Good morning.

I am reporting on **four categories** of Great Lakes indicators (Resource Use, Climate Change, Land Use/Land Cover and Human Health) and most of the indicators track trends in human resource use and waste generation. Overall, the pressures on Great Lakes resources are growing, primarily due to population growth in the basin, but also to some increasing rates in per capita resource use.

Just two weeks ago, the U.S. population topped the 300 million milestone and is expected to reach **400 million in about 37 years**. In the **Ontario Golden Horseshoe Area** alone, forecasts predict **that** portion of the Canadian population will grow by an additional **3.7 million people by 2031.**

Two PopClock websites provide **real-time estimates** of both country's populations. The U.S. and Canadian populations posted on this slide represent estimates **as of 10 o'clock** this morning.

Given that roughly **10% of Americans and 30% of Canadians** live in GL Basin, the up to the hour GL Basin population is an estimated **39,812,870**.

Keep your eye on the counter.

U.S. PopClock http://www.census.gov/main/www/popclock.html

Canadian PopClock http://www.statcan.ca/english/edu/clock/population.htm

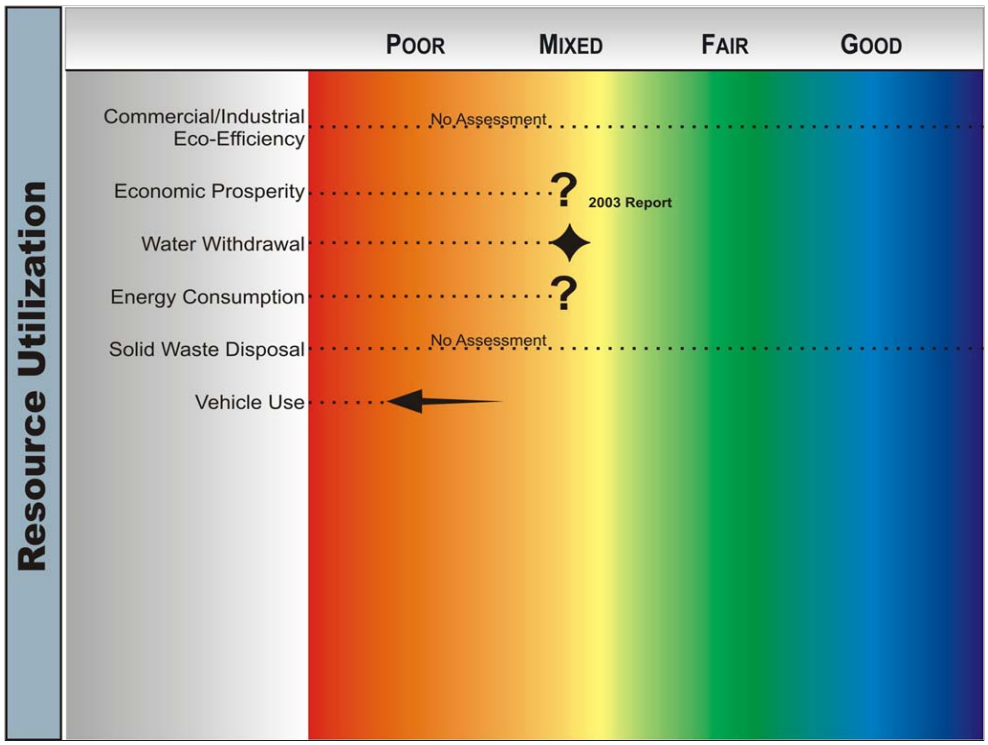
According to the U.S. Census Bureau, one person is added to the U.S. population **every 11 seconds**. In Canada one person is added to the population **every minute and 36 seconds**.

About **60%** of the U.S. gain is from birth rates outpacing death rates and a whopping **40%** is from net immigration.

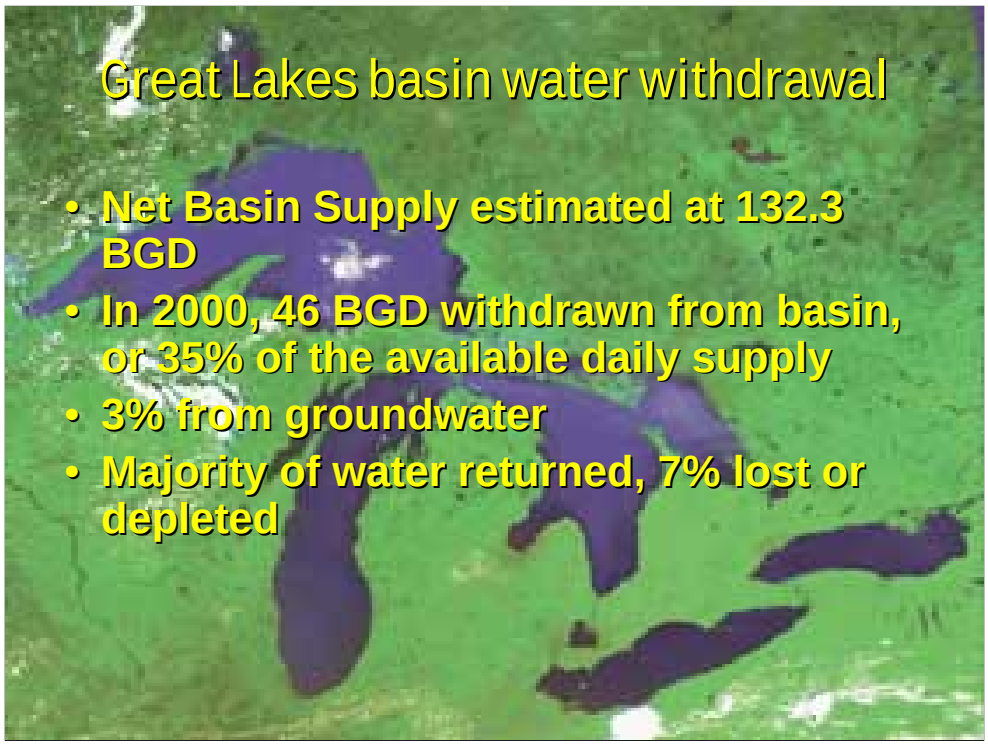
Not only are there more of us, but **increasingly, more of us are living alone**. **One-person households** account for **more than a quarter** of the U.S. population (Population Reference Bureau). That means, on average, we are using more resources -- more housing, more water, more energy and more land.

By nature, most resources are finite. But **pressures on them are continually increasing** -- in the Great Lakes basin and the rest of the world.

If we monitor our use – of water, energy, land – and waste production, we gain a better understanding of our impact on the region and its carrying capacity.

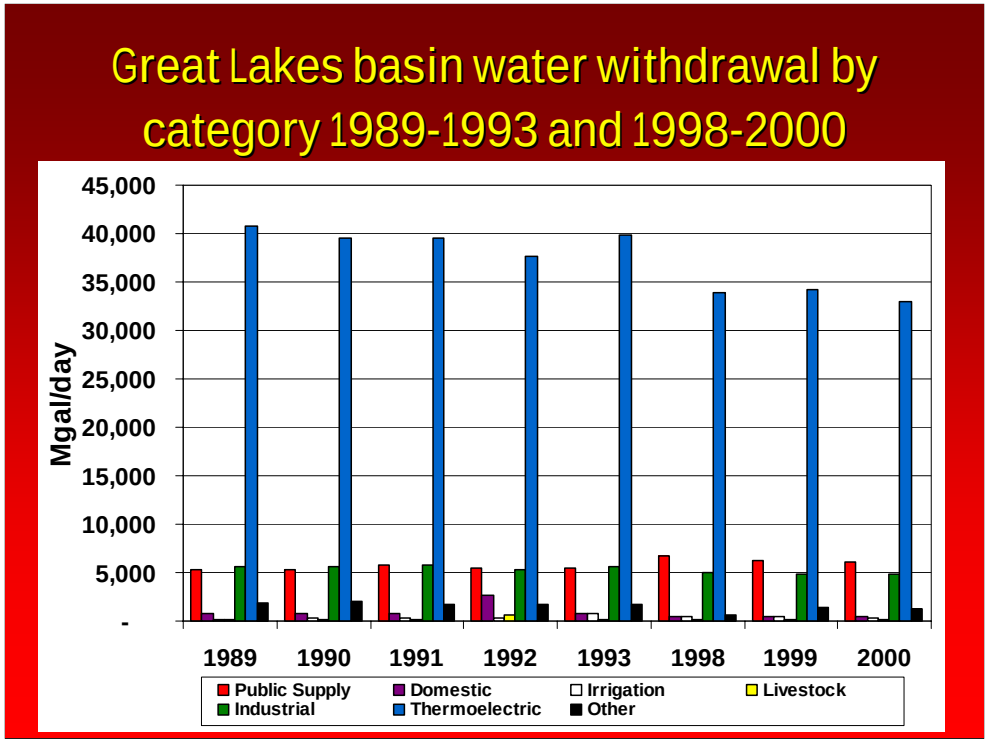


The status of Great Lakes resource utilization is mixed, and the overall trend is often undetermined due to incomplete data, inconsistent reporting or a lack of assessment.



The **net basin supply of water** is estimated at slightly **more than 132 billion gallons per day**. **In 2000**, water was withdrawn from the Great Lakes at a **rate of 46 billion gallons per day**. Three percent of the total comes from groundwater. That means we are **using about 35% of the available daily supply**.

The **majority** of water withdrawn is **returned to the basin** through discharge or run-off; however, approximately **7% is lost** through evapo-transpiration **or depleted** by human activities.



This **chart shows water withdrawals by user category for two periods of years**.

•A little more than 80% of the total was withdrawn by thermoelectric and industrial users, with power plants using the greatest volumes;

•13% was withdrawn for public water supplies;

•2% by agricultural sectors; and

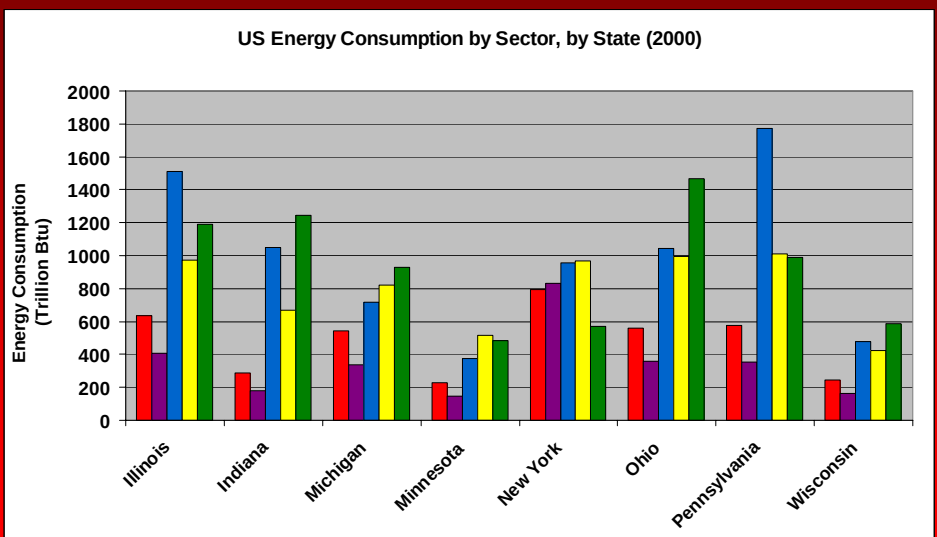
•3% was withdrawn for environmental, recreational, navigational, and quality control purposes.

Canadian withdrawals have decreased by roughly 30% since the 1990s while **U.S. withdrawals have decreased by more than 20%** since 1980. **However**, the declines are **largely due to reduced withdrawals by thermoelectric generators** which **mask** generally **increasing use for public water supply**.

In the immediate future, the greatest pressure for increased withdrawals will come from communities bordering the basin, where existing water supplies are scarce or of poor quality. These localities might look to the Great Lakes as a source of water.

To reduce water demand, higher water prices have been widely advocated. Public education on water conservation and promotion of water-saving technologies will also help.

Energy consumption

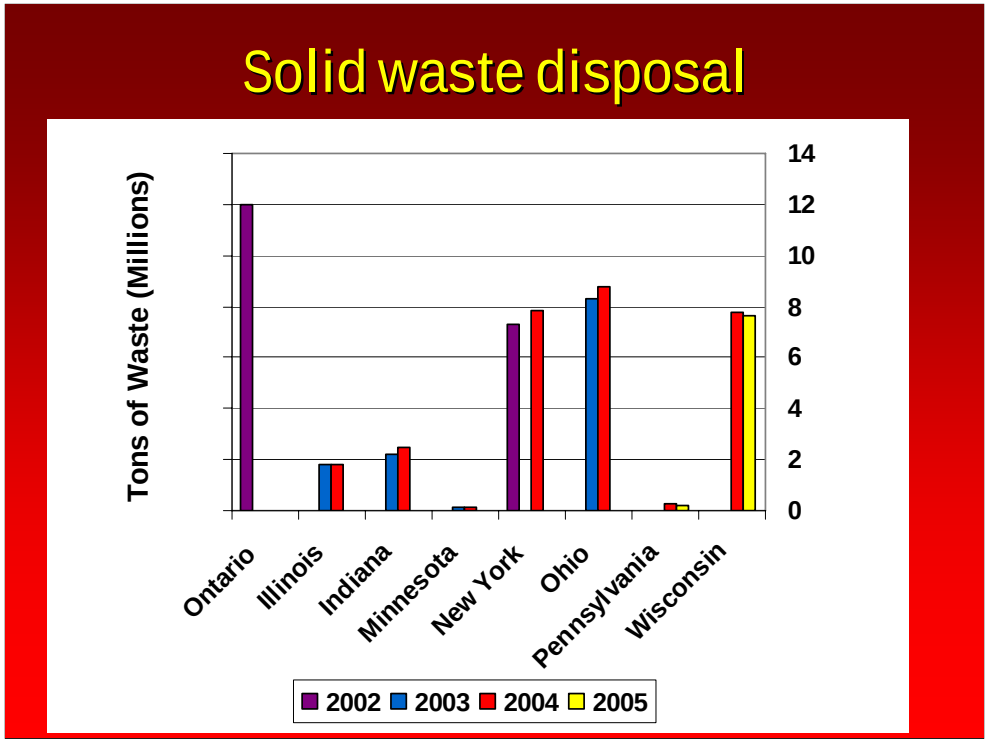


Canada and the U.S. are among the largest energy **producers and consumers** in the world.

Between 1999 and 2000, the **per capita energy consumption decreased in the U.S. by nearly 1% but increased in Ontario by 2%.** With growing populations, energy consumption will likely continue to rise.

The graph shows energy consumption by sector for Great Lakes states in 2000. **Industries and electric utilities** are generally the largest consumers with **transportation a close third**. Other data for **Ontario** (not shown on the chart), indicate the largest change in energy consumption between 2000 and 2002 was a **4.4% increase in the commercial sector**.

Fossil fuels are the leading source of energy consumption on both the U.S. and Canadian sides of the basin. However, many Great Lakes **industries are now using bio-fuels,** resulting in a decrease in fossil fuel consumption. And there is a **growing investment** in **renewable energy** sources.

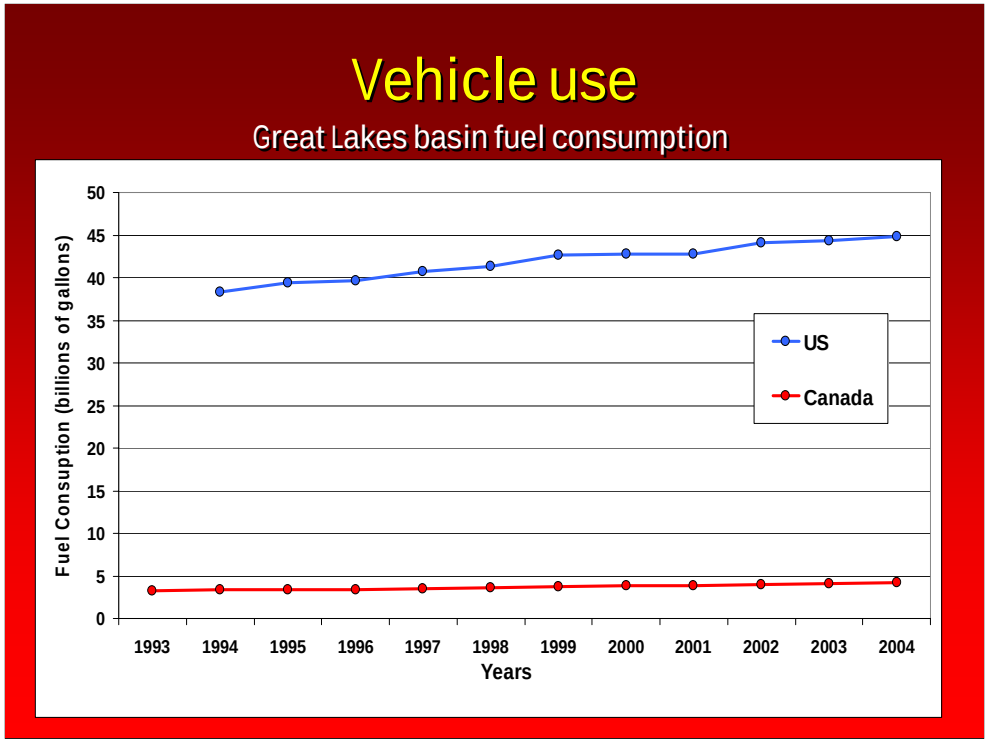


Over time, the **change in waste disposal tonnages** can be **used as an indicator for solid waste generation.** But **more consistent and comparable data are needed**. Data are incompatible from one jurisdiction to the next.

The chart shows that **recording periods between states and provinces vary.** Further complicating the assessment, waste may be generated in one jurisdiction and disposed of in another.

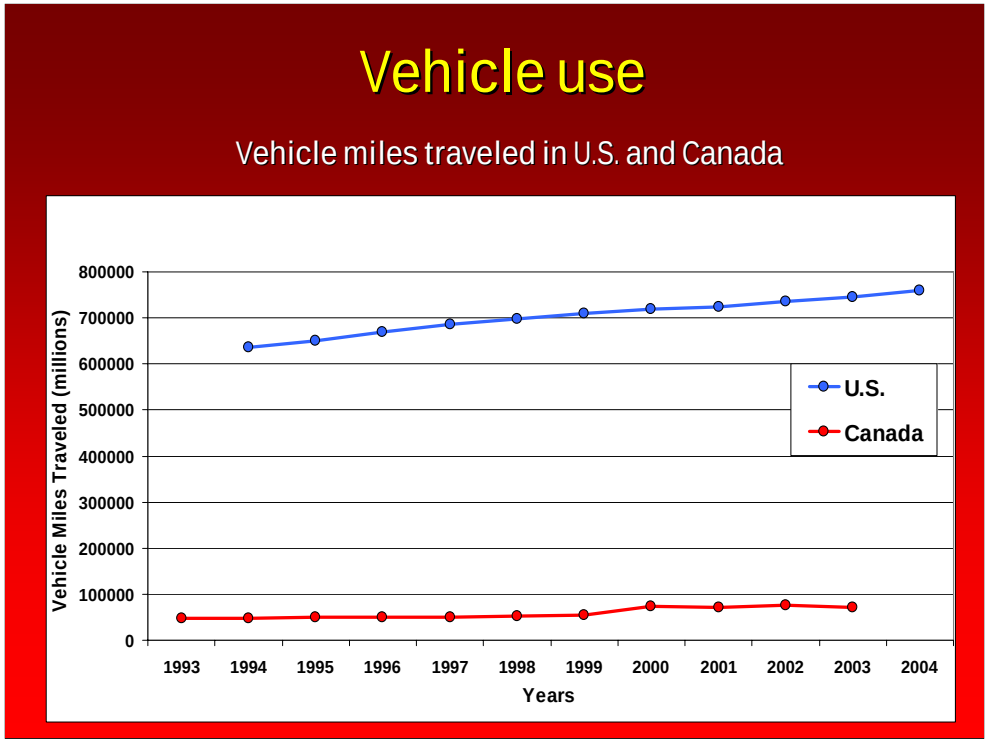
There is **good news in the three "Rs".** Programs that **reduce, reuse or recycle** waste are underway. **Ontario's Waste Diversion Act was passed in 2002**, providing a mandate to reduce, reuse or recycle waste. The goal is to **divert 60% of the waste by 2008**.

In addition to prolonging the life of landfills, waste prevention and recycling also reduce greenhouse gases by decreasing methane emissions, saving energy, and increasing forest carbon sequestration, since fewer trees are harvested.



Population growth and urban sprawl in the Great Lakes basin has led to an increase in the number of vehicles on the roads, fuel consumption, and miles traveled.

This **graph shows fuel consumption** in thousands of gallons **by states and provinces** in the basin. While the total fuel consumed by the states is substantially larger, the **rate of increase is slightly greater for the provinces**. **Over ten year periods** (1994-2004 for U.S. data and 1993-2003 for Canadian data) **fuel consumption increased by 17% in the U.S.** portions of the Great Lakes basin and by **20% in the Canadian portion.**



In addition to rising fuel consumption, **we're traveling more miles, and probably liking it less** as the roads become more congested. This figure shows a trend similar to the previous graph. During 10 year time frames, the total number **vehicle miles traveled** in the U.S. portion of the basin was substantially greater than total miles for the Canadian portion. However, the rate of increase in miles traveled was greater in the Canadian portion. Miles traveled within the basin **increased 20% for the U.S. and 54% for Canada**.

Another upward trend is that the increase in registered vehicles continues to outpace the increase in licensed drivers. **For example**, in the Great Lakes states, the number of licensed drivers increased by 8% between 1994 and 2004, while the number of registered vehicles increased by about 11%.

Conclusions about the resource use indicators are:

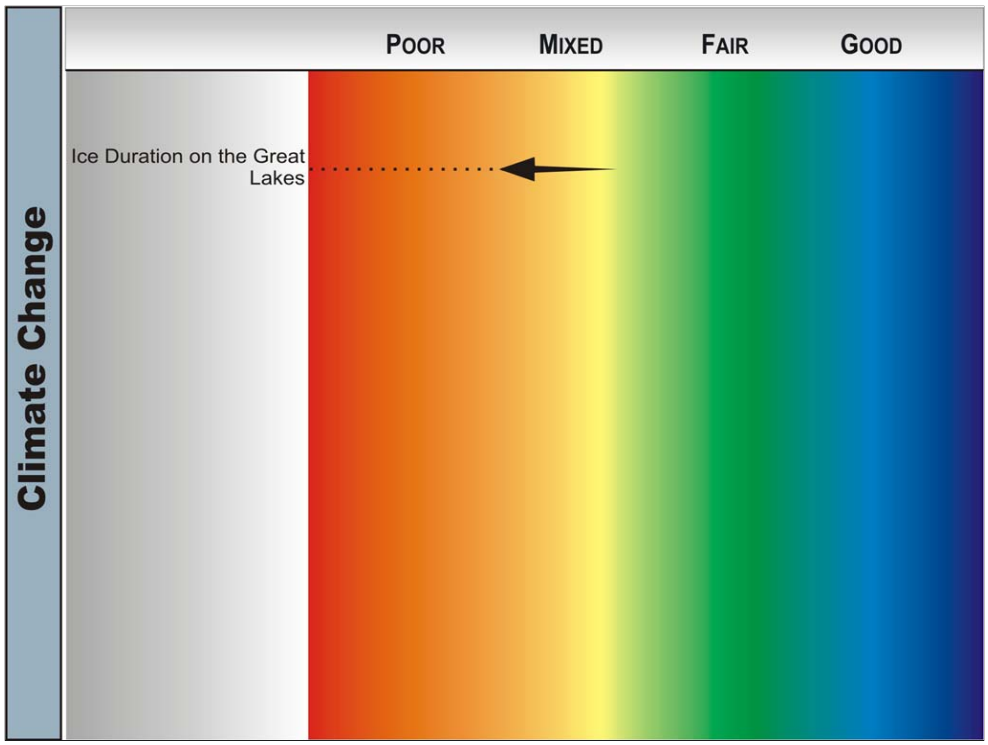
While total water withdrawals from the basin declined slightly, demands from communities bordering the basin are expected to rise.

Per capita energy consumption has changed only slightly (down for U.S. and up for Canada), but total **energy consumption may rise with increasing populations.**

Population growth and urban sprawl have lead to an increase in the number of licensed drivers, number of vehicles on the road, gallons of fuel consumed and total miles traveled.

And the PopClock keeps ticking.

There is no scientific doubt that our climate is warming.



The status and trend of climate change and impacts to the Great Lakes ecosystem are incomplete.

Additional work is needed to develop robust indicators and establish long term monitoring that assesses impacts over time and helps coastal communities adapt to the changes that are coming.

Computer models, still under development, suggest that the climate of the Great Lakes region will grow warmer and **possibly** drier during the 21st century. Any increases in precipitation are not expected to compensate for the drying effects of increased evapotranspiration in a warmer climate. Therefore, surface waters, groundwater and soil moisture are all predicted to decline.

Many impacts to the region are expected. Some of the changes ahead may include:

•Continued declines in the duration of winter ice cover and possible declines in lake levels as evaporation during winter increases.

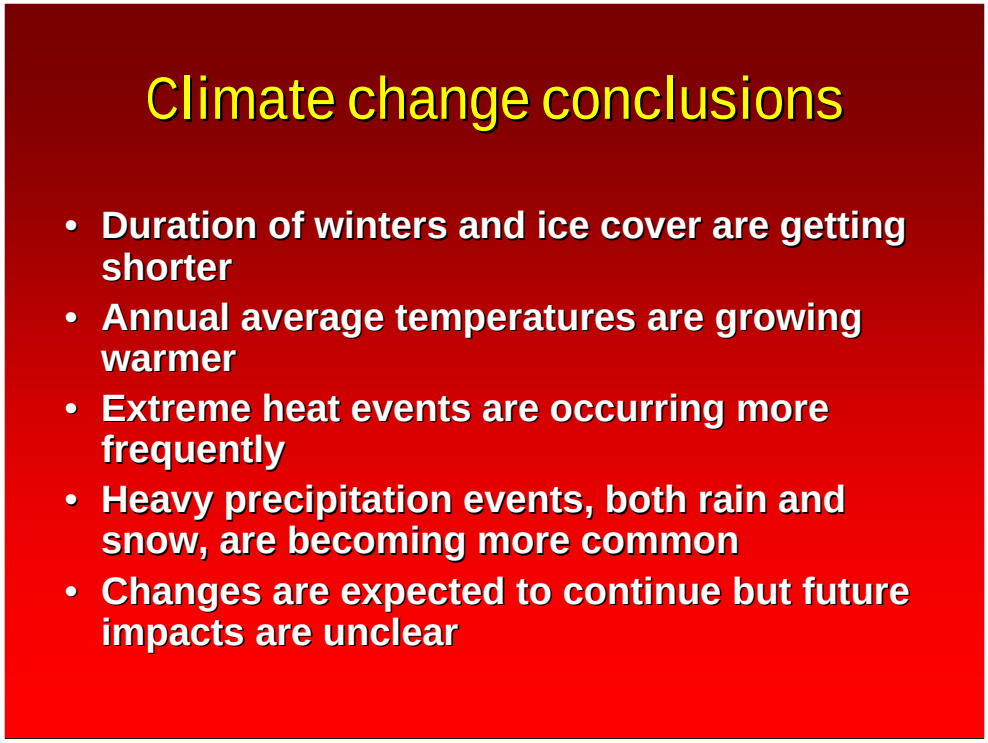
•The costs of shipping and dredging would increase with lower lake levels; and the shipping season may become extended.

•Invasions by species found south of the region and by warmwater, non-native species will likely increase the stress on native species.

•A change in the distribution of forests and an increase in forest pests are expected.

•Lower water levels combined with warmer water temperatures may accelerate the bioaccumulation of mercury and other contaminants in the food chain.

•And an increase in the frequency of winter runoff and intense storms may deliver more non-point source pollutants to the lakes.



Known conclusions with regard to climate change are:

•Duration of Great Lakes winters and ice cover are getting shorter.

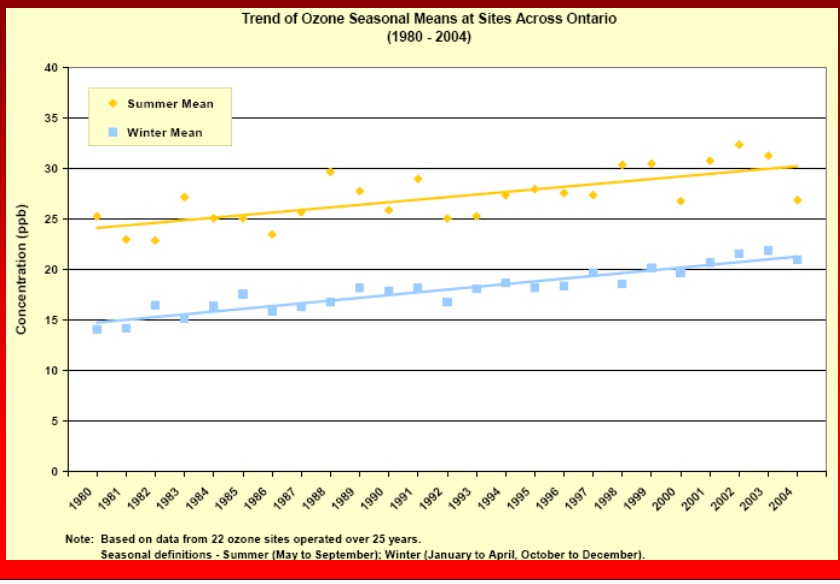
•Annual average temperatures are growing warmer.

•Extreme heat events are occurring more frequently.

•Heavy precipitation events, both rain and snow, are becoming more common.

•And changes are expected to continue, but the extent of future impacts remains unclear.

Trend of ozone seasonal means at sites across Ontario

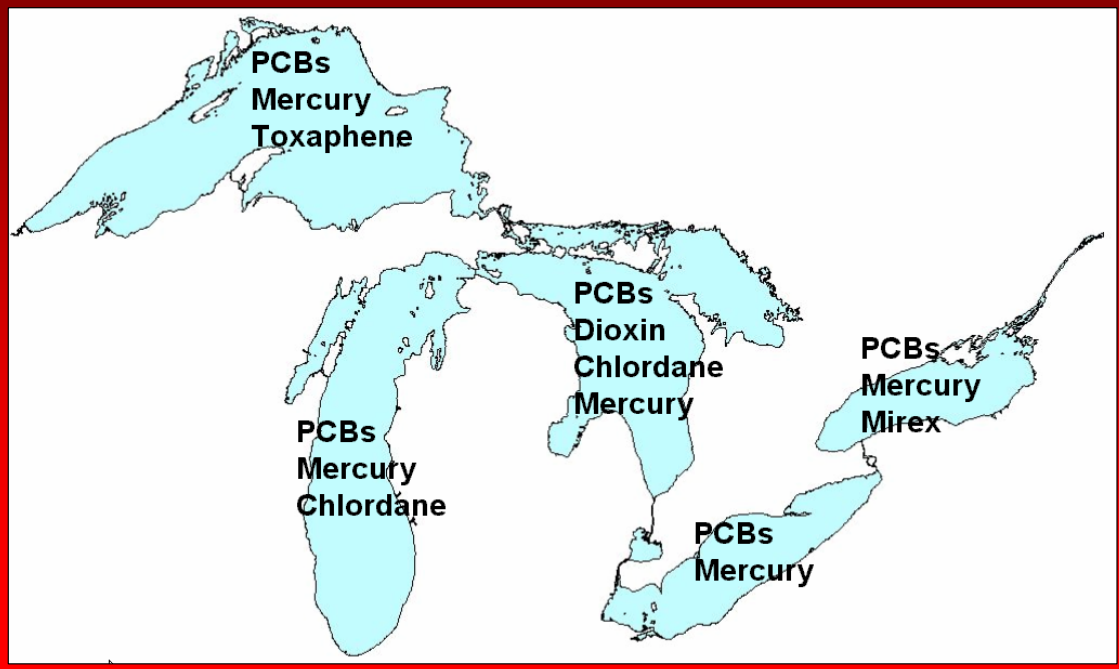


However, **some areas experience continuing air quality problems**, notably the **Detroit-Windsor-Ottawa** corridor, **portions** of the **Lake Michigan** basin, and the **Buffalo-Niagara area**. Regional pollutants such as, **ground-level ozone** and fine particulates, are **steadily increasing** in **areas across Ontario.**

Canada's Clean Air Act was recently introduced which will **strengthen regulation of air pollutants.**

Again, population growth and climate change may negatively impact air quality, and an increase in the number of identified toxins present in the air further complicates this assessment.

Contaminants that drive Great Lakes fish consumption advisories in the U.S. and Canada



Although there has been a **decline in many** persistent bioaccumulative toxic **(PBT) chemicals** in the Great Lakes **since the 1970's**, **fish consumption advisories persist for all of the lakes**. The **contaminants that drive consumption advisories** are **shown for each lake**.

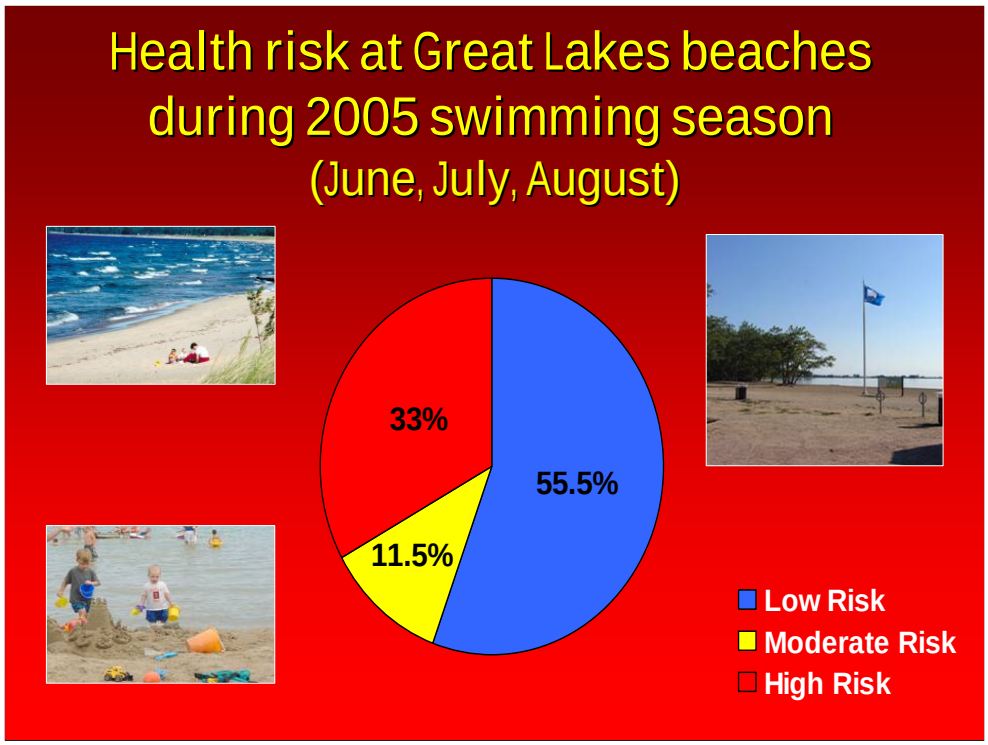
Data collected for **PCBs in coho salmon and lake trout** show **concentrations are generally declining** in all of the lakes. **Mercury levels in walleye are also declining**, although **no significant decline is evident in Lake Ontario**. As organochlorine contaminant levels decline, **mercury is expected to become** a **more important** contaminant of concern. Contaminants such as **mercury, PBDEs and dioxins need to be better understood and monitored more frequently.**

Since **each state, province and tribe** are **responsible** for developing their advisories, the advice is sometimes **different for the same lake and fish species within that lake**. To **eliminate** this **confusion** and **better protect fish consumers**, the United States has developed a **uniform fish advisory protocol for PCBs** for the entire basin and **protocols for chlordane and mercury** are being finalized.

Consumption advisories are important for protecting the public from exposure risks, **especially for sensitive populations**. **Education and outreach** are **also essential** to **help people choose** and prepare their fish wisely, **and to recognize** that while some fish may pose health risks, others provide substantial health benefits.

No routine programs presently exist to monitor biological **markers of human exposure** to persistent bioaccumulative chemicals. **Individual epidemiological studies** have been conducted, and additional studies are **ongoing within specific Great Lakes populations**. In these studies, **blood serum from women of child-bearing age** served as **biomarkers for mercury, PCBs, and DDEs**, and **hair samples** were **also shown** to be a **good biomarker for mercury**.

Generally, **people who ate more frequent fish meals** had the highest levels of contaminants. Because there have been **no large-scale or basin-wide studies**, the **status of this indicator is mixed and no trends can be determined.**



There has been an **increase in beach monitoring and in the number of beaches reporting** in both the United States and Canada. Over the last 8 years, the **percentage of beaches open** during the swimming season **remains relatively constant in the U.S.** (at roughly 70%) and **is slightly declining in Canada** (at 52%). This chart shows that **in 2005, 67% of Great Lakes beaches** in the U.S. and Canada had a **low to moderate risk** of closure while **33% were at high risk** for closure.

Closures are due to a variety of reasons, including *E. coli* bacteria counts, poor water clarity, algae abundance, or preemptive beach closures based on storm events and predictive models.

Measures to track and remediate bacterial sources are being taken to improve conditions at many problematic Great Lakes beaches. However, **as populations and coastal communities grow**, **additional point and non-point** source pollution **may result in additional beach postings**, particularly **during wet weather** conditions.

Human health conclusions

- **Quality of treated drinking water remains good**
- **Urban and local air pollutants are decreasing, however, population growth may impact future air pollution levels**
- **A decline in some contaminants has not eliminated the need for fish consumption advisories**
- **One-third of Great Lakes beaches are at high risk for closures**

•Quality of treated drinking water remains good.

•Urban and local air pollutants are decreasing, however, population growth may impact future pollution levels.

•A decline in some contaminants has not eliminated the need for fish consumption advisories.

•There has been an increase in beach monitoring; however, a third of monitored beaches still have a high risk for closures.

During this presentation, the Great Lakes basin population has increased by an estimated **18 people**. By the **end of our conference**, this number will increase by **nearly 2200** people.

As resource managers, we're often challenged to do more with less. Perhaps **our greatest challenge is how do we do less damage to the Great Lakes with ever more people?**

Thank you.

Citation: USGS National Hydrography Dataset (1999); USGS 1992 National Cover Dataset (1999); USGS 8-digit Watersheds (Hydrologic Unit Code; 1994); Riparian Areas created by the USDA Forest Service North Central Research Station (2005).

Ontario Ministry of Natural Resources – NRVIS Watershed Coverage (1994); Landcover (2002); Riparian Areas created by Forest Evaluation Section

Map data from USDA Forest Service, Information Management and Analysis Group, Durham, NH and U.S. EPA, Great Lakes National Program Office.

Map created by U.S. EPA, Great Lake National Program Office, Technical Assistance and Analysis Branch