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The Research Problem & Purpose

Residential landscapes offer a variety of ecosystem benefits include provisioning, regulating, supporting, & cultural services. While much research has used economic valuation techniques to estimate the monetary value of ecosystem services (ESs), little work has examined expressed preferences for ESs broadly. Moreover, few studies have explored cultural services in depth. We fill these gaps by examining how ecosystem services are valued by residents in outdoors areas of their homes (i.e., their yards). First, we present *various dimensions of ecosystem services* in residential landscapes (below box). Next, we test the *urban homogenization thesis* (center right), which posits that the social-ecological characteristics—or, in this analysis, ecosystem service preferences—are common among people in diverse cities regardless of the biophysical conditions of native ecosystems. In other words:

We examine the degree to which regional settings affect ecosystem service preferences across 6 U.S. cities, particularly comparing humid eastern vs. arid western regions & cold northerly vs. warm southerly cities.

Comparative Study Methods

Field surveys were conducted in the 6 cities below. For both yard choices overall & for vegetation choices specifically, we asked participating homeowners to indicate whether a holistic set of ecosystem services were not important or slightly, moderately, or very important. The cities were analyzed by regions, as shown below.

| Cities | Sample Size (n) | Broader Regional Classifications |
|-------------------|-----------------|--|
| Phoenix (PHX) | 30 | Cool North: BLT, BOS, MSP (n=71) |
| Los Angeles (LAX) | 10 | |
| Miami (MIA) | 23 | Warm South: PHX, LAX, MIA (n=63) |
| Minneapolis (MSP) | 21 | |
| Boston (BOS) | 31 | Humid East: MSP, BOS, BLT, MIA (n=94) |
| Baltimore (BLT) | 19 | |
| Total | 134 | Arid West: PHX, LAX (n=40) |



Ecosystem Service Variables

Factor analysis & Cronbach's alpha tests were conducted to create reliable indices that reflect distinctive dimensions of ecosystem services (for details, see poster by Munoz-Encinas et al.) or contact Kelli.Larson@asu.edu. As seen in the bulleted list (top center), the ESs evaluated reflect a wide variety of landscape values. Several of the services represent composite variables equating to the average of 2 or more variables. For those with 2 variables, **Spearman's rho values** indicate significant correlations. For those with 3, **Cronbach's alpha** denotes internal consistency (>0.7 is highly reliable & >0.5 is acceptable for early stages of research). The other variables represent single question items.

Dimensions of Ecosystem Services

Listed below, composite variables reflect a wide variety of provisioning, regulating, supporting & cultural services. To the right of the arrows are verbatim survey items.

*****3 asterisks indicates the services that statistically differ across regions of the U.S., as detailed in the graphs below & to the right.**

PROVISIONING

- Local Nature*** → vegetation is native to the area * vegetation supports wildlife (rho = 0.49)
- Floral Biodiversity → yard provides flowers * yard offers a variety of plants (rho = 0.53)
- Edible Vegetation → provides food

SUPPORTING

- Environmental Services → yard reduces pollution in local water bodies * yard reduces flooding or standing water * yard provides nutrients to improve soils (alpha = 0.75)
- Local Conditions → is suited to my yard conditions
- Air Quality → yard improves the air we breathe

REGULATING

- Cooling*** → vegetation provides shade or helps cool the climate
- Climate Regulation*** → yard helps with climate change

CULTURAL

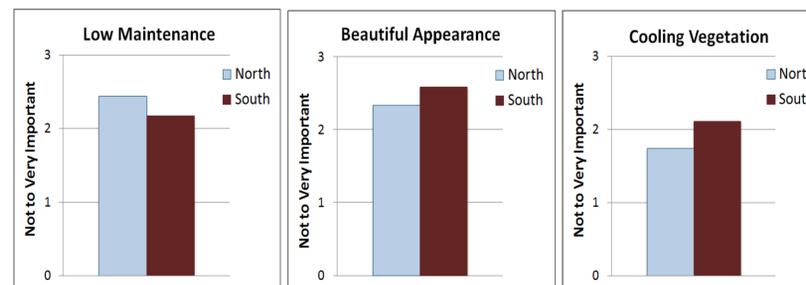
- Social Values → yard reflects my religious/spiritual values * yard reflects my tradition & heritage * yard provides opportunities to explore & learn about nature & the environment (alpha = 0.75)
- Beautiful Appearances*** → creates a beautiful yard * vegetation creates a beautiful yard (rho = 0.65)
- Neat Aesthetic → yard is neat & orderly * vegetation is neat & orderly (rho = 0.68)
- Weed-Free → yard reduces weeds
- Greenness → yard makes things green
- Natural Aesthetic → yard looks natural
- Low Maintenance*** → yard is easy to maintain * vegetation is easy to maintain (rho = 0.48)
- Low Costs → yard is inexpensive * vegetation is inexpensive (rho = 0.76)
- Enjoyment → yard provides personal enjoyment
- Social Environment → yard supports socializing
- Privacy → vegetation provides privacy or seclusion
- Local Custom → vegetation is common in my neighborhood
- Legacy → vegetation was planted by previous owner

Regional Differences In ES Preferences

To test for regional differences, we used Mann-Whitney U tests. Of 21 ecosystem services examined, 3/4ths (16) did not differ across regions. Thus, overall:

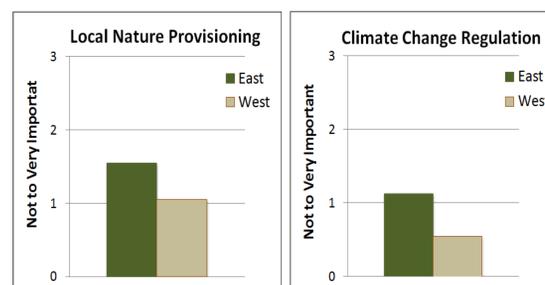
Only select ecosystem service preferences for residential landscapes exhibited heterogeneity across diverse regions of the U.S.

For the 5 services that significantly differed across regions ($p < 0.01$), mean responses are graphed below for North vs. South (3 variables) and East vs. West (2 variables).



As seen above, the Northern cities placed higher value on low maintenance yards compared to Southerners, whereas residents of Southern cities valued appearances more than Northerners. As expected, residents in the warm Southerly regions also valued the cooling effects of vegetation more so than those in colder areas.

The graphs at right show differences between the East & West. First, in Eastern cities, residents expressed higher values for native plants & wildlife relative to the West. Second, the East placed more importance on climate change regulation compared to the West.

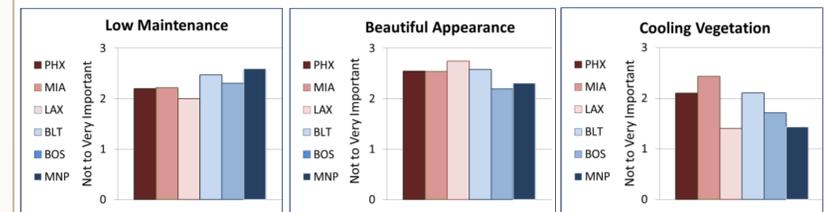


***The 5 bar graphs above exhibit statistical differences at $p < 0.01$.

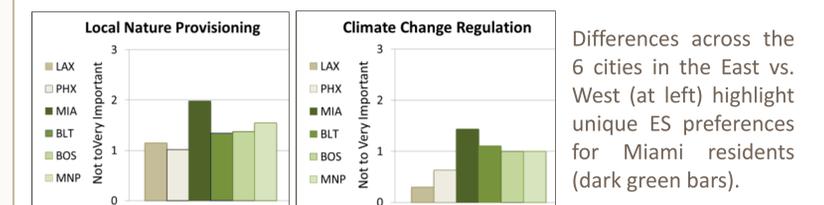
City-level differences for these variables are shown in the graphs at the upper right.

City-Level Differences in ES Preferences

The graphs below show the mean values for each variable that significantly differed across the broader East–West & North–South groups. Across the North & South, the differences lie in social lifestyle preferences & cooling vegetation.



Residents in warm Phoenix & Miami expressed greater importance for cooling landscapes compared to other cities, including LA (above right). Among the northern cities, cold Minneapolis placed the lowest importance on cooling, then cool Boston, and finally, relatively temperate Baltimore. Meanwhile, all 3 northern cities placed greater value on low maintenance landscapes compared to all 3 southern cities (above left). LA residents greatly valued beautiful landscapes, especially relative to Boston & Minneapolis (above center).



Differences across the 6 cities in the East vs. West (at left) highlight unique ES preferences for Miami residents (dark green bars).

Miami stood out in placing the highest priority on local nature provisioning & climate regulation (above left & right, respectively). The other eastern cities are similar in their preferences & show slightly higher values placed on both of these services compared to the 2 western cities. However, Phoenix residents placed lower value on climate regulation than LA. *Caution must be used in interpreting these findings given the low sample sizes for each city, especially LA.*

Conclusions & Next Steps

Overall, ecosystem service preferences for residential landscapes exhibited homogeneity across U.S. cities & regions.

Based on our survey results, this is true for important ESs such as personal enjoyment & wildlife as well as social norms such as neat, weed-free yards.

But significant differences revealed heterogeneity in terms of:

- Select Lifestyle Preferences → North emphasized practicality of low-maintenance, whereas South prioritized appearances
- Hot Climate Conditions → South valued cooling more than the North
- Certain Environmental Services → East appeared more environmentally minded than the West, specifically valuing nature provisioning (native plants & wildlife) & helping with climate change

Future research will add to these findings by:

- Identifying Explanatory Factors → how do social lifestyle factors (e.g., income, life stage, urban to rural living, etc.) affect ES preferences?
- Examining Biophysical Conditions → do expressed ecosystem service preferences (e.g., for cooling, biodiversity) manifest in people's yards?

Additional work is also needed to understand ES preferences for residential landscapes across a wider array of cities with larger sample sizes.

For more information on this project, see the companion poster by Munoz et al. or contact Kelli.Larson@asu.edu.

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