

## Measures of Natural Amenities

The six measures used in this study were selected on the basis of a conception of the environmental qualities most people prefer, availability of measures, simplicity, nonredundancy, and the correlation to population change (table 1). Hawaii and Alaska were not included, as data were not always available. Because it is difficult to handle a number of separate indicators in a given analysis, a simple additive scale was developed, with some adjustment for the interrelationships among the measures.

### **Warm winter (average January temperature).**

People are attracted to areas with warm winters. Southern areas of the country generally have the warmest winters, while the upper Midwest and the Rocky Mountains experience the coldest (see Map 1). Coastal areas are generally warmer than inland. This measure, and the others relating to climate, was drawn from the Area Resources tape issued at the time by the Center for National Health Statistics, U.S. Department of Health and Human Services.

### **Winter sun (average January days of sun).**

Brochures almost inevitably show sunny skies. The Southwest has the sunniest Januaries while the Pacific Northwest has the cloudiest (Map 2). Some areas around the Great Lakes also have frequent January overcast.

**Table 1—Natural amenity statistics for nonmetro counties**

Measure	Units	Average	Minimum	Maximum
January temperature	Degrees F	32.9	1.1	67.2
Days of sun in January	Days	15.2	4.8	26.6
July temperature	Degrees F	75.9	55.5	93.7
July humidity	Percent	56	14	80
Water area	Percent	3.2	0	75
Topography	Scale	8.9	1	21

Sources: Calculated by ERS from sources described in text.

**Temperate summer (low winter-summer temperature gap).** While less so with the widespread use of air conditioning, summer heat is still a drawback. Places warm in the winter tend to be hot in the summer: the correlation coefficient between average January and average July temperatures is 0.74 for counties. What seems most desirable is a temperate climate, with relatively little temperature gain between January and July.

One possible measure of temperate climate would be the gain in temperature between January and July, with a low gain indicating a more favorable climate. However, places cold in the winter tend to have greater gains in temperature between winter and summer. The size of the variance in average July temperature across counties is only 20 percent of the size of variance in average January temperature. This means that the temperature difference between January and July is largely redundant with the January temperature measure.

To solve this problem, the residual of a simple regression of July temperature on January temperature was used to reflect low gain in temperature, i.e., a temperate climate. In effect, we asked how much higher or lower the July temperature is, given what one would predict on the basis of the January temperature. Since residuals are not correlated with independent variables, this produced a measure of temperate climate not at all redundant with the January temperature measure.

Mountainous areas and areas along the west coast tend to have the most temperate summers according to this measure (Map 3). The Central and Southern Plains, southern Arizona, and the Imperial Valley in California have the least temperate summers.

### **Summer humidity (low average July humidity).**

Humidity, which adds to summer discomfort, is relatively low in the West, except along the coast (Map 4). July humidity is high in much of the Southeast (although humidity tends to be lower in southern Florida than in northern Florida and southern Georgia.).

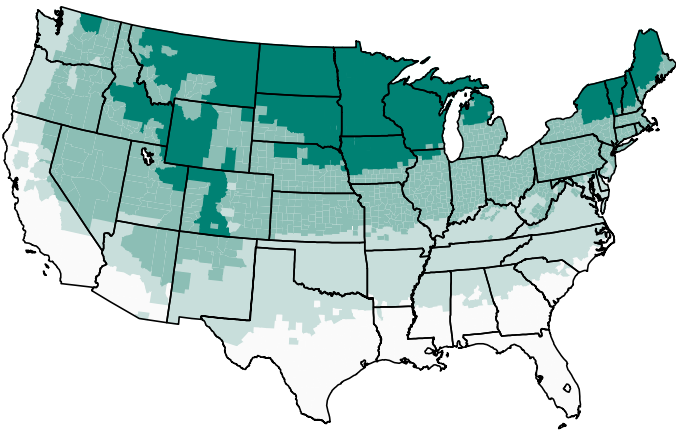
### **Topographic variation (topography scale).**

In general, the more varied the topography, the more appealing the setting. To measure topography, we

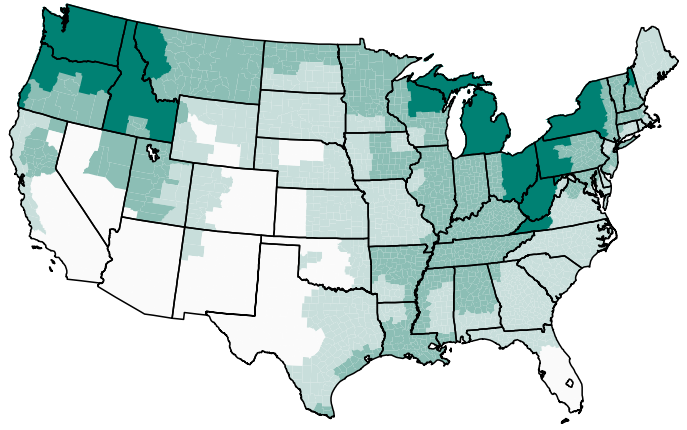
Figure 1

# Maps of natural amenity measures

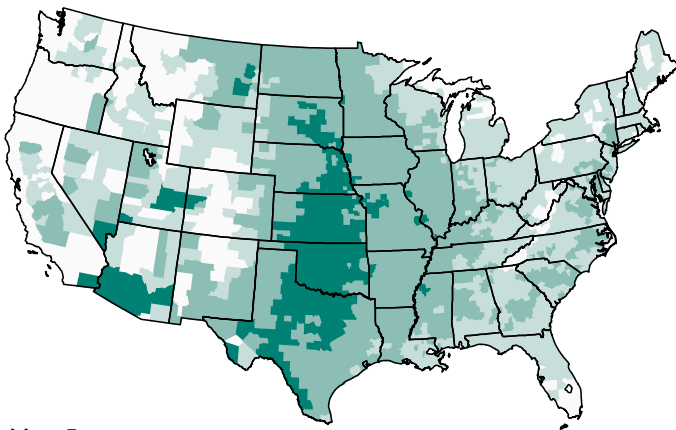
Map 1  
Warm winter



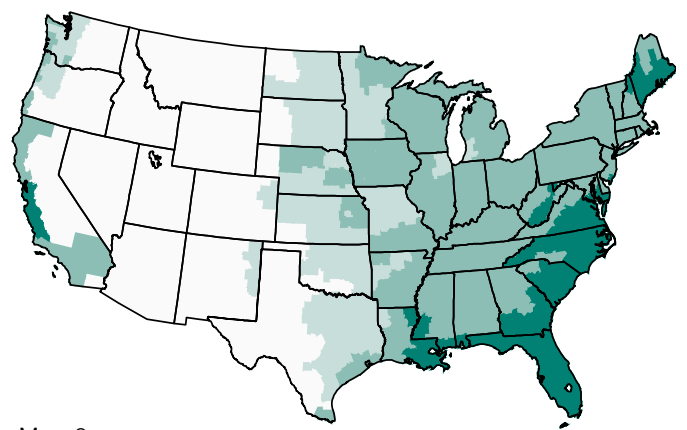
Map 2  
Winter sun



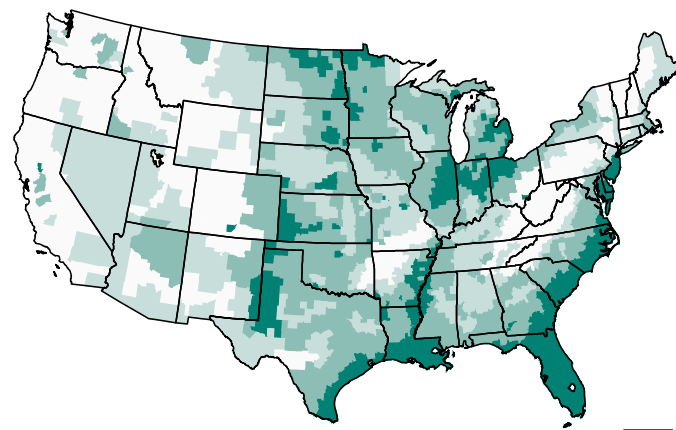
Map 3  
Temperate summer



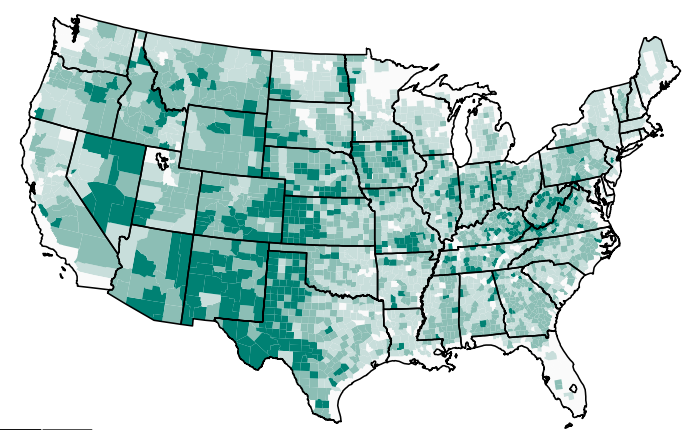
Map 4  
Low summer humidity



Map 5  
Topographic variation



Map 6  
Water area



Low scores  High scores

Note: Maps are standard deviation (s.d.) units from mean, with darkest color over 1 s.d. below mean and lightest over 1 s.d. above. Lighter colors indicate higher scores.

drew on a topographic map in *The National Atlas of the United States of America* (1970). This map delineated five basic land formations: plains, tablelands, plains with hills or mountains, open hills or mountains, and hills and mountains. Within each of these broad categories, land was distinguished by its degree of variation. For example, the “plains” category ranged from “flat plains” to “irregular plains,” and the “hills and mountains” category ranged from “hills” to “high mountains.” A total of 21 categories were delineated. We created a county map overlay and mapped the topography onto the county map. Where a county had more than one type of land formation, we assigned the highest of the categories that applied, provided this higher category appeared to apply to at least 25 percent of the county area. At the high end of the scale, the resulting county map reproduces the principal mountain ranges in the country and, at the low end, the coastal plains (Map 5).

**Water area (water area as proportion of total county area).** Coastal areas and areas with lakes are more pleasant than areas lacking surface water. Coding water area proved a problem, however. In this data tape, from the Bureau of the Census, coastal waters, because the boundaries extend out 3 miles, are inevitably large and dwarf inland lakes in their surface area. The problem is particularly distorting in the Great Lakes, as the entire water area within U.S. boundaries is assigned to counties along the shores.

Two adjustments were made to reduce what seemed to be the undue influence of coastal waters. First, we limited the amount of water area measured to a maximum of 250 square miles. This reduced the outlier problem in the Great Lakes, but still left the measure as one that discriminated coastal from inland counties but gave inland lakes and ponds little weight. The second adjustment was to take the logarithm of the percentage of county area in water, a transformation that accentuates differences at the low end and reduces them at the high end. Implicit in the transformation is the assumption that a difference between 5 percent and 10 percent in water surface area improves the attractiveness of an area as much as a difference between 10 and 20 percent.

A mapping of this measure shows some broad regional variations (Map 6). For instance, lakes and ponds are relatively rare in the Southwest and the Western Plains, particularly compared with the lakes areas of Minnesota and Wisconsin.<sup>2</sup>

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<sup>2</sup> The above set of measures was culled from an original 12. We initially considered land in forest and (low) elevation as measures. Land in forest had no relationship with population change, however, either alone or in combination with other measures. The low elevation was included in the original scale and is discussed in Appendix 2 along with the original scale. Four other available climate measures—January precipitation and humidity and July precipitation and days of sun—were less intuitive amenities than the ones selected, highly related to the measures included, and less effective in predicting population change.