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Changing landowners, changing ecosystem? Land-ownership motivations as drivers of land management practices

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ABSTRACT

Motivations for owning rural land are shifting from an agricultural-production orientation to a preference for natural and cultural amenities. Resultant changes in land management have significant implications for the type and distribution of landscape-level disturbances that affect the delivery of ecosystem services. We examined the relationship between motivations for owning land and the implementation of conservation land management practices by landowners in the Southern Great Plains of the United States. Using a mail survey, we classified landowners into three groups: agricultural production, multiple-objective, and lifestyle-oriented. Cross tabulations of landowner group with past, current, and future use of 12 different land management practices (related to prescribed grazing, vegetation management, restoration, and water management) found that lifestyle-oriented landowners were overall less likely to adopt these practices. To the degree that the cultural landscape of rural lands transitions from production-oriented to lifestyle-oriented landowners, the ecological landscape and the associated flow of ecosystem services will likely change. This poses new challenges to natural resource managers regarding education, outreach, and policy; however, a better understanding about the net ecological consequences of lower rates of adoption of conservation management practices requires consideration of the ecological tradeoffs associated with the changing resource dependency of rural landowners.

1. Introduction

A clear link exists between human behavior and land-cover change whereby a private landowner's reason for owning land translates into land use preferences and ultimately land management practices. That is, individual motivations for owning land shape land-use goals and energize behaviors necessary to achieve those goals (Greiner et al., 2009), either intentionally or unintentionally influencing the structure and functioning of ecosystems across a landscape (Dale et al., 2005; Hansen and Brown, 2005; Wilcox et al., 2011). The subsequent changes in the spatial distribution, timing and flow of ecosystem services feed back to affect the livelihoods of people and sustainability of communities (Collins et al., 2011; Kofinas and Chapin, 2009).

Motivations for owning rural land are currently shifting from an agricultural production orientation to a preference for natural and cultural amenities. In some areas of the United States, migration away from urban, suburban, and exurban areas is leading to the subdivision and sale of rural lands to lifestyle-oriented landowners who purchase land primarily for recreation, for its esthetic qualities, and to experience the rural lifestyle (Brown et al., 2005; Gosnell and Abrams, 2009; Johnson, 2008). This trend is occurring in a number of post-industrialist countries including Australia (Gill et al., 2010; Luck et al., 2011; Maybery et al., 2005; Mendham and Curtis, 2010) and countries in Western Europe (Brown and Kandel, 2006; Hujala et al., 2007; Moss, 2006). These changes in motivation for land ownership have significant implications for the type and distribution of ecological disturbance across the landscape that ultimately affects the delivery of ecosystem services (Collins et al., 2011).

The phenomenon of changing land ownership has been well documented in the intermountain and western United States (e.g., Gosnell and Travis, 2005; Jackson-Smith et al., 2006; Theobald, 2001) and the eastern forestlands (Butler, 2008; Kendra and Hull, 2005; Majumdar et al., 2008, 2009); but, landscapes in the southern Great Plains face similar pressure from changes in land ownership (Brown et al., 2005; Johnson and Rathge, 2006; Mitchell, 2000). In Texas the change has been particularly striking. Between 1997 and

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2007 the number of farms and ranches less than 40 hectares increased by 22% while the appraised market value of land increased by 140%; and, more than 849,000 hectares of farms, ranches and forestlands were converted to other uses (Wilkins et al., 2009).

This change paints a picture of a social landscape that is undergoing a significant shift in who owns the land and why. Traditional farmers and ranchers tend to be more resource dependent and production focused compared to lifestyle-oriented landowners (Sorice et al., 2012). They also are likely to have greater local knowledge of the resources as well as the skills needed to achieve land management goals. In contrast, lifestyle-oriented landowners may have stronger pro-environmental attitudes (Jones et al., 2003), a greater willingness and financial capacity to engage in conservation practices (Greiner et al., 2009), but lack the knowledge and skill to do so (Gill et al., 2010; Mendham and Curtis, 2010). Compared to agricultural producers, lifestyle-oriented landowners may value cultural ecosystem services, such aesthetics and recreation, over provisioning or regulating services (Martín-López et al., 2012). Thus, a shift in the type of landowner not only changes the structure of rural communities (Brown and Kandel, 2006; Robbins et al., 2009) and desired social outcomes and subsequent policies (Yung and Belsky, 2007) but can drive changes in land use and ultimately in land cover and ecosystem function across the landscape. Although there has always been heterogeneity to some degree across the rural landscape, landowners with agricultural production values have been the predominant culture for generations. Culture change can be thought of as a so-called slow variable that can remain stable for extended periods of time but that yields substantial social and ecological change when it does occur. Given that culture is a major driver in the state of a social–ecological system (Gunderson and Holling, 2002), understanding the potential change in land management behavior is critical for anticipating and predicting ecological regime shifts.

One outstanding question is whether or not changes in land ownership have a negative effect on the capacity for rural communities to sustain the supply of ecosystem services (Chapin III et al., 2009). Our study informs this important question by addressing the role of motivations for land ownership and land-management behavior. We use a behavioral approach to identify the antecedent relationships between motivation for owning land and the application of conservation-oriented land management practices that promote ecosystem sustainability. Rangelands in a Texas watershed, which are undergoing ecological conversion from grasslands to woodlands, serve as a case study to categorize landowners based on their motivations for owning land. We subsequently examined the implementation of land management practices identified by the United States' Natural Resource Conservation Service (NRCS) as conservation practices. Specifically, our objectives were to: 1) use existing socio-demographic data explore social change in the landscape over time; and 2) use a typology of landowners to relate land-use motivations to land-management practices to better understand the relationship between landowner type and soil and water conservation.

2. Materials and methods

2.1. Study area

Rangelands are comprised of diverse ecosystems and landforms that are unsuited for intensive agriculture or forestry because of climatic, soil and/or topographic limitations (SRM, 1998; Holechek et al., 2004). In the southern Great Plains, such ecosystems have been maintained as grasslands for centuries because of natural disturbances (e.g., lightning-strike fires, bison grazing) as well as early human disturbances (e.g., Native American-generated fires). European immigrants established crop cultivation and livestock grazing in this area beginning in the 1870s (Parton et al., 2007; Wishart, 2004). In cases where supplemental irrigation was not available for crop production, formerly cultivated areas often reverted back to rangelands.

Although these grasslands have coevolved with human drivers of land use, it was the last phase of human use of semi-arid grasslands beginning around 1875 that has led to the fundamental changes in these landscapes and their ability to support rural livelihoods associated with livestock ranching (Parton et al., 2007; Wilcox et al., 2011). These changes were set in motion by active fire suppression and the severe overgrazing that occurred during the last decades of the 19th century (Box, 1967; Wilcox et al., 2012)—one outcome of which was highly degraded landscapes that no longer supported frequent fires. The virtual elimination of fire from these landscapes in combination with heavy grazing has favored the expansion of fire sensitive woody plants within these ecosystems, the net result being that many former grasslands and savannas in the southern great plains have now converted to shrublands and woodlands (Archer, 1994; Archer et al., 2001). This phenomenon, known as woody plant encroachment (WPE), has far-ranging consequences for both human and ecological systems, because it alters the delivery of ecosystem services including: forage availability, grassland wildlife habitat, carbon and other biogeochemical cycling, aesthetics, among others (Archer et al., 2011; Eldridge et al., 2011; Stafford Smith et al., 2009). Despite this, WPE is not well understood as a complex problem with both ecological and social dimensions.

One way of enhancing the ecological resilience of rangeland ecosystems (i.e, the ability of rangelands to absorb disturbance and maintain the grassland state) is through the use of land management practices that maintain or restore healthy grasslands and reduce soil loss. Through cost-sharing programs, the United States Natural Resources Conservation Service promotes a number of activities as so-called conservation practices for rangelands related to grazing management, woody plant management, rangeland restoration, and water and riparian management (NRCS, 2011) (see Table 1). The NRCS considers these land-management practices as best practices that help rangeland owners sustain their operations over the long term, yet landowners do not universally adopt the behaviors or participate in the cost-share programs. A comprehensive understanding of the factors that influence the adoption of conservation practices amongst agricultural producers continues to be elusive (see Lockeretz, 1990; Prokopy, 2008; Rogers, 2003). Given these challenges with production-oriented landowners, questions remain about their adoption as the social landscape changes.

Our study focused on the Cowhouse Creek watershed (159,850 ha) in north-central Texas. It is a 145-km long tributary of the Brazos River, flowing through portions of four rural counties (Bell, Coryell, Hamilton, and Mills County) and discharging into a 50 km^2 reservoir, Lake Belton. The watershed is dominated by privately-owned rangelands except in Bell County, which is owned by the Fort Hood U.S. Army installation. Because our focus was on private lands, we excluded the federal property from our research.

2.2. Demographic change

We explored socio-demographic changes in the research area by utilizing a combination of U.S. Census data, U.S. Agricultural Census data, and texaslandtrends.org, an online source of change specific to Texas (Wilkins et al., 2009). We focused on the change in:

- Number of farms
- Size of farms

Table 1
A description of conservation practices identified by the U.S. Natural Resource Conservation Service.

Practice	Description
Grazing management	
Prescribed grazing	The controlled harvest of vegetation by adjusting livestock grazing
Rotational grazing	Strategically moving livestock to fresh pastures areas to allow vegetation in previously grazed pastures to regenerate.
Woody plant management	
Mechanical brush management	Mechanical removal, reduction, or manipulation of woody plants in order to restore ground cover by grasses and forbs, and improve rangeland conditions for livestock and/or wildlife. Increased ground cover can reduce erosion, improve water quality, and enhance stream flow.
Herbicides	Management or removal of invasive or noxious woody plants using chemical methods
Prescribed burning	A controlled burn applied to a predetermined portion of land. It can reduce woody plants, restore rangeland, and improve herbaceous plant production for grazing and/or wildlife habitat.
Restoration	
Reseeding	The broadcasting or drilling of native or introduced grass and forb seeds to improve ground cover and forage for livestock and/or wildlife. It may also improve water infiltration and reduce runoff/erosion.
Contour ripping	A mechanical treatment that chisels the soil to reduce erosion and stormwater runoff. It increases infiltration and leads to improved grass and forb cover
Gully plugs	A low dam or weir constructed with rock that slows the flow of water and catches sediment in eroded areas.
Water and riparian management	
Stock tanks or header dams	Impoundments used to provide a permanent water source as well as to reduce runoff and flood damage
Shaped grass waterways	A natural or constructed vegetated channel to convey runoff without creating gullies.
Riparian buffer zones	Area of vegetation (trees/shrubs) located adjacent to a body of water that improves aquatic habitat and buffers against sediment, fertilizers and pesticides.

- Land values
- Extent of native rangelands
- Wildlife management focus, and the
- Number of second homes

We provide descriptive results to provide a broader social context in which the motivation–behavior relationship of landowners can be better understood.

2.3. Sampling

We constructed the sampling frame for the watershed using information obtained from each county's tax appraisal district office. This served as the overall list from which we drew the sample. For Hamilton and Coryell counties we used geographic information systems to select landowners within the watershed. For Mills County, the tax appraiser provided names and addresses of landowners in a school district that overlapped the northeast portion of the watershed. Landowner names and contact information from both data sources were compiled into a single list. To ensure that properties were large enough to necessitate the larger-scale land management and planning these practices require we randomly selected 800 landowners owning at least 20 hectares (ha) of land. We examined this list and removed addresses with identified problems and duplicate entries resulting in a final sample size of 767 landowners.

2.4. Data collection and analysis

In February 2009 we mailed a self-administered questionnaire to selected landowners. We used a slightly modified Dillman (2000) procedure consisting of a pre-questionnaire notification letter, a questionnaire, a postcard reminder, a replacement questionnaire, and a final postcard reminder mailed over a six-week period. The questionnaire requested information on land use, land ownership motivations, landowner characteristics and demographic information.

To examine land-management behavior we asked landowners to indicate their use of each of 12 land management practices identified by the U.S. Natural Resource Conservation Service as production-related conservation practices. We considered two prescribed grazing management practices (adjusting livestock numbers based on available forage and using a rotational grazing system), three vegetation management practices (mechanical brush removal, herbicides, prescribed fire), four restoration practices (reseeding with native species, reseeding with introduced species, contour ripping, gully plugs) and three water management practices (water storage tanks or header dams, shaped grass waterways, riparian buffers).

We asked respondents to check all that apply of the following options: No; Yes, in the past; Yes, currently; Yes, in the future; Unsure; and, Not Applicable. A landowner response of "not applicable" indicated that a landowner had no reason to engage in such a practice. For example, a landowner without livestock cannot engage in rotational grazing. Providing this option also reduced measurement error due to survey-item nonresponse. For each analysis landowners who indicated a particular management practice was not applicable to them were removed from that analysis. We assumed that landowners accurately judged whether or not the practice applied to them. A landowner response of "No" indicates that the land management practice was applicable to their ranching operation but never applied. We considered a landowner to be engaged in a land practice on an "on-going" basis if they selected any combination of past, present or future action. Each category provided binary indicators of past and current behavior as well as on-going behavior (e.g., checking past and future) and behavioral intention (i.e., future behavior).

We previously used this data to determine the type of landowner. Sorice et al. (2012) describe in detail how we asked landowners to respond to 17 reasons why they own their land. For each item landowners indicated the level of importance using a 7-point Likert-type scale where 1 = Not important at all, 4 = Moderately important, and 7 = Very important. Landowners also responded to 6 additional profit-oriented reasons (e.g., My place is a way to financially provide for my family) using a 7-point Likert-type scale where 1 = Strongly Disagree and 7 = Strongly Agree. These items were combined into six dimensions of land ownership motivations using an exploratory factor analysis: agricultural production, profit-orientation, rural lifestyle, financial investment, mineral extraction, and operating a wildlife enterprise. We then used a *k*-medians cluster analysis to group landowners based on these six motivations and validated the results using a socio-demographic analysis.

To explore the relationship between landowner type and use of land-management practices, we conducted a chi-square analysis for each land management practice. Because our goal was to identify potential behavior differences that could lead to changes in land cover, we relaxed our alpha to $\alpha = 0.10$. Some tables contained small or zero counts so we used an exact chi-square test to obtain exact p-values (Siegel and Castellan Jr., 1988; Stokes et al., 2000). We used residual analysis to determine the relationships between landowner type and behavior (i.e., cells of the chi-square table) that contributed to a statistically significant result. 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 Jr., 1988).

3. Results

3.1. Demographic analysis

Data from the USDA agricultural census and data compiled by texaslandtrends.org (Wilkins et al., 2009) indicate that land ownership and use has been changing in these counties. From 1997 to 2005, the number of farms increased in Coryell (+35%), Hamilton (+12%) and Mills (+34%) while the average size of farms respectively decreased by 62%, 9%, and 17% (USDA NASS, 2011). Fig. 1 shows that smaller farms (1–19 ha) saw the greatest increase and larger farms (≥202 ha) decreased in all three counties. Further, between 1997 and 2007, the number of hectares of native rangelands in these three counties decreased by 3%, the appraised market value of land increased by 310%, and wildlife management as a land use grew by over 300% (Wilkins et al., 2009). The average number of seasonal, recreational and occasional use homes in the region increased 22% between 1990 and 2010 (U.S. Census Bureau, 2010). The demographic indicators support the notion that the social landscape is trending away from a dependency on production-oriented livelihoods.

3.2. Landowner motivations

We obtained a raw response rate of 59% and, after removing ineligible respondents, an adjusted response rate of 64%. Of the remaining responses, 312 were complete enough to be used in this analysis. The number of observations varies for each chi-square analysis due to item nonresponse in the survey data.

Based on the exploratory factor analysis of land-ownership motivations and subsequent cluster analysis, the typology consisted of three landowner groups. Sorice et al. (2012) provide details and validation, and we summarize those results here (Fig. 2). The first group, agricultural producers (26% of landowners), consisted of landowners whose primary motivations included ranching and obtaining a profit from the land. Of the three groups they were the most dependent on their land, managed the most land and grazed the most cattle. The second group, multiple-use landowners (35%), were production oriented, but had more diverse motives including owning land for lifestyle reasons, financial investment, agricultural production, and operating a wildlife enterprise (e.g., hunting leases). This group was not as profit oriented as the first group. The third group, lifestyle-oriented landowners (39%), was motivated primarily by lifestyle considerations, and owning land as a financial investment played a secondary role. For this group all other land-ownership motivations were of little importance.

3.3. Management practices

3.3.1. Grazing management

To understand the relationship between landowner type and use of land management practices, we first examined landowner engagement in grazing management practices that help to conserve soil. Most agricultural-production landowners (72%) and multiple-objective landowners (69%) reported matching livestock numbers to environmental conditions currently or on an ongoing basis ($X^2_{(10)} = 26.13$, $p = 0.003$) (Table 2). In contrast, more than expected lifestyle-oriented landowners indicated they do not engage in this practice and fewer than expected reported adjusting livestock numbers currently or on an on-going basis. Similarly, agricultural-production landowners were more likely than expected to engage in rotational grazing while lifestyle-oriented landowners were less likely to do so ($X^2_{(10)} = 32.66$, $p < 0.001$).

3.3.2. Woody plant management

We found that most agricultural producers (63%) and multiple-objective landowners (57%) currently engage in mechanical brush control (currently and on-going) as a way to prevent the encroachment of woody plants on grasslands (Table 3). Almost half of the lifestyle-oriented landowners (47%) employ mechanical brush control techniques. There was no statistical difference between landowner type and the use of this management practice ($X^2_{(10)} = 10.00$, $p = 0.445$). However, agricultural producers were more likely than expected to use herbicides while lifestyle-oriented landowners were less likely than expected to use them ($X^2_{(10)} = 28.06$, $p = 0.002$). The use of prescribed burning to maintain grasslands was significant ($X^2_{(10)} = 16.71$, $p = 0.08$). Over

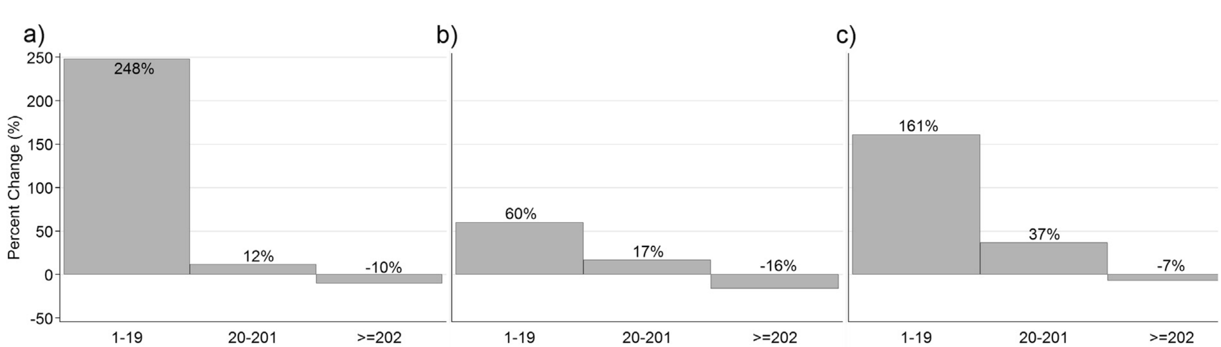

Fig. 1. Percent change (1992–2007) in the number of farms for three classes of farm size: 1–19 ha, 20–201 ha, and 202 ha or greater. Counties examined include a) Coryell, b) Hamilton, and c) Mills County. Source: USDA NASS (2011).

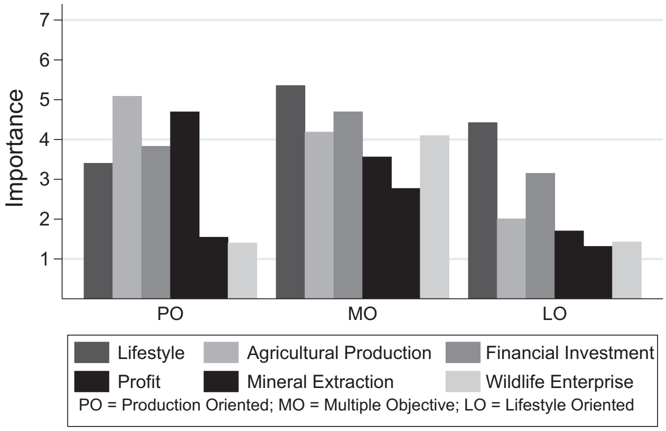

Fig. 2. Results of cluster analysis showing average importance of each land-ownership motivation for the three clusters. Adopted from Sorice et al. (2012).

half of agricultural producers (64%), multiple-objective landowners (57%), and lifestyle-oriented landowners (69%) do not use prescribed burning. Multiple-objective landowners were more likely than expected to employ this technique, although only 9% of this group reported currently using it. Agricultural producers were less likely than expected to use it.

Table 2
Distribution of implementation of grazing management practices by landowner type. Cell numbers are column percentages for: a) adjusting livestock numbers based on available forage and b) rotational grazing. Landowner type: AP = agricultural producer, MO = Multiple-objective, LO = Lifestyle-oriented landowner.

	AP (%)	MO (%)	LO (%)	Chi-square, $X^2_{(df)}$
a)				
No	9	7↓	21⬆	$X^2_{(10)} = 26.13$, $p = 0.003$, $n = 221$
Past	14	11	14	
Current	30	30	16⬇	
Future	3⬇	7	16⬆	
On-going	42	39	23⬇	
Unsure	2↓	5	10	
Total	100	100	100	
b)				
No	6⬇	19	37⬆	$X^2_{(10)} = 32.66$, $p < 0.001$, $n = 211$
Past	9	5	12	
Current	37⬆	28	16⬇	
Future	5	9	13	
On-going	40⬆	34	16⬇	
Unsure	3	5	4	
Total	100	100	100	

⬆ Adjusted Standardized Residual > 1.96; ↑ Adjusted Standardized Residual > 1.64. The number of observations in this cell is significantly larger than expected.
⬇ Adjusted Standardized Residual < 1.96; ↓ Adjusted Standardized Residual < 1.64. The number of observations in this cell is significantly less than expected.

Table 3
Distribution of implementation of woody plant management by landowner type. Cell numbers are column percentages for: a) mechanical brush control, b) herbicides, c) prescribed burning. Landowner type: AP = agricultural producer, MO = Multiple-objective, LO = Lifestyle-oriented landowner.

	AP (%)	MO (%)	LO (%)	
a)				
No	18	12	21	$X^2_{(10)} = 10.00$, $p = 0.445$, $n = 239$
Past	9	20	14	
Current	24	24	21	
Future	8	8	11	
On-going	39	33	26	
Unsure	2	3	6	
Total	100	100	100	
b)				
No	22⬇	42	48	$X^2_{(10)} = 28.06$, $p = 0.002$, $n = 240$
Past	9	6	14	
Current	22⬆	14	8⬇	
Future	6	10	12	
On-going	36⬆	23	11⬇	
Unsure	4	6	7	
Total	100.0	100.0	100.0	
c)				
No	64	57	69	$X^2_{(10)} = 16.71$, $p = 0.08$, $n = 238$
Past	8	11	5	
Current	0↓	9⬆	1	
Future	12	8	8	
On-going	6	2	2	
Unsure	11	12	14	
Total	100.0	100.0	100.0	

⬆ Adjusted Standardized Residual > 1.96; ↑ Adjusted Standardized Residual > 1.64. The number of observations in this cell is significantly larger than expected.
⬇ Adjusted Standardized Residual < 1.96; ↓ Adjusted Standardized Residual < 1.64. The number of observations in this cell is significantly less than expected.

3.3.3. Restoration

Lifestyle-oriented landowners were less likely than expected to report using reseeding to restore grasses and forbs (Reseed Native Species: $X^2_{(10)} = 16.29$, $p = 0.09$; Reseed Introduced Species: $X^2_{(10)} = 28.76$, $p = 0.001$; Table 4). There were no differences between landowner types for the use of contour ripping: 10–25% of landowners in each group reported using this technique currently or on an on-going basis ($X^2_{(10)} = 11.05$, $p = 0.356$). Whereas 40% of agricultural producers reported using gully plugs currently or on an on-going basis, only 11% of lifestyle-oriented landowners used them ($X^2_{(10)} = 26.28$, $p < 0.003$).

3.3.4. Water and riparian management

Landowner use of practices to conserve water followed a similar trend to grazing and vegetation management (Table 5). Lifestyle-oriented landowners were less likely than expected to install tanks or header dams ($X^2_{(10)} = 24.96$, $p = 0.005$), use shaped-grass

Table 4
Distribution of implementation of restoration by landowner type. Cell numbers are column percentages for: a) reseed with native grasses, b) reseed with introduced grasses, c) contour ripping, d) gully plugs. Landowner type: AP = agricultural producer, MO = Multiple-objective, LO = Lifestyle-oriented landowner.

	AP (%)	MO (%)	LO (%)	
a)				
No	37	33↓	48⬆	$X^2_{(10)} = 16.29$, $p = 0.09$, $n = 239$
Past	18	10	13	
Current	9	15⬆	2⬇	
Future	11	19	19	
On-going	14	13	7	
Unsure	11	10	11	
Total	100	100	100	
b)				
No	28	30	47⬆	$X^2_{(10)} = 28.76$, $p = 0.001$, n= 242
Past	23	13⬇	25	
Current	14	16⬆	1⬇	
Future	8	11	9	
On-going	20⬆	16	5⬇	
Unsure	8	13	14	
Total	100	100	100	
c)				
No	46	40	51	$X^2_{(10)} = 11.05$, $p = 0.356$, $n = 235$
Past	15	15	13	
Current	9	9	6	
Future	8	9	13	
On-going	15	13	4	
Unsure	6	14	13	
Total	100	100	100	
d)				
No	23	23↓	41⬆	$X^2_{(10)} = 26.28$, $p < 0.003$, $n = 232$
Past	16	20	17	
Current	23⬆	12	4⬇	
Future	9	14	12	
On-going	20	17	7⬇	
Unsure	8	14	18	
Total	100	100	100	

⬆ Adjusted Standardized Residual > 1.96; ↑ Adjusted Standardized Residual > 1.64. The number of observations in this cell is significantly larger than expected.
⬇ Adjusted Standardized Residual < 1.96; ↓ Adjusted Standardized Residual < 1.64. The number of observations in this cell is significantly less than expected.

waterways ($X^2_{(10)} = 40.68$, $p < 0.001$), or riparian buffer zones ($X^2_{(10)} = 20.42$, $p = 0.024$). Agricultural-production landowners were more likely to have engaged, currently engage or plan to engage in these activities.

3.3.5. Conservation practices applicability

Finally, as discussed above we provided landowners with the option of choosing “not applicable” for each land management practice. Although the purpose was to reduce measurement error (e.g., item nonresponse) by providing a response category for

Table 5
Distribution of implementation of water management practices by landowner type (column percentages). Water Management Practices: a) installing tanks or header dams, b) shaped grass waterways, c) gully plugs, d) riparian buffer zones. Landowner type: AP = agricultural producer, MO = Multiple-objective, LO = Lifestyle-oriented landowner.

	AP (%)	MO (%)	LO (%)	
a)				
No	21	16↓	31⬆	$X^2_{(10)} = 24.96$, $p = 0.005$, $n = 240$
Past	15	19	25	
Current	31⬆	19	11⬇	
Future	7⬇	19	20	
On-going	22	21	9⬇	
Unsure	3	7	3	
Total	100	100	100	
b)				
No	31⬇	35	55⬆	$X^2_{(10)} = 40.68$, $p < 0.001$, $n = 232$
Past	14	12	6	
Current	20⬆	12	0⬇	
Future	8	11	8	
On-going	18⬆	12	2⬇	
Unsure	9⬇	19	28⬆	
Total	100	100	100	
c)				
No	21⬇	27	43⬆	$X^2_{(10)} = 20.42$, $p = 0.024$, $n = 232$
Past	17⬆	7	7	
Current	25	24	12⬇	
Future	3	6	6	
On-going	21	15	11	
Unsure	13	21	21	
Total	100	100	100	

⬆ Adjusted Standardized Residual > 1.96. ↑ Adjusted Standardized Residual > 1.64. The number of observations in this cell is significantly larger than expected.
⬇ Adjusted Standardized Residual < 1.96; ↓ Adjusted Standardized Residual < 1.64. The number of observations in this cell is significantly less than expected.

landowners who had no reason to engage in such a practice, it may also provide insight into which landowner groups perceive the utility of a particular land management practice on their land. On average, 11% (SD = 3%, MD = 10%) of landowners chose “not applicable” for the land management practices. Of those landowners that chose this option, 78% (SD = 7%, MD = 78%) were lifestyle-oriented landowners. This indicates that lifestyle-oriented landowners are those who are less likely to perceive the need for these land management practices.

4. Discussion

We used rangelands in central Texas as a case to explore the potential relationship between changes in the rural landowner and the potential for social–ecological transformation of these ecosystems as a result of the use (or nonuse) of conservation management practices identified by the U.S. NRCS. We used a behavioral approach to understand the utilization of land management practices that are conventionally considered to be mainstream conservation practices inasmuch as they are reflected in policy and funding mechanisms (e.g., NRCS, 2011). Our findings inform the discussion on the potential positive or negative ecological consequences associated with a demographic trend in which lifestyle-oriented landowners increasingly dominate the central Texas landscape.

Overall, lifestyle-oriented landowners were more likely to say they have never used many of the conservation practices. This result differs from Mendham et al. (2012), who found that “newer” landowners implemented conservation practices at the same general rate as “longer term” landowners. However, it is congruent with previous research that suggests that although lifestyle-oriented landowners tend to express more interest in conservation-based environmental management, they may not have the knowledge or skills to manage their land accordingly (Jackson-Smith et al., 2005; Jones et al., 2003; Kreuter et al., 2004; Mendham and Curtis, 2010).

To some degree the lack of adoption of these land management practices by lifestyle-oriented landowners may be troubling given the assumption that engaging in them enhances the sustainability of rangelands. However, this conclusion may oversimplify the issue—a more comparative perspective may be warranted. For example, agricultural-production landowners were more likely than expected to use herbicides to control woody brush. Although lifestyle-oriented landowners were less likely than expected to use herbicides, almost half reported engaging in mechanical brush control currently or on an on-going basis. Comparing the two groups may reflect different preferences for methods of controlling brush.

In general, lifestyle-oriented landowners were not as engaged in grazing management or watershed management practices. Again, taken at face value, this could be cause for concern; however, the proportion of grazed land and the average number of cattle grazed on that land are lower for this group than for either the agricultural-production or the multiple-objective groups (Sorice et al., 2012). Livestock overgrazing has been identified as a primary driver of degradation on semi-arid rangelands (Bailey and Brown, 2011). Thus, reduced grazing pressure as a result of the amenity-based culture may facilitate the maintenance and recovery of degraded ecosystem services (Wilcox et al., 2012) even in the face of other forces such as woody plant expansion (Wilcox and Huang, 2010). Further, a lower reliance on livestock may be linked to lower adoption of water management practices given that riparian areas may already receive protection from grazing because the landowners are not trying to maximize forage utilization on their land. Although we examined behavior vis-à-vis conservation practices, a further understanding is needed of the interactions between lifestyle-oriented landowners and the inherent changes in press-pulse dynamics of landscape disturbance patterns that result (Gosnell et al., 2012).

We did not look at changes in land ownership motivation per se; however, assuming that changing demographics are associated with changing land-ownership motivations, there are likely implications for the ecological landscape and the associated flow of ecosystem services via modified landscape disturbance patterns (Collins et al., 2011). That is, a change in culture (as identified here as a shift in land-ownership motivation) could act as a slow variable in the social–ecological system that drives ecological change. In our sample lifestyle-oriented landowners comprise a significant portion of the landscape in central Texas but have little dependence on the resource for sustaining their livelihoods (Sorice et al., 2012). Along with different motivations for land use, this group may also have different preferences for ecosystem services, focusing on cultural services over provisioning and regulating services (Gosnell and Abrams, 2009; Jones et al., 2003; Martín-López et al., 2012; Mendham et al., 2012).

Answering the question of whether ecological consequences due to a change from production-oriented landowners to lifestyle-oriented landowners are positive or negative is complex. The smaller property size and increased number of households across the landscape creates problems for ecosystem integrity and functioning due to land fragmentation and resource consumption (Hansen et al., 2002). Behaviorally, lifestyle-oriented landowners may not be as likely to adopt conservation-oriented land management practices. But, this occurs in the context of a land-use-related ecological footprint. Reduced resource dependency may lead to an overall reduced pressure on the land that, despite the fact they do not adopt conservation management practices, results in a net benefit of desired ecosystem services (e.g., regulating and supporting services). Gill et al. (2010) argue that the negative ecological outcomes of amenity-focused landowners are more likely a structural issue (e.g., land subdivision) and the result of processes such as land planning, or lack thereof, rather than the land management practice employed.

Our study adds to this growing body of literature on amenity landowners. Specifically, we demonstrate that changes in the composition of private landowners known to be occurring in the eastern, intermountain, and western regions of United States is also likely occurring in parts of the southern Great Plains (where typical natural amenities are less available). Similar to other research, we found that landowners with lower levels of resource dependency have different attitudes toward the land and motivations for owning it that lead to land management behaviors that are different than the production-oriented landowners (see Gosnell and Abrams, 2009; Gosnell et al., 2012 for in-depth reviews). As lifestyle-oriented landowners migrate to rural areas they bring with them their own culture, values and vision for what rural areas should look and feel like (Luck et al., 2011). They often bring higher incomes (Hunter et al., 2005) and alternate ways of interacting with the local community (Yung and Belsky, 2007). They may have different needs for educational and social services, employment, and recreation opportunities that change the fabric of society (Luck et al., 2011; Robbins et al., 2009). We found that this group also brings a lower inclination to adopt mainstream conservation land management practices. These changes in land ownership create new and different disturbances on the landscape that lead to changes in ecosystem structure and function (Collins et al., 2011). At face value this poses new challenges to natural resource managers regarding education, outreach, and policy. However, a better understanding about the net ecological consequences of lower rates of adoption of traditional conservation management practices requires consideration of not only specific behaviors but the ecological footprint associated with resource dependency.

5. Conclusion

Grassland conversion to woodlands served as the context for our case study to understand landowner behavior. This phenomenon is a worldwide phenomenon, occurring on every continent on Earth (Wilcox et al., 2011) and is driven by a combination of stochastic processes and human behavior (e.g., agricultural intensification, human-induced degradation, changes in climate). Our case study framed this ecological change not in terms of land use per se but in terms of a landowner's psychological foundation for owning and managing land. Behavioral approaches to understanding social drivers of ecological change focus on the motives and attitudes of landowners in order to determine the underpinnings of land ownership and land-use decisions (Burton, 2004). To the degree that these values and attitudes are shared by community members, a culture of land use behavior can develop. Understanding the base motivations for land ownership can help social–ecological research efforts to understand drivers of change. Additionally, it can also help extension and education efforts to develop interventions that promote the adoption of more conservation-oriented practices.

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