Chapter 8
The Geographic Distribution of Land Trust Activities in the United States: An Analysis Based on 2005 National Land Trust Census Report Data

Ronald C. Hess and George M. Pomeroy

Abstract This study is concerned with the geographic patterns of land conservation strategies employed by the 1,667 land trusts included in the Land Trust Alliance's 2005 National Land Trust Census. The spatial distribution of land trusts, the number of acres owned, acreage under conservation easement, and the total number of acres protected by all means by the various land trusts are considered, and these are in turn mapped, analyzed, and discussed: this is done first by utilizing sum totals and then again by using location quotients to find patterns of concentration relative to the United States. Possible causal factors for the spatial distribution patterns found such as per capita income and population are also examined. Several three-dimensional visualizations are presented to offer a unique perspective as well as to facilitate an increased understanding of certain patterns of concentration than could be achieved from traditional mapping techniques and location quotient tables alone.

Keywords Land trust • Geographic distribution • Location quotient • Per capita income • Spatial visualization • USA

8.1 Background

Air and water are considered common property resources that cannot be owned because they provide benefits to all. Land is different in that it can be owned, but not so different in that it can provide many public benefits regardless of whom owns it. Obviously, the public derives benefits from certain types of land, such as farmland and ranchland that produce food, forestland that provides wildlife habitat as well as adding to our oxygen

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supply, and wetland that improves water quality. Perhaps less obvious, however, are the benefits gained from simply the sheer beauty of scenic landscapes, historic places, and open space. Negative externalities that go along with development, particularly sprawl development, are the loss of many of these public benefits. Although land use regulation may seem like the obvious choice to protect these public benefits and manage growth, such measures have had only limited success as many areas do not have zoning and thus comprehensive plans go unenforced (Daniels 2004). For reasons such as these, there has been a shift known as 'the land trust' toward another way of protecting these benefits now and for future generations (Daniels 2004).

Land trusts are nonprofit organizations that conserve land in perpetuity for public benefit. That is, they protect land from development by acquiring it through fee simple purchases, as donations, or by acquiring only specific development rights associated with the land through purchase or donation without actually taking ownership of the land itself, also known as a conservation easement (Brewer 2003). Tax breaks may be awarded to property owners who donate a conservation easement to a non-profit (501C3) land trust (Yuan-Farrell et al. 2005). Strangely, however, the holder of a conservation easement does not have the right to develop the land, because conservation easements differ from traditional easements, such as those held by utility companies, which allow the holder a specific use of the property; conservation easements simply deny the owner of the land certain uses (Gustanski and Squires 2000). This provision also creates a burden for land trusts to monitor the land in perpetuity and to ensure that the terms of the conservation easement are kept throughout the generations, because once the specific rights associated with the conservation easement are severed from the bundle of usual property rights, they remain with the conservation easement, and the land trust that holds such, regardless of changing land ownership or time passed (Land Trust Alliance 2009).

Land trusts, which have been around since 1891, exist on several geographic scales, and conserve various land types. They remained relatively few in number before 1950, with only 53 in existence at that time (Trustees History 2009). By 1980, they had increased in number to 431, an eightfold increase (Brewer 2003). Today, there are 1,700 private land trusts with more than two million members that have collectively conserved 37 million acres of land in the United States (Land Trust Alliance 2009): this equates to an area roughly the combined size of Pennsylvania, Maryland, and Delaware (U.S. Census Bureau 2009). Most of these 1,700 private land trusts are local in scope, operating at the level of several counties to small villages. Others, such as the Trustees of Reservations, which also has the distinction of being the first land trust, operates at the Massachusetts State level. Still others, such as The Trust for Public Land (2009), which conserves urban, rural, and historic sites for public enjoyment, and The Conservation Fund (2009), which conserves a variety of land types in all 50 states, are national in scope. International Land Trusts exist as well; these include the Nature Conservancy (2009), which focuses on ecological land conservation and operates in more than 30 countries, and Ducks Unlimited (2009), which conserves wetlands and waterfowl habitats throughout North America (Brewer 2003).

8.1.1 The Land Trust Alliance

The Land Trust Alliance (LTA), based in Washington, DC, is an umbrella organization that unites land trusts by providing operational standards intended to ensure that a land trust endures over the long term. The Alliance also advocates favorable tax policies as well as providing publications, training, and support (Land Trust Alliance 2009). Key components in the LTA operational standards, to which most land trusts have agreed, are rules of conduct, increased budget requirements, and stewardship endowments, necessary for long-term compliance monitoring. Although some land conservation organizations consider themselves land trusts, the Land Trust Alliance has a very specific definition that it uses to determine if a land conservation organization is actually a land trust: "A land trust is a nonprofit organization that, as all or part of its mission, actively works to conserve land by undertaking or assisting in land or conservation easement acquisition, or by its stewardship of such land or easements" (Land Trust Alliance 2009).

8.2 Literature Review

Existing studies concerning land trusts and conservation easements tend to be of an informational nature or concerned with specific topics such as public access, goals, legislation, tax benefit, permanence, or another specific purpose (Brewer 2003; Lieberknecht 2009; Kiesecker et al. 2007). Yet, surprisingly, even at the national level no studies were found that examined the geographic patterns of land trust activities such as the spatial distribution of a land trust, acres owned, acres under conservation easement, and total acres protected by land trusts. Studies of such patterns could provide clues or links to causal factors, thus improving our understanding and perhaps lead to additional studies.

Although no specific studies exploring the geographic patterns of these land trust activities were found, two studies had some relevance. A study by Yuan-Farrell et al. (2005) used statistical analysis to search for factors contributing to the spatial distribution of conservation easements in California, and conservation easement preference patterns were mapped. Although only regional in nature, the study does address patterns of conservation easements, albeit based more on contributing factors. Another study by Wikle (1998) identified spatial patterns in concentration of membership among The Nature Conservancy, Natural Resources Defense Council, and the Wildlife Fund throughout the U.S. Using county-level location quotients, rankings, and mapping, membership patterns among these organizations were examined. The study found similar strong membership concentrations in the Northeast, West, and Rocky Mountain states and similar weaker membership concentrations in the Midwest and South. Based on these concentration patterns, conclusions were drawn that included the suggestion that higher levels of income and education correspond to higher membership ratios, and similar patterns may exist for other environmental

organizations. Using similar techniques, this research aims to reveal the geographic patterns and concentrations of specific land trust activities, as well as to consider possible causal factors contributing to such patterns.

8.3 Data

The Land Trust Alliance conducts a census every 5 years that tracks trends in private land conservation at the national level. This census records various attributes connected with private land conservation such as amounts and type. Some of the main items surveyed, and the main items of interest in this study, include the number of land trusts and the year they were founded, the number of acres owned by land trusts, the number of conservation easements acres, and the total number of acres protected by all means. Other items, although not an exhaustive list, include the number of board members, operating budget, whether the land trust practices stewardship, whether the land trust seeks to acquire land or conservation easements, and the primary land type sought for conservation.

These data were collected by the Land Trust Alliance during the first 8 months of 2006 by a survey that was conducted online and by mail of 1,840 land conservation organizations. Respondents were instructed to provide information up to the last day of 2005. Based on the Land Trust Alliance's definition of land trusts mentioned previously, 173 of these organizations were determined not to be land trusts, leaving 1,667 land trusts in the final census report. Of these, more than 940 responded. Additional information was supplemented beyond the survey results by other means such as telephone, e-mail, and land trust support centers and the use of previously collected data in the absence of new data.

In addition to the census dataset, other data were gathered to facilitate the study objectives, including additional boundary files: "counties," and "cities and towns," which were obtained from the GIS Data Depot and published by the U.S. Geologic Survey in 1999, and "zipcodes," shapefiles obtained from the U.S. Census Bureau 2007 TIGER/Line® Shapefiles. These data were necessary to attach the survey data to spatial features. Additionally, per capita income by state from 1980 to 2005 was downloaded in table form from the U.S. Department of Commerce, Bureau of Economic Analysis, and recent population statistics that included the year 2005 were downloaded in table form from the U.S. Census Bureau to facilitate some comparative analysis.

8.4 Methods, Results, and Discussion

The 2005 National Land Trust Census Data were provided in Microsoft Access format and were directly imported into an ArcGIS geodatabase. Data were joined to cities and towns, zip codes, counties, metropolitan statistical areas,

regions, and states, layers using a series of joins, sum totals, data exports, and other traditional methods. Income and population data were also imported and joined using similar methods.

8.4.1 Land Trusts: Density

A dot density map showing land trusts per state in 2005 was generated as a first step to look for general density patterns (Fig. 8.1). This map clearly shows that the highest densities of land trusts are found on the East and West coasts with the Northeast having the highest density overall and California, while not quite as dense, clearly having the highest density among the Pacific States as well as the entire West. What also stands out on this map is the relatively few land trusts present in the northern central U.S. as well as the central portion of the U.S. in general. Also of note is the low density of Alaska, which although not shown to scale covers an area larger than Texas.

8.4.2 Geographic Patterns

Next, three choropleth maps were produced to search for factors that might be associated with the spatial pattern of land trusts. These, as most maps produced in this project, use a quantile classification scheme consisting of three classes. This particular classification scheme was chosen because it is easy to understand conceptually, facilitates easy comparison even when different color schemes are used, and as 51

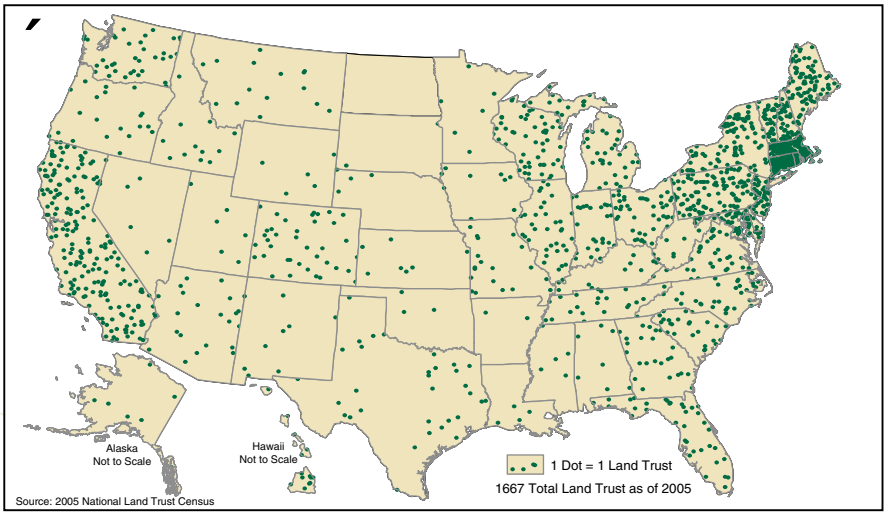

Fig. 8.1 Density of U.S. land trusts in 2005

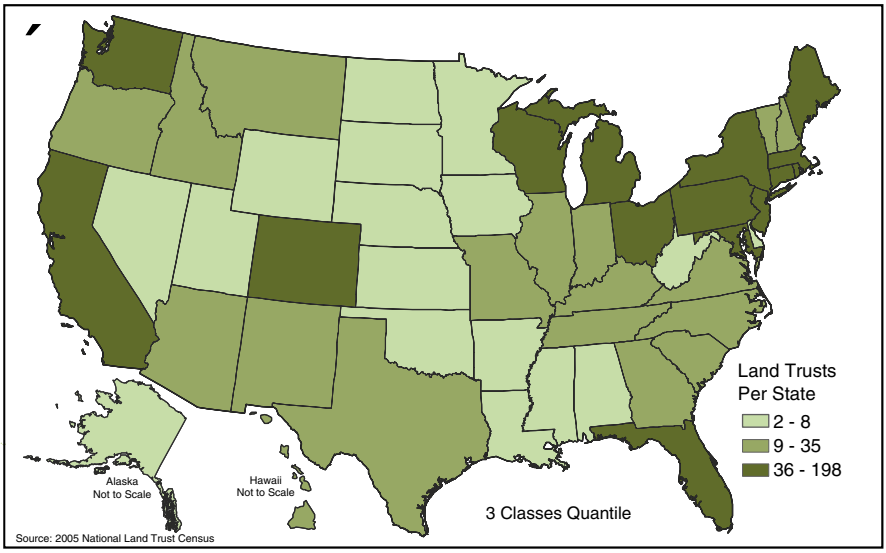

Fig. 8.2 Number of land trusts per state

divides equally by 3, 17 areal units fit perfectly into each tertile. This classification scheme is similar to the one in the study by Yuan-Farrell et al. (2005), which used choropleth maps with three classes to show the spatial pattern of densities for conservation easements in California. The first of these choropleth maps shows the number of land trusts per state (Fig. 8.2).

Obvious patterns exist on this map, which compares well with the dot density map shown previously as they both represent the same data. This pattern suggests a strong association between other factors such as income or population or perhaps others. If only two factors are correlated strongly enough, either positively or negatively, such comparable patterns should stand out. However, many independent variables may be correlated to varying degrees, and co-correlations may also exist.

Two additional maps were created as a means of comparison to look for any obvious association between per capita income and population in connection with the number of land trusts per state, as well as successive maps in this study (Figs. 8.3 and 8.4). States classed in the highest group in all figures include New York, Massachusetts, California, and New Jersey. One could argue on the basis of individual states that patterns exist but none stands out distinctly. What seems most noteworthy is the obvious dissimilarities such as can be seen with Maine, which is classed high in the number of land trusts and yet is low in both population and per capita income. Alaska on the other hand is high in per capita income and low in the number of land trusts. Sometimes striking similarities are present, such as the one mentioned at the beginning of the preceding paragraph, but no obvious associations were found. Yet, factors such as population can be examined in other ways, such as the concentration of land trusts as compared to population, a concept that is addressed later.

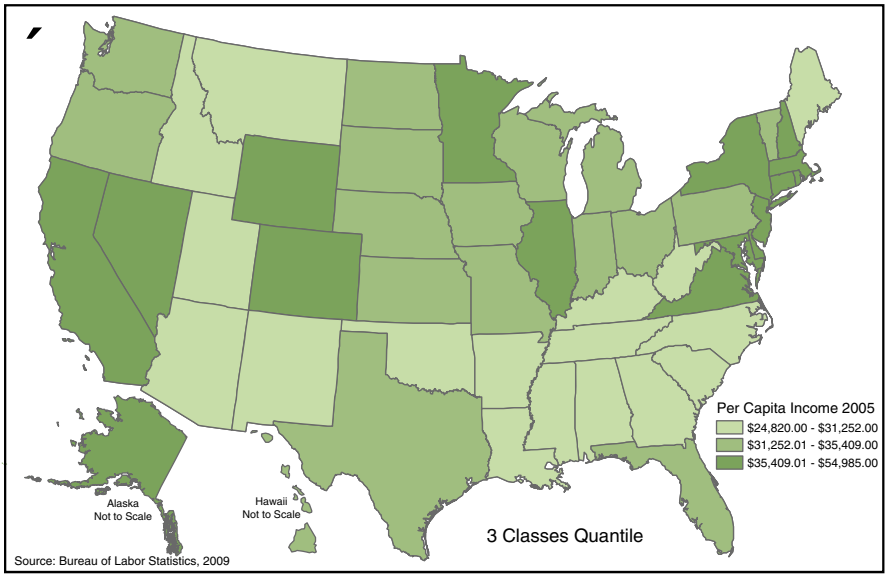

Fig. 8.3 Per capita income per state, 2005

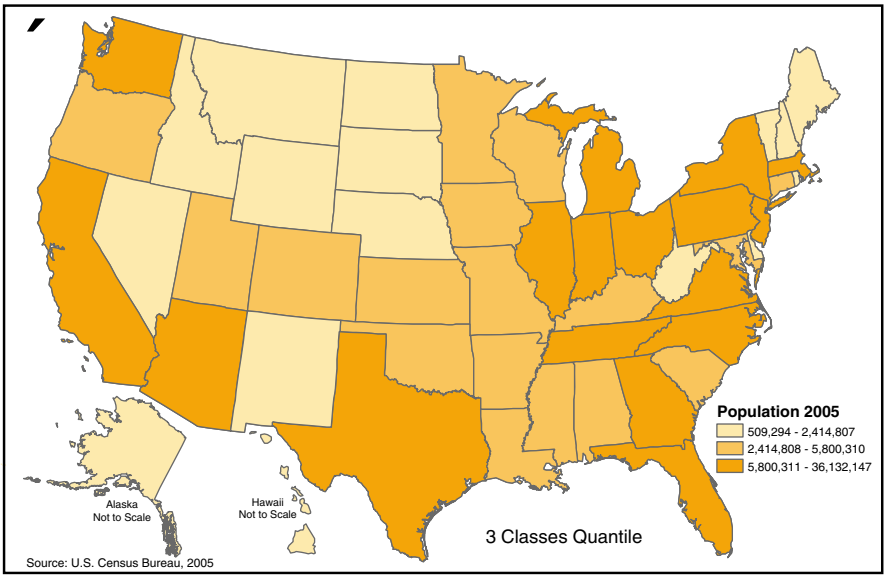

Fig. 8.4 Population per state, 2005

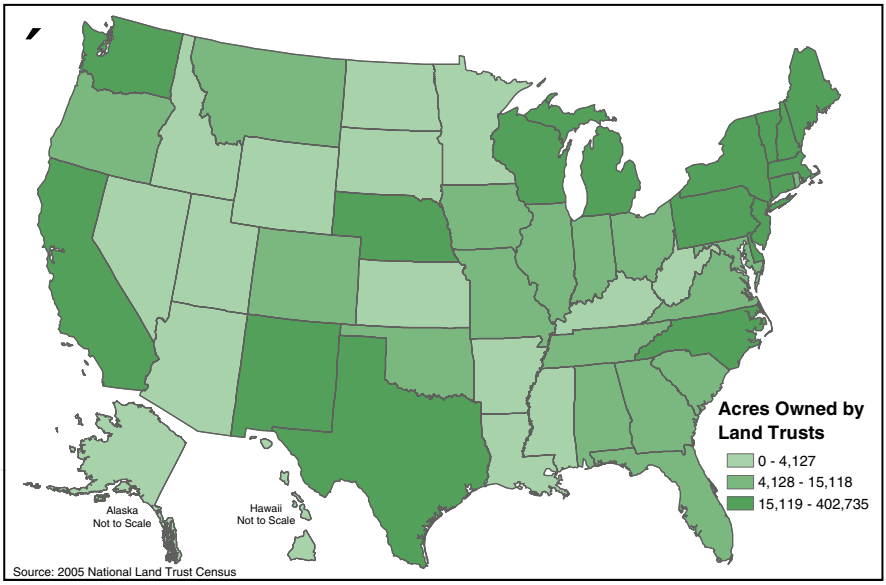

Fig. 8.5 Acres owned by land trusts

To consider acres owned by land trust, another map was created (Fig. 8.5). Not surprisingly, certain recognizable patterns are present in this spatial distribution. Many acres are owned by land trusts in the Northeast as well as the New England states because there is a high density of land trusts there as well as a long history with such trusts. Michigan and Wisconsin also have a high density of land trusts, as do California and Washington. Texas and New Mexico, on the other hand, have somewhere between 9 and 35 land trusts per state yet rank among the highest in acres owned (Fig. 8.2). Also notable is Florida, which was classed as high in the number of land trusts yet in acres owned is somewhere in the midrange classification. One possibility is that although Florida has more land trusts, less acreage is owned, which could also be a result of a preference toward conservation easements over land acquisition.

Figure 8.6 shows the spatial distribution of conservation easements only. Florida is shown in the midrange in this map as well, so the initial suggestion that Florida has more land trust and less acres probably is the better of the two conclusions suggested. The spatial distribution in Fig. 8.6 shows a cluster of states: Iowa, Missouri, Illinois, Indiana, and Oklahoma are classed in the lowest range for conservation easement acres, yet these same states are in the midrange for acres owned. Other states such as Arkansas and Kansas were also part of this cluster of states with the fewest conservation easement acres, but were also in the lowest class with respect to acres owned. Montana, which is shown in the highest class, is also unexpected as this state has only 14 land trust and many more acres under conservation easement than under ownership, suggesting a possible preference for conservation easements

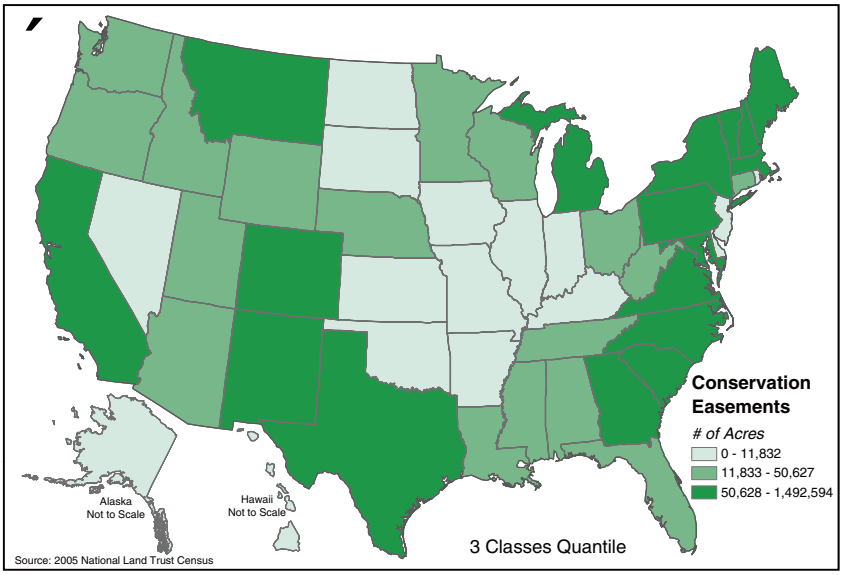

Fig. 8.6 Acres held in conservation easement by land trusts

here as well (Figs. 8.1 and 8.5). This conclusion seems to hold when looking at the total acres protected by land trusts, as Montana is also in the highest class there as well (Fig. 8.7).

When looking at total acres protected, it is hard not to notice the strip-like pattern that appears or seems to divide the country in half. This pattern coincides well with the dot density map shown earlier (Fig. 8.1), suggesting that not only are there few land trusts in these states, few acres are protected as well. Another pattern that has held for each three-classed choropleth map shown thus far is that Massachusetts, New York, and California have been in the highest class on each (Figs. 8.2, 8.3, 8.4, 8.5, 8.6, 8.7), which means that these three states were highest in the number of land trusts, per capita income, population, number of acres owned, number of acres under conservation easements, and total number of acres protected by all means.

Noticing that these three states were highest in income, one could argue that there appears to be a distribution pattern reflecting a spatial bias toward the New England and Mid-Atlantic states and California on many of the maps produced thus far. In light of this, it seemed prudent to create a map that showed the spatial distribution of the ratio of acres owned by land trust to per capita income (Fig. 8.8). A table was also created and ratio values were ranked in three reverse-order quantiles (Table 8.1).

This map is almost identical to the map created for acres owned. In fact, the only two states with a different classification are Idaho and Colorado, whose classifications have been reversed. It was tempting to claim that there must be some association between the variables “acres owned” and “per capita income, but a closer examination

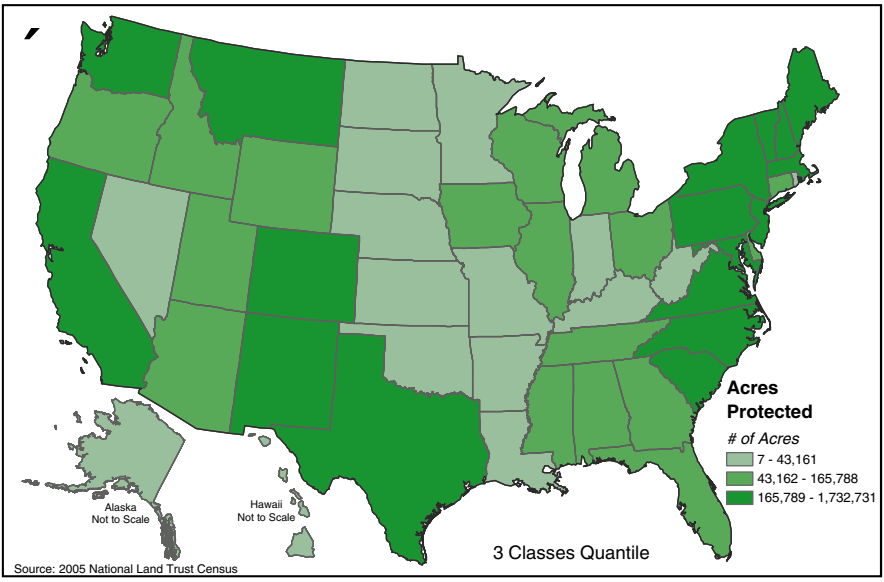

Fig. 8.7 Total acres protected by land trusts through all means

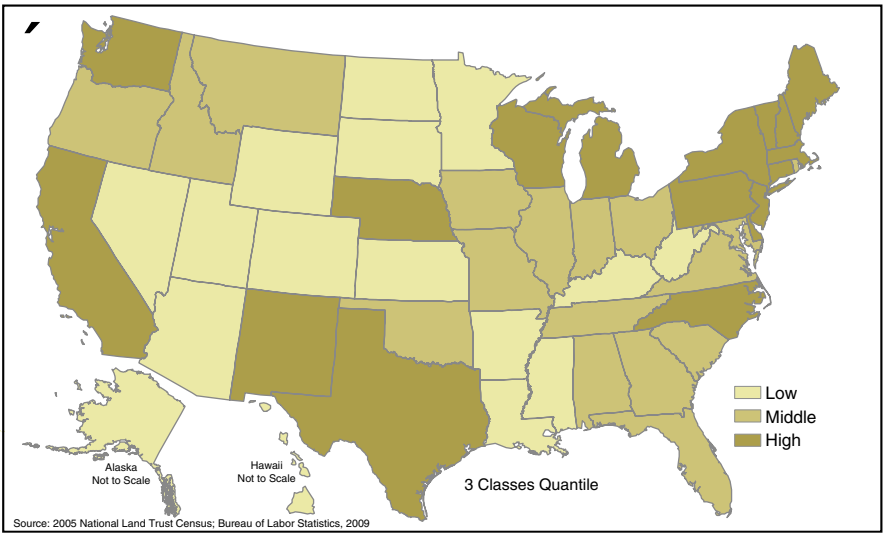

Fig. 8.8 Ratio of acres owned by land trusts to per capita income

Table 8.1 Acres owned by land trusts in state 2005 divided by per capita income, 2005, ranked in three reverse-order quantiles

Highest quantile			Middle quantile			Lowest quantile		
State	Ratio value	Rank	State	Ratio value	Rank	State	Ratio value	Rank
New Mexico	14.5686	51	Rhode Island	0.4182	34	Colorado	0.1271	17
California	8.2188	50	Tennessee	0.4159	33	Utah	0.0799	16
New York	4.1538	49	Iowa	0.3836	32	Kentucky	0.0604	15
Maine	2.6966	48	Indiana	0.3755	31	Minnesota	0.0581	14
Massachusetts	2.6754	47	Ohio	0.3504	30	Arkansas	0.0379	13
Vermont	2.0765	46	Missouri	0.3317	29	Arizona	0.0373	12
New Hampshire	2.0756	45	Virginia	0.3161	28	Mississippi	0.0309	11
New Jersey	1.2649	44	Montana	0.2992	27	Alaska	0.0297	10
Connecticut	1.0529	43	Florida	0.2906	26	West Virginia	0.0267	9
Pennsylvania	1.0153	42	South Carolina	0.2706	25	Wyoming	0.0180	8
Michigan	1.0063	41	Oregon	0.2318	24	Nevada	0.0137	7
Texas	0.8809	40	Illinois	0.2134	23	Louisiana	0.0104	6
North Carolina	0.7593	39	Oklahoma	0.1794	22	South Dakota	0.0089	5
Washington	0.6464	38	Alabama	0.1696	21	Hawaii	0.0084	4
Delaware	0.5861	37	Georgia	0.1664	20	Kansas	0.0056	3
Wisconsin	0.5399	36	Idaho	0.1466	19	District of Columbia	0.0000	2
Nebraska	0.5158	35	Maryland	0.1277	18	North Dakota	0.0000	1

Source: National Land Trust Census (2005), Land Trust Alliance (2009)
Ranked in three reverse order quantiles

of the differences in ratio values between the extremes in the highest class from Table 8.1 prompted concern that, perhaps as a result of per capita income having such a narrow range of values, the classes were not much affected. The only way to settle this was to check the two variables to see if they were correlated. Although statistical analysis was not intended to be part of this study, an exception was made here. A Pearson's correlation performed on the two variables showed the correlation coefficient to be 0.094, although results from both the chi-squared and the Kolmogorov–Smirnov test showed the data were not normally distributed. A Kendall tau rank correlation nonparametric test was then performed, as this test does not require normally distributed data. The result was a correlation coefficient of $0.25 p_{<0.01}$, which is very low.

8.4.3 Location Quotients to Reveal Patterns of Concentration

Another way to determine spatial distribution patterns is through the use of location quotients. Location quotients are simply the percentage of the activity in the local region divided by the percentage of the activity in the base region, which shows the

concentration of that activity with respect to the base region. Location quotients were computed using the following equation:

$$LQ = \frac{A_l / B_l}{A_{us} / B_{us}}$$

where A_l = the total activity in the state (for purposes of this study, these activities included the number of land trusts, acres owned, easement acres, and total acres protected), B_l = the comparative base of the state (population and area are used), A_{us} = the total activity of the entire region (U.S.), and B_{us} = the base of the entire region to which to compare the activity. Location quotient (LQ) values greater than 1 indicate that an activity is more concentrated in the state than in the U.S., values equal to 1 indicate that the activity is equally concentrated in the state as in the U.S., and values less than 1 indicate that the activity is less concentrated in the state than in the U.S. To identify any states that were close to being equal in concentration to the U.S. but may not have ratio values of exactly 1, modified breakpoints were used for mapping purposes. The three classes used were manually defined: in order of lowest to highest these were 0.00–0.80, 0.81–1.20, and 1.21 or greater.

Using location quotient values to compare the concentrations of spatial patterns of specific land trust activities, namely, acres owned, acres with conservation easements, and total acres protected by all means, is similar to the way Wikle (1998) used location quotients in his analysis of spatial concentration of membership patterns for three environmental organizations. In addition, in this study location quotients were also used to show the spatial pattern of the concentration of land trusts compared with population.

Figure 8.9, using location quotients, shows the concentration of the number of land trusts to population. Many of the New England States show as more concentrated than the nation as a whole. With Massachusetts and Connecticut, this is most likely the result of the sheer high number of land trusts. Maine, in fact, has the highest concentration as it has many land trusts and ranks low in population (Fig. 8.4, Table 8.2). Alaska, which has a low number of land trusts, but a high number in comparison to its population, is also more highly concentrated than the nation. What is most interesting, however, is the four Mountain States that are in the highest class, which gives the illusion of a spatial pattern that is more weighted in this region. The New England States all have ratios much higher, however, Montana being the only Mountain State with a ratio greater than 2 (Table 8.2).

Another way to show these geographic patterns of concentration is using ArcScene to add another dimension. Height can be shown proportional to the location quotient values, which allows one to really see the differences in concentration. Figure 8.10 shows the concentration of acres owned by land trusts using area as the base. The pattern displayed for the highest class shows many of the same states that were in the highest class in Fig. 8.5, with the exception of Washington, Texas, and North Carolina.

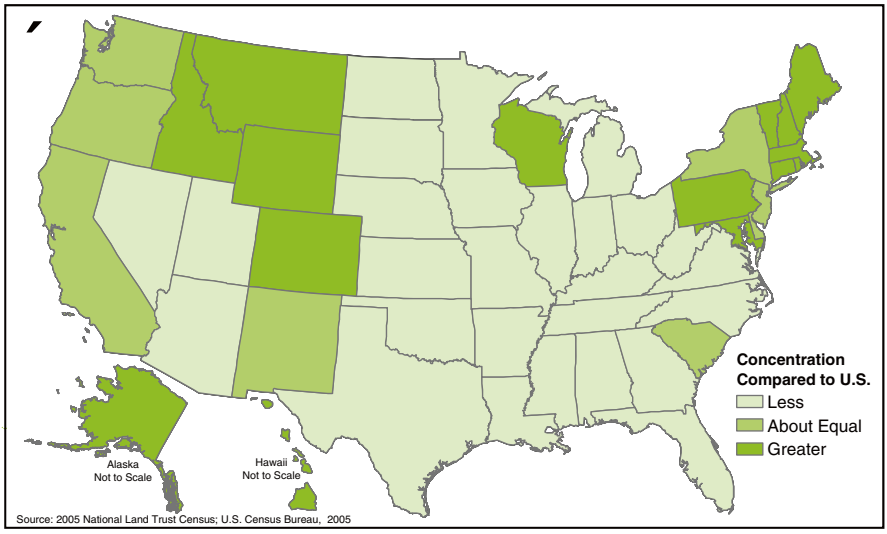

Fig. 8.9 Location quotients for the number of land trust per state using population as the base. Concentration determined using location quotients. Location quotients calculated as ratio of land trusts per state to population of state divided by the ratio of land trusts per U.S. to population U.S. Classes manually defined: LQ < 0.81 (concentration <U.S.), LQ 0.81–1.20 (concentration ≈ U.S.), LQ > 1.20 (concentration > U.S.) (*Source*: 2005 National Land Trust Census, Land Trust Alliance (2009))

The Northeast states really stand out along with Michigan, California, and New Mexico. This figure, however, shows just how much more concentrated many of these Northeast States are, particularly the New England States, as evidenced by their skyscraper-like appearance. Massachusetts and Rhode Island have ratios greater than 30 (Table 8.3). This technique would also have proved useful for the study by Wikle (1998) for membership concentration among three environmental organizations.

Figures 8.11 and 8.12 were also produced, showing the geographic pattern of concentration for conservation easement acres and total acres protected by all means. The figures each show a region of the East from South Carolina to Maine that is mostly high in concentration. In fact, it becomes clear just how weighted the pattern of geographic concentration really is. From the location quotient values, Maine ranks the highest with respect to conservation easement acres with Vermont coming in second, and Vermont ranks highest in concentration for total acres protected with Maine ranking second (Tables 8.4, 8.5). An uninterrupted region from South Carolina to Maine appears to dominate both maps. This technique is clearly powerful and would have proved useful to Wikle (1998) for membership concentration patterns revealed.

Table 8.2 Location quotients: land trusts in state per state population 2005 divided by land trusts in United States per U.S. population, 2005, ranked in three reverse-order quantiles

Highest quantile			Middle quantile			Lowest quantile		
State	Location quotient	Rank	State	Location quotient	Rank	State	Location quotient	Rank
Maine	11.4369	51	Washington	1.0180	34	Illinois	0.4876	17
Vermont	9.9886	50	South Carolina	1.0029	33	Iowa	0.4795	16
Rhode Island	7.7655	49	Oregon	0.9767	32	Georgia	0.4704	15
Connecticut	6.4837	49	California	0.9744	31	South Dakota	0.4583	14
New Hampshire	4.7509	47	New Jersey	0.8770	30	Kansas	0.4535	13
Massachusetts	4.4739	46	New York	0.8311	29	Utah	0.4320	12
Montana	2.8505	45	New Mexico	0.8299	28	Kentucky	0.4261	11
Hawaii	1.9521	44	West Virginia	0.7829	27	Nevada	0.3682	10
Alaska	1.8755	43	Michigan	0.7730	26	Mississippi	0.3652	9
Maryland	1.8097	42	Indiana	0.7655	25	Florida	0.3598	8
Wyoming	1.7457	41	Virginia	0.7519	24	Alabama	0.2731	7
Wisconsin	1.7022	40	Ohio	0.6825	23	Texas	0.2489	6
District of Columbia	1.6149	39	North Carolina	0.6553	22	Minnesota	0.2079	5
Idaho	1.4931	38	Arizona	0.6287	21	Louisiana	0.1575	4
Colorado	1.4483	37	Tennessee	0.6262	20	Oklahoma	0.1504	3
Pennsylvania	1.3590	36	Missouri	0.5825	19	Arkansas	0.1280	2
Delaware	1.0540	35	Nebraska	0.5055	18	North Dakota	0.0000	1

Source: National Land Trust Census (2005), U.S. Census Bureau (2005), Land Trust Alliance (2009)

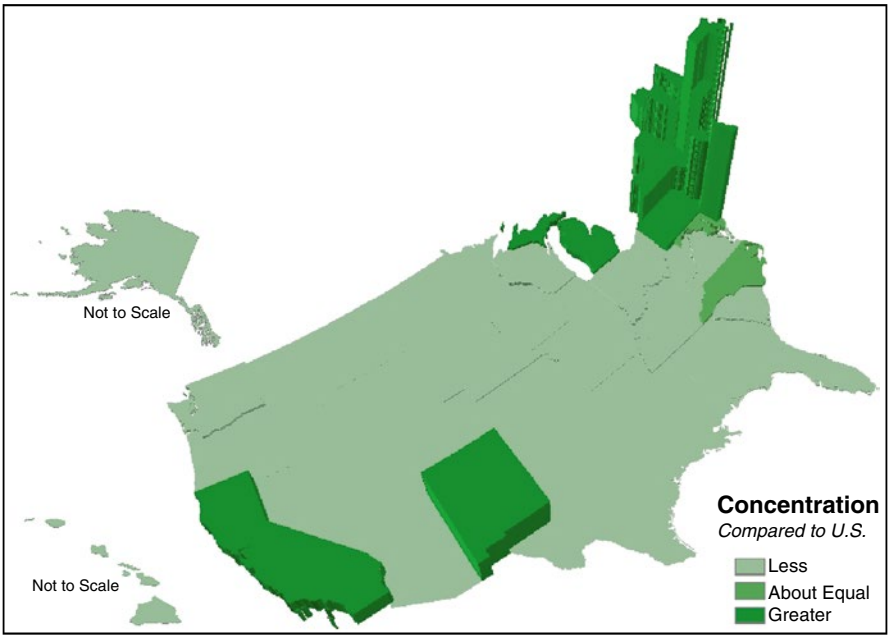

Fig. 8.10 Concentration of acres owned by land trusts. Location quotients for the number of acres owned per state using area as the base (Classes manually defined: LQ < 0.81 (Concentration < U.S.), LQ = 0.81–1.20(Concentration ≈ U.S.), LQ > 1.20, (Concentration > U.S.). State heights extruded proportional to actual LQ value (*Source*: National Land Trust Census (2005), Land Trust Alliance (2009))

8.5 Further Discussion

When considering activities throughout the United States for geographic patterns, a quick generalization can easily be made. Obviously, there is uneven distribution with the East far more heavily weighted than the rest of the country. This view especially holds true when examining the geographic patterns of concentrations among the various land trust activities as mapped and from location quotient values. The central portion of the country shows a lack of land trust activity, which was also confirmed from location quotients that showed their relative concentrations, using population as the base for the number of land trusts, and area as the base for acres owned, conservation easement acres, and total protected acres. In the West, California is in the highest class in 11 of the 12 choropleth maps produced. When viewed in terms of concentration, patterns for acres owned, conservation easement acres, and total acres protected by land trusts, several of the Mountain States such as Montana, Colorado, and New Mexico appear (Figs. 8.10, 8.11, 8.12). Also worthy of note is that Massachusetts was in the highest class in every figure produced. Geographic patterns of sum total data by state such as the number of acres owned, conservation easement acres, and total acres protected show Texas and New Mexico in the highest class there. For

Table 8.3 Location quotients: acres owned by land trusts in state per area of state divided by acres owned by land trusts in the United States per area of U.S., ranked in three reverse-order quantiles

Highest quantile			Middle quantile			Lowest quantile		
State	Location quotient	Rank	State	Location quotient	Rank	State	Location quotient	Rank
Massachusetts	30.5224	51	Indiana	0.6791	34	Colorado	0.0975	17
Rhode Island	30.4592	50	Tennessee	0.6771	33	Hawaii	0.0953	16
Delaware	22.2576	49	Virginia	0.6415	32	Kentucky	0.0899	15
Connecticut	21.2985	48	Ohio	0.5815	31	West Virginia	0.0631	14
New Hampshire	18.1242	47	South Carolina	0.5233	30	Utah	0.0556	13
New Jersey	15.5246	46	Nebraska	0.4720	29	Minnesota	0.0541	12
Vermont	15.1708	45	Iowa	0.4639	28	Arkansas	0.0405	11
New York	7.2941	44	Florida	0.3641	27	Mississippi	0.0346	10
New Mexico	6.9632	43	Missouri	0.3190	26	District of Columbia	0.0319	9
Maine	5.5162	42	Illinois	0.2882	25	Arizona	0.0209	8
California	4.0614	41	Texas	0.2277	24	Wyoming	0.0142	7
Pennsylvania	1.6444	40	Alabama	0.2011	23	Louisiana	0.0118	6
Michigan	1.2116	39	Georgia	0.1859	22	Nevada	0.0093	5
Maryland	1.1529	38	Oregon	0.1613	21	South Dakota	0.0076	4
North Carolina	0.9957	37	Oklahoma	0.1583	20	Kansas	0.0047	3
Washington	0.7161	36	Montana	0.1257	19	Alaska	0.0039	2
Wisconsin	0.6801	35	Idaho	0.1042	18	North Dakota	0.0000	1

Source: National Land Trust Census (2005), Land Trust Alliance (2009)

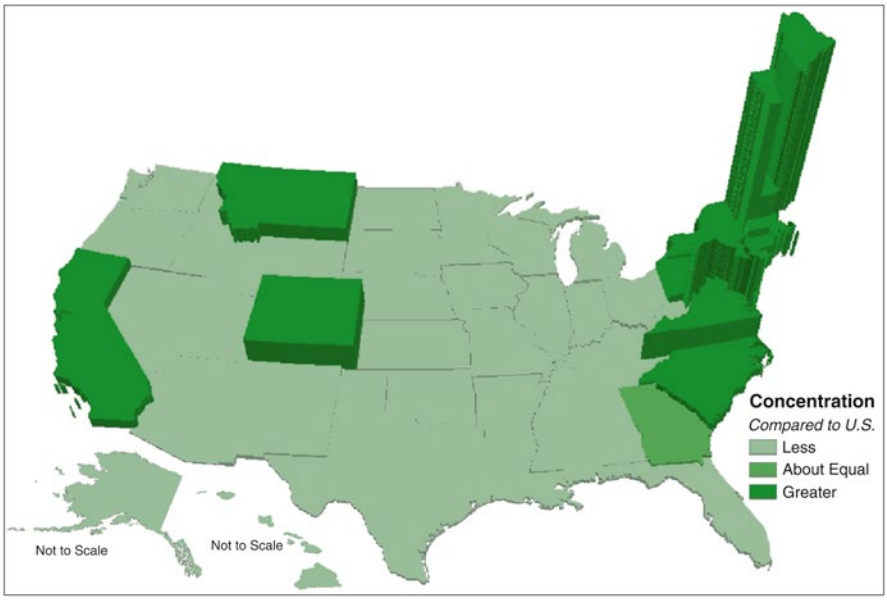

Fig. 8.11 Concentration of acres under conservation easements by land trusts. Concentration determined using location quotients. Location quotients calculated as ratio of easement acres per state to area of state divided by the ratio of easement acres per U.S. to area U.S. Classes manually defined: LQ < 0.81 (concentration < U.S.), LQ 0.81–1.20 (concentration ≈ U.S.), LQ > 1.20 (concentration > U.S.). State heights extruded proportional to actual LQ value. (*Source:* 2005 National Land Trust Census, Land Trust Alliance (2009))

acres owned, New Mexico should be in this highest class, as acres owned by land trusts in New Mexico are the highest in the U.S. exceeding California, the state that ranks second with a difference of almost 100,000 acres.

It is also r'ecognized that choropleth maps, and all maps in general, have their limitations, and one has to be careful about the judgments or conclusions arrived solely from interpretations from the maps, which is why there was a reluctance to point out specific causal factors in the absence of overwhelming evidence. Location quotients also have problems in that values below the equally concentrated level, that is, values less than one, are compressed, and values above one can go to infinity (Wikle 1998).

8.6 Summary and Conclusion

This study utilized a variety of techniques to analyze the geographic patterns of land trust activities across the U.S. These techniques included classifying and mapping aggregate totals for each of the land trust activities considered, making some

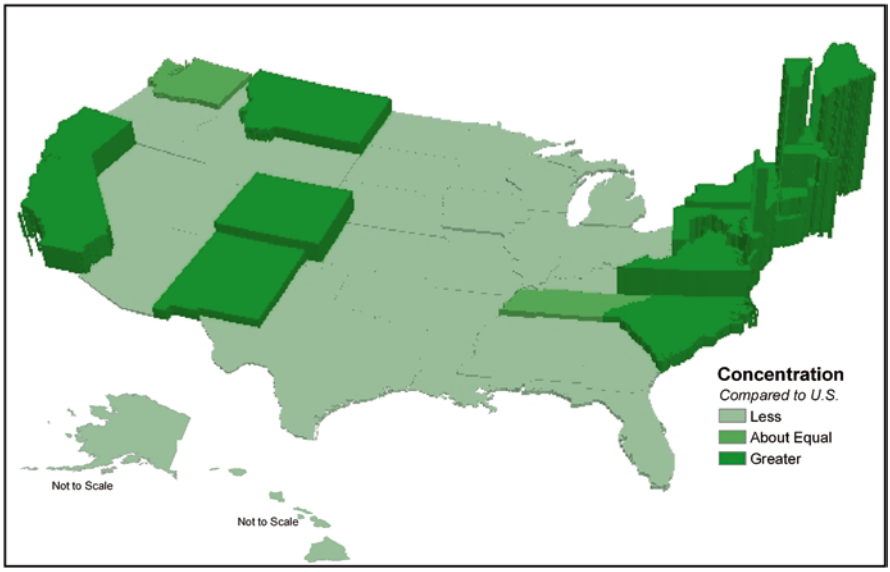

Fig. 8.12 Concentration of total acres protected by land trusts. Concentration determined using location quotients. Location quotients calculated as ratio of total acres protected per state to area of state divided by the ratio of total acres protected per U.S. to area U.S. Classes manually defined: LQ < 0.81 (concentration < U.S.), LQ 0.81–1.20 (concentration ≈ U.S.), LQ > 1.20 (concentration > U.S.). State heights extruded proportional to actual LQ value (*Source*: 2005 National Land Trust Census, Land Trust Alliance (2009))

comparisons in search of causal factors for such patterns, using location quotients to determine geographic patterns of relative concentration, and further, utilizing a variety of two-dimensional and three-dimensional mapping techniques. Analyses included computing location quotients, which were mapped and used to show the spatial patterns of relative concentrations of each of these land trust activities within the U.S. Comparative analysis and even limited statistical calculations were employed to find possible causal factors such as population and per capita income that might be associated with the spatial patterns found. However, none stood out distinctly. A multiple regression analysis in combination with similar techniques utilized in this study may find such predictive factors. Studies utilizing a combination of multiple regression analysis, correlations, location quotients, and mapping may reveal specific causal factors not uncovered in this study and would provide an avenue for future research.

Table 8.4 Location quotients: acres under easement by land trusts in state per area of state divided by acres owned by land trusts in the United States per area of U.S., ranked in three reverse-order quantiles

Highest quantile			Middle quantile			Lowest quantile		
State	Location quotient	Rank	State	Location quotient	Rank	State	Location quotient	Rank
Maine	26.6409	51	New Mexico	0.6698	34	Arizona	0.1799	17
Vermont	23.8922	50	Delaware	0.6689	33	Minnesota	0.1664	16
Maryland	11.2768	49	Mississippi	0.5837	32	Nebraska	0.0959	15
New Hampshire	8.2973	48	Michigan	0.5433	31	Indiana	0.0891	14
Virginia	5.2670	47	Alabama	0.5375	30	South Dakota	0.0801	13
Colorado	4.6862	46	Ohio	0.4914	29	Missouri	0.0778	12
Massachusetts	4.3247	45	Florida	0.3852	28	Illinois	0.0768	11
Rhode Island	4.3199	44	West Virginia	0.3828	27	Kentucky	0.0716	10
Connecticut	2.8570	43	Washington	0.3728	26	Iowa	0.0612	9
Montana	2.7876	42	Wisconsin	0.3470	25	District of Columbia	0.0521	8
New York	2.2590	41	Louisiana	0.3011	24	Kansas	0.0348	7
South Carolina	1.8290	40	Oregon	0.2994	23	Oklahoma	0.0288	6
Pennsylvania	1.7631	39	Wyoming	0.2897	22	Arkansas	0.0252	5
California	1.5560	38	Tennessee	0.2874	21	Hawaii	0.0191	4
North Carolina	1.3211	37	Texas	0.2855	20	Alaska	0.0048	3
New Jersey	0.9047	36	Utah	0.2328	19	North Dakota	0.0000	2
Georgia	0.8581	35	Idaho	0.2065	18	Nevada	0.0000	1

Source: National Land Trust Census (2005)

Table 8.5 Location quotients: acres protected by land trusts in state per area of state divided by acres protected by land trusts in the United States per area of U.S., ranked in three reverse-order quantiles

Highest quantile			Middle quantile			Lowest quantile		
State	Location quotient	Rank	State	Location quotient	Rank	State	Location quotient	Rank
Vermont	18.1127	51	North Carolina	1.4052	34	Oregon	0.2318	17
Maine	16.1097	50	Tennessee	1.1879	33	Idaho	0.2132	16
Delaware	15.1424	49	Washington	0.9860	32	Indiana	0.1706	15
Massachusetts	10.5018	48	Alabama	0.5650	31	Louisiana	0.1635	14
New Hampshire	8.5867	47	Michigan	0.5509	30	Nebraska	0.1352	13
New Jersey	8.5588	46	Georgia	0.5299	29	Minnesota	0.1205	12
Rhode Island	7.1302	45	Iowa	0.4699	28	Missouri	0.0969	11
Maryland	6.6203	44	Florida	0.4686	27	Kentucky	0.0855	10
Connecticut	5.8306	43	Wisconsin	0.4192	26	South Dakota	0.0802	9
Virginia	5.0161	42	Ohio	0.3712	25	Nevada	0.0399	8
New York	3.8768	41	Illinois	0.3446	24	Oklahoma	0.0394	7
California	3.3121	40	Mississippi	0.3445	23	District of Columbia	0.0320	6
Pennsylvania	2.9299	39	Wyoming	0.3261	22	Hawaii	0.0257	5
Colorado	2.7792	38	West Virginia	0.3147	21	Arkansas	0.0241	4
Montana	1.9422	37	Arizona	0.2826	20	Alaska	0.0226	3
South Carolina	1.7241	36	Texas	0.2776	19	Kansas	0.0212	2
New Mexico	1.4230	35	Utah	0.2724	18	North Dakota	0.0041	1

Source: National Land Trust Census (2005)

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