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Socio-Environmental Resilience and Complex Urban Systems Modeling

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The increasing pressure of climate change has inspired two normative agendas; socio-technical transitions and socio-ecological resilience, both sharing a complex-systems epistemology (Gillard et al. 2016). Socio-technical solutions include a continuous, massive data gathering exercise now underway in urban places under the guise of developing a 'smart'(er) city. This has led to the creation of data-rich environments where large data sets have become central to monitoring and forming a response to anomalies. Some have argued that these kinds of data sets can help in planning for resilient cities (Norberg and Cumming 2008; Batty 2013).
In this paper, we focus on a more nuanced, ecologically based, socio-environmental perspective of resilience planning that is often given less consideration. Here, we broadly discuss (and model) the tightly linked, mutually influenced, social and biophysical subsystems that are critical for understanding urban resilience. We argue for the need to incorporate these sub system linkages into the resilience planning lexicon through the integration of systems models and planning support systems.
We make our case by first providing a context for urban resilience from a socio-ecological and planning perspective. We highlight the data needs for this type of resilient planning and compare it to currently collected data streams in various smart city efforts. This helps to define an approach for operationalizing socio-environmental resilience planning using robust systems models and planning support systems. For this, we draw from our experiences in coupling a spatio-temporal land use model (the Landuse Evolution and impact Assessment Model (LEAM)) with water quality and quantity models in Stockholm Sweden. We describe the coupling of these systems models using a robust Planning Support System (PSS) structural framework. We use the coupled model simulations and PSS to analyze the connection between urban land use transformation (social) and water (environmental) systems within the context of planning for a more resilient Stockholm. This work shows that complex urban systems models can help bridge the divide between socio-technological and socio-environmental systems knowledge and achieving resilient urban areas.