Northeast Midwest Economic Review

NORTHEAST-MIDWEST INSTITUTE
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POLICY

FEATURES

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The Northeast-Midwest Institute is a Washington-based, non-profit, and non-partisan research organization dedicated to economic vitality, environmental quality, and regional equity for Northeast and Midwest states. Formed in the mid-1970's, it fulfills its mission by conducting research and analysis, developing and advancing innovative policies, providing evaluation of key federal programs, disseminating information, and highlighting sound economic and environmental technologies and practices.

The Institute works closely with the Northeast-Midwest Congressional and Senate Coalitions. Formed in 1976, the House Coalition, co-chaired by Reps. Bob Franks (R-NJ) and Marty Meehan (D-MA), is a bipartisan group of 117 lawmakers who recognize the common problems facing their states. The Northeast-Midwest Senate Coalition was formed in 1978 and now is chaired by Sens. Daniel Patrick Moynihan (D-NY) and James Jeffords (R-VT). Together, the Coalitions seek to influence those issues of greatest importance to the Northeast and Midwest.

NEWS

Oil Crisis

Members of the Northeast-Midwest Congressional and Senate Coalitions have responded to skyrocketing oil prices with a variety of initiatives. First, they convinced President Clinton to release $300 million in emergency Low Income Home Energy Assistance Program (LIHEAP) money. Second, they've met with the president and energy secretary to spur the release of Strategic Petroleum Reserve oil. Third, they've introduced bills that would create a regional heating oil reserve, establish a system of oil swaps into and out of the SPR, and encourage summer fill programs for heating oil and propane.

Coalition leaders also are spearheading efforts to obtain adequate appropriations for LIHEAP, Weatherization Assistance Program, and State Energy Program, as well as energy efficiency efforts within the Department of Energy.

Trade Adjustment Assistance

The Northeast-Midwest Congressional and Senate Coalitions also are circulating letters seeking appropriations for the Trade Adjustment Assistance for Firms (TAA) program at the U.S. Department of Commerce. TAA has a successful history of assisting small and mid-sized manufacturing firms and agricultural businesses experiencing sales and job losses due to imports. The program provides technical assistance to firms needing to improve their operations, product development, management information systems, marketing, and production. Costs associated with this program are typically shared equally by the firm and the federal government.

Upper Mississippi River Basin Conservation Act

Rep. Ron Kind (D-WI) and other members of the Upper Mississippi River Task Force this week will introduce the Upper Mississippi River Basin Conservation Act. The bill's purpose is to develop a coordinated public-private approach to reducing nutrient and sediment losses in the Upper Mississippi River basin. Relying on existing federal, state, and local programs, the bill establishes a water quality monitoring network and an integrated computer modeling program.

Brownfield Appropriations

The Northeast-Midwest Senate and Congressional Coalitions are leading letters seeking adequate appropriations for brownfield reuse programs at the Environmental Protection Agency (EPA) and the Department of Housing and Urban Development (HUD). Of the EPA's total brownfield request of $91 million, approximately a third is for revolving loan funds, while $57 million is for grants for technical assistance, assessment activities, and the development of state Superfund and Voluntary Cleanup Programs. With this funding level, the EPA anticipates adding 50 new pilot communities to the existing group of 307, which already receive brownfields grants. The Coalitions are supporting a $50 million appropriation for HUD's Brownfields Economic Development Initiative.

Agriculture Appropriations

The Northeast-Midwest Coalitions are sending letters to the appropriations committees requesting that the U.S. Department of Agriculture (USDA) be given the authority to operate the Conservation Reserve Program, Wetlands Reserve Program, and Environmental Quality Incentives Program at currently authorized levels. In addition, they are asking for support of the Farmland Protection Program as well as two critical programs through the Natural Resources Conservation Service (NRCS): Conservation Technical Assistance; and the Resource, Conservation, and Development Councils. ■

The Great Lakes at the Millennium

by Rochelle Sturtevant and Allegra Cangelosi

The Great Lakes constitute a unique natural system and an international treasure of critical importance to the economies of two nations. The United States and Canada are fortunate to share this resource and must act cooperatively in order to ensure its future.

Statistics help put the magnitude of this vital ecosystem into perspective. The Great Lakes constitute the United States' longest shoreline, in excess of 10,000 miles. Their 5,500 cubic miles of fresh waters span 94,250 square miles. The drainage basin of the Great Lakes encompasses an area nearly twice as large as the lakes themselves, an area nearly equal to the state of Texas. This ecosystem is now home to 40 million U.S. and Canadian residents. Over 90 percent of the 29 million U.S. residents of the basin rely on the Great Lakes for drinking water.

The Great Lakes Basin is home to 20 percent of U.S. manufacturing. Much of this industry draws on Great Lakes water as a raw material and relies on waterborne transportation for trade. The Great Lakes are also home to a large commercial and recreational fishery that brings billions of dollars to the region's economy.

Challenges to the Economic and Environmental Health of the Great Lakes

While great strides have been made since the 1960's in protecting and restoring the Great Lakes ecosystem, the challenges facing the region remain formidable. A recent survey of Great Lakes stakeholders, including federal program managers, state agency officials, and non-governmental organizations operating in the Great Lakes, identified a long list of challenges to enhancing the economic and environmental health of the Great Lakes. Continuing and expanding concerns include: persistent toxic chemicals; endocrine disruptors; water quality problems; fish toxicity; atmospheric sources of toxins; contaminated sediments; non-point source pollution; non-indigenous invasive species; biodiversity; habitat; fishery restoration; loss of shoreline (especially fragile wetland areas) due to erosion and development; fluctuations in Great Lakes water levels; water diversions and consumptive uses; bulk export of water; recreational boating needs; and commercial navigation expansion. These environmental and economic challenges interact synergistically and unpredictably to wreak devastating impacts on the health and stability of the Great Lakes system.

Although priorities have shifted slightly over the past three decades, most of the region's top environmental concerns still represent variations on toxic pollution, physical degradation, and biological pollution (exotic species, pathogens). Water quantity concerns which have arisen over recent years reached new heights in the last two years as the region experienced first record-high lake levels followed by near-record lows, and following approval (and subsequent withdrawal) by the government of Ontario of a permit for a venture capital corporation to withdraw water from Lake Superior for export to foreign markets. Concerns of the Great Lakes maritime community focus on invasive species, maintaining regional competitiveness of the maritime industry, and expansion of commercial navigation infrastructure.

Great Lakes Water Quality Laws — A Model of Interjurisdictional Cooperation

Since the Boundary Waters Treaty of 1909, the United States and Canada have formally cooperated to address water quality problems in the Great Lakes basin. The Boundary Waters Treaty provided for the creation of the International Joint Commission (IJC), which held its first meeting in 1911. The IJC has the authority to resolve disputes over the use of water resources that cross the international boundary, and it advises the two governments about issues of concern.

The U.S. and Canada signed the Great Lakes Water Quality Agreement in 1972. The GLWQA established common water quality objectives for phosphorus, oil, visible solid wastes, and other pollutants. Amendments to the Agreement in 1978 expanded the phosphorus control program and initiated joint controls for persistent toxic chemicals. The 1978 GLWQA also launched ecosystem management of the Great Lakes. In 1987, the GLWQA was again amended, this time to strengthen certain ecosystem management provisions, including Remedial Action Plans (RAPs) for geographic Areas of Concern (AOCs) and Lakewide Management Plans (LAMPs) for critical pollutants. The 1987 GLWQA also recognized several "new" pollution sources, including nonpoint runoff, air deposition, contaminated sediments, and contaminated groundwater. Over the years, the GLWQA has been a highly successful framework for

achieving the protection and restoration of the Great Lakes ecosystem.

Within each federal government, many environmental laws affect management of the Great Lakes. Congress passed the first Clean Water Act (CWA) in 1972, giving the lead for meeting U.S. obligations under the GLWQA to the U.S. Environmental Protection Agency (Great Lakes National Program Office), with support from numerous other agencies in both the regulatory and research arenas.

Although federal law provides regulatory authority and a framework for environmental protection in the Great Lakes, each of the eight Great Lakes states has its own laws and priorities that influence the resource's management. Not surprisingly, cooperation among the states has proven critical to every environmental success. In 1955, the eight Great Lakes states joined together in a congressionally-authorized interstate compact establishing the Great Lakes Commission to provide policy research and advisory service on environmental and economic development issues facing the Great Lakes region. The Council of Great Lakes Governors was formed in 1983 as a forum for cooperative policy development among the region's state leaders.

Eutrophication and Nutrient Pollution

In the 1960's, eutrophication caused by nutrient pollution (primarily phosphorus) led to severe degradation of the lower Great Lakes and many embayments of the upper Great Lakes. Enormous algal blooms were a frequent occurrence. Decomposition of algae resulted in anoxia (lack of oxygen), bad odors, and taste problems in the drinking water. Forage fish died in large numbers, and developed and industrial areas were nearly devoid of aquatic life.

The goal of improving the region's environmental quality, primarily with an eye to confronting the related problems of nutrient pollution and eutrophication, spurred the formation of the first intergovernmental partnerships.

Although we have made great strides in limiting the amount of new toxic pollutants entering the Great Lakes ecosystem, we still deal with contaminants that were deposited into the sediments decades ago.

Together, these government partnerships invested more than $10 billion in better sewage treatment, instituted phosphate bans, and initiated pollution runoff controls.

The good news is that reductions in annual phosphorus loadings have been achieved in all five Great Lakes, with current loads well below the target levels set by the 1978 Canada-U.S. Great Lakes Water Quality Agreement. Phosphorus controls appear to have been successful in controlling nearshore and offshore nuisance algal blooms, and the extent of anoxia has decreased. Although we have made great strides since Lake Erie was declared dead, problems remain in some areas, highlighting the need to follow through on our control strategies. The central basin of Lake Erie continues to have seasonal problems with anoxia, as do several bays near population centers. It is clear that our strategies to control eutrophication do work, but it is equally clear that any relaxation of this control will result in a recurrence of the problem.

Toxic Chemical Pollution — Preventing Pollution at its Source

In the mid-1900's, persistent toxic substances were recognized as a problem throughout the Great Lakes region. Declines in the populations of bald eagles and cormorants were noted in the 1950's. Deformities of tern chicks and other waterfowl were frequently cited during the late 1960's and early 1970's. In 1965, ranch-raised Great Lakes fish experienced reproductive failures. In 1969, the Cuyahoga River, a major tributary of Lake Erie running through industrialized Cleveland, actually caught fire due to the accumulation of flammable contaminants floating on the water surface. Studies conducted by the Agency for Toxic Substances Disease Registry indicate that consumption of Great Lakes fish still poses health risks for certain groups, including pregnant women and infants of nursing mothers.

Scientists have detected more than 360 contaminants in the Great Lakes ecosystem, many of which are known to have an adverse impact on plant and animal life, including humans. Eleven of these contaminants have been identified by the International Joint Commission as posing the greatest concern because they are persistent, bio-accumulative, and known to have detrimental effects. A class of chemicals known to mimic estrogen, disrupting the endocrine system and reproduction in wildlife (and potentially humans), is an increasing cause of concern in the region.

Chemical contaminants enter the Great Lakes from a variety of sources, including point source discharges, nonpoint source runoff, and atmospheric deposition. Contaminants deposited years or even decades ago also can be released into the water column from sediments.

Large industries have made significant reductions in their discharges of

toxic substances, particularly over the past 25 years, but they still release considerable amounts of hazardous pollutants. Point-source discharges also include municipal sewage systems and leaking dump sites. The IJC estimated in 1989 that more than 2,900 tonnes of selected toxins were discharged annually through the 1,200 sewage treatment plants surrounding the lakes. Millions of additional tonnes of hazardous wastes have been dumped in areas immediately surrounding the Great Lakes, and many of these sites have been documented to be leaking toxic waste.

In the last third of the last century, beginning with the signing of the Great Lakes Water Quality Agreement in 1972, the United States and Canada have undertaken the effort to reverse contamination problems in the Great Lakes. As early as 1977, improvements were noted in the populations of bald eagles and cormorants. The road toward cleanup of toxics in the Great Lakes, however, is a long one, and the journey still underway.

In April 1997, the U.S. Environmental Protection Agency Administrator and the Canadian Minister of the Environment agreed to a milestone plan for the virtual elimination of toxic substances from the Great Lakes by the year 2006, a first step in fulfilling promises made by President Clinton and Prime Minister Chretien in 1995. This agreement represents the first time that the United States and Canada jointly set specific reduction targets for toxic pollutants. Among the U.S. targets, the strategy calls for 50 percent cutback in the use of mercury nationally; 90 percent reduction in PCBs used in electrical equipment nationally; 75 percent cut in releases of dioxins and furans (air releases nationally, as well as water releases in the Great Lakes); and zero release of chlordane, aldrin/dieldrin, DDT, mirex, and toxaphene. The United States and Canada also committed to increasing efforts to address air quality issues, most notably in ground level ozone and particulate matter.

The Legacy of Sediment Contamination

Many contaminants (such as metals and complex organics) slowly settle out of the water column and are buried in the sediments. Unfortunately, contaminants often are resuspended by the actions of wind, water currents, ship traffic, dredging, and wildlife. Resuspended sediments reenter the water column, the airshed, and frequently the food chain as well. A 1992 study by EPA found that greater than 90 percent of the PCB contamination in Green Bay sport fish came from contaminated sediments. Today, although we have made great strides in limiting the amount of new toxic pollutants entering the Great Lakes ecosystem, we still deal with contaminants that were deposited into the sediments decades ago.

The International Joint Commission designated 43 Areas of Concern (31 wholly or partly in the United States) as places where human use of the aquatic resource is severely impaired. In 42 of these cases (including all of the U.S. sites) the impairment is due primarily to contaminated sediments. Remedial Action Planning Committees have been established for each site, but progress beyond the planning stage has been slow. Major financial commitments will be required to fulfill these plans and to implement site clean-ups. Continued efforts to remove and dispose of contaminated sediments are critical to assure safe operation of Great Lakes harbors. Even more important in the long term are efforts to develop and test new technologies for the remediation (decontamination) of these sediments.

New System Inputs: Addressing Nonpoint Source Pollution and Air Deposition

As the region has made gains in controlling point sources, nonpoint sources have grown in their relative contribution to the region's toxic pollution problem. Increasingly, regional priorities are shifting to the development of technologies and policies for the control of pollution entering the Great Lakes from nonpoint sources. Runoff from agricultural lands contributes significant loads of toxic pesticides to the lakes. Agricultural runoff also includes fertilizers, animal wastes, and sediments that contribute to eutrophication and blockage of navigation channels. Nonpoint source discharges into the lakes also increasingly include urban runoff, such as lawn and garden chemicals, as well as oil, gas, and other household hazardous wastes.

Agricultural runoff carries toxic loads as well as large volumes of "clean" sediment into the Great Lakes and its tributaries. This material chokes navigation channels, making it necessary to physically dredge the sediments in order to maintain navigation. High sediment loads also destroy habitat and impede the life processes of bottom-dwelling organisms. While increasing use by farmers of erosion control measures has helped to check this problem, far more work is needed to keep the soil on the land and out of the waterways.

From a basin-wide perspective, atmospheric deposition remains the single most important pathway by which certain critical contaminants enter the Great Lakes. Measurement of atmospheric deposition rates is complicated by the cycles of deposition-volatilization-redeposition. A significant portion of the contamination in atmospheric deposition may originate from volatilization of contaminants

from sediments. While the significance of air pollution sources within the Great Lakes should not be underestimated, contaminants reaching the Great Lakes via the atmosphere also may have traveled long distances. National (and international) air pollution standards are needed to control the amount of toxics entering the Great Lakes.

Physical Degradation — Erosion and Development

Shoreline erosion along the Great Lakes is a matter of increasing concern. In some regions, the shoreline is moving landward at rates in excess of 30 feet per year. Most shoreline erosion problems are the result of inappropriate development and the loss of protective wetland vegetation. Remaining today is only a fraction of the wetlands that originally ringed the Great Lakes and protected the shoreline from the action of waves and ice. Preservation of these remnant wetlands is a high priority, both for the protection of the shoreline and for the preservation of unique wildlife habitats. Restoration of Great Lakes wetlands will occur only slowly at best, but it remains a key necessity for both the preservation of the Great Lakes shoreline and the restoration of fish and wildlife resources.

In the Great Lakes, the traditional solution to shoreline erosion has been to "armor" the shore through the use of concrete breakwalls or steel sheet piling. Shoreline armoring is extremely costly — far too costly to protect individual homes and businesses. Shoreline armoring also tends to set up the system for catastrophic failure; the structure prevents erosion until the structure and the land it protects is undermined by wave action, at which time the structure and a significant amount of the land behind it may suddenly "fall into the lake." Further, shoreline armoring destroys natural coastal habitat and limits recreational access to nearshore environments. In recent years there has been growing interest in the use of "soft" engineering alternatives. Soft engineering is achieved by using rocks, vegetation, and other materials that soften the land-water interface, thereby improving ecology without compromising the engineered integrity of the shoreline. Soft engineering includes such practices as restoration of coastal wetlands and beaches, and underwater structures to redirect wave action. Soft engineering uses ecological principles and practices to achieve stabilization of shorelines and safety, while enhancing habitat, improving aesthetics, and possibly saving money. While there are many places in the Great Lakes where hard engineering will continue to be required for navigational purposes, use of soft engineering techniques in appropriate locations may prove to be an economical alternative capable of affecting significant changes to the lakes system.

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Development also threatens the physical integrity of the Great Lakes shorelines. More than 40 percent of the U.S. shoreline along each of the middle and lower Great Lakes (Michigan, Huron, Erie, and Ontario) is developed residential area. Only a small fraction of the shoreline remains undeveloped (designated for recreational or other uses) — 29 percent of Lake Michigan's shoreline, 29 percent of Lake Erie's, 19 percent of Lake Ontario's, and only 11 percent of Lake Huron's. As the basin's population continues to increase and the urban centers continue to grow, more development pressure affects the sensitive shoreline environments.

Shoreland development results in loss and/or degradation of habitat in the nearshore zones of the lakes as well as along the shoreline. Associated problems include reduction in native plant cover, loss of sensitive native species populations, and reduction in ecosystem services such as nutrient entrapment.

Sustainable development and "smart growth" are the buzzwords for coastal land management planning as we enter the 21st century. Controlling urban and suburban sprawl through revitalized local planning efforts will be central to any success. However, state and federal governments will need to play a role in fostering well-planned coastal communities and improved land-use planning throughout the Great Lakes region. Given that sprawl is becoming a major issue, even as evidenced by recent elections, and that regulation is generally limited to local authority that does not have a bird's-eye view of the sprawl problem, how the federal government becomes involved in land use practices is likely to be critical. Federal incentives for brownfields redevelopment and other coastal land use planning initiatives hold some promise as a part of this solution.

Understanding land-use patterns also will be key to wise stewardship of the physical integrity of our coast. Integrated coastal watershed and land-use research is needed to better understand how land-use patterns affect coastal ecosystems and how land-use patterns are themselves influenced by changes in the coastal environment, such as water level variations.

Researchers need to go further in the development of the relatively new field of human-dimension ecology. The pressures placed on our coastal and estuarine resources by increased human uses such as development and recreation may be causing subtle changes to the ecology of the Great Lakes ecosystems that must be identified and measured before they become economically irreversible. Finding compatible solutions for land use (e.g., agriculture, forestry, development) that can address a community's economic needs without compromising ecological integrity and environmental health is a difficult challenge, but one which must be met.

Invasive Species — Biological Pollution

More than 130 non-indigenous species have become established in the Great Lakes since the 1800's. Due in large part to increases in the volume of shipping traffic, the introduction of new exotic species increased dramatically over the past 50 years. While many of these species have had no serious ecological impact, the introduction of a single key species can, as in the example of the sea lamprey, cause a sudden and dramatic shift in the entire ecosystem's structure. New species can dramatically change the interactions between existing species (and between those species and their non-living environment), creating ecosystems that are unstable and unpredictable. Invasive species are a major factor impacting the region's rare and endangered native species.

The sea lamprey first invaded the upper Great Lakes following construction of the Welland Canal in 1829. The cause of the delay between the opening of this invasion route and the actual first sighting in 1921 is unknown, but such delays are typical of species invasions. Adult sea lamprey are parasitic upon native trout and salmoides. Each adult lamprey can destroy 10 to 40 pounds of fish during its parasitic period. Before the implementation of control efforts, the sea lamprey virtually destroyed the entire region's prosperous recreational and commercial fishery. Fish stocks have still not returned to their historical abundances, and the fish species composition probably will never return to normal. Lamprey control has been only partially successful despite the expenditures of millions of dollars on chemical lampricides and alternative control efforts. New efforts are underway to shift lamprey control to non-chemical alternatives that are more cost-effective.

Zebra mussels are a stark example of the explosive growth potential of exotic species. Zebra mussels were first discovered in the Great Lakes in the 1960's. Just one year after introduction, their population was estimated at densities of 30,000 per square meter. Many scientists now consider the ecosystem changes caused by zebra mussels to be more significant than the changes caused by nutrient and toxic loadings combined. Zebra mussels also have had extensive economic impacts. Large water users on the Great Lakes now spend an annual average of $350,000 to $400,000 per user just to clear zebra mussels from their intake pipes. Quagga mussels, a near relative of the infamous zebra mussel, are able to survive in deeper waters and different sediment types, effectively expanding the "zebra mussel" problem to new areas of the lakes.

Several recent invaders of the Great Lakes also are cause for serious concern. The spiny water flea and the fishhook flea, nearly microscopic crustaceans, are gradually replacing their native counterparts. Since the long spines of these invaders make them harder for fish to capture and digest, these invaders are destabilizing the food chain at its base. Goby populations are expanding explosively in the Great Lakes and displacing native species. Since gobies feed on bottom-dwelling organisms (including zebra mussels) and in turn are fed upon by bass, they provide a direct link by which the entry of contaminants into the food chain (terminating in human consumption of bass) is accelerated. Eurasian ruffe, recently introduced into Lake Superior, are expanding their range rapidly with as yet unknown consequences for the native species with which they interact.

The potential for the accidental importation of fish diseases (caused by microscopic invaders) is a growing concern to the Great Lakes community, which relies on the fishery to support a multi-billion-dollar industry. Such invasions have occurred in other parts of the world, and recognition of the vulnerability of the Great Lakes fishery to similar attacks is increasing. The related potential for the importation of human disease-causing organisms such as cholera and dinoflagellates (responsible for "red" and "brown" tides and associated shellfish poisonings) is also of growing concern.

The Great Lakes Fishery

The Great Lakes commercial fishery began slowly, but grew during the 19th century as fishing technology expanded, most notably with the development of effective gill nets. Commercial catches measured in the millions of pounds well before 1900. 1998 estimates place the value of the U.S. commercial fishery (a small component of the total U.S. Great Lakes fishery activity) at $46 million. The Canadian commercial fishery is much larger, and both pale in comparison to the value of the recreational fishery, estimated to have a value in excess of $4 billion to the U.S. economy (based on a 1989 study by Sea Grant).

Lake Erie is the southernmost, shallowest, and warmest of the Great

Lakes. As a result, Lake Erie receives more sediment and nutrients than the other Great Lakes and is the most productive, frequently producing more fish for human consumption than the other four Great Lakes combined. The cleanup of Lake Erie has paid huge dividends. The harvest of walleye by Ohio anglers was approximately 112,000 in 1976. Today, if anglers harvest two million, it is considered a bad year, and Lake Erie has become the "Walleye Capitol of the World."

Urban, industrial, and agricultural development have caused remarkable changes in the lakes' flora and fauna and associated habitats. By 1900 Atlantic salmon were gone, and lake sturgeon were in trouble. Lake trout populations collapsed in the mid-1950's. The once commercially valuable blue pike was last seen in 1965. Three of the endemic deepwater ciscos are now believed extinct. Some sculpin species are seriously depleted or extirpated. Today, the lakes have aquatic communities that are structurally and functionally volatile and that exhibit rapid changes in species' number and abundance. These stresses have been so profound that they have challenged and broadened the thinking of fishery experts. Successful fish management of the Great Lakes is now actively focused on the lakes as ecosystems. As a result, effective management requires the coordination and integration of efforts of many governmental agencies. Fishery-management decision makers now must consider the potential effects on the whole system rather than only the effects within jurisdictional boundaries.

The food webs of the Great Lakes ecosystem support and maintain our multi-billion-dollar fisheries. Yet we do not have sufficient understanding and knowledge of how these food webs function to enable us to predict the effects of nutrient changes, new invader organisms, climate variability, water level changes, and other stressors, on either the Great Lakes ecosystem or the fisheries. As a result, we cannot reliably predict fishery year classes or recruitment, or how that may change from year to year as a result of stressors and variants.

Understanding land-use patterns also will be key to wise stewardship of the physical integrity of our coast.

Rebuilding the native fish populations to a level at which they can be sustained by natural reproduction is one of the principle goals of Great Lakes fishery management. Lake sturgeon are the largest freshwater fish indigenous to the Great Lakes and the only endemic sturgeon species. Historically, fish measuring 11 feet in length with weights in excess of 200 pounds were not unknown. By the early 1900's many populations of lake sturgeon throughout their range had been greatly reduced or extirpated as a result of overfishing, habitat loss, the construction of dams, and pollution. Lake sturgeon are listed as either threatened or endangered by 19 of the 20 states within its original range in the United States. Lake sturgeon continue to represent an important biological component of the Great Lakes fish community. Conservation and restoration of lake sturgeon have been made a high priority for Great Lakes fishery restoration. Other important species on which current restoration efforts are focusing include native brook trout, lake trout and salmonids

Protection of human health is of paramount importance — people still cannot eat a wide variety of Great Lakes fish due to the presence of toxic contaminants in the Great Lakes. Eating Great Lakes fish poses potential human health and developmental risks, particularly to sub-populations including infants and elderly people, sportfishers, pregnant women, and tribal peoples. Although polychlorinated biphenyls (PCBs) declined dramatically in top predator fish (whole fish) in the late 1970's and 1980's, recent data suggest that PCB concentrations in these fish are either slowly increasing, or are potentially leveling off at concentrations that are still capable of causing health problems in fish, fish-eating wildlife, and humans. The Agency for Toxic Substances Disease Registry is conducting on-going research into the human health effects of consuming Great Lakes fish.

The states and tribes have primary responsibility for protecting their residents from the health risks of consuming contaminated noncommercially caught fish and wildlife. They do this by issuing consumption advisories for the general population as well as for sensitive subpopulations. These advisories inform the public that high concentrations of chemical contaminants have been found in local fish and wildlife, and include recommendations to limit or avoid consumption of certain fish and wildlife species from specific waterbodies or waterbody types. Continuing advisories against eating Great Lakes fish (at more than certain quantities) remain a concern for the region.

The Great Lakes Hydrologic System

While the Great Lakes represent 20 percent of the world's fresh water supply, only about 1 percent of this water is available for use. This 1 percent represents the volume of the Great Lakes that is renewed each year through inflows from outside the basin, precipitation, and other natural sources of water.

The majority of the water supply of the Great Lakes comes from annual precipitation, much of which falls directly into the lakes. Some of the precipitation falls on lands within the basin and subsequently runs into streams and rivers, eventually reaching the Great Lakes. The USGS has recently learned that a substantial portion of the flows in the rivers actually comes from groundwater inflow. Much of this groundwater, however, is generally tied back to precipitation. Losses from the system occur primarily from evaporation. During periods of warm weather, the amount of evaporative losses can be significant.

At present, diversions from the Hudson Bay watershed into Lake Superior provide about two percent of the available water (0.02 percent of volume), and a little under 2 percent leaves the basin through a diversion of Lake Michigan waters into the Chicago Sanitary and Ship Canal and then into the Mississippi Basin. Several smaller diversions in and out of the basin have minor impacts on hydrology. Water is also lost to the basin when it is withdrawn and then consumed by direct evaporation, transpiration from plants, incorporation into products, or infiltration into the ground.

Over the past 150 years, the Great Lakes Basin has seen cycles of high precipitation and low precipitation. These cycles may run over decades. Since water levels on the lakes are essentially tied to the balance between precipitation and evaporation, dry warm periods, such as the basin has experienced over the last year, reduce the volume available and lower lake water levels.

Consumptive Uses of Water in the Great Lakes Basin

The International Joint Commission has conducted a preliminary examination of water use data in the Great Lakes Basin. Based on a very preliminary analysis, the International Joint Commission interim report concludes that withdrawals and consumptive use in the Basin appear to have slowed. If current trends continue, a modest increase in consumptive use for the entire Basin of about 5 percent can be expected between 1995 and 2021.

Close to 90 percent of water withdrawn in the Basin is taken from the lakes themselves, with the remaining 10 percent being withdrawn from tributary streams and groundwater sources. An estimated 5 percent of the water is consumed and is therefore lost to the Basin. Since 1988, the Great Lakes Commission has maintained a database on Regional Water Use on behalf of the states and provinces. This Regional Water Use Database is current for most jurisdictions to 1993. As of 1993, consumptive use in the Great Lakes Basin was estimated to be 116 m3/s (as compared to a withdrawal of about 2,493 m3/s).

In total, consumptive use is 36 percent for Canada and 64 percent for the United States. The largest user is Ontario at 29 percent followed, by Michigan at 22 percent; Wisconsin at 21 percent; Indiana at 7 percent; New York, Quebec, and Ohio at 6 percent each; Minnesota at 2 percent; and Pennsylvania and Illinois at less than 1 percent each.

The percentage of withdrawn water that is consumed within the Great Lakes system varies with the type of use to which the water is put. When water is used for irrigation, about 80 percent is consumed (due to evaporation). At the other extreme, when water is used for thermoelectric power, less than 1 percent is consumed. The percentage of water lost to the Basin when it is used for public supply and for industrial purposes—the other large water-using categories—is on the order of 10 percent for each. The net largest consumptive use is for irrigation at 30 percent, followed by public water supply at 26 percent; industrial use at 25 percent; fossil fuel, thermoelectric, and nuclear thermoelectric uses at 6 percent each; self-supplied domestic use at 4 percent; and livestock watering at 3 percent.

Consumptive use data for groundwater are not currently available. Groundwater is the primary source of water for about 3.3 million of the 17 million people served by public supplies in the U.S. portion of the Basin. It is also the source of water for many of the 4.9 million people who supply their own water. The effects of groundwater withdrawal may therefore be of concern on a local or subregional basis, particularly with respect to urban sprawl, even if withdrawals do not have a major impact on the overall water budget of the Basin.

Great Lakes Water Levels

During the past 30 years water levels have remained higher than the long-term average. In 1997 and 1998, water levels were significantly above average. Starting in the fall of 1998, lake levels began to drop precipitously, reaching levels which had not been observed since the mid-1960's, approximately 1.6 feet lower than the average from 1990-1997.

The difference between the amount of water coming into a lake and the amount going out is the determining factor in whether water levels will rise or fall. When precipitation increases and cooler, cloudy conditions result in less evaporation, water levels generally rise. Prolonged periods of low precipitation and warm temperatures generally result in lowering of water levels. Water levels in the Great Lakes generally rise in the spring, due to snowmelt and precipitation. Typically, lake levels fall during the late summer and fall due to increased evaporation.

Extreme fluctuations due to storms, wind or ice jams can last from a couple

of hours to several days. Ice jams decrease the amount of water flowing out of a lake, which will temporarily increase its level until it is cleared. Sustained high winds also can cause short-term fluctuations. Strong winds from one direction can push the water level up at one end of the lake and make the level drop by a corresponding amount at the opposite end. When the winds ceases, the water returns to its original position.

Global warming is likely to create the conditions which lead to lowering of lake water levels. Climate change models predict that residents of the Basin will experience prolonged changes in lake level, bringing about a gradual yet fundamental shift.

Two water level regulation points on the Great Lakes are overseen by the International Joint Commission. A structure on the St. Marys River regulates Lake Superior, and a power-generating facility on the St. Lawrence River controls water levels on Lake Ontario. Lake Superior outflows are set monthly, and regulation decisions include consideration of the relative levels of both Superior and Huron/Michigan. Water release is not allowed to interfere with navigation, and minimum outflows are mandated for fish habitat in the St. Mary's River. Lake Ontario levels are managed to compress fluctuations and generate power, with a minimum of protection for Montreal Harbor. Flood protection is provided for downstream residents, and outflows are set weekly. The Corps of Engineers and the International Joint Commission currently consider the needs of five interests: riparian, hydroelectric power, navigation, recreation, and environment in regulating lake levels. Currently, the needs of recreational boater are not considered in the decision-making process. A study of the regulation process has been proposed as has reopening the Orders of Control for Lake Ontario. Funding from both the U.S. and Canada will be needed to undertake the studies needed for review of the implications of lake level control and issues of equitability in the control regime. Any changes to the water regulation process would not be sudden and would require a public review and comment process.

Due in large part to increases in the volume of shipping traffic, the introduction of new exotic species increased dramatically over the past 50 years.... A single key species can, as in the example of the sea lamprey, cause a sudden and dramatic shift in the entire ecosystem's structure.

Waves are the primary erosion factor acting on the Great Lakes shorelines. Variation in lake levels have little effect on the creation of waves; however, lake levels do have an effect on where wave energy is dissipated on the beach profile. During periods of rapidly declining water levels, offshore sediments are typically brought on-shore, causing beaches to expand. Wider beaches during sustained low water levels provide a natural armoring feature to reduce the waves' ability to attack the bottom of the bluff, resulting in temporary slowing of bluff erosion. During periods of increasing water levels, wave attack on bluff surfaces (which may have been weakened by wave action at the bluff base) often leads to catastrophic collapse.

Sedimentation problems relating to the erosion associated with increased precipitation and high water levels may cause water quality problems. Low water levels may indirectly affect water quality. As the lake levels fall and the waters recede, municipal water intakes must be monitored to ensure their submergence in water unaffected by common shoreline problems such as turbidity and possible algal blooms. Exposure of toxic sediments may be a concern, as well as disposal of sediments from emergency dredging.

Continued low water levels present a scenario in which fish habitat loss is a significant possibility. Broad shallows provide critical habitat for the 120 native fish species, in addition to the bordering wetlands. Drops in water level will move the shoreline away from these established habitat and reduce the overall habitat available for adult fish. Wetlands in particular need to be carefully monitored in low water years to gain greater understanding of the ecological impacts of low water in the Great Lakes.

Artificial restrictions in annual water level variation can lead to environmental problems, especially for wetlands. Great Lakes wetlands rely on low water years to promote the germination and establishment of many vegetation types. High water years help to prevent the wetland areas from filling with sediment or otherwise losing their natural connections to the Lakes.

Low water levels cause increased problems for both commercial and recreational navigation. Shipping is dependent upon the available draft in the maintained channels. A 1,000-foot-long vessel forfeits carrying 270 tons of cargo for each one-inch reduction in draft. During low water periods greater care must be taken navigating the approaches to many areas. Low water can make it difficult for private

boaters and marina operators to get their boats into and out of the water. Damage to boats could result from props, keels, or hulls striking boulders or shoals. The Army Corps of Engineers is not responsible for maintaining private harbors and marinas, where service may be disrupted by low water levels. The Corps expects to accelerate its dredging program in low water years and is working to expedite the permitting process for private dredging and disposal. Dredging or excavation performed in waters of the United States without a permit or not complying with a permit is considered a violation of Federal law and could result in required restoration, fines, or jail sentences.

Great Lakes Water Diversions and Bulk Export

The Great Lakes region has long recognized the importance of cooperation between the state and provincial governments that share jurisdiction over the Great Lakes. With the signing of the Great Lakes Charter in 1985, the Great Lakes Governors and Premiers formally agreed to a voluntary, Basin-wide framework for managing the water resources of the Great Lakes. The non-binding Great Lakes Charter requests state governors and provincial premiers to consult together on diversions above a certain threshold volume. Since that time, the prior notice and consultation process established under the Charter has been effectively invoked five times to deal with proposed withdrawals of Great Lakes water.

In 1986, one year after the signing of the Great Lakes Charter, the U.S. Congress amended the federal Water Resources Development Act (WRDA). The Water Resources Development Act of 1986 requires that all eight Great Lakes governors approve any proposed diversion of U.S. water from the Great Lakes basin, whether to a domestic or foreign recipient, before it may proceed. There have been three proposals to divert water from the Great Lakes since the passage of the WRDA, none of which was for bulk export. The review of each of these proposals took a minimum of one year in order to assess their potential impact on the ecosystem. Two proposals were approved with conditions that ensure the on-going protection of the Great Lakes, and one proposal was not approved. In the spirit of the Charter, the Great Lakes Premiers of Ontario and Quebec have participated in the review of proposed diversions, including those not covered under the Charter.

In April of 1998, the province of Ontario approved a permit for a venture capital corporation, the NOVA Group, to export up to 600 million liters of water drawn from Lake Superior per year (at no more than 10 million liters per day). The planned recipient for this export has never been identified more specifically than "Asian markets." The province did not consult with the Canadian federal government prior to issuing the permit; under Canada's Constitution, a province has the right to export water from any lake within its boundaries provided that no areas of federal jurisdiction are involved. The province was not required to consult with the United States because the volume of water involved fell below the 19 million liter per day (average) threshold for consultation laid out in the non-binding Great Lakes Charter. Under pressure from both federal governments and citizens of the basin, Ontario began actions to revoke the permit in May. The NOVA Group voluntarily relinquished its permit on the condition that it was "first in line" should similar permits be considered in the future. There are no proposals to export Great Lakes water at this time nor are any anticipated within the next year. However, the "NOVA Group" permit highlighted the inadequacies of existing arrangements for protection of the Great Lakes water resources. Regional policy makers have moved quickly to begin the process of filling the gaps in existing policies.

In February of 1999, the International Joint Commission was asked by the governments of Canada and the U.S. to examine, report upon and provide recommendations on the effects on the Great Lakes of bulk removal of water from the lakes. The IJC was requested to examine current and potential consumptive uses of water, existing and potential diversions in and out of the Great Lakes Basin, the cumulative effects of existing and potential removals, and current laws and policies affecting the sustainability of the resource. Since receiving the reference, the Commission has held public hearings in locations throughout the basin, conducted meetings with experts in fields related to the Great Lakes ecosystem and operation, begun consultation with state, provincial and local officials, and solicited input from the public at large. The IJC interim report was released in August of 1999, and its final report is due in February of 2000.

Meanwhile, the Great Lakes governors have commissioned a legal analysis of the laws governing diversions and consumptive uses. In a September 1999 statement, the governors set forth the following series of principles on which the management regime for Great Lakes water should be based.

1. **It must protect the resource.** Resource protection, restoration, and conservation must be the foundation for the legal standard upon which decisions concerning water withdrawals are based.
2. **It must be durable.** The framework for decisions must be able to endure legal challenges including, but not

limited to, interstate commerce and international trade. It must be constitutionally sound on a bi-national basis, and the citizens of the Basin must support this framework.

3. **It must be simple.** The process for making decisions and resolving disputes should be straightforward, transparent and based on common sense.
4. **It must be efficient.** Implementation of the decision-making process should engage existing authorities and institutions without necessitating the establishment of new and large bureaucracies. The decision-making process should be flexible and responsive to the demands it will confront.
5. **It must retain authority in the Basin.** Decision-making must remain vested in those authorities, the Great Lakes Governors and Premiers, who manage the resource on a day-to-day basis.

International Trade. The NOVA permit raised for the first time the specter of international trade law as a potential force for governing bulk diversion of Great Lakes Water. Experts disagree on the interpretation of international law with respect to bulk water exports. A carve-out for bulk water exists in the North American Free Trade Agreement accommodating these arrangements. The three parties (U.S., Canada, and Mexico) issued a joint declaration to the effect that water in its natural state is not a "good" for the purposes of NAFTA. This declaration is likely binding on the NAFTA parties but not other governments. The General Agreement on Tariffs and Trade, among other international trade laws, does not include such a carve-out. Most agree that fresh water would likely be treated as a "good" under existing international trade law.

Some note that trade rules and environmental regulation are increasingly coming into conflict because, as tariffs have fallen, the multilateral trading system has turned its attention to the elimination of discriminatory domestic regulations that utilize trade measures to accomplish their objectives. Thus, in the area of water exports, any discussion of limiting the trade in bulk water will undoubtedly involve a discussion of the role and applicability of the trade rules to the domestic policy under consideration. Areas of potential friction between the trade regime and efforts to limit bulk water exports include national treatment and prohibition on quantitative restrictions. "National treatment" — treating foreign and domestic producers and products alike — is one of the bedrock principles of the international trade regime and will make it extremely difficult to "just say no" to bulk water exports if bulk water diversions are allowed domestically. The World Trade Organization (WTO) prohibition on quantitative restrictions makes any ban and/or "just say no" policy on water exports a potential violation of international trade rules.

The Great Lakes delegation is seeking formal assurance at the international level that existing and reasonably foreseeable future local uses of Great Lakes water are completely compatible with WTO rules.

Especially relevant are GATT Articles XI (regarding quantitative restrictions on exports and imports) and XX (b) and (g) (regarding exceptions for the protection of human, animal or plant life or health and the conservation of exhaustible natural resources, respectively). One review of GATT/WTO cases on conservation measures suggests that GATT Article XX(g) provides the greatest scope for developing an effective and environmentally sound approach to the issue of bulk water exports. However, others warn that while the WTO dispute settlement jurisprudence via Article XX has been improving its sensitivity to environmental concerns, reform of international trade rules is needed. Potential policy ideas and trade rule reform worth exploring include: an explicit exclusion of bulk water exports as a "good" under NAFTA and the WTO, and an explicit exception for bulk water exports to the national treatment and quantitative restriction disciplines similar to the "trade in logs" exception currently granted in NAFTA.

In a November 1999 meeting, the U.S. Trade Representative Office received a clear message from the Great Lakes delegation that the concern over whether WTO rules might interfere with the ability of Great Lakes states to control access to — and in particular exports of — Great Lakes water is acute. The delegation is seeking formal assurance at the international level that existing and reasonably foreseeable future local uses of Great Lakes water are completely compatible with WTO rules. While it may not by necessary for the USTR to raise Great Lakes water specifically in the current round of negotiations, some form of formal recognition of WTO compatibility (with existing and foreseeable uses) is clearly needed. One alternative under discussion is an "agreed interpretation" at a general counsel's meeting. If this issue is going to create a political furor at the WTO, members of the Great Lakes delegation

would rather know and deal with it now, than 20 years from now when water is an even more explosive issue than it is today.

Groundwater. In August of 1997, in its response to a permit application by the Crandon Mining Corporation, the Army Corps of Engineers determined that Section 1109 of the Water Resources Development Act of 1986 applied only to surface waters and not to groundwaters of the Great Lakes Basin. The Crandon Mining Corporation had proposed to draw groundwater from the Great Lakes Basin for use in its mining processes and to discharge the resulting treated wastewater into the Wisconsin River (outside the Great Lakes Basin). This determination allows groundwater diversions to bypass the requirement for unanimous approval of a diversion by all eight Great Lakes governors. While the specific issue of the Crandon Mine diversion is no longer a concern, the status of groundwater with respect to existing arrangements regarding water diversions has yet to be resolved. This "loophole" is especially disturbing in light of a recent USGS study showing that a substantial portion of the flows in the rivers actually comes from groundwater inflow. A provision in the Water Resources Development Act of 1999 requiring the Army Corps of Engineers to inventory existing information on the biohydrology of the Great Lakes Basin explicitly includes groundwater hydrology as a portion of the system to be inventoried.

Great Lakes Indicators — The Need for Monitoring

Great Lakes indicators are needed to provide decision-makers with the information necessary to understand the current condition of the Great Lakes environment, to evaluate progress of programs and remediation efforts, and to strategically and efficiently target future efforts to protect and restore the chemical, physical, and biological integrity of the Great Lakes. Merely identifying indicators, of course, is insufficient. The research and monitoring to track the historical changes in the indicators is essential to meeting these needs. Unfortunately, over the last decade, funding for basic monitoring efforts has declined even as the Great Lakes community has begun the task of identifying key indicators and their best uses.

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The Great Lakes National Program Office (GLNPO) initiated a project to describe the environmental condition of the Great Lakes in a way that can be easily understood. Through several years of bi-national, multi-organizational effort, EPA and its partners have identified 80 comprehensive, basin-wide indicators. The Lakes can now be assessed based on 19 of those indicators. GLNPO efforts contribute directly to 4 of the 19 indicators that are being used as representative examples: Benthos Diversity and Abundance, Phosphorus Concentrations, Atmospheric Deposition of Toxic Chemicals, and Chemical Contaminants in Fish Tissue. Some of the others are also routinely collected and reported; however, in many cases, the information is not readily available. EPA's Great Lakes program describes trends in concentrations of toxics in Great Lakes top predator fish; beach closings; concentrations of toxic chemicals in the air; trophic status and phosphorus; and contaminated sediment remediation. Information is provided to state and federal environmental managers to drive decision-making. Several agencies use the indicators for their reporting of progress under the Government Performance and Results Act.

Since EPA and its partners do not now monitor all indicators, challenges remain. Coordinated, multi-agency research and environmental measurements will be necessary to support implementation of the suite of these indicators. The State of the Lakes Ecosystem Conference (SOLEC) process is being used to identify gaps. Research is needed to support scientifically valid Great Lakes indicators and to answer questions about which of the 80 indicators recently proposed through the SOLEC process can be appropriate surrogates for larger processes. Research is also needed to consider whether implementation of the indicators is economically and technically feasible.

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Delivering E-Commerce

by Fred Helmstetter

In the course of preparing a transportation and trade analysis for the Upper Midwest, Northeast-Midwest staff consistently hear from state officials about the changing nature of supply chains, driven in part by the explosive growth of business-to-consumer electronic commerce. This trend is altering the way consumer goods are distributed throughout the country and modifying the role of state transportation departments.

The growth of business-to-consumer electronic commerce (often called B2C e-commerce) has indeed been staggering. This past holiday season, on-line sales were estimated at over $8 billion, nearly triple the 1998 level of $3 billion. A trade association of Internet retailers predicts that by 2003, residential deliveries of on-line purchases will more than double from the current 3 million a day to 6.5 million per day. In a recent speech, the U.S. Federal Highway Administrator estimated that by 2020, 40 percent of all goods consumed in the United Sates will be ordered via the Internet. Such a transformation may seem unlikely from today's perspective, but consider that the generation entering adulthood in 2020 will never have known a world without Amazon.com.

Consumers increasingly will demand what some have called the "pizza model" of distribution. They will expect more and more goods to be delivered directly and quickly to their homes. Many of the new entrepreneurial online retailers, however, are inexperienced in transportation logistics. According to one study, more than half of these "e-tailers" underestimate the costs associated with a package's shipment.

In their defense, B2C e-commerce is changing the way supply chains work. In contrast to current practices, online purchases usually move directly from manufacturers to consumers, removing the manufacturers' warehouses and distribution centers from the transportation equation. To complicate matters, e-tail shipments also move in smaller lots, typically comprised of several small packages instead of several large pallets. Moreover, e-tailers have difficulty predicting both on-line orders and replenishment requirements, largely because the number of web users continues to grow exponentially. To help address these challenges, e-tailers are relying on third party logistics providers (3PLs), which can do everything from finding a source manufacturer, to delivering the product, to managing customer returns. The dominant 3PL is UPS, which controls an estimated 80 percent of the total B2C parcel delivery market.

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State transportation departments are essential players in this new economy because e-commerce can be successful only if distribution is efficient and on time. At present, nearly 20 percent of on-line deliveries arrive later than promised. The private sector is increasingly looking to state DOTs to be supply-chain facilitators, helping to make transportation networks as reliable as possible. The Federal Highway Administration (FHWA) already is examining ways to encourage that type of role within the next transportation reauthorization legislation. FHWA officials plan to emphasize expanded information technology applications that can enable the current infrastructure to be operated more effectively. This additional "info-structure" will be necessary to manage the growing number of UPS and FedEx trucks and other vehicles on the nation's existing roadways.

The reauthorization also may include more innovative financing programs that would allow states to address bottlenecks at border crossings and intermodal connections. It also may include inducements for more partnership arrangements, such as multi-jurisdictional and public-private cooperation, which can help leverage available resources and address transportation challenges across borders. In the e-commerce world, reliable and efficient transportation will be crucial. That in turn may mean new paradigms for both industry and government.

Fred Helmstetter is a policy analyst at the Northeast-Midwest Institute.

Retail Gasoline Prices Sold to End User

(excludes federal, state, and local taxes)

	Dec-98	Oct-99	Nov-99	Dec-99	Monthly % Change	Annual % Change
New England						
Connecticut	64.0	93.1	93.8	96.0	2.3	50.0
Maine	65.2	99.5	98.5	96.3	-2.2	47.7
Massachusetts	63.0	92.8	93.6	95.8	2.4	52.1
New Hampshire	64.0	94.4	94.4	95.8	1.5	49.7
Rhode Island	58.2	88.1	89.0	91.1	2.4	56.5
Vermont	63.1	94.7	94.6	97.1	2.6	53.9
Mid-Atlantic						
Delaware	58.6	90.4	90.5	91.5	1.1	56.1
Maryland	57.3	85.5	87.3	89.1	2.1	55.5
New Jersey	66.3	94.2	94.9	96.8	2.0	46.0
New York	61.3	91.8	92.3	94.8	2.7	54.6
Pennsylvania	53.2	85.9	85.9	88.3	2.8	66.0
Midwest						
Illinois	58.3	86.7	89.7	90.5	0.9	55.2
Indiana	55.9	80.3	84.2	85.2	1.2	52.4
Iowa	50.7	77.9	79.2	82.9	4.7	63.5
Michigan	51.3	80.5	85.8	86.2	0.5	68.0
Minnesota	60.1	88.6	90.5	91.3	0.9	51.9
Ohio	55.1	82.9	91.0	91.1	0.1	65.3
Wisconsin	53.3	84.6	87.3	87.7	0.5	64.5
South						
Alabama	58.7	82.7	83.8	86.8	3.6	47.9
Arkansas	51.3	81.1	83.1	85.3	2.6	66.3
Florida	59.3	85.8	86.6	89.3	3.1	50.6
Georgia	54.8	80.3	82.4	84.4	2.4	54.0
Kentucky	55.7	86.2	89.9	92.3	2.7	65.7
Louisiana	56.7	85.6	86.2	88.7	2.9	56.4
Mississippi	58.9	84.1	83.9	86.5	3.1	46.9
North Carolina	55.3	81.8	83.7	86.5	3.3	56.4
Oklahoma	47.5	77.9	77.6	79.9	3.0	68.2
South Carolina	53.3	80.8	82.3	84.8	3.0	59.1
Tennessee	52.5	81.3	84.7	86.9	2.6	65.5
Texas	54.0	82.3	82.5	85.5	3.6	58.3
Virginia	58.5	84.9	86.4	89.0	3.0	52.1
West Virginia	56.1	81.6	86.5	89.3	3.2	59.2
West						
Alaska	89.4	109.2	110.5	NA	NA	NA
Arizona	64.8	89.0	91.3	95.3	4.4	47.1
California	71.6	92.7	91.6	93.4	2.0	30.4
Colorado	62.6	95.6	93.2	93.8	0.6	49.8
Hawaii	107.1	97.0	96.8	99.8	3.1	-6.8
Idaho	65.0	99.0	96.8	94.3	-2.6	45.1
Kansas	49.3	78.9	80.0	82.9	3.6	68.2
Missouri	47.4	79.9	81.7	84.9	3.9	79.1
Montana	61.3	93.6	96.3	NA	NA	NA
Nebraska	53.0	80.4	80.3	82.9	3.2	56.4
Nevada	74.7	102.2	101.2	105.0	3.8	40.6
New Mexico	62.3	94.7	94.7	95.4	0.7	53.1
North Dakota	60.6	90.0	90.8	91.8	1.1	51.5
Oregon	69.0	99.2	95.4	96.5	1.2	39.9
South Dakota	61.2	87.8	88.0	90.4	2.7	47.7
Utah	59.8	97.2	92.2	94.0	2.0	57.2
Washington	66.8	97.5	95.7	96.6	0.9	44.6
Wyoming	66.3	99.5	96.5	93.9	-2.7	41.6

NA=not available

SOURCE:Northeast-Midwest Institute staff calculations of Energy Information Agency data

A New Twist on Technology-Led Economic Development

Eamonn Fingleton — in his book *In Praise of Hard Industries: Why Manufacturing, Not the Information Economy, is the Key to Future Prosperity* — draws an incisive contrast between the information economy and that of manufacturing. He argues that the information and services sector cannot sustain the U.S. economy in the long run. Manufacturing can, but the U.S. is falling behind. He concludes that American prosperity will depend to a large extent on the strength of a competitive manufacturing base that delivers high wages, low unemployment, and increased exports. The winners in the long run will be those countries that support and foster manufacturers of quality products that cut production costs, improve productivity, and reduce environmental impacts.

The federal government certainly recognizes the relationship between technology development and the national economy. Its own studies show that nearly 50 percent of this nation's economic growth since World War II derives from the development and use of new technologies. Washington has invested heavily in defense systems, space exploration, medical research, and energy production. By comparison, the government directs little funding toward technology development for basic industry, even though the economic and environmental paybacks could be enormous.

The Department of Energy's Office of Industrial Technologies (OIT) sponsors one of the few initiatives targeting basic industries, particularly the energy-intensive, waste-intensive firms producing chemicals, steel, aluminum, glass, metal casting, forest products, agriculture (especially organic chemical feedstocks), mining, and petroleum products. OIT has invited company executives to meet and develop a vision of where they need to be by the year 2020 in order to be globally competitive. It then challenges these so-called "industries of the future" (IOF) to identify and place a priority on the technologies that need to be developed. OIT then partners with companies, academia, and other research institutions to develop those technologies.

OIT recently invited states to partner in this IOF effort in order to involve more companies and research institutions. West Virginia, Kentucky, and Idaho are leading the pack. In West Virginia, the manager of the National Research Center for Coal and Energy at West Virginia University obtained support from the governor and university president. The governor, in fact, highlights the importance of the state initiative in fostering productive alliances between the state's industry and its academic institutions.

Most states, unfortunately, still focus their technology-based economic development strategies on the computer, biomedical, and electronics industries. Few have seen the opportunities that exist in developing the next generation of technologies for bedrock industries needed to develop and sustain advanced economies.

Many of these energy-intensive industries, and the resources to develop the next generation of technologies for them, reside in the Northeast-Midwest region. For instance, the National Environmental Technology for Waste Prevention Initiate at the University of Massachusetts and the Massachusetts Chemical Technology Alliance have decided to spearhead an initiative in Massachusetts, with the active support of Senator Edward Kennedy. A Pennsylvania initiative, with backing from the Pittsburgh delegation, builds on an exciting Steel Showcase being held in Pittsburgh on May 4-5. More states in the Northeast-Midwest, however, need to seize the opportunities the way West Virginia, Kentucky, and Idaho have. ■

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