DISSERTATION DEFENSE

Effects of Urbanization on Arthropod Diversity, Community Structure and Trophic Dynamics

by Christofer Bang Jr.

Monday November 15, 8:30am, in GIOS 481

Committee: Stanley H. Faeth (Co-Chair), John L. Sabo (Co-Chair), Nancy B. Grimm, J. Marty Anderies, Paige S. Warren

Abstract: Urban ecosystems cover less than 3% of the Earth's land surface, yet more than half of the human population lives in urban areas. The process of urbanization stresses biodiversity and other ecosystem functions within and far beyond the city. To understand the mechanisms underlying observed changes in biodiversity patterns, several observational and experimental studies were performed in the metropolitan area of Phoenix, Arizona, and the surrounding Sonoran Desert. The first study was comprised of seven years of arthropod monitoring using pitfall traps in common urban land use types. This study revealed differences in community structure, diversity and abundance over time and between urban and wildland habitats. Urban habitats with high productivity had higher abundances of arthropods, but lower diversity compared to wildland habitats. Arthropod abundance in less productive urban habitats was positively correlated with precipitation, but abundance in high productivity urban habitats was completely decoupled from annual fluctuations in precipitation. This study showed the buffering capacity and the habitat heterogeneity of urban areas.

To test the mechanisms controlling community diversity and structure in urban areas, a major field experiment was initiated. Productivity of the native shrub *Encelia farinosa* and bird predation of associated arthropods were manipulated to test whether bottom-up or top-down forces were more important in urban habitats compared to wildland habitats. Abundance, richness and similarity were monitored, revealing clear differences between urban and wildland habitats. An unusually cold and dry first season had a negative effect on plant growth and arthropod abundance. Plants in urban habitats were relatively unaffected by the low temperature. An increase in arthropod abundance with water availability indicated bottom-up forces in wildland habitats, whereas results from bird exclusions suggested that bird predation may not be as prominent in cities as previously thought. In contrast to the pitfall study, arthropod abundance was lower in urban habitats.

A second field experiment testing the sheltering effect of urban structures demonstrated that reduced wind speed is an important factor facilitating plant growth in urban areas. A mathematical model incorporating wind, water and temperature demonstrated that urban habitats may be more robust than wildland habitats, supporting the empirical results.