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Tuesday, Nov. 10
3:30 PM – 5:00 PM
SESSION 31: Sustainability, Decision Making and Education

The Role of Water Conservation Technology, Economics, and Institutions for Managing Groundwater Use Conflicts - Saichon Seedang, Michigan State University-IWR, East Lansing, MI (co-authors: Patricia Norris, Jon Bartholic)

Concerns over groundwater use impacts on stream ecosystems have emerged in many parts of the country. There are no exceptions, even in water rich areas such as Michigan and other states of the Great Lakes Basin. The enactment of a series of Michigan water use laws during 2006-2008 resulted in the establishment of groundwater policies that consider ecological water use to be a part of water allocation decisions, though conflicts have evolved from these changes of policy. The new Michigan water use laws increased the role of state agencies for overseeing and managing groundwater use by requiring registering and permitting for large withdrawals. In addition, the laws introduced a new decision tool, the Water Withdrawal Assessment Tool, to assess and evaluate the impact of groundwater withdrawal on stream flows. The state cannot register or permit any new or increased withdrawals that may reduce or impair the ability to support characteristic fish populations. Michigan's adoption of the riparian doctrine means that surface and groundwater use rights lie with property owners, and the introduction of the state's new laws may result in potential water use conflicts if a new or increased withdrawal is denied. Important questions associated with potential conflicts include: in what areas is water availability likely to be limited, how will existing and potential water users respond to limited water, and what opportunities may exist to resolve conflicts? This paper discusses potential water use conflicts resulting from recently enacted groundwater use laws in Michigan and how the role of water conservation technology, economics, and institutions can be used to shape water policy. It also focuses on an innovative policy that incorporates technology, economics, and community involvement that may be introduced to resolve these potential water use conflicts and can possibly be applied to other Great Lakes states.

Using Agent-based Models to Study Farmer Behavior in Irrigation Water Usage - Sanyogita Andriyas, Utah State University, Logan, UT (co-authors: Mac McKee, Thomas B. Hardy)

Optimal management of irrigation water is a potential concern all over the world. Currently, most farmers decide to irrigate on the basis of experience, visual inspection of crop or soil status, or water availability, regardless of whether the crop needs it or not. From the perspective of irrigation canal management, these behavioral factors make it difficult to forecast short-term aggregate demand for irrigation water. In forecasting irrigation water demand, various socio-economic factors are usually ignored, such as remaining water rights, anticipated yield, and expected sale price. This paper attempts to explore possible important socio-economic factors that influence a farmer's decision process for ordering irrigation water in order to obtain an overall estimate of short-term water demand at the canal level. The object-oriented capability of the Java language has been exploited to create an agent-based environment in which "agents" (farmers, fields, crops) are modeled to follow simple rules of behavior and allowed to interact over time. The rules of action can be modified and allowed to emerge in order to test various hypotheses which are found to influence the process of decision making with regard to irrigation.

Computer-Aided Negotiations of Water Resources Disputes: An Interdisciplinary Case Study-Based Course - Megan Rivera, HydroLogics, Inc., Columbia, MD (co-authors: Daniel P. Sheer, Andrew J. Miller)

Water resources managers must balance many competing objectives, such as securing a reliable water supply, mitigating flood damage, enhancing ecosystems, supplying irrigation, producing hydropower,

protecting fisheries, and maintaining recreational areas. These objectives draw on knowledge from a wide range of disciplines-- economics to hydrology, law to ecology. In addition, negotiation skills are needed to create mutually beneficial solutions to resource disputes. An innovative course, Computer-Aided Negotiations of Water Resources Disputes, was developed with support from NSF's Course, Curriculum, and Laboratory Improvement Program and piloted in fall 2008. Thirteen undergraduates at the University of Maryland Baltimore County successfully negotiated an alternative management policy for the Delaware River Basin. Each student role-played a stakeholder, developing performance measures, such as the number of days flows caused property damage, acres of habitat for endangered dwarf wedge mussels, safe yield for northern New Jersey water supply, and number of recreation impact days on Lake Wallenpaupack. The students, then, worked in small groups to develop alternative operating policies that targeted all of the performance measures. They used the same computer model as the Delaware River Basin Commission to develop and evaluate alternatives. Because the consent decree on the Delaware River Basin requires all of the decree parties to agree to proposed operational changes, their alternatives needed to performed as well or better than the current operations for all the parties. Finally, the students combined their operating policies in preparation for and during two Computer Aided Negotiation (CAN) sessions. All of the groups contributed to the operating policy. Many of the experiences the students had during the semester mirrored the experiences of participants in actual CAN processes. According to the students' post-course survey, the elements of the course that best supported them in the negotiation process were discussions with the instructor, information on the internet, information presented in class, written documents, and other course requirements. There has been widespread interest in offering the course in various formats, and we will be providing targeted support to help facilitate course adoption in the fall 2010 semester.

NSF IGERT at Southern Illinois: Watershed Science and Policy - Christopher Lant, Southern Illinois University, Carbondale, IL (co-authors: Nicholas Pinter, Lizette Chevalier, Matthew Whiles, Sara Baer)

The proposed Integrated Graduate Education and Research Traineeship (IGERT) program would establish a PhD program in Watershed Science and Policy at Southern Illinois University Carbondale (SIUC), emphasizing three key elements: (1) multidisciplinary education crossing traditional boundaries between science and policy, (2) team-based critical thinking and problem-solving, and (3) the application of scientific knowledge within a policy and management context. The central approach will be to train each year's IGERT class as a collaborative, interdisciplinary cadre – "a nucleus or core group of trained personnel able to assume control and to train others." In this model, the SIUC Watershed IGERT would recruit, mentor, and train a diverse group of outstanding PhD students to become the scientists, managers, and leaders who will tackle tomorrow's interconnected environmental, social, economic, and technical challenges at watershed and river basin scales. The late 20th century brought a new era in water-resources management, emphasizing collaboration and involving stakeholders in consensus-building and adaptive management. Traditional, single-discipline graduate education can no longer address the complex issues of water and watershed management in the 21st century. Instead, this new era demands inter-disciplinary approaches that integrate scientific research with resource management and policy-making, with the goal of creating science-literate leaders and policy-literate scientists for placement in government, academia, and the for-profit and non-profit private sectors. The SIUC IGERT program would respond to these needs with several unique features: (1) team-based collaboration; (2) a ground-up multidisciplinary approach to watershed issues; (3) integration of under-represented groups as students, mentors, and trainees; (4) model-based data synthesis; (5) practical experience via extended internships; (6) exposure to transboundary rivers and international watershed-management issues; and (7) graduates with training in national and international best practice in integrated watershed science and management. This proposal addresses several of NSF's current focus areas—coupled natural and human systems as well as coupled biological and physical systems—while increasing the diversity of inter-disciplinary scientists and building capabilities to diagnose and resolve complex environmental challenges.

Reasons for Low Access to Water in Expanding Urban Centres - the Example of Quetta - Ian Cordery, UNSW, Sydney, NSW, Australia (co-author: Kamran Asghar)

Accessibility to a safe water supply is essential for human life. In the last 30 years the proportion of the world population with such access has declined. Developing countries are reluctant to install or upgrade piped water supply infrastructure as this is viewed as prohibitively expensive. Solutions that are economically feasible and sustainable are needed. A survey of 546 water users and water vendors was conducted in Quetta , Pakistan. The Survey data revealed that while the poor in Quetta are already paying high prices for water delivered by vendors, more than half the households receiving government provided piped water refuse to pay anything, and overall the majority of respondents believe piped water should be provided free of charge. The current piped water supply in Quetta was found to be irregular and unreliable forcing most to depend on vendor supplied water, and to pay high prices for that water. As a result of low payment collection, the public water supply body is struggling to maintain the current inadequate system. This is an inequitable and unsustainable situation. Currently the 30% of households with a piped but unmetered water connection are charged about Rs125 ($US2.10) per month, but vendors charge about Rs1 ($US0.02) for 6 litres. The inequity and economic absurdity of the situation is obvious. Funds currently actually paid to water vendors by the population of more than 1.5M would easily fund the operation of a potentially safe, reliable, piped water supply system for all. Imaginative tariffs for metered supply would be needed to ensure the poor were not excluded. However, due to the very low payment collection the water supply body cannot maintain its inadequate system. Construction of a universal self funding piped and metered supply system would seem to be the logical solution. However before self funding could be realised a major public education program would be needed to inform the population of the real cost of water and to persuade the legislators of the need to enforce collection of water charges.