Symposium: Effects of Human Choices on Characteristics of Urban Ecosystems

Most urban ecology in cities remains an "ecology in cities" rather than an "ecology of cities." Accomplishing the latter requires the inclusion of humans within the concept of "ecosystem," both how humans alter the properties of urban ecosystems and how these alterations in turn influence human well-being. These influences are both direct (e.g., physiological and psychological influences on the human organism) and indirect, by influencing ecosystem sustainability.

For the 2007 ESA meeting, Larry Baker, Loren Byrne, Jason Walker, and Alex Felson organized a symposium to address the relationships among human choices and urban ecosystems. In the introductory talk of this symposium, these authors discussed how the cumulative effect of individual household choices can have major effects on the properties of urban ecosystems. For example, direct resource consumption by households accounts for 40% of U.S. energy use; in the Twin Cities of Minnesota, households account for 75–80% of total N and P inputs. Households also have a major impact on vegetation biodiversity in cities. Drawing from the social science literature, this first talk introduced the variety of conceptual models that have been put forth to understand how humans make choices. Economists use classic supply–demand models to understand consumption of market goods (such as energy) and other tools to understand the value of nonmarket goods. Environmental psychologists have often used the Theory of Planned Behavior and related models to explain barriers to adopting specific environmental practices. Political scientists focusing on group processes stress the process by which choices are made and the distributive effects of decisions. Although ecologists often focus on how human behaviors are environmentally destructive, there are also many examples of how collective choices have had very positive environmental outcomes. These include large declines in soil erosion and smaller declines in fertilizer P use by farmers in the United States, widespread adoption of household recycling, greatly reduced household water consumption in some water conservation programs, and rapid increases in the sales of the Prius hybrid automobile in recent years. Programs leading to these positive environmental choices generally include a mix of several of the following: a persistent, meaningful message; dissemination of accurate, trusted knowledge; early adoption by trusted individuals; financial incentives or disincentives; targeting of high-consumption individuals; direct regulations; personal economic benefit and feedback.

Three presenters examined factors regarding choices of managing the vegetation in urbanized landscapes. Morgan Grove from the Baltimore Ecosystem Study (BES-LTER) discussed an "ecology of prestige" in which consumption and expenditure on environmentally relevant goods and services are motivated by group identity and perceptions of social status associated with different lifestyles, and have used this theory to examine landscaping patterns. Grove and his colleagues combined high-resolution social and ecological spatial and temporal data such as property parcels and land cover (>1 m) with composite measures of population, social stratification, and lifestyle for this presentation. Fig. 1 shows the relationship between percentage tree canopy cover (height of bars) with PRIZM lifestyle classifications. Of particular interest in a long-term context is the relationship between cause and effect: the possibility that some social groups are attracted to and conserve existing, desirable landscapes at a neighborhood scale, while others move to and rehabilitate their landscapes.

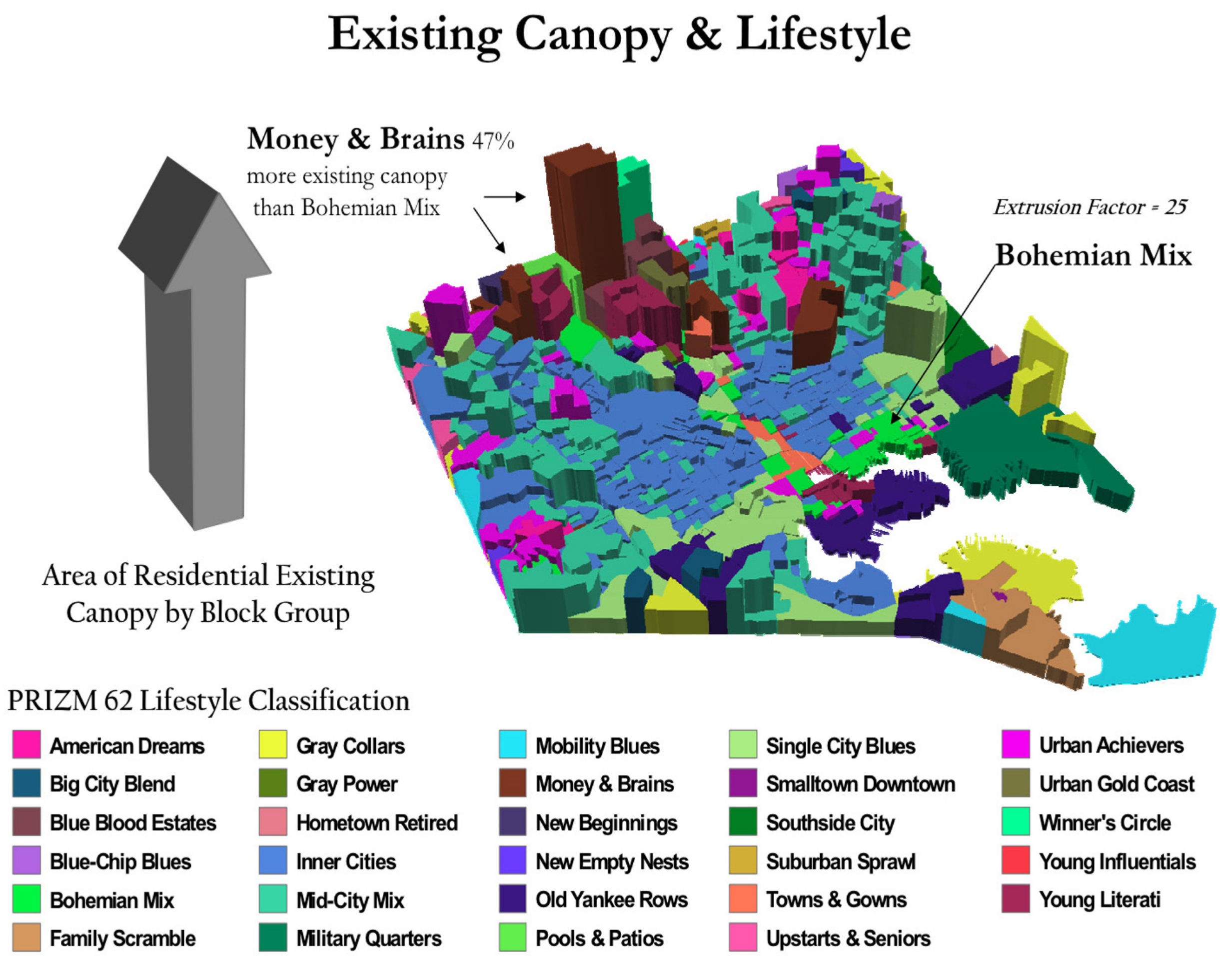

Fig. 1. Tree canopy (% cover) vs. PRIZM lifestyle categories for the Baltimore area.

Vivek Shandas from Portland State University examined the effect of landscape preferences on stream condition in the Puget Sound lowland for seven streams with varying levels of urbanization.

Biological measurements included a Benthic Index of Biotic Integrity (BIBI) and riparian tree canopy, determined by remove sensing. Homeowner preferences were determined by administering a stated-preference survey that included visual, behavioral, and informational dimensions of property management. Riparian canopy was directly correlated with BIBI (R2 = 0.58). Although survey responses stated a strong preference for heavily canopied scenes (R2 = 0.8), there was no relationship between stated preference and actual amount of riparian canopy on respondents' properties.

There was also a direct correlation between property value ($/square foot) and percentage forest on riparian parcels. Survey results indicated that there were significant barriers to adoption of a preferred condition (riparian canopy), particularly a lack of knowledge and land use restrictions. The most trusted sources of information were professional associations and friends, family and neighbors; the lowest were state and federal government. A key conclusion is that understanding how vegetation choices are made is critical to engaging private property owners in conservation behavior.

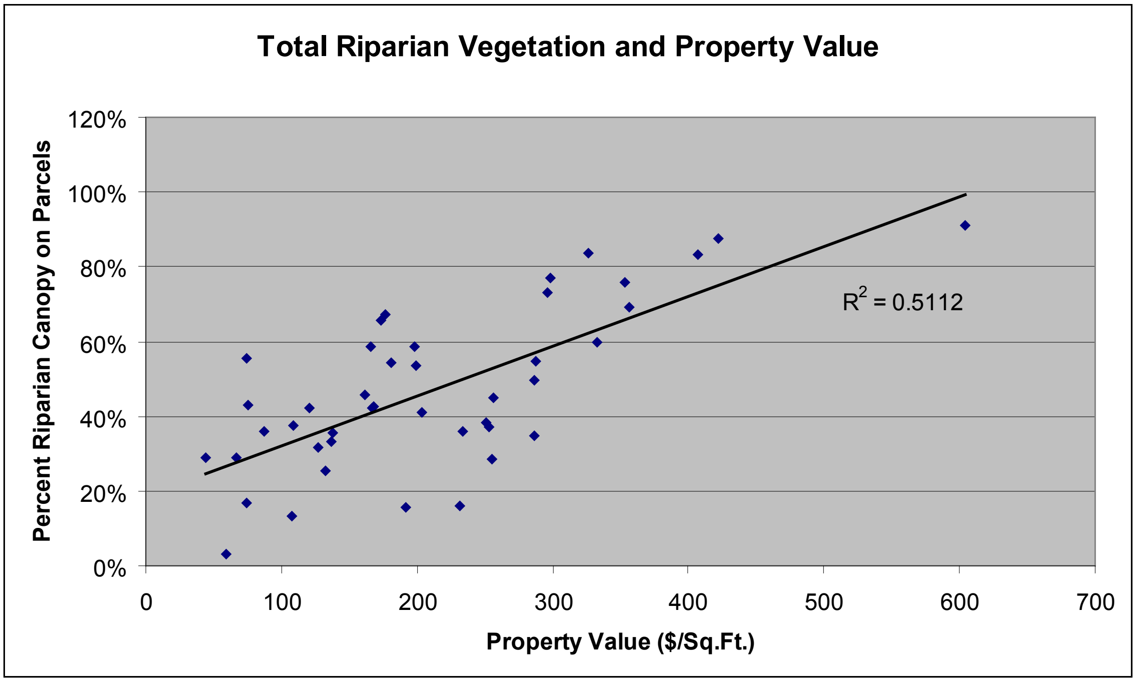

Fig. 2. Relationship between riparian canopy (% cover) and property value ($/square foot).

In "Money grows trees: a socioecological path analysis," Jason Walker and John Briggs from the Central Arizona–Phoenix (CAP) LTER project examined the question, "How does social stratification affect residential development in the Phoenix metropolitan area, and how do those interacting factors determine woody vegetation abundance?" To answer this question, vegetation was classified throughout the CAP system (Fig. 2) and social data were compiled from U.S. Census tracks. Path analysis, a type of structural equation modeling, was used to analyze results. Results showed that income had both direct and indirect effects on vegetation, as did age of neighborhood (older → more vegetation) and housing density (higher → more vegetation). Affluent communities have a disproportionately strong effect on the amount of urban vegetation within Phoenix.

Tony Brazel's presentation (co-authored by Sharon Harlan, Lela Preshad, Will Stefanov, Darell Jenerette, Lisa Larsen, and Nancy Jones) examined the shaping of urban microclimates (Figs. 3 and 4). The urban heat island is particularly problematic in Phoenix, contributing to discomfort, heat exhaustion, air pollution, increased energy costs, and other problems. Choices of landscaping, water systems, housing types, density patterns, architectural design of communities play a large part in the shaping and evolution of space–time microclimates.

Microclimate at the neighborhood scale is strongly affected by vegetation cover and housing density, with higher temperatures occurring in low-income neighborhoods. Surveys in Phoenix reveal a perception that the

Fig. 3. Aerial photograph (left) and classified vegetation cover (right).

urban climate is warming and that air pollution is worsening. There is willingness to pay (via home prices) for temperature reductions of 5°–10° F. Respondents also strongly prefer mesic or oasis landscapes over xeric or native desert landscapes. The future resides in debates on preservation, adaptation, and mitigation of urban ecological factors that would shape microclimates—thus, a shaping that has various levels of human influence and intentionality.

Kristen Nelson's presentation, "Influence of choice on nutrient fluxes through households and what influences choices," focused on behavioral factors that control fluxes of C, N, and P through individual households. She presented (with co-authors Sarah Hobbie, Jennifer King, Paul Hartzheim, and Larry Baker) a "Household Flux Calculator" (HFC), a spreadsheet model that calculates the fluxes of C and P for individual households based on a variety of household behaviors and decisions, such as energy use, transportation, diet, and lawn management practices. Results show that fluxes of C and N vary by a factor of three among households in the same neighborhood (Falcon Heights, a suburb in the Twin Cities area), indicating that household choices play an important role in determining the magnitude of elemental fluxes. The Theory of Planned Behavior (Fig. 5) provided insights into critical measures that could influence the key decisions: knowledge, attitudes, norms, and perceived control. In the Falcon Heights study, respondents reported that select behaviors (driving, eating meat, energy use, and producing trash) were not strongly influenced by family and friends. Perceived control was much higher for meat consumption than other behaviors. Understanding what influences household choices could assist in designing policy to influence behaviors in pollution management.

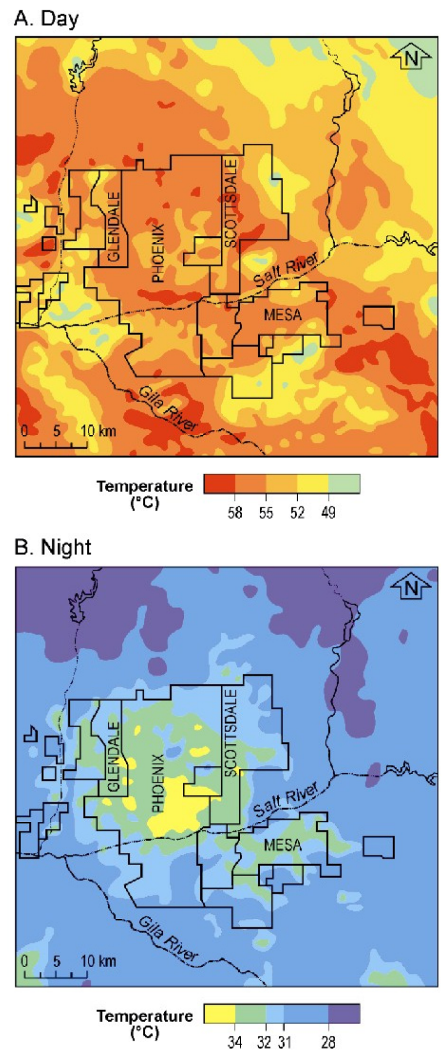

Fig. 4 (right). Soil temperatures in Phoenix during the day (top) and night (bottom).

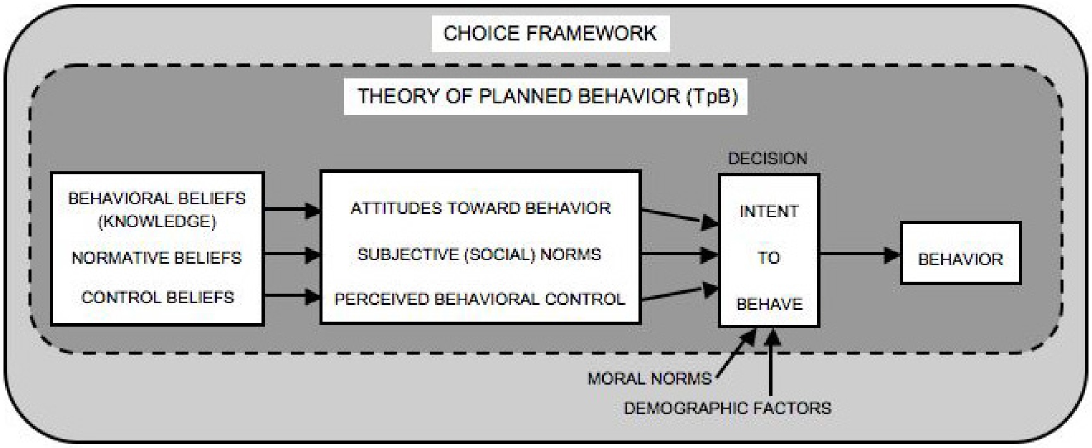

Fig. 5. Schematic of the Theory of Planned Behavior.

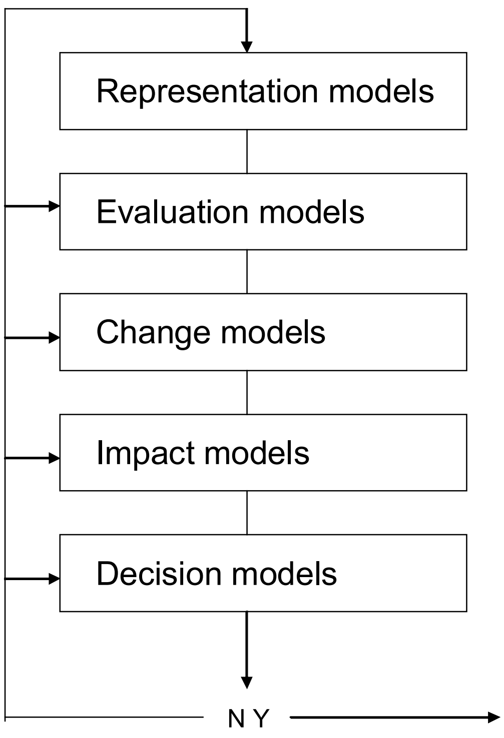

Fig. 6. A framework for comparing participation cases, after Steinitz (2002)

Kristina Hill and Miranda Maupin's presentation "Participatory planning in ecological design: urban cases from the Pacific Northwest" examined the question "What are key components of a successful public participation process that leads to improved ecosystem function in a city?" Two case studies were examined: Seattle's Central Waterfront Plan, and the Northgate South Lot project, which sought to transform a 1950s shopping mall into an ecologically friendly neighborhood. Both were evaluated using a framework developed by Steinitz (1990). The Seattle Central Waterfront Plan failed because evaluation focused exclusively on salmon restoration, no explicit impact models were used for prediction, and the decision model did not include state government, which subsequently did not provide funding. The Northgate South Lot planning process succeeded because the representation models provided key information about sediment loading and removal efficiency, the evaluation matrix incorporated ecologically relevant data, the proposal teams took input from ecologists and civil engineers, and an explicit impact model allowed a reasoned final choice.

The discussion following the presentations focused on three questions: (1) What role should ecologists play in influencing human choices? (2) What are the most significant actions or behavioral changes that could be made to have the greatest results, and (3) How do we elicit a participatory role from the public?

Literature cited

Steinitz, C. 1990. A framework for theory applicable to the education of landscape architects and other design professionals. Landscape Journal 9:136–143.

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