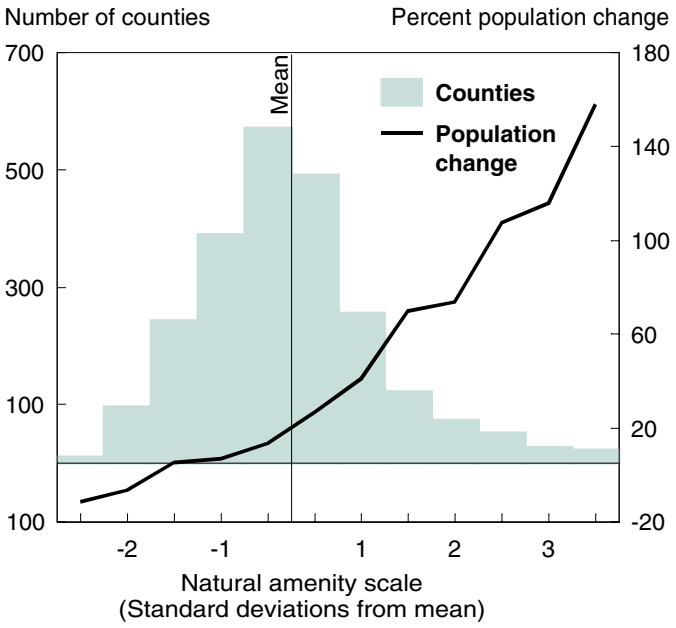
Can these measures be summarized in a scale of natural amenities so that we can conceive of areas as differing in their levels of "natural amenities"? We created the simplest type of scale and tested its ability to predict county population change against the combined predictive ability of the six separate items. Because each item had different scales, the amenity measures were standardized so each had a mean of zero and a standard deviation of one. The combined scale was created by summing those standardized measures.

Although each measure has an equal direct influence on the resulting scale, their correlations with the natural amenity scale differ because the measures themselves have different correlations with each other (table 2). Measures having strong positive correlations with the other amenity measures (topographic variation, for instance) are more strongly related to the scale than measures that tend to be weakly or even negatively associated with other amenities (water area, for instance).

Figure 3
Number of counties and mean nonmetro county population change, by natural amenities



The amenity scale itself has a bell-shaped distribution, which makes it appropriate for statistical analyses without further transformations (fig. 3). The higher the score on the scale, the higher the level of average population growth during 1970-96. The relationship is quite strong: counties with extremely low scores on the scale tended to lose population over the 1970-96 period, while counties with extremely high scores tended to double their populations over the period. High-amenity counties have accounted for much of the rural population growth. The counties in the top quarter of the natural amenities scale, with only 22 percent of the nonmetro population in 1970, had over half of the gain in nonmetro population between 1970 and 1996. At the same time, a high score on the scale does not guarantee growth: much of the variation in population growth occurs at the high end of the scale (see appendix fig. 1).

How well does the scale predict population growth compared with using the scale items separately? Regressions on rural county population change indicate that the scale captures much of the variance explained by the individual measures.[3] For 1970-96, the individual amenity measures added 24 percentage points to the variance "explained" by the economic base, poverty, population density, and urban influence—more than doubling the total variance explained (table 5). Using the natural amenity scale instead of the individual measures reduced the additional variance explained by less than 8 percent, so not much

[3] If we were able to predict population change exactly on the basis of the measures used in the analysis, the variance explained would be one. If the measures used were of no use in predicting change, the variance explained would be zero. While the natural amenities scale improves our ability to estimate population change, and thereby understand its bases, the measures used in the present analysis leave much of their change unexplained.

predictive ability is lost by combining the items into a single scale—at least for long-term population change.

For the shorter time periods, neither the set of individual items nor the index are as effective in predicting population change, because of other influences unique to each decade. The amenity scale is less able to capture the variance in population change associated with the set of amenity items in the 1980's and early 1990's than in the 1970's or over the entire 1970-96 period, but still the proportion captured remained above 85 percent. No matter what the time period, the amenity scale explains about as much (and sometimes much more) of the variance in population change as all the economic base and settlement pattern variables combined. The amenity measures, whether in a scale or considered separately, were least effective in 1980-90, a period of net outmigration from rural areas, suggesting that natural amenities are more relevant for rural county inmigration than for outmigration. This suggests that the pull of high amenities is greater than the push of low amenities.

To explore the contributions of the individual items to the scale, the analyses were rerun, each time with a different item removed from the scale. For some time periods, one or another item contributed little to the predictive ability of the scale, but in no case was the overall amenity scale less effective in predicting population growth than a reduced scale. For population change, temperate summer and topographic variation are the most central items in the scale. Their removals reduce the effectiveness of the scale the most.

Table 5–Comparison of county population change regression results using the natural amenity items individually and as a scale [1]

Statistic	Formula	1970-80	1980-90	1990-96	1970-96
A. Adjusted R^2					
1 Base measures only		0.163	0.213	0.119	0.193
2 Six amenity items added to base		0.363	0.401	0.320	0.437
3 Amenity scale added to base		0.351	0.375	0.290	0.418
B. Addition to adjusted R^2					
1 All measures individually	(A2-A1)	0.201	0.188	0.201	0.244
2 Amenity scale	(A3-A1)	0.188	0.162	0.171	0.225
3 Difference	(B1-B2)	0.013	0.026	0.030	0.019
C. Percent loss in additional variance explained when scale is used, rather than individual items	(100xB3/B1)	6.3	13.8	14.9	7.7

[1] Other measures in the analysis include county economic type, high poverty, population density and its square, and the urban influence code.

Figure 4

Amenity scale by county, 1970-96

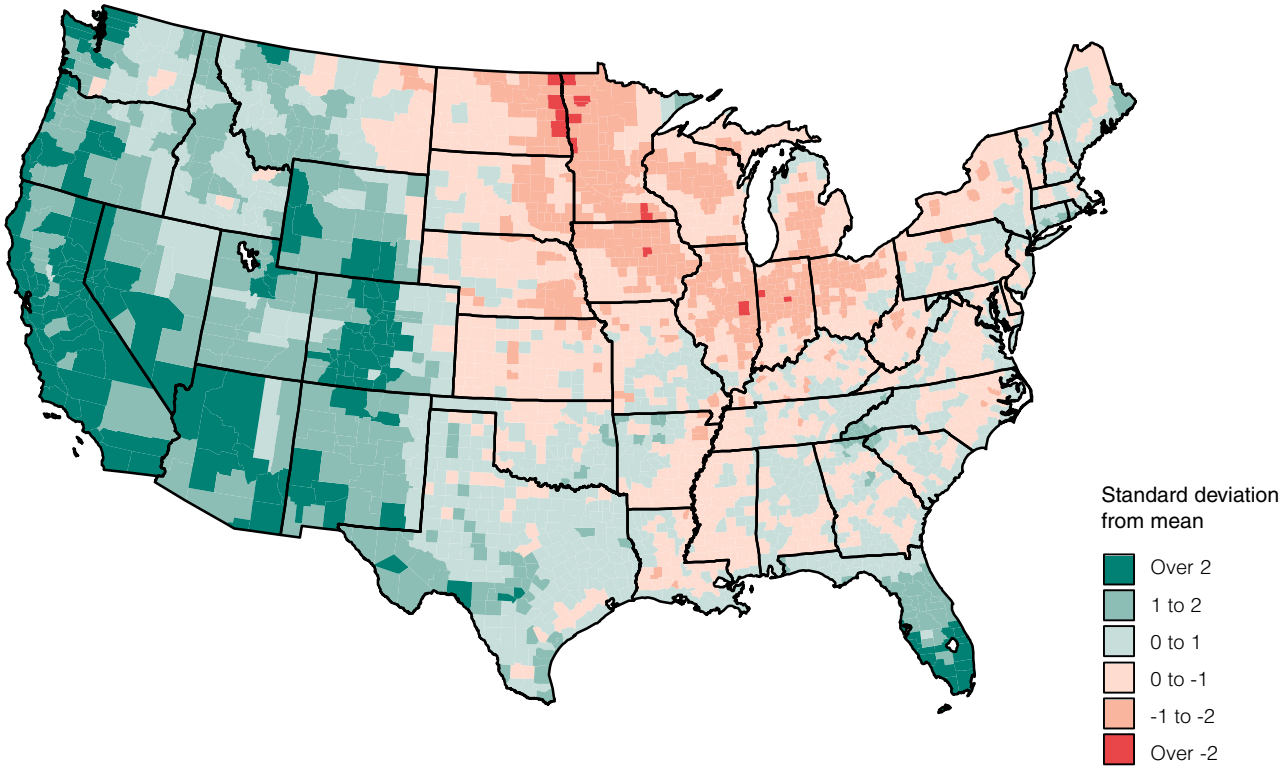


Figure 5

Population change by county, 1970-96