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## Analyzing the Relationship between Climate, Vegetation Characteristics, and Water Use for the Oklahoma City Metro Area

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**Abstract:** Oklahoma's highly variable weather and large precipitation gradient work together with population growth and urbanization to create a landscape that is extremely vulnerable to climatic extremes. As shown by the drought in 2011-2013, Oklahoma's municipal water supply has come under stress from additional demand. To develop sustainable natural resource supplies that support a vibrant economy with healthy citizens, we need to develop robust understanding of these complex socio-environmental systems, which can be used to empower decision makers to effectively adapt to climate variability/change. For this purpose, we develop a spatio-temporal simulation model for the Oklahoma City Metropolitan area, which helps elucidating the relationship between climate, land use/cover, and residential water use. Major outcomes are the development of sub-models on spatio-temporal development patterns and factors driving household water use and landscape greenness. These intermediate results have already led to improved understanding of the system under study. For example, we initially expected that landscape greenness, reflecting both vegetation cover and condition, would be strongly influenced by residential water use (irrigation), which would allow the landscape to be buffered against drought and other climate stress. Contrary to this expectation, we found that climate, particularly temperature, is a much more important driver of vegetation greenness. Here, we will describe the different sub-models and our approach for combining them into one integrated model making use of the ENVISION modeling framework. We will furthermore discuss how our work can be visualized in form of story maps and how the model may help effective decision support.

**Keywords:** socio-environmental systems; Oklahoma EPSCoR; climate change; ENVISION; water use;