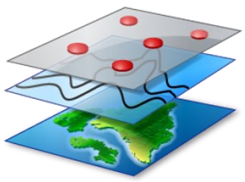
OKLAHOMA
EPSCoR UPDATE
Promoting Innovative Research
OK NSF Experimental Program to Stimulate Research | May 2017

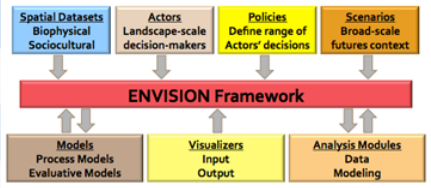
Modeling Land and Water Use Synergies in Oklahoma City

Oklahoma's highly variable weather and large precipitation gradient work together to create a diverse landscape that is extremely vulnerable to climatic extremes. As shown by the prolonged drought in 2011-2013, Oklahoma's municipal water supply has come under stress due to additional demand. To develop sustainable natural resource supplies that support a vibrant economy with healthy and productive citizens, we need to develop robust knowledge about social and ecological systems, which will be used to empower city planners and other decision makers to effectively adapt to climate variability and climate change.

An EPSCoR research team led by Dr. Tracy Boyer, Associate Professor in Agricultural Economics, Oklahoma State University (OSU); Dr. Jennifer Koch, Assistant Professor in Geography and Environmental Sustainability, University of Oklahoma (OU); and Dr. Heather McCarthy, Assistant Professor in Microbiology and Plant Biology (OU); and OSU faculty collaborators, Drs. Peter Kedron (Geography) and Richard Melstrom (Agricultural Econ.), is developing an integrated socio-ecological systems model for the Oklahoma City (OKC) Metropolitan area, using the ENVISION framework. Postdoctoral researchers, Dr. Monika Ghimire (OSU) and Dr. Qintao Zhou (OU) collaborate frequently to integrate the sizable data and modeling needs into the modeling platform.



"ENVISION is a platform for integrating many large datasets to develop simulations of how land use and climate will effect human well-being, in this case as measured by municipal water use, outdoor activity, and recreational use," Boyer said. "For the first cut, we are modeling water use, but as we work with the city, state agencies, and epidemiologists, we hope to garner further support to look at other interesting issues common to many cities such as the urban heat island effect, air quality, and human health," Boyer added. The strength of the



ENVISION framework lies in its ability to synthesize newly collected as well as existing data, models, and findings into one integrated simulation model. For example, Drs. Boyer and Ghimire found that the use of inclining block rates for water pricing in Oklahoma City, which began in 2014, reduced water use by 14% for a 10% increase in price. Such a change is necessary to induce high volume users to reduce summer peaks in demand due mainly to irrigation. A group led by Dr. Melstrom recently completed data collection on fishing, which is a popular outdoor activity among diverse populations in the OKC metro area. This study will provide a socio-economic indicator of how climate variability affects outdoor recreational behavior. Recreational behavior serves as a proxy for access to activities that promote well-being and community in urban areas.

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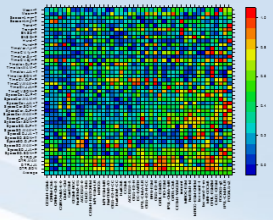
Additionally, OKC ENVISION team has created a concept for analyzing dynamic relationships between climate, domestic water use, and greenness of the landscape with the involvement of stakeholders from agencies such as Oklahoma City Water Utilities Trust, Oklahoma City Planning, and Oklahoma City Parks and Recreation. The relevant data, models, and findings needed for the integrated model have been compiled, and simulation scenarios are anticipated by the end of summer 2017.



The resulting research will enhance our understanding of how socio-ecological systems can adapt sustainably to increased climate variability through the development of an innovative integrated model to project and explore future states of socio-ecological systems. The model will help us understand our adaptive capacity and how we use ecosystem services such as freshwater, green space, and recreation in a changing climate. The principle outputs will aid in future planning by showing potential future land use. By modeling demand for water given natural stressors, demographic change, changing pricing policy, and changing land use, city planners, other decision makers, utility managers, and citizens can better anticipate and manage environmental risks from heat and drought.