LAND MANAGEMENT TRENDS OF SMALL ACREAGE LANDOWNERS IN A HIGH GROWTH EXURBAN WATERSHED IN CENTRAL TEXAS

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DIRECTED RESEARCH

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ABSTRACT

The lifestyle- or amenity-oriented landowner is a major force on the rural and exurban landscape and creates an ecology that is unique, yet even in its heterogeneity, is present across most developed areas of the planet. The land management behaviors of these landowners, often living on parcels between 2 to 40 acres, is overlooked by many land conservation studies in favor of the large acreage tracts targeted for protection by conservation agencies and organizations. As a group, however, these landowners control vast amounts of the rural countryside in many areas, and, rather than devaluing those landscapes as vast ecological losses, research can illuminate the type of landscape these actors may produce and why. These inquiries can also inform county extension service programming and other conservation actors seeking to encourage implementation of best practices in these landscapes.

This research explores the link between land management attitudes, actions, and ideologies of small acreage exurban landowners and their implications for the landscape as a whole. In particular, this research is a case study of the land management dynamics in a high growth exurban region of Central Texas. A survey gathered in-depth landscape preferences and management actions for a random sample of small acreage landowners in the Onion Creek watershed outside of Austin, Texas. The study's focus on small acreage residential landowners provides new insights into this class and type of exurban actor, by using survey data to create three recognizable exurban land management aesthetics or archetypes and linked land management actions that are at work across the exurban landscape. "Ranchland", "suburban", and "wild / natural" land management archetypes engage in various degrees of brush management, suburban-style gardening, native planting, and relative non-management. Regardless of their archetype, however, many of these actors demonstrate a high motivation for

various kinds of conservation actions mediated by a desire to enact their idealized vision of the Texas Hill Country landscape on their parcel of land. The archetypes presented in this research are an opportunity to visualize the various idealizations of a natural Texas Hill Country that effect the types of management actions each actor is likely to employ. These actions, in turn, will create emerging exurban ecologies that will shape the future landscapes in these amenity rich regions. Conservation educators and other programmers can work in concert with these landowner variables to strategize the implementation of land management best practices with small acreage landowners in these regions.

I. INTRODUCTION

Purpose Statement

The purpose of this study is to help improve land management in areas of the Texas Hill Country that are experiencing rapid low-density residential growth. This research creates and analyzes a dataset that has the potential to inform land managers, educators, policy makers and future researchers about the land management actions and trends of small acreage residential landowners in exurban areas. County-based agricultural extension programs, in particular, seek to normalize best practice management actions across the region and the results of this research identify themes that can focus outreach and education strategies towards these ends.

This research also seeks to add much needed additional perspectives to the growing scholarly discourse on the global phenomena of exurban growth through this study of landowner land management behaviors in a high growth area within commuting distance of a major American city.

Research Questions

This research investigates parcel-scale land management perceptions and behaviors by exurban landowners in a watershed experiencing rapid low-density residential growth in Central Texas. Analysis of survey results in this case study explores the relative diversity of land management behaviors among small acreage landowners in the Central Texas region and links those actions to landowner typologies and ideologies.

Research questions guiding this work are:

- What land management perceptions are held by small acreage exurban landowners in the Central Texas region?
- What land management actions are undertaken by small acreage exurban landowners in Central Texas?
- What landowner characteristics are linked to their land management perceptions and actions?
- How do these factors influence spatial and ecological relationships at the landscape-scale?

Research Hypothesis

The actions of small acreage exurban landowners in the Onion Creek Watershed are heavily influenced by living in a landscape that they perceive as both "working" Texas ranchland as well as "natural" or "unspoiled" Texas Hill Country. Landowners' individual preferences will express different degrees of these landscape ideals. The research hypothesis is that each landowner's management actions will be a reflection of their idealized vision of the landscape as demonstrated by their survey response results.

II. BACKGROUND

Overview

In an effort to improve society and protect ecological integrity, policy makers, planners, and scientists have struggled to make sense of the implications of the interaction between urban areas and the hinterlands. In early inquiry, the von Thünen model of populous city and sparser countryside had assumed that the wide open country would provide the dense urban population with food, clean water, and other services as well as a less quantifiable "home" for the myriad of earth's wildlife. As population grows, this model might simply respond with a larger urban area. Increasingly in the United States, however, uneven residential pressures are pushing people farther into the countryside. Especially in areas with perceived environmental or cultural amenities and/or within commuting distance to urban centers, the population and building density of rural places is on the rise. The outer-ring "urban sprawl" of suburban communities is certainly an important population center, but another important trend is the growth of distinct ex-urban (de)centers and smaller-parcel landholdings in hinterland agricultural and undeveloped "natural" areas. These areas of deconcentrated, low-density residential areas are a widespread feature of the U.S. today (Brown et al. 2005; Taylor and Hurley 2016). The growth of these exurban areas is driven in part by a wealthy middle class that can afford to live on small acreage country "estates" and commute to the city for work (Wilkinson 2006), with natural amenities like waterfront property and expansive views as

part of the attraction (Taylor 2011; Cadieux & Hurley 2011; Abrams et al. 2012; Hurley 2013).

Historically, agricultural and other productivist uses of the hinterlands have been more influential than other non-productivist uses in their impacts upon the non-urban landscape. With increasing residential growth, however, rural land prices are rising steadily and traditional agricultural landscapes are being split into smaller parcels unfit for larger-scale agriculture (Nelson 1990; Livanis et al. 2006). While risks to undeveloped natural landscapes have traditionally been the foci of studies of rural land change, with agricultural expansion as the cause, agricultural landscapes are increasingly grouped along with "wild" space as places that are at risk from the pressures of "sprawl" and fragmentation (Gosnell et al. 2006; Robbins et al. 2012; Abrams & Bliss 2013; Hiner 2014). As they transition to uneven residential use, many rural lands will continue to be both "wild" and agricultural in their nature with the addition of new and complex social and biological variables associated with more dense human habitation.

The spatial analysis of land use and cover and the study of its change through time have led to improved management and planning of the diverse landscapes undergoing urbanization and the ecosystem services upon which society depends. Scientific inquiry into the nature of land change in exurbia must explore new variables relating to the exurban landowners and the challenges and opportunities they entail. Scholars have recently noted the need to explore residential motivations of exurbanites, including how the ideology of nature plays into the desire to live in a rural area (Cadieux & Hurley 2011; Taylor 2011; Cadieux and Taylor 2013).

While the American West tends to dominate studies of amenity migration and its challenges for ecological integrity, the rural lands of Texas represent an opportunity to pursue a case study of a region that shares many similarities with existing studies, but also that potentially illustrates key differences and adds to the growing body of literature. This study's focus on a Central Texas landscape combines key ecological issues frequently featured in research on the West with a landscape dominated by private land tenure that characterizes the landscapes found in much of the east. The Onion Creek Watershed is part of the scenic Texas Hill Country landscape that is subject to amenity-based residential growth region-wide (see Figure 1). This watershed also experiences heavy growth pressure due to its close proximity to some of the fastest growing areas of the United States, Austin, Texas and the Interstate 35 corridor between Austin and San Antonio, Texas.

Figure 1. The "natural" character of the study area, the Onion Creek watershed, upstream from Austin, Texas. The aesthetic and recreational value of stream corridors and tree-cloaked limestone ridges in the Hill Country of Central Texas are major amenities that have drawn many residents into areas of former ranchland.

Smaller parcel size is the dominant trend in exurban areas similar to the Onion Creek watershed in the Texas Hill Country and the mix of land management actions undertaken by these types of landowners may be the "new normal". Land management behaviors that have strong relationships with landowner characteristics, including various dimensions of landowner identity, will be predictors of the landscape we will see in the future. If some landowner characteristics seem to predict brush clearing behavior it will be important to know what those predictive characteristics are. If landowners who identify with a ranching heritage heavily populate a landscape and tend to participate in brush clearing activities, a landscape with less mesquite and juniper may be the expected future outcome. Certain dimensions of landowner knowledge or identity may, in fact, have the potential to be affected by extension service programs or other community stewardship education efforts and may be important components in efforts to exact change or other protection or control efforts on the overall landscape of a region. The predominant social view favoring the removal of Ashe juniper (colloquially known cedar), for instance, is a by-product of the area's ranching history but certainly is promulgated culturally by traditional agricultural extension education efforts.

Site and Situation

This study examines a single watershed in Hays County in the Edwards Plateau region of central Texas, known locally as the "Hill Country", an allusion to the many steep hills and valleys that characterize the area. The region is assigned a "subtropical subhumid" designation in the *Climatic Atlas of Texas* (Larkin and Bomar 1983), with

high climatic variability in the region causing periods of both extreme flood and drought. In most areas shallow clay soils lie on limestone uplands, with deeper calcareous soils in canyons and valley bottoms. Following European colonization, valley bottoms have traditionally been associated with small scale tillage-based agriculture while much of the upland was used as ranchland. According to the 2001 National Land Cover Dataset, land cover in the county is predominately shrubland / grassland (49%) evergreen (juniper) woodland (31%), and mixed hardwood woodland (12%) (Table 1).

This area of Central Texas has experienced heavy population growth and development pressure (Bernard and Rice 2014). Fragmentation of large rural landholdings is a demonstrable phenomenon throughout much of Central Texas (Wilkins et al. 2003). In recent years, Hays County has been ranked as one of the highest residential growth regions in the United States. In the 2001 data, just 5% of the county was developed, and this was predominately concentrated within the small (as in Buda, Texas with a 2013 population 10,209) to medium (San Marcos, Texas with a 2013 population of 54,706) urban areas of the county (US Bureau of the Census 2013).

As a result of this residential growth, land cover change between the 1992 and 2001 show the greatest area of change being a 14% loss of woodland cover and a 13% gain in grassland, perhaps due to a common land management action of thinning juniper to promote grassland cover and/or increase water infiltration (Table 2) (USGS 2003). Additionally, Wilkins et al. (2003) noted that as smaller parcels become more common, the type of grass cover appears to change, favoring improved pasture over native grasslands.

Table 1. 2001 National Land Cover Dataset, Hays County, Texas.

Category	Approx. Area (acres)	Percent of County
Open Water	1,901	0.4%
Developed, Open Space	15,139	3.5%
Developed, Low Intensity	4,877	1.1%
Developed, Medium Intensity	2,358	0.5%
Developed, High Intensity	1,144	0.3%
Barren Land	486	0.1%
Deciduous Forest	51,339	11.8%
Evergreen Forest	132,510	30.5%
Mixed Forest	156	0.0%
Shrub/Scrub	130,693	30.1%
Herbaceous	75,983	17.5%
Hay/Pasture	5,131	1.2%
Cultivated Crops	10,512	2.4%
Woody Wetlands	2,086	0.5%
Emergent Herbaceous Wetlands	3	0.0%

(USGS 2001)

Table 2. Hays County Land Use and Land Cover Changes between 1992 and 2001.

Land Cover Category	Gain (ac)	Loss (ac)	Net Change (ac)	% Change from 1992
Open Water	343	2	341	22%
Urban	4,450	27	4,423	23%
Barren	282	11	271	126%
Forest	2,573	33,684	(31,111)	-14%
Grassland/Shrub	28,822	4,334	24,488	13%
Agriculture	2,649	1,752	897	6%
Wetlands	691	0	691	48%

(USGS 2003)

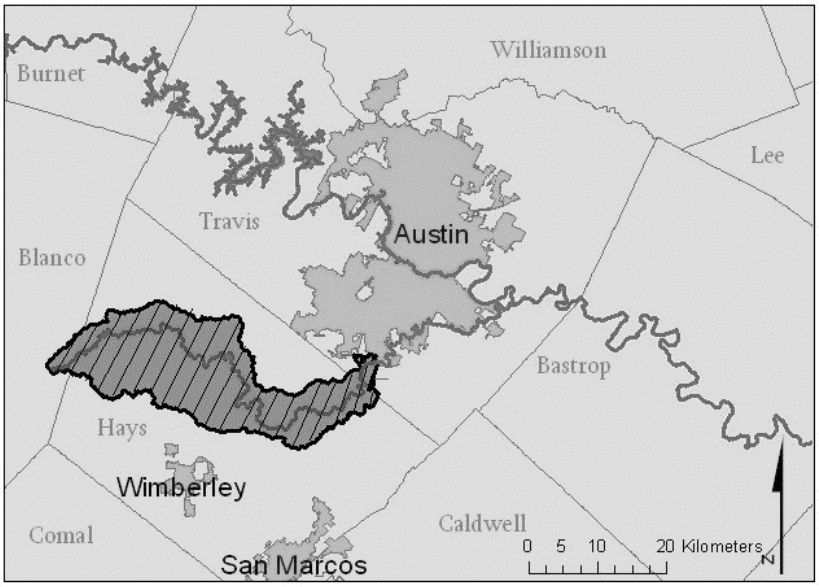


Figure 2. Location of the study area in Hays County, Texas. The Onion Creek watershed is nested within the larger (Texas) Colorado River watershed, which runs through Austin, Texas. The study area is 424 km^2 and excludes urban areas of the watershed (182 km^2) after it enters the southern boundary of the city of Austin.

The study area includes all areas of the Onion Creek watershed upstream from where the creek enters the boundary of the city of Austin, Texas (Figure 2). Unique geological and geographic characteristics give the study area's land uses a disproportionately high potential to effect environmental quality in adjacent areas (Hauwert et al. 2002; Hunt et al. 2005). The downstream reaches of the watershed outside the highlighted study area, for example, are entirely within the city limits of a major metropolitan area, Austin, Texas. The karst geology of the area also includes numerous sink holes and caves that funnel surface water directly into the Edwards Aquifer (Mahler

et al. 1999), an important regional water source and home to numerous threatened and endangered species (Bowles and Arsuffi 1993). Because of the environmental sensitivity of landscapes within the study area (and elsewhere), municipal and non-profit entities, such as the City of Austin, Hays County, and Hill Country Conservancy, manage thousands of acres of land. For example, the Onion Creek Management Unit is found in the case study site, which is managed by the City of Austin Water Utility Wildlands Conservation Division for water quality. The 2,556 acre site is in the recharge zone of the Barton Springs segment of the Edwards Aquifer and has numerous recharge features, including a cave in the bed of Onion Creek which creates a whirlpool funneling water directly into the aquifer. While much of this land is not open to the public, it does represent a much higher percentage of public land (around 20%) than the average for the rest of the state or region (under 5%). Overall, Texas has a comparatively low proportion of public land with 95.8% being privately held (US Bureau of the Census 1991).

The furthest point in the study area is no more than 42 kilometers away from the boundaries of the city of Austin, which has a population within the city limits of 790,390 (and rising), with over 1.8 million people in the general metropolitan area (US Bureau of the Census 2010). The lower 40 kilometers of Onion Creek's 127 total kilometers are inside the city limits of Austin and excluded from this study. For the purposes of this study, a *rural area* is one that is outside the boundary of any census recognized population center. The study area is approximately 424 kilometers square, roughly 78% of the entire watershed.

III. LITERATURE REVIEW

One of the challenges for the conservation community is learning how to work with this growing mosaic of landowner types at work on the rural landscape. These new residents are implementing multiple land uses and land-management behaviors, and in their wake, are creating a complex social and ecological dynamic across the countryside. Landscape-scale conservation efforts are traditionally undertaken by working with large-scale landowners who are often uniformly production-minded. This new landscape will prove to be much more difficult for conservationists to maneuver.

These new patterns of land ownership are driving (or being driven by) profound social, economic, and ecological changes in rural lands. With dynamic ties to both ecological function and social process, fragmenting ecosystems are observed throughout rural regions worldwide (Wear et al. 1996; Bissonette and Storch 2002; Gonzalez-Abraham et al. 2007). Research into the complex drivers and issues associated with land fragmentation is a nexus of social and biological study. While much of this body of work has not been interdisciplinary, recent research has done well to more fully integrate the diverse fields of study necessary to more fully understand land fragmentation issues.

Rapid change in land ownership is a major contributor to the fragmentation of rural landscapes. In a text demonstrating land change by revisiting a 1905 federal biological survey of Texas, zoologist David J. Schmidly (2002) identified habitat fragmentation as the most serious threat to landscape integrity today. Schmidly noted that the traditional uses of rural lands in the state, such as agriculture and forestry, are being usurped by residential and recreational uses. At the same time, the conservation of

wildlands near urban areas is also increasingly desired. The various dimensions and drivers of land use must be understood to predict the landscapes of the future. A fuller picture of these land use dynamics, however, cannot be had without a serious look and at the interaction between rural residents and the ecosystems they inhabit.

Biogeographic Explorations of Land Fragmentation

Underlying this research is a tradition of biologic and geographic inquiry into the nature of humankind's footprint on the earth. While the phenomena of rural land change at the hands of consumptive rural users may be fairly young, this growing body of work does highlight the importance of past studies on landscape change. The study of land fragmentation owes much to German geographer Carl Troll who coined the term *landscape ecology* from his work in the 1950s using aerial photography to link spatial pattern to ecological process. In the emerging field of landscape ecology, MacArthur and Wilson's (1967) theory of island biogeography was a first attempt to predict species number and pattern on these fragmented patches by studying the variables of patch area and distance to an ecological "mainland". Concepts of connectivity corridors and edge or boundary effects further inform the dynamic nature of patch - landscape interactions that increase in fragmented landscapes (Forman 1995).

In biological terms, fragmented landscapes often consist of remnant areas of native vegetation surrounded by a matrix of residential and agricultural land. A more diverse grouping of land uses within a landscape brings more opportunity for conflicting edges to have an impact upon neighboring parcels (Geoghegan et al. 1997). As fragmentation reduces the potential habitat area, the extinction risk for local populations

is raised, and, as the fragmented patches become more isolated, the rate of natural colonization by other organisms or species decreases (Hanski 1999). Saunders et al. (1991) characterizes fragmented ecosystems in terms of the ways in which the flora of a patch may be affected including microclimate changes in wind, radiation, and water availability. Fine-scale landscape change brought on by rural landowners could have an enormous impact on these kinds of variables.

Land parcel size itself predicts the dynamics of land cover found within the parcel. Robinson (2012) looked at spatial patterns of land cover and its relation to parcel size. In general, the smaller the parcel size, the more fragmentation of land cover types that was found. In his regional study in Michigan, Robinson found the percentage of each land parcel that was tree covered increased with larger parcels. Impervious cover area was fairly consistent across large and small parcels, meaning the percentage of parcel covered by impervious cover was much less for larger parcels. Large parcels were also much more likely to be a mosaic of land covers and not simply a house and maintained lawn, as compared to smaller parcels. As the trend in parcel size continues to decrease, this research highlights the potential ecological vulnerability implicit with smaller parcels. The moderately sized residential parcels under investigation in this study, however, may represent a kind of in-between that includes diverse land covers as well as the regular occurrence of house and lawn.

Minor changes to land cover and parcel boundaries also can have important biological effects. Martin et al. (2006) found that the spatial structure of boundaries around parcels and patches may be as important as other factors in determining ecological function and further shows that changes to these boundaries are more

prevalent than changes in the land use itself. Landscape dynamic subtleties like these are also apparent in Lambin's (1997) finding that even slight modifications of land cover may have as significant of an environmental effect as full land cover conversions. Biological response to a fragmented landscape can be very fine scale and hard to detect. In 2013, Battles et al. found small differences in Green Anole lizards in fairly similar rural environments that differed only in minor amounts of human disturbance. In areas with some small amounts of human disturbance, female lizards consistently had less bio-mass index values. Again, land management and residential behaviors on small acreage plots could have big impacts on these factors.

Some studies challenge whether the growth of small-acreage rural residential lots necessarily has negative ecological consequences. Walker et al. (2003) found a general increase in canopy cover around exurban development in the Sierra Nevada, though the ecological consequences of such increased canopy cover can be further debated (Walker et al. 2003, Wacker and Kelly 2004). Gill et al. (2010) theorizes that the ecological impact of amenity landowners may be due to structural issues like land subdivision, much more than land management actions. On larger acreage, Sorice et al. (2014) conceptualize many potential issues with the land management behaviors of the growing number of amenity or lifestyle-oriented landowners on Texas rangelands, but also question whether their comparative lack of adoption of grazing and watershed management practices is offset by the idea that they are overall much more likely to have a reduced stocking rate on their land.

Historical land use patterns that may create amenities and other landscape qualities that attract or repel future land development are frequently shaped by complex

interactions of biophysical and social dynamics. William R. Travis' "amenity gold rush" of the American West owes to the juxtaposition of the inherent natural resources of the region, the historical exploitation of that resource (including the base network of roads and infrastructure built for that purpose), a growing personal preference for such landscapes, and now an economy of landscape consumption that supports it (Travis 2007). De Blois et al. (2001) note parcel-scale geological conditions that render a particular site less useful for agriculture in sites otherwise dominated by large cultivated fields. These sites with more tree cover, historically used for pasture or timber production may now be more highly desired in the amenity-based residential real estate market. In Southeastern Pennsylvania, Hurley et al. (2017) document how a landform that was a historic geologic barrier to agriculture has influenced modern amenity-based residential development and desire for conservation actions. Gonzalez-Abraham (2007) found both historic and new development residential clustering around rural areas with natural amenities, like large bodies of water or expansive views. York et al. (2011) studied key variables in exurban land cover changes in the Southwestern U.S. and found water development infrastructure and historical transportation networks as the key elements in the patterns of growth found there. Without these items, development could not occur. Population dynamics, topography, and institutional barriers were also important variables.

Social Dimensions of Fragmenting Land Ownership and Land Management

Socio-political dynamics play an important role in the dynamics of the changing rural matrix and a growing literature of rural studies and political ecology have begun to

explore this area of research (see, for example, Cadieux and Taylor 2013; Hiner 2015; Taylor and Hurley 2016). As noted above, the draw of a "rural house with a view" clearly begs study that explores this social phenomena and moves beyond purely ecological studies of fragmentation.

Social trends in land tenure effect land use and cover. Salamon (1993) notes the rapid change in land ownership that was beginning to occur in rural areas in the 1980s. In a study in rural Illinois, many landowners had held their parcels for less than 15 years and, as a trend, farmland was turning over ownership in excess of 4% each year. In Walker et al.'s (2003) study of change in Nevada County, California, rural residential use increased from 30% to 70% between 1957 and 2001. While all resource consumption-based land uses decreased, a small increase in land used for part-time or small-scale agricultural activities was observed during the more recent years of the study. Walker et al. observed the median size of landholdings in Nevada County decrease from 550 acres in 1957 to 9 acres in 2001. Walker et al.'s findings challenge the idea of simplistic rural residential landscape transitions, with many landowners having a great diversity of land use intentions and eventual land cover results.

The future of some landscapes, however, may already be written out. Walker et al. (2003) also note the wide-ranging existence of prior land use zoning overlays across the landscape as well as the stated future development intentions of larger-scale landowners masking a potential of much further land subdivision in the future. As such, an invisible blueprint of future fragmentation is already imprinted on the landscape.

In addition to these indicators of future development, recent interdisciplinary research has highlighted that land use decisions are heavily influenced by social and

economic drivers as well as ecological constraints and historical land cover patterns (Lee et al. 1992; Haines-Young and Potschin 2000). The attitudes and perceptions of different types of landowners inform their interactions with lands of a similar type (Gonzalez-Abraham at al. 2007). These predictable land use decisions can in turn affect the biological processes of the entire landscape (Turner et al. 1996). Wear and Flamm (1993) found that land cover was predicted by landowner characteristics, environmental attributes, and distance to population or market centers. Other research adds important predicting variables for parcel size and shape (Dale et al. 1993). In a study in the southeastern United States, Wear et al. (1996) found that a temporal shift from primarily forest management to residential use has resulted in significant changes in cover type. Further, holders of small private parcels in Wear et al.'s study tended to have greater variability in land use decisions.

Economic factors are also part of the land use equation. While Bockstael (1996) lamented the lack of an economic perspective in models of land use change, Classen and Tegene (1999) argue that many studies have assumed the primary motivator of rural land use decisions to be the maximization of monetary gain, upon the weighing of costs, benefits, and risks. The agricultural utility of a landscape can be a good predictor of its vegetation pattern; whether motivated by the earning potential of siting a soybean field on deep soil or leaving rocky soil uncultivated because of its poor productivity (de Blois et al. 2001). However, Koontz (2001) finds that many landowner decisions are not financially motivated. Even those landowners who earn income from their land make many of their decisions to maximize nonmonetary benefits. In an exurban landscape in the foothills of the Sierra Nevada, Hiner (2015) found that many landowners viewed

environment, economic, and social viability as interconnected parts of a healthy system. Though there is common ground, personal political and environmental ideologies may highlight the importance of one of these areas over the others. These ideological differences may manifest themselves in politically polarized exurban areas where residents view environmental protection regulations from vastly different lenses (Hiner 2015).

Cultural differences can also affect how different people interact with the landscape. The work of Buijs et al. (2009) show cultural differences in landscape preferences. Where one social group may view an ideal manifestation of nature as an intact, diverse, and perhaps impenetrable riparian area, others may view a well-manicured lawn down to a river's edge as the ideal. In their study of Muslim immigrants to Holland, Buijs et al. document how second-generation immigrants from this community demonstrate a middle ground between the wilderness-oriented view of ideal nature espoused by native Dutch people and the human-dominated view of nature held by recent Muslim immigrants. These evolving views of nature are important considerations for how a potential landowner might impact or manage their landscape.

The look and feel of landscape may play an ever important role in land management activities. Gosnell and Abrams (2011) review literature exploring the shift from productivist to consumptive attitudes towards the landscape. Their analysis indicates that even owners that use a landscape for production-oriented reasons often favor recreation and aesthetics when making land management decisions.

The interactions between amenity-oriented landowners and the landscape in rural areas is a modern phenomenon. In rural Australia, Cooke and Lane (2015) document how

landowners interact with a landscape and its embodied history to create modern landscape forms. Their "landscape legacy" concept is an attempt to explain how past actions and future aspirations create new amenity ecologies. Cooke and Lane also question the utility of the traditional notion of a pre-colonial landscape target in conservation and biological landscape restoration. They argue that ecological restoration in the modern human-dominated age should be more inclusive of the human actors in a landscape and their dynamic interaction with the unique environment that they find themselves in. The concept of "amenity ecologies" recognizes the micro-scale novel interactions that these human actors are a part of in their landscape.

The diverse and complex ways in which people forge a "sense of place", or a relationship with their physical environment, can have profound impacts on a landscape. As Cheng et al. observes (2003), this "sense of place" helps people find order in the world, and hence, shapes natural resource planning and management. Nesbitt and Weiner (2001) document the conflicting environmental imaginaries produced by social interactions with natural resources at various sites within Central Appalachia. Historical social struggles over local nature resources, often in conflict with outsiders, have transformed the way residents interact with nature. Gosnell and Abrams (2011) further explore how the construction of rural ideals in the environmental imaginary contributes to a sense of place and order in a region. In many exurban areas, the ideal environment is increasingly the construction of not just long time locals, but also in-migrants who now find themselves able to live in these rural places. In their literature review, Gosnell and Abrams state that "the desire among urban populations to possess an idealized rural lifestyle is seen by many scholars as a powerful transformative factor, particularly in light

of technological and workplace changes that allow many white-collar workers to work remotely from almost anywhere" (Gosnell and Abrams 2011).

Connections with the "natural" are an important part of many exurbanite's experience in their landscape. Cadieux (2013) writes of the ideological connection with nature that exurbanites feel when they engage in tree planting. Tree planting and related actions, even when actively removing "weedy" native tree species (successional intervention), are often divorced from their connection to human land management decisions and thought of as a nature's course, or simply, the way things should be in the natural world.

Landowners' land management motivations may be strongly related to their stated reasons for living in the region. Walker et al. (2003) found that 95% of survey respondents included the landscape as a major motivator. Landowners in Walker et al.'s (2003) Nevada County study were motivated by landscape quality and even though many of them self-identified as strong property rights advocates, they nonetheless also expressed support for strong local environmental protections. With 68% favoring controlling growth through government interventions and 81% responding that the county "needs strong protection of private property rights". Many respondents also noted the contradictions inherent in their statements (Walker et al. 2003).

Contrary to popular myth, long-time residents may not be monolithically pitted against new comers in every growth-centric local debate. Hiner (2014) explored political identities among long-time local and in-migrant populations. Certain stereotypes like longtime "locals" of a rural area espousing conservative viewpoints may be fairly correct on the surface, but newer in-migrants also held fairly conservative views on specific

issues. In fact, as Hiner explored the social construct of “been heres” and “come heres”, she found this label had little impact on political ideology. Political ideology (viewed through the metric of political party affiliation) was much more important in terms of explaining views on private property rights, then whether a landowner was a newcomer to the region or not. Overall, Hiner found a great diversity of views that did not conform to a generalized characterization of long-time rural people vs. newcomers. Hiner’s research supports the idea that ideologies (political, fiscal, environmental, or otherwise) may be the strongest driver of land use ideals and attitudes that could lead to certain observable impacts in land management (2014; 2015).

Land use goals and actions, however, may not be perfectly aligned. Gilig et al. (2009) looked at land use perceptions across the UK and the value-action gap that decouples espoused environmental values from actual land use actions. The researchers note the strong desire of many urban dwellers to live in the country while also acknowledging that residential encroachment into rural areas is an environmental problem. Their value of environmental protection may not trump the potential action of moving to a home in the countryside. Many farmers also have long-term stewardship as a value, but sometimes make financial decisions that are counter to conservationist strategies.

In the western Sierra Nevada, Marvin (2003) found a strong relationship between developed area and total parcel size for those parcels 0.24 to 2.5 acres in size. For each acre increase in parcel size, Marvin observed an 11% increase in developed area. That relationship, however, did not hold with parcels over 2.5 acres in size. In those larger parcels, the factor most strongly correlated with the amount of developed area in each

parcel was the landowners' land management ideology, with environmental-minded landowners developing significantly less of their properties than property rights-oriented landowners. Marvin (2003) used an anonymous survey to assign land ownership philosophies among local landowners. The study separated respondents into one of two groups based on private property versus environmentalist attitudes. Marvin notes that the dichotomy perhaps over generalized differences between the two groups, though many survey responses tended to highlight diametric opposition to the opposing ideology.

Developers, some of whom may be amenity migrants themselves, play active roles in the maintenance of these landscapes. Hurley (2013) explores the ways in which developers and amenity migrant land buyers interact with a landscape to produce landscapes conforming to and reinforcing a particular sense of place or ideology of nature. Hurley highlights studies where designers and developers have created novel styles of development that often espouse an environmental or conservation ethc. Hurley's study also highlights the idea that some amenity migrants actively participate in the design and development of residential real estate projects, espousing different commitments to conserving the existing rural-ecological landscape, and thereby further shaping their vision of an ideal local amenity landscape (2013).

As this research shows, insight into the perceptions and motivations behind a landowner's land use activities, as well as knowledge of the economic drivers of land use change, will aid in the prediction of future development patterns and their effects upon the landscape. Klepeis et al. (2008) note that while the reasons people seek out residential parcels in amenity-rich landscapes is well understood, the land use practices of these new(ish) residents remains an important research topic. Cooke and Lane (2015) also see a

lack of scholarly attention paid to amenity landowners and their relationship to the land. Recent studies have sought to bridge this gap (Hurley et al. 2017, McKinnon et al. in press). This research builds on the foundations set forth in these prior studies.

Parcelization and Small Acreage Land Ownership in Texas

As a state, Texas exhibits land fragmentation trends on par with the United States as a whole. Wilkins et al.'s 2003 publication from a partnership between the Texas A&M University and the American Farmland Trust analyzes data on state trends in land ownership size, land use, and land values. In the 1990s, a mean of 250,000 acres per year were parceled out of large farms or ranches greater than 500 acres. An important land use trend during this decade was the conversion of smaller parcels of native grassland to "improved" or non-native pasture. At the same time, land values in the Central Texas area had risen upwards of 50% while agricultural land values averaged for the state increased at less than one percent annually (Wilkinson et al. 2003).

The study acknowledges that a statewide survey can obscure differences among the many different ecological regions in the state. When analyzed by ecological region, "improved" pasture was strongly associated with smaller parcel sizes in South Texas, Blackland Prairie, and the Oak Woods and Prairie regions. In addition, the amount of acreage in cropland was positively associated with a higher number of large parcel ownerships in all regions.

The size and agricultural value of land parcels have important implications for their potential future development. Kjelland et al. (2007) grouped Texas land parcels in three size classes and found a correlation in parcel size with changes in property densities

and land values. Though Texas does exhibit some consolidation of farmlands into larger properties, the dominant trend is the parcelization of land into smaller units and more landowners. Medium sized ranch properties (202 – 809 ha) are generally decreasing in number. In general, the researchers found the tax assessed, non-agricultural value of a property to be a good predictor of higher population density and thus, a higher risk factor for a potential future decrease in property size. Kjelland et al. (2007) note that landscape conservation actors often work with medium and large agricultural landowners to achieve conservation goals. With decreasing property sizes, it will be much more difficult for a stakeholders to harness integrated land management decisions from small landowners.

In another study Wilkins et al. (2003) compared property boundaries within Bastrop County in Central Texas to remotely sensed images at multiple scales. The landscape became more fragmented in areas where the number of ownerships increased with time. Low-density rural development, or the growth of residential multi-acre lots, was associated with an overall loss of native grassland. Landscape characteristics were consistently found to be influenced by an increase in ownership density across multiple scales.

In addition to parcel and landscape factors, the owner is obviously an important part of any site's land use. A rural self-identity, for example, may be a predictor of conservation action. Lai and Lyons (2011) studied connections to the land held by rural Texas Hill Country landowners and their motivations to perform conservation activities on the lands they owned. They found that landowners who derived some form of tourism or recreation business from their property were more committed to the "natural" and "outdoor-oriented" socio-psychological meanings they attributed to both their own

property and the Texas Hill Country as a whole. The “tourism” landowner also invested significantly more in land management activities. In general, those landowners who were more committed to a sense of place that espoused a deep sense of ruralness and natural character to the Texas Hill Country engaged in more conservation practices. These landowners also spent more time and money increasing their land management capacity by seeking experiences like a local cooperative extension service workshop or other conservation training.

Sorice et al. (2012) examined land ownership motivations in a rural area of Central Texas through landowner surveys and found three dimensions of land ownership types at work across moderate to large acreage parcels: agricultural operation; rural lifestyle; or financial investment. Two-thirds of landowners in the area were involved in at least some type or farming or ranching and 24% focused exclusively on that enterprise. Thirty-nine percent of landowners surveyed stated they owned their land exclusively for lifestyle reasons. The researchers hypothesized that the lifestyle-motivated rural landowner is becoming more dominant. In further study, Sorice et al. (2014) sought to explore the landscape consequences of these new lifestyle-oriented rural landowners. Despite the implication that lifestyle landowners are more ecosystem-centric than traditional agricultural landowners, the study found that they were less likely to have initiated a conservation practice on their land than other rural landowners. Even so, these landowners were also less likely to have engaged in potentially harmful activities on their land like herbicide use or overstocking with grazing animals. Sorice et al. (2014) and Gill (2010) suggest that any negative environmental attributes of this new class of landowner may be less likely to be the result of their direct management of the landscape and more

likely to be related to the cumulative impact of increased housing units and related infrastructure.

The Need for Additional Research on the Actions of Small Acreage Landowners

The social and ecological integrity of fragmented modern landscapes is maintained by a complex web of biological and social interactions. Recent research is moving beyond the tautological finding that increased rural population density causes land fragmentation and delves deeper into the social-ecological effects and feedbacks associated with fragmentation of/in rural-to-exurban landscapes. In particular, little is known about the land management preferences of smaller acreage land holders. Many studies of ecosystem function in fragmenting landscapes assume that only large parcels, 40 acres or greater as a minimum threshold, are a prerequisite for landscape-scale conservation (MacArthur and Wilson 1967; Saunders et al. 1991; Newburn et al. 2006; Sorice et al. 2012; Sorice et al. 2014). Smaller parcels, however, may make up the bulk of land parcel sizes in an area and can contain significant natural land cover. In a montane California study area, Marvin (2003) observed that over 50% of the rural area was held in parcels 5 to 160 acres in size.

Questions about why the managers of smaller land parcels may be removing native rangeland, and what proportion of their landholdings tend to remain in a natural condition, will help to illuminate the full impact of this population trend and its effects. In addition, analyses that use multiple approaches, tools, and techniques may afford a

clearer view into the complex web of physical and social interactions that play out in our modern landscapes.

Amenity-oriented exurban land ownership is intimately linked to what the future holds for the landscape. Research in this realm rests upon von Thünen's Agricultural Land Use Theory (1966), which links spatial pattern to economic process. I argue that this theory can and should be used in more contemporary settings; however, rather than relying on the agricultural commodity market as a driver, it is the real estate market selling a post-productivist rural idyll that exerts pressure onto the countryside. The resulting spatial patterns inject new variables into von Thünen's concentric rings around the city. This research is thus poised to provide a contemporary update to von Thünen's model by exploring the motivations and land management behaviors exhibited by this new class of landowner, perhaps exerting their land management actions in ever powerful rings around every urban area.

IV. METHODS

The Onion Creek watershed was chosen as a study site because of its proximity to Texas State University as well as its unique ecological and geological conditions that make rapid residential growth in the area a particularly important social issue. The watershed unit presents a discrete area of study that also has ecological significance. In addition, the entire study area is upstream from the city of Austin, further increasing the importance of land management actions to the population of the greater metropolitan area in this region. This study focuses exclusively on residential parcels ranging from 2 to 40 acres in size in this watershed. A minimum parcel size of 2 acres was chosen to account

for the likelihood of one acre of residential land cover on a landowner's property, potentially leaving one acre or more of less developed land that may get some sort of management treatment by the landowner. The state allows various appraisal districts to consider one acre on each residential parcel as a "homestead" site and exclude that acre from agricultural or open land tax valuation. The 40-acre maximum parcel size excludes larger acreage parcels that are often included in conservation management programs and campaigns (Sorice et al. 2014). Of the 7,948 land parcels in the study area, 37% (2,968) of the parcels meet the acreage criteria for this study, and, of these, 1,669 are estimated to be residential based on publicly available ad valorem tax data.

Spatial data was collected showing parcel boundaries, landowner data, and other parcel-specific information from the Hays County Appraisal District. A GIS tool constructed a sample of 300 parcels, each between 2 and 40 acres in size, chosen at random from all applicable parcels in the study area. Landowners of these 300 parcels received two postcards asking them to participate in an online survey that explored the land management ideas and actions employed on their parcels. The survey and associated research procedure was submitted to the Texas State University Institutional Review Board and, as IRB Application 20170407, was approved as exempt on October 11, 2016. Survey procedures followed those set out by Dillman (2000). Surveys were returned anonymously. Survey data collection and initial analysis were performed with Qualtrics Survey Software.

In addition to collecting demographic information, the long form survey was designed to mimic an in-depth discussion of a landowner's preferences, actions, and relationship to their land. Survey questions were constructed to measure the importance

landowners place on specific elements and land-based activities they might participate in on their land (see Appendix A). Drawing from research from Sorice et al. (2012 & 2014), topics included residential, recreation, wildlife, agriculture, and financial dimensions. Questions gauging a landowner's political ideology were borrowed from Walker et al. (2003). Additional questions asked participants to report how they have changed various cover types on their property since they first acquired their land as well as how often they participate in various land management activities. In concert, the questions were designed to tease out differences in land management relative to the region and its ecologies as well as provide insights into motivations and ideologies of these landowners.

Discrete answers were collected for most questions using a seven point Lickert-type scale for land ownership and management motivation questions with some "Yes", "No", or "N/A" for land management questions. Open response questions at the end of the survey asked respondents to explore how local landscapes influence their land management decisions as well as what they would like their property to look like in the future.

Responses were grouped according to landowner ideologies, motivations, and typologies following Sorice at al. (2014 and 2012) and Walker et al. (2003) (see Appendix B). Landowner motivations, as drawn from the literature, included rural lifestyle, financial investment, profit orientation, agricultural production, operating a wildlife enterprise, and mineral extraction. Landowner typologies included lifestyle-oriented owners, agricultural production-oriented owners, and multiple-use landowners (Sorice et al. 2012). Landowner political ideologies lie on a scale that includes private

property-centric views and attitudes on one end and environmental-centric view and attitudes on the other (Walker et al. 2003).

Of 300 survey invitations mailed, 34 land owners responded to the online survey for a response rate of 11.33%. One incomplete response was removed from the study before analysis. The in-depth survey took respondents on average 28 minutes to complete. The length of the survey may have dissuaded some potential invitees from participating. In addition, the low completion rate may be complicated by a potential bias where those that were more highly motivated by discussions of land management could be more likely to complete the survey.

V. FINDINGS

Respondent's demographic data were generally comparable to overall demographic data from the study area aggregated at the census survey tract level (Table 3). Respondents did, however, tend to be older with a higher median income. This is perhaps to be expected with older residents having more free time and being more likely to complete surveys (Holbrook et al. 2007). In addition, it can be assumed that homeowners with larger than average incomes are more likely to reside in home sites of 2 acres or greater.

Parcel size ranged from 2 to 12 acres for participants in this study with a mean size of 5.6 acres. These results appear to be in line with predominant small acreage ownership in the area. Overall, 37% of parcels in the study area are between 2 to 40 acres in size, with 3 to 10 acre parcels being common in small acreage subdivisions in the region.

Years of land parcel ownership ranged from 1 to 40 years with a mean of 15 years of ownership. It is not known what the average years of land ownership is throughout the region. In addition, this study did not further identify whether a recent landowner was coming from outside the immediate area, the greater region, or the state as a whole when they took possession of their property.

Table 3
Comparison of survey respondent's demographic data with overall study area census data

	Survey Respondents	Census Tracts*
Age		
20-24	0%(0)	6%(661)
25-34	3%(1)	15%(1660)
35-49	21%(7)	34%(3880)
50-64	42%(14)	29%(3298)
65 and over	33%(11)	13%(1442)
Race		
White	91%(30)	89%(17,430)
Black	0%(0)	1.5%(302)
Asian	0%(0)	1%(193)
American Indian / Alaska Native	3%(1)	.5%(103)
Other / Undisclosed	6% (2)	6% (1,102)
2 or More Races	0%(0)	2%(471)
Ethnicity		
Hispanic or Latino	not recorded	25% (4,358)
Not Hispanic or Latino	not recorded	75%(13,072)
Sex		
Male	68%(22)	49%(7,737)
Female	29%(11)	51%(7,975)
Annual income		
Estimated Median	$103,000	$59,569^

* Census Tracts from the Study Area include Hays County Texas Census Tracts 109.02, 108.06, and 108.07
^ Median Annual Income Data is from Hays County in its entirety

"Quality of life" was cited by 73% of respondents as their main reason for living in the area, followed by access to a major metropolitan area (40%), good school districts (33%), proximity to family (30%), and the area being an important part of who they are (18%).

Forty-five percent of survey participants identified their parcel as rural, 21% as suburban, and 30% as both. Eighty-two percent could see other homes from their home site. Sixty percent of respondents had dogs on their property, followed by 48% with cats, 18% no animals, 12% horses or cattle, 9% chickens, and 6% bees. The majority of respondents (64%) had a private well with 21% relying on a municipal or rural water system, and one respondent having only rain water collection. Twenty-seven percent of respondents had a rain water collection system in addition to other sources.

Overall, 100% of survey respondents reported that maintaining their house and landscape were very important (Table 4). These homestead elements were the only items that were unanimously ranked highly by every survey respondent. Eighteen-percent ranked building more living space as moderately important compared to 52% for building more storage space. Maintaining vegetable and flower gardens were moderately important for 55% and 61% of respondents respectively. Forty-eight percent of respondents reported that the idea of increasing areas of plantings was moderately important or greater.

Recreation by landowners was also a very important dimension of small parcel land ownership. Ninety-seven percent reported that they use their land as a place to relax, with 91% reporting the importance of passive recreation. On-site active recreation opportunities were less important overall, with 21% of respondents reporting the

importance of active recreation like biking, off-road motorized vehicle use, and target shooting.

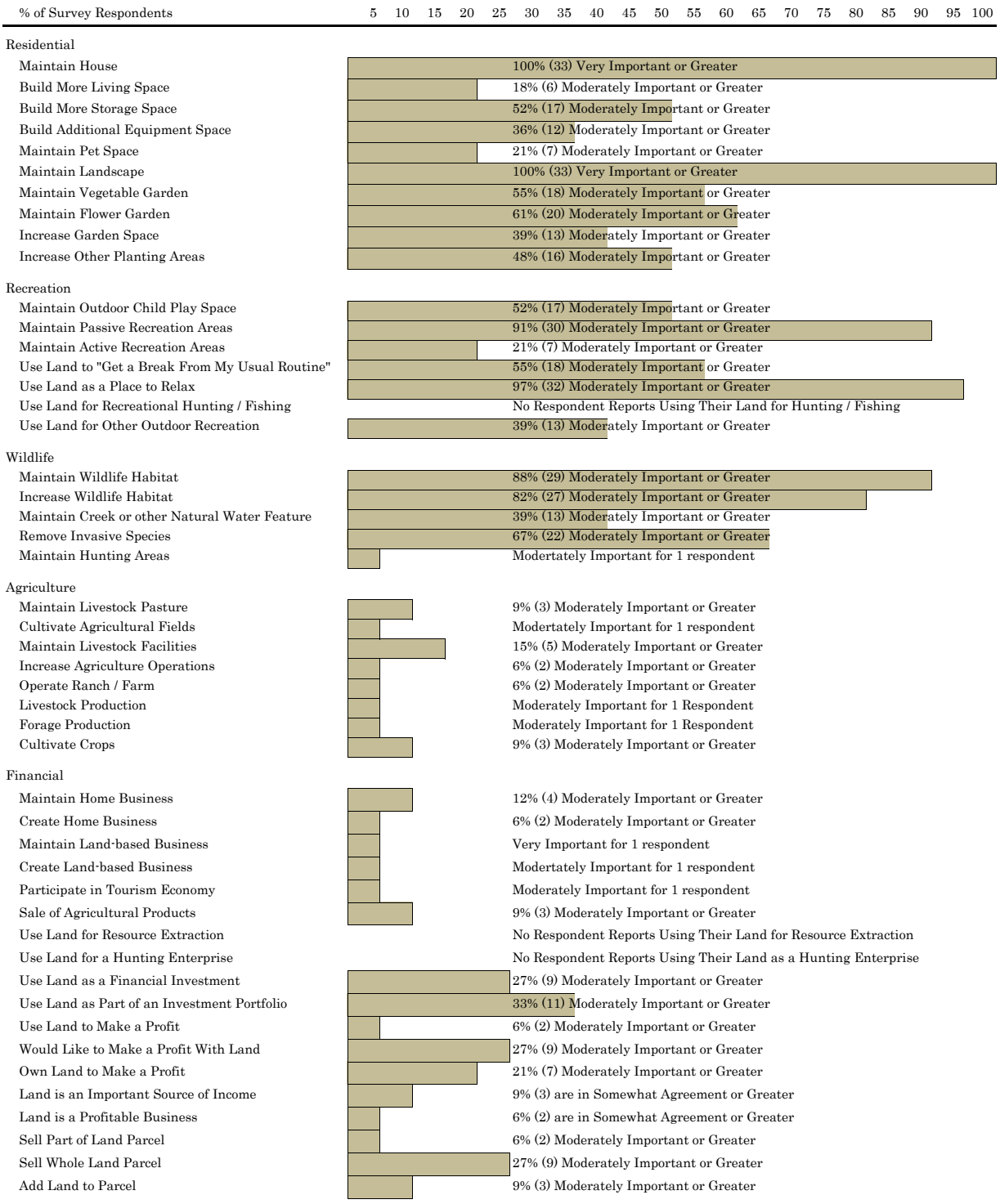
Survey respondents ranked wildlife motivations relatively high. Eighty-eight percent of respondents reported the importance of maintaining wildlife habitat on their land with 82% expressing the desire to increase wildlife habitat and 67% reporting that the removal of invasive species was important to them. Thirty nine-percent of respondents ranked maintaining a creek or other water feature as moderately important, perhaps limited by the number of respondents who already have such a feature on their property. Only one respondent ranked maintaining a hunting area as moderately important.

Agriculture ranked low in the survey with 15% of respondents reporting the importance of maintaining facilities for livestock. Only two responses noted the importance of increasing agriculture operations in the future. Additionally, two respondents reported income-generating agricultural operations on their land, including one livestock and one apiary operation.

Financial dimensions of land ownership ranked moderately in the survey. Thirty-three percent of respondents reported that the idea that their land parcel was a part of their investment portfolio was moderately important or greater. Twenty-seven percent reported that selling their whole parcel was an important factor they are considering and 33% noted that they would like to make a profit with their land.

Table 4

Summary of the importance of land features / management actions to survey respondents



Of land-based activities survey participants participate in for pleasure, 82% enjoy wildlife watching, 67% gardening, 39% hiking, 21% picnicking, 18% hosting outdoor parties, 12% gathering pecans and/or blackberries, and 9% engaging in animal husbandry. At least one response each was also recorded for biking, swimming, and off-road vehicle use.

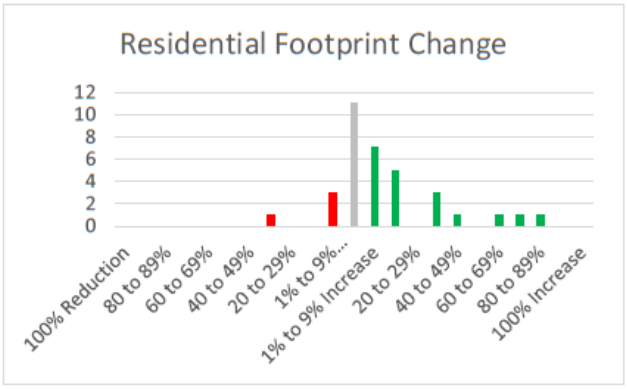
Survey respondents were also asked to think about the land cover on their parcel when they first acquired their land and how it differs from the land cover found today. Responses generally follow patterns of increased development or disturbance (Table 5). Thirty-three percent of respondents reported no change in their residential footprint while 58% reported at least some level of increase. Fifty-eight percent of respondents reported at least some increase in the footprint of land that they at least occasionally manage. Thirty-three percent reported no change to that footprint and 9% reported a decrease. An increase of garden cover was reported by nearly half of the respondents, with the other half reporting no change.

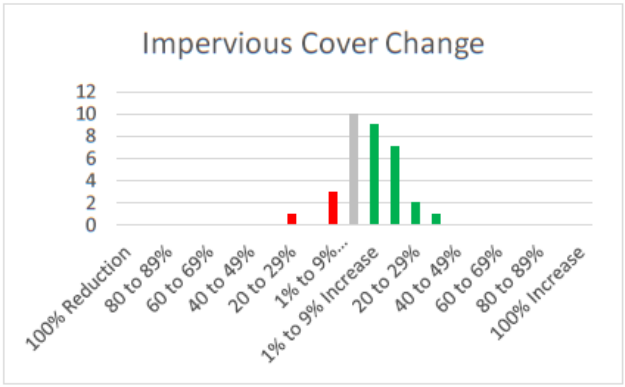
Changes in grass cover, including an increase in the areas maintained as lawn and the addition of improved non-native pasture grasses like Bermuda, was a phenomenon seen in prior studies. Seventy-one percent reported no change to the turf grass cover on their property and 21% reported some degree of increase. Three participants (9%) reported a decrease in turf grass cover. In terms of native grass cover, in addition to 58% of respondents reporting no change, there was nearly equal numbers reporting either a loss or addition of this cover type with twenty-four percent indicating a reduction in native grass cover and 21% indicating some level of increase.

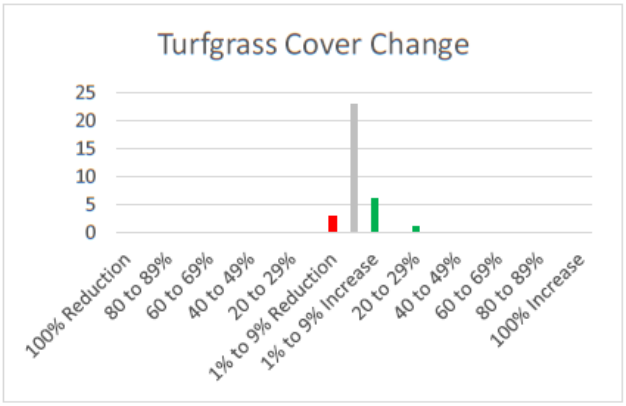
Table 5

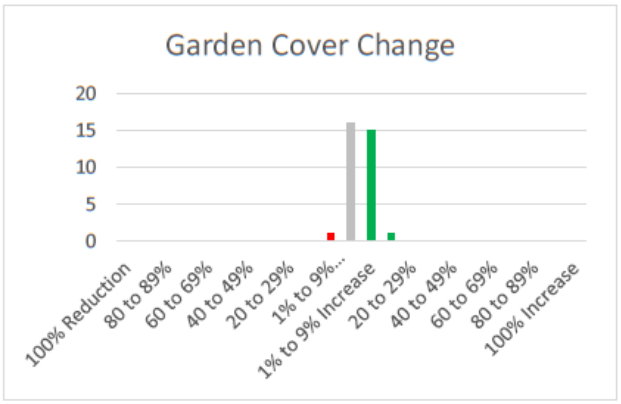
Landscape Change by Landowner Since Acquiring Property

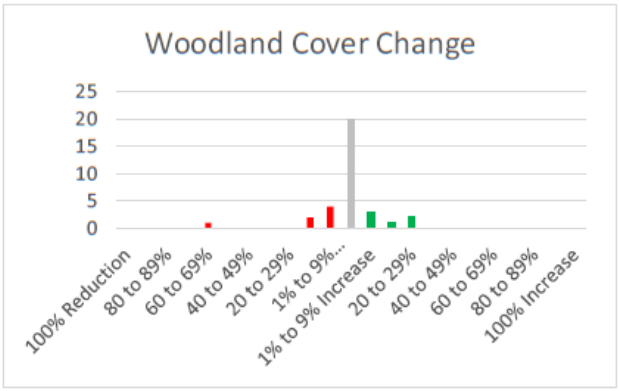
Number of Survey Respondents on Vertical Axis. Land Change on Horizontal Axis. No change in land cover is represented in gray.











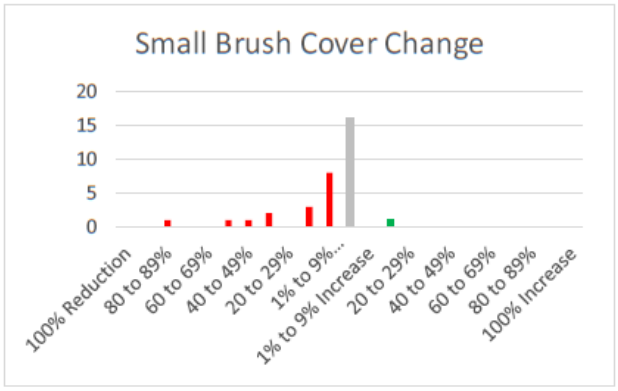
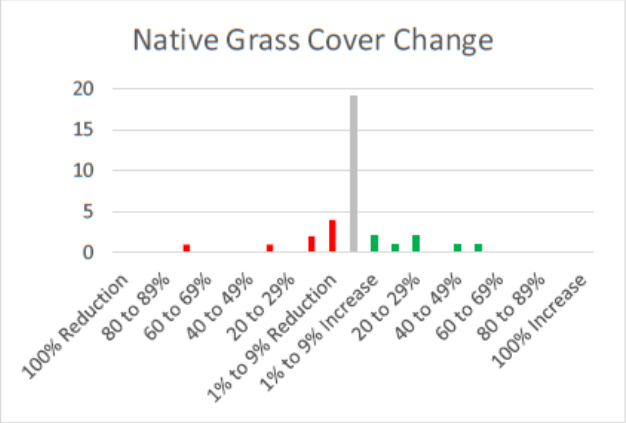
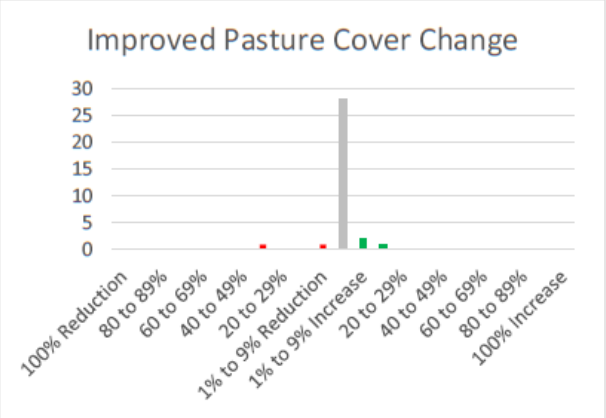
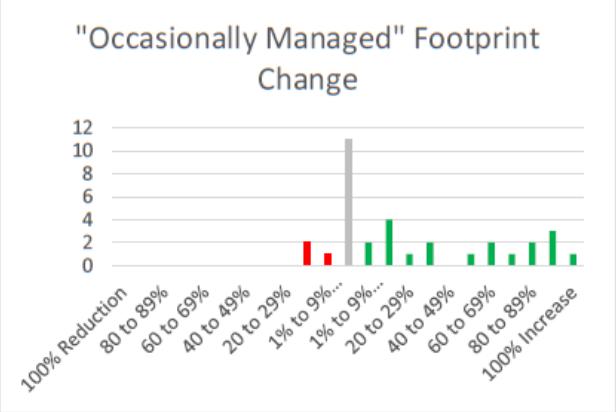
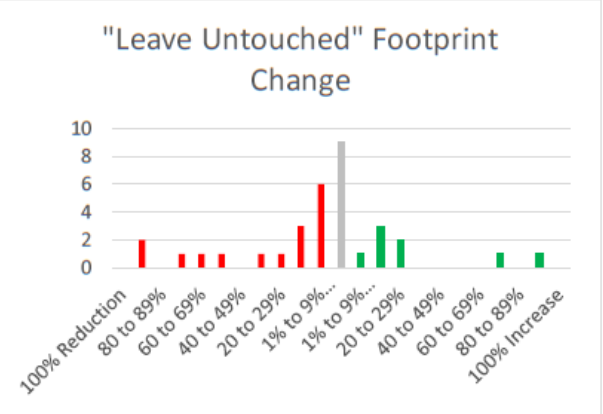


Table 5 Continued. Landscape Change by Landowner Since Acquiring Property









Responses about woodland and brush cover were somewhat consistent with the prevailing ranch management best practices to remove brushy growth, though a significant amount of survey participants' landscapes did not exhibit a reduction in brush. Sixty-one percent of respondents reported no change in woodland cover while 21% reported a decrease and 18% an increase. Forty-eight percent reported no change in brush cover and an additional 48% reported some level of decreased brush cover on their land parcel.

Overall, 27% of survey participants indicated they are likely to change their land use footprint in the near future and 30% reported they might do so. Forty-two percent indicated they would not. Of those who stated they may or definitely will change their land use footprint, the majority (39%) reported that they would construct additional storage on their property. Twenty-four percent reported adding garden space, 18% additional living space, 12% additional animal space, and 12% reported intended native landscape restoration activities.

Specific land management actions relating to lawn management were the most reported, with 73% mowing large expanses of yard regularly and 52% reporting they maintain a small residential yard (Table 6). The mowing of open areas, presumably including both native grasses and brush, also ranked high with 48% of survey respondents reporting this action. Sixty-four percent of respondents reported actively removing certain plants or animals. These ranged from the removal of colonizing native plant species like Ashe juniper and cactus to nonnative invaders like King Ranch bluestem and Malta star-thistle to problem animals like raccoons or skunks.

Fifty-five percent reported the active removal of brush on their property, with 48% of respondents reporting Ashe juniper removal specifically. Herbicide use for herbaceous weed or brush removal activities was reported by 24% of survey participants. An equal number of survey participants (8) wrote in "none ever" or similar sentiments to emphasize the lack (and likely disdain) of herbicide use on their property. Planting was also reported by a moderately high amount of respondents with 39% engaging in native plantings, 30% in tree plantings, and 23% in grass seeding. Forty-eight percent of respondents reported actively working to manage their native woodland cover and 36% to manage their prairie or native grass cover. Over all of the actions, 52% of survey participants stated that they engage contractors or other hired help in support of at least some of these activities.

Ninety-four percent of respondents believe they are able to solve most land management problems they encounter on their property and 45% feel they would benefit from additional land management trainings. Twelve landowners (36%) stated they lacked money to meet land management goals, fourteen (42%) stated they lack time, and thirteen (39%) stated they lack skills to meet their goals.

Survey participants were also asked how local landscapes and the surrounding area influences their land management decisions. Fifty-three percent reported that they try to mimic the rural qualities of the area by planting natives or preserving native cover while thirty-three percent stated they do not think these landscapes impact their land management decisions. Two respondents reported that they leave “cedar” brush in contrast to general local land management practices. When asked what they would like their property to look like in the future, 33% stated they would like their property to look

Table 6. Land Management Actions of Survey Respondents

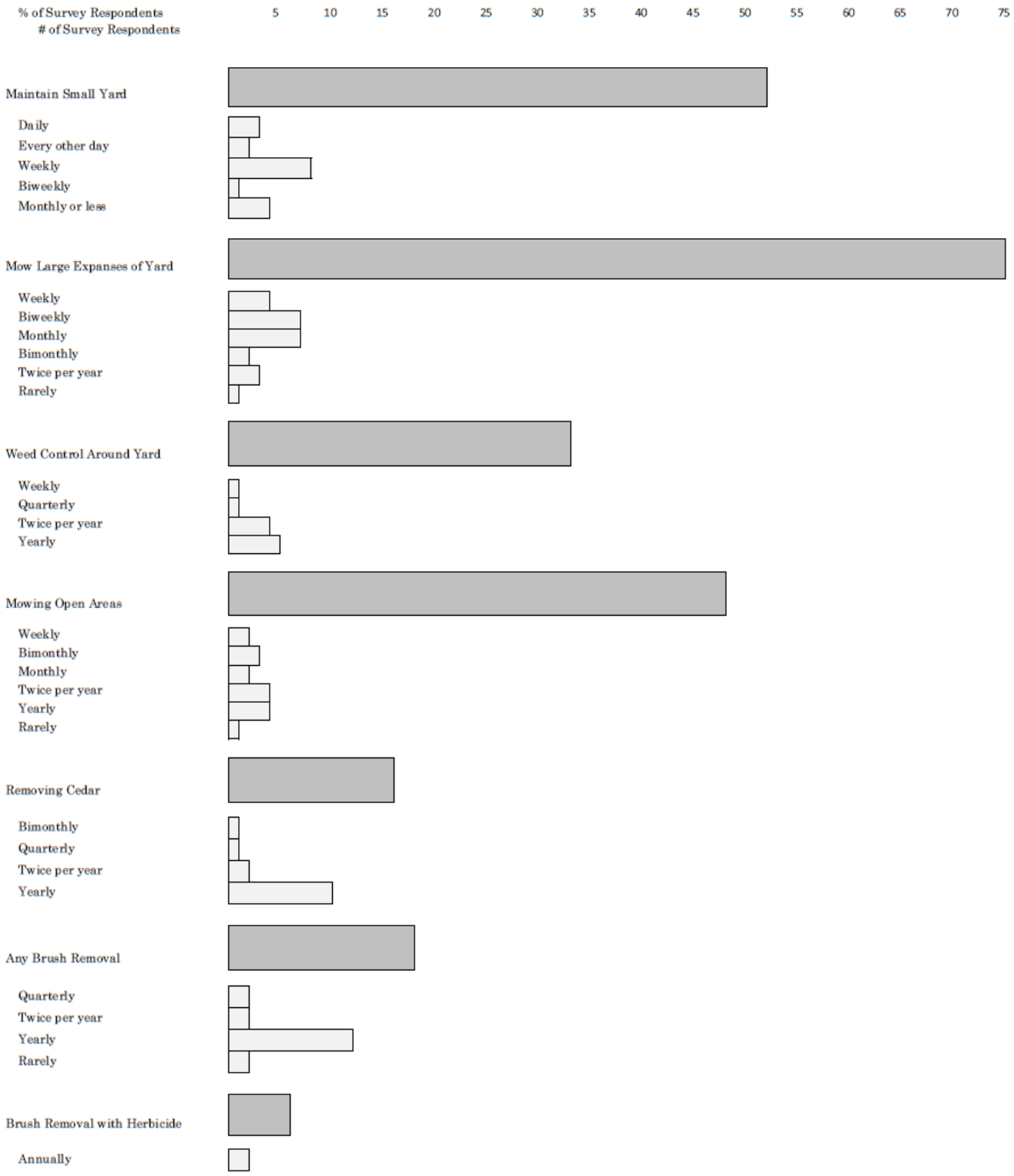
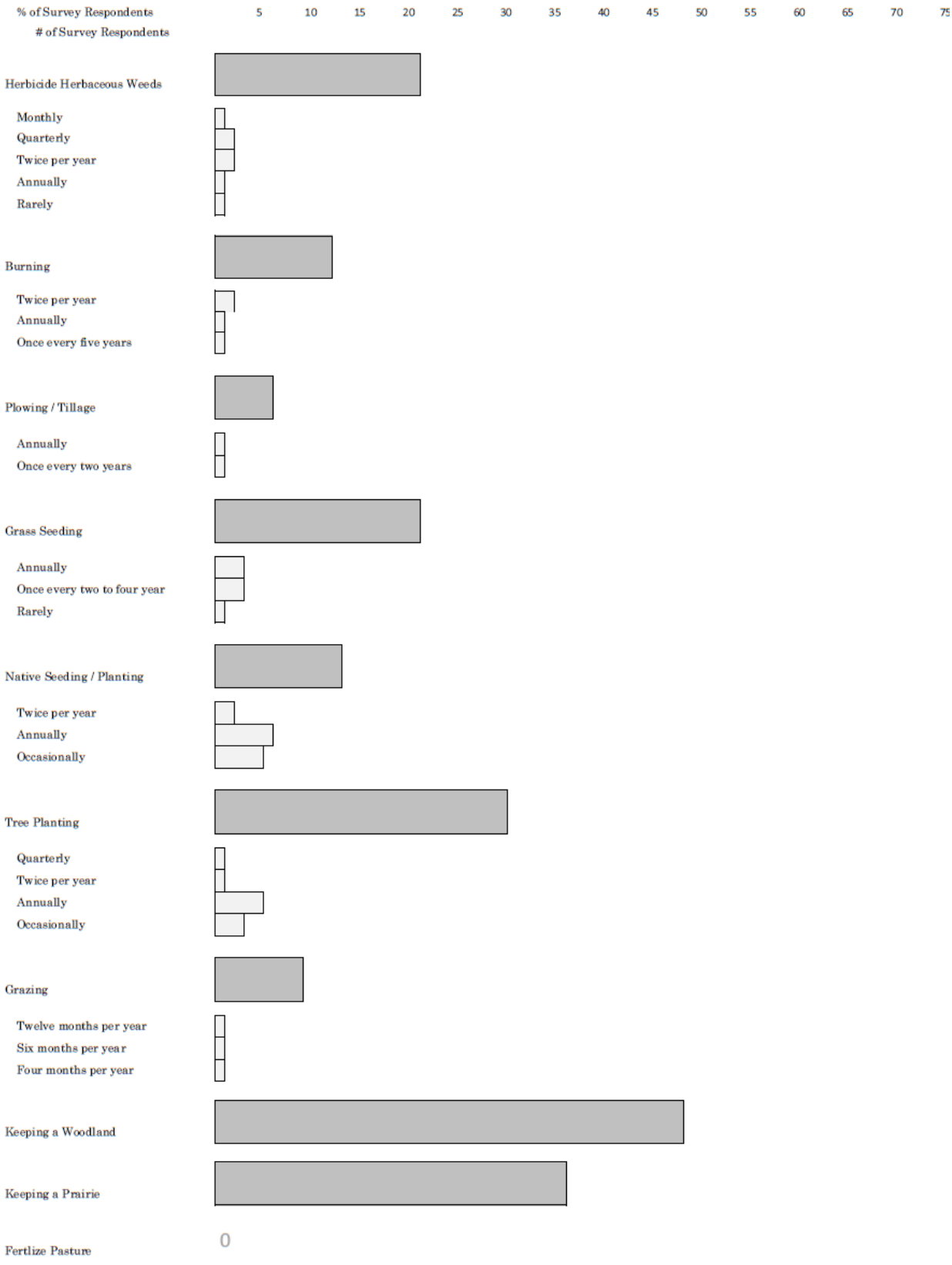


Table 6, Continued. Land Management Actions of Survey Respondents.



the same as it does today. Twelve percent reported they would like to see less cedar or other brush, 12% would like to see their property look more "wild", and 9% would like to see more woodland cover. Thirty-percent of survey participants mentioned native plants in their response to this question.

VI. DISCUSSION

Typologies of Land Management Commitments

Survey participants were grouped into a number of typologies based on their suite of answers to specific survey questions. Typologies include the respondents' orientation as a lifestyle- or production-oriented landowner, their political ideology in terms of degrees to which they support private property rights and environmental protection, and the degrees to which various land themes (like agriculture, wildlife, and lifestyle) motivate the respondent.

Grouping participants through a lens of lifestyle- or production-oriented landowners placed nearly all participants in the lifestyle typology. Only two landowners were labelled as multiple-objective households (which includes both lifestyle and production orientations), with one being a small scale livestock producer and the other stressing that the land's investment potential was one of the main reasons that she owned her parcel.

While the political ideology of environmental issues is often portrayed as a dichotomy or conflict between protecting property rights and strong protection measures,

all landowners in this study showed at least some degree of support for both private property rights and environmental protection. Ranked on a four point scale that included null, low, moderate, and high values for each ideology, 52% of participants were ranked as high for private property rights and 73% were ranked as high for environmental protection. Five survey participants heavily favored private property rights, three heavily favored environmental protection, and 24 respondents (76%) had survey answers that placed them as moderate or high in both ideologies.

Landowner motivations were also ranked null, low, moderate, and high. All survey participants showed at least some degree of motivation for the lifestyle and wildlife dimensions of land ownership, with lifestyle as a moderate to high motivator for all respondents and only two participants showing a motivation for wildlife that was lower than moderate. Profit (68%) and investment (58%) were also significant motivators, with the assumed main factor for most respondents being home value rather than income generated from a working landscape. Agriculture motivated four (12%) survey participants and three respondents were motivated by the potential for hunting on their property. One landowner showed a motivation for natural resource extraction (low), though he did not report that activity on his property.

Survey participants were also given the opportunity to rank some specific themes (a lower cost of living, proximity to family or friends, and proximity to employment) as greater motivators than their general experience living on their land. Even though all participants ranked their interactions with the land as a moderate to high motivation for living where they do, the participants were essentially asked one more time if these other lifestyle factors trumped the amenity of the land itself in terms of being the most

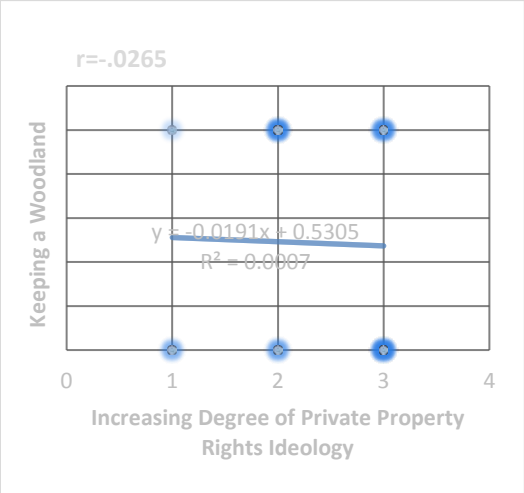
important reason for living on their parcel. Nine participants (27%) reported that proximity to family and friends was most important, six (18%) reported that a lower cost of living was the most important factor, and three (9%) reported than proximity to employment was most important. Seven survey participants (21%) included their experience on their land as an equally important factor along with a mix of these other themes. Twelve participants (36%) maintained that their land experience was their most important motivating factor for living where they do.

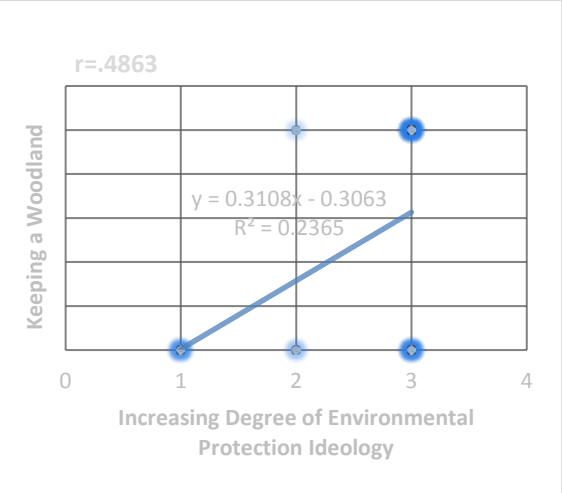
Correlations between landowner typologies and land management actions or intentions were generally weak, but general trend lines indicate that the strength of a landowners' environmental protection ideology may direct them to be active land managers (Table 7). Certainly many survey participants with an inclination towards private property rights also often reported a suite of land management actions, but a private property-oriented ideology was less predictive of land management behavior. Again, all landowners in the survey exhibited some degree of both private property rights and environmental protection ideologies.

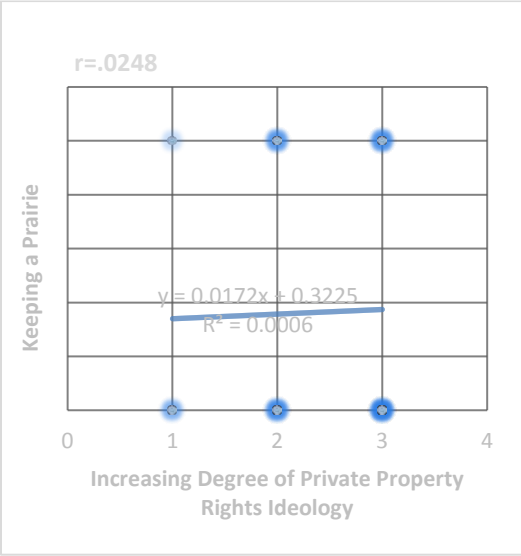
The idea of an amenity-oriented landowner living in exurbia who feels that their home is firmly situated amongst the nature of the countryside is alive and well in the Onion Creek watershed. With nearly every resident in the study motivated by themes of rural lifestyle and wildlife, these findings suggest a near saturation of amenity-oriented landowners. Further, these findings point to the fact that most of the large acreage land holders present in the study area are probably amenity-oriented themselves, with any livestock or other agricultural production likely being a cultural tradition practiced by

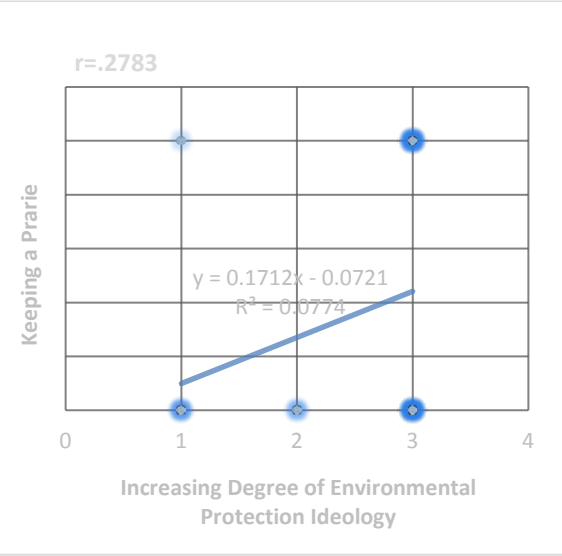
Table 7

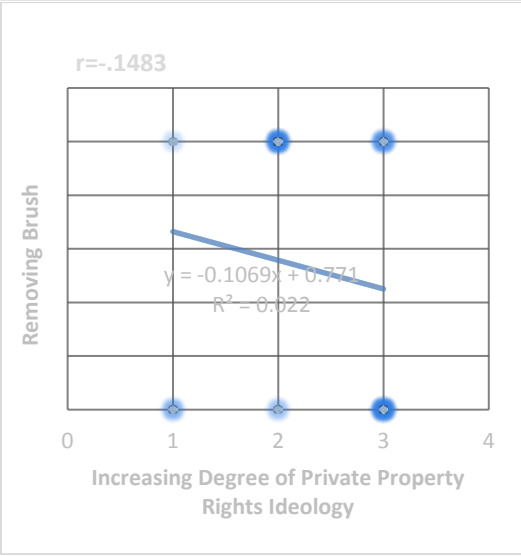
Comparison of Correlation Plots of Political Ideology with Land Management Actions

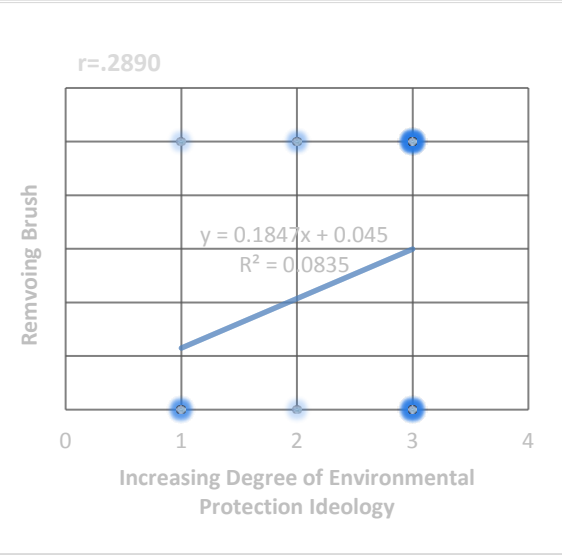












family heirs or the ranch managers of wealthy new-comers. Based on these results, the days of agricultural operations pinned to market dynamics is likely over in the Onion Creek Watershed. The lands where the bottom-line did matter are now the five-acre subdivisions studied here, or, in some cases, have been drawn into the reserve of conservation lands managed by the City of Austin. And so, land management in this landscape is characterized by a suite of activities that are carried out by a diverse set of actors. Moreover, these landowners are largely motivated by the same things.

Each actor's construction of an idealized Texas Hill Country, however, can vary widely, as does each land owner's background and life experience. In this study, one attorney thinks the local landscape has a big effect on how they manage their land, while another attorney thinks it has little effect. A realtor and an engineer both independently wish for a future landscape with less cedar while a sales manager and a biology professor wish for a healthy stand of the same species. The professor stated, "we favor oak-juniper [woodland] when [the] surrounding land practices favor brush clearing and juniper removal." The realtor, however, equated juniper trees with water quantity loss on the landscape and stated he would like to see "fewer cedar trees [and the] return of [the] creek in our backyard." All four landowners profess an affinity for a natural Texas Hill Country. Add to this a varied environmental and land management history of each parcel of the land and you have a truly heterogeneous landscape. Perhaps with a house every five to ten acres, but heterogeneous nonetheless.

To make preliminary sense of this heterogeneity on the landscape, I constructed several archetypes to characterize the five- to ten-acre landowners who participated in this study (Figures 8 & 9). As the study results indicate, these archetypes do not easily correlate with the political ideologies (private property rights and environmental

protection) or land owner motivations typologies presented here. These are manifestations of an environmental imaginary, constructed through each landowners' personal experience, which plays out through specific environmental management regimes that are employed to varying degrees across this amenity landscape (See Nesbitt and Weiner 2001; Cadieux and Taylor 2013; Taylor and Hurley 2016). Each landowner, subject to the whims of time, money, and climate, is enacting their version of their imaginary in the landscapes of the Texas Hill Country. To some, it is nature put at a safe (suburban) distance from their home, separated by turf grass and a flower garden edged with local limestone. To others, it is an emulation of the ranching heritage that conquered the Hill Country, and was oft-repeated by President Lynden Baines Johnson in his addresses to the nation. To still others its grass- and Live oak-covered hills and valleys, roamed by deer and turkey. And perhaps to some, its also dark thickets of the otherwise unwanted "cedar" with mountain lions prowling about. All of this is the Texas Hill Country and thousands of unwritten and unspoken land management plans work toward these visions.

These archetypes may be a useful tool in efforts to plan the trajectory of these landscapes or to present land management trainings that are tailored to the motivations and environmental imaginaries of local landowners. If conservation-minded agencies or organizations seek to affect changes to prevailing land management attitudes, I believe they would do wise to pay attention to these dimensions of land ownership.

As exurban small acreage parcels have increased in the area, forest cover, presumably Ashe juniper, has decreased (Table 2). The dominant ideologies of nature that are expressed through land management on both large ranch and conservation lands

as well as the smaller homestead parcels that were the focus of this study include, to a large degree, the notion that Ashe juniper should be aggressively controlled. Forty-eight percent of survey participants reported controlling Ashe juniper, from the full breadth of archetypes presented here. Only a small percentage of respondents in this study mentioned the idea that Ashe juniper belonged in their landscape. These included those respondents that were relative non-managers of their landscape as well as the biology professor who noted that he expressly includes Ashe juniper in his vision of a natural

Figure 8.

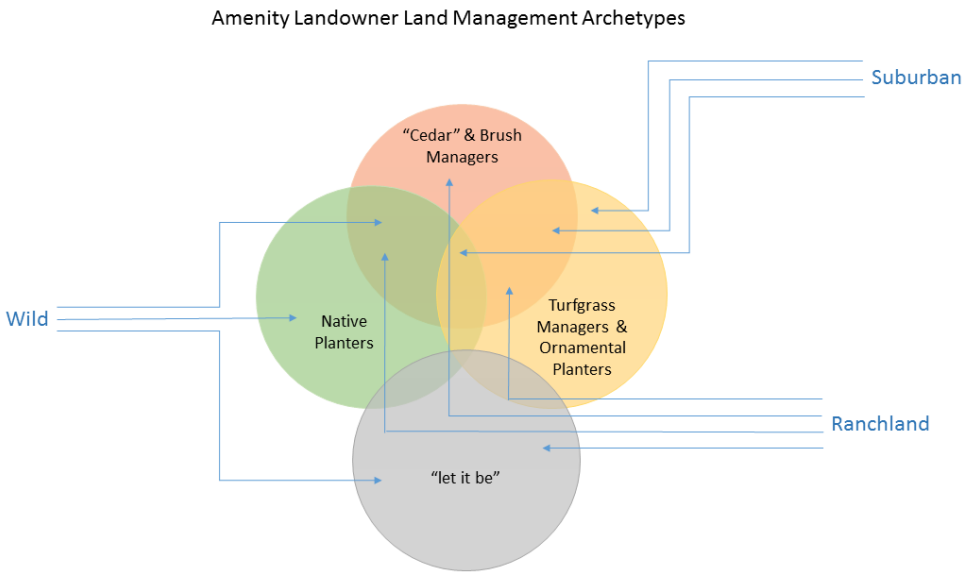


Figure 9.

Two of the highlighted exurban landowner archetypes are pictured. On the left, a suburban-style rural home site with turfgrass and common non-native plantings framed by the celebrated native Live Oak trees and some native limestone masonry. On the right, the entrance to a wild- or ranchland-style home site with minimal noticeable land management actions, but which might include occasional mowing, low brush removal, and drive maintenance.

Texas Hill Country. Though the prevailing land management literature has never relegated the Ashe juniper to that of nonnative invader, common land management best practices do actively refute the idea that the juniper was as widespread as it is today. Some emerging thought, however, challenges those assumptions (Nelle 2012). Whatever the prehistoric role of Ashe juniper on the landscape, it is clear that there was a post-colonial period of intense harvesting followed by a wave of heavy regeneration upon overgrazed and eroded limestone hillsides. As suggested by Cooke and Lane (2015), it is sometimes not clear whether the prevailing idealized landscape images (or restoration benchmarks) are actually referencing the pre-colonial landscape that they intend to represent or something else in the not-so-distant past.

Drawing from Cooke and Lane's amenity ecologies, there are potentially a number of novel exurban ecologies in this study area. While the expanding Hill Country

deer population creates a problem for the regeneration of hardwood tree species (Russell and Fowler 2002), a myriad of amenity landowners' gardens and other enclosures create an opportunity for a diverse matrix of native hardwood refugia around the region. In another example, a full 97% of survey respondents reported that taking care of their land was an important part of who they are. In this study, there clearly exists a majority of landowners looking for ways to improve the landscape around them. This could create a rich opportunity to watch for erosion issues around the region. Ranchers have historically employed a diverse array of techniques to control water erosion in this flash flood prone landscape and the increasing density of stewardship-minded landowners could make a bigger impact.

The implications of amenity ecologies may also include the stewardship of species that may have aesthetic value but are undesired by the conservation and biology community (Knoot et al. 2010). One survey response noted that Ashe juniper screening trees were being retained along the edges of a parcel, even while the landowner conceded that the trees may have negative ecological consequences.

Widespread among the biological sciences is a fear that residential growth in rural areas may bring with it an increase in non-native and invasive species (Klepeis et al. 2008). The assumption being that the increased transport, planting, and/or lack of control of invasive species is an ecological consequence, or amenity ecology, of the increasing prevalence of small parcel rural land ownership. A relatively large portion of the survey respondents in this study, however, indicated the importance of invasive species removal. In addition, almost half of the respondents stated they are engaged in plant removal activities. Altogether, this group of landowners may in fact be quite an army against the advance of invasive species. The key, of course, is that one's environmental imaginary

must be primed to view certain species as a problem on the landscape. For better or worse, that cultural mission has largely been accomplished for the Ashe juniper tree, but creating a cultural buzz around other invasive species presents an additional challenge.

While this study shows the propensity for conservation actions from amenity landowners, there are numerous additional potential conservation threats that should be studied in more detail. First, the parcelization of large tracts of habitat for residential development is, of course, a long-standing research theme, but there are also numerous potential amenity landowner interactions with the landscape that warrant a closer look. Second, outdoor cats present a serious issue for bird conservation (Lepczyk et al. 2004) and while this study did not expressly include a question about the lifestyle of cats in each household, the potential for outdoor cat issues is evident by the large proportion of survey respondents with the animal. Third, the judicious use of herbicide is often a key component of invasive species control efforts (Kettenring and Adams 2011), yet a significant portion of survey participants showed a disdain for the use of any herbicide on their property. While 48% of survey respondents expressed a desire for the removal of invasive species, 24% indicated they would not approve of herbicide use in that effort.

Further, land change data reported by survey participants (Table 5) show a steady increase in the disturbed land on each parcel. Even if landowners have the intent to steward the open land on their parcel site, a temporal trend of increasing development of built-up or otherwise impacted land cover presents a problem for the future. This development may occur slowly during the tenure of the current landowner or more rapidly after the sale of a parcel to a new owner.

Land tenure is also an important component of a land owner's stewardship capability with more experience on a landscape lending to a better understanding of the

effects of human interventions (Cooke and Lane 2015). While landowners in this study had, on average, fifteen years of ownership, 27% of respondents indicated they may be selling their parcel in the near future. Changes in ownership in amenity landscapes should be a component of future scholarship, with both its frequency and the implications of the transition being potential research topics.

VII. CONCLUSION

Small acreage rural landholdings are a large part of the rural patchwork in this study, with small acreage landowners representing 25% or more of the area (Hays County Appraisal District 2007). Similar land ownership patterns across high amenity exurban areas nationwide mean that the land management ideals and behaviors acted on in this large expanse of the rural landscape have the potential to make a profound impact on the environmental and social dynamics of the land as a whole.

Influenced by a dynamic set of personal and environmental factors, the small acreage rural landowner in the Onion Creek Watershed is highly motivated to undertake conservation actions. Conservation and wildlife interactions are, indeed, a significant part of the reason they live where they do. Their actions, and the actions of other unseen actors like the real estate industry that cater to them, shape at least a quarter of the countryside. Indeed, each landowner's management actions in this study appears to be a function of their idealized vision of the landscape. Their ideal vision of the Texas Hill Country, be it a suburban-style home with a hill country view or a cabin in a rugged oak savannah, plays out across the landscape. And water conservation measures on the

suburban-like site may be as important ecologically as the reintroduction of native trees on a home site considered more “wild”.

It is relatively easy to consider individual elements like water catchment systems and tree planting when trying to plan for the future of landscapes like these. The real complexity is accounting for the dynamic interplay between a landowner’s vision for the landscape (itself complex) and the incredible variation of landforms, land histories, climatic variation, and other biophysical variables that are present at each site. This is a monumental task, and one that should progress as amenity landowners and ecologies continue to be a major part of the world’s rural landscapes.

Exurban landscapes and the diverse management practices shaped by exurban environmental imaginaries will continue to provide opportunities and challenges to the conservation community. While conservation biologists can and should continue to pursue the protection of large acreage parcels of habitat, the ecological contributions and threats posed by small acreage amenity landowners should not be overlooked. That so many of these landowners are willing to engage in invasive species removal presents a real opportunity to harness their energy (and time and money) for restoration efforts. The strong desire to remove Ashe juniper (cedar) growth from many landowner’s properties is an outgrowth of this willingness to engage, but could also be considered as a potential cautionary tale. It is possible that the cultural imperative to remove cedar from one’s property has gone too far. While any regional restoration goal in regard to juniper is not clearly articulated, the literature does seem to hint at the benefit of the cautious removal of some cedar, rather than all of it. For many landowners, however, the mission is to remove it all. The desire for “no cedar” from many of these exurban residents is leaving its mark on the today’s landscape. If the cultural (landscape) fads of tomorrow take as

tight a grip as the current attitudes toward juniper, there certainly will be correlated impacts on the landscape.

In summary, there does appear to be room for conservation education, as typified by county extension service programming, to have cultural influence on the desire for certain kind of landscapes and landscape actions. And for a large percentage of landowners, that desire likely transforms into some land management behavior exerted on the landscape. Harnessed by public programs or not, the growth and habits of this increasingly common landowner on the rural exurban landscape will have impacts for centuries to come.

APPENDIX A: SURVEY QUESTIONS

The following survey was formatted for online delivery using Qualtrics survey software:

Chris Sheffield, a graduate student at Texas State University, is conducting a research study to understand land management actions of small acreage rural residential landowners. You are being asked to complete this survey because you own or manage a property of 2 to 40 acres.

Participation is voluntary. The survey will take approximately 30 minutes or less to complete. You must be at least 18 years old to take this survey.

This study involves no foreseeable serious risks. We ask that you try to answer all questions; however, if there are any items that make you uncomfortable or that you would prefer to skip, please leave the answer blank. Your responses are anonymous.

If you have any questions or concerns feel free to contact Chris Sheffield or his faculty advisor.

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cs1498@txstate.edu

Dr. Colleen Hiner, Professor
Geography Department
512-245-1327
cch64@txstate.edu

This project 2017047 was approved by the Texas State IRB on October 11, 2016. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser 512-245-3413 – (lasser@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 - (meg201@txstate.edu).

If you would prefer not to participate, please do not fill out a survey.

If you consent to participate, please complete the survey.

As an incentive for taking the time to participate in this research, you will be given a chance to enter a drawing for a $100 Visa gift card after completion of the survey. Thank you for your participation.

How many acres is your property (all parcels) that you live on?

How many years have you owned your property?

What are your main reasons for living in this area? (please select all that apply)

- ❑ Close to family (1)
- ❑ Close to employment (2)
- ❑ Quality of life (3)
- ❑ Good school district (4)
- ❑ Close to major metro area (5)
- ❑ Grew up in the area (6)
- ❑ Grew up on this land parcel (7)
- ❑ Own a business here (8)
- ❑ Close to friends (9)
- ❑ I feel the area is an important part of who I am (10)
- ❑ I am just getting to know the area (11)
- ❑ Other (please specify) (12) _____

Would you call your property rural or suburban?

- ❑ Rural (1)
- ❑ Suburban (2)
- ❑ Both (3)
- ❑ Other (please specify) (4) _____

Can you see other homesites from your residence?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Sometimes (3)

What animals do you keep on your land?

- ❑ None (1)
- ❑ Dog(s) (2)
- ❑ Cat(s) (3)
- ❑ Cattle (4)
- ❑ Sheep (5)
- ❑ Goats (6)
- ❑ Chickens or other fowl (7)
- ❑ Bees (8)
- ❑ Other (please specify) (9) _____

What are the water sources for your land? (select all that apply)

- ❑ Private well (1)
- ❑ City / rural water system (2)
- ❑ Water delivery service (3)
- ❑ Rainwater catchment system (4)
- ❑ Reclaimed waste water or gray water system (5)
- ❑ Stocktank or other water impoundment (6)
- ❑ Creek or river (7)
- ❑ Other (please specify) (8) _____

In the following questions, please select how important each land management activity or goal is for you.

	In terms of residential and other related space on your property (like your house and associated landscaping, patios, household storage sheds, etc.), how important are these goals to you? please select the best answer for each item below						
	Not Important (1)	Low Importance (2)	Slightly Important (3)	Neutral (4)	Moderately Important (5)	Very Important (6)	Extremely Important (7)
Maintain a house and associated out buildings. (1)	❍	❍	❍	❍	❍	❍	❍
Maintain an outdoor landscape. (2)	❍	❍	❍	❍	❍	❍	❍
Maintain an outdoor area for children. (3)	❍	❍	❍	❍	❍	❍	❍
Maintain an outdoor space for vegetable gardening. (4)	❍	❍	❍	❍	❍	❍	❍
Maintain an outdoor space for flower gardening. (5)	❍	❍	❍	❍	❍	❍	❍
Maintain facilities or space for household pets. (6)	❍	❍	❍	❍	❍	❍	❍

Increase garden space or other plantings. (7)	❍	❍	❍	❍	❍	❍	❍
Build an additional home site or other living space. (8)	❍	❍	❍	❍	❍	❍	❍
Build additional storage space. (9)	❍	❍	❍	❍	❍	❍	❍
Other (please specify) (10)	❍	❍	❍	❍	❍	❍	❍

	In terms of any open space on your property, how important are the following goals to you? please select the best answer for each item below						
	Not Important (1)	Low Importance (2)	Slightly Important (3)	Neutral (4)	Moderately Important (5)	Very Important (6)	Extremely Important (7)
Maintain outdoor space for passive recreation (like relaxation, walking, wildlife viewing, play, etc.). (1)	❍	❍	❍	❍	❍	❍	❍
Maintain outdoor space for active recreation (like mountain biking, atv riding, target range, etc.). (2)	❍	❍	❍	❍	❍	❍	❍
Maintain outdoor space for hunting and/or fishing. (3)	❍	❍	❍	❍	❍	❍	❍
Maintain wildlife habitat. (4)	❍	❍	❍	❍	❍	❍	❍
Maintain a creek, stock tank, or other natural water feature. (5)	❍	❍	❍	❍	❍	❍	❍

Remove invasive weeds and other species (like cutting brush). (6)	❍	❍	❍	❍	❍	❍	❍
Maintain a pasture for livestock. (7)	❍	❍	❍	❍	❍	❍	❍
Cultivate / maintain an agricultural field. (8)	❍	❍	❍	❍	❍	❍	❍
Maintain facilities or space for livestock, fowl, or other agricultural animals. (9)	❍	❍	❍	❍	❍	❍	❍
Construct additional buildings for animals, equipment, or other non-home storage. (10)	❍	❍	❍	❍	❍	❍	❍
Increase agricultural operations. (11)	❍	❍	❍	❍	❍	❍	❍
Increase wildlife habitat. (12)	❍	❍	❍	❍	❍	❍	❍
Increase garden space. (13)	❍	❍	❍	❍	❍	❍	❍

Other (please specify) (14)	❍	❍	❍	❍	❍	❍	❍

	In terms of current or potential economic use of your property, how important are the following goals to you? please select the best answer for each item below						
	Not Important (1)	Low Importance (2)	Slightly Important (3)	Neutral (4)	Moderately Important (5)	Very Important (6)	Extremely Important (7)
Maintain a home-based business. (1)	❍	❍	❍	❍	❍	❍	❍
Maintain a land-based business. (2)	❍	❍	❍	❍	❍	❍	❍
Create a home-based business. (3)	❍	❍	❍	❍	❍	❍	❍
Create a land-based business. (4)	❍	❍	❍	❍	❍	❍	❍
Sale of livestock or other agricultural products. (5)	❍	❍	❍	❍	❍	❍	❍
Participation in the tourist economy of the region (house rental, bed & breakfast, tours, etc.). (6)	❍	❍	❍	❍	❍	❍	❍
Other (please specify) (7)	❍	❍	❍	❍	❍	❍	❍

	In terms of potential future real estate transactions, how important are the following goals to you? please select the best answer for each item below						
	Not Important (1)	Low Importance (2)	Slight Importance (3)	Neutral (4)	Moderately Important (5)	Very Important (6)	Extremely Important (7)
Place a part of your land on the real estate market. (1)	❍	❍	❍	❍	❍	❍	❍
Place your whole property on the real estate. (2)	❍	❍	❍	❍	❍	❍	❍
Buy or add land to your property. (3)	❍	❍	❍	❍	❍	❍	❍
Other (please specify) (4)	❍	❍	❍	❍	❍	❍	❍

How much time do you or your family personally spend managing your land per week? (Please do not include maintaining your home.)

- ❍ Less than one hour (1)
- ❍ 2 to 5 hours (2)
- ❍ 6 to 10 hours (3)
- ❍ One to two days (4)
- ❍ Three to four days (5)
- ❍ Five days or more (6)

How much time does a land management service or other hired help spend managing your land per week? (Please do not include maintaining your home.)

- ❍ Less than one hour (1)
- ❍ 2 to 5 hours (2)
- ❍ 6 to 10 hours (3)
- ❍ One to two days (4)
- ❍ Three to four days (5)
- ❍ Five days or more (6)

How much money do you spend managing your land per year? (please do not include maintaining your home)

- ❍ Less than $250 (1)
- ❍ $250 to $999 (2)
- ❍ $1,000 to $4,999 (3)
- ❍ $5,000 to $9,999 (4)
- ❍ $10,000 to $25,000 (5)
- ❍ $25,000 to $99,999 (6)
- ❍ $100,000 or more (7)

	Please record how important these land uses are for you on your property. please select the best answer for each item below:						
	Not Important (1)	Low Importance (2)	Slightly Important (3)	Neutral (4)	Moderately Important (5)	Very Important (6)	Extremely Important (7)
I use my land to operate a farm or ranch. (1)	❍	❍	❍	❍	❍	❍	❍
I use my land for livestrock production. (2)	❍	❍	❍	❍	❍	❍	❍
I use my land for hay / forage production. (3)	❍	❍	❍	❍	❍	❍	❍
I use my land to cultivate crops. (4)	❍	❍	❍	❍	❍	❍	❍
I use my land to get a break from my usual routine. (5)	❍	❍	❍	❍	❍	❍	❍
I use my land as a place to relax. (6)	❍	❍	❍	❍	❍	❍	❍
I use my land for recreational hunting and fishing. (7)	❍	❍	❍	❍	❍	❍	❍
I use my land for recreation (other than hunting and fishing) (8)	❍	❍	❍	❍	❍	❍	❍

I use my land for mineral or other natural resource extraction. (9)	❍	❍	❍	❍	❍	❍	❍
I use my land for a huting enterprise or business. (10)	❍	❍	❍	❍	❍	❍	❍
I use my land for financial investment. (11)	❍	❍	❍	❍	❍	❍	❍
I use my land as part of my investment portfolio. (12)	❍	❍	❍	❍	❍	❍	❍
I use my land to make a profit. (13)	❍	❍	❍	❍	❍	❍	❍
In general, I'd like to make a profit with my land. (14)	❍	❍	❍	❍	❍	❍	❍
I own my land to make a profit. (15)	❍	❍	❍	❍	❍	❍	❍

	Please record whether you agree or disagree with these statements.						
	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This county needs strong protection of private property rights. (1)	❍	❍	❍	❍	❍	❍	❍
My land is an important source of income. (2)	❍	❍	❍	❍	❍	❍	❍
My land is a profitable business (3)	❍	❍	❍	❍	❍	❍	❍
Making a profit from my land is very important. (4)	❍	❍	❍	❍	❍	❍	❍
In general, I'd like to make a profit with my land. (5)	❍	❍	❍	❍	❍	❍	❍
My land is a way to financially provide for my family. (6)	❍	❍	❍	❍	❍	❍	❍
I own my land to make a profit. (7)	❍	❍	❍	❍	❍	❍	❍
Making money from my land is not my main goal. (8)	❍	❍	❍	❍	❍	❍	❍

Where I live has less to do with working on or experiencing my land and more to do with proximity to my employment. (9)	❍	❍	❍	❍	❍	❍	❍
Where I live has less to do with working on or experiencing my land and more to do with proximity to friends and family. (10)	❍	❍	❍	❍	❍	❍	❍
Where I live has less to do with working on or experiencing my land and more to do with a lower cost of living. (11)	❍	❍	❍	❍	❍	❍	❍
This county needs strong environmental protection. (12)	❍	❍	❍	❍	❍	❍	❍

	Please continue to record whether you agree or disagree with these statements.						
	Strongly disagreed	Disagree	Somewhat disagree	Neither agree nor disagreed	Somewhat agree	Agree	Stongly Agree
This area needs protection of the land use rights of individual property owners. (1)	❍	❍	❍	❍	❍	❍	❍
This area needs controls on land use to preserve its rural character. (2)	❍	❍	❍	❍	❍	❍	❍
Ranching/Farming is an important part of who I am. (3)	❍	❍	❍	❍	❍	❍	❍
Taking care of my property is an important part of who I am. (4)	❍	❍	❍	❍	❍	❍	❍
Managing the plants and wildlife on my property is an important part of who I am. (5)	❍	❍	❍	❍	❍	❍	❍
Living in a rural area is an important part of who I am. (6)	❍	❍	❍	❍	❍	❍	❍
I am able to solve most land management problems I encounter on my place. (7)	❍	❍	❍	❍	❍	❍	❍
I feel like I would benefit from participating in land management trainings. (8)	❍	❍	❍	❍	❍	❍	❍
I lack money to meet my land management objectives. (9)	❍	❍	❍	❍	❍	❍	❍
I lack time to meet my land management objectives. (10)	❍	❍	❍	❍	❍	❍	❍

I lack skills or training to meet my land management objectives. (11)	❍	❍	❍	❍	❍	❍	❍

How many acres of your property's footprint is used for primarily residential purposes (house, patio, lawn, landscaping, & playscape)? (one acre is roughly the size of a football field)

- ❑ All of my property (1)
- ❑ 1 acre or less (2)
- ❑ 2 acres (3)
- ❑ 3 acres (4)
- ❑ 4 acres (5)
- ❑ 5 acres or more (6)

In the following questions, please specify, to the best of your ability, how much of your property is associated with the noted land covers. Note that for each of these questions, your first response will focus on your current situation and your second response will focus on what the property was like when you first purchased it.

What percentage of your property do you consider as having a purely residential or suburban use footprint (both now and in the past)? (include your house, patio, lawn, landscaping, playscape, and other associated items)

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

What percentage of your property is covered in impervious (non-permeable) surfaces like buildings or roads (including paved and gravel driveways)?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

How much of your property is covered in turfgrass?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

How much of your property is covered in a garden?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

How much of your property is covered in woodland?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

How much of your property is covered in brush?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

How much of your property is covered in grassland, meadow or native grass pasture?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

How much of your property is covered in non-irrigated cropland or improved pasture (Bermuda Grass pasture, for example)?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

How much of your property is covered in irrigated pasture or cropland (not including gardens)?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

What percentage of your property do you regularly manage (mowing, planting, home site, etc.)?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

What percentage of your property do you manage in some way (occasional brush removal, etc.)?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

What percentage of your property do you leave mostly untouched?

_____ Current (1)
_____ When you first purchased or came to manage your property. (2)

Are you likely to change your land cover footprint in the future (more turf grass, bigger garden, additional structures, animal enclosures, etc.)?

- ❍ Definitely yes (1)
- ❍ Probably yes (2)
- ❍ Might or might not (3)
- ❍ Probably not (4)
- ❍ Definitely not (5)

If so, in what ways? (select all that apply)

- ❑ Additional living space(s) (1)
- ❑ Add a pool (2)
- ❑ Additional storage structure(s) (3)
- ❑ Additional turf grass area(s) (4)
- ❑ Larger Garden (5)
- ❑ Add a stock tank or pond (6)
- ❑ Improved pasture for livestock (7)
- ❑ Additional animal enclosures (8)
- ❑ Native landscape restoration (9)
- ❑ Other (please specify) (10) _____

On your property, do you engage in any land-based activities for profit (bed & breakfast, animal husbandry, vegetable production, hunt leases, etc.)?

- ❍ Yes (1)
- ❍ No (2)

If so, what are they? (select all that apply)

- ❑ Short term house or room rental (airbnb, homeaway, vrbo, etc.) (1)
- ❑ Long term house, room, or space rental (2)
- ❑ Agricultural lease (rental of pasture or farmland) (3)
- ❑ Hunting lease (4)
- ❑ Guided hunts (5)
- ❑ Vegetable or flower production (6)
- ❑ Livestock enterprise (7)
- ❑ Chicken or other fowl enterprise (8)
- ❑ Other animal enterprise (please specify) (9) _____
- ❑ Gather nuts, berries, mushrooms, and/or other items (not including garden or field crops). If so, what species? (10) _____
- ❑ Other (please specify) (11) _____

On your property, what land-based activities do you or your immediate family engage in for recreation or pleasure? (select all that apply)

- ❑ Gardening (1)
- ❑ Hunting (2)
- ❑ Wildlife watching (3)
- ❑ ATV, dirt bike, or other off road vehicle use (4)
- ❑ Walking / Hiking (5)
- ❑ Reunions / partys (6)
- ❑ Picnincing (7)
- ❑ Swimming (8)
- ❑ Fishing (9)
- ❑ Bicycling (10)
- ❑ Farming (11)
- ❑ Animal husbandry (12)
- ❑ Gather nuts, berries, mushrooms, and/or other items (not including garden or field crops). If so, what species? (13) _____
- ❑ Other (please specify) (14) _____

Do you invite or allow family and friends to use your property for recreational activities?

- ❍ Yes (1)
- ❍ No (2)

If so, what activities? (select all that apply)

What types of vegetation management activities do you pursue on your land and how often do you or others perform this work? (select all that apply)

- ❑ Maintaining small yard or garden areas (less than 1/2 acre) near home. How often? (1) _____
- ❑ Mowing large expanses of yard. How often? (2) _____
- ❑ Weed control and/or fertilizing large expanses of yard. How often? (3) _____
- ❑ Mowing / Shredding of open areas (not including any turf grass areas). How often? (4) _____
- ❑ Keeping a woodland area (unmanaged for the most part) (5)
- ❑ Keeping a prairie area (unmowed for most of the year) (6)
- ❑ Removing Ashe Juniper (Cedar). How often? (7) _____
- ❑ Brush removal using chainsaws or other cutting tools. How often? (8) _____
- ❑ Brush removal using herbicide. How often? (9) _____
- ❑ Herbaceous weed control using herbicide. How often? (10) _____
- ❑ Prescribed burning. How often? (11) _____
- ❑ Fertilizing pasture areas. How often? (12) _____
- ❑ Plowing or other tillage. How often? (13) _____
- ❑ Grass seeding. How often? (14) _____
- ❑ Native seeding or planting. How often? (15) _____
- ❑ Tree planting. How often? (16) _____
- ❑ Grazing. How many months per year? (17) _____
- ❑ Rotational Grazing. How often? (18) _____
- ❑ Maintaining riparian buffer areas (keeping tall grass or wooded areas near waterways). How often do you maintain them? (19) _____
- ❑ Maintaining a stock tank(s). How often do you maintain them? (20) _____
- ❑ Other (please specify) (21) _____

What types of land management activities are generally performed for you by a land management service or other hired help?

- ❑ Maintaining small yard or garden areas (less than 1/2 acre) near home. (1)
- ❑ Mowing large expanses of yard. (2)
- ❑ Weed control and/or fertilizing large expanses of yard. (3)
- ❑ Mowing / Shredding of open areas (not including any turf grass areas). (4)
- ❑ Managing a woodland area. (5)
- ❑ Managing a prairie area (6)
- ❑ Removing Ashe Juniper (Cedar). (7)
- ❑ Brush removal using chainsaws or other cutting tools. (8)
- ❑ Brush removal using herbicide. (9)
- ❑ Herbaceous weed control using herbicide. (10)
- ❑ Prescribed burning. (11)
- ❑ Fertilizing pasture areas. (12)
- ❑ Plowing or other tillage. (13)
- ❑ Grass seeding. (14)
- ❑ Native seeding or planting. (15)
- ❑ Tree planting. (16)
- ❑ Grazing management. (17)
- ❑ Maintaining riparian buffer areas (keeping tall grass or wooded areas near waterways). (18)
- ❑ Maintaining a stock tank(s) or other water source. (19)
- ❑ Other (please specify) (20) _____

Do you actively remove certain plants or animals from your land?

- ❍ Yes (1)
- ❍ No (2)

If so, what species are they?

Do you plant crops or other vegetation on your land away from your main home site?

- ❍ Yes (1)
- ❍ No (2)

If so, what are they? (select all that apply)

- ❑ Ornamental plants and flowers (1)
- ❑ Native plants (2)
- ❑ Vegetable crops (3)
- ❑ Animal forage crops (4)
- ❑ Screening trees and shrubs (5)
- ❑ Shade trees (6)
- ❑ Please specify the names or species of the plantings most important to your land (7) _____

How do you use water on your landscape? (please do not include regular household use.)

- ❑ Regular irrigation of turfgrass (1)
- ❑ Occasional watering of turfgrass or garden areas. (2)
- ❑ Regular irrigation of vegetable or ornamental garden (3)
- ❑ Supplemental watering of planted trees or ornamentals (4)
- ❑ Supplemental watering of native landscape (5)
- ❑ Provide water for livestock or other domesticated animals (6)
- ❑ Provide water for wildlife (7)
- ❑ Fill pool, stock tank, or other water feature (8)
- ❑ Other (please specify) (9) _____

When thinking about the ways you manage your land, how do local landscapes or the surrounding area influence your decisions?

What would you like your property to look like in the future?

You are almost finished with the survey! Please complete the demographic questions below.

In what year were you born?

What is your gender?

- ❍ Male (1)
- ❍ Female (2)

What is your ethnicity?

- ❍ White (1)
- ❍ Black or African American (2)
- ❍ American Indian or Alaska Native (3)
- ❍ Asian (4)
- ❍ Native Hawaiian or Pacific Islander (5)
- ❍ Other (6)

What is your household income?

- ❍ Less than $10,000 (1)
- ❍ $10,000 - $19,999 (2)
- ❍ $20,000 - $29,999 (3)
- ❍ $30,000 - $39,999 (4)
- ❍ $40,000 - $49,999 (5)
- ❍ $50,000 - $59,999 (6)
- ❍ $60,000 - $69,999 (7)
- ❍ $70,000 - $79,999 (8)
- ❍ $80,000 - $89,999 (9)
- ❍ $90,000 - $99,999 (10)
- ❍ $100,000 - $149,999 (11)
- ❍ More than $150,000 (12)

What is your highest level of education completed?

- ❍ Less than high school (1)
- ❍ High school graduate (2)
- ❍ Some college (3)
- ❍ 2 year degree (4)
- ❍ 4 year degree (5)
- ❍ Professional degree (6)
- ❍ Doctorate (7)

What is your employment status?

- ❍ Employed full time (1)
- ❍ Employed part time (2)
- ❍ Unemployed looking for work (3)
- ❍ Unemployed not looking for work (4)
- ❍ Retired (5)
- ❍ Student (6)
- ❍ Disabled (7)

What is your occupation?

If you would like to be entered into a drawing to receive a $100 VISA gift card as an incentive for participating in the survey, please enter an email or phone number to be placed into the drawing. Please note that this contact information will solely be used for the drawing and will not be connected to your survey responses.

The researcher would like to engage a limited number of survey participants in a deeper discussion of the land management actions they use on their land. If you are willing to participate in further discussion with the researcher about your land, please include contact information here. Participating in this discussion, as with participation in the survey as a whole, is completely voluntary.

APPENDIX B: LANDOWNER TYPOLOGIES

Production-oriented landowner Typology

Lickert Scale	1 Not Important	2 Low Importance	3 Slightly Important	4 Neutral	5 Moderately Important	6 Very Important	7 Extremely Important	
I use my land to operate a farm or ranch. I use my land for livestock production. I use my land for hay/forage production. I use my land to cultivate crops. I use my land for wildlife management. I use my land for mineral extraction. I use my land for a hunting enterprise or business. I use my land for any enterprise or business that I am involved in.								Production-oriented landowners must answer 6 or 7 on at least one of these survey items.
I use my land to make a profit.								must answer 5, 6, or 7 on this survey item.
I use my land to make some extra money. I use my land for financial investment I use my land as part of my investment portfolio. I will use my land to resell for profit.								Production-oriented landowners can have any answer to these survey items.
I use my land to get a break from my usual routine. I use my land as a place to relax. I use my land to enjoy the outdoors. I use my land for recreation (other than hunting and fishing). I use my land for recreational hunting and fishing.								Production-oriented landowners must answer 1, 2, 3, or 4 on all of these survey items.
	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Agree	Strongly Agree	
My land is an important source of income.								must answer 6 or 7 on this survey item.
My land is a profitable business. Making a profit from my land is very important. In general, I'd like to make a profit with my land. My land is a way to financially provide for my family. I own my land to make a profit.								Production-oriented landowners can have any answer to these survey items.
Making money from my land is not my main goal.								must answer 1, 2, 3, or 4 on this item.
Where I live has less to do with working on or experiencing my land and more to do with proximity to my employment. Where I live has less to do with working on or experiencing my land and more to do with proximity to friends and family. Where I live has less to do with working on or experiencing my land and more to do with a lower cost of living.								Production-oriented landowners can have any answer to these survey items.

Lifestyle-oriented landowner Typology

Lickert Scale	1 Not Important	2 Low Importance	3 Slightly Important	4 Neutral	5 Moderately Important	6 Very Important	7 Extremely Important	
I use my land to operate a farm or ranch.								Lifestyle-oriented landowners must answer 1, 2, or 4 on all of these survey items. Any answer is OK on number 8 because some respondants considered it a question about their garden.
I use my land for livestock production.								
I use my land for hay/forage production.								
I use my land to cultivate crops.								
~~I use my land for wildlife management.~~								
I use my land for mineral extraction.								
I use my land for a hunting enterprise or business.								
I use my land for any enterprise or business that I am involved in.								
I use my land to make a profit.								must answer 1,2,3, or 4 on this survey item.
~~I use my land to make some extra money.~~								Lifestyle-oriented landowners can have any answer to these survey items.
I use my land for financial investment								
I use my land as part of my investment portfolio.								
~~I will use my land to resell for profit.~~								
I use my land to get a break from my usual routine.								Lifestyle-oriented landowners must answer 5, 6, or 7 on at least one of these survey items.
I use my land as a place to relax.								
~~I use my land to enjoy the outdoors.~~								
I use my land for recreation (other than hunting and fishing).								
I use my land for recreational hunting and fishing.								
	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Agree	Strongly Agree	
My land is an important source of income.								must answer 1, 2, 3, 4, or 5 on this survey item.
My land is a profitable business.								Lifestyle-oriented landowners can have any answer to these survey items.
Making a profit from my land is very important.								
In general, I'd like to make a profit with my land.								
My land is a way to financially provide for my family.								
I own my land to make a profit.								
Making money from my land is not my main goal.								can have any answer on this item.
Where I live has less to do with working on or experiencing my land and more to do with proximity to my employment.								Lifestyle-oriented landowners can have any answer to these survey items.
Where I live has less to do with working on or experiencing my land and more to do with proximity to friends and family.								
Where I live has less to do with working on or experiencing my land and more to do with a lower cost of living.								

Multiple Objective-oriented landowner Typology

Lickert Scale	1 Not Important	2 Low Importance	3 Slightly Important	4 Neutral	5 Moderately Important	6 Very Important	7 Extremely Important	
I use my land to operate a farm or ranch.								Multiple Objective-oriented landowners must answer 3 to 7 on at least one of these survey items.
I use my land for livestock production.								
I use my land for hay/forage production.								
I use my land to cultivate crops.								
~~I use my land for wildlife management.~~								
I use my land for mineral extraction.								
I use my land for a hunting enterprise or business.								
~~I use my land for any enterprise or business that I am involved in.~~								
I use my land to make a profit.								must answer 3 to 7 on this survey item.
~~I use my land to make some extra money.~~								Multiple Objective-oriented landowners must answer 3 to 7 on at least one of these survey items.
I use my land for financial investment								
I use my land as part of my investment portfolio.								
I will use my land to resell for profit.								
I use my land to get a break from my usual routine.								Multiple Objective-oriented landowners must answer 3 to 7 on at least one of these survey items.
I use my land as a place to relax.								
~~I use my land to enjoy the outdoors.~~								
I use my land for recreation (other than hunting and fishing).								
I use my land for recreational hunting and fishing.								
	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Agree	Strongly Agree	
My land is an important source of income.								must answer 3 to 7 on this survey item.
My land is a profitable business.								Multiple Objective-oriented landowners must answer 3 to 7 on these survey items.
Making a profit from my land is very important.								
In general, I'd like to make a profit with my land.								
My land is a way to financially provide for my family.								
I own my land to make a profit.								
Making money from my land is not my main goal.								must answer 3 to 7 on this survey item.
Where I live has less to do with working on or experiencing my land and more to do with proximity to my employment.								Multiple Objective-oriented landowners must answer 1 to 5 on these survey items.
Where I live has less to do with working on or experiencing my land and more to do with proximity to friends and family.								
Where I live has less to do with working on or experiencing my land and more to do with a lower cost of living.								

Landowner Motivations

Lickert Scale	1 Not Important	2 Low Importance	3 Slightly Important	4 Neutral	5 Moderately Important	6 Very Important	7 Extremely Important	
Agricultural Production Landowner Motivations								
I use my land to operate a farm or ranch. I use my land for livestock production. I use my land for hay/forage production. I use my land to cultivate crops.								Agricultural production motivations will be ranked low, medium, and high for a landowner based on a trigger survey response to any these questions.
Lifestyle Landowner Motivations								
I use my land to get a break from my usual routine. I use my land as a place to relax. ~~I use my land to enjoy the outdoors.~~ I use my land for recreation (other than hunting and fishing). I use my land for recreational hunting and fishing.								Lifestyle motivations will be ranked low, medium, and high for a landowner based on a trigger survey response to any these questions.
Mineral Extraction Landowner Motivations								
I use my land for mineral extraction.								Mineral extraction motivations will be ranked low, medium, and high based on survey responses to this question.
Wildlife (Recreational or Enterprise) Landowner Motivations								
I use my land for a hunting enterprise or business.								Wildlife enterprise motivations will be ranked low, medium, and high based on survey responses to this question.
Financial Investment Landowner Motivations								
I use my land for financial investment I use my land as part of my investment portfolio.								Financial investment motivations will be ranked low, medium, and high based on a trigger survey response to any of these questions.
Profit Landowner Motivations								
I use my land to make a profit. In general, I'd like to make a profit with my land. I own my land to make a profit.				*Neutral*	*Somewhate Agree*	*Agree*	*Strongly Agree*	Profit motivations will be ranked low, medium, and high based on a trigger survey response to any of these questions.
Wildlife Landowner Motivations								
Managing wildlife is an important part of who I am. Maintain Wildlife Habitat Increase Wildlie Habitat				*Neutral*	*Somewhate Agree*	*Agree*	*Strongly Agree*	Wildlife motivations will be ranked low, medium, and high based on a trigger survey response to any of these questions.

Landowner Political Ideology

Lickert Scale	1	2	3	4	5	6	7	
	Strongly Disagree	*Disagree*	*Somewhat Disagree*	*Neither Agree or Disagree*	*Somewhat Agree*	*Agree*	*Strongly Agree*	
Private Property Rights Ideology								
The county needs strong protection of private property rights This area needs protection of the land use rights of individual property owners.								Private property rights political idealogy will be ranked null, low, moderate, or high for a landowner based on a trigger survey responses to this question.
Environmental Protection Ideology								
The county needs strong environmental protection This area needs controls on land use to preserve its rural character								Environmental protection political idealogy will be ranked null, low, moderate, or high for a landowner based on a trigger survey responsse to this question.

References

Abrams J., H. Gosnell, N. J. Gill, and P. J. Klepeis. 2012. "Re-creating the rural, reconstructing nature: An International literature review of the environmental implications of amenity migration." *Conservation and Society* 10: 270-84

Abrams, J. and J. C. Bliss. 2013. "Amenity landownership, land use change, and the re-creation of working landscapes." *Society and Natural Resources* 26 (7): 845-859.

Bockstael, N. F. 1996. "Modeling economics and ecology: The importance of a spatial perspective." *American Journal of Agricultural Economics* 78: 1168-1180.

Bowles, D. E. and T. L. Arsuffi. 1993. "Karst aquatic ecosystems of the Edwards Plateau region of Central Texas, USA: A consideration of their importance, threats to their existence, and efforts for their conservation." *Aquatic Conservation: Marine and Freshwater Ecosystems 3* (4): 317-329.

Brown, D.G., K. M.Johnson, T.R. Loveland, D.M. Theobald. 2005. "Rural land-use trends in the conterminous United States, 1950–2000." *Ecological Applications*, 15(6), 1851-1863.

Cadieux, K. V. 2013. "The mortality of trees in exurbia's pastoral modernity." In *Landscape and the Ideology of Nature in Exurbia: Green Sprawl*. ed. K. V. Cadieux and L. Taylor, 252-294. New York, NY: Routledge.

Cadieux, K. V. and P. T. Hurley. 2011. "Amenity migration, exurbia, and emerging rural landscapes: Global natural amenity as place and as process." *GeoJournal*, 76 (4): 297-302.

Cadieux, K. V. and L. Taylor. 2013. *Landscape and the Ideology of Nature in Exurbia: Green Sprawl.* New York, NY: Routledge.

Cheng, A. S., L. E. Kruger, and S. E. Daniels. 2003. ""Place" as an integrating concept in natural resource politics: Propositions for a social science research Agenda." *Society &Natural Resources 16* (2): 87-104.

Classen, R. and A. Tegene. 1999. "Agricultural land use choice: A discrete choice approach." *Agricultural Resource Economic Review* 28: 26-36.

Cooke, B. and R. Lane. 2015. "Re-thinking rural amenity ecologies for environmental management in the Anthropocene." *Geoforum* 65: 232-242.

Dale, V. H., R. V. O'Neill, M. Pedlowski, and F. Southworth. 1993. "Causes and effects of land-use change in Central Rondonia, Brazil." *Photogrammetric Engineering and Remote Sensing* 59: 997-1005.

de Blois, S., G. Domon, and A. Bouchard. 2001. "Environmental, historical, and contextual determinants of vegetation cover: A landscape perspective." *Landscape Ecology* 16: 421-436.

Depew, J. J. 2004. "*Habitat Selection and Movement Patterns of Cattle and White-Tailed Deer in a Temperate Savanna*." Master's Thesis, Texas A&M University.

Dillman, D. A. 2000. *Mail and Internet Surveys: The Tailored Design Method* (Vol. 2). New York: Wiley.

Forman, R. T. T. 1995. *Land Mosaics: The Ecology of Landscapes and Regions*. Cambridge: Cambridge University Press.

Geoghegan, J., L. Wainger, and N. Blockstael. 1997. Spatial landscape indices in a hedonic framework: An ecological economics analysis using GIS. *Ecological Economics* 23:251-264.

Gill, N., Klepeis, P., & Chisholm, L. 2010. Stewardship among lifestyle oriented rural landowners. *Journal of environmental planning and management*, *53*(3), 317-334.

Gonzalez-Abraham, C. E., V. C. Radeloff, R. B. Hammer, T. J. Hawbaker, S. I. Stewart, and M. K. Clayton. 2007. Building patterns and landscape fragmentation in Northern Wisconsin, USA. *Landscape Ecology* 22:217-230.

Gosnell, H., & J. Abrams. 2011. Amenity migration: Diverse conceptualizations of drivers, socioeconomic dimensions, and emerging challenges. *GeoJournal*, *76*(4), 303-322.

Gosnell, H., Haggerty J. H., & W. R. Travis. 2006. Ranchland ownership change in the Greater Yellowstone ecosystem, 1990-2001: Implications for conservation. *Society & Natural Resources,* 19 (8)

Haines-Young, R. H. and M. B. Potschin. 2000. Multifunctionality and value. In *Multifunctional Landscapes*, eds. J. Brandt, B. Tress, and G. Tress, 111-118. Roskilde: Centre for Landscape Research.

Hanski, I. 1999. *Metapopulation Ecology*. Oxford: Oxford University Press.

Hauwert, N. M., Johns, D. A., Sansom, J. W., & Aley, T. J. 2002. Groundwater tracing of the Barton Springs Edwards Aquifer, Travis and Hays Counties, Texas.

Hays County Central Appraisal District. 2007. *Hays CAD Frequently Asked Questions*. <www.hayscad.com>. Last Accessed 6 April 2007.

Hiner, C. C. 2015. (False) Dichotomies, political ideologies, and preferences for environmental management along the rural-urban interface in Calaveras County, California. *Journal of Applied Geography,* 65**,** 13-27.

Hiner, C. C. 2014. “Been-heres vs. come-heres” and other identities and ideologies along the rural–urban interface: A comparative case study in Calaveras County, California. *Land Use Policy*, *41*, 70-83.

Holbrook, A. L., Krosnick, J. A. and Pfent, A. 2007. “The Causes and Consequences of Response Rates in Surveys by the News Media and Government Contractor Survey Research Firms.” in *Advances in Telephone Survey Methodology*, eds J. M. Lepkowski, C. Tucker, J. M. Brick, E. D. D. Leeuw, L. Japec, P. J. Lavrakas, M. W. Link and R. L. Sangster, 499-678. Hoboken, NJ: John Wiley & Sons.

Hunt, B., Smith, B., Campbell, S., Beery, J., Hauwert, N., & Johns, D. 2005. Dye tracing recharge features under high-flow conditions, Onion Creek, Barton Springs Segment of the Edwards aquifer, Hays County, Texas. *Austin Geological Society Bulletin*, *1*, 70-86.

Hurley, P.T., M. Maccaroni, and A. Williams. 2017. Resistant actors, resistant landscapes? A historical political ecology of a forested conservation object in exurban southeastern Pennsylvania. *Landscape Research*, 42(3), 291-306.

Hurley, P.T. 2013. “Whose sense of place? A political ecology of amenity development.” In *Place-Based Conservation*, ed. D. R. Williams, 165-180. Netherlands: Springer.

Kettenring, K.M. and C.R. Adams. 2011. Lessons learned from invasive plant control experiments: A systematic review and meta-analysis. *Journal of Applied Ecology*, 48(4): 970-979.

Klepeis, P., N. Gill, and L. Chisholm. 2009. Emerging amenity landscapes: Invasive weeds and land subdivision in rural Australia. *Land Use Policy*, 26(2): 380-392.

Knoot, T.G., Schulte, L.A., and Rickenbach, M. 2010. Oak conservation and restoration on private forestlands: Negotiating a social-ecological landscape. *Environmental Management*, 45(1):155-164.

Koontz, T. M. 2001. Money talks but to whom? Financial versus nonmonetary motivations in land use decisions. *Society and Natural Resources* 14:51-65.

Lambin, E. F.1997. Modelling and monitoring land cover change processes in tropical regions. *Progress in Physical Geography* 21:375-393.

Larkin, T. J. and G. W. Bomar. 1983. *Climatic Atlas of Texas*. Report LP-192. Austin: Texas Department of Water Resources.

Lai, P. H., & Lyons, K. 2011. Place-meaning and sustainable land management: Motivations of Texas hill country landowners. *Tourism Geographies*, *13*(3), 360-380.

Lee, R. G., R. O. Flamm, M. G. Turner, C. Bledsoe, P. Chandler, C. DeFarrari, R. Gottfried, R. J. Naiman, N. Schumaker, and D. N. Wear. 1992. Integrating sustainable development and environmental vitality. In *Watershed Management: Balancing Sustainability and Environmental Change*, ed. R. J. Naiman, 499-521. New York: Springer–Verlag.

Lepczyk, C.A., A.G. Mertig, and J. Liu. 2004. Landowners and cat predation across rural-to-urban landscapes. *Biological Conservation*, 115(2): 191-201.

Livanis, G., C.B. Moss, V.E. Breneman, and R.F. Nehring. 2006. Urban sprawl and farmland prices. *American Journal of Agricultural Economics*, 88(4), 915-929.

MacArthur, R. H. and E. O. Wilson. 1967. *The Theory of Island Biogeography*. Princeton: Princeton University Press.

Mahler, B. J., Lynch, L., & Bennett, P. C. 1999. Mobile sediment in an urbanizing karst aquifer: Implications for contaminant transport. *Environmental geology*, *39*(1), 25-38.

Martin, M. J. R., C. L. DePablo, and P. M. DeAgar. 2006. Landscape changes over time: Comparison of land uses, boundaries, and mosaics. *Landscape Ecology* 21:1075-1088.

Marvin, S. J. 2003. *Land-cover and Ownership Change on Rural-residential Parcels in the Central Sierra Nevada, CA: 1952-2000*. Dissertation. University of California, Berkeley.

McKinnon, I., P.T. Hurley, C.C. Hiner, and M. Maccaroni. In press. Uneven urban metabolisms: Toward an integrative (ex)urban political ecology of sustainability in and around the city.

Nelle, S. 2012. The great grassland myth of the Texas Hill Country. *Texas Wildlife*, July 2012: 46-51.

Nelson, A.C. 1990. Economic critique of US prime farmland preservation policies: Towards state policies that influence productive, consumptive, and speculative value components of the farmland market to prevent urban sprawl and foster agricultural production in the United States. *Journal of Rural Studies*, 6(2), 119-142.

Nesbitt, J.T. and D. Weiner. 2001. Conflicting environmental imaginaries and the politics of nature in Central Appalachia. *Geoforum*, 32(3), 333-349.

Newburn, D. A., Berck, P., & Merenlender, A. M. 2006. Habitat and open space at risk of land-use conversion: Targeting strategies for land conservation. *American Journal of Agricultural Economics*, 88(1), 28-42.

Robbins, P., Martin, S., & Gilbertz, S. 2012. Developing the commons: Contradictions of growth in exurban Montana. *The Professional Geographer*, 64*(*3), 317-331.

Robinson, D. T. 2012. Land-cover fragmentation and configuration of ownership parcels in an exurban landscape. *Urban Ecosystems*, 15(1), 53-69.

Russell, F. and N. Fowler. 2002. Failure of adult recruitment in Quercus buckleyi populations on the eastern edwards plateau, Texas. *The American Midland Naturalist*, 148(2): 201-217.

Salamon, S. 1993. Culture and agricultural land tenure. *Rural Sociology* 58:580-598.

Saunders, D. A., R. J. Hobbs, and C. R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. *Conservation Biology* 5:18-32.

Schmidly, D. J. 2002. *Texas Natural History: A Century of Change*. Lubbock: Texas Tech University Press.

Sorice, M. G., Kreuter, U. P., Wilcox, B. P., & Fox, W. E. 2014. Changing landowners, changing ecosystem? Land-ownership motivations as drivers of land management practices. *Journal of environmental management*, *133*, 144-152.

Sorice, M. G., Kreuter, U. P., Wilcox, B. P., & Fox, W. E. 2012. Classifying land-ownership motivations in central, Texas, USA: A first step in understanding drivers of large-scale land cover change. *Journal of Arid Environments*, *80*, 56-64.

Taylor, L. 2011. No boundaries: Exurbia and the study of contemporary urban dispersion. *GeoJournal*, *76*(4), 323-339.

Taylor, L. & P. T. Hurley. 2016. *A Comparative Political Ecology of Exurbia: Planning, Environmental Management, and Landscape Change.* Cham, Switzerland: Springer.

Thünen, Johann Heinrich von. 1966. *Von Thünen's Isolated State: An English edition of: Der isolierte Staat.* Oxford: Pergamon Press.

Travis, W. R. 2007. *New Geographies of the American West: Land Use and the Changing Patterns of Place*. Island Press.

Turner, M. G., D. N. Wear, and R. O. Flamm. 1996. Land ownership and land-cover change in the Southern Appalachian Highlands and the Olympic Peninsula. *Ecological Applications* 6:1150-1172.

US Bureau of the Census. 1991. Statistical Abstract of the United States: 1991 (11th ed) Washington, DC, 1991, p. 201.

US Bureau of the Census. 2006. Population in metropolitan and micropolitan statistical areas in alphabetical order and numerical and percent change for the United States and Puerto Rico: 1990 and 2000. Retrieved May 15, 2016 from http://www.census.gov/population/cen2000/phc-t29/tab01a.xls

US Bureau of the Census. 2010. *2010 Census Interactive Population Search: Austin, Texas.* Retrieved May 15, 2016, from http://www.census.gov/2010census/popmap/ipmtext.php?fl=48.

US Geological Survey. 2001. National Land Cover Database NLCD. U.S. Geological Survey, Sioux Falls, SD. Retrieved May 15, 2016, from www.mrlc.gov.

US Geological Survey. 2003. National Land Cover Database NLCD 1992/2001 Change (edition 1.0). U.S. Geological Survey, Sioux Falls, SD. Retrieved May 15, 2016, from www.mrlc.gov.

Walker, P., Marvin, S., & Fortmann, L. 2003. Landscape changes in Nevada County reflect social and ecological transitions. *California Agriculture*, *57*(4), 115-121.

Wear, D. N. and R. O. Flamm. 1993. Public and private disturbance regimes in the Southern Appalachians. *Natural Resource Modeling* 7:379-397.

Wear, D. N., M. G. Turner, and R. O. Flamm. 1996. Ecosystem management with multiple owners: Landscape dynamics in a Southern Appalachian watershed. *Ecological Applications* 6:1173 –1188.

Wilkins, N., A. Hays, D. Kubenka, D. Steinbach, W. Grant, E. Gonzalez, M. Kjelland, and J. Shackelford. 2003. *Texas Rural Lands: Trends and Conservation Implications for the 21st Century*. College Station: Texas A&M University Extension.

Wilkinson, T. 2006. Owning the views: Architecture, consumer self-restraint and zoning. *New West*, 31 May 2006.