An Examination of Pollution and Poverty in the Great Lakes Basin

POVERTY AND POLLUTION MAP

Census Subdivisions in the Great Lakes Basin with Poverty Rates at or above the National Average of 11.8 Per Cent and Air Releases of Combined Pollutants over 1 Million Kilograms*

Sault Ste Marie
Espanola
Owen Sound
Windsor   London   Hamilton   Toronto   Hull   Thurso   Cornwall   Lachute
Salaberry-de-Valleyfield
Melocheville
Montréal
Montréal-Est
Sorel-Tracy
Joliette
Grand-Mère
Shawinigan
Trois-Rivières
Bécancour

Kirkland Lake   Rouyn-Noranda   Senneterre   Saint-Basile   Saint-Romuald   Québec

Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie

Legend
- High Poverty and Pollution
- Below High Poverty and Pollution Threshold
- No Data
- Great Lakes Basin Boundaries

0   125   250   500 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data,
Environment Canada; 2005 Census Subdivision and 2001 Income
Data and Poverty Rate, Statistics Canada

* From industrial sources reporting combined (toxics and criteria air contaminants) air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families

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Executive Summary

The relationship between pollution, such as air pollution or industrial emissions, and social factors, such as income or ethnicity, has been studied extensively in the United States. Such studies have led to a movement within the environmental community often referred to as environmental justice or environmental equity.

In Canada, relatively few studies exist examining the relationship between pollution and social factors. Most of the Canadian studies to date have primarily addressed this issue in the academic arena, although recent efforts have started to expand the scope of the discussion. These efforts include networking across communities and among stakeholder groups.

No Canadian environmental non-governmental organization has studied the relationship between pollution and social factors in a substantive way. To address this gap and to contribute to the dialogue, the PollutionWatch partners (the Canadian Environmental Law Association and Environmental Defence) set out to examine the relationship between one measure of pollution – reported industrial air releases – and one social factor – income (specifically, a measure of poverty) – in a specific area of Canada – the Great Lakes basin. According to Statistics Canada, the average national poverty rate was 11.8% (based on LICO total income for economic families before tax, 2001 Census). This study aims to examine whether areas with high pollution releases also have more people of low income.

By mapping air release data of pollutants considered toxic and criteria air contaminants from the National Pollutant Release Inventory (NPRI), the federal government's national pollution reporting program, and income data from Statistics Canada, the PollutionWatch partners were able to explore two key questions: (1) Which areas in the Great Lakes basin have higher air releases of pollutants from industrial facilities? (2) Do areas with higher releases of air pollutants also have higher percentages of people living in poverty?

This study finds (see section 3):

- Large amounts of pollutants are released from industrial facilities in the Great Lakes basin; more than 1 billion kilograms, about 25% of total air pollutants reported in Canada, were reported being released to the air in 2005 in the Great Lakes basin.
- The reported releases of air pollutants from industrial facilities vary widely across the Great Lakes basin.
- There are some areas in the Great Lakes basin, such as Montreal and Windsor, that have both high reported air releases (combined air pollutants and toxic air pollutants) and high poverty rates. People living in these areas may have a double challenge: high potential for exposure to pollutants, as well as all the physical and social vulnerabilities that come with living in poverty (Figure 14 and 15).
- Areas with higher air releases of pollutants tend to have higher poverty rates. Areas with lower releases of pollutants tend to have lower poverty rates. There is a large amount of variability, so not all areas with high releases of pollutants have high poverty rates. For

census subdivisions in the Great Lakes basin, the amount of toxic air pollutants released (log transformed) was significantly correlated to the poverty measure (r=0.184, n=262, p=0.003). **In other words, as the amount of toxic pollutants released increased, the incidence of poverty also tended to increase in the census subdivisions in the Great Lakes basin.** Correlation coefficients using releases of CACs (log transformed) and poverty were also significant (r=0.205, n=320, p=0.0003). Correlation coefficients using releases of combined air pollutants (log transformed) and poverty were also significant (r=0.205, n=320, p=0.0002).

Mapping pollution and income data at the census subdivision level throughout the Great Lakes basin offers one look at the relationship between pollution and poverty. To examine the link more closely, the PollutionWatch partners also mapped pollution and income data at the census tract and neighbourhood levels for the City of Toronto (see section 3). Exploring the relationship at this level, the study found:

- Similar to the Great Lakes basin as a whole, the releases of air pollutants from industrial facilities and poverty rates vary across Toronto. Some areas in Toronto clearly face a double challenge: higher air releases from reporting facilities and higher poverty rates.
- 17 neighbourhoods in Toronto have high emissions of combined air releases (toxic and criteria air contaminants), as well as poverty rates above the national average. Many of these neighbourhoods have already been identified as priority areas through the Toronto Strong Neighbourhoods Strategy, released in June 2005.

An Examination of Pollution and Poverty in the Great Lakes Basin clearly shows the need to reduce both pollution and poverty, and also to connect these efforts. This study demonstrates there are still large amounts of pollutants being released from industrial facilities, and still large areas with high poverty rates. For some communities, these two challenges collide.

As a start, governments, agencies and public interest non-governmental organizations – including health, environmental, and social justice/anti-poverty organizations – must develop effective strategies to reduce both pollution and poverty. They must also pay extra attention in cities and neighbourhoods that are twice challenged: once by poverty and once by pollution.

Section 1 outlines the purpose of the study and provides an overview of environmental justice work in Canada and the United States. Section 2 provides an overview of the project methodology. In section 3 of the study, the results from mapping pollution and poverty data at the census subdivision level in the Great Lakes basin is presented. This section also focuses on the census tract and neighbourhood levels in Toronto. In section 4 of the study, the PollutionWatch partners outline a number of recommendations to contribute to the ongoing policy and program work to reduce poverty, including the integration of pollution as a factor contributing to the challenges faced by people living in poverty in the Great Lakes basin.

In support of the work of various organizations, including the World Health Organization, to promote research and policy programs that address social determinants of health such as poverty and pollution and the United Way's anti-poverty efforts, the Canadian Environmental Law Association and Environmental Defence recommend:

1. Formal recognition by all levels of government that pollution can affect people's mental, physical and emotional health and that people living in poverty may be additionally affected by pollution.

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2. In light of the findings of this study that some low income communities also experience high pollution releases, further research be conducted by all levels of government, academics, anti-poverty and environmental organizations to gain a better understanding as to how people's mental, physical and emotional health is affected by living in poverty in communities with high pollution burdens. These findings should help inform the development of anti-poverty reduction plans.

3. Governments develop, in consultation with a diverse range of communities, including anti-poverty, environmental and health sectors, to develop a clear environmental equity policy framework that considers how the connections between poverty and pollution can be integrated in concrete ways into environmental decision-making processes (e.g., environmental approvals, standards approvals, management of toxic substances, etc.). The process of facility siting and permit renewals should include the consideration of cumulative loadings from multiple sources in the air shed.

4. As the province of Ontario considers the development and enactment of a Toxics Use Reduction law, this law should include prevention and elimination of the most harmful substances, such as cancer causing substances and reproductive and developmental toxicants.

5. The City of Toronto should pass the proposed Environmental Reporting, Disclosure and Innovation Programme, allowing for better tracking of pollutants in Toronto's neighbourhoods. Other municipalities in the Great Lakes basin should consider similar environmental reporting and disclosure programs for their communities.

In addition, the PollutionWatch partners recommend that in all communities, but especially in those communities twice challenged by pollution and poverty, municipal governments work with local agencies and the community to:

- take account of the sources and nature of pollution in the community;

- create and communicate a "pollution map" of the community;

- take account of environmental equity considerations in community planning, including siting of industrial facilities;

- engage with and develop strategies to reduce and prevent pollution from all sources: industrial facilities, mobile and other sources;

- require pollution prevention planning for industrial sources within the community;

- continue to monitor the community and report on indicators of mental, physical and emotional health and consider ways to integrate findings with measures of local pollution; and,

- increase support for many anti-poverty measures such as school food programs, literacy support, community centre programs, child care programs and supportive housing in ways that would help to reduce the impacts of the pollution burden.

1. Introduction: Pollution and Poverty

In 2001, two Canadian non-governmental environmental organizations, the Canadian Environmental Law Association (www.cela.ca) and Environmental Defence (www.environmentaldefence.ca), jointly created an online pollution tracking tool known as PollutionWatch (www.PollutionWatch.org). This innovative tool allows individuals to track pollution from industrial facilities in their communities and to compare pollution levels of facilities across Canada. PollutionWatch allows people to see the amount of pollutants released over time and see if these pollutants are considered carcinogens, reproductive toxins, or are associated with other adverse environmental and health effects.

Previous PollutionWatch reports have documented large amounts of pollution entering the Great Lakes basin. In 2002, the amount of toxic pollutants released from industrial facilities located in the Great Lakes basin reporting to the National Pollutant Release Inventory (NPRI) was over 151 million kilograms to air, water, land and transferred off-site. That same year, reporting facilities also reported releasing to the air an additional 1,104 million kilograms of criteria air contaminants (CACs) that contribute to smog, acid rain and haze (see reports: *Great Lakes, Great Pollution: Canadian Pollutant Releases and Transfers to the Great Lakes* (2005) and *Partners in Pollution: An Assessment of Continuing Canada and United States Contributions to Great Lakes Pollution* (2006) from www.PollutionWatch.org).

This pollution burden is significant for many communities in the Great Lakes basin. Over the past several decades, the governments of Canada and the United States have led a number of initiatives that specifically aim to address the levels of toxic substances found in the Great Lakes basin. Through PollutionWatch, and other evidence gathered on toxic substances, it is clear that the challenges posed by toxic pollution differ across the basin. Not all communities experience the same pollution burden, nor do all communities have the same resources, income, or ability to advocate for effective action to address these pollution burdens.

There is a considerable amount of literature in the U.S. addressing the disproportionate impact of pollution on low income people. There is some literature covering this issue in Canada. This report examines the relationship between pollution and poverty in the Great Lakes basin.

This approach supports the current priorities of the Canadian Environmental Law Association and Environmental Defence, who recognize through their work on pollution and health that people of low income may be particularly vulnerable to the impacts of pollution. People of low income have several significant challenges that contribute to their vulnerability to the impacts of pollution. The challenges faced include limited access to affordable housing options, social and legal services, and affordable nutritional sources of food, among many. People of low income may also live in areas with higher amounts of pollution, so they may receive a higher "dose" of pollution.

The PollutionWatch partners, through this study, *An Examination of Pollution and Poverty in the Great Lakes Basin,* set out to examine if areas in the Great Lakes basin with high pollution releases also have more people of low income. Through its methodology (described in Section 2 of this report), this study uses one measure of pollution – air releases, and one measure of socio-economic factor – income, to:

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1) locate the areas in the Great Lakes basin with the largest releases of air pollutants from industrial facilities reporting to the NPRI;
2) locate the areas in the Great Lakes basin with the highest levels of poverty; and,
3) explore the relationship between pollution and poverty in the Great Lakes basin.

a. Environmental Justice Movement

Much work has been done in the U.S. to investigate the relationship between some measures of pollution, such as air quality data or presence and proximity of industrial facilities, and some measures pertaining to factors such as race, ethnicity and/or income, such as home ownership, property values, percent African American, percent Latino. This approach to examining the relationship between pollution and poverty is known by different names, including environmental justice, environmental injustice, environmental racism or environmental equity. The U.S. Environmental Protection Agency (EPA) defines environmental justice as "a disproportionate share of negative environmental consequences which flow either directly from industrial, municipal and commercial operations" or indirectly from the way "federal, state, local and tribal programs and policies are carried out."

Given the specific scope of this study, it is not meant to be a comprehensive summary of all academic work on pollution and poverty and environmental justice. While many researchers have found a relationship between pollution and poverty, others have not (Maantay, 2002). Some researchers have tried to determine if race/ethnicity or income is the most important factor in determining proximity to industrial facilities. Others have tried to determine if the people settled first and then the facility was built or vice versa. Some have used a variety of measures of air pollution, including plume dispersion modeling, toxicity weighting of air releases, and air monitoring data. Other researchers have experimented with different geographic units, mapping techniques, and statistical analyses. Early reports using 1990 data on toxic air pollutants found, for example, that people of colour were more likely to live near industrial sources of air pollution. African Americans were found to be more likely than Whites to live in areas with higher toxic air pollutants in every large U.S. metropolitan area (American Lung Association, 2007).

Many researchers in the U.S. have found a higher percentage of African Americans than Whites live closer to industrial facilities and are more likely to live near many industrial facilities. Studies looking at emissions from power plants found that 68% of African Americans live within 30 miles of a coal fired power plant compared to only 56% of Whites (American Lung Association, 2007). Researchers found an income gradient around Toxics Release Inventory (TRI) facilities in the San Francisco Bay area, with lower income and lower home ownership closer to TRI facilities (CJTC, 2007).

The U.S. web site Scorecard (www.scorecard.org) uses TRI data to locate communities with unequal burdens. Typing in a zip code will produce a summary of environmental justice measures in a community. This site identifies 1,051 counties in the U.S. where People of Color are numerically worse off than the rest of the population for the environmental burden and releases of toxic chemicals (based on 1998 releases).

In the U.S., these early findings of unequal burdens led to a number of reforms. In 1994, a Presidential Executive Order required all federal agencies to develop strategies to incorporate environmental justice concerns. This led to an institutionalization of environmental justice in the U.S. government, which is not generally seen in Canada. In the U.S., environmental justice is to

be integrated in all departments, and is coordinated by the Inter Agency Working Group, consisting of the heads of 11 departments. The Presidential Executive Order also created the U.S. EPA Office of Environmental Justice to coordinate inter-agency environmental justice activities. The EPA also created a multi-stakeholder, independent group, the National Environmental Justice Advisory Council. Memorandums from EPA administrators further committed the EPA to integrate environmental justice into all EPA programs (Whitman, 2001; Johnson 2005). For example, the EPA has the authority to consider environmental justice in issuing permits for industrial facilities, and designing air monitoring programs. Since 1994, the EPA has also provided grants to organizations for environmental justice projects.

Less work on environmental justice has been done in Canada. Several studies have been done in Hamilton, Ontario. These studies found that levels of particulates and gaseous air pollutants such as sulphur dioxide varied across Hamilton. This resulted in different doses of pollution in different areas of the city. Persons in poorer neighbourhoods generally received higher doses of air pollution (Jerrett, 2007). Pollution as measured by ambient air monitors was associated with low educational attainment, low income, and high employment in manufacturing (Jerrett, 2004).

A study in Montreal analyzed the relationship between total NPRI releases per kilometre and socioeconomic characteristics. Pollution measures were inversely related to income (as pollution goes up, income goes down) and positively associated with unemployment rate (as pollution goes up, unemployment also goes up), while there was no strong association with the broad categories of visible minority or immigrant population (Premji *et al,* 2007). The study authors further broke down the immigrant data into specific ethnic groups and found that the proportion of immigrants from Southern and South East Asia was associated with higher pollutant releases.

A study by Sandanayake out of the University of Toronto also found a significant correlation between proximity to an NPRI facility and low income in several larger Canadian cities (Toronto, Montreal, Vancouver, Ottawa, Calgary, Hamilton, Halifax and St. John) but not in smaller Canadian cities such as Red Deer, Victoria, Saskatoon and Sudbury (Sandanayake, 2007).

Different patterns of poverty and race or ethnicity may be one of the key reasons why less work has been done in Canada on the relationship between pollution and poverty. One of the goals of this study is to start the conversation in Canada on the interconnection between pollution and poverty and to propose ways to bring these two issues together, along with actions to reduce both pollution and poverty.

Some progress is being made on this front. There are intriguing processes of collaboration currently underway that have the potential to examine and influence pollution burden and income connections. For example, the 25 in 5 Network for Poverty Reduction is a multisectoral network of over 100 organizations working toward elimination of poverty in Ontario (see www.socialplanningtoronto.org/25in5/index.html), while the Colour of Poverty is a province-wide community-based network that works on issues around the racialization of poverty. They have developed several excellent educational tools as part of their Colour of Poverty Campaign (see www.colourofpoverty.ca). Through extensive consultation with community groups and through organized Forums, Colour of Poverty has also developed a Framework for Action, which is a list of policy measures & program initiatives whose aim is to enable governments and key institutional actors to create policy frameworks that reflect an appreciation for the implications of racialization and related forms of exclusion.

The PollutionWatch partners believe that it is time to link pollution reduction efforts with efforts to reduce poverty, and to link poverty reduction efforts with efforts to reduce and eliminate pollution.

b. Poverty, Pollution and Health

There are many factors or determinants that contribute to human health, as outlined by the World Health Organization and the Public Health Agency of Canada's Population Health Framework (see Figure 1) (World Health Organization in CPCHE, 2005; Public Health Agency of Canada, 2008). Some of these determinants, such as biology and genetics, cannot be changed, while other health determinants, such as environmental exposures, are preventable.

Figure 1: Determinants of Health

Source: World Health Organization, undated.

The World Health Organization Commission on the Social Determinants of Health works with countries to facilitate and strengthen government action to systematically address the causes of health inequities (Public Health Agency of Canada, 2008). It aims to achieve the following:

- Improve performance of health policy, meaning all policies across government which have an impact on health outcomes.
- Increase capacity to design, implement and monitor intervention and address the social gradient of health.
- Place equity as the central concern in all government planning, policy and decision making.
- Strengthen the knowledge base and evidence for intersectoral policy and interventions.
- Mobilize the support of different actors such as global institutions and civil society to address the social determinants.

- Build political commitment to act on the social determinants of health. (World Health Organization, 2008)

In its 2008 report, Closing the Gap in a Generation, the World Health Organization Commission on Social Determinants of Health lays out the "rationale for a global movement to advance health equity through action on the social determinants of health." (Message from the Chair)

In a parallel approach, the Federation of Canadian Municipalities has developed thoughtful statements of key issues and policy statements on a variety of issues directly related to environmental equity. For example, the Policy Statement on Social Economic Development and the Policy Statement on Sustainable Development are among two of the key issue areas for the Federation and there are potential linkages between the two policies that would be of interest to future work on environment and equity (Federation of Canadian Municipalities, 2008).

The connections and issues of health and poverty have also been explored by Dr. Kellie Leitch (Leitch, 2007) in her study entitled *Reaching for the Top*, which references poverty as a key health determinant for all children, and for First Nations and refugee children in particular.

Similarly, the Chief Public Health Officer's Report on the State of Public Health in Canada 2008 contains a thorough treatment of social determinants of health and focuses on factors contributing to inequalities and recommendations for addressing them (Butler-Jones, 2008).

i. Income as a Determinant of Health

Living in poverty is a major determinant of health. Poverty is often associated with greater likelihood of chemical exposure (CPCHE, 2005). Research has shown associations between living in poverty and poorer health, low birth weight, shorter life expectancy, lower educational achievement and lower reading and writing ability of children (Lynch *et al.*, 1998; Ke, 2007; Mehdipanah, 2006). Poverty can lead to a number of conditions such as malnutrition (both the lack of food and lack of nutritious choices), obesity, depression, and learning difficulties (CPCHE 2005; CEC 2006).

Communities or groups within poor communities may also experience social vulnerability. This can be the result of many factors: low income, low language skills, social isolation and low education. Social vulnerability can result in decreased access to information, decreased ability to act on information, and decreased access to decision-making institutions (CJTC, 2007).

ii. Pollution as a Determinant of Health

Pollution is one of many challenges faced by communities. Exposure to high levels of pollution, particularly pollutants, such as lead and smog causing substances (e.g. particulate matters, sulphur oxides, etc.), place additional burdens on the citizens of a community.

Conditions such as malnutrition can render the body more vulnerable to the effects of pollution. For example, people, in particular children, who have low calcium and iron levels, are less able to bind metals such as lead. This generally occurs when the person does not drink milk or eat costly dairy foods. The presence of calcium in the body is important. Lead can be bound to calcium which is either stored in the bone or excreted from the body. When it is not bound up

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with calcium, lead is more likely to have an impact by traveling to the brain and other sensitive organs in the body.

A poor diet can also compromise a child's immune system and its ability to detoxify and excrete pesticides (CPCHE, 2005). In this way, malnourished people may be at greater risk as a result of exposure to certain pollutants than people with a healthier diet (CPCHE, 2005). The same is true for people living with diabetes who can be more sensitive to the effects of pollution such as particulate matter. Exposure to these pollutants renders the poor more likely to have respiratory problems, heart attacks and strokes. Being poor also can mean that people are more likely to live in low cost and substandard housing, which can also cause health problems (CPCHE, 2005).

iii. Sub-populations such as Children, Elderly, and People with Illnesses are More Vulnerable

Certain groups of people are more vulnerable to the effects of pollution than others. One such group is children who, because of their small size, unique physiology, rate of metabolism and behaviour patterns, can be more vulnerable to pollution than adults. Kilogram for kilogram of body weight, a child breathes more air, eats more food and drinks more water than an adult (CPCHE, 2005). This means that when a child is exposed to the same amount of a given chemical as an adult, the impact of that exposure will be greater (Health Canada, 2008). A child's ability to break down and eliminate pollutants is poorly developed at birth, leaving a child susceptible to the impacts of pollutants at critical times in his or her development. Children are also at the start of their lives, and therefore have a lifetime ahead of them to develop diseases with a long latency period (CEC, 2006).

Another group that is particularly sensitive to pollution is the elderly, who may have worse health outcomes compared to adults. Elderly people carry a lifetime burden of environmental contaminants which, in addition to other health challenges that seniors face, can increase their vulnerability to environmental exposure (Health Canada, 2008). Other vulnerable groups include Aboriginal people and those with suppressed immune systems. Research is also emerging which suggests that certain ethnic groups or populations may be more vulnerable to pollution than others because of their unique physiological pathways (CPCHE, 2005).

iv. Access to Justice, Health and Social Agencies

Organizations working on reducing poverty have shown that people of low income face many obstacles in their daily lives. The Policy Research Initiative, a research institute providing advice to Human Resources and Social Development Canada, defines poverty in this way:

> Nationally and internationally, there is growing recognition that poverty involves more than just income deprivation. It can also extend to (or result from) exclusion from essential goods and services, meaningful employment and decent earnings, adequate and affordable housing, safe neighbourhoods with public amenities, health and well-being, social networks, and basic human rights (Canadian Mental Health Association, 2007; Government of Canada, 2008).

By referring to this definition, some organizations are suggesting that people of low income face numerous challenges that prevent them from achieving good health.

In the courts, it has been noted that lower income Canadians face barriers in virtually all facets of society from employment and access to services to supportive housing. Some examples of barriers faced by people of low income include: purchase of costly uniforms for potential employees as a condition of employment; or efforts to open financial accounts may depend on providing extensive identification such as driver's license or credit cards which people of low income may not possess (Iding, 2003).

With the understanding that environmental degradation has significant impacts on all levels of society, and knowing that the most vulnerable groups are the most impacted from environmental degradation, this study set out to examine if areas in the Great Lakes basin with high pollution releases also have more people of low income.

2. Methodology

a. Great Lakes Basin Focus

The Great Lakes basin receives significant amounts of pollution from multiple sources in Canada as well as the U.S. This region is also home to more than 9 million Canadians. Many significant policy decisions on chemicals management in Canada, as well as in North America, originated from Great Lakes projects. While progress in reducing levels of toxic substances has been made in the Great Lakes basin in the past three decades, additional work is required to ensure that pollution levels from toxic substances do not impact the health of the Great Lakes basin and its residents.

Our organizations have a continuing interest in reducing pollution in the Great Lakes. Previous PollutionWatch reports have documented the extent of pollution in the Great Lakes basin. Mapping pollution in the Great Lakes basin will point to the need to look at cumulative impacts of pollution, rather than taking a source by source approach. In addition, there is very little literature demonstrating the linkages between pollution and income in the Great Lakes basin. A better understanding of the relationship between income and pollution levels may contribute to current policy work to address Great Lakes pollution, and identify areas challenged by pollution and poverty, which require further attention.

b. Strengths and Limitations of this Study

This study is one of the first efforts to map NPRI data using Statistics Canada's geographic boundaries. This allows the wealth of existing socio-economic data available on census subdivisions to be viewed alongside the new pollution data map layers. This study is also one of the first to investigate the relationship between income data and pollution data in the Great Lakes basin conducted by environmental non-governmental organizations.

It is important, however, that readers of this study are aware of some of the limitations related to the pollution and income mapping. Appendix D provides a more detailed overview of the methodology used by the project team to complete mapping and analyses of data and to assess the links between pollution and income. Some limitations related to this approach are as follows:

- The pollution data obtained from the NPRI reflects air releases from a limited list of pollutants and are reported mainly from larger industrial sources. NPRI data do not include all pollutants or all sources of pollutants to the environment (e.g. mobile and

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transboundary sources of pollutants). Please see the section on NPRI data in Appendix D for further limitations of NPRI data.

- NPRI data represents the amount of reported pollutants released into the environment. This data is not necessarily a direct measure of exposure or health effects. NPRI data is only one source for understanding exposure and health impacts.

- Pollution does not respect boundaries. Many pollutants will travel hundreds of kilometres from their source. Therefore, the pollution maps should be seen as indicating the location and amount of releases from industrial facilities, not necessarily the total pollution load in the environment in a given area.

- Though high releases of toxic and smog-causing pollutants occur, air dispersion may decrease the concentration of pollutants away from the NPRI facility. Air dispersion accounts for the actual decline in concentrations of the chemical away from the source through meteorology, terrain effects, air currents, and degradation by reaction with other chemicals in the atmosphere. The best way to determine the level of pollutant concentrations is to conduct regular monitoring throughout the year. While air dispersion is an important element in determining the impacts of air pollution on a community, this study does not account for air dispersion.

- Mapping allows readers to see areas with larger or smaller air releases of pollutants. An NPRI facility may be on the edge of an area and its reported air releases may also affect the surrounding areas.

- There are many ways to measure income. This study uses one commonly accepted method: Low Income Cut-offs, or LICO. This threshold is defined as the "income below which a family is likely to spend 20 percentage points more of its income on food, shelter and clothing than the average family."

- For some census subdivisions, there is no LICO data available, due to a small number of people living in the area. Statistics Canada also does not calculate a LICO for Aboriginal communities. This turned out to be an important limitation in the dataset as many of the high pollution areas are near Aboriginal communities (for example Sudbury, Sarnia and Haldimand). Statistics Canada provides other measures of income on Aboriginal communities, but these were either not comparable to the LICO measure used for this study, or not available for all Aboriginal communities in the Great Lakes basin.

- Statistics Canada sets census subdivision (CSD) areas based on municipal boundaries and other factors, and so CSDs may differ in area.

- The study does not examine pollution or income data over time, and therefore does not include analysis of changes over time.

3. Results

a. Pollution

This study finds:

- There are almost 2,000 NPRI facilities in the Great Lakes basin that reported releasing pollutants to the air in 2005 (see Table 1). These facilities can release toxic pollutants, those often associated with contamination (refer to NPRI Part 1, 2 and 3), or criteria air

contaminants (CACs), which are associated with smog or acid rain and respiratory impacts (refer to NPRI Part 4), or a combination of both categories of pollutants.

- In 2005, NPRI facilities in the Great Lakes basin released over 51 million kilograms of toxic air pollutants. In addition, NPRI facilities released over 1,000 million kilograms of criteria air contaminants (CACs). In total, the NPRI facilities in the Great Lakes basin (see Figure 2) released over 1 billion kilograms of combined air pollutants (toxics and criteria air contaminants), about 25% of the total air releases reported by NPRI facilities in Canada.

- There are large differences among areas in the Great Lakes basin in the amount of pollution released from industrial facilities. A few census subdivisions stand out as the locations of mega-polluters in the Great Lakes basin: Greater Sudbury, Haldimand, St. Clair, Sarnia, Toronto, Hamilton, Mississauga, Oshawa, Thunder Bay and Windsor. In all of these CSDs, NPRI reporting facilities released over 1 million kilograms of toxic air pollutants in 2005.

- Facilities which release large amounts of toxic pollutants also tend to release large amounts of criteria air contaminants (CACs).

The following sections present results by category of air pollutants (i.e., toxic air pollutants, criteria air contaminants, combined air pollutants).

Table 1: Summary of air releases of pollutants from NPRI facilities in census subdivisions (CSDs) in the Great Lakes basin in 2005

	Type of Air Pollutant Release		
	Toxic Pollutants	**Criteria Air Contaminants**	**Combined Air Pollutants**
Total number of CSDs in Great Lakes basin that report to NPRI	**282**	**340**	345
Total number of NPRI facilities	**1,398**	**1,798**	1,978
Total amount of pollutants reported in the Great Lakes basin in 2005 (kg)	**51,301,570**	**1,095,281,842**	**1,047,526,062**

NOTE: Toxic pollutants are those reported in Part 1, 2 and 3 to NPRI. Criteria air contaminants are those pollutants reported in Part 4 of NPRI. The combined air pollutants total does not include the group of volatile organic compounds (VOCs) reported as part of criteria air contaminants under the NPRI as to avoid double counting of individual VOCs reported as toxic pollutants.

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Figure 2: Location of NPRI facilities in the Great Lakes basin in 2005

POLLUTION MAP

Census Subdivisions and National Pollutant
Release Inventory Facilities in the Great Lakes Basin

Lake Superior

Lake Michigan

Lake Huron

Lake Ontario

Lake Erie

Legend

Census Subdivisions

° National Pollutant Release Inventory Facility

— Great Lakes Basin Boundaries

0   125   250   500 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data,
Environment Canada; 2005 Census Subdivision Data, Statistics Canada

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i. Releases of Toxic Air Pollutants

The total amount of toxic pollutants released from NPRI facilities in the Great Lakes basin in 2005 was 51,301,570 kilograms.

Figure 3: Air releases of toxic pollutants (kg) in census subdivisions in the Great Lakes basin in 2005

POLLUTION MAP

Air Releases* of Toxic Pollutants in Census Subdivisions in the Great Lakes Basin

Air Releases of Toxic Pollutants in Kilograms

- 1,000,001 to 15,000,000
- 300,001 to 1,000,000
- 30,001 to 300,000
- 0.1 to 30,000
- No Reported Releases
- — Great Lakes Basin Boundaries

0   125   250   500 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data,
Environment Canada; 2005 Census Subdivision Data, Statistics Canada
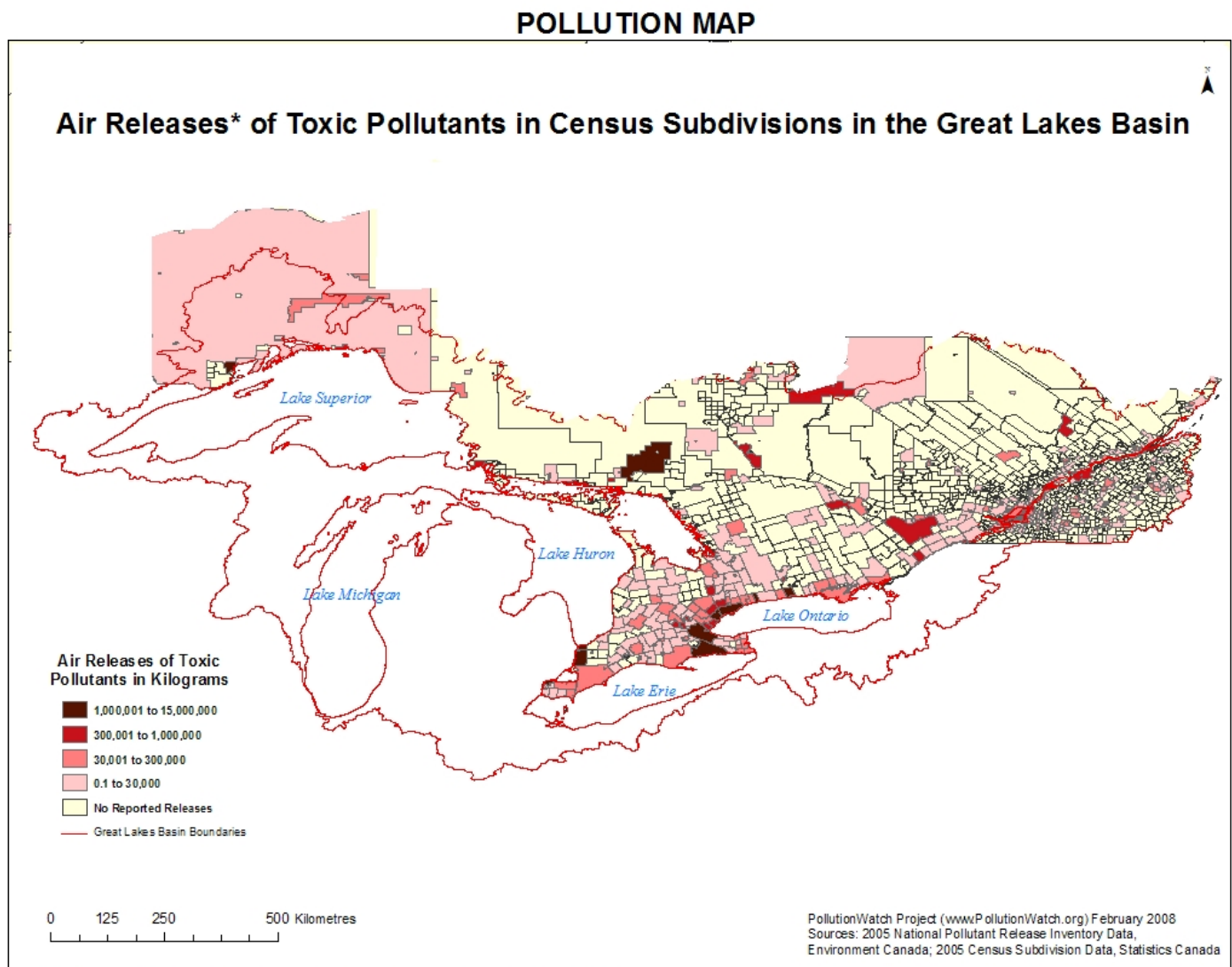
* From industrial sources reporting toxic air pollutants to the National Pollutant Release Inventory

Industrial releases of toxic pollutants vary widely across the Great Lakes basin. Some areas have very large releases of toxic pollutants (over 1 million kilograms) and some areas have very small releases of toxic pollutants (less than 20,000 kilograms).

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Approximately 20% of the 1,450 census subdivisions in the Great Lakes basin have an NPRI facility that reports air releases of toxic pollutants, which means that releases of toxic pollutants occur in fairly specific areas in the Great Lakes basin. The remaining 80% of the census subdivision areas in the Great Lakes have no facilities that meet the reporting thresholds of NPRI (generally 10 people and 10 tonnes of a pollutant; see Appendix D on NPRI data). However, in these areas, there may be smaller industrial sources and mobile sources of pollution that are not required to report to NPRI. In addition, pollution released in one area can easily travel to other areas.

Some of these census subdivisions have NPRI facilities with much larger air releases than others. The darkest shade on Figure 3 represents census subdivisions with NPRI facilities that release of over 1 million kilograms of toxic pollutants. There are 10 areas in the Great Lakes basin with the highest air releases of toxic pollutants, all in the Ontario portion of the basin (see Table 2). The next darkest shade on the map (see Figure 3) represents census subdivisions with NPRI facilities that release 300,001 to 1 million kilograms of toxic pollutants.
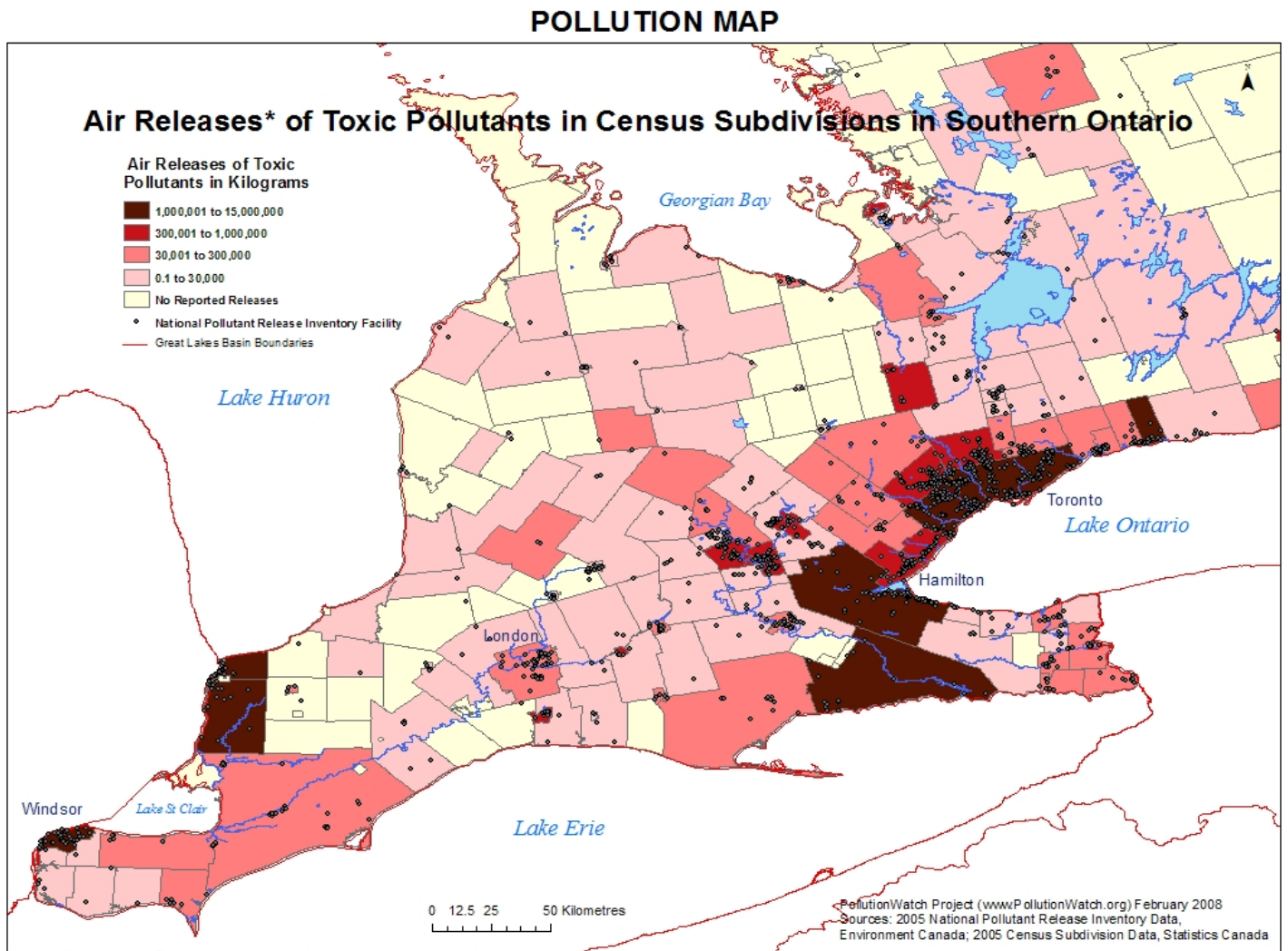
Table 2: Top 10 census subdivisions with the highest amounts of air releases of toxic pollutants in 2005 (kg) and the incidence of low income in economic families in 2001

Rank in Great Lakes basin	Name of Census Subdivision (CSD)	Province	Poverty Rate % in 2001	Number of NPRI Facilities that Report Toxics	Air Releases of Toxic Pollutants (kg) in 2005*
1	Greater Sudbury	Ontario	11.5	10	4,573,623
2	Haldimand	Ontario	6.3	7	3,010,746
3	St. Clair	Ontario	5.8	12	2,990,673
4	Sarnia	Ontario	11.3	8	2,837,269
5	Toronto	Ontario	19.4	150	2,819,466
6	Hamilton	Ontario	16.1	39	2,240,453
7	Mississauga	Ontario	11.3	71	1,653,908
8	Oshawa	Ontario	11.1	6	1,611,357
9	Thunder Bay	Ontario	11.1	11	1,216,208
10	Windsor	Ontario	13.2	30	1,007,380
	Total - top 10 CSDs			**344**	**23,961,083**
	Total all CSDs			**1,398**	**51,301,570**
	Top 10 as % of total			**24.6%**	**46.7%**

* CSDs with air releases of toxic pollutants above 1 million kg

With the exception of Greater Sudbury, all of the areas with the highest releases of toxic pollutants occur in southern Ontario. Taking a closer look at southern Ontario (see Figure 4), the project team noted the census subdivisions with 'highest' (over 1 million kg) and 'high' (300,001 to 1 million kg) releases of toxic pollutants are around the Golden Horseshoe area, and in the Sarnia and Windsor areas. St. Clair and Sarnia census subdivisions are adjacent areas that, if combined, would result in the census subdivision area with the largest releases of toxic air pollutants. The Greater Toronto area also has large releases of toxic pollutants.
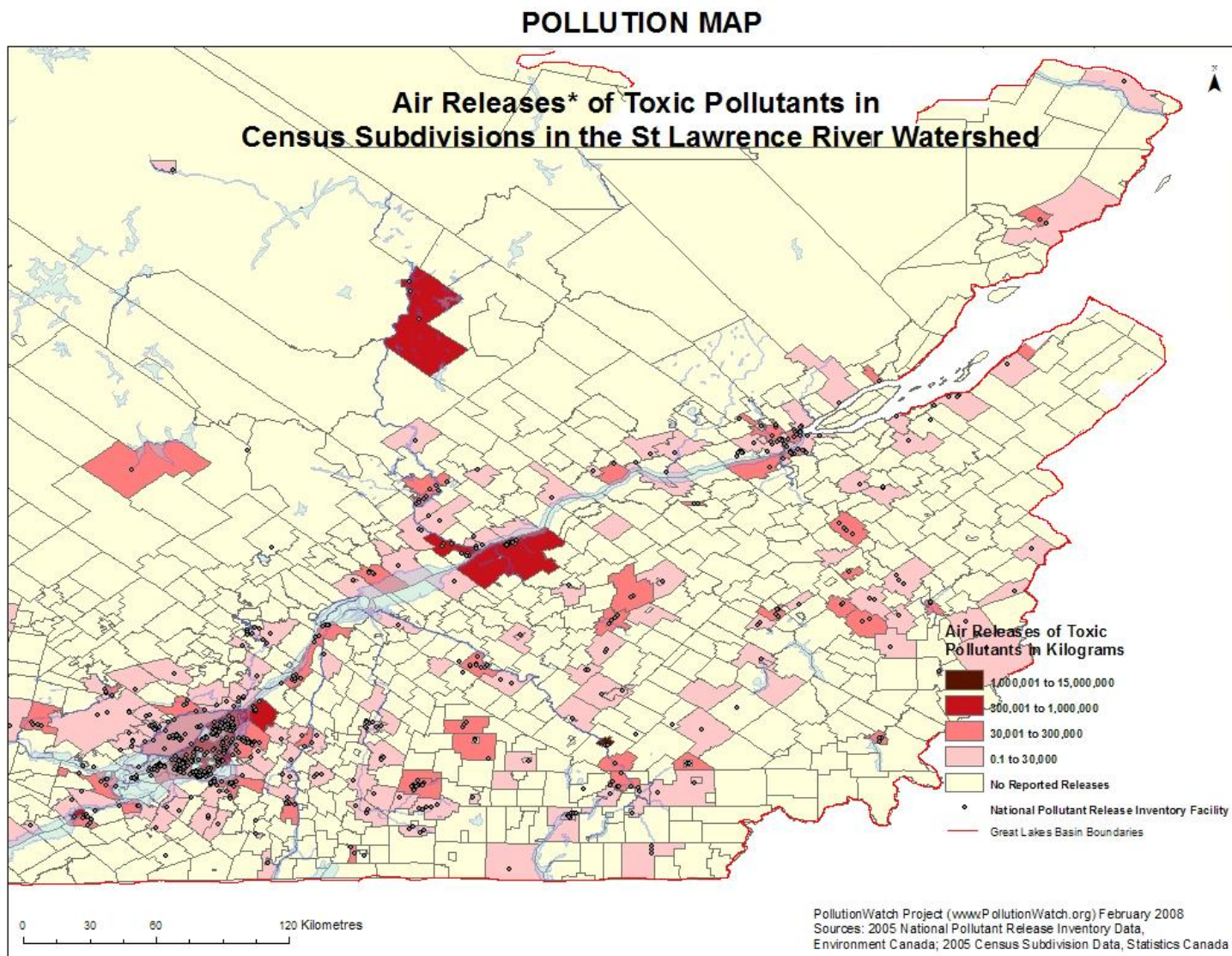
Figure 4: Air releases of toxic pollutants (kg) in census subdivisions in the southern Ontario portion of the Great Lakes basin in 2005

POLLUTION MAP

* From industrial sources reporting toxic air pollutants to the National Pollutant Release Inventory

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While there are no census subdivisions in the Quebec portion of the Great Lakes basin with reported releases of toxic pollutants in the 'highest' category (over 1 million kg), there are many with 'high' releases (300,001 to 1 million kg) (see Figure 5). A close look at the St Lawrence River portion of the Great Lakes basin reveals that there are 11 census subdivisions with releases in the 'high' category: Bécancour, Saint-Laurent, Montréal-Est, Témiscaming, La Tuque, Varennes, Grande-Ile, Montréal, Val-d'Or, Trois Rivières and Thurso.

Figure 5: Air releases of toxic pollutants (kg) in census subdivisions in the St. Lawrence River portion of the Great Lakes basin in 2005

POLLUTION MAP

Air Releases* of Toxic Pollutants in Census Subdivisions in the St Lawrence River Watershed

Air Releases of Toxic Pollutants in Kilograms

- 1,000,001 to 15,000,000
- 300,001 to 1,000,000
- 30,001 to 300,000
- 0.1 to 30,000
- No Reported Releases
- National Pollutant Release Inventory Facility
- Great Lakes Basin Boundaries

0   30   60   120 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data, Environment Canada; 2005 Census Subdivision Data, Statistics Canada

* From industrial sources reporting toxic air pollutants to the National Pollutant Release Inventory

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Facilities which emit large amounts of toxic pollutants also tend to release large amounts of CACs. Air releases of toxic pollutants and air releases of criteria air contaminants are highly correlated (Pearson correlation coefficient $r=0.87$, $p<0.001$).

ii. Releases of Criteria Air Contaminants (CACs)

The total amount of CACs released in the Great Lakes basin from NPRI facilities in 2005 was 1,095,281,842 kilograms. This amount is much larger than the toxic air pollutants noted in the previous section because the CACs, which are included in the combined air pollutants total, are generally released in much larger amounts. CACs are pollutants reported in Part 4 of the NPRI and include carbon monoxide (CO), total particulate matter (TPM), particulate matter equal to or less than 10 microns (PM_{10}), particulate matter equal to or less than 2.5 microns ($PM_{2.5}$), sulphur dioxide (SO_2), nitrogen oxides (NO_x) and volatile organic compounds (VOCs). These types of pollutants are often associated with adverse environmental effects such as acid rain, smog and haze.

Exposure to these pollutants is also associated with various health effects. Pollutants such as particulates, sulfates and nitrogen oxides may aggravate asthma symptoms. These air pollutants are also linked to heart and respiratory problems. In a 2008 study looking at eight Canadian cities, government scientists estimated that 5,900 deaths per year were linked to air pollution (Health Canada, 2008).

The releases of CACs are not evenly spread throughout the Great Lakes basin. There are some areas with very large releases (over 15 million kilograms) and some areas with very small releases (less than 20,000 kilograms) of CACs. The top two census subdivisions, Greater Sudbury and Haldimand, accounted for more than one third (34%) of the total releases. The top 10 census subdivisions accounted for almost 66% of the total releases (see Table 3).

Table 3: Top 10 census subdivisions in the Great Lakes basin with the highest air releases of criteria air contaminants in 2005 (kg) and the incidence of low income in economic families in 2001

Rank in the Great Lakes Basin	Name of Census Subdivision (CSD)	Province	Poverty Rate in 2001 (%)	Number of NPRI Facilities that Report CACs	Air Releases of Criteria Air Contaminants (kg) in 2005
1	Greater Sudbury	Ontario	11.5	20	245,632,576
2	Haldimand	Ontario	6.3	8	128,797,515
3	St. Clair	Ontario	5.8	15	71,257,006
4	Sarnia	Ontario	11.3	21	61,259,787
5	Hamilton	Ontario	16.1	41	58,459,377
6	Becancour	Ontario	11.9	9	45,579,386
7	Mississauga	Ontario	11.3	82	29,707,960
8	Rouyn-Noranda	Quebec	12.3	2	27,212,078
9	Deschambault	Quebec	N/A	1	26,006,500
10	Sorel-Tracy	Quebec	14.1	5	25,695,946
	Total top CSDs			**204**	**721,618,373**
	Total - all CSDs			**1,798**	**1,095,281,842**
	Top as % of all CSDs			**11.3%**	**65.9%**

"N/A" means income data not available from Statistics Canada. This is often due to a small population in the census subdivision.

iii. Releases of Combined Air Pollutants

The total releases of combined air pollutants in the Great Lakes basin in 2005 were 1,047,526,062 kilograms. Combined air releases are the sum of toxic pollutants and CACs, minus volatile organic compounds (VOCs). VOCs are excluded to avoid potential double counting, as some of the same compounds are reported as a toxic pollutant and also as a VOC under NPRI. In addition, only total particulate matter is included in the CAC total to avoid adding together TPM, PM_{10} and $PM_{2.5}$.

The releases of combined air pollutants are not evenly spread throughout the Great Lakes basin. Similar to toxic pollutants, about 80% of the census subdivisions in the Great Lakes basin do not have facilities that are required to report to NPRI for combined air pollutants. About 320 census subdivisions have facilities that report to NPRI for combined air pollutants. Of these 320 census subdivisions, the top two census subdivisions, Greater Sudbury and Haldimand, accounted for more than one third (36%) of the total combined air releases (see Table 4).

Table 4: Top census subdivisions in the Great Lakes basin with over 1 million kg of releases of combined air pollutants (toxic and criteria air contaminants) in 2005 (kg) and the incidence of low income in economic families in 2001
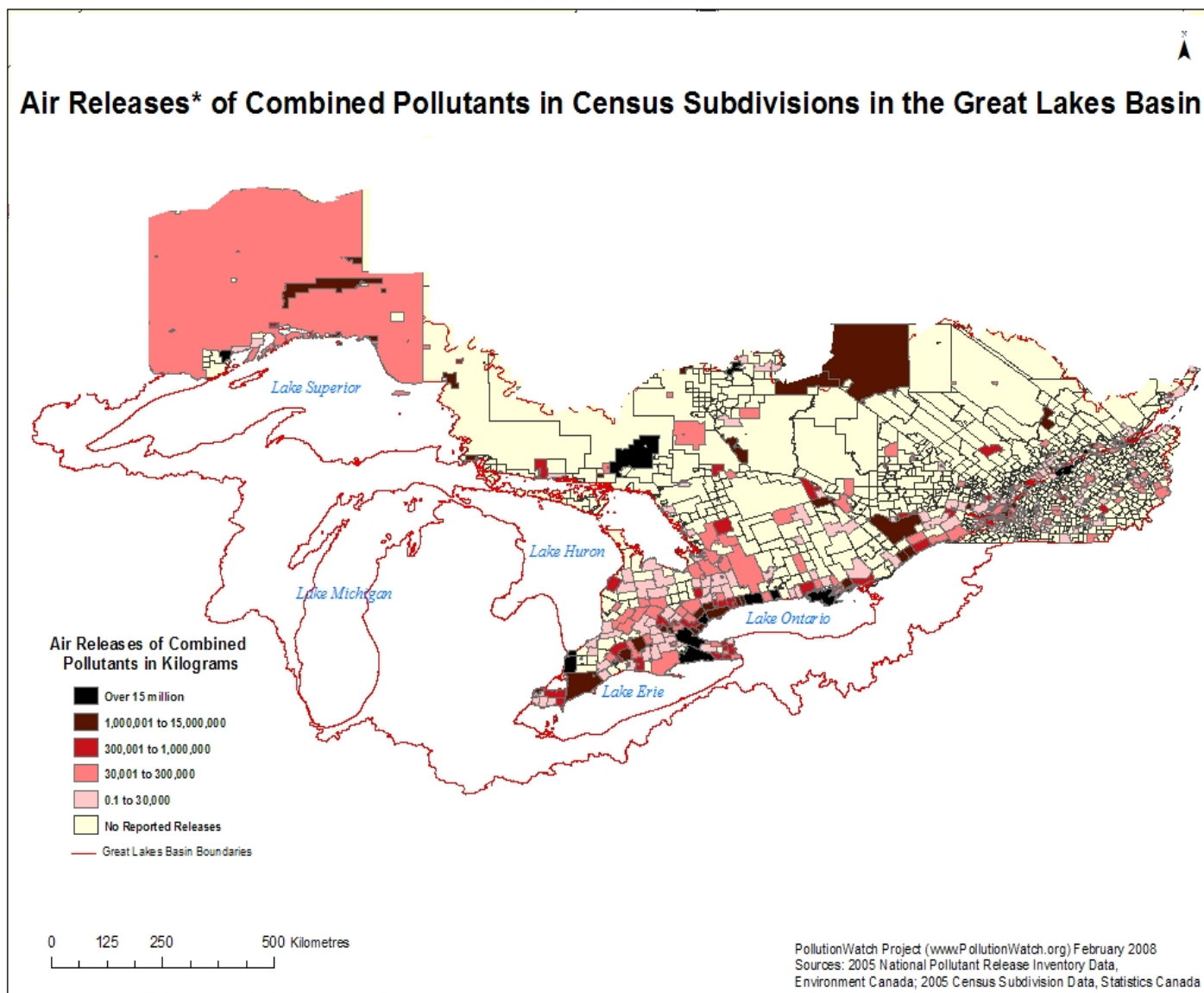
Rank in the Great Lakes Basin	Name of Census Subdivision (CSD)	Province	Poverty Rate in 2001 (%)	Number of NPRI Facilities Reporting Combined Air Pollutants	Air Releases of Combined Air Pollutants (kg)
1	Greater Sudbury	Ontario	11.5	19	249,973,413
2	Haldimand	Ontario	6.3	10	130,766,095
3	St. Clair	Ontario	5.8	15	72,273,300
4	Sarnia	Ontario	11.3	23	59,578,497
5	Hamilton	Ontario	16.1	52	58,788,549
6	Becancour	Quebec	11.9	9	45,680,098
7	Rouyn-Noranda	Quebec	12.3	2	27,313,949
8	Deschambault	Quebec	N/A	1	26,154,257
9	Sorel-Tracy	Quebec	14.1	5	25,716,304
10	Mississauga	Ontario	11.3	94	25,373,913
11	Shawinigan	Quebec	22.5	4	19,791,035
12	Prince Edward	Ontario	7.5	2	17,343,079
13	Thunder Bay	Ontario	11.1	20	16,776,873
	Total - top CSDs			**256**	**775,799,936**
	Total - all CSDs			**1978**	**1,047,526,062**
	Top as % of all CSDs in the Great Lakes Basin			**12.9%**	**74.1%**

"N/A" means data is not available from Statistics Canada often due to small population.

On the map (see Figure 6), the census divisions with the highest combined air releases (over 15 million kg) are the darkest shade. These 13 top census subdivisions accounted almost three quarters of the total releases of combined air pollutants (see Table 4).

Figure 6: Air releases of combined air pollutants (kg) in census subdivisions in the Great Lakes basin in 2005

POLLUTION MAP

Air Releases* of Combined Pollutants in Census Subdivisions in the Great Lakes Basin

Air Releases of Combined Pollutants in Kilograms

- Over 15 million
- 1,000,001 to 15,000,000
- 300,001 to 1,000,000
- 30,001 to 300,000
- 0.1 to 30,000
- No Reported Releases
- Great Lakes Basin Boundaries

Lake Superior
Lake Huron
Lake Michigan
Lake Ontario
Lake Erie

0   125   250   500 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data,
Environment Canada; 2005 Census Subdivision Data, Statistics Canada

* From industrial sources reporting combined (toxics and criteria air contaminants) air pollutants to the National Pollutant Release Inventory   3

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A focus on southern Ontario shows that many of the census subdivision areas along Lake Ontario have the 'highest' (over 15 million kg) or 'high' (between 1 and 15 million kg) releases of combined air pollutants. Other areas of 'high' releases are along the Highway 401 corridor including Woodstock, St. Mary's, Chatham Kent, Ingersoll, Kitchener, London, and Cambridge (see Figure 7).

Figure 7: Air releases of combined air pollutants (kg) in census subdivisions in the southern Ontario portion of the Great Lakes basin in 2005

POLLUTION MAP
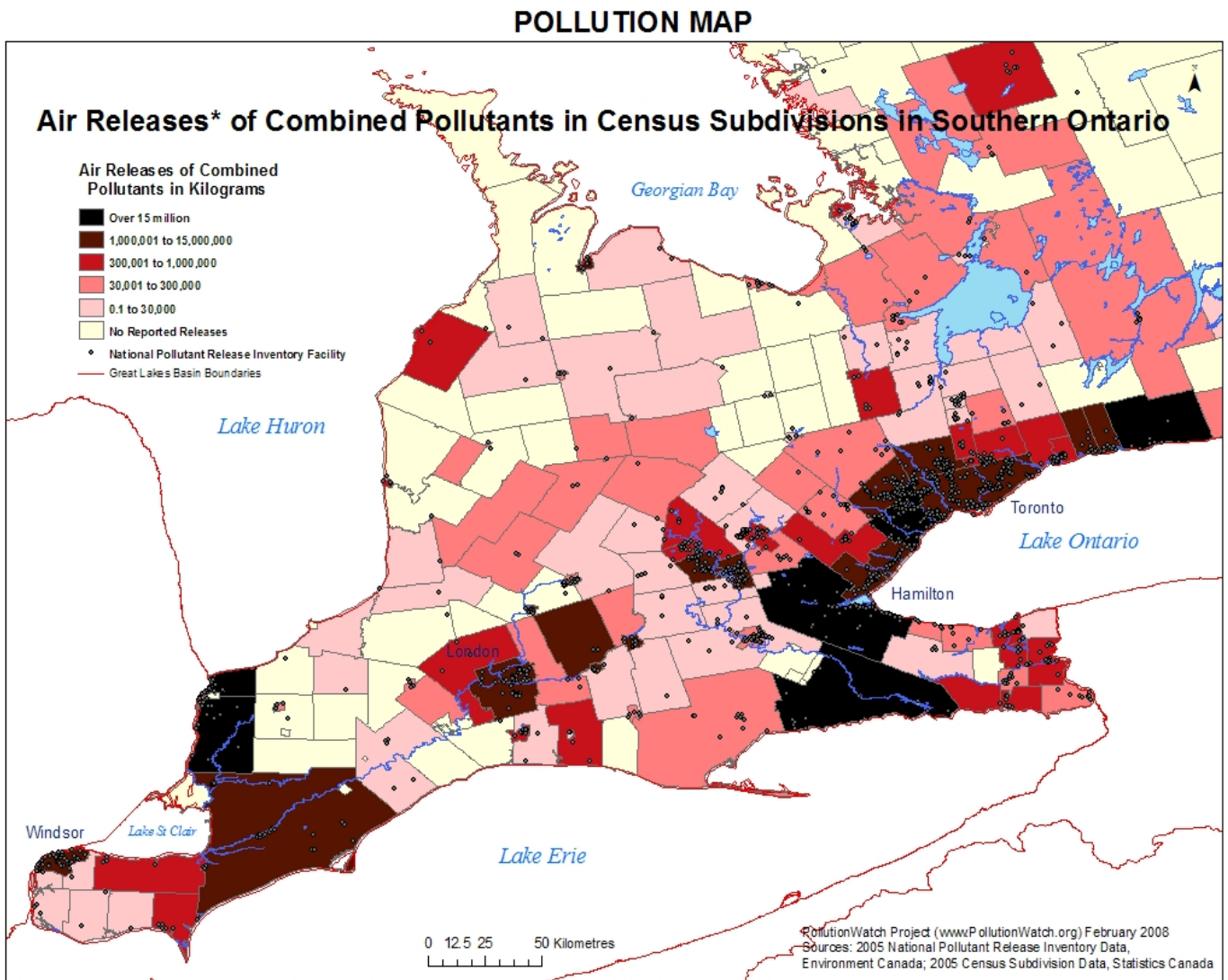
* From industrial sources reporting combined (toxics and criteria air contaminants) air pollutants to the National Pollutant Release Inventory

In the St. Lawrence River watershed, there are five census subdivisions with the 'highest' combined air releases (over 15 million kg): Bécancour, Rouyn-Noranda, Deschambault, Sorel-Tracy and Shawingan (see Figure 8). This is a contrast to the toxic pollutants map of this area, where no census subdivision was in the 'highest' range for toxic pollutant releases. There are also a large number of census subdivision areas with 'high' combined air releases (between 1 and 15 million kg).

Figure 8: Air releases of combined air pollutants (kg) in census subdivisions in the St. Lawrence River portion of the Great Lakes basin in 2005
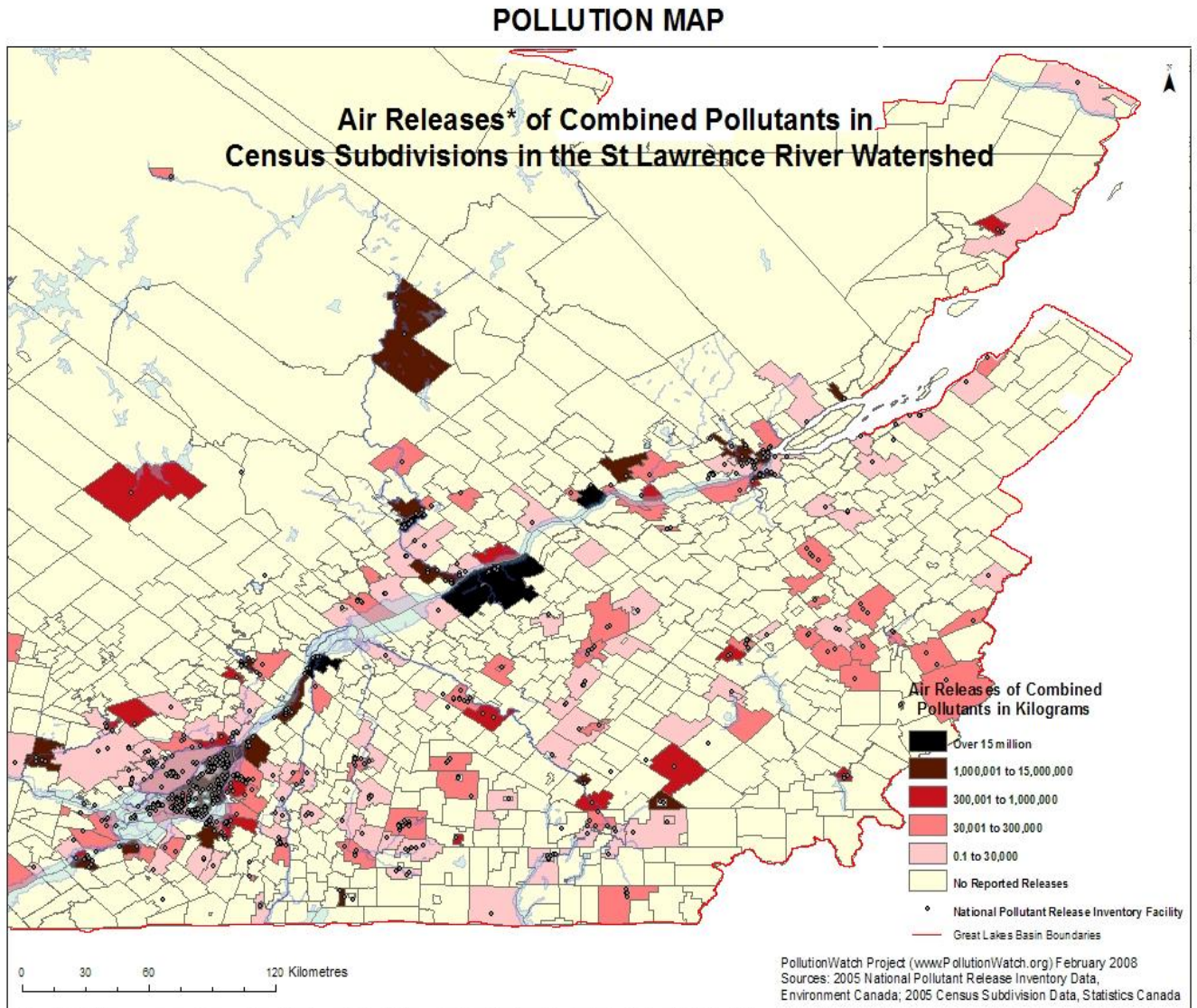
b. Poverty

This study finds that:

- The incidence of low income levels varies across the Great Lakes basin (see Figures 9, 10, 11).

- The highest poverty rate is 37.3% in McGarry, Ontario and the lowest poverty rate is 1.7% in Guelph-Eramosa, Ontario (see Table 5).

- In general, the province of Quebec has a higher incidence of poverty than Ontario.

- The average national poverty rate was 11.8% (based on LICO total income for economic families before tax, 2001 Census). Therefore, in 2000, 11.8% of the economic families in Canada had a total income below the "low income cutoff levels", indicating that they are living in "straightened circumstances" or the level that social groups consider "living in poverty."

- There are 374 census subdivisions in the Great Lakes basin with poverty rates above the national average of 11.8%. Therefore, 35% of the census subdivisions in the Great Lakes basin have poverty rates above the national average (Note: based on areas with income data reported).

- There are many census subdivisions in the Great Lakes basin with no incidence of poverty data available due to small numbers of people living in these census subdivisions or due to the administration of the census data. Statistics Canada does not release income or poverty data for these areas, which include Aboriginal communities. There are 397 census subdivisions in the Great Lakes basin with no poverty data, or about 27% of the total number of census subdivisions in the Great Lakes basin.

Figure 9: Incidence of low income in census subdivisions in the Great Lakes basin (based on economic families before tax, 2001 census)

POVERTY MAP

Poverty in Census Subdivisions in the Great Lakes Basin

Lake Superior

Lake Huron

Lake Michigan

Lake Ontario

Lake Erie

Percentage of Economic Families
Living in Poverty

- 21.4 to 37.3
- 12.1 to 21.3
- 4.5 to 12.0
- 0.1 to 4.4
- No Data
— Great Lakes Basin Boundaries

0   125   250   500 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 Census Subdivision and 2001 Income Data,
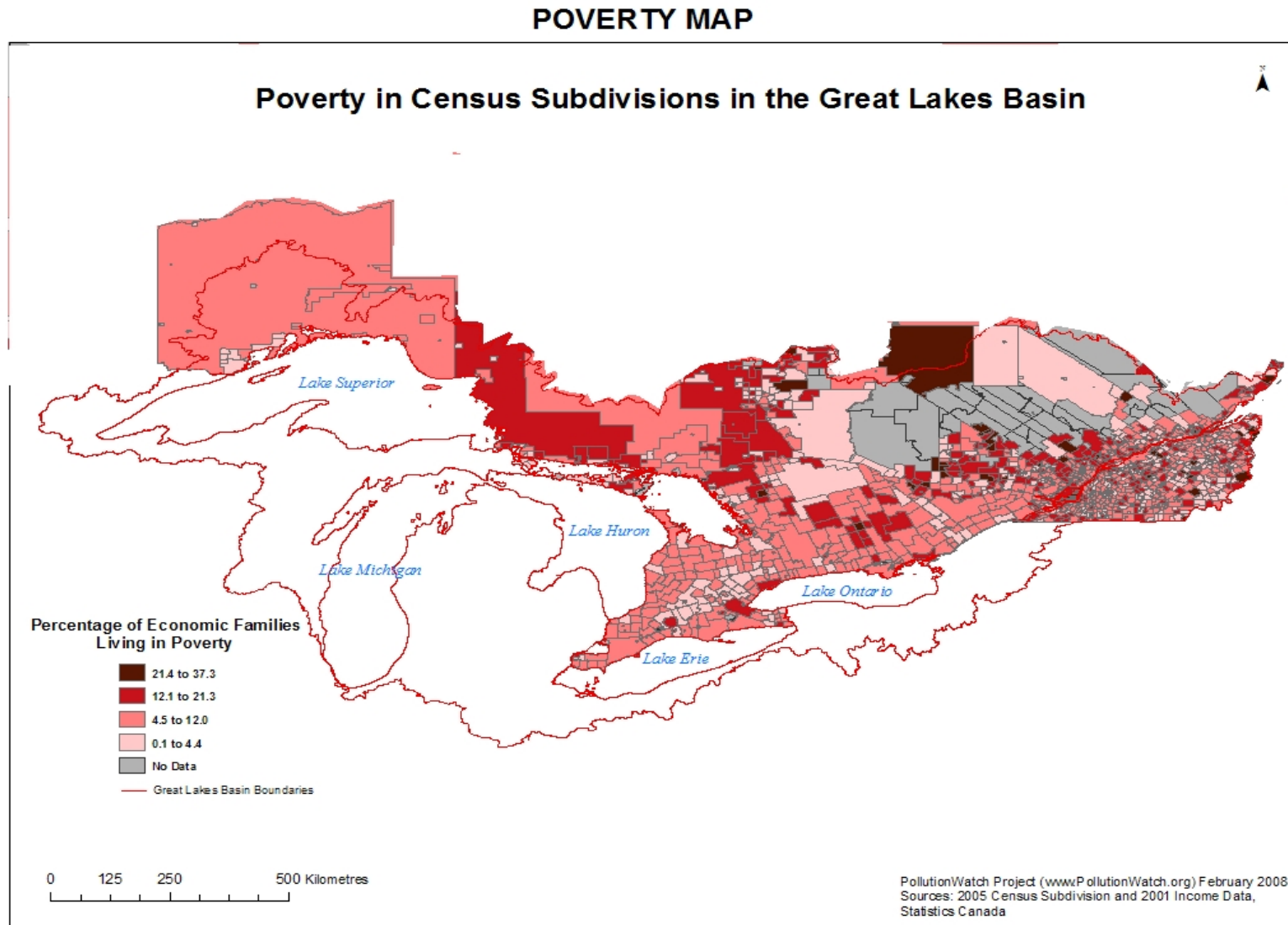Statistics Canada

4

Figure 10: Incidence of low income in census subdivisions in the southern Ontario portion of the Great Lakes basin (based on economic families before tax, 2001 census)
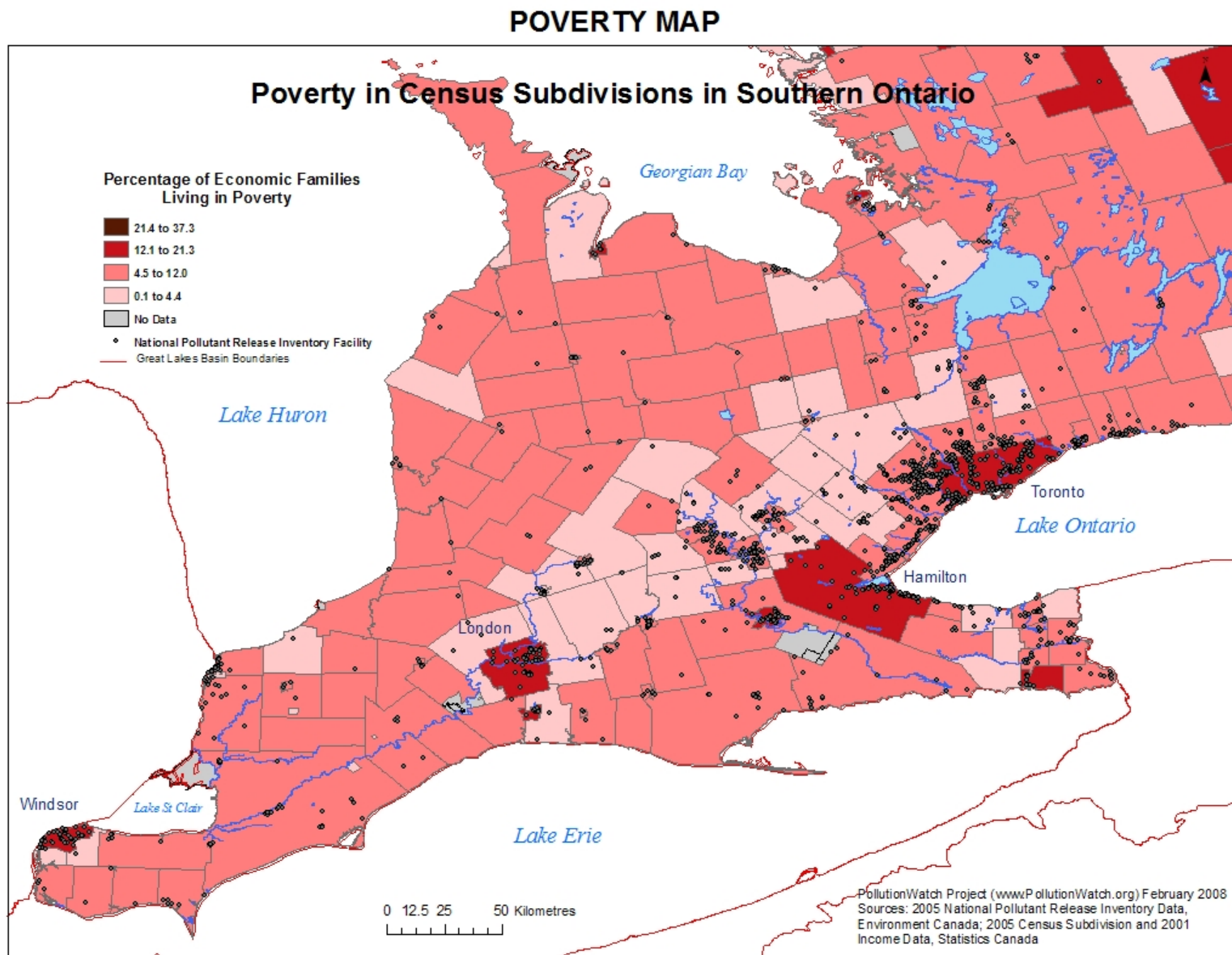

POVERTY MAP

Poverty in Census Subdivisions in Southern Ontario

Percentage of Economic Families
Living in Poverty

- 21.4 to 37.3
- 12.1 to 21.3
- 4.5 to 12.0
- 0.1 to 4.4
- No Data
- National Pollutant Release Inventory Facility
- Great Lakes Basin Boundaries

Georgian Bay

Lake Huron

Toronto

Lake Ontario

Hamilton

London

Windsor   Lake St Clair

Lake Erie

0 12.5 25   50 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data,
Environment Canada; 2005 Census Subdivision and 2001
Income Data, Statistics Canada

Figure 11: Incidence of low income in census subdivisions in the St. Lawrence River portion of the Great Lakes basin (based on economic families before tax, 2001 census)
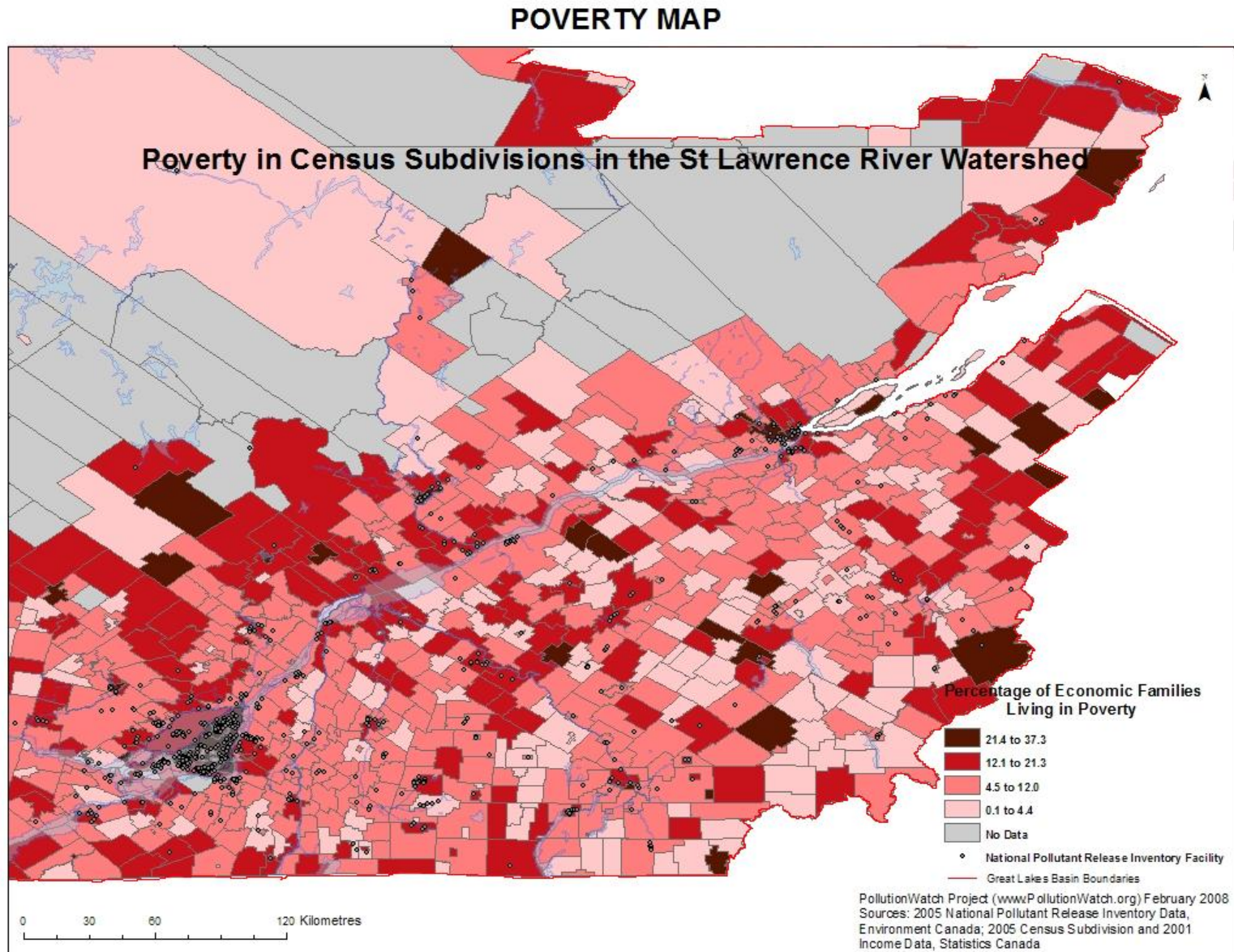

POVERTY MAP

Table 5: Census subdivisions in the Great Lakes basin with the highest incidence of low income in 2001

Rank	Name of Census Subdivision	Province	Poverty Rate %	Air Releases of Toxics (kg) in 2005	Air Releases of CACs (kg) in 2005	Air Releases of Combined Air Pollutants (Toxics and CACs) (kg) in 2005
1	McGarry	Ontario	37.3	-	-	-
2	Sainte-Apoline-de-Patton	Quebec	36.6	-	-	-
3	Kinnear Mills	Quebec	36.2	-	-	-
4	Saint Joseph de Sorel, Que.	Quebec	35.8	4,923	843,971	833,625
5	Gracefield	Quebec	34.1	-	-	-
6	Montreal-Nord	Quebec	33.2	-	-	-
7	Namur	Quebec	32.7	-	-	-
8	Ascot	Quebec	30.1	-	-	-
9	East Hereford	Quebec	29.1	-	-	-
10	Manseau	Quebec	28.9	-	-	-

"- " indicates no NPRI facility within the census subdivision

c. Pollution and Poverty

Combining both the pollution maps and maps showing the incidence of poverty in the Great Lakes basin, the relationship between pollution and poverty begins to emerge (see Figures 14-19). There are many areas in the Great Lakes basin that have both high reported air releases and high poverty rates. People living in these areas may have a double challenge: high potential for exposure to pollutants and all the physical and social vulnerabilities that come with living in poverty. Living in poverty may also make it harder to access the tools necessary to advocate for a reduction in pollution.

It is important to note that many census subdivisions in the Great Lakes basin do not have a reporting NPRI facility. The census subdivisions with the highest poverty rates often do not have NPRI facilities. The census subdivisions with the lowest poverty rates often do not have NPRI facilities. This is similar to findings of other studies.

This study finds that:

- 27 census subdivisions in the Great Lakes basin have both high poverty (at or above the national average of 11.8 per cent), and high pollution (air releases of combined air pollutants over 1 million kilograms) (see Figure 14). For a complete list of census subdivisions that have high air releases of combined pollutants and high poverty rates, refer to Appendix A.

- 37 census subdivisions in the Great Lakes basin have both high poverty (at or above the national average of 11.8 per cent), and high pollution (air releases of toxic pollutants over 100,000 kg) (see Figure 15). For a complete list of census subdivisions that have high air releases of toxic pollutants and high poverty rates, refer to Appendix A.

There is a significant positive correlation between air releases of pollutants and poverty rates in census subdivisions in the Great Lakes basin. In general, in areas with higher releases of pollutants there are often higher poverty rates. Areas with low releases of pollutants often also tend to have low poverty rates. There is a lot of scatter in all plots of pollution and poverty. There is a large amount of variability. Not all areas with high pollution levels have high poverty rates. This variability is to be expected as many factors determine the location and emissions of an industrial facility and also location of people of low income. This study finds:

- For census subdivisions in the Great Lakes basin, the amount of toxic air pollutants released (log transformed) was significantly correlated to the poverty measure, (r=0.184, n=262, p=0.003). **In other words, as the amount of toxic pollutants released increased, the incidence of poverty also tended to increase in the census subdivisions in the Great Lakes basin.** Correlation coefficients using releases of CACs (log transformed) and poverty were also significant (r=0.205,n=320, p=0.0003). Correlation coefficients using releases of combined air pollutants (log transformed) and poverty were also significant (r=0.205, n=320, p=0.0002).

- Based on the Analysis of Variance (ANOVA) results, there was a statistically significant difference in the means of the poverty rates among the different toxic pollutant groups (F ratio=4.048, p=0.008). **When these means were further examined, there was a significant difference between the poverty rates in areas with the highest releases of pollutants and lowest releases of toxic pollutants (Group 1 and 4, p<0.001)**. There was also a significant difference between poverty rates in the areas with medium releases of toxic pollutants and the lowest releases of toxic pollutants (Group 2 and 4, p<0.001). Similarly, there was a significant difference between poverty rates in the areas with lower and lowest releases of toxic pollutants (Group 3 and 4, p< 0.001). Other comparisons: Group 1 and 3 were significant (p=0.041); Group 1 and 2 were not significant (p>0.05); Group 2 and 3 were not significant (p=0.052).

- These results were also similar for other pollutants, CACs, and combined pollutants. ANOVA found a statistically significant difference among the means of poverty rates in different pollutant groups (criteria air contaminants, F ratio=4.079, p=0.003 and for combined air pollutants F ratio=6.591, p=0.000). Tests to determine where the differences lie found a significant difference in the means of poverty in the area with the highest releases of combined pollutants and the areas with the lowest releases (Group 1 and 5, p=0.009). For criteria air contaminants, there was a significant difference in the means of poverty rates in the areas with high releases and areas with low releases (Group 2 and 5, p=0.004).

- The census subdivisions with the highest releases of combined air pollutants also have the highest percentage of high poverty rates of all pollution groups.

- There are no census subdivisions with the highest releases of combined air pollutants which had the lowest poverty rates.

- Similarly, there are no census subdivisions with the lowest releases of combined air pollutants and highest poverty rates.

- Generally, the census subdivisions with lowest amounts of pollution also have the lowest poverty rates for all pollution groups (see Figure 12).

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In Figure 12, the mean of the incidence of poverty in the areas with the highest releases of toxic pollutants (darkest colour on the maps – Map Group 1), is similar to the areas with the high releases (Map Group 2), but significantly different than areas with medium releases (Map Group 3) and areas with lower releases (lightest colour on the maps – Map Group 4).

Figure 12: Mean of incidence of poverty in census subdivisions based on air releases of toxic pollutants
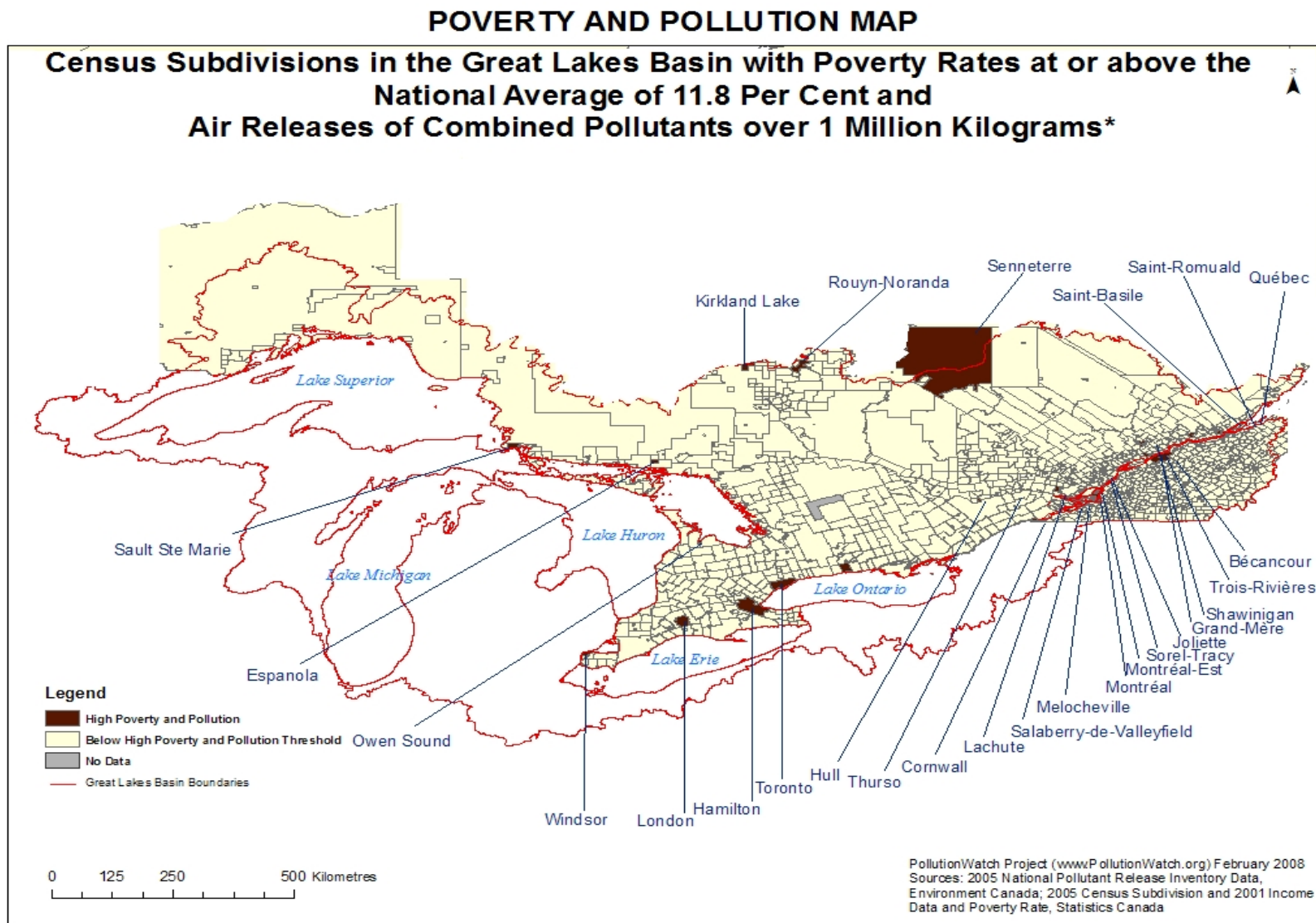

Least Squares Means
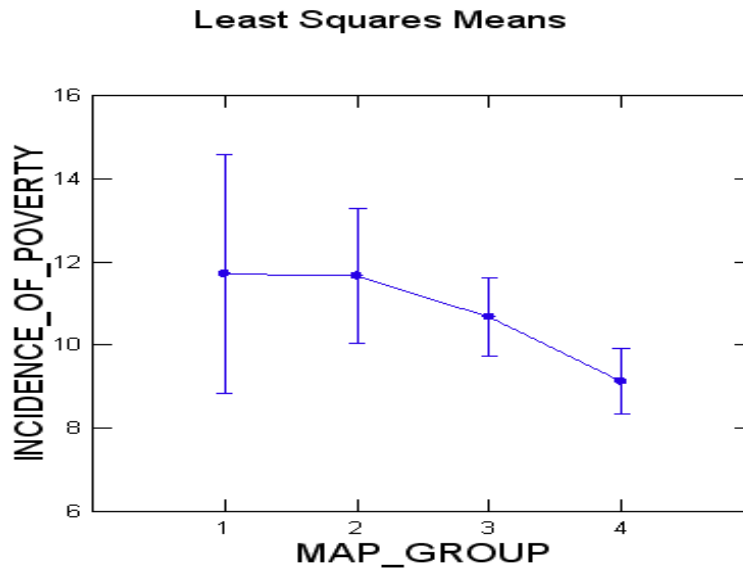
In Figure 13, census subdivisions were divided into 5 groups, ranging from those with the highest amount of combined air releases (more than 15 million kg) that appear the darkest shade on the maps, to areas with the lowest releases of combined air releases (from 0.1 to 30,000 kg) that appear the lightest shade on the maps. The number of census subdivisions falling into each of the poverty groups was calculated. None of the areas with the highest releases of combined air releases had low poverty rates (no blue bar). Moving from areas with high releases to areas with low releases, the percentage of areas with the lowest poverty rates increases (bigger blue bar). The areas with the lowest releases of combined air pollutants, had the highest percentage of areas with low poverty rates, as demonstrated by the blue bar at the top of the column on the right. In these low release areas, there were also no areas with the highest poverty rates (no purple bar).

Figure 13: Air Releases of Combined Pollutants from NPRI Facilities and Incidence of Poverty in the Great Lakes basin
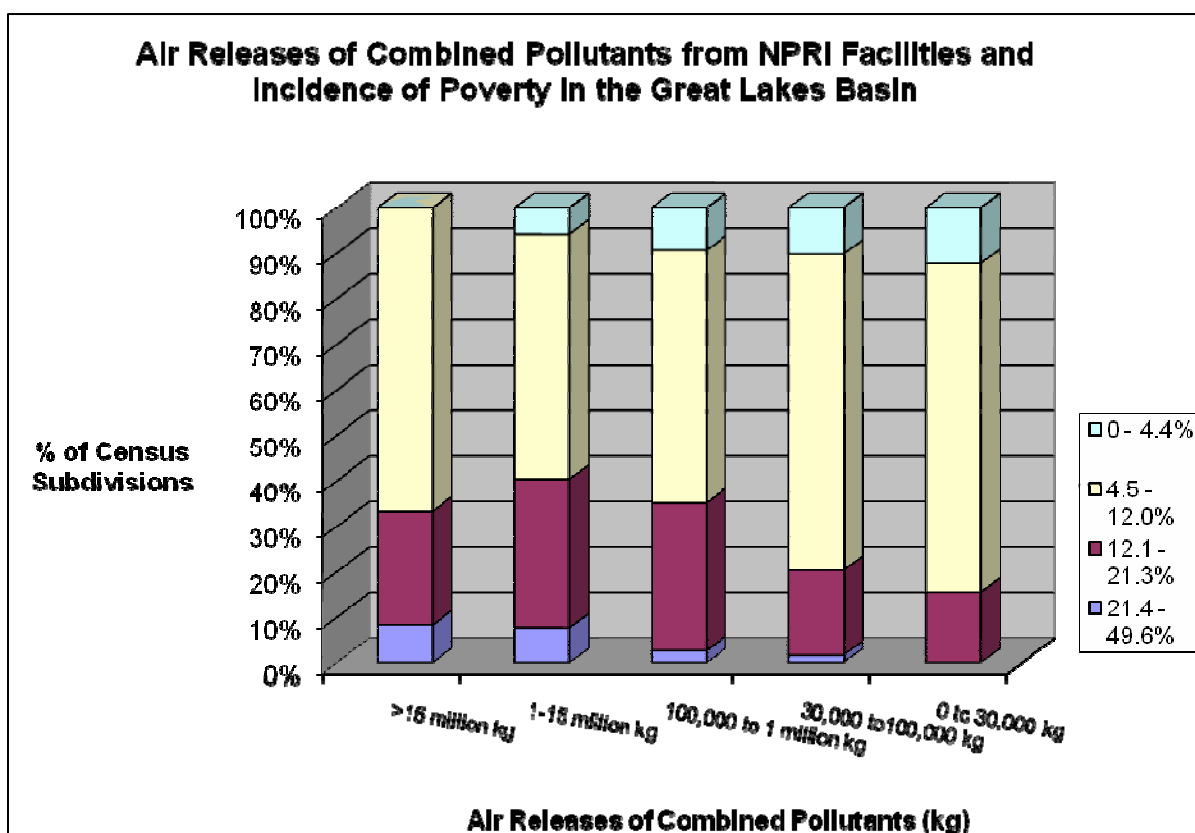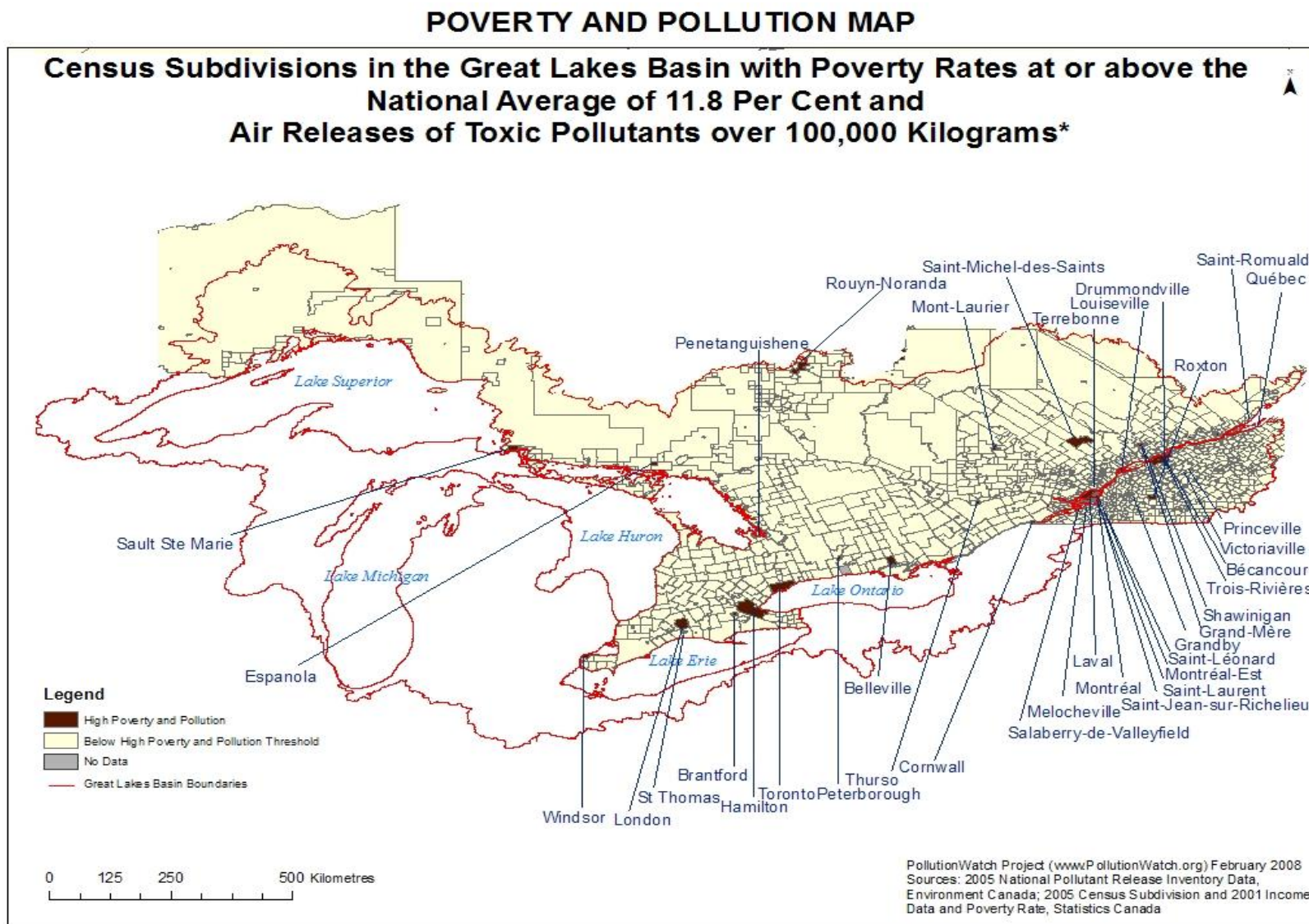

The following map (see Figure 14) highlights the census subdivisions with combined air releases of over 1 million kilograms. The majority of the pollutants released under combined air releases are CACs, such as nitrogen oxides, sulphur dioxide and, in some cases, carbon monoxide. It is important to note that industrial facilities that report to the NPRI are often not the only significant sources of CACs in communities. Traffic, for example, can also be a significant source of carbon monoxide.

Figure 14: Air releases of combined pollutants and incidence of poverty in the Great Lakes basin

POVERTY AND POLLUTION MAP

Census Subdivisions in the Great Lakes Basin with Poverty Rates at or above the National Average of 11.8 Per Cent and Air Releases of Combined Pollutants over 1 Million Kilograms*

Legend
- High Poverty and Pollution
- Below High Poverty and Pollution Threshold
- No Data
- Great Lakes Basin Boundaries

0   125   250   500 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data,
Environment Canada; 2005 Census Subdivision and 2001 Income
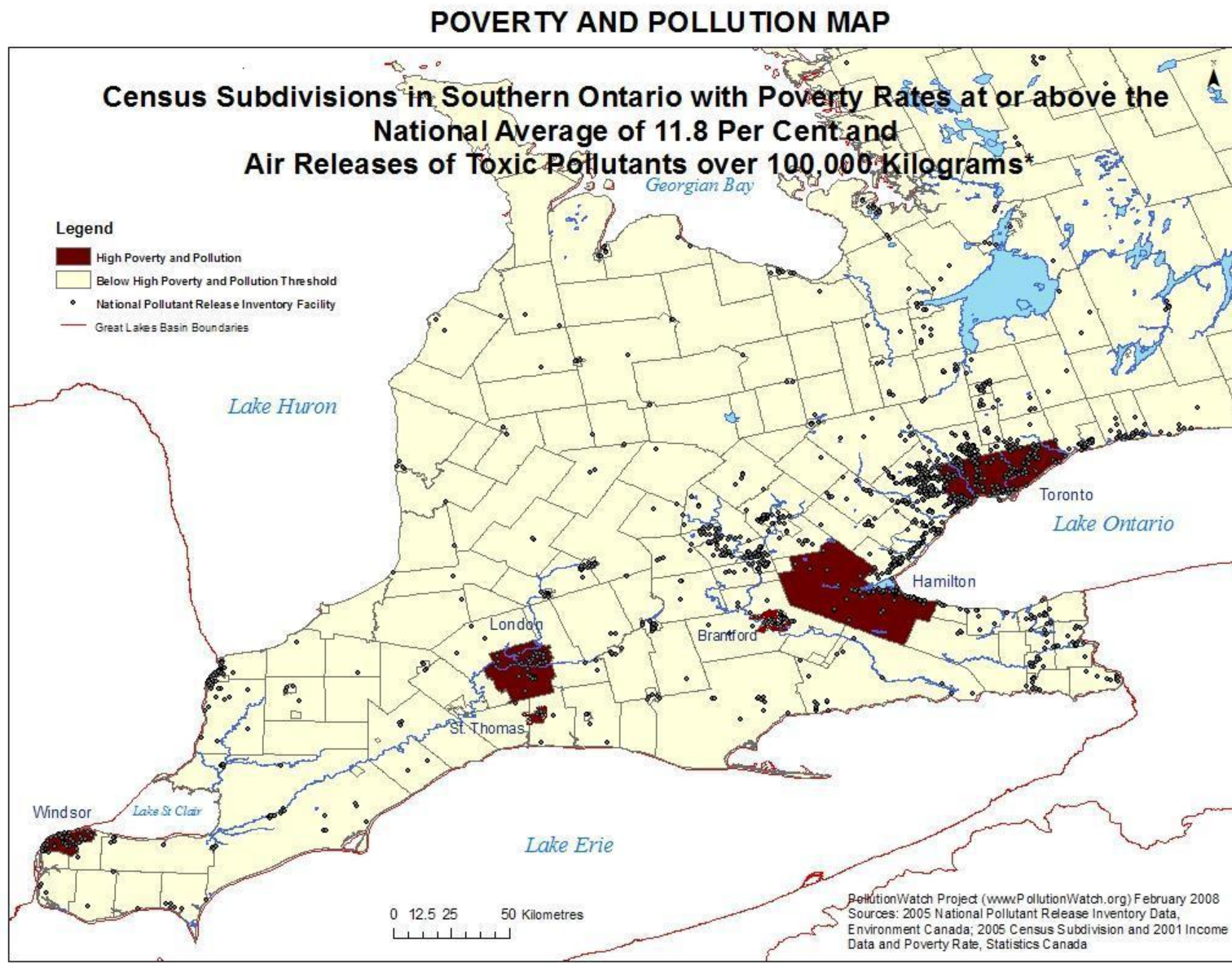Data and Poverty Rate, Statistics Canada

* From industrial sources reporting combined (toxics and criteria air contaminants) air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families

Figure 15: Air releases of toxic air pollutants and incidence of poverty in the Great Lakes basin

POVERTY AND POLLUTION MAP

Census Subdivisions in the Great Lakes Basin with Poverty Rates at or above the National Average of 11.8 Per Cent and Air Releases of Toxic Pollutants over 100,000 Kilograms*

Legend
- High Poverty and Pollution
- Below High Poverty and Pollution Threshold
- No Data
- Great Lakes Basin Boundaries

0   125   250   500 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data, Environment Canada; 2005 Census Subdivision and 2001 Income Data and Poverty Rate, Statistics Canada
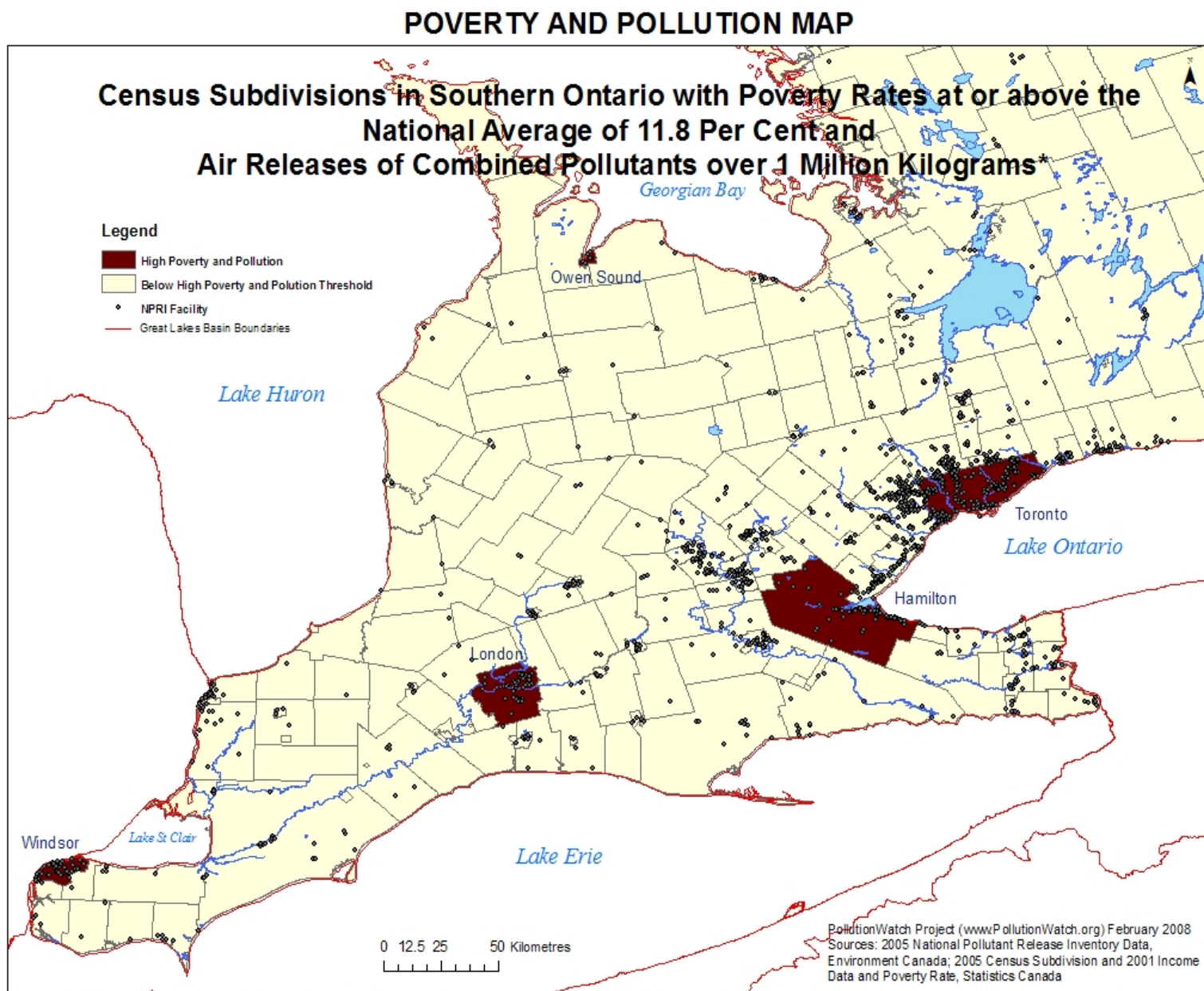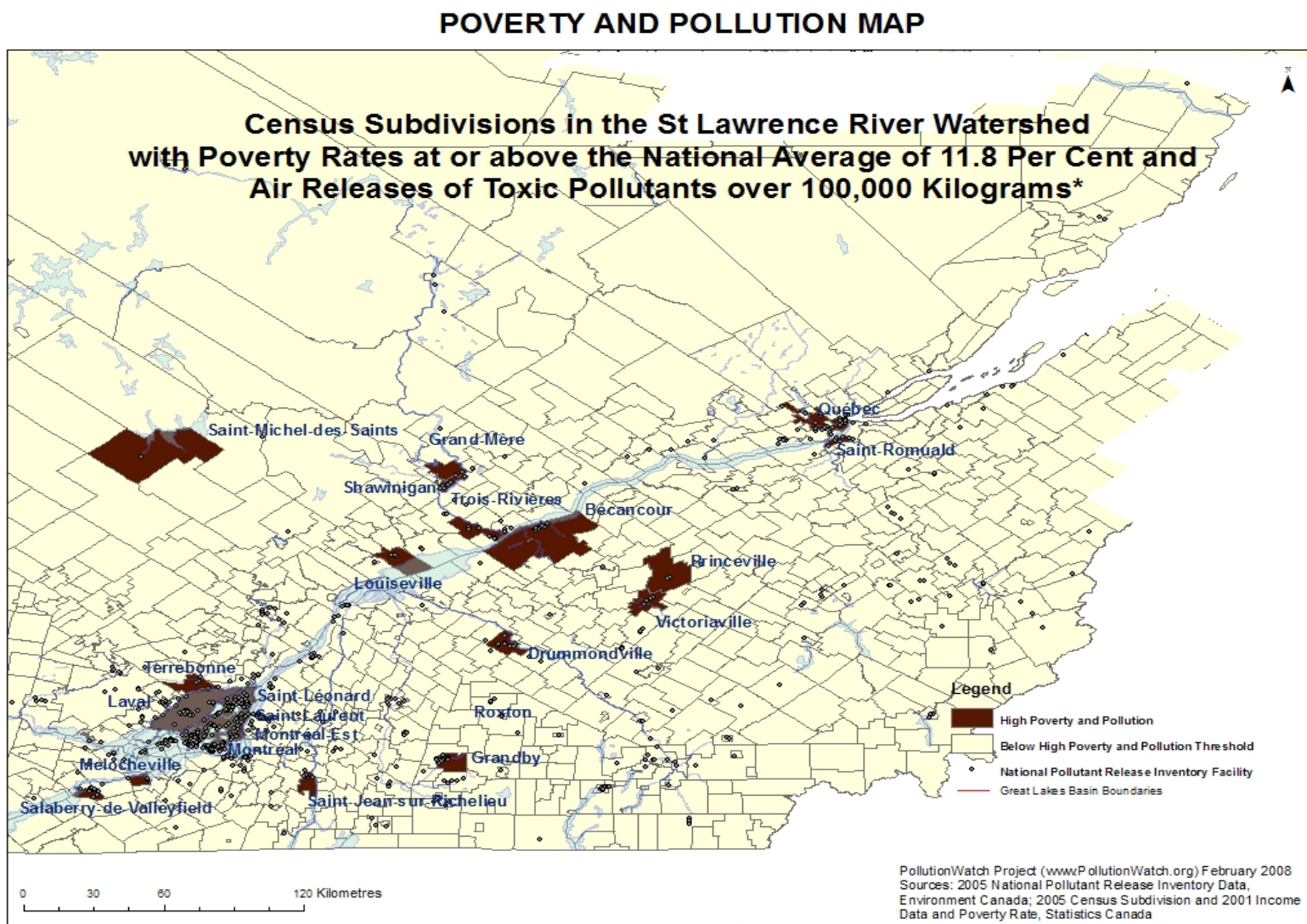
* From industrial sources reporting toxic air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families

23

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Figure 16: Air releases of toxic pollutants and incidence of poverty in southern Ontario

POVERTY AND POLLUTION MAP

Census Subdivisions in Southern Ontario with Poverty Rates at or above the
National Average of 11.8 Per Cent and
Air Releases of Toxic Pollutants over 100,000 Kilograms*

Georgian Bay

Legend

■ High Poverty and Pollution

☐ Below High Poverty and Pollution Threshold

· National Pollutant Release Inventory Facility

— Great Lakes Basin Boundaries

Lake Huron

Toronto

Lake Ontario

Hamilton

London

Brantford

St. Thomas

Windsor   *Lake St Clair*

Lake Erie

0 12.5 25   50 Kilometres

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data,
Environment Canada; 2005 Census Subdivision and 2001 Income
Data and Poverty Rate, Statistics Canada

9

* From industrial sources reporting toxic air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families
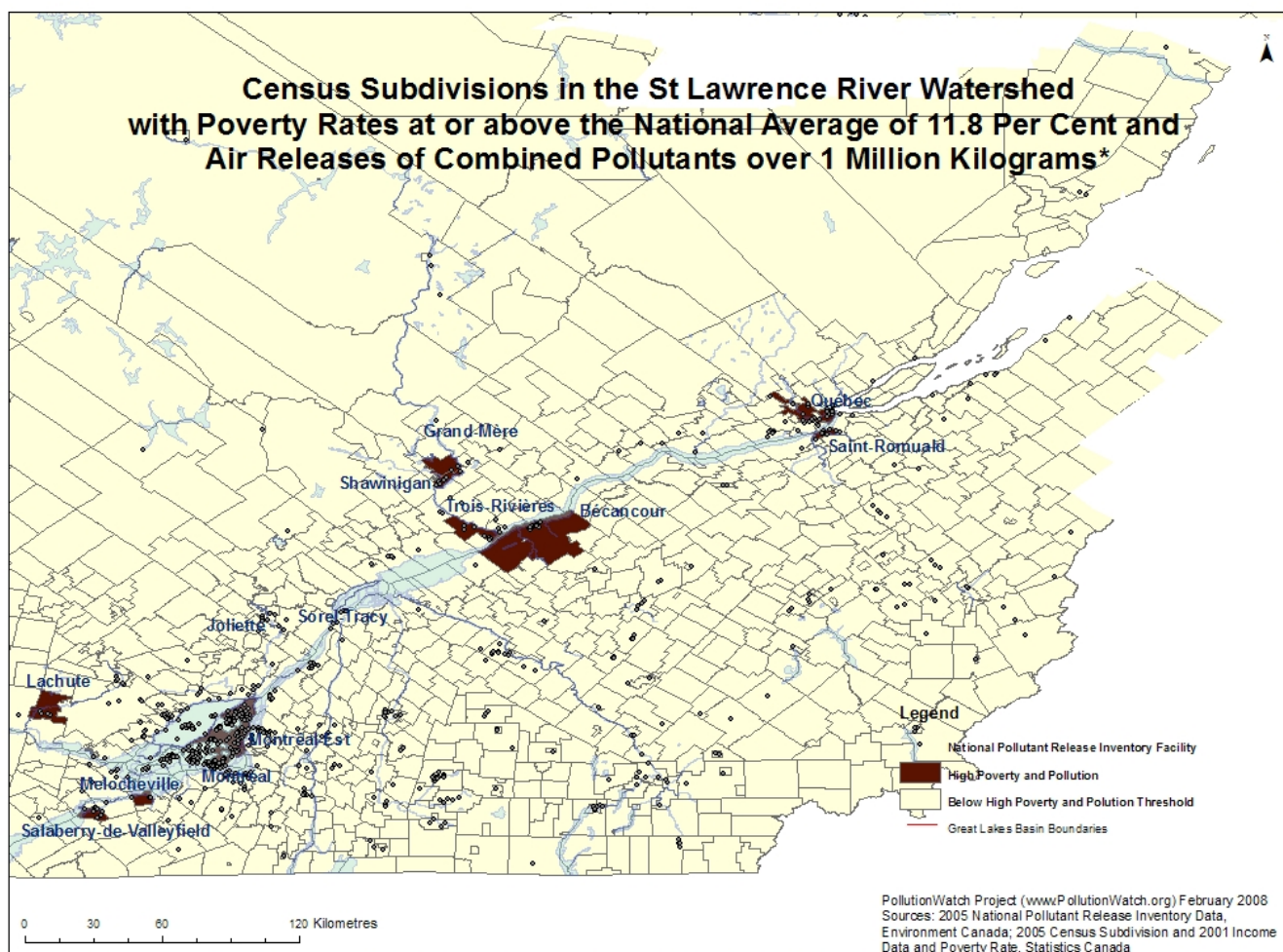
Figure 17: Air releases of combined pollutants and incidence of poverty in southern Ontario

POVERTY AND POLLUTION MAP

Census Subdivisions in Southern Ontario with Poverty Rates at or above the National Average of 11.8 Per Cent and Air Releases of Combined Pollutants over 1 Million Kilograms*

Legend
- High Poverty and Pollution
- Below High Poverty and Polution Threshold
- NPRI Facility
- Great Lakes Basin Boundaries

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data, Environment Canada; 2005 Census Subdivision and 2001 Income Data and Poverty Rate, Statistics Canada

0 12.5 25   50 Kilometres

35

* From industrial sources reporting combined (toxics and criteria air contaminants) air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families   10

Figure 18: Air releases of toxic pollutants and incidence of poverty in the St. Lawrence River watershed

POVERTY AND POLLUTION MAP

Census Subdivisions in the St Lawrence River Watershed with Poverty Rates at or above the National Average of 11.8 Per Cent and Air Releases of Toxic Pollutants over 100,000 Kilograms*

Legend
- High Poverty and Pollution
- Below High Poverty and Pollution Threshold
- National Pollutant Release Inventory Facility
- Great Lakes Basin Boundaries

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data, Environment Canada; 2005 Census Subdivision and 2001 Income Data and Poverty Rate, Statistics Canada

* From industrial sources reporting toxic air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families

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Figure 19: Air releases of combined pollutants and incidence of poverty in the St. Lawrence River watershed

POVERTY AND POLLUTION MAP

Census Subdivisions in the St Lawrence River Watershed with Poverty Rates at or above the National Average of 11.8 Per Cent and Air Releases of Combined Pollutants over 1 Million Kilograms*

* From industrial sources reporting combined (toxics and criteria air contaminants) air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families

The census subdivision in the Great Lakes basin with the highest poverty rate and with an NPRI facility is Saint Joseph de Sorel, Quebec, along the St. Lawrence River about 50 kilometres west of Montreal. It has a poverty rate of 35.8% and the pollutants are released from one NPRI facility, the U.S.-owned steel foundry, Les Forges de Sorel Ciel. Montreal has the next highest poverty rate and over 43 NPRI facilities reporting fairly large releases of toxic pollutants and large air releases of CACs. The Saint Laurent census subdivision has a poverty rate of 24.7% and is ranked in the top 15 for reported releases of toxic air pollutants. Thurso, along the Ottawa River, about 50 kilometres east of Ottawa, has smaller toxic pollutant releases and larger amounts of releases of CACs. Shawinigan, near Trois Rivières about 150 km east from Montreal, has smaller reported air releases of toxic pollutants and large reported air releases of CACs (ranked #11 in Great Lakes basin) (see Table 6).

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Table 6: Air releases of pollutants in census subdivisions with the highest poverty rates in the Great Lakes basin

Rank	Name of Census Subdivision (CSD)	Province	Poverty Rate (%)	Number of NPRI Facilities	Air Releases of Toxic Air Pollutants in 2005 (kg)	Air Releases of CACs in 2005 (kg)	Air Releases of Combined Air Pollutants in 2005 (kg)
1	Saint Joseph de Sorel, Que.	Quebec	35.8	1	4,923	843,971	833,625
2	Montréal	Quebec	26.5	43	494,499	11,059,518	9,451,843
3	Saint Laurent	Quebec	24.7	9	666,956	826,598	689,016
4	Thurso	Quebec	22.6	2	302,894	4,774,851	4,656,071
5	Shawinigan	Quebec	22.5	3	272,412	19,722,812	19,791,035
6	Saint-Léonard	Quebec	22.2	7	121,611	817,272	121,611
7	Quebec	Quebec	22.1	8	186,085	2,521,992	2,310,802
8	Senneterre	Quebec	21.7	3	24,030	1,683,788	1,636,618
9	Saint Jérôme	Quebec	21.7	3	46,094	497,570	373,914
10	Lachine	Quebec	21.1	8	59,052	201,730	91,052
11	Montreal Est	Quebec	20.2	16	587,935	16,248,975	14,962,514
12	Longueuil	Quebec	20.1	9	36,240	1,168,242	577,975
13	Toronto	Ontario	19.4	197	2,819,466	13,205,592	7,134,465
14	Hawkesbury	Ontario	19.4	3	37,506	249,124	154,520
15	Lachute	Quebec	19.3	4	39,693	1,016,983	1,039,762
	Total - top 15 CSDs			316	5,699,396	74,839,018	63,824,823
	Total - all CSDs			1987	51,301,570	1,095,281,842	1,047,526,062
	Top 15 as % of all CSDs			15.9%	11.1%	6.8%	6.1%

Most census subdivisions in the Great Lakes basin do not have a reporting NPRI facility. As stated above, the census subdivisions with the highest poverty rates often do not have NPRI facilities. The census subdivisions with the lowest poverty rate often do not have NPRI facilities. This is similar to findings of other studies. Some researchers have held that thought this is because of the ability of high income areas to repel industrial facilities, while the lowest income areas do not attract industrial facilities.

The area in the Ontario portion of the Great Lakes basin with the highest poverty rate is Toronto, with a poverty rate of 19.4%. Toronto ranks #5 for reported air releases of toxic pollutants, #16 for reported releases of CACs and #23 for reported combined air releases.

d. Toronto

Many researchers looking at relationships between pollution and poverty have found more connections at local geographic levels such as neighbourhoods and city blocks (Lynch *et al.*, 1998; Ke, 2007; Mehdipanah, 2006). This is often due to the highly localized patterns of poverty, which may be lost when larger geographic levels are analyzed. The project team focused on one census subdivision area, the City of Toronto, to further explore the relationship between air releases from NPRI facilities and poverty rates. Toronto is well-suited to this type of analysis: it has a large number of NPRI facilities, high and localized poverty rates, a large number of census tracts, a wealth of data available from Statistics Canada, and the ability to draw upon previous poverty work by the City of Toronto, United Way Toronto, Canadian Council on Social Development and pollution work from the Toronto Environmental Alliance.

The United Way Toronto and Canadian Council on Social Development 2004 report, *Poverty by Postal Code,* studied the geographic concentration of family poverty in Toronto neighbourhoods and found significant shifts over a period of 20 years. In 1981, most 'poor' families in Toronto lived in mixed income neighbourhoods. In 2001, 'poor' families were more concentrated in neighbourhoods with high levels of poverty. The report also found that there has been a rapid increase in the number of high poverty neighbourhoods in Toronto, and that residents of high poverty neighbourhoods are much more likely to be newcomers to Canada and visible minorities (United Way Toronto and Canadian Council on Social Development, 2004). We know from our everyday life that neighbourhoods do matter, as they are central to the fulfillment of social, recreational and service needs. We also know from research that there are associations between living in poverty and poorer health, low birth weight, shorter life expectancy, lower educational achievement and lower child literacy (United Way Toronto and Canadian Council on Social Development, 2004).

Toronto Public Health estimates that five common air pollutants ($PM_{2.5}$ and PM_{10}, NO_x, SO_2, CO and ground level ozone) contribute to about 1,700 premature deaths and 6,000 hospitalizations per year in Toronto. In addition, a wide range of cardiorespiratory ailments affect tens of thousands of people with less serious health outcomes (Toronto Public Health, 2004).

The project team mapped poverty rates and air pollution amounts at the census tract level in Toronto and also by neighbourhoods, which are groups of census tracts. Census tracts are small urban or rural neighbourhood-like communities in Canada's Census Metropolitan Areas and some Census Agglomerations, having an urban core population of 50,000 or more in the previous census. The population in a Census Tract ranges from 2,500 to 8,000, averaging 4,000 in size, except for census tracts in business districts.

According to Statistics Canada, a family of two living in Toronto would be considered "low income" if their total income was below $22,964 (year 2000 dollars, before tax). A family of three is considered low income if their income is below $28,560. For a family of four, the LICO is $34,572. A family of five would be considered low income with an income of $38,646.

The first important picture that emerges when reviewing Toronto is that pollution is concentrated in a relatively few census tracts. It is important to note that air releases reported by NPRI facilities can cross over neighbourhood boundaries. Approximately 55 of the 519 (11%) census tracts in Toronto have NPRI facilities. Therefore, most of the census tracts (89%) in Toronto do not have facilities that report to the NPRI. This does not mean that there are no pollution sources or no pollution in these census tracts, as not all facilities or sources of pollution are

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required to report to the NPRI. The City of Toronto's proposed Environmental Reporting, Disclosure and Innovation Programme would begin to provide additional information on pollution sources by collecting pollution release information from smaller and medium sized facilities not presently captured by the NPRI. This would be a major advancement in our knowledge of releases of pollutants in Toronto, and would provide new opportunities and tools for facilities to learn and adopt new methods of pollution prevention.

The total amount of toxic air pollutants reported from NPRI facilities in Toronto for 2005 was 2,819,466 kg. The total amount of CACs reported released was 13,205,592 kg and total combined air pollutants was 7,134,465 kg in 2005 (see Table 7). The total for combined air pollutants is lower than criteria air contaminants because Toronto has many facilities that release a large amount of VOCs. As outlined in the methodology section, VOCs reported as a group of substances under CACs are not included in the total combined air releases to avoid double counting some individual VOCs that are also reported as toxic pollutants. The total for combined air pollutants, therefore, is often an underestimation of the pollutant releases to air.

Table 7: Releases of air pollutants from NPRI facilities in Toronto in 2005 (kg)

	Type of air release		
	Toxics	**CACs**	**Combined**
Total number of census tracts in Toronto that report to NPRI	55	64	73
Total number of facilities	150	156	197
Total amount reported in Toronto (kg)	**2,819,466**	**13,205,592**	**7,134,465**

NOTE: the combined air pollutants total does not include the group of VOCs reported as part of Criteria Air Contaminants as to avoid double counting of individual VOCs reported as toxic pollutants.

The releases of toxic pollutants are concentrated in 15 census tracts in Toronto, which account for 87% of the releases to air. Many of these census tracts form part of the same neighbourhood (see Table 8).

Table 8: Top 15 census tracts in Toronto with the highest amounts of air releases of toxic air pollutants in 2005 (kg)

Name of Neighbourhood containing Census Tract	Census Tract Number	Poverty Rate of Census Tract (%)	Air Releases of Toxic Air Pollutants in 2005 (kg)	Number of NPRI Facilities
Alderwood	0211.00	6.4	279,825	10
Humbermede	0313.00	16.0	275,205	6
Humber summit	0315.03	17.9	272,215	1
Humber summit	0315.01	15.8	259,460	1
West Humber	0247.01	16.4	249,472	2
West Hill	0360.00	12.8	182,571	1
Cliffcrest	0335.00	21.2	158,720	2
Clairlea-Birchmont	0347.00	12.5	124,266	3
Clairlea-Birchmont	0348.00	11.2	107,084	1
Agincourt-Malvern	0377.02	15.4	105,965	1
Islington-City Centre	0214.00	6.7	100,040	1
York University Heights	0311.06	39.5	98,624	3
Milliken	0378.19	17.9	91,197	1
Eringate	0236.02	7.1	78,831	1
Junction Area	0106.00	27.3	67,574	1
Total - top 15			**2,451,049**	**35**
Total all census tracts in Toronto			**2,819,466**	**292**
Top 15 as % of all Toronto			**86.9%**	**12.0%**

On the map of releases of toxic pollutants from NPRI facilities in Toronto (see Figure 20), neighbourhoods with the highest releases (over 100,001 kg) are the darkest shaded areas and the lightest shaded area represents the lowest releases of toxic pollutants.

The map shows a "U" shaped pattern, with 'highest' and 'high' releases in neighbourhoods in the north west, down through the western boundary of Toronto, across the core and then continuing through some neighbourhoods in the north east (see Figure 21).

The same "U" shaped pattern is also evident in the map of releases of criteria air contaminants (see Figure 21) and of combined air pollutants (see Figure 22).

Income data showing people living in poverty in Toronto generally follows the same "U" shaped pattern as the distribution of high pollution data, with the addition of areas in the north (see Figure 23). Some neighbourhoods exhibit pockets of poverty within their boundaries, which is often evident at the census tract level. Previous reports on income and health in Toronto have described a core of wealthier urban neighbourhoods surrounded by poorer neighbourhoods (Toronto City Staff, 2008). Shading on the map for poverty rates goes from dark, for the highest percentage of economic families living in poverty (from 21.4% to 72.8%), to light, for the lowest percentage of economic families living in poverty (from 0.1% to 4.4%).
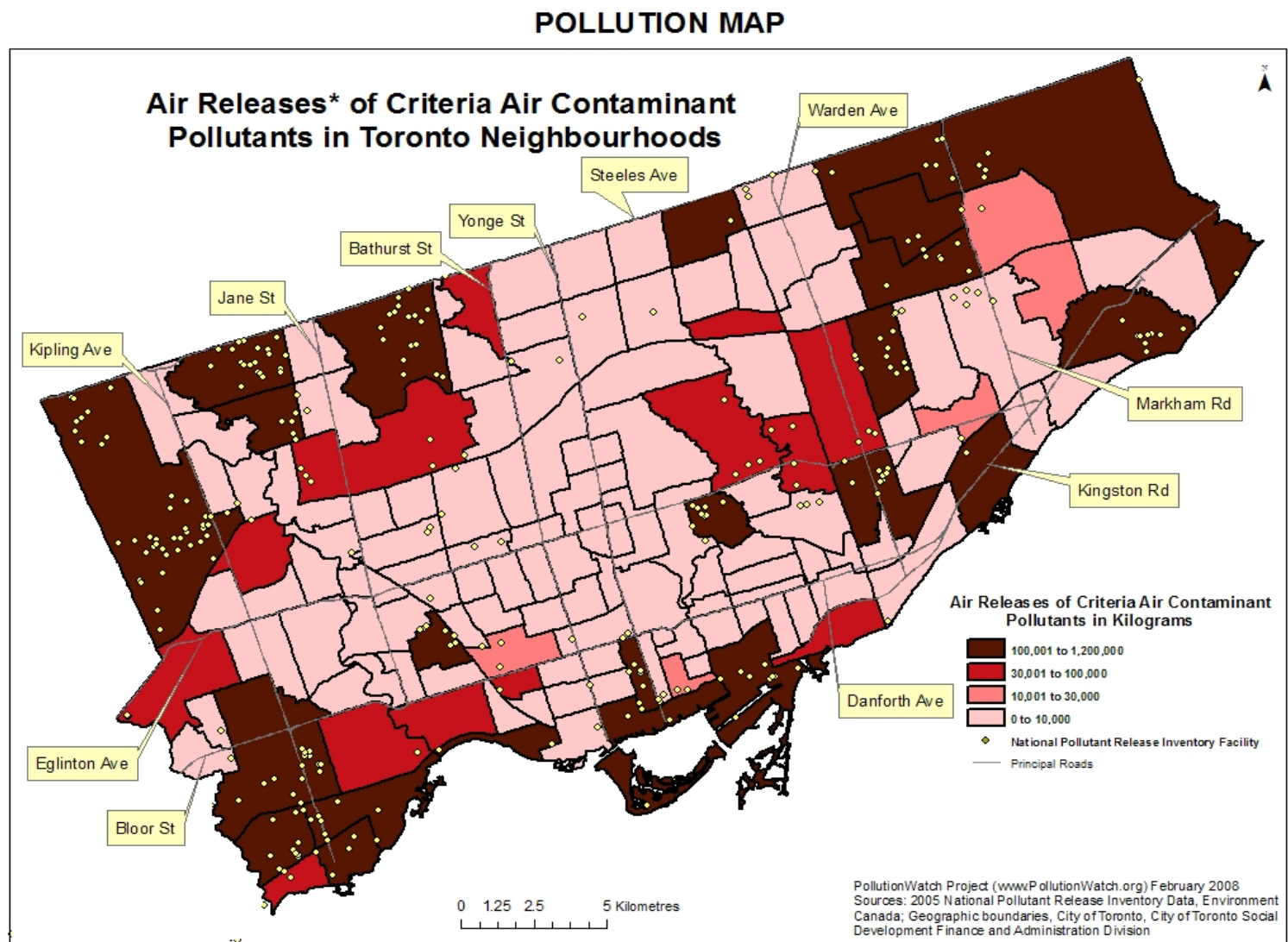
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Figure 20: Air releases of toxic pollutants (kg) from NPRI facilities in neighbourhoods in Toronto in 2005

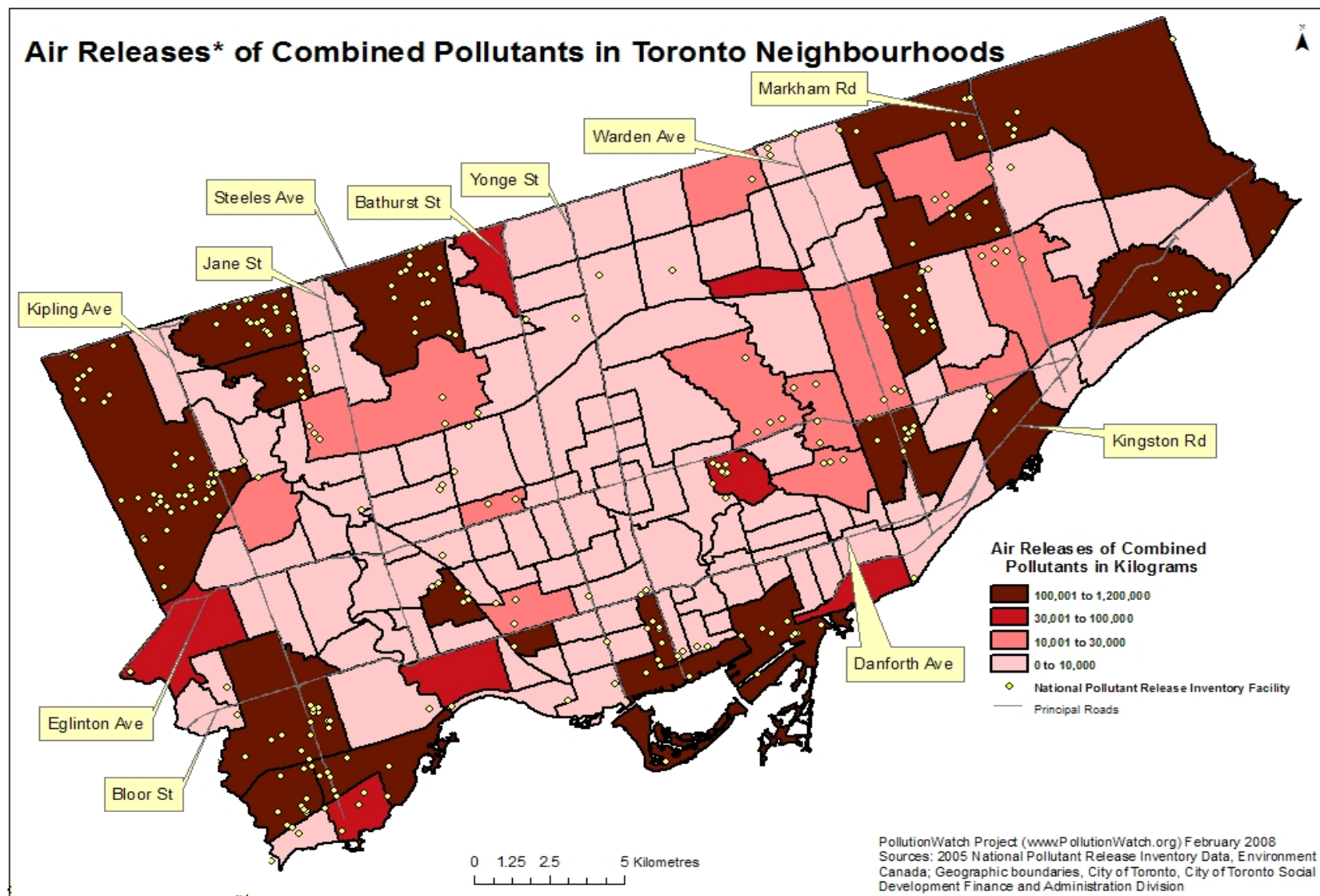**Figure 21:** Air releases of criteria air contaminants (kg) from NPRI facilities in neighbourhoods in Toronto in 2005

POLLUTION MAP

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Figure 22: Air releases of combined air pollutants (kg) from NPRI facilities in neighbourhoods in Toronto in 2005

Figure 23: Incidence of low income in neighbourhoods in Toronto (based on economic families before tax, 2001 census)
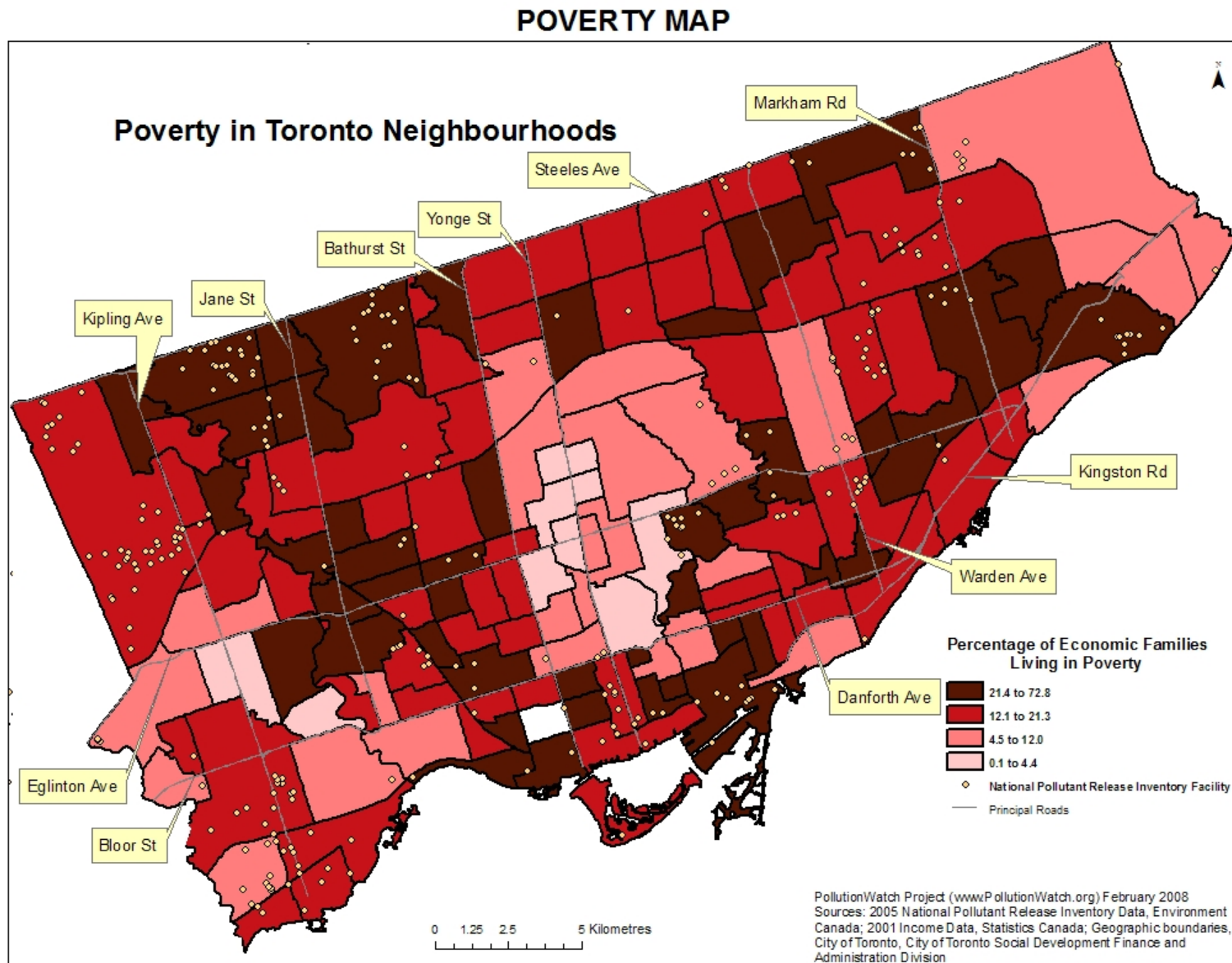
Figure 24: Releases of toxic air pollutants from NPRI facilities in 2005 and incidence of poverty in Toronto

POVERTY AND POLLUTION MAP

Toronto Neighbourhoods with Poverty Rates at or above the National Average of 11.8 Per Cent and Air Releases of Toxic Pollutants over 100,000 Kilograms*

Legend
High Poverty and Pollution
Below High Poverty and Pollution Threshold
National Pollutant Release Inventory Facility
Principal Roads

PollutionWatch Project (www.PollutionWatch.org) February 2008
Sources: 2005 National Pollutant Release Inventory Data, Environment Canada; 2001 Income Data and Poverty Rate, Statistics Canada; Geographic boundaries, City of Toronto, City of Toronto Social Development Finance and Administration Division

* From industrial sources reporting toxic air pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families

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Figure 25: Releases of criteria air contaminants from NPRI facilities in 2005 and incidence of poverty in Toronto

POVERTY AND POLLUTION MAP

Toronto Neighbourhoods with Poverty Rates at or Above the National Average of 11.8 Per Cent and Air Releases of Criteria Air Contaminant Pollutants over 100,000 Kilograms*
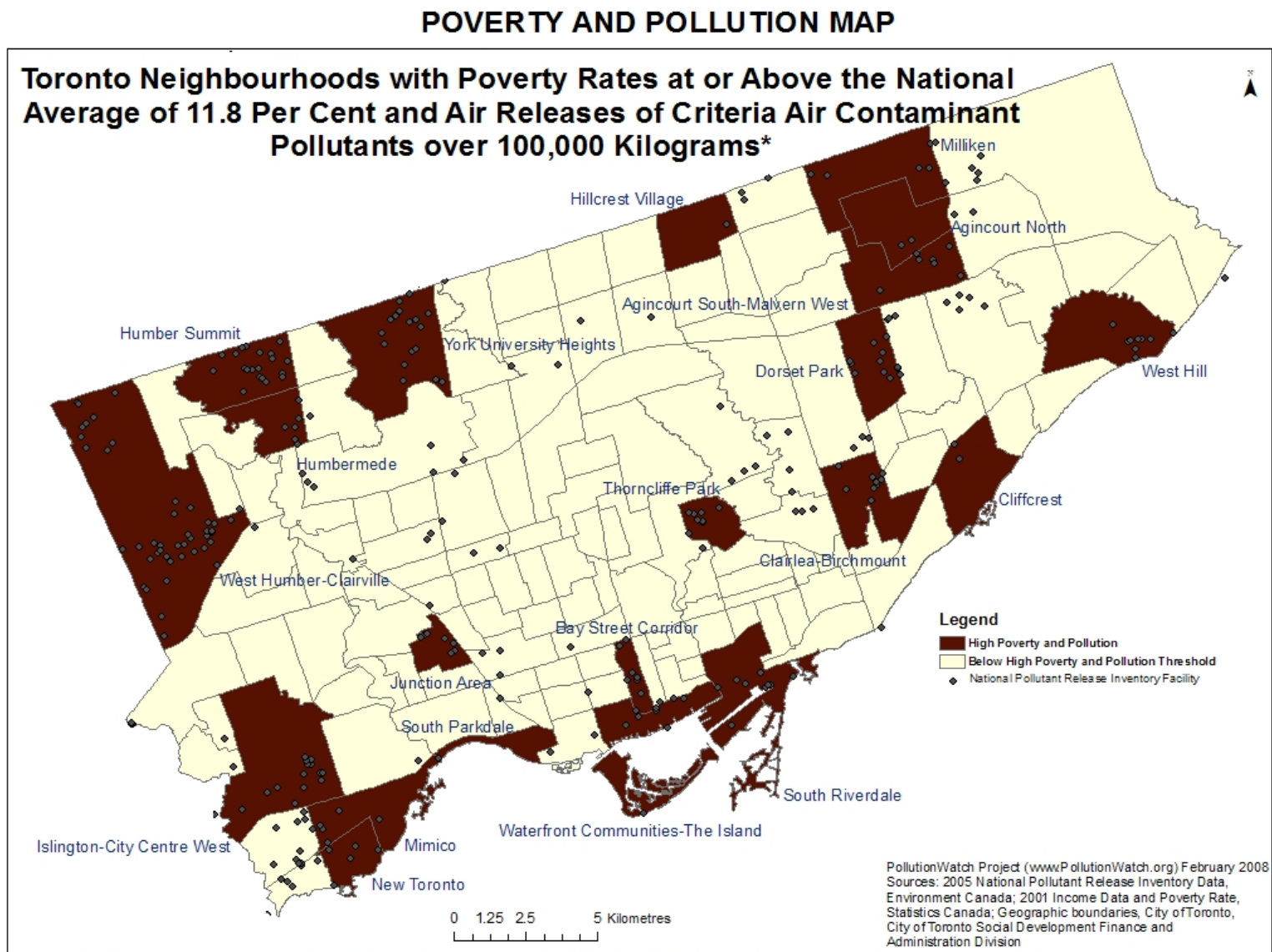
* From industrial sources reporting criteria air contaminant pollutants to the National Pollutant Release Inventory; national poverty rate based on economic families

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Figure 26: Releases of combined air pollutants from NPRI facilities in 2005 and incidence of poverty in Toronto
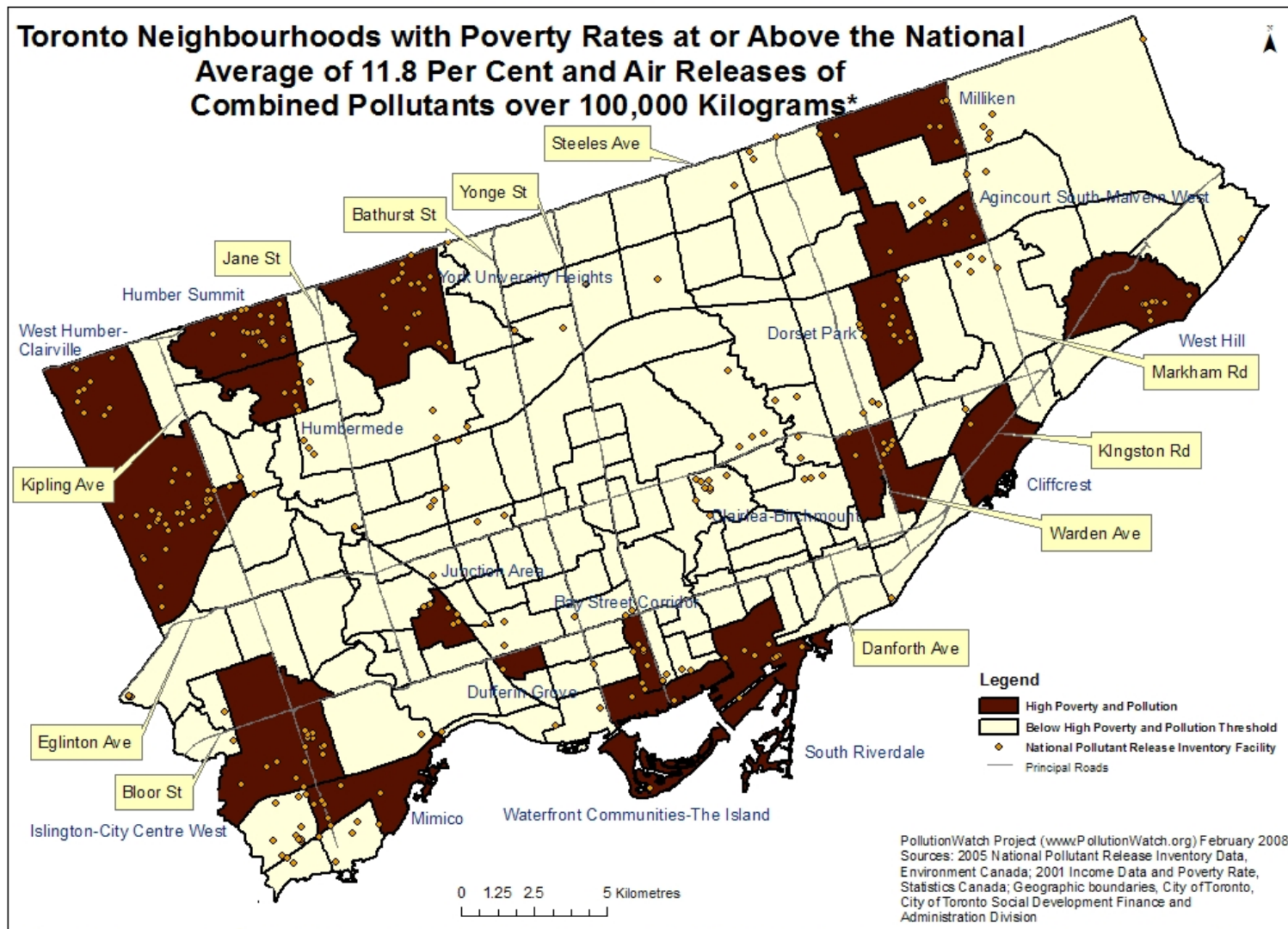
POVERTY AND POLLUTION MAP

In the analysis of the income and pollution data together, it becomes evident there are some neighbourhoods in Toronto that may be facing a double challenge: higher releases of pollutants from NPRI facilities and higher poverty rates. The maps identify seven neighbourhoods that have high releases of toxic pollutants and poverty rates above the national average, and 17 neighbourhoods that have high releases of combined air pollutants and poverty rates above the national average (see Figures 24 and 26).

Many of these neighbourhoods have already been identified as priority areas through the Toronto Strong Neighbourhoods Strategy, which identifies 13 areas to be strengthened through targeted investments in services and facilities (Toronto Staff Report, page 7). We also see the same pattern in Toronto as in the Great Lakes basin: some census tracts with high poverty have no NPRI facilities, and some census tracts with low poverty have no NPRI facilities.

Exploring the relationship between pollution and poverty at the census tract and neighbourhood levels in Toronto, the study found:

- Similar to the Great Lakes basin as a whole, the releases of air pollutants from industrial facilities and poverty rates vary across Toronto. Some areas in Toronto clearly face a double challenge: higher air releases from reporting facilities and higher poverty rates.

- 17 neighbourhoods in Toronto have high emissions of combined air releases, as well as poverty rates above the national average. Many of these neighbourhoods have already been identified as priority areas through the Toronto Strong Neighbourhoods Strategy, released in June 2005.

The following section outlines a number of measures that the PollutionWatch partners view as essential components in addressing the issue of poverty and pollution levels in our communities. In addition, the results of the study demonstrate that the impact of pollution should be a key factor when developing poverty reduction strategies.

4. Findings

There are five findings from this Great Lakes study:

1. High pollution levels – Large amounts of pollutants are released from industrial facilities in the Great Lakes basin. Over one billion kilograms of pollutants (toxics and smog causing pollutants), were reported being released to the air in 2005 from industrial facilities in the Great Lakes basin. This staggering amount of pollutants was released in just one year, 2005. For pollutants that are not easily broken down over time, this continuous release represents a huge pollution burden for Great Lakes communities and environment.

2. Unequal pollution burdens – The amount of air pollution released from industrial sources varies tremendously from one area to another in the Great Lakes basin. Some areas in the basin have industrial facilities releasing much more pollution than others. Industrial facilities in just 10 census subdivision areas release almost half of the toxic pollutants in the entire Great Lakes basin: Greater Sudbury, Haldimand, St. Clair, Sarnia, Toronto, Hamilton, Mississauga, Oshawa, Thunder Bay and Windsor.

3. Pollution and poverty – This study identifies areas in the Great Lakes basin where communities may face a double challenge: releases of high amounts of air pollutants as

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well as all the physical and social vulnerabilities that come with living in poverty. It suggests that some low income communities may also have high releases of pollution. There are areas in the Great Lakes basin, such as Montreal and Windsor, which have both high reported air releases and high poverty rates.

4. Promising methodology – Mapping pollution data to reveal community differences allows people to quickly identify their home and the releases from industrial facilities in their neighbourhood. It also allows pollution data to be easily included with other socio-economic information available at census subdivision levels. The methodology of the study can be replicated for future studies focused on investigating the links between pollution and income. Furthermore, the methodology applied in this study also allows for the addition of other sources of pollution or socio-economic data (e.g., health indicators, education, race, etc.) to be considered for future investigation.

5. Findings for Toronto – the study demonstrates that there are census tract areas and neighbourhoods in Toronto that experience both high pollutant releases and high poverty. There are 17 neighbourhoods that have been identified with high pollutant releases and high poverty.

5. Recommendations

As this study demonstrates, there are still large amounts of pollutants being released from industrial facilities, and still large areas with high poverty rates. For some communities, these two challenges collide.

Governments, agencies and public interest non-governmental organizations including health, environment and social justice/anti-poverty organizations, need to take extra care in areas that are twice challenged: once by poverty and once by pollution. Within these areas, we must also pay attention to people living with a third challenge - those who are in an especially vulnerable group such as children, seniors, or immune suppressed.

In support of the work of various organizations, including the World Health Organization, to promote research and policy programs that address social determinants of health such as poverty and pollution and the United Way's anti-poverty efforts, the Canadian Environmental Law Association and Environmental Defence recommend:

1. Formal recognition by all levels of government that pollution can affect people's mental, physical and emotional health and that people living in poverty may be additionally affected by pollution.

2. In light of the findings of this study that some low income communities also experience high pollution releases, further research be conducted by all levels of government, academics, anti-poverty and environmental organizations to gain a better understanding as to how people's mental, physical and emotional health is affected by living in poverty in communities with high pollution burdens. These findings should help inform the development of anti-poverty reduction plans.

3. Governments develop, in consultation with a diverse range of communities, including anti-poverty, environmental and health sectors, to develop a clear environmental equity policy framework that considers how the connections between poverty and pollution can be integrated in concrete ways into environmental decision-making processes (e.g.,

environmental approvals, standards approvals, management of toxic substances, etc.). The process of facility siting and permit renewals should include the consideration of cumulative loadings from multiple sources in the air shed.

4. As the province of Ontario considers the development and enactment of a Toxics Use Reduction law, this law should include prevention and elimination of the most harmful substances, such as cancer causing substances and reproductive and developmental toxicants.

5. The City of Toronto should pass the proposed Environmental Reporting, Disclosure and Innovation Programme, allowing for better tracking of pollutants in Toronto's neighbourhoods. Other municipalities in the Great Lakes basin should consider similar environmental reporting and disclosure programs for their communities.

In addition, the PollutionWatch partners recommend that in all communities, but especially in those communities twice challenged by pollution and poverty, municipal governments work with local agencies and the community to:

- take account of the sources and nature of pollution in the community;

- create and communicate a "pollution map" of the community;

- take account of environmental equity considerations in community planning, including siting of industrial facilities;

- engage with and develop strategies to reduce and prevent pollution from all sources: industrial facilities, mobile and other sources;

- require pollution prevention planning for industrial sources within the community;

- continue to monitor the community and report on indicators of mental, physical and emotional health and consider ways to integrate findings with measures of local pollution; and,

- increase support for many anti-poverty measures such as school food programs, literacy support, community centre programs, child care programs and supportive housing in ways that would help to reduce the impacts of the pollution burden.

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Appendix A

Census Subdivisions in the Great Lakes Basin with Poverty Rates at or above the National Average of 11.8% in 2001 and Air Releases of Combined Pollutants above 1 million kilograms from NPRI Facilities in 2005

Census Subdivision Name (CSDs)	Census Subdivision ID#*	Air releases of Toxic Pollutants in 2005 (kg)	Air releases of Criteria Air Contaminants (CACs) in 2005 (kg)	Air releases of Combined (toxics and CACs) in 2005 (kg)	Incidence of Poverty in 2001 (%)
Hamilton	3525005	2,240,453	58,459,377	58,788,549	16.1
Bécancour	2438010	692,500	45,579,386	45,680,098	11.9
Rouyn-Noranda	2486033	101,871	27,212,078	27,313,949	12.3
Sorel-Tracy	2453052	30,500	25,695,946	25,716,304	14.1
Shawinigan	2436028	272,412	19,722,812	19,791,035	22.5
Montréal-Est	2466005	587,935	16,248,975	14,962,514	20.2
Sault Ste. Marie	3557061	364,495	14,439,101	13,845,095	13.5
Melocheville	2470060	107,697	9,461,000	9,542,697	15.0
Montréal	2466025	494,499	11,059,518	9,451,843	26.5
Saint-Romuald	2425025	168,128	8,573,863	7,981,183	14.5
Toronto	3520005	2,819,466	13,205,592	7,134,465	19.4
Windsor	3537039	1,007,380	8,412,711	7,023,209	13.2
Salaberry-de-Valleyfield	2470045	106,728	8,036,315	6,514,506	18.4
Trois-Rivières	2437065	371,805	6,456,454	5,999,475	18.2
Joliette	2461025	29,113	5,757,456	5,703,089	19.2
Saint-Basile	2434038	299	5,340,980	5,320,299	13.2
Thurso	2480050	302,894	4,774,851	4,656,071	22.6
Espanola	3552026	311,826	4,510,685	4,505,528	15.6
Cornwall	3501012	642,468	3,512,262	3,334,161	19.0
Owen Sound	3542059	14,899	2,555,849	2,520,754	13.9
Grand-Mère	2436055	127,025	2,708,417	2,463,901	17.8
Québec	2423025	186,085	2,521,992	2,310,802	22.1
Hull	2481020		2,200,378	2,184,401	18.0
Senneterre	2489040	24,030	1,683,788	1,636,618	21.7
Kirkland Lake	3554068	408	1,600,444	1,567,698	17.0
London	3539036	287,180	1,864,821	1,168,920	12.7
Lachute	2476020	39,693	1,016,983	1,039,762	19.3

*Sources - Statistics Canada 2001, incidence of poverty based on total income of economic family LICO before tax; National Pollutant Release Inventory 2005 data

Census Subdivisions in the Great Lakes Basin with Poverty Rates at or above the National Average of 11.8% in 2001 and Air Releases of Toxic Pollutants above 100,000 kilograms from NPRI Facilities in 2005

Census Subdivision Name	Census Subdivision ID #	Air Releases of Toxic Pollutants in 2005 (kg)	Air releases of Criteria Air Contaminants (CACs) in 2005 (kg)	Air Releases of Combined (toxics and CACs) (kg)	Incidence of Poverty in 2001 (%)
Toronto	3520005	2,819,466	13,205,592	7,134,465	19.4
Hamilton	3525005	2,240,453	58,459,377	58,788,549	16.1
Windsor	3537039	1,007,380	8,412,711	7,023,209	13.2
Bécancour	2438010	692,500	45,579,386	45,680,098	11.9
Saint-Laurent	2466075	666,956	826,598	689,016	24.7
Cornwall	3501012	642,468	3,512,262	3,334,161	19.0
Montréal-Est	2466005	587,935	16,248,975	14,962,514	20.2
Montréal	2466025	494,499	11,059,518	9,451,843	26.5
St. Thomas	3534021	392,754	1,284,319	494,892	12.4
Trois-Rivières	2437065	371,805	6,456,454	5,999,475	18.2
Sault Ste. Marie	3557061	364,495	14,439,101	13,845,095	13.5
Peterborough	3515014	340,375	550,445	365,647	13.1
Penetanguishene	3543072	340,334	1,239,206	340,334	12.9
Espanola	3552026	311,826	4,510,685	4,505,528	15.6
Thurso	2480050	302,894	4,774,851	4,656,071	22.6
London	3539036	287,180	1,864,821	1,168,920	12.7
Shawinigan	2436028	272,412	19,722,812	19,791,035	22.5
Laval	2465005	252,108	635,963	261,865	13.0
Terrebonne	2464010	221,851	912,690	221,851	15.9
Roxton	2448015	196,500	172,800	196,500	11.8
Québec	2423025	186,085	2,521,992	2,310,802	22.1
Louiseville	2451015	184,551	195,716	184,551	14.9
Saint-Romuald	2425025	168,128	8,573,863	7,981,183	14.5
Mont-Laurier	2479085	166,360	294,960	240,150	18.2
Victoriaville	2439062	153,722	222,482	180,663	12.4
Belleville	3512005	152,375	596,692	192,443	12.8
Brantford	3529006	147,067	600,386	198,888	12.2
Drummondville	2449057	145,160	148,043	186,207	13.7
Granby	2447015	144,272	367,886	144,272	12.9
Saint-Jean-sur-Richelieu	2456080	133,105	159,996	133,105	16.4
Saint-Michel-des-Saints	2462085	129,016	1,244,544	821,897	15.2
Grand-Mère	2436055	127,025	2,708,417	2,463,901	17.8
Princeville	2432033	122,300	114,900	122,300	16.7
Saint-Léonard	2466015	121,611	817,272	121,611	22.2
Melocheville	2470060	107,697	9,461,000	9,542,697	15.0
Salaberry-de-Valleyfield	2470045	106,728	8,036,315	6,514,506	18.4
Rouyn-Noranda	2486033	101,871	27,212,078	27,313,949	12.3

*Sources - Statistics Canada 2001, incidence of poverty based on total income of economic family LICO before tax; National Pollutant Release Inventory 2005 data

Appendix B: Low Income Cutoff Levels based on Total Income before Tax, Canada, 2000

Source: Statistics Canada based on 2001 census

Size of economic family	Low Income Cutoffs (before tax)				
	Size of Area of Residence				
	Population of 500,000 or more	Population of 100,000-499,999	Population of 30,000-99,999	Small urban regions	Rural (farm and non farm)
1	$18,371	$15,757	$15,648	$14,561	$12,696
2	$22,964	$19,697	$19,561	$18,201	$15,870
3	$28,560	$24,497	$24,326	$22,635	$19,738
4	$34,572	$29,653	$29,448	$27,401	$23,892
5	$38,646	$33,148	$32,917	$30,629	$26,708
6	$42,719	$36,642	$36,387	$33,857	$29,524
7+	$46,793	$40,137	$39,857	$37,085	$32,340

Low income cutoffs are based on the 1992 Family Expenditure survey and are expressed in constant 2000 dollars.

Source: Statistics Canada 2001 Census: analysis series: Income of Canadian Families. May 2003. Catalogue number 96F0030XIE2001014

From this table, a family of four living in a large Canadian city such as Toronto with a total income of $34,572 would be considered substantially worse off than average.

Appendix C: Creation of Toronto "Neighbourhood" Boundaries

TORONTO

The neighbourhood boundaries were developed by the City of Toronto[1] to help government and community agencies with their local planning by providing socio-economic data at a meaningful geographic scale. At the time (circa 2000) no boundaries existed to analyse data at the neighbourhood level. The only alternative was to use Statistics Canada Census Tracts. This proved problematic not in the way Census Tracts are defined, but in the many different ways of aggregation up to a "neighbourhood level".

Therefore the approach taken was to come to consensus as to the most appropriate way of aggregating census tracts as the building blocks. Three major assumptions were used before the process began:

1. Census tracts are the most appropriate building block to use given the availability of data over time
2. Income is the key variable that determines a neighbourhood
3. Boundaries must <u>not</u> conform to any existing service or political boundary (unless they fit the criteria set out below), as these are biased and not statistically meaningful for demographic and social planning purposes. Political boundaries are also subject to frequent revision and that vastly complicates temporal comparisons.

Not all people define "neighbourhood" the same way. For the purposes of planning and statistical reporting however, these neighbourhoods were defined based on Statistics Canada census tracts. Census tracts include several city blocks and have on average about 4,000 people. Most service agencies have service areas that are defined by main streets, former municipal boundaries, or natural boundaries such as rivers. These service areas include several census tracts. It is not uncommon for service areas of community agencies to overlap. Choices about neighbourhood boundaries were made to make the data in the profiles useful to as many users as possible, and are not intended to be definitive statements or judgements about where a neighbourhood starts or ends. The boundaries for these neighbourhoods were developed using the following criteria:

1. originally based on an Urban Development Services Residential Communities map, based on planning areas in former municipalities, and existing Public Health neighbourhood planning areas;
2. no neighbourhood be comprised of a single census tract;
3. minimum neighbourhood population of at least 7,000 to 10,000;
4. where census tracts were combined to meet criteria 2 or 3 above, they were joined with the most similar adjacent area according to the percentage of the population living in low income households;

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[1] Toronto Community & Neighbourhood Services Department and Toronto Public Health.

5. respect existing boundaries such as service boundaries of community agencies, natural boundaries (rivers), and man-made boundaries (streets, highways, etc.) as much as possible;
6. maintain neighbourhood areas small enough for service organizations to combine them to fit within their service area; and
7. the final number of neighbourhood areas be "manageable" for the purposes of data presentation and reporting.

Input was received by the following stakeholders in the preparation of the final set:

- Public Health
- Library
- Police
- Parks & Recreation
- Planning
- Key Community Agencies across the City of Toronto

The following limitations should be noted when using these boundaries:

1. There may be smaller distinct "communities" within each neighbourhood.
2. Users may consider utilizing more than one "neighbourhood" for service analyses when that service is on the edge of a neighbourhood boundary.
3. The aggregation of Census Tract data up to neighbourhoods is problematic in some areas where suppression exists at the CT level.
4. The boundaries do not coincide with Ward or service boundaries. This was intentional in order to preserve the integrity of the boundaries for purely socio-economic planning purposes.

If using these boundaries please reference them as follows:

Neighbourhood Boundaries v.2
City of Toronto, Social Development & Administration Division

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Appendix D: Methodology

Geography

- The project team selected one geographic region of Canada, the Great Lakes basin, based on organizational priorities and previous policy work focused on this region.

- The project team generated Great Lakes watershed maps based on maps provided by the Great Lakes Information Network and additional information from other researchers.

- Through Statistics Canada, the project team purchased geographic data files for census subdivisions for Ontario and Quebec and census tracts in the Toronto area.

- Statistics Canada census subdivisions are "a general term applying to municipalities (as determined by provincial legislation) or their equivalents. Municipalities are the units of local government. Each Indian reserve and settlement is treated as a separate census subdivision." (Noted from standard geographical classification found in www.statscan.ca)

- There are about 500 census subdivisions in Ontario and about 1,300 in Quebec.

- Census tracts are generally a smaller area than census subdivisions. Census tracts are defined by Statistics Canada as "small relatively stable geographic areas that are located within a Census Metropolitan Area and larger census agglomeration and usually have a population of 2,500 to 8,000."

- There are approximately 500 census tracts in the Census Metropolitan Area of Toronto.

- Using the geographic boundaries purchased through Statistics Canada, mapping was completed using ArcView 9.0 software. The census subdivisions which fell within the Great Lakes basin were identified. Approximately 1,450 census subdivisions are located within the Great Lakes basin.

- Based on scoping exercises, interviews conducted with Statistics Canada and review of data availability, the project team selected one area, Toronto, for more detailed analysis at the census tract level. Toronto was chosen due to its relatively high rates of poverty among communities within the Great Lakes basin, high releases of pollutants, and the presence of work completed previously by the City of Toronto, United Way and others from which to learn.

- The project team mapped two geographic scales: census tract and neighbourhoods. The neighbourhood boundaries, which divide the city into 140 neighbourhoods, were provided by the City of Toronto Social Development Finance & Administration Division. The City's neighbourhoods are based on the aggregation of similar income-based Census Tracts (see Appendix C for more details).

- Locations of NPRI facilities were mapped using the reported postal codes of the each facility. These postal codes were converted into geocoding for ArcView using a Statistics Canada product known as Postal Code Converter with assistance from the University of Toronto, Geography Department. Additional efforts were required to successfully map approximately 100 NPRI facilities because these facilities lacked a postal code or the postal code converter identified problems with its coordinates. For these facilities, street addresses were mapped using the Yahoo maps to obtain the correct postal code. These facilities' locations were then recoded using the Postal Code Converter.

- Overall, the data was mapped using a variety of geographic scales:

    1. a basin wide view using the entire Great Lakes basin;
    2. regional views (southern Ontario, St Lawrence River Valley); and
    3. census tracts and neighbourhoods in Toronto.

Pollutants

Facility mapping

- The locations of all NPRI facilities in Ontario and Quebec were downloaded from the Environment Canada web site in the month of June 2007. Only those NPRI facilities that were within the Great Lakes basin were included in this study. These facilities had been previously identified through earlier PollutionWatch work, and were also further verified through postal codes and mapping.

- There are about 2,000 NPRI facilities within the Great Lakes basin (see Figure 2).

- It is recognized that an NPRI facility may be close to the boundary of a census subdivision, and the releases of air pollutants may affect more than the identified census subdivision area. Air pollutants can also travel long distances depending on a number of factors: wind speed, atmospheric conditions, type of pollutant, topography, etc. It is important to keep in mind that some facilities can release air pollutants that travel for hundreds of kilometres. While the maps are useful to illustrate differences in releases of pollutants in the Great Lakes basin, it is important to note that often pollution does not respect physical boundaries, and may travel well beyond the map's census subdivision boundaries. This study does not use modeling to calculate plumes, as this was beyond the scope of the project. Readers can learn more about which facilities are located within a census subdivision, the type of pollutants released into the air, and the trends over time by using the PollutionWatch web site at www.PollutionWatch.org. To locate facilities, visitors to the web site can search by postal code or create a map using an address.

NPRI data

- The project team used 2005 data from Environment Canada's National Pollutant Release Inventory (NPRI) (www.ec.gc.ca/pdb/npri). The 2005 NPRI data (version dated November 2007) was downloaded for total air releases for each chemical reported by facilities in Ontario and Quebec. Total air releases include pollutants released to air through the stack, fugitive emissions and spills, leaks and other releases. The 2005 data were the most recent NPRI data available at the time of the development of this study.

- NPRI data are useful for identifying releases and transfers of a selected list of pollutants from larger industrial facilities. As with any data, however, NPRI data have some important limitations (also visit www.PollutionWatch.org/tools/understandData.jsp under "Understanding the Data," see section "What are the limitations of the data?" or www.ec.gc.ca/pdb/npri/). In brief, the NPRI data:

    o do not include all sources of pollution (for example, the data do not include mobile sources such as releases from personal and commercial vehicles, or natural sources such as forest fires);

    o do not include reporting for all chemicals of concern (the NPRI reports on 323 chemicals);

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- o do not include emissions from area sources such as gas stations and dry cleaners;

- o are self reported by industrial facilities and each facility reporting under NPRI may use a variety of methods to estimate emissions;

- o are only required from those facilities meeting certain thresholds (generally 10 tonnes and 10 employees);

- o are not necessarily an estimate of the health or exposure risks of the chemical releases and transfers;

- o document the release of a substance from an industrial source which may not automatically lead to human exposure. The degree of human exposure may not be proportionate to the number of tonnes released. There are many factors to consider when determining human exposure such as: route of exposure, duration and frequency of exposure, rate of uptake of the substance, individual age, gender and ethnicity, the disease, overall health, nutritional and pregnancy status of the individual (CEC, 2006);

- o include chemicals that can differ in their toxicity, persistence and bioaccumulation;

- o are one source of information on pollutants in the environment. Other sources of information include: ambient air monitoring, chemical inventories, modeling estimates, actual levels in people, fish and plants and industrial emission rates of chemicals (CEC, 2006);

- Because of these limitations, while NPRI data are useful, they only provide a partial picture of pollutants in the environment and the potential for human exposure. NPRI data need to be combined with other information to fully assess pollutant exposure and human health effects.

- It is also recognized that the pollution data (2005) used in this study are more recent than the poverty data (2001). The study used the most recent pollution and poverty data available at the time the project was initiated.

- The air releases from NPRI facilities were separated into:

  1. toxic pollutants;
  2. criteria air contaminants (CACs); and,
  3. combined air pollutants.

- Toxic pollutants are those pollutants reporting in Part 1, 2 and 3 of the NPRI. Examples of toxic pollutants are mercury, cadmium and styrene. The word "toxic" is used to describe this group of pollutants to distinguish it from other groups of pollutants such as criteria air contaminants which are also reported under NPRI (see next bullet). It does not mean that each pollutant in this group has been found to be "toxic" under the *Canadian Environmental Protection Act, 1999*.

- Criteria air contaminants are pollutants reported in Part 4 of the NPRI. These types of pollutants are often associated with smog and acid rain. They include:

- o carbon monoxide (CO);

- o total particulate matter (TPM);

- o particulate matter less than or equal to 10 microns (PM_{10});

- o particulate matter less than or equal to 2.5 microns ($PM_{2.5}$);

- o sulphur dioxide (SO_2);

- o oxides of nitrogen (NO_x), and;

- o volatile organic compounds (VOCs).

- Under PollutionWatch, combined air releases are the sum of toxic pollutants and criteria air contaminants (CACs) minus volatile organic compounds (VOCs) reported as a group under the category of CACs under the NPRI. VOCs reported as a group under CACs are excluded to avoid potential double counting which could occur because some of the same compounds are reported as an individual toxic pollutant and also as part of the group of VOCs. An example is benzene, which is reported in Part 1 of NPRI and also forms part of the group of VOCs reported in Part 4. In addition, only total particulate matter (TPM) is included in the CAC total to avoid adding TPM, PM_{10} and $PM_{2.5}$ together. PM_{10} and $PM_{2.5}$ are subsets of TPM and cannot be added together.

- The project team explored a variety of methods to group pollution data. This study grouped pollution data by using the natural break method in ArcView 9.0, which seeks to minimize differences within a group and maximize differences between groups. These groups were then further customized to further allow the groups to distinguish the range of air releases. The method for grouping that was not adopted for this project was the use of quartiles because the data are not normally distributed and a few areas have very high releases (data outliers). Using quartiles based on amount of air releases would have resulted in groups containing only one or two census subdivisions. While pollution maps based on quartiles would be useful to point out the areas with the highest air releases, they are less useful in distinguishing among areas with medium or lower releases.

Poverty

- After much discussion and research with various organizations working on social and poverty issues, as well as Statistics Canada, the project team decided to use a commonly accepted measure of poverty known as the number of people with income below a "Low Income Cutoff" ("LICO" or "poverty lines").

- The Government of Canada has no official measure of poverty. However, Statistics Canada does define a number of different income measures. The LICO measure is often used by social development groups to determine poverty. Statistics Canada considers that low income cutoffs "convey the income level at which a family may be in straitened circumstances because it has to spend a greater proportion of its income on necessities than the average family of similar size. Specifically, the threshold is defined as the income below which a family is likely to spend 20 percentage points more of its income on food, shelter and clothing than the average family." There are separate cutoffs for seven sizes of family - from unattached individuals to families of seven or more persons - and for five community sizes - from rural areas to urban areas with a population of 500,000 (see Appendix 3). LICO is calculated from interviews asking people about the amount of money spent on shelter, food and clothing. Statistics Canada notes limitations in the application of LICO as a poverty measure (Statistics Canada, undated).

- Statistics Canada calculates the LICO for different community sizes and for different family sizes, and for a particular year. The LICO used in this study is based on economic families before tax for the year 2000 (2001 Census data). It is acknowledged that this is not a perfect measure of poverty, but it is a commonly accepted measure that is consistent with other poverty research.

- The project team considered other measures of poverty based on different Statistics Canada income data, but these data were not available at all geographic ranges of interest to the project team.

- An economic family is defined by Statistics Canada as "a group of two or more persons who live in the same dwelling and are related by blood, marriage, common law or adoption."

- Total Income is defined by Statistics Canada as "income from all sources including government transfers and before deduction of federal and provincial taxes" (Statistics Canada, undated).

- According to 2001 census data, there were about 4,711,000 Canadians living in low income (before tax, 2001), of whom 3,076,000 are persons living in economic families (Statistics Canada Summary Table 202-0802).

- The data for LICO based on the 2001 Census was purchased from Statistics Canada for census subdivisions for Ontario and Quebec and census tracts in the Toronto area. The LICO data for the 2006 Census were not available at the time of development of this project. 2001 Census data was the most recent data available.

- Selected poverty variables were re-weighted and provided at the neighbourhood level by the City of Toronto's Social Development Finance & Administration Division.

- The income data was extracted from the Statistics Canada's browser and loaded into ArcView 9.0. For some census subdivisions and Aboriginal communities, there is no LICO data available due to a small number of people living in the area. Statistics Canada does not calculate a LICO for Aboriginal communities. This turned out to be an important limitation in our dataset as many of the high pollution areas are near Aboriginal communities (for example Sudbury, Sarnia and Haldimand). Statistics Canada provides other measures of income on Aboriginal communities, but these were either not comparable to the LICO measure used for this study, or not available for all Aboriginal communities in the Great Lakes basin.

- The project team mapped the percentage of economic families that are living below LICO for census subdivisions in the Great Lakes basin and for census tracts in the Toronto area.

- Because the poverty data follow a normal distribution, the percentage bands are based on natural break method which takes into account the distribution of the data.

Statistical Analysis

- Statistical analysis was used to explore the relationship between pollution and poverty. The project team explored two statistical questions:

    1. What is the relationship between pollution and poverty?
    2. Is there a difference in poverty rates in areas that have high releases of pollutants compared to areas that have low releases of pollutants?

    - A histogram of the pollution data demonstrated that the pollution data do not follow a normal distribution. The pollution data were highly skewed (Skewness was over 11 for the pollution data. Data that follow a normal distribution often have a skewness of 0 and ranges between -0.8 and +0.8). Transforming data using log transformation is a commonly used technique to rescale the data (Sokal and Rohlf, 1995). The pollution data were transformed so that they fit a normal distribution, and were more suited to the

assumptions of some statistical analyses. Since the data were so skewed, they were log transformed. The log transformed data have a much reduced skewness (toxics - 0.99, CACs - 0.24 and combined pollutants - 0.45).

- Correlation analysis was then used with the log transformed pollution variables (in toxics, in CACs and in combined pollution) and the poverty variable (incidence of poverty in economic families in a census subdivision). Only those census subdivisions with pollution data were included in the analysis. Finding a statistically significant correlation between pollution and poverty can have multiple explanations: there is a direct cause and effect relationship; there is a reverse cause and effect relationship; the relationship may be a result of a third variable; and, the relationship may be the result of a complex interaction of multiple variables.

Appendix E: About PollutionWatch

About PollutionWatch (www.PollutionWatch.org) is a collaborative project of Environmental Defence and the Canadian Environmental Law Association. The web site tracks releases and transfers of pollutants across Canada based on data collected by Environment Canada through the National Pollutant Release Inventory (NPRI) and emissions of greenhouse gases based on the federal government's mandatory Greenhouse Gas Emissions Reporting Program. NPRI and the Greenhouse Gas Emissions Reporting Program do not include data from all pollutants or sources. Visitors to the PollutionWatch web site can identify facilities in their home towns by searching by postal code or by a specific street address, access "quick lists" of the facilities reporting the largest releases and transfers of pollutants and greenhouse gases in the country, or create their own ranked lists of facilities by province, industrial sector, or corporation.

The data used in this PollutionWatch study are based on publicly available databases collected by the federal government. PollutionWatch makes no warranties or representation of any kind with respect to its contents and disclaims all such representations and warranties. Neither PollutionWatch nor any other person acting on its behalf makes any warranty, expressed or implied, or assumes any legal responsibility for the accuracy of any information or accepts liability from the use or damages from the use.

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