Society and Natural Resources, 23:1253–1258

ISSN: 0894-1920 print/1521-0723 online
DOI: 10.1080/08941920903030132

Routledge
Taylor & Francis Group

Research Note

Constructing a Community-Level Amenity Index

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The study of amenity-driven regional change has proliferated in recent years, especially in the American West. While methods of quantifying amenity levels have progressed, they usually rely on traditional and inflexible methods of creating indices. This research note describes a method of manual indexing that allows a flexible and replicable way of assessing amenity levels for various geographic scales and research contexts. We apply this method to nine amenity-based communities in Colorado and direct researchers to resources for exploring alterations for other applications. Results show that the method permits ranking and grouping communities according to relative amenity levels.

Keywords community studies, methods, natural resource amenities, social indicators

"Population change in rural counties since 1970 has been strongly related to their attractiveness as places to live" (McGranahan 1999, iii). Attractiveness can be thought of as a place's amenity level, or its "amenityness." Amenityness varies qualitatively and quantitatively across places and geographic scales.

Well-known amenity indices exist, most notably the Economic Research Service (ERS) 1999 county-level index. Different techniques have been created for the study of communities (Winkler et al. 2007), which the ERS index cannot distinguish. Our research seeks to understand varying community responses to forest disturbance by bark beetles in north central Colorado (Flint et al. 2008). To better understand local contexts, we needed to differentiate communities across a common amenity-oriented landscape—something not possible with the ERS amenity index or other approaches

Received 9 May 2008; accepted 2 October 2008.

Support for this research was provided by the USDA Forest Service, Pacific Northwest Research Station. The authors appreciate the helpful suggestions from the editor and anonymous reviewers.

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that do not measure actual amenities. We delineated communities using city limits observed in the 2000 Census and created an amenity index subdivided into two subindices: natural resource-based amenities and socioeconomic indicators of amenities (i.e., the social ramifications of the amenities). Our method allows flexibility to define subcategories of variables rather than indiscriminately combining variables based on predetermined statistical formulas.

We study Breckenridge, Dillon, Frisco, Granby, Kremmling, Silverthorne, Steamboat Springs, Vail, and Walden, Colorado. These communities vary from luxury resort towns (e.g., Vail and Breckenridge) to communities combining extractive industries like ranching and logging with second-home development and outdoor recreation (e.g., Granby, Kremmling, and Walden). Breckenridge, Dillon, Frisco, and Silverthorne are all in Summit County. Our index can, given available data, measure differences between entities at any level of geography, in this case, the subcounty level.

Variable Selection

Mindful of our study context, we surveyed existing literature to guide variable selection. The definition of "amenity" varies by context and audience; in large cities it may mean access to restaurants or theatres. Table 1 lists the relevant amenities and indicators of amenities for forest-oriented north central Colorado. Indicators of amenities are found using U.S. Census data, while measuring the amenities themselves requires other data sources, such as tourism websites and area maps. The GIS data is publicly available and, with moderate manipulation, allows us to add a spatial element at the community level.

One of our indicators, employment diversity, is not drawn from existing amenity theory. We use the Shannon–Weaver index to measure employment diversity. Higher values indicate that employment is more evenly distributed among industries within the place (Plane and Rogerson 1994). We expect amenity-rich places to have employment concentrated in amenity-based industries, reducing employment diversity. To reflect this, we subtract each community's Shannon–Weaver value from one before scaling it. The Shannon–Weaver measure is calculated as:

$$\mathrm{H} = -\sum_{k=1}^{n} [(P_k/P)\ln(P_k/P)]$$

where P is the employment and k is industry.

Indexing Methods

Davidson and Shah (1997) provide a comprehensive explanation of indexing. Although their application is to risk assessment, they review various methods involving scaling and weighting for index construction that are applicable to a wide range of research approaches (e.g., Rosselet-McCauley 2008).

Scaling, which involves conversion of data to z-scores, facilitates comparison between variables. Each variable's distribution should be assessed and transformed if necessary before scaling. Weighting, by manipulating the variance of each variable, determines how strongly each variable influences each subindex. To weight the variables, we entered the scaled variables into factor analysis separately for each

Table 1. Variable selection

Amenities	Literature citation
Area in forest cover within a 10-mile radius (%)[a]	Crawford and Wilson (2005)
Area owned by the U.S. Forest Service within a 10-mile radius (%)[b]	Crawford and Wilson (2005)
Total number of recreation locations within a 10-mile radius (ski slopes, golf courses, fishing access, bike paths, trailheads, boat launches, picnic areas, and campsites)[c,d]	Beale and Johnson (1998), Green (2001)
Area in open water within a 1-mile radius (%)[a]	McGranahan (1999), Green (2001)
Indicators of amenities	**Literature citation**
Employment diversity[e]	None
Median household income[e]	Crawford and Wilson (2005), Green (2001), Winkler et al. (2007)
Seasonal housing (%)[e]	Beale and Johnson (1998), Green (2001), McGranahan (1999), Winkler et al. (2007)
Population growth, 1990–2000[e,f]	Smutny (2002)
In-migrants from out of state (%)[e]	Winkler et al. (2007)
In-migrants from out of county (%)[e]	Smith and Krannich (2000)
College educated (%)[e]	Winkler et al. (2007)
Housing built 1995–2000 (%)[e]	Winkler et al. (2007)
Housing valued over $500,000 (%)[e]	Winkler et al. (2007)
Median rent[e]	Winkler et al. (2007)
Median value of owner-occupied housing[e]	Winkler et al. (2007)
Employment in arts, entertainment, recreation, accommodation and food services (%)[e]	Beale and Johnson (1998), Crawford and Wilson (2005), McGranahan (1999), Winkler et al. (2007)

Note. Radius refers to the distance from the city limits, as defined by the U.S. Census place polygon TIGER files.
[a]U.S. Geological Survey, n.d.
[b]U.S. Forest Service, n.d.
[c]U.S. Forest Service, 1991, 1997, and 2005.
[d]Colorado Tourism Office, 2005.
[e]U.S. Bureau of the Census, 2000.
[f]U.S. Bureau of the Census, 1990.

subindex.[1] Factor analysis is not used for data reduction here; only the first component is used, regardless of eigenvalues. The first component "explains the highest percentage of the total variation in the original variables . . . thus offer[ing] the single linear combination of the original variables that best summarizes the information captured in those variables" (Davidson and Shah 1997, 132). Factor analysis assigns weights to each variable in the predefined subindices, amenities and indicators of amenities. We calculated the weight for each variable within each subindex as:

$$w_i = p_i{}^* \left[1 - \left(\left(\left(\sum_{i=1}^{n} p_i\right) - 1\right) \Big/ \sum_{i=1}^{n} p_i\right)\right]$$

where p is the factor loading for each variable and i is the variable.

A few considerations remain. First, negative weights should be individually evaluated to ensure that they produce interpretable results. Second, factor analysis scores are ideal for weighting when the variables are highly correlated, as our variables are. Third, because the method uses the loadings from only the first component, some variables (in our case, percent new housing) may not be well represented. Fourth, because it is inconsistent with the objective of using factor analysis for weighting, the present model has no rotation. Finally, we weighted the two subindices. Theory should guide weight assignment. In this case, there is no theoretical reason not to weight the two subindices equally. The final index was calculated as:

$$\text{Index} = 0.5\left(\sum_{i=1}^{n} w_i a\right) + 0.5\left(\sum_{i=1}^{n} w_i I\right)$$

where a is the amenities subindex and I is the indicator of the amenities subindex.

Table 2 shows the results. Consistent with the standardization of the data, the final index centers near zero. Most important are the communities' relative index scores and ranks. The results indicate that communities follow a linear gradient (likely the outcome of the indexing method) but can be grouped. Frisco has the highest level of amenityness, due largely to its superior access to amenities, high incomes, and high housing costs. Breckenridge, Dillon, Silverthorne, and Vail cluster together. Though we expected Breckenridge and Vail to rank highest, their low access to water and, in the case of Vail, fewer overall recreational amenities (defined in Table 1), placed them below Frisco. We do not control for the size of each recreation location, which may result in the underestimation of access to recreation in Vail. Steamboat

Table 2. Amenityness Index results

Community	Amenities score	Indicators of amenities score	Total Amenityness Index score	Rank
Frisco	0.96	0.73	0.85	1
Breckenridge	0.39	0.78	0.58	2
Dillon	0.97	0.14	0.56	3
Silverthorne	0.59	0.26	0.43	4
Vail	0.11	0.52	0.32	5
Steamboat Springs	–0.25	0.16	–0.04	6
Granby	–0.41	–0.60	–0.51	7
Kremmling	–0.76	–0.69	–0.72	8
Walden	–1.60	–1.32	–1.46	9

Springs lies at the center of the distribution due to its relatively low level of recreational amenities and low access to both Forest Service land and water. Granby and Kremmling, followed by Walden, settle to the bottom of the distribution, which is not surprising given their greater economic dependence on extractive resources.

Conclusion

The method described herein offers a way to flexibly develop amenity indices that can distinguish actual amenities from indicators of amenities at a variety of geographic scales. The results permit the ranking of places by amenity level and potential use in subsequent parametric or nonparametric analysis of researcher-collected survey data. We hope this clarifies an alternative indexing method for quantifying amenities and their socioeconomic indicators, emphasizing manual index construction and locally relevant information.

Note

1. All variable loadings except one were above .60, and the percent of variance explained by the first factors was approximately 70%. The mean values of variable communalities for the factor analysis for the two subindices were .74 and .86, respectively. These attributes suggest stability in the variable relationships and to some extent mitigate concerns about the small sample size in this particular application (Guadagnoli and Velicer 1988; MacCallum et al. 2001). Exploration of this amenity indexing technique with larger sample sizes is encouraged.

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