The U.S. National Watershed-Economy Connectivity Project (NWEP)

Benjamin L. Ruddell, Arizona State University, bruddell@asu.edu

Abstract

The human economy results in massive non-natural fluxes of water, energy, nutrients, and raw materials in and out a city. It is therefore essential to quantify these anthropogenic fluxes and flows, in addition to the natural fluxes and flows (e.g. natural climate, hydrology, nutrient cycling, nitrogen deposition and emission). Urban Metabolism and Footprinting techniques are a maturing family of methods based on analysis of economic trade data that allow us to quantify anthropogenic fluxes and flows, and the inter-connections with distant ecosystems, created by human economic demand. These techniques reveal unseen vulnerabilities and sustainability problems for cities, and show us that remote ecosystems and natural resources have connectivity to the world’s urban economic powerhouses. By understanding these connections, we can use engineering, business, and economic policy to drive sustainability on both ends of the connection. Cities have tremendous indirect financial and political power to manage and improve global ecosystem impacts through their systemic connections- or to worsen problem.

The National Watershed-Economy Connectivity Project (NWEP) is mapping these connections for every county and city in the United States, creating a transformational database for municipal and corporate ecological sustainability decision making. The primary connection via which cities impact water resources is irrigated agriculture, and the impacts occur especially at small spatial scales below 100 km2 and during the warm part of the growing season. A successful determination of this connectivity requires robust data and modeling of watersheds and the economy at these scales. This talk gives specific examples of how to determine how sustainable and diversified a city’s direct and indirect water supply is, and how to take proactive action to select for more sustainable connections. Right-sizing of water supplies and value-based water allocation policies for cities are also discussed. These principles will become increasingly critical for water resource management in a future where everyone is directly or indirectly affected by climate change, drought, and strained natural resources.

Bio

Dr. Ruddell serves on the Engineering Faculty at Arizona State University. He is a specialist in complex systems and network theory approaches, and in their applications to improve modeling and policy in the domain of ecohydrology, climate, cities, health, energy, and water resources. Recent interdisciplinary findings of this work includes diagnostics of self-organization and complexity in ecohydrological models, forecasting of ecosystem state change under climate change, delineation of human health and power grid relationships to climate events in southwestern US cities, and mapping of connections between US cities and water resources. Dr. Ruddell works with urban planners and utility operators, along with disciplinary modeling and science experts, to achieve real-world impacts using empirical systems science.