



Climate Change: Are you preparing for it?



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Introduction

Elected officials, planners, and policymakers face many issues concerning the environment, the economy, and the safety and well-being of the people they serve. Meanwhile, citizens are better informed and demand more accountability from their elected officials on climate change predictions, pollution problems, and the preservation of natural areas. Clearly, the American mindset is changing. Economic growth based on twentieth-century tactics may no longer meet our needs. Communities are looking for new ways to build and grow, while reducing their effect on the environment.

Scientists still debate the full impact of climate change; a few may even debate whether it is occurring. Many climate change publications describe what happened in the past, what is happening now, and what likely will happen in the future. The latest and most complete of these is the 4th Assessment Report, *Climate Change 2007*, by the Intergovernmental Panel on Climate Change (IPCC) (http://www.ipcc.ch/publications_and_data/publications_and_data.htm).

The uncertainty about climate change predictions at the local level is the biggest roadblock to gaining support for addressing the problem. Such uncertainty makes it hard to communicate the issues in ways that are relevant to citizens and communities. The authors of this publication believe that climate change is occurring and give an overview of how it will affect the Midwestern United States, particularly Northwest Indiana. This publication should help regional policymakers



understand potential environmental changes due to a changing climate.

The Importance of Building Support

If you are developing new procedures and policies for economic growth, include as many interest groups and perspectives as possible. The best-laid plans often crumble when planners and builders fail to see eye-to-eye. Local businesses, industry, and residences all have their own ideas on how to resolve environmental issues. So, listen before taking action. Address concerns early. Otherwise, you may heavily invest in plans that turn out to be very unpopular among different interest groups. Operations run more smoothly and have a greater impact when everyone is “on the same page.” In other words, the more people you have on your side, the better.

No matter how *likely* future climate change may be, there is still uncertainty. Many people find it difficult to

fully accept even well-grounded predictions. Also, often policymakers are under pressure to invest resources to solve current, pressing issues at the expense long-term projects. Therefore, it's tough to gain public support for investing resources in strategies designed to help prepare for climate change.

Instead of pitting climate change against more immediate issues, you can keep climate change in mind when investing in new, more immediate projects. Climate change preparation doesn't have to be the primary purpose for a policy or project, but may be part of it. Many projects underway in communities across the United States were designed to relieve traffic congestion, improve air and water quality, and develop emergency response procedures. These are desirable for those listed reasons, but also help reduce the impact of future climate change.

Climate Change in the Midwest

Most climate change models have slight variations, but most agree on global increases in temperature of both land and aquatic ecosystems; more frequent heat waves and heavy rainfall or snowfall events; and rising sea level due to melting glaciers, sea ice, and snow cover.¹ The following is a general overview of some of the climate predictions made for the Midwestern United States.^{2, 3, 4, 5}

- *Warmer summers and milder winters*—Warmer summers and milder winters are expected in the Midwest. Milder winters mean more invasive species, pathogens, insects, and weeds that wreak havoc on natural and agricultural systems. Increased numbers of pests, such as mosquitoes and ticks that can carry and spread disease, cause health concerns.
- *More heat waves*—The models predict more extremely hot days (above 100°F) and ozone-action days. Extreme temperatures and poor air quality threaten human health and increase energy demand for homes, businesses, and industry. High demand for power during extreme heat days means more blackouts and brownouts.
- *Increased evapotranspiration (movement of water into the air)*—Less summer rain coupled with hot summers and mild winters causes evapotranspiration to exceed rainfall. As a result, lake levels could drop, and we could have less available groundwater.
- *More extreme rainfall events*—While the models predict less summer rain, they also predict more extreme rainfall events in the Midwest in the spring and fall. Such extreme events cause flooding, erosion, and an influx of pollutants into Lake Michigan.

Lake Michigan, Our Most Valuable Asset

Expect Lake Michigan water levels to drop as much as two feet over the next 90 years.^{2,3} As a result of lower water levels, the lakeshore will recede drastically in some places. This will affect real estate values, recreation, tourism, industry, and shipping.^{2,3}

Northwest Indiana depends on Lake Michigan for drinking water, recreation, transportation, and industry. Lower lake levels will be a problem during hot summers when water demand increases for irrigation and for recharging aquifers.^{2,4} Groundwater systems used for drinking and irrigation are already low and likely to go lower.⁴

Lower lake levels, hot summers, and mild winters will raise the overall lake water temperature.^{2,3,4} Increased water temperatures will promote the invasion of exotic species and will increase bacteria and algae that will, in turn, reduce levels of oxygen dissolved in the water (hypoxia).^{2,3,4,5} Warmer water will cause a decline of coldwater fish species and will increase the level of mercury in fish, making fish inedible.²



The combination of lower lake levels and more extreme precipitation events could cause higher concentrations of nutrients and pollutants in Lake Michigan. Last year, Porter, Lake, and Laporte County wastewater treatment facilities reported to the Indiana Department of Environmental Management that over 1.7 billion gallons of sanitary sewer overflow was released untreated into Lake Michigan. (This excludes combined sewer overflows.)⁶ Such overflows introduce large amounts of nutrients and pollution into the lake. As lake water levels drop, the concentrations of these pollutants increase. Increased

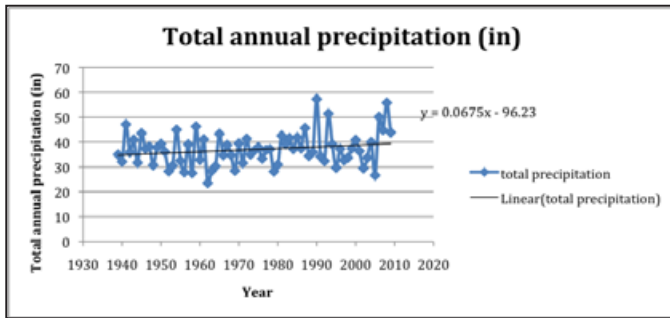


Figure 1. Total annual precipitation (in) from 1939 to 2009. Linear trend line shows that total precipitation is increasing approximately 0.07 in per year.

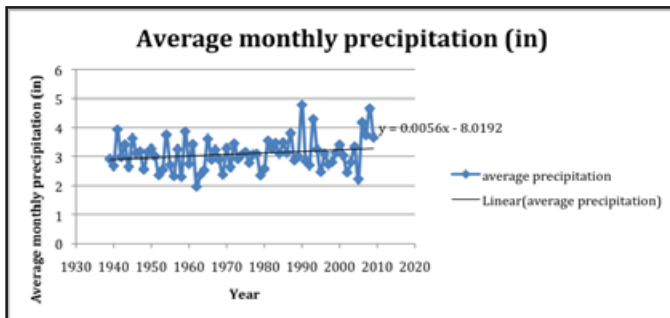


Figure 2. Average monthly precipitation each year from 1939 to 2009. Linear trend shows that the average monthly precipitation is increasing approximately 0.005 in per year.

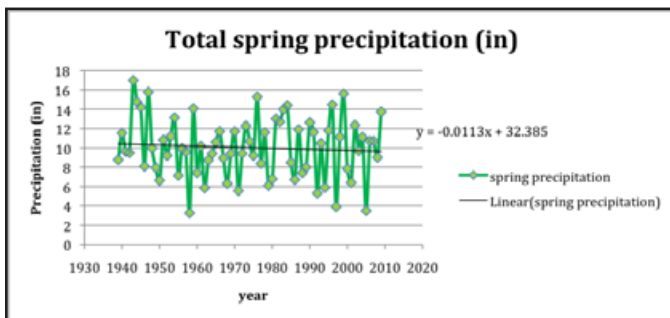


Figure 3. Total precipitation occurring during the months of March, April, and May each year from 1939 to 2009. The linear trend line shows that spring precipitation is decreasing at a rate of approximately 0.01 in per year.

nutrient and pollutant concentrations coupled with warmer summers likely will promote growth of harmful algal blooms, increase hypoxia, increase waterborne pathogens, increase undesirable plants and animals, and reduce water quality.

Local Trends

We studied local climate data to determine climate trends for the Northwest Indiana region. All of the graphs were created using data retrieved through the Hobart monitoring station in Lake County (1939–1999) and the Indiana Dunes National Lakeshore monitoring station in Porter County (1999–2009)⁷

Precipitation

Local data show that the total annual precipitation and average monthly precipitation have been increasing over time (Fig. 1 and 2). Total precipitation in spring (March, April, and May) is decreasing (Fig. 3), while total precipitation in the fall (September, October, and November) is increasing (Fig. 4). Therefore, trends from 1939 to 2009 seem to show that more precipitation is currently occurring in the fall and less in the spring. Before 1980, on average, more precipitation occurred in the spring (Fig. 5). If such trends continue, spring drought and moist

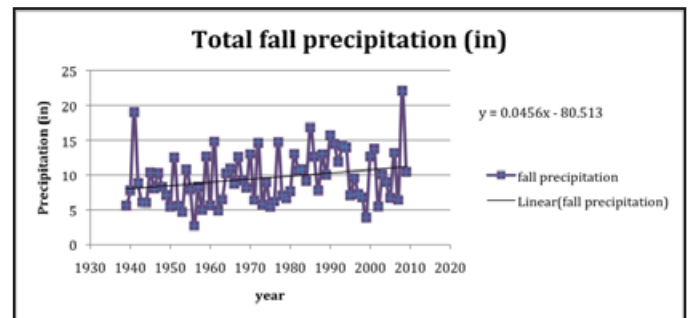


Figure 4. Total precipitation occurring during the months of September, October, and November each year from 1939 to 2009. The linear trend line shows that fall precipitation is increasing at a rate of approximately 0.045 in per year.

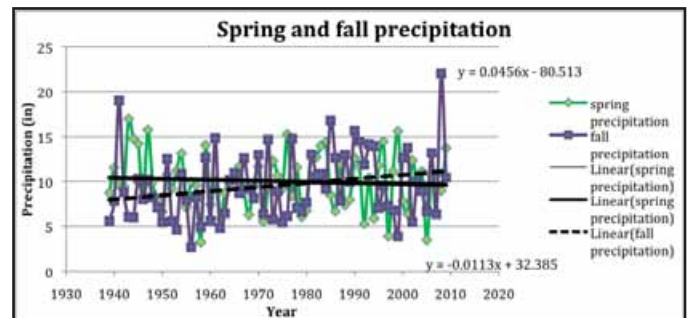


Figure 5. By combining the data in figures 3 and 4, it seems that it is likely less precipitation will occur in the spring and more in the fall.

harvest seasons may cause concern for agricultural crops. Communities may face increased demand for water in the spring and summer, and an increased risk for flooding in the fall.

Temperature

The data appear to show that the temperature in Northwest Indiana is getting milder. The average annual temperature is decreasing (Fig. 6). The number of days in a year that are uncomfortably hot (above 80°F), as well as the number of extremely cold days (below 0°F), seems to be decreasing (Fig. 7, 8). The number of days in a year with temperatures below 32°F (when frost occurs), seems to be decreasing (Fig. 9). The number of days between the last day of spring with temperatures below 32°F and the first day of fall with temperatures below 32°F (i.e., the growing season) seems to be increasing (Fig. 10). If these trends continue, there may be a shift in the climate zone and a longer growing season. Over the long term, such conditions may affect the types of crops grown in the area. Milder winters could help pests and weeds survive, promote the invasion of exotic species, and reduce the amount of ice covering lakes, ponds, and rivers. Reduced ice coverage would speed evaporation and lower lake levels.

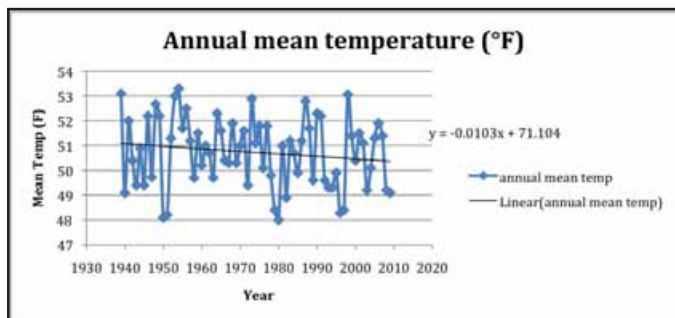


Figure 6. Mean annual temperature (°F) from 1939 to 2009. The linear trend line shows that temperatures are decreasing at approximately 0.01°F per year.

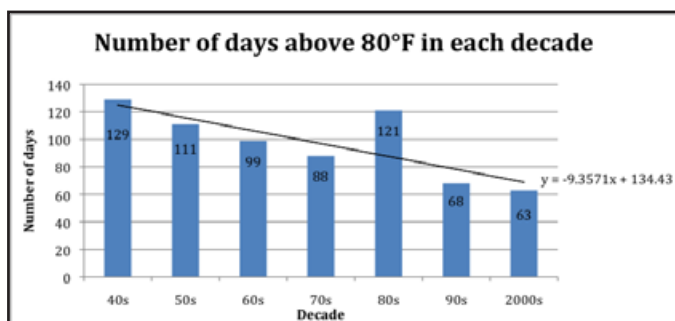


Figure 7. The number of days in each decade where temperatures exceeded 80°F. The linear trend line shows that the number of days is decreasing at approximately 9 days every 10 years.

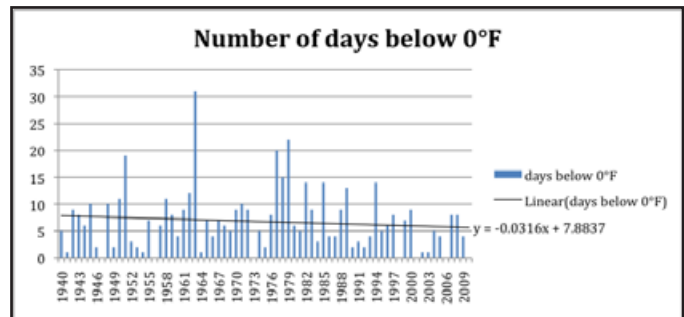


Figure 8. Number of days below 0°F each year from 1940 to 2009. The linear trend line shows that the number of extremely cold days seems to be decreasing at a rate of approximately 1 day every 34 years.

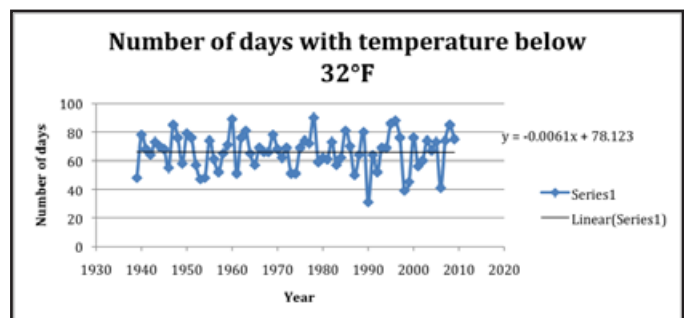


Figure 9. Number of days in the year with temperatures below 32°F (frost days) from 1939 to 2009. The linear trend line shows that the number of frost days is decreasing at a rate of approximately 0.006 days per year (approximately 1 day every 165 years).

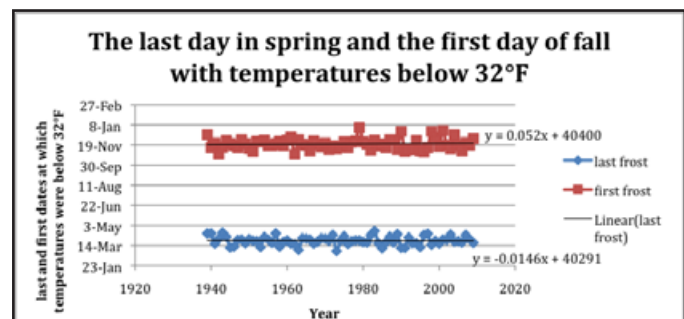


Figure 10. The last day in spring and the first day in fall with temperatures below 32°F (frost days) in each year from 1939 to 2009. The linear trend lines show that the last frost day in spring is occurring earlier, while the first frost day in the fall is occurring later. The distance between the two trend lines represent the growing season. Assuming the trends are accurate, the growing season is increasing by approximately 1 day every 15 years.

Climate Change Predictions for Indiana

The Union of Concerned Scientists' 2009 climate change report for the Indiana region (http://www.ucsusa.org/assets/documents/global_warming/climate-change-indiana.pdf) projects hotter summers, heavier rains,—especially in the winter and spring months—and warmer winters. The growing season will be lengthened because of these changes. However, more rain in the spring could delay planting the crops. A longer growing season will enable pests to expand their ranges and will increase the risks of floods.

The data for this report project some of the same findings. However, some Indiana data contradict the national report for the Midwest—such as a decrease in the number of days above 80°F and drier spring seasons. Overall, there are similarities in the data, such as milder winters and longer growing seasons for crops. The differences observed between the national forecasts for climate change in the Midwest and this study may stem from the fact that these data come from one particular, isolated area, northwestern Indiana, and are not a compilation of many data sets from many locations in the Midwest.

Preparing for Climate Change

Your community can use a number of strategies to prepare for future climate stress and reduce its effects. Through careful planning and policy, you can reduce greenhouse gas emissions, improve water and air quality, conserve water supplies, and increase your community's overall resiliency. You need to think outside the box and develop new strategies to resolve old problems. You need to identify your community's needs, as well as available resources. Below are three approaches that are gaining popularity among communities.

Local Food Production

Communities should promote local food and agriculture production through local Community Supported Agricultural Programs (CSA). Communities could provide incentives to promote farmers' markets where residents and restaurants can buy locally produced food. Also, local officials may promote community gardens in urban areas—especially where people live far from grocery stores.

Smart Growth

Many communities have adopted smart development ideas and worked them into their urban plans. Smart development or smart growth is a form of urban planning that tries to reduce urban sprawl by putting businesses, schools, and resources closer to people's homes. Smart growth theories advocate bike paths, public transportation, and green space, which reduce the need for cars. The goals of smart growth are to reduce energy consumption, pollution, and environmental impact, thus developing more sustainable communities and improving the quality of life.

Green Infrastructure

The U. S. Environmental Protection Agency (EPA) advocates using green infrastructure to cost-effectively manage water resources while you protect unique, natural areas. Green infrastructure depends on environmentally friendly techniques and benefits we gain from the natural environment. For example, when communities preserve forests, they help improve air quality and reduce evaporation. Preserved wetlands improve water quality and reduce flood risks. Naturally meandering streams and flood plains can reduce water flow and flood risks. Permeable landscapes and natural flood plains can help recharge underground aquifers that supply water in times of drought.

Before designating areas as part of a green infrastructure, your community must first do research to determine what areas will most benefit the community. Then, you enact policy to protect the areas and adapt existing infrastructure to efficiently use the services the area provides.

Investigation

If you are developing an adaptive strategy plan for your community, please, know you are not alone. Many communities have started using smart growth ideas and are developing green infrastructure. You can develop a plan that works well for you by studying the successes and failures of others, learning from their experiences, and building on those.

Below are some resources that may help you develop a plan that meets the needs of your community.

Additional Resources

Coastal Climate Adaptation

<http://collaborate.csc.noaa.gov/climateadaptation/default.aspx>

This is a climate adaptation website hosted by the NOAA Coastal Services Center. This extremely useful website provides climate adaptation case studies and guidance books tailored towards local governments and practitioners.

Chicago Climate Action Plan

www.chicagoclimateaction.org

This website provides useful information regarding how climate change is expected to affect the Chicago area, and how Chicago is planning to cope with climate change. The website itself is a good example of communicating climate change predictions and action plans to a greater audience.

Chicago Wilderness

www.chicagowilderness.org

The Chicago Wilderness's Climate Action Plan for Nature discusses climate change in the greater Chicago region with a particular emphasis on the importance of protecting biodiversity. The Chicago Wilderness website also provides useful information on the state of the environment in the Chicago region, as well as on green infrastructure.

Environmental Protection Agency

http://cfpub.epa.gov/npdes/home.cfm?program_id=298

This site provides a lot of information regarding green infrastructure. This includes case studies, technical information, and possible sources of funding. If you are interested in pursuing green infrastructure techniques, this is the place to start.

Intergovernmental Panel on Climate Change

www.ipcc.ch

The Intergovernmental Panel on Climate Change is the leading body for the assessment of climate change, established by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO). It provides the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences.

Post Carbon Institute

www.postcarbon.org

Post Carbon Institute provides individuals, communities, businesses, and governments with the resources to understand and respond to the interrelated economic, energy, and environmental crises that define the 21st century.

POWER

www.planningwithpower.org/

Planning with Power is an educational site hosted by the Illinois-Indiana Sea Grant Program and the Purdue Cooperative Extension service linking land use planning to watershed planning at the local level.

Photo credits

Mlive.com (the images of low Lake Michigan levels)
www.blog.mlive.com

U.S. Fish and Wildlife Service
www.fws.gov

References

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6. Indiana Department of Environmental Management. 2009 Sewer bypass/overflow report. Data accessed 2010 from <http://www.in.gov/idem/5105.htm>
7. Midwest Regional Climate Center. Online data accessed 2010 from http://mcc.sws.uiuc.edu/prod_serv/prodserv.htm

For More Information

ID-255 *Protecting Our Water and Environmental Resources*

ID-256 *Nonpoint Source Pollution: A Threat to Our Waters*

ID-257 *Impacts of Development on Waterways*

ID-258 *Strategies for Coping with Runoff*

ID-259 *How to Get Started: Protecting Your Community from Polluted Runoff*

ID-260 *The Relationship Between Land Use Decisions and the Impacts on Our Water and Natural Resources*

FNR-245 *Brownfields: A Rural Community Problem*

FNR-255 *Stormwater Runoff*

FNR-256 *Stormwater and Non-point Source Pollution*

FNR-257 *Open Space Planning*

FNR-409-W *Smart Growth and Protection of Natural Resources*

FNR-415-W *Sustainable Land Use: Impact on Climate Change and Health*

Planning with POWER Presentation module Model Ordinances are available.

These publications are available on the *Planning with POWER* Web site: www.planningwithpower.org

Local Decision Maker, a new Web-based GIS planning tool and decision support system is now available at: www.purdue.edu/ldm

If you are interested in pursuing the Smart Growth principles, the protection of natural resources and natural resources based planning, contact Robert McCormick at 765-494-3627 or rmccormi@purdue.edu.

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