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Classifying land-ownership motivations in central, Texas, USA: A first step in understanding drivers of large-scale land cover change

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ABSTRACT

Land-ownership patterns in rural areas are undergoing changes. To explore the critical question of how changing land ownership in a watershed potentially drives land use, we examined differences in individual landowners' reasons for owning drylands. We conducted a mail survey of 767 landowners in three counties of central Texas, USA. Using exploratory factor analysis we reduced motivations into six dimensions: agricultural production, profit-orientation, rural lifestyle, financial investment, mineral extraction, and wildlife enterprise. A cluster analysis of these dimensions classified landowners into three groups: agricultural production, multiple-objective, and lifestyle-oriented. We validated these classifications using variables related to land management, land characteristics, ranching and farming perceptions, and demographics. The landowner groups performed well in discriminating between socio-demographic variables. Although landowners in central Texas are still largely involved in agricultural production (61%), only 24% focus on it exclusively. More than one third (39%) own land exclusively for lifestyle reasons. Changing motivations for owning land may be indicative of a cultural shift that can lead to landscape-scale changes in land cover. Policy tools and education efforts that recognize this heterogeneity in landowners will enhance the resiliency and sustainability of rural communities and of the dryland ecosystems on which they depend.

1. Introduction

Rural lands are increasingly being sold and subdivided for low-density residential and commercial development. There is concern that as the landscape becomes more fragmented, it will be less able to provide the ecosystem services we all depend on, including clean and abundant water, high biodiversity, recreational value, wildlife habitat, and open space (Gosnell and Travis, 2005; Gosnell et al., 2006; Theobald, 2001). Landscape fragmentation is taking place in drylands in Texas (Kjelland et al., 2007), much of the American West (Gosnell and Travis, 2005; Gosnell et al., 2006), and in other developed countries (e.g., Australia; Gill et al., 2010; Mendham and Curtis, 2010). The average size of rural properties has been decreasing as land is sold to so-called amenity buyers, who purchase land primarily for recreation, for its aesthetic qualities, and to experience the rural lifestyle.

The shift in type of landowner—from the traditional rancher or farmer to the amenity buyer—may represent a cultural change that has significant implications for future land use and land cover, because the ways landowners view their lands drive land-management preferences, land use, and ultimately land cover. In aggregate, changes in these land management practices can affect ecosystem dynamics (Gosnell and Travis, 2005; Gunderson et al., 2002; Theobald, 2001; Zheng et al., 2010). Unlike ranchers and farmers, amenity buyers tend to purchase smaller parcels and are less dependent on ranching or farming for income generation (Gill et al., 2010; Mendham and Curtis, 2010). The amenity buyer may actually be more strongly oriented toward environmental conservation than the rancher or farmer (Gosnell et al., 2006), but often lacks the skill and knowledge to implement conservation-oriented land management practices (Mendham and Curtis, 2010). With more landowners expressing increasingly diverse motivations and preferences for land use comes less predictability and more complexity in coordinating conservation and management efforts at the ecosystem scale (e.g., Majumdar et al., 2008).

At present there is no consensus regarding the potential positive or negative ecological consequences of this land-ownership trend

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(Gill et al., 2010). On one hand, a greater number of households on smaller land holdings certainly exacerbates land fragmentation, as roads and related infrastructure multiply (Theobald et al., 1996), and also leads to increased resource consumption (Liu et al., 2003). Rural development may also negatively affect wildlife habitat as well as ecological patterns (e.g., Zheng et al., 2010) and processes (e.g., Hansen et al., 2002).

On the other hand, there are positive aspects to changing land ownership. For example, livestock overgrazing has been a primary driver of land degradation (Bailey and Brown, 2011). Greater numbers of amenity-motivated landowners may reduce grazing pressure on drylands, leading to improvements in some ecosystem services—such as higher groundwater recharge and streamflow (e.g., Wilcox and Huang, 2010). In addition, amenity-motivated land-ownership may drive conservation efforts: if economic growth is closely tied to the presence of natural amenities, rural communities will be motivated to choose policies that promote scenery protection and wildlife protection over extractive industries (Hansen et al., 2002).

To maintain the resilience of dryland ecosystems, both agricultural producers and amenity landowners must recognize the value of cooperative efforts at larger spatial scales (Morton et al., 2010). Such efforts will require that stakeholders understand how the increasingly diverse motives for owning land affect the sustainability of drylands. Land-ownership motivation may be defined as the underlying reasons for owning land—reasons that both shape land-use goals and energize behavior to achieve those goals (e.g., Greiner et al., 2009).

To develop an understanding of the effects of land-ownership change on larger-scale ecological processes and services, the first step is to inventory and analyze what motivates land ownership on drylands. This analysis provides a baseline for subsequent investigation of the extent to which these motivations may affect land stewardship and the future flow of ecosystem services (Maybery et al., 2005). Our objectives were to 1) classify landowners into homogeneous subgroups on the basis of their motivations for land ownership, and 2) explore the validity of these subgroups by relating them to landowner and land-use demographics. We hypothesized that landowners who own land predominantly to experience the rural lifestyle would be less dependent on their land for income, less likely to operate their land for agricultural production, and thus less likely to identify themselves as a rancher. Further, we expected these lifestyle-oriented landowners to be less likely to take an active role in managing their land.

A categorization scheme of this type, based on simple indicators, provides a framework for identifying and monitoring slow-changing variables such as the changes in knowledge and shared beliefs (cultural) that can occur at multiple scales across a landscape. Because changes in these "slow variables" are the basis of major changes in a system's state (Gunderson and Holling, 2002), understanding them is critical to our ability to predict or anticipate thresholds of social and ecological regime shifts in coupled human–dryland systems (Wilcox et al., 2011).

2. Study area

Our study focused on the Cowhouse Creek watershed in north-central Texas (Fig. 1). It lies within the Limestone Cut Plain (sometimes referred to as the Lampasas Cut Plain) and is characterized by limestone-capped mesas with eroded side slopes, and

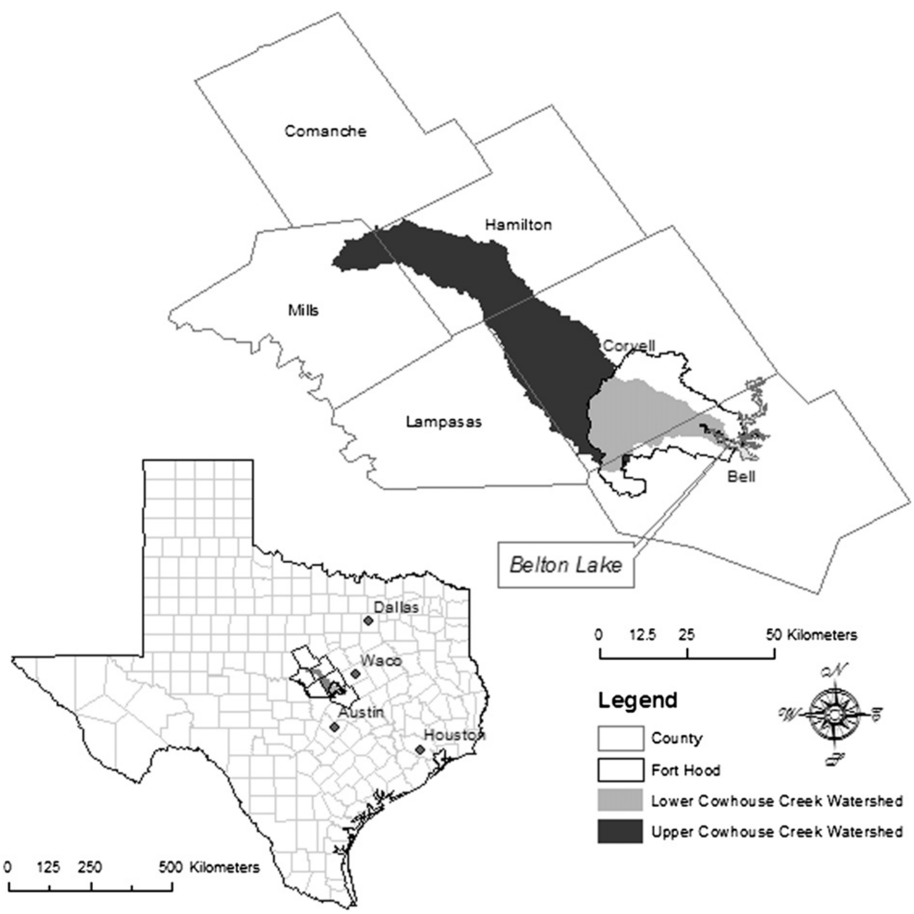

Fig. 1. The upper Cowhouse Creek watershed in central Texas, USA, where a survey of rangeland owners ($N = 767$) was conducted in 2010.

broad flat valleys (Griffith et al., 2007). Soils are typically shallow. Mean annual precipitation varies from 75 to 85 cm with rainfall increasing towards the east. Temperatures average 0 °C (minimum) and 14 °C (maximum) in January and 22 °C (minimum) and 94 °C (maximum) in July.

The Cowhouse Creek is a 145-km long tributary of the Brazos River and flows north to south through portions of four rural counties (Mills, Hamilton, Coryell, and Bell County) before emptying into Belton Lake. The watershed encompasses 159,850 ha and is dominated by rangelands. The upstream portion consists mostly of private lands while the downstream third (Bell County) is on federal property—specifically, the Fort Hood U.S. Army installation.

In this watershed and others throughout the Southern Great Plains of the United States woodlands and shrublands are expanding at the expense of grasslands (Fowler and Simmons, 2009). This woody plant encroachment represents an ecological shift that has far-ranging consequences for people. Yet this issue is neither well understood nor widely appreciated as a complex problem with both ecological and social dimensions (Wilcox et al., 2011). For example, increasing woodlands may increase the costs of maintaining forage for cattle, reducing the profitability of the ranching sector. Ecologically, conversion of land to woodlands may increase the potential for carbon sequestration under certain conditions (Barger et al., 2011) and threaten biodiversity (Sorice et al., 2011).

Land tenure in the watershed and in Texas is predominantly private property. Private property rights in the United States permit sale and subdivision of land with little interference from state and national governments. Land-use planning often occurs at the local level. Thus, there are no regulations that limit the degree of subdivision.

Although our study is cross-sectional, we argue that land-ownership patterns in the watershed under private ownership are representative of Texas as a whole (Kjelland et al., 2007; Wilkins et al., 2003, 2009). Recent U.S. Census of Agriculture data support this assertion, showing a net increase in the number of farms between 1992 and 2007 (Table 1). In each of the three counties the number of farms increased faster than the hectares of land being farmed, and there was a decrease in the average size of farms. The increase in the number of farms included both small and mid-sized holdings; but it was the smaller farms (1–19 ha) that saw the greatest increase. Conversely, the number of larger farms (≥202 ha) decreased in all three counties.

Table 1
Changes in demographic variables for the three counties[a] included in this study and for the State of Texas[b], 1992–2007 (%).

Variable	Coryell County	Hamilton County	Mills County	State of Texas
Number of farms	35%	12%	34%	37%
Hectares in farms	−19%	2%	11%	−0.4%
Average farm hectares	−62%	−9%	−17%	−27%
Property taxes[c]	254%	170%	193%	–
Estimated market value of land & buildings (average $/ac)	254%	206%	259%	155%
Size of farm				
1–19 ha	248%	60%	161%	106%
20–202 ha	12%	17%	37%	22%
202 ha or greater	−10%	−16%	−7%	−5%
Beef cows				
Number	21%	5%	–	1%
Number of farms	1%	4%	19%	11%

Note: Negative numbers indicate percent decrease over time and positive numbers indicate percent increase.
[a] Bell County is not included because the Cowhouse Creek watershed in that county is on federal lands.
[b] Source: United States Census of Agriculture.
[c] Source: Texas Comptroller of Public Accounts open records request.

3. Methods

3.1. Sampling

The population of interest was landowners owing land within the Cowhouse Creek watershed. Because the ecological boundaries of the watershed cross three counties (political boundaries), we constructed the sampling frame for the watershed using information obtained from each county's tax appraisal district office. For Hamilton and Coryell counties we used geographic information systems to determine which portions of each county lay within the boundaries of the watershed. For Mills County, the tax appraiser provided names and addresses of landowners in a school district that encompasses the portion of the watershed in the county. We randomly selected 800 landowners owning at least 20 ha (to ensure that properties were large enough to require larger-scale management). After addresses with identified problems and duplicate entries had been removed from the list, we had a final initial sample size of 767 landowners.

In February 2009 we sent the self-administered mail survey using a slightly modified Dillman (2000) procedure (a notification letter, a questionnaire, a postcard reminder, a replacement questionnaire, and a final postcard reminder). We used a mail survey because it is an economical way to get a large sample size, which enhances both the reliability and generalizability of our results. Further, we were working with an educated, highly literate population and the mail survey permitted respondents to work at their own pace. The questionnaire requested information on land use, land-ownership motivations, landowner characteristics and demographic information.

3.2. Data analysis

Although previous work in forestry research has used the methodology of segmenting landowners on the basis of land-ownership motivations (e.g., Majumdar et al., 2008), none has attempted to rigorously categorize the ownership motivations of landholders in western U.S. drylands. We measured motivation for owning land via 17 items, using a 7-point scale in which 1 = *Not Important at All*, and 7 = *Very Important* (see Table 2). We conducted

Table 2
Exploratory factor analysis of land-ownership motivations (principal factors with promax rotation). Bold type indicates variables that load on a particular factor ($n = 312$).

Motivation for ownership items	Agricultural production	Lifestyle	Financial investment	Cronbach's alpha
Operate farm/ranch	**0.8378**	−0.0035	−0.0115	0.85
Livestock production	**0.8363**	−0.0842	0.0148	
Hay/forage production	**0.7556**	−0.0137	0.0636	
Cultivate crops	**0.5717**	0.0388	0.0194	
Break from usual routine	−0.1199	**0.8063**	0.0364	0.84
Change of pace	−0.0425	**0.7834**	0.0026	
Place to relax	−0.0010	**0.6665**	−0.0310	
Enjoy outdoors	0.1555	**0.6609**	0.0102	
Recreation (not hunting/fishing)	−0.1175	**0.6036**	0.0058	
Wildlife management	0.0842	**0.5789**	−0.056	
Hunting/fishing (recreational)	0.0489	**0.5486**	0.0399	
Financial investment	0.0030	0.0296	**0.8470**	0.75
Part of investment portfolio	0.1284	−0.0063	**0.7673**	
Resale for profit	−0.1597	−0.0076	**0.5468**	
Eigenvalues	3.22	2.62	1.36	

an exploratory factor analysis with promax rotation to reduce the number of items and identify the underlying dimensions of land-ownership motivations. During this analysis, three items were dropped: (1) whether or not the land was owned to make a profit (this item was added to a second factor analysis related to financial dependence on land for income—see below); (2) mineral extraction; and (3) hunting enterprise. The latter two items did not sufficiently load on any factors but both were retained as single items for later analyses, as they are legitimate reasons for land ownership. Next, we assessed inter-item reliability using Cronbach's alpha. And finally, we calculated factor scores for each individual using the regression scoring method.

In a second, separate factor analysis, we considered seven items measuring landowner dependence on the land for income. This analysis included whether or not the land was owned to make a profit (one of the items dropped from the first factor analysis). These seven items were measured separately in the survey using a 7-point scale in which 1 = *Strongly Disagree* and 7 = *Strongly Agree* (see Table 3). We used the same approach as for the initial exploratory factor analysis to reduce the number of items for further analysis.

Using the results of the land-ownership and profit-motivation factor analyses, we conducted a K-medians cluster analysis to classify landowners into a predetermined number of homogeneous, nonoverlapping clusters or landowner groups. The median served as the centroid of each cluster and distances from the centroid were calculated via Euclidean distances. We explored 2-, 3-, 4-, and 5-cluster solutions, choosing the solution that provided the most meaningful results, sufficiently discriminated between clusters, was most parsimonious, and yielded a fairly equal distribution of landowners.

After determining the number of landowner groups to retain, we examined the validity of the each group using socio-demographic data. Specifically, we examined variables related to land-management objectives, hectares managed, land use, self-identification as a rancher, perceived competence for land management, absentee land-ownership, employment status, employment in the agricultural industry, age, education, income generated from land, and annual household income. "Hectares managed" is the number of hectares about which a landowner actively makes day-to-day decision and includes any additional hectares leased in by the landowner but removes any hectares leased out. We roughly estimated the average stocking rate of cattle for each landowner, by dividing the average number of cattle owned during the preceding 5 years by the number of hectares owned and/or leased. We calculated ranching experience as a proportion of the respondent's adult life. We used the age of 18 to determine this because it is the age at which individuals are legally recognized as adults. It was calculated as: (years of ranching experience since the age of 18)/(age − 18).

We measured self-identity as a rancher or farmer, using four items (e.g., *Ranching/farming is an important part of who I am*) with a 7-point scale (*strongly disagree* to *strongly agree*). We also measured competence, using four items (e.g., *I am able to solve most problems I encounter on my place*) with a 7-point scale (*strongly disagree* to *strongly agree*).

To test for differences among landowners in each resulting cluster, we analyzed categorical data using chi-square tests. We then formally determined where differences occur within a statistically significant chi-square table, by analyzing the residuals (the difference between the observed and expected values). Next we standardized and adjusted these residuals so that they could be interpreted as z-scores (adjusted standardized residuals greater than 1.96 indicate that the number of observations in a cell was significantly greater than the expected number, whereas residuals less than −1.96 indicate that the number of observations was significantly less than expected) (Siegel and Castellan, 1988). Finally we analyzed ordinal and interval data using the Kruskal–Wallis one-way analysis of variance by ranks test, and conducted post-hoc tests using the Mann–Whitney U test (Sheskin, 2004).

Table 3
Exploratory factor analysis of landowner dependence on land for income ($n = 312$).

Financial dependence on land items	Profit[a]
Place[b] is a profitable business	0.8783
Place[b] is important source of income	0.8426
Making a profit very important	0.8337
In general, I make a profit	0.8141
Place[b] is a way to financially provide for my family	0.7680
To make a profit[c]	0.7526
Making money not my main goal[d]	0.4585
Eigenvalue	4.2058

[a] Cronbach's alpha = 0.90.
[b] Landowners were instructed to consider ownership of multiple properties in the study area as one overall "place"—a term commonly used to refer to land holdings in this watershed.
[c] Item transferred from land-ownership motivation items (see Table 2) and scored as 1 = *Not Important at All* to 7 = *Very Important*.
[d] Item reverse coded.

4. Results

Of the 767 surveys initially mailed, 455 were returned for a raw response rate of 59%. After the removal of 61 surveys that were returned blank—37 because of ineligibility (e.g., no longer owns land, deceased, etc.) and 24 because they were undeliverable—the adjusted response rate was 64%. Of the remaining 394 useable questionnaires 82 had missing data on individual items, leaving 312 to be used in the factor analysis. The number of observations varies when exploring the landowner types because of item nonresponse in the survey data.

4.1. Land-ownership motivations

From the exploratory factor analysis of reasons for land ownership, we identified three dimensions of land-ownership motivations (Table 2). The first dimension, *agricultural production*, focuses on production-related motivations for operating a farm or a ranch (*Cronbach's alpha*, $\alpha = 0.85$). The second dimension, *lifestyle*, consisted mainly of reasons related to escape from routine and general enjoyment of the rural lifestyle, as well as amenity motivations such as recreation and wildlife management ($\alpha = 0.84$). We labeled the third dimension *financial investment* ($\alpha = 0.75$). This captures, for example, the idea of land as real estate in which individuals may invest to diversify and grow their financial portfolio. Next, we explored the dimensionality of the seven items in the second factor analysis examining landowner dependence on their land for income. Our analysis indicated that financial dependence is best represented by one dimension we labeled *profit motivation* ($\alpha = 0.90$) (Table 3).

Correlations of the four dimensions from the factor analyses with two additional dimensions derived from the single motivation items—owning land to operate a wildlife enterprise and owning land for mineral extraction—showed that all of the land-ownership motivations were correlated except agricultural production and rural lifestyle (Table 4). The strongest correlation was between agricultural production and profit motivation ($r = 0.69$), followed by mineral extraction with both wildlife enterprise ($r = 0.33$) and financial investment ($r = 0.32$). Profit-orientation was negatively correlated with the rural lifestyle dimension ($r = -0.15$).

Table 4
Correlation matrix relating motivations used in subsequent cluster analysis.

Motivations	1	2	3	4	5
1 Agricultural production					
2 Lifestyle	−0.01				
3 Financial investment	0.23*	0.17*			
4 Profit	0.69*	−0.15*	0.30*		
5 Wildlife enterprise	0.15*	0.27*	0.18*	0.17*	
6 Mineral extraction	0.17*	0.18*	0.32*	0.20*	0.33*

*$p < 0.05$.

We used these six dimensions as the basis for the k-medians cluster analysis. We found a 3-cluster solution to be meaningful, interpretable, and parsimonious ($n = 290$; Fig. 2). Cluster 1 was characterized by agricultural-production and profit-orientation motivations. Cluster 2 was characterized by the following multiple motivations in descending order: rural lifestyle, investment, agricultural production, and wildlife enterprise. Cluster 3′s land-ownership motivation was predominantly rural lifestyle, with all other dimensions having low importance. On the basis of these results, we labeled cluster 1, *agricultural-production landowners*, cluster 2, *multiple-objective landowners*, and cluster 3, *lifestyle-oriented landowners*. For this last cluster, we use the term *lifestyle-oriented landowner* rather than *amenity buyer* because in the literature on the "New West," the latter term broadly incorporates natural amenities such as climate and topography (e.g., Gosnell and Travis, 2005; Gosnell et al., 2006; Rudzitis, 1999), whereas we measured items related more to benefits that may occur within the context of natural amenities.

4.2. Socio-demographic analysis

Demographically, the clusters were similar. The average age of landowners was 60 years (*Standard Deviation (SD)* = 13, *Median (MD)* = 62, *Range* = 24–90) and did not differ among the three clusters (Kruskal–Wallis $X^2 = 2.95$, $df = 2$, $p = 0.23$). About half (51%) of surveyed landowners made $75,000 USD or less. Annual household income was not statistically different across clusters (*Pearson* $X^2 = 7.05$, $df = 6$, $p = 0.32$; Table 5). The average education level was 14 years (*SD* = 2, MD = 15, Range = 7–17). Although years of education were significantly higher for cluster 2, this amounted to only a one-year difference on average (Table 6). In the next section, we use Table 5 and Table 6 to describe these clusters.

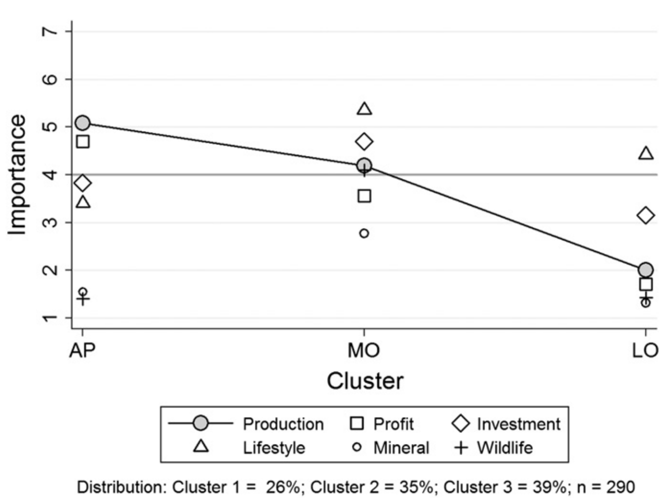

Fig. 2. Results of cluster analysis displaying unstandardized means for each of the three clusters. AP = agricultural production, MO = multiple-objective, LO = lifestyle-oriented landowners; 1 = Not Important at All, 4 = Moderately Important, 7 = Very Important.

4.3. Landowner types

4.3.1. Cluster 1: agricultural production landowners

For landowners grouped in cluster 1 (26% of respondents), agricultural production and profit were the strongest motivations for owning land. Investment and recreation were moderately to slightly important and operating a wildlife enterprise and mineral extraction were not important. This cluster managed more land (*M* = 275 ha, *Md* = 118 ha) and grazed more cattle (*M* = 0.13, *Md* = 0.08, *Range* = 0–1) than clusters 2 or 3 (Tables 5 and 6). They were more likely than expected to manage their land for livestock (62%) and less likely to manage it for wildlife (0%). Accordingly, landowners in this cluster were more likely than expected to be employed in the agricultural industry (44%) and to derive at least some of their income from activities on their land (98%). They had more ranching experience (*M* = 0.68, *Md* = 0.89, *Range* = 0–1), worked on their land more hours per week (*M* = 29 h, *Md* = 30 h), self-identified as ranchers or farmers (*M* = 5.8, *Md* = 6.5, *Range* = 1–7), and considered themselves to be more competent at managing their land (*M* = 6.0, *Md* = 6.5, *Range* = 1–7) compared with landowners in clusters 2 or 3. They also were more likely than expected to hold more than one job to meet monthly household expenses (22%). Finally, landowners in cluster 1 were more likely than expected to reside on their land full time (70%). Those that did not reside on their land lived closer to their property (*M* = 69 km, *Md* = 25 km) but did not spend more days visiting their land than landowners in other clusters.

4.3.2. Cluster 2: multiple-objective landowners

This cluster, characterized by a diversity of motivations for owning land, accounted for 35% of respondents. The most important land-ownership motivation for cluster 2 was rural lifestyle followed by investment, agricultural production, and wildlife enterprise. Each of these motivations was considered to be at least moderately important; profit-orientation and mineral extraction were considered slightly important. This indicates that although their main motivation may be to experience the rural lifestyle, landowners this cluster actively manage their land with profit as some motivation. Cluster 2 was similar to cluster 1 regarding both the proportion of land grazed in the past 5 years (*M* = 0.75, *Md* = 1, *Range* = 0–1) and the average number of cattle per hectare in the past 5 years (*M* = 0.09, *Md* = 0.08, *Range* = 0–1). Those in this group were more likely than expected to have a second home or cabin on their property (39%). For other variables—such as hectares managed, livestock management objectives, wildlife management objectives, hours spent working on the land per week, employment in the agricultural industry, ranching experience, self-identity as a rancher, competence, residing on their property, and income from their land, the scores of landowners in this cluster fell between those of cluster 1 and cluster 3.

4.3.3. Cluster 3: lifestyle-oriented landowners

This cluster was composed of 39% of respondents and is characterized by a desire to experience the rural lifestyle as the predominant motivation for land ownership. Financial investment was somewhat important, but all other motivations were fairly unimportant. The members this cluster, compared with those in the other two, managed the smallest-size properties (*M* = 275 ha, *Md* = 118 ha), were less likely than expected to manage their land for livestock (29%) but more likely than expected to manage for wildlife (29%). Accordingly, those in this group grazed the least number of cattle on average over the past 5 years (*M* = 0.10, *Md* = 0.00,

Table 5
Comparison of categorical demographic variables across landowner groups.

Demographic Variable	Cluster 1 Agricultural Production		Cluster 2 Multiple Objectives		Cluster 3 Lifestyle-Oriented		Chi-Square
	f	% [a]	*f*	% [a]	*f*	% [a]	
Management objective							
Livestock							18.88*
No	27⇓	38%⇓	49	51%	70⇑	71%⇑	
Yes	44⇑	62%⇑	48	49%	29⇓	29%⇓	
Wildlife							24.2*,[b]
No	71⇑	100%⇑	77	79%	70⇓	71%⇓	
Yes	0⇓	0%⇓	20	21%	29⇑	29%⇑	
Reside on land full-time							14.32*
No	22⇓	30%⇓	53	53%	65⇑	58%⇑	
Yes	51⇑	70%⇑	47	47%	48⇓	42%⇓	
Second home/cabin							15.48*
No	64⇑	88%⇑	61⇓	61%⇓	74	66%	
Yes	9⇓	12%⇓	39⇑	39%⇑	38	34%	
Employment status							0.20
Retired	31	43%	38	40%	41	39%	
In work force	41	57%	58	60%	64	61%	
Agriculture industry employment							42.84*
No	42⇓	56%⇓	73	74%	104⇑	96%⇑	
Yes	33⇑	44%⇑	25	26%	4⇓	4%⇓	
Hold more than one job							10.81*
No	58⇓	78%⇓	80	82%	101⇑	94%⇑	
Yes	16⇑	22%⇑	17	18%	6⇓	6%⇓	
Percent income from land							105.80*,[b]
0%	2⇓	2%⇓	31	33%	81⇑	73%⇑	
1%–25%	50⇑	67%⇑	50	53%	30⇓	27%⇓	
Greater than 25%	23⇑	31%⇑	13	14%	0⇓	0%⇓	
Annual income							7.05
Less than $50,000	21	31%	18	20%	26	26%	
$50,000-$75,000	14	20%	17	19%	26	26%	
$75,000-$100,000	17	25%	20	22%	23	23%	
More than $100,000	16	24%	35⇑	39%⇑	26	26%	

$^*p < 0.001$.
⇑ Adjusted Standardized Residual > 1.96. The number of observations in this cell is significantly larger than expected.
⇓ Adjusted Standardized Residual < −1.96. The number of observations in this cell is significantly less than expected.
[a] Within-cluster percentages.
[b] Because expected values were less than 5, an exact chi-square statistic was used.

Table 6
Comparing ordinal and interval-level demographic variables across landowner subgroups.

Variable	Cluster 1 Agricultural Production		Cluster 2 Multiple objectives		Cluster 3 Lifestyle-Oriented		Kruskal–Wallis[a]	*p*-value	Post-hoc Test[b]
	Mean	Median	Mean	Median	Mean	Median			
Hectares managed ($n = 287$)	274.98	118.37	153.78	81.95	40.77	8.09	65.97	<0.001	abc
Proportion of land grazed in past 5 years ($n = 245$)	0.86	1	0.75	1	0.38	0	52.609	<0.001	aac
Average number of cattle grazed per hectare in past 5 years ($n = 275$)	0.13	0.08	0.09	0.08	0.10	0	18.39	<0.001	aac
Hours land operated per week	28.66	30	16.22	12	8.90	6	58.62	<0.001	abc
Ranching experience (Proportion of life) ($n = 275$)	0.68	0.89	0.54	0.52	0.28	0.15	51.10	<0.001	abc
Rancher identity[c] ($n = 287$)	5.82	6.5	4.64	5	2.68	2.5	98.37	<0.001	abc
Competence[d] ($n = 288$)	6.05	6.5	5.67	6	5.49	5.75	8.00	0.018	abb
Age ($n = 283$)	61.85	62	61.36	61	58.57	58	2.95	0.229	aaa
Education ($n = 286$)	14.32	14	14.98	16	14.42	14	5.72	0.057	aba
Kilometers (one-way) from place[e,f] ($n = 139$)	179	64	216	174	388	161	9.513	0.009	abb
Days visiting place[e,f] ($n = 138$)	112	55	73	52	68	38	0.94	0.624	aaa

[a] Degrees of freedom for all tests = 2.
[b] Different notations denote significant differences at $p < 0.05$ for Clusters 1, 2, and 3 based on Mann–Whitney U tests.
[c] Cronbach's alpha = 0.91.
[d] Cronbach's alpha = 0.80.
[e] For landowners who do not reside on their place.
[f] Landowners were instructed to consider ownership of multiple properties in the study area as one overall "place"—a term commonly used to refer to land holdings in this watershed.

Range = 0–1) and were less likely than expected to be employed in the agricultural industry (4%). They were also more likely than expected to obtain no income from their land (73%). Their ranching experience was the lowest of the three clusters (*M* = 0.28, *Md* = 0.15), they worked on their land less than those in other clusters (*M* = 9 h/week, *Md* = 6 h/week), did not self-identify as principally ranchers or farmers (*M* = 2.7, *Md* = 2.5, *Range* = 1–7), and had the lowest self-reported competence scores (*M* = 5.5, *Md* = 5.8, *Range* = 1–7). Finally, landowners in this cluster were less likely than expected to reside on their property full time (42%) and absentee landowners lived farther from their property than landowners in cluster 1 (but not farther than those in cluster 2). The number of days absentee landowners visited their land in a year was not statistically different among the three groups.

5. Discussion

Our study showed that landowners in central Texas are still involved in agricultural production, at least to some degree. Almost two-thirds of landowners (61%) engage in some farming or ranching activities, but only 24% focus explicitly on agricultural production. Well over half of the 61% of landowners involved in agricultural production (35%) have multiple objectives for their land, including wildlife and financial investment—probably reflecting the decreasing profitability of ranching and farming. It is interesting to note that the members of this group have the same average age as those focused solely on agricultural production, and that they rated lifestyle as the most important reason for owning land. Thus, inter-generational cultural differences are not evident in our data.

Our results also indicate that the largest proportion of landowners own land almost exclusively for lifestyle reasons (39%). As Robbins et al. (2009) note, there no doubt has always been a diversity of motivations for land ownership (i.e., lifestyle-oriented landowners have always been part of the social landscape in rural areas); but our current interest or concern is whether a shift in dominance is taking place, from one landowner type to another, and if so, what are the implications for the landscape? Our cross-sectional data cannot address any potential shift in land-ownership; however, Table 1 provides supporting evidence of a shift in the Cowhouse Creek watershed, and other literature suggests this is the case in Texas (Kjelland et al., 2007; Wilkins et al., 2009). Such a demographic shift is indicative of a cultural shift—a change in the shared beliefs and knowledge of rural landowners as a group. In social–ecological terms, culture is a "slow variable" that drives the coupled human–dryland system (Lynam and Stafford Smith, 2004). Slow variables are so labeled because they can remain relatively stable over long periods of time. When they do change, however, the effects on the entire social and ecological system can be substantial. A cultural shift can lead to changes in landscape-scale land cover as the new dominant cultural group makes decisions that, for example, favor woodlands over rangelands; or, alternatively, that favor the use of fire and other land management practices necessary to maintain rangeland systems.

The findings from our analysis of land-ownership motivations raise a number of issues for dryland ecosystems. The first of these relates to a potential shift in rural Texas and elsewhere from a predominantly agrarian economy to one based on services (nonagricultural jobs—such as retail, health, and education) (e.g., Gosnell and Abrams, 2009; Gill et al., 2010). If that happens, the natural amenities that were passively consumed by ranchers and farmers will become a rural community's primary "asset" (Robbins et al., 2009). One question in particular is whether such a shift will catalyze (or, retrospectively, has catalyzed) the development of so-called ranchettes, small-scale ranches generally characterized by upscale homes on fewer acres than traditional ranches. This could give rise to an autocatalytic feedback loop that drives marginally-profitable ranchers and farmers out of business as increased demand for real estate leads to increases in land prices and property taxes. Further research is needed to understand the ways in which extractive and amenity-based economies interact with each other (Robbins et al., 2009) and with the ecosystem. Rather than one type of economy displacing another, future research might consider policy tools that enhance the resiliency of rural communities by embracing both economies.

The second issue relates to cultural differences between so-called traditional landowners, who focus on agricultural production, and amenity buyers—differences that may result in values-based conflicts. In our research area in Texas, monoculture woodlands of invasive ashe juniper (*Juniperus ashei*) have encroached onto rangelands resulting in land degradation and the loss of forage productivity (Archer, 1995). Many traditional landowners clear these woody plants (using fire, herbicides and mechanical means); in contrast, many amenity buyers prefer the monoculture woodlands, under the misguided assumption that they benefit wildlife. This dichotomy calls for considerable extension and outreach efforts to educate landowners having little or no land management background and to *persuade* them of the value of rangelands. Additionally, extension and outreach programs will need to change from a traditional one biased toward agricultural production as the dominant value, so as not to alienate amenity buyers. Top-down approaches from centralized institutions should give way to innovative bottom-up approaches that generate social capital among diverse landowners (e.g., Wagner et al., 2007); are grounded in learning principles (Toman et al., 2006); use social marketing to identify constraints and costs working against the provision of a collective good such as a healthy watershed; and develop measures for allaying those constraints and costs (see McKenzie-Mohr, 2000).

As the nature of land-ownership continues to shift, values-based conflicts stemming from increased landowner heterogeneity (e.g., Yung and Belsky, 2007) may manifest as competing policy preferences. Here too innovative, bottom-up approaches will be called for: landowner groups and associations that generate social capital are a means of heading off or coping with potential conflict. Further, with social marketing to identify the benefits and barriers underlying land-management decisions, landowners can be categorized into smaller, more homogeneous groups—not only making the delivery of programs more efficient (Butler et al., 2007) but enabling the development of policy instruments (cost-sharing and other incentive programs) better tailored to and more consistent with the underlying objectives of each group (Cocklin et al., 2007).

The third issue raised by our findings is the uncertainty regarding whether a shift toward a landscape dominated by amenity-motivated landowners will enhance or undermine the sustainability of dryland systems. On the positive side, the lifestyle-oriented landowners in our study may have stronger pro-environmental values (Jones et al., 2003), which could increase provision of some ecosystem services. For example, Gosnell et al. (2007) found that amenity-motivated landowners were more likely to create riparian buffers, restore natural hydrologic features, and adjust water allocation to benefit the aquatic ecosystem. On the negative side, both biodiversity and ecosystem services could be disrupted by the establishment of subdivisions, ranchettes, and the associated increase in recreational activity that fragment natural habitats—displacing wildlife and changing land cover (Hansen et al., 2002; Maestas et al., 2001). Agricultural lands can increase biodiversity by maintaining land in early and mid-successional states (Firbank, 2005; Maestas et al., 2001; Tscharntke et al., 2005). The removal of livestock that results from rural residential development or the preference of amenity buyers has the potential to decrease overall species richness if the early and mid-successional states are not maintained (e.g., Bock et al., 2006).

As Robbins et al. (2009) argue, enhancing sustainability on rangelands and in other dryland ecosystems is not simply a function of who owns the land—traditional ranchers or amenity buyers. Rural landscapes are composed of a mix of landowners that together generate the overall landscape matrix. Our results support this, showing that almost three-quarters of landowners ranked other land-ownership motivations as more important than agricultural production. Although our analysis generated three groups, they may be best thought of as a continuum, with agricultural producers at one end of the spectrum and lifestyle-oriented landowners at the other. To achieve the objective of sustainability in rural areas where land subdivision is on the rise—such as Texas, the western United States, and Australia (e.g., Gill et al., 2010; Mendham and Curtis, 2010)—it is imperative for all landowners—those oriented mainly to agricultural production, those oriented mainly to the amenities provided by the rural lifestyle, and those in between—to coordinate and apply ecologically sound land management practices. More research is needed to understand the dynamics of rural communities and how land-ownership motivations yield the land-use preferences that result in large-scale changes in land cover. This understanding can then form the basis for land-use planning, policy, and education that will enhance the resiliency of these communities and ultimately the sustainability of dryland systems.

The approach presented in this paper is a useful way to characterize and link cultural factors that drive changes in land use and, as a consequence, changes in land cover. Unlike approaches based on studies focusing on demographic indicators (e.g., Coppock and Birkenfeld, 1999; Liffmann et al., 2000; Rowe et al., 2001; Smith and Martin, 1972), ours is not bound by the context in which it is measured. It can be applied in any social–ecological system in which the rural restructuring phenomena occurs, and at multiple scales, as a way to inventory and track basic psychological orientations of landowners toward their land. Further, although demographic factors may be broadly related to land-use preferences, they do not drive decision-making. Because motivations are antecedents of behavior, they are more salient for understanding the land-use preferences that drive land-management decisions, which in turn lead to changes in land cover. Thus, land-ownership motivations, along with other indicators (e.g., Jackson-Smith et al., 2005), can enhance our understanding of how individual decision-making leads to large-scale changes in land cover.

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