killings rate skyrocketed in most of the municipalities in the states of Chihuahua, Durango and Guerrero, while violence also began looming in areas along the border with Guatemala.
   For 2010, killings were totally out of control, with most of the municipalities hardest hit recording homicide rates above 25.1 per 100,000 people. That compares to 21.6 in Panama; 24.9 in the Dominican Republic; 11.3 in Costa Rica; 33.4 in Colombia; 4.6 in the U.S.; 1.2 in Ireland; and 0.8 in Germany for the same year (UNODC 2011).
   Mexico, meanwhile reported a national homicide rate of 12.7, 17.7 and 21.5 homicides per 100,000 people, respectively, for the years 2008, 2009, and 2010.

Analytical Maps

3. Map Series: Relationship Between Drug-Related Killings and Drug Hubs
   This series shows a spatial relationship between the areas hardest hit by drug-related killings and municipalities that are drug hubs, defined as those areas that produce or smuggle two and three different drugs in the same year. The maps show that these areas are not necessarily the main producers. The series also shows a relationship between killings and the main highways (those which have at least 4 lanes).
   The series shows how the number of drug hubs has been increasing since 2007, particularly in the areas near the cities of Acapulco, Morelia, and Chihuahua. From 254
municipalities that were two drugs’ hubs in 2007, the number jumped to 307 in 2010, while the three drugs’ hubs went from 20 to 87 in the same period.

These maps also show an increasing concentration of killings around Mexico City, especially in Morelos and Mexico states over time. Meanwhile, gruesome homicides started appearing along the Gulf Coast, a territory in dispute between the Zetas and the Gulf drug cartels, in an area where no drug hubs have yet been detected.

**CONCLUSIONS & POLICY IMPLICATIONS**

By making a visual analysis, it is easy to discern that municipalities that are main producers of one drug are not necessarily violent. Conversely, municipalities which bear the brunt of drug-related homicides tend to be the ones that become drug hubs and happen to be well connected or close to main highways. Drug hubs are not necessarily in main production areas and vice versa. A good example of this is the state of Oaxaca, which has many municipalities that have been traditional producers of marijuana. There are almost no drug hubs there, however, and no related killings reported.

While the analysis presented here makes it easy to conclude that violence is not strictly tied to drug trafficking and production, it is much harder to determine if there is a relationship between population density and drug hubs. Municipalities that are drug hubs, however, coincide with areas of great marginalization in Nayarit, Guerrero and Michoacán states, as well as in the “Golden Triangle” of production located in the conjunction of Durango, Chihuahua, and Sinaloa states. Social and economic marginalization, therefore, can be seen as a much greater indicator of a region’s likelihood to become a drug hub than population density.

The fact that homicides in 2010 greatly increased in the Gulf Coast, particularly in Tamaulipas state — where the data collected does not allow us to determine whether drug hubs exist there or not — may indicate the changing business of the drug organizations. The Gulf Coast is an area in dispute between the fierce Zetas and Gulf Cartels, and the Zetas have become known for kidnapping immigrants heading north in an attempt to sneak into the United States, many of whom have been killed by the traffickers. In this way, the growing drug-related violence in this area suggests that, in the ever-evolving environment in which drug organizations develop, trafficking is only one of the criminal activities cartels now perform. Therefore, their new crimes may very likely cause much more, and new forms of, violence in the near future.

The policy implications are many, and go from changing the military strategy against the drug cartels for one that includes institution building and antipoverty plans. Another recommendation would be to develop more strict controls in the main highways.

This paper’s research and analysis indicates that any serious effort at reducing Mexico’s growing drug violence epidemic should start with further study of the country’s elaborate transportation networks for illegal drugs, as well as additional research to determine which kind of narcotic — cocaine versus marijuana versus opium poppy versus methamphetamine and other synthetic or designer drugs — has more incidence in the killings. Further effort also must be made to determine how that effect changes over time, as smuggling patterns shift and the U.S. market for illegal drugs changes.
APPENDIX
EXTENDED METHODOLOGY

A. Index Map and Mexico’s main characteristics
Data used: States, Muni_States, Main_Cities, Population, Marginality, North America Basemap
- Downloading the data from respective websites.
- Join the Population data with the Muni_States shapefile and export to create a new shapefile called Population.
- Join the Marginality data with the Muni_States shapefile then export the data to create a new shapefile called Marginality.
- From the localidadUrbana shapefile, selected the most well-known cities and those with the highest homicide rate, and export the data to create a new shapefile called Main_Cities.
- Then use the Feature to Point tool and convert it to a point shapefile. Name it Main-CitiesPoint.
- Added a field to Population to calculate the area in square miles with the Calculate Geometry function. Symbolize the population by using PopTot05, normalized by Area (per square mile).
- Set the scale manually to 6 six classes: < 25, 50, 100, 300, 1,000 and > 1,000.
- Mexico has a lot of variation in the size of its municipalities. Those in the north, near the border with the U.S. tend to be large, while those in the center of the country and surrounding the capital of the country, are smaller. A special case is the state of Oaxaca, which has a large indigenous population living as communities, which constitutes a big chunk of the municipalities in Mexico.
- Symbolize the Marginality layer based on High and Very High.

B. Set the areas and variables to study and the time span.
1. Drug areas:
   - Data used: Marijuana_Seizures, Opium_Seizures, Coca_Seizures, Labs_Seizures, Muni_States, States
   - Download the data from the respective websites.
   - Join Muni_States shapefile with the Marijuana_Seizures, Opium_Seizures, Coca_Seizures, Labs_Seizures tables. The tables from the Ministry of Defense lack the keys for the geographical areas (codes for areas), so a common field with the Muni_States shapefile was created.
   - I set the minimum matching records level at 90 percent for each joint.
   - Export the Data (all features) and create a consolidated shapefile of drug eradications (marijuana and opium poppy) and seizures (cocaine and labs) with the joint data. Name the new shapefile AllDrugs.
   - Make a query by Attribute and select from AllDrugs the municipalities that had at least 10 hectares of marijuana eradicated every year. Export the data to create a new shapefile, call it MarijMainProducers.
   - Repeat the same steps for Opium. Name the new shapefile OpiumMainProducers.
   - Repeat the process with Cocaine and Labs, in these cases selecting the municipalities that had at least 10 kilograms of cocaine and one Lab seized in
some of the four years between 2007 and 2010, respectively. Name the new
shapefiles CocaMainRoutes and LabsMainAreas.

- Draw two maps: marijuana and opium eradication, and cocaine and labs seizures.

**2. Drug-related homicides areas (2007-2010).**
Data used: Muni_States, TotDrug_Kills, TotDrugKills_PopClipped
- Download the data for killings from the respective websites.
- Join the table of the total homicides to the polygon for municipalities. Export the
data as a new layer and name it TotDrug_Kills.
- Then, join the shapefile to the Population table. Export the data and create a new
shapefile.
- Finally, do a query to select the municipalities that have at least one killing every
year. Export the selection to create the final shapefile TotDrugKills_PopClipped,
which will be used in the analysis.
- Create the layouts for every year. Symbolize by Quantity, and Graduated Colors.
  Set the Value to the corresponding year (Y2007, Y2008, Y2009, Y2010) and
  normalize by Population (PopTot05).
- Set the classification to Manual, and 5 categories: 5 or less, 5.1 to 10, 10.1 to 25,
  25.1 to 40, and 40.1 to the greatest homicide rate this particular year.
- Use the same template to draw the maps, including the same classification to be
able to make comparisons.

**C. Examining the relationship between drug-related killings and drug
eradications and seizures over time.**
Data used: Muni_States, States, TotDrug_Kills, Marijuana_Seizures,
Opium_Seizures, Coca_Seizures, Labs_Seizures
- Convert the TotDrug_Kills polygon shapefile to a point shapefile by using the
  Feature to Point tool of the ArcToolbox.
- Select the municipalities which had at least one homicide every year. Each time,
  export the selection as a shapefile and create a layer with the killings for the
  respective year (TotKills_07, TotKills_08, TotKills_09, and TotKills_10).
- Join the drug layers (Marijuana_Seizures, Opium_Seizures, Coca_Seizures, and
  Labs_Seizures) by using a spatial joint. Name the new layer All_Drugs.
- Localize the “drug hubs” (municipalities that had eradications and/or seizures for
two and three types of different drugs during the year under analysis) by making a
query to select the hubs for each year.
- Calculate how many combinations of different drugs necessary to look for. Use
  factorials to calculate 4C2 = 6 and 4C3 = 4.
- Export the selected data as shapefiles. Name them TwoDrugsHubs and
  ThreeDrugsHubs.
- Repeat the same operation for each year.
- Make a definition query to show only the municipalities which had more than 10
  killings during the year being analyzed. Even though this number can appear
  small, there are some municipalities that are extremely small, and for which
  the killing of 10 people in a given year is a large figure.
- Signalize the possible clusters of homicides which do not follow the pattern.
DRAWBACKS & DATA LIMITATIONS

One drawback comes from the nature of the data I am working with: homicides reported to the municipal level. Because the data lacks the exact geographic coordinates where killings occurred, it is impossible to determine the exact areas that have been hardest hit by violence.

Another problem is that the shapefiles from INEGI have little relevant data in their attribute tables. That means I have less leeway to choose the features I want to show and the symbology I want to apply.

I am working on a nationwide level, with irregular polygons, which means that, visually, data might appear grouped or suggesting certain patterns in areas where there are larger concentrations of smaller municipalities. A good example is the state of Oaxaca, with 571 municipalities that account for a quarter of the total number in the country but have relatively small populations. Another example is Mexico City and surrounding Mexico State, located at the center of the country.

The process of joining attribute data from tables to a shapefile had additional complications due to the lack of an area code for each municipality at every state for the killings and drug data. The outcome was that the joints had to be based on the names of the municipalities hyphenated to the state they belonged to, with the consequence that they sometimes did not coincide. The data on drugs from the Ministry of Defense was especially difficult to work with because of abbreviations in the names, frequent misspellings of names and other information, data referenced to a specific city instead of a larger municipality, and geopolitical reorganizations of many municipalities in recent years. However, the study kept as a standard of at least a 90 percent successful matched record in every joint performed.

The data collected for this study includes eradications of marijuana and opium poppy, and seizures of cocaine and synthetic drug labs. To further advance study in this area, it would be extremely useful to obtain available data on smuggling marijuana, poppy and synthetic drugs as well.
REFERENCES (Other than the GIS data)


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