

## Writing Sample

### Cities as Complex Social-Ecological Systems

What does it mean to take an ecosystem approach to the study of ecology and/or society? Broadly considered, an ecosystem has no pre-determined scale or boundaries and is instead defined as the interaction between organisms and their environment (Tansley 1935). Its boundaries are drawn in order to answer a specific question. In this sense an ecosystem is a dynamic concept—rather than a physical entity—taking into account many interactions that vary over time. This approach naturally lends itself to defining hierarchical or nested systems, which are characterized by elements interacting horizontally with each other and vertically with larger organizing structures. Cities, like natural ecosystems, can be characterized as complex open systems (Kay et al. 1994, 1999) and may dominate or be more equal parts of a larger network of other urban areas (Ausubel and Herman 1988). Alberti et al. (2003) extend that globally and, certainly at regional scales, environments are human-dominated and the study of social-ecological systems is necessary to accurately describe social and ecological processes.

These social-ecological systems are self-organizing and can be thought of in terms of resilience (adaptability) and transformability (ability to fundamentally change state) (Walker 2006). According to Levin (1998) a complex adaptive system is that in which “patterns at higher levels emerge from localized interactions and selection processes acting at lower levels.” This is true of ecosystems, and also the economy, where the actions of individuals are made with intent, but “self organize” into larger patterns that do not embody the same intent (Alberti et al. 2003, Ausubel and Herman 1988, Walker 2006). These systems are dependent upon history and relationships among elements which often are time-lagged and non-linear (Levin 1998). As recipients of energy flows, complex adaptive systems naturally go through phases of organization: exploitation/growth, conservation, release and reorganization (Kay et al. 1994, 1999). The larger the reach and complexity of the system, the greater the uncertainties and risks associated with individual actions. Insufficient efforts have been taken to model complex dynamics at the global (Janssen 1998) and more local scales.

Though a legitimate challenge, researchers such as Alberti et al. (2003) see the opportunity to finally link ecological and social sciences in the study of cities as emergent phenomena embedded within a spatial and historical context of interacting processes. If we approach cities as social-ecological systems we must embrace change and evolution. There is no single optimal state towards which we may strive (Walker 2006, Rotmans 2006) and planning for maintenance or avoidance of change seems unrealistic, and even dangerous. Rather we anticipate change and plan for resilience—the degree to which a system can undergo change and retain its major organization and functioning—and build it into our cities (Alberti et al. 2003, Walker 2006). Here the goal becomes maintaining the social-ecological system’s ability to evolve and develop.