



Bridging over water troubles

Dr Jon F Bartholic is Director of the Institute of Water Research, an organisation that provides timely information to address contemporary land and water resource issues. He discusses some of their ongoing programmes and reveals his hopes for future achievements

Can you introduce the core aims of the Institute of Water Research (IWR) and explain what makes its approach unique?

The uniqueness of our approach lies in the fact that we address real-world contemporary challenges through a process that includes co-creation of solutions (that generally involves real-time decision support tools). This co-creation involves end users, government, industry, environmentalists and policy makers, as well as both basic and applied researchers, educators and technical support.

IWR facilitates, informs, enriches and operationalises the process. The indigenous knowledge of end users is frequently a critical part of the ultimate operational system. Information technology systems that are usually web accessible for all participants are often maintained by IWR and continually updated to allow analysis of progress, identification of potential new problems and acknowledgment of successes.

The IWR website is rich in content, including online tools and courses. Why are these activities important for the Institute?

We look at the website as a component of a larger outreach activity for the dissemination of new information and ideas. As such, it provides access to our array of web-accessible tools. IWR is continually evolving, with new research findings and tools to equip leaders and organisations with resources, education and motivation. The utilisation of these findings and technologies helps assure a more sustainable planet that incorporates sustainable practices for an ever-growing population.

Tool innovation and development is key for IWR. Can you give an insight into some of the tools the Institute is involved with?

We have ongoing projects in collaboration with Michigan's Department of Environmental

Quality and numerous other government agencies, state-wide water guidance committees and basin-wide organisations. We are continuing development on a number of tools to aid with more informed decision making, in order to both enhance food production and assure sustainable water resource ecological systems.

Many discussions have involved the evolution of the Water Withdrawal Assessment Tool (WWAT) process that we initially programmed and brought online. The WWAT system has guided decision making relative to new high-capacity wells over the past five years. Now, however, the system is revealing numerous watersheds in the state that may be approaching their limit, as new wells may be having an adverse resource impact on nearby streams. Thus, even more advanced approaches need to evolve in order to better manage today's problems. IWR is working to co-create these progressive web-based decision-support systems for guiding actions related to water quantity and quality, using systems such as the Great Lakes Watershed Management System, High Impact Targeting, and Environmental Learning Using Computer Interactive Decisions.

As part of IWR's commitment to education, students learn from a breadth of topics including science, law and economics. How does Michigan State University support these interdisciplinary approaches?

Many of the faculty and staff at IWR have joint appointments and/or assignments in academic departments in a variety of colleges throughout the University. Through these individuals our activities find their way into widely dispersed classes. Additionally, we have developed a Watershed Management Certificate Programme which has four three-credit courses that are available on the web. These classes can be taken for credit by Michigan State University students

or attended by others for a Certificate of Completion.

Overall, offering this series of courses has benefited students and those working in a variety of professions; they have been able to attend the programme and greatly enhance their understanding of environmental and watershed management and planning.

Finally, what do you hope to achieve before 2020, in terms of improving wider engagement in, and commitment to, sustainable practices?

We are confident that we have provided many individuals and organisations with new concepts, processes and tools to serve as a starting point for further growth and dissemination of 21st Century information technologies. Furthermore, we hope that the development of new and improved tools will help our users find solutions to guide the sustainability of natural and agricultural systems and their interactions. Some of our successes will inform and motivate individuals around the globe to co-create with colleagues to evolve even better management methods solutions, and new policies that specifically incorporate the decision-support technologies.

As more systems are put in place, databases can compile information from the deployed web tools with the aid of satellites and expanding ground measurements and other data inputs. This is so that, in real-time over space, we can keep assessing the degree of our progress, learn from the outcomes and continue to improve decision-support tools. In analysing the interconnectivity between them and users, we can ensure a brighter future.

Water wonderful world

Researchers at **Michigan State University** are creating integrated information technology systems to inform decisions that improve water quality and sustain food production and ecology. They hope their work will help provide solutions for future generations

WATER IS ESSENTIAL for life and yet, according to the latest figures on Water.org, 769 million people in the world currently do not have access to it. More than 840,000 people die each year from a water-related disease, so even those with access to water are not necessarily safe from harm. Indeed, according to an announcement made by the World Economic Forum in January 2015, the water crisis facing humankind is the single biggest global threat (based on its impact on society as a measure of devastation).

As the Earth is effectively a closed system, the total amount of water it contains is more or less constant. The volume – made up of liquid, solid, gas or biological – totals approximately 1.4 billion cubic metres. However, while the net volume of water will never change, the population of the Earth will. The UN has projected that there will be approximately 2-3 billion more people on the planet by 2050. This increase will naturally lead to greater demand for water for a range of uses, such as drinking, washing, power, transportation, ecological needs and food production. It is therefore extremely important for the human race to consider ways in which the world's natural resources of water can be protected both now and for future generations.

QUALITY COORDINATIONS

The Michigan State University (MSU) Institute of Water Research (IWR) was established to address some of the challenges facing contemporary land and water resources. Led by Director Dr Jon F Bartholic, the team coordinates multidisciplinary efforts surrounding water quality and quantity problems, and investigates land use from a watershed perspective. One key method of satisfying the need to conduct and facilitate research and outreach has been the development of methods to understand the processes affecting resources, monitor trends and model the potential impacts of behaviours.

Ultimately, IWR provides vision, supports activities and supplies information on constituents within critical water issues. Educating people on the problem is necessary for solutions to be widely adopted and to emphasise the universal responsibility required to protect resources. "At IWR we have encompassed techniques and approaches that utilise satellites, databases, modelling and the internet to provide various scenarios and options at different scales," Bartholic adds.

INFORMATION FLOW

The team's endeavours have culminated in the establishment of a series of web-based tools to aid and empower local organisations and units

SIDMA

The Social Indicators Data Management and Analysis (SIDMA) tool, part of the Social Indicator Planning & Evaluation System developed by the Great Lakes Regional Social Indicators team, provides the general public with consistent measures of change within a specific watershed. It can be used by decision makers at local, state and federal levels to estimate and assess the impact of any efforts and resources put in place.

Tracking progress is an effective tool for measuring the success of a system, or for confirming whether or not attitudes, awareness and behaviours are changing within a particular community. Encouraging individuals to take responsibility for their actions is key to achieving water quality goals in the future.

www.iwr.msu.edu/sidma

INSTITUTE OF WATER RESEARCH

OBJECTIVE

To establish an institute that effectively links science and technology for the sustainable management of water resources.

KEY COLLABORATORS

US: **The Nature Conservancy • US Army Corp Engineers • Great Lakes Protection Fund • US Environmental Protection Agency • Great Lakes Restoration Initiative • US Department of Agriculture • National Institutes of Food and Agriculture • US Geological Survey • US Department of Agriculture • Natural Resources Conservation Services • US Environmental Protection Agency • The Stewardship Network • Great Lakes Commission • Michigan Department of Agriculture & Rural Development • University of Michigan • AgBio Research; Michigan State University Extension**, Michigan State University

INTERNATIONAL: **American University of Central Asia**, Kyrgyzstan • **Lanzhou University**, China • **MS Swaminathan Research Foundation**, India

CONTACT

Dr Jon F Bartholic
Director

Institute of Water Research
Michigan State University
East Lansing
Michigan
48823-5243
USA

T +1 517 353 3742
E iwr@msu.edu

www.iwr.msu.edu

[@IWR_MSU](https://twitter.com/IWR_MSU)

www.facebook.com/IWR.MSU



DR JON F BARTHOLIC is Director of the Michigan Institute of Water Research (IWR). He focuses on water quality-quantity issues, using information technologies to develop

web-based decision support systems to address a wide range of critical water-land use issues from a watershed perspective. As Director, he collaborates with universities and international colleagues, as well as local, state, regional, governmental and international organisations. IWR is one of 54 water institutes located at each land grant university in the US and its territories.



of government in protecting the world's natural resources. For example, the Great Lakes Watershed Management System (GLWMS), is one of the first online systems to allow web-based field level estimates of sediment and nutrient load reductions. It enables users to conduct field-scale scenario evaluations of land cover changes and develop best management practices (BMPs) online.

Additionally, the System enables users to discover the benefits of particular actions: "The BMPs are automatically geo-referenced so cumulative benefits can be determined and shown spatially," Bartholic points out. "GLWMS can enhance local cooperation, understanding and problem/solution implementation." Such a web-accessible science-based system ensures that those responsible for implementing practices can do so from a well-informed perspective.

ENCOURAGING EVOLUTION

Other systems co-created by the multidisciplinary team, including NECO, SIDMA

and GLCCN (see boxouts), intend to ensure informed decisions are made for improving water quality and availability. Alongside this, MSU supports IWR's commitment to educating students in alternative ways: "Students are provided with access to the newest web-based information technology tools being developed. This growing group of better informed individuals from throughout the state and region has established an impressive network for dissemination and utilisation of new findings from IWR and other research facilities," Bartholic explains.

Ultimately, the programmes and tools IWR has established, and continues to develop, facilitate an education, leading to better qualified critical feedback, which is crucial to applying newfound knowledge. By encouraging collaborations and pooling of knowledge, the potential reach for the employment of sustainable practices is global.

NECO

Networked Neighborhoods for Eco-Conservation Online (NECO) is a web-based system developed by IWR. It helps individuals in the Great Lakes region map to share information, photos and experiences about their rain barrels, rain gardens and other water conservation practices.

The site has three main goals:

- Increase the effectiveness of existing environmental groups and organisations
- Motivate individuals to adopt environmentally beneficial behaviours and practices
- Improve the health of the Great Lakes through the adoption of environmental stewardship practices

By focusing on connecting people through their site and social media channels, NECO encourages and inspires people from the region to come together to make a tangible difference to their environment.

www.networkedneighbors.org

GLCCN

The Great Lakes Clean Communities Network (GLCCN) was established to facilitate change by encouraging people to forge partnerships, collaborate and generate new ideas. Supported by the Great Lakes Protection Fund, the Network, which is set to launch later this year, features a central online hub and will include four main components:

- **Connect:** Creating a network of environmental practitioners in communities and organisations throughout the Great Lakes
- **Share:** Providing a platform for people to discuss their ideas and strategies to address environmental concerns in a community
- **Tools:** A catalogue of helpful online tools, tips and technology to help improve the local environment
- **EcoScore:** Enabling individuals to chart and evaluate progress towards achieving their own environmental goals

www.iwr.msu.edu/glccn