MSU: Our Natural Resources Are Protected and Preserved

- The Remote Sensing and Geographic Information Systems group has **worked with over 200 Michigan townships to develop land cover/land use data in support of land use planning.**
- At MSU's Kellogg Biological Station, the federally funded Long Term Ecological Research (LTER) site is internationally renowned for work on the **ecology of field crops important to Michigan** agriculture. MSU Extension agents and farmers use LTER research to manage crops more efficiently with less environmental impact and greater economic return.

Outcomes for Michigan's Future:

- MSU offers a **doctoral specialization in environmental science and policy** to educate professionals who understand the complexity of environmental issues and can work comfortably in multidisciplinary teams that include sciences, engineering, social sciences, and the humanities.
- MSU has **one of the nation's four Breast Cancer and the Environment Centers.** It will fill gaps in knowledge of the impact of in-utero, early postnatal, and pubertal environmental exposures on mammary gland development and their influence on future breast cancer risk. The center is funded by the National Cancer Institute and the National Institute for Environmental Health Sciences.
- **Detection of hundreds of known pathogens using DNA biochips** is now closer to reality through grants to an MSU research team from the National Institutes of Health, Michigan Economic Development Counsel (MEDC), and the Department of Defense. A hand-held device for detecting harmful agents will help ensure the safety of water, air, and agricultural products. In the near future this technology will incorporate nanoparticles and microfluidics to achieve automation, cost effectiveness, and enhanced sensitivity. Automated early warning systems to detect single cells of a broad variety of harmful agents are the ultimate goal.
- MSU Researchers with EPA funding are **examining how climate change and variability from year to year may affect Michigan agriculture and the state's tourism and recreation industry,** focusing initially on the tart cherry and skiing industries. The project links state-of-the science analysis and regular discussion with industry leaders.

Spotlight on Success

A chemical engineering researcher and his students developed technology for the design and engineering of novel starch-based foam and film materials for packaging. A Michigan company, KTM Industries, manufactures and commercializes the sheets under the Green Cell trade name. A Green Cell protective packaging system designed for Toyota's video entertainment system, windshield, and end cap has been used for over 12 months by Toyota Motor Sales, USA, without any system failure.

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For more information contact:
Ann Beaujean, director, State Relations, beaujean@msu.edu, 355-5060, www.msu.edu/unit/vpga
Information compiled by Tom Dietz, director, Environmental Science and Policy Program.

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Outcomes for Michigan's Future

MSU: Helping Protect and Preserve Our Natural Resources

In Brief:

- **Environmental industries are important to Michigan's economy.** Recent estimates (2003) show that:
  - **Sales** due to environmental industries totaled $12.9 billion
  - The number of environment-related **jobs** totaled nearly 217,000
  - The environment industry generated **3.9 percent of the gross state product**
  - Environment-related jobs comprised **4.9 percent of total Michigan employment**
- Michigan environmental industries generated **4.3 percent of U.S. environmental industry sales** and provided **4.4 percent of the nation's environment-related jobs.** Substantial growth is possible in this sector, and research is an essential nutrient for that growth.
- **Wildlife-related recreation is a major Michigan industry.** Nearly a million citizens enjoy 9 million days of recreational hunting annually with total expenditures of over a half billion dollars. Over 2.5 million Michigan citizens actively participate in wildlife viewing in the state and expend $700 million annually.
- **Public and private decision makers need information on the economics and management of Michigan's lakes, rivers, and other natural resources** in order to make decisions about protecting and sustaining the ecological and economic benefits of the state's natural resources.

Situation:

The **remediation of sites contaminated with hazardous materials** became a national priority in the early 1980s. Among federal and state laws addressing such environmental issues are the Federal Safe Drinking Water Act Amendments of 1996, which required states to perform source water assessments for all public drinking water systems, P.A. 148 (Acts of 2003), which requires the Michigan Department of Environmental Quality (MDEQ) to prepare a statewide groundwater inventory and map, and the U.S. Environmental Protection Agency (EPA) mandate that, by 2006, states develop nutrient standards that will help protect lakes greater than one acre. With more than 12,000 public water sources, of which over 10,500 are small

noncommunity groundwater systems, and 21,000 lakes greater than one acre, Michigan's effort to meet these and similar requirements is substantial.

Managing the intense **wildlife-dependent activity in Michigan** requires both biological and social information. Development of wild lands and forests creates a range of problems for traditional use of these natural resources. Problems include the **expanding range of bears** in lower Michigan, the **increasing wolf population** in both the upper and lower peninsulas, the **potential invasion of chronic wasting disease** in the wild deer herd, the impact of privately owned cervids on **wildlife disease transmission,** the **effect of land use** on highly valued species, and **competition among users** for limited natural resources.

Understanding **land use** is crucial to some of the most widely discussed and contentious issues in the state, including **urban sprawl, conversion of agricultural land** to alternative uses, **wetlands and other habitat preservation, environmentally dependent industries,** and **rural residential development.**

MSU Capacity:

Michigan State University has a long history of **conducting research that promotes stewardship of the state's natural resources.**

- MSU has linked more than 130 faculty representing all areas of the university in the **Environmental Science and Policy Program.** These faculty include some of the most noted experts in the world on issues such as agriculture, environmental toxins, invasive species, and land use.
- The **Land Policy Program** coordinates land use, land cover, and land policy research and education activities at MSU in order to provide effective science-based solutions and education programs to policy makers.

Among the many projects that demonstrate **MSU's capability to help protect and preserve Michigan's natural resources** are these:

- The Institute of Water Research and the Remote Sensing and GIS Group at MSU along with the U.S. Geological Survey are **assisting the MDEQ to meet the requirements of P.A. 148.**
- An MSU expert on the ecology of lakes, rivers, and bays who helped the U.S. EPA develop criteria for nutrient loadings is now **helping MDEQ develop its standards.** The Muskegon Watershed Research Partnership, which he leads, is developing new tools for managing aquatic ecosystems in Michigan, highly refined ecosystem models for state and township managers, and ways of engaging the public in the scientific and management process.
- MSU faculty are working with the Michigan Department of Natural Resources (MDNR) to develop a new system for **monitoring and inventorying inland lake fisheries** and new analysis tools and classification systems for interpreting the results.
- To support the MDNR's **Black Bear Management Program, MSU researchers developed a state-of-the-art** population-estimation protocol that uses genetic markers obtained from hair samples gathered during the summer and tissue samples gathered from bears legally harvested during the fall hunt.
- A team of MSU ecologists and economists seeks solutions to **sustain economic and ecological benefits of forest and wildlife resources** in the upper peninsula by analyzing market and nonmarket values of natural resources as well as short- and long-term ecological consequences of management activities.

MSU researchers work to **mitigate the negative effects of environmental factors on the health of Michigan's citizens** in projects like these:

- MSU and University of Michigan scientists created a unique mobile laboratory to take to urban locations where children's asthma levels are high. In it they **test for pollutants in ambient air and determine their effects on the airways** of laboratory animals, which likely parallel the effects on school children who have long-term, ongoing exposure to the pollutants.

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- An MSU study team identified Michigan farmers and their family members with asthma to **determine what percentage of their asthma is caused or aggravated by farm work.**
- An MSU study on pregnancy, environment, and child health investigates the **effect of toxicant exposure during pregnancy and via breastfeeding on the development of allergic diseases** such as atopic eczema and asthma in various Western Michigan communities. The project is supported by the EPA.
- Grants from the Centers for Disease Control support MSU research into the **effects of consumption of Great Lakes fish** on mental functioning in the elderly, on infertility in families, and on the fertility of children whose mothers were exposed to fish-borne contaminants during pregnancy. With support from the National Institute of Environmental Health Sciences, MSU partners with physicians in Detroit and Grand Rapids to examine the relationship of male fertility to exposure to environmental chemicals and toxic elements through consumption of fish and from other environmental sources.

MSU is working on **"green" technologies** like these:

- In work funded by the National Science Foundation, the U.S. Department of Agriculture, and the EPA, MSU faculty are devising new **"green" composite materials for structural applications to replace petroleum-based plastics and composites.** These green materials can be "triggered" to biodegrade after use without a negative impact on the environment and will create new opportunities for Michigan farmers to produce nonfood biomass for value-added applications in the Michigan manufacturing sector and will also reduce environmental problems.
- The Department of Defense, EPA, and the Department of Energy have funded research with MSU and the Xenon Corporation on the **use of ultraviolet light as an environmentally benign process for the cleaning and surface preparation of materials.**

Successes:

- MSU researchers provided guidance to 42 local health department jurisdictions (the entire state except Wayne County) to **enhance their groundwater assessment expertise and develop new geospatial capabilities in order to gather data required by the federal Safe Drinking Water Act.** A comprehensive portal for educational materials related to contaminated site investigation and remediation is available online (www.envirotools.org).
- MSU faculty served as a resource for developing and evaluating new regulations for lake and stream fisheries, particularly the **effects of the 2,500 plus dams in the state and how to deal with the retirement of large numbers of them in the next 10 to 25 years.**
- MSU researchers played a key role in **developing technical information and models needed to manage Great Lakes fish populations and communities,** helping to evaluate policies for major management actions: fishing regulations to limit fishing mortality, planting hatchery reared fish, and controlling sea lamprey. Faculty played a key role in developing lake trout and lake whitefish stock assessments that were essential for the consent agreement negotiations between the State of Michigan, the Native American tribes of Michigan, and the U.S. Fish and Wildlife Service.
- Agricultural economists **compared the cost-effectiveness of command and control regulations and incentive-based strategies for preventing the introduction of new invasive species into the Great Lakes.** They are applying the same approach to developing cost-effective methods for reducing the risk of bovine tuberculosis in cattle and deer in Michigan.
- The MSU Blood Lead Level group developed an effective approach to **screening children for risk of lead poisoning.** Working with the Michigan Department of Community Health, they developed a Web site that provides a quick and cost-free assessment of whether or not a child needs more expensive blood testing for lead levels. This approach assures that blood tests are used when the risk is substantial but not when the risk is low.