

The influence of personal belief, agency mission and city size on open space decision making processes in three southwestern cities

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Abstract The southwest has experienced dramatic population increases over the last 30 years, a trend that is expected to continue. Open space conservation is important both from the standpoint of preserving ecosystem services as well as maintaining quality of life for urban populations. Federal agencies manage a large proportion of the public land in the Southwestern U.S. We surveyed federal land management agencies with jurisdiction in three cities representing a gradient in size and population: Phoenix, Arizona, Albuquerque and Las Cruces, New Mexico. A questionnaire was sent via email to 918 federal land and resource managers, professionals, and researchers. We also collected comments from respondents to identify specific perceptions concerning the use and importance of open space. Our primary questions sought to elicit individual preferences regarding open space as well as respondent perceptions of the relation between agency mission and open space management. Certain questions asked respondents to provide their own views on these topics, while other questions asked them to provide their opinions concerning agency views. We looked for differences among respondents from different cities and from different government departments, and compared lower- versus higher-grade employees. Individuals from Phoenix tended to value open space more than those from Albuquerque and Las Cruces, which we attribute in part to differences in resource availability among the cities studied. Higher-grade employees tended to agree more that federal agencies were addressing potential future issues, and may reflect different levels of awareness of agency activities among respondents. Our study highlights the importance of considering agency mission and landscape context in multijurisdictional open space planning.

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Introduction

As human populations and activities spread to the farthest reaches of Earth's systems, the biophysical environment of cities is reemerging as a provider of life-sustaining ecosystem services. Nearly 60 % of the world's population lives in cities and towns (United Nations 2012) where natural and semi-natural open space provides an important source of clean water and air, supports farms, ranches and timberlands and improves our quality of life (Brander and Koetse 2011; Thompson 2002). Urban populations are expected to continue to grow and comprise nearly 70 % of the world's population by 2050 (United Nations 2012). Rapid urbanization puts increasing pressure on local ecosystem's goods and services by reducing the availability of natural or open lands. In turn, the loss of open space can decrease the resilience of cities to variations in climate and natural disturbances (Schneider et al. 2012). The most profound driver of land use change and loss of open space is population growth, which in turn is driven by economic conditions and land use policy and governance (Lubowski et al. 2008; Macie and Hermansen 2002). As open and natural land is lost to development and infrastructure, increased pressure is placed on remaining open space to continue to provide natural resource amenities. Population increases and associated land use change also fragment open space and create open space remnants, embedded within a matrix of developed lands, with potential negative implications for the continued provision of natural amenities (Benedict and McMahon 2002; Esbah et al. 2009).

The U.S. has experienced substantial increases in urbanization over the last decades, particularly in the West where populations have increased rapidly (Lubowski et al. 2008). Growth within the southwestern U.S. cities is expected to continue by 80 % over the next 20 years (Alig et al. 2004; USFS 2012). Increasing human populations in the Southwest, in particular, are expected to impact federally managed open space because the greatest growth is expected for areas close to protected public lands such as national forests, parks, monuments and rangelands (Wu and Plantinga 2003; Rasker et al. 2004; Harper and Crow 2006).

Much of the recent expansion in western states has been characterized by rural development, or the trend of building new homes and commercial structures at low densities, which creates a fragmented series of open space areas (Harper and Crow 2006). This is significant because the way in which development occurs across a given landscape has a profound influence on how important ecosystem services and amenities are preserved (Esbah et al. 2009; USFS 2012; York et al. 2011). In particular, rural development is thought to reduce the capacity of remaining open space to provide environmental, social and economic benefits, and increase conflicts between competing land uses (Harper and Crow 2006; Esbah et al. 2009; York et al. 2011). Ironically, it is the specific ideal and desire for the natural amenities provided by rural communities that draws people to rural areas. In turn, there is more demand to develop adjacent to open space lands, with measureable negative impacts on those lands through increased fragmentation, edge effects and reduced habitat value (Esbah et al. 2009; Wu and Plantinga 2003). Thus, as more people seek to benefit from the natural amenities provided by rural areas, those same amenities become endangered (Harper and Crow 2006; York et al. 2011). This is a predominate issue within the southwestern U.S. where such development patterns tend to be the norm (York et al. 2011). In this paper, we describe the results of a survey to explore how city size and growth relate to attitudes, beliefs and ultimately management of open space. We were specifically interested to understand how federal land management agencies view the importance of open space given different city sizes and degrees of urbanization because federal agencies administer

a large proportion of land in the SW (Fig. 1). Where cities have experienced rapid expansion, open space might be viewed as more valuable because of its increasing rarity (Kline 2006). Alternatively, as pressure increases from more diverse and populous users, attitudes regarding open space utilization and management may become polarized among stakeholders. We focus on three cities that represent a range of growth conditions within the southwestern United States: Phoenix, Arizona and Albuquerque and Las Cruces, New Mexico (Fig. 1).

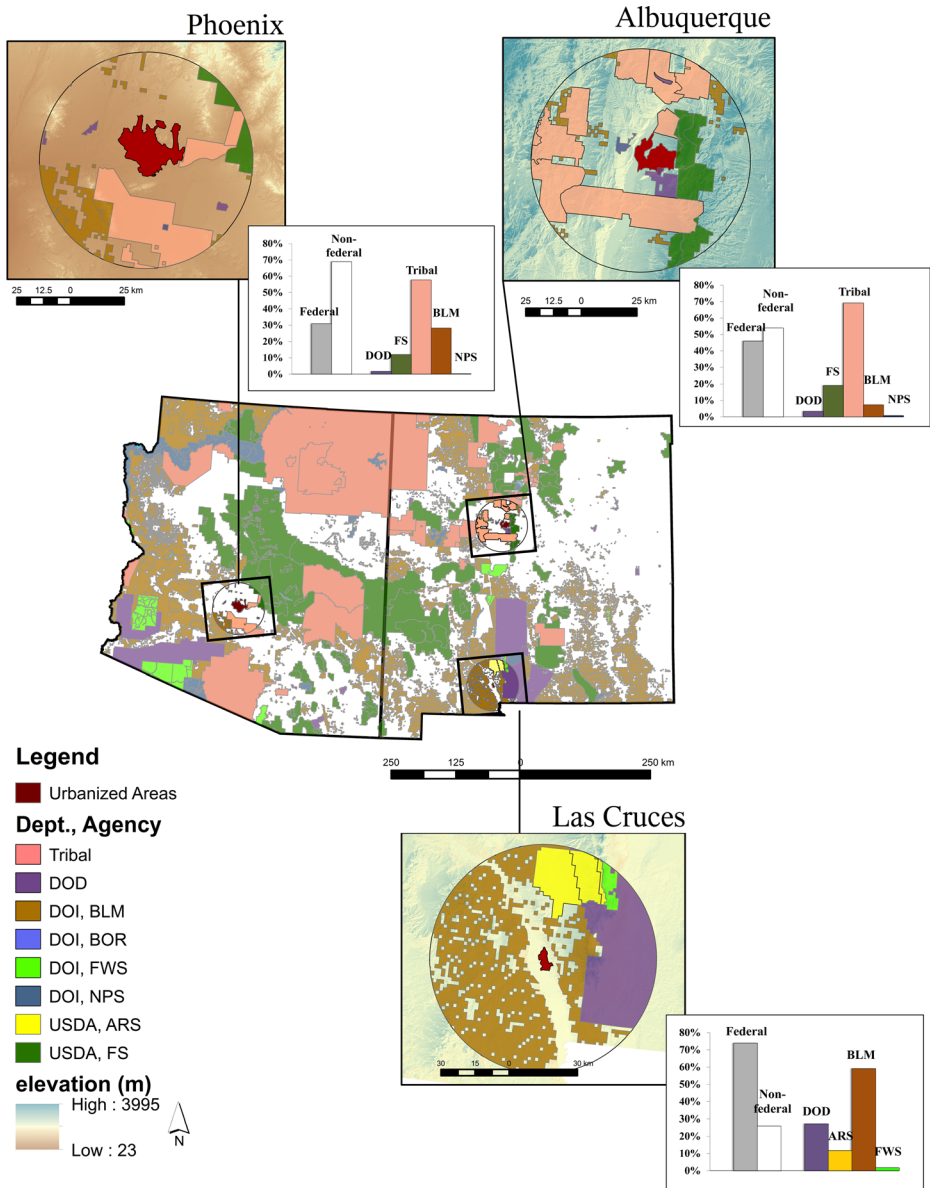


Fig. 1 Arizona and New Mexico have large areas of federally managed and non-private lands. Insets show proportion of land managed by different entities within 50 km radius of three cities under study

Historically, the economies of Phoenix, Albuquerque, and Las Cruces relied on agriculture (Redman and Foster 2008) but following World War II, these cities began to transition to more industrial enterprises (Luckingham 1984). With this shift has come substantial population growth: Phoenix has grown from 80,000 in 1940 to approximately 4 million today and Albuquerque and Las Cruces grew by more than 400,000 and 125,000 people, respectively, between 1950 and 2000 (York et al. 2011). Unlike cities in the northeastern part of the US that were historically dominated by walking and public transit infrastructure, these southwestern cities developed low-density, residential suburban areas dominated by automobile use, with fragmented landscapes on the urban fringe (Grimm et al. 2008; York et al. 2011; Boone et al. 2012;). Patchy development has resulted from the relatively unhindered room for growth provided by vast expanses of flat agricultural or undeveloped land. Thus, these cities typify many of the issues inherent in rural development (Harper and Crow 2006): lack of efficient infrastructure, longer commute times and associated energy expenditure and air quality concerns, and conflicts due to ‘leapfrog’ type development (York et al. 2011; Heim 2001). Some (Benedict and McMahon 2002; York et al. 2011) suggest that in this setting there is a great need to preserve existing open space and create open space sustainability plans so that southwestern cities will continue to benefit from natural resource amenities

To fully understand how decisions are made for conserving open space under population growth, we must consider the management framework in which these spaces exist (Hermansen 2003). Publicly owned, non-private lands are the most common source of open and green spaces within urban areas. This holds true in our study where non-privately held (federal, state, tribal, and military) land accounts for roughly 83 % of Arizona and 53 % of New Mexico (Fig. 1). Likewise, approximately 40 % of the total land in the vicinity of Las Cruces, Albuquerque and Phoenix are publically held (Fig. 1). Non-private lands are managed by multiple local, state and federal agencies, each with cultures that guide decision making processes (Kurtz 2003). There is, therefore, a complex matrix of open space types and purposes where decision making processes are not linked and often lack a unified vision (Bengston et al. 2004). Local urban managers are often focused on economic growth with only secondary consideration of environmental and social concerns, which hinders the establishment of urban sustainability strategies (Giddings et al. 2002; Sanchez-Rodriguez 2008). In contrast, many federal and state managers work at larger spatial and temporal scales and are less focused on specific urban issues (e.g. DOI’s Strategic plan 2011–2016 and BLM’s National Landscape Conservation System, 2011, but see USFS’s Open Space Conservation Strategy, 2007). This unlinked condition challenges attempts to study open space value and management outcomes (Pauleit and Duhme 2000) and may diminish the efforts of land management agencies to preserve important ecosystem services. We focus on federal land management agencies as a first step towards understanding how trends in population growth, personal attitudes and beliefs, and institutional mandates influence land management decision making processes. Federal agencies generally play a small role in growth management due to a lack of a unified national land use strategy and a general lack of authority over private or locally owned land use and development (Bengston et al. 2004) yet they manage a majority of the open space land proximate to these cities (Fig. 1). Agency mission, particularly among federal land owning agencies, is an important influence on management practice and implementation. Underlying agency mission is agency culture, which encompasses the values, visions, beliefs and habits of organizations at broad levels (Allaire and Firsirotu 1984; Kurtz 2003; Apple 2000). Though it is outside the scope of the current study to address agency culture, we can explore differences in perceptions regarding agency mission.

We have little information on how land management agencies incorporate considerations of ecosystem services and preferences into management actions (Ernstson 2008). Successful strategies and plans to preserve open space require substantial buy-in and coordination from a variety of land management agencies (Bengston et al. 2004). However, the fragmented nature of management regimes of urban governance hinders such sustainability planning (Bengston et al. 2004; Kern and Alber 2008). To date, no studies have addressed the role of federal agencies in open space preservation in the fast growing urban centers in the western U.S. We also lack studies which link the potential influence of population growth on open space valuation to federal agency decision making processes. Through an analysis of federal land management agency personnel, we aim to describe how perceptions on the use, preservation and management of open space are influenced by the context of the city size and population interacting with land use and management views. In this way, we can identify common goals and concerns to better understand the next step for creating functional open space plans and strategies.

Methods

1) Study Location:

We focused our analysis on the southwestern states of Arizona and New Mexico. Although New Mexico has a somewhat greater land area (121,298 sq. miles versus 113,594 sq. miles), it has a smaller population and metropolitan (metro) areas (Fig. 1). Arizona's population is three times greater (6,626,624 versus 2,085,287) and more dense (56.3 versus 17.0 persons/mi²) than New Mexico's (U.S. Census 2013). There are also ethnic, linguistic, and income differences between the two states. The median 2012 household income in Arizona is \$50,752 while it is \$44,631 in New Mexico (U.S. Census 2013). In New Mexico the major ethnic groups are: Hispanic/Latino 46.7 %, White/Non-Hispanic 40.2 % and American Indian/Alaska Native 10.1 %. In Arizona the composition is: White/Non-Hispanic 57.4 %, Hispanic/Latino 30.1 % and American Indian/Alaska Native 5.2 %. In New Mexico 36.2 % speak a language other than English in the home while 27.1 % of Arizona households report a language other than English spoken in the home. The three cities under study, Phoenix, Albuquerque, and Las Cruces, differ in geographical extent and population size (Fig. 1). The Phoenix metro area population is four times as large (4,192,887) as the largest metro area in New Mexico, Albuquerque (900,000) (US Census Bureau, <http://quickfacts.census.gov/qfd/>). Las Cruces population is 101,047. All three cities are located in arid areas, have mild to moderate winters with hot summers, rely on irrigation for agriculture, and are surrounded by large areas of public land. Proportion of federal lands proximate (50 km) to each urban center is inversely related to urban population size. These characteristics provide us with a range of conditions against which we test how degree of urbanization or city size influences attitudes and beliefs.

2) Target Population:

We focused our analysis on federal land managers and professionals with jurisdiction in one or more of our target study locations. To assess perceptions regarding open space importance and management, we conducted an online survey using SurveyMonkey (<http://www.surveymonkey.com/>). We targeted employees of the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (BOR), National Park Service (NPS), and Fish and Wildlife Service (FWS) within the Department

of the Interior (DOI), Air Force and Army Installations and the Army Corps of Engineers within the Department of Defense (DoD), and the U.S. Forest Service (USFS), Natural Resources Conservation Service (NRCS), and Agricultural Research Service (ARS) within the Department of Agriculture (USDA). We generated an email list from directories available online or in printed form for all federal employees who held management or professional positions in natural or cultural resource management or research. Emails for DoD personnel were gathered with the assistance of installation points of contact who forwarded relevant contact information to our team.

3) **Survey:**

Within a letter of intent, introductory email and the survey, we described open space as:

Undeveloped lands or lands that are managed for public recreation, preservation of important ecological or cultural resources, or similar public benefit. Open space may include scenic, cultural, and recreational resources, agricultural lands, fish and wildlife habitat, and other ecologically important areas, with varying levels of public access.

- 3.1 **Content-** We constructed a survey of 30 Likert questions divided among 5 topical areas (Online Resource 1): **1)** Agency role. This section solicited respondent's views of their agency's management and decisions regarding open space. **2)** Homeowners/Stakeholder values. This section identified agency employee perceptions of homeowner/stakeholder views concerning residence near public lands. **3)** Open Space Utilization. This section identified respondent's perceptions regarding the importance and use of open spaces. **4)** Open Space Planning. This section dealt with ongoing and future issues for providing open space. **5)** Land Use conflicts. Questions in this section dealt with the respondent's perceptions regarding continued growth trends and issues.

Respondents could select among 6 response categories: Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), Strongly Disagree (SD) and Not Applicable (NA). Unlimited comments were allowed after each question and respondents could skip questions. We also collected demographic information.

- 3.2 **Administration-** We sent a letter of intent to agency heads to verify participation and gain permission for survey activity. We pre-tested the survey on a group of FS employees and collaborators to identify appropriateness of survey questions and wording. We emailed the survey using SurveyMonkey to 918 target employees on August 22, 2011. We used SurveyMonkey functions to limit submissions to one per individual. We also used SurveyMonkey to send weekly reminders to participants who had not yet started the survey. Because these are automatic functions available through SurveyMonkey, we personally never viewed participant names or email thus maintaining respondent anonymity. We closed the survey on September 27, 2011.

- 3.3 **Response and Non-Response Bias-** Response or social desirability bias is the tendency to respond in a way that will be viewed favorably by others or to respond in the way the questioner wants (Bowling 2005). We avoided some response bias problems by maintaining strict anonymity in the survey. In addition, the questionnaire was administered impersonally via computer to provide a higher sense of neutrality and discourage response bias. Email surveys may also generate more candid responses from participants (Trayhmann et al. 1999). Non-response bias

occurs when the answers of respondents differ from the potential responses of those who do not answer (Groves et al. 2002). Non-response bias becomes a problem when a probability sample is being used to generalize to a larger population. However, we did not use a probability sample and do not attempt to generalize our results to a larger population. We also tried to increase the response rate by sending out weekly reminders to those who had not responded, a “last day” alert, and implementing a single time extension. In total we sent out four reminders.

4) Quantitative analysis:

We analyzed Likert responses using an ordered logistical regression analysis and paired comparisons (Sidak adjustments) (SAS 9.2) to determine level of agreement across each independent variable. The survey allowed users to skip questions and so the number of responses available for statistical analysis varied among questions. Due to the small number of respondents in certain demographic categories (Fig. 2), we combined agencies and analyzed differences in agreement (dependent variable) among employees from each of the primary departments, **DoD**, **USDA**, and **DOI** as well as analyzed level of agreement across the three metro areas, Albuquerque (**ABQ**), Las Cruces (**LC**), and Phoenix (**PNX**). Grade level is also likely to influence responses because it is an indicator of tenure as well as familiarity with agency mission. We explore this effect by dividing the analysis among three pay-grades: entry level employees (**GS9** or lower), professionals (**GS11–13**), and managers (**GS14** and above).

Our data showed a strong left skew (most respondents agreed, Table 1) and we combined SD and D categories: our final response categories were: SA, A, N, and D. Seventy-four individuals reported jurisdiction in more than one

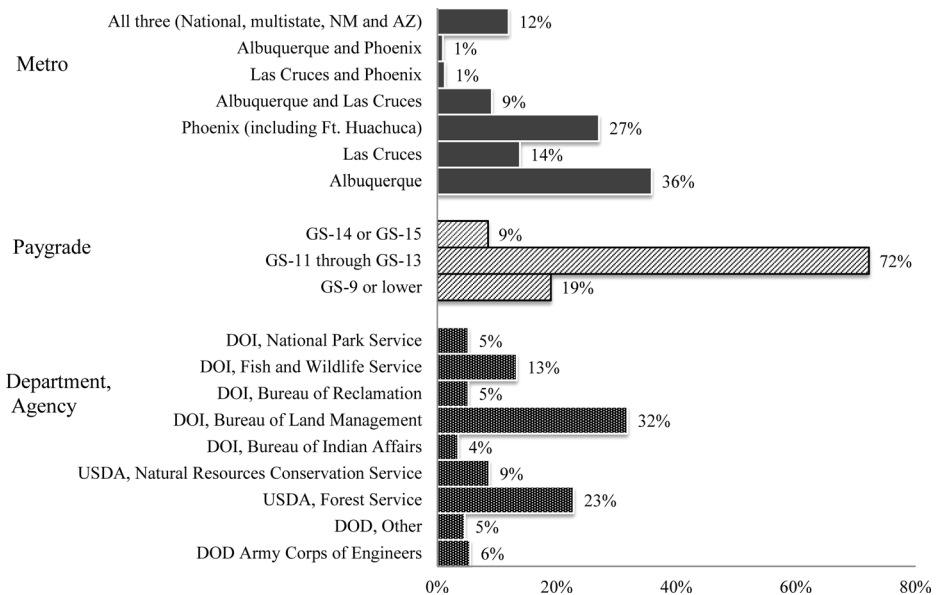


Fig. 2 Breakdown of respondent demographics for three categories: Jurisdiction of managing agency/office; Pay Grade; and, Department, Agency

Table 1 Percent response per Likert category

Question	SA	A	N	D	SD	n	Mean	StDev
1	54%	35%	7%	2%	1%	321	1.65	0.91
2	23%	39%	21%	10%	5%	320	2.39	1.19
3	27%	45%	17%	3%	3%	321	2.22	1.22
4	28%	52%	13%	4%	2%	321	2.06	1.01
5	38%	47%	10%	3%	0%	320	1.87	0.97
6	3%	16%	16%	43%	19%	318	3.70	1.14
7	7%	28%	36%	11%	3%	320	3.23	1.47
8	77%	22%	1%	0%	0%	317	1.25	0.48
9	70%	25%	3%	1%	0%	315	1.35	0.60
10	78%	20%	2%	0%	0%	313	1.25	0.49
11	30%	40%	15%	11%	4%	309	2.17	1.11
12	5%	32%	29%	27%	7%	316	2.99	1.04
13	38%	45%	8%	7%	2%	313	1.88	0.93
14	10%	26%	21%	35%	8%	313	3.09	1.19
15	21%	50%	15%	8%	4%	313	2.24	1.03
16	6%	37%	27%	12%	3%	313	3.12	1.46
17	8%	43%	26%	7%	3%	310	2.94	1.48
18	9%	35%	22%	19%	5%	311	3.10	1.44
19	4%	27%	27%	21%	7%	312	3.44	1.42
20	37%	40%	13%	9%	1%	310	2.00	1.02
21	30%	44%	11%	12%	1%	308	2.15	1.11
22	36%	45%	12%	7%	1%	304	1.92	0.90
23	25%	46%	14%	10%	2%	308	2.28	1.19
24	40%	51%	5%	1%	1%	302	1.78	0.96
25	31%	47%	10%	6%	1%	307	2.15	1.27
26	39%	51%	6%	1%	0%	306	1.80	0.94
27	31%	53%	11%	3%	0%	306	1.96	0.98
28	27%	56%	9%	5%	0%	303	2.01	0.96
29	30%	41%	10%	1%	1%	304	2.54	1.74
30	8%	33%	28%	14%	3%	310	3.16	1.50

(SA strongly agree; A agree; N neutral; D disagree; SD strongly disagree) and mean and standard deviation for 30 questions regarding open space decision making processes. Means are based on numerical range 1–5 where 1 represents SA and 5 represents SD. Blue shading highlights the 3 most common responses for each question where darker colors indicate greater response frequency. Font colors indicate top 10 % questions (highest agreement-Bold) and bottom questions (least agreement- *Italics*) Lines indicate survey category breaks (see text) See Online Resource 1 for questions

metropolitan area. We conducted pair-comparisons to generate results based on the occurrence of each reported claim to each metro area using estimate statements within SAS Logistic procedure. Estimate statements compare all instances of one city against all instances for the other two cities. For instance, in the case that we have 20 respondents each reporting from ABQ only and LC only and 1 respondent reporting from ABQ and LC, the analysis calculates least squared means estimates and odds ratios for 21 ABQ respondents against 21 LC respondents. This method provides information on the influence of each metro area on response independent of whether an individual self-reported from one or multiple metro areas.

5) Qualitative analysis

We summarized and analyzed comments provided by respondents to identify underlying attitudes regarding how agency mission, city size and personal preferences of agency personnel influence agency decisions. This qualitative analysis offered an added, in-depth view of the role and importance of open space to the various agency personnel who participated in the survey. We received a total of 699 comments from all 30 survey questions (Online Resource 3). All comments were counted, recorded, and ordered by agency and by metro area. Comments were voluntary and, thus, this analysis only represents the opinions of those who chose to provide more detailed written information.

Results

We received surveys from 357 of 918 or 38 % of the respondents. We dropped 25 surveys sent to non-targets (e.g. Jurisdiction in Texas and Colorado, administrators) or that were blank. Our final dataset consisted of 322 surveys (35 % response rate) from nine agencies (Fig. 2). Survey respondents tended to agree with questionnaire statements (Table 1). Overall, we found significant effects for 9 questions (Figs. 3–5). City pair differences were identified for 4 questions (2, 15, 20, and 23), with a consistent tendency for respondents from Phoenix to agree more with statements than those from other cities (Fig. 3). Department level differences were seen for 3 questions (2, 11, and 22) with the most common difference occurring between DoD and other departments (Fig. 4). Pay-grade accounted for the largest number (6) of differences (questions 14, 15, 19, 20, and 22) with differences consistently detected between the highest and lowest pay grades (Fig. 5). We found multiple effects for two questions: 20 and 22, which regarded the threat from growing populations and urbanization, respectively. Higher pay grades were less likely to agree that increased population and urbanization constituted a threat to open space. DoD personnel agreed more than other departments that urbanization is a threat and respondents from Phoenix were more likely to agree that increased population is an issue.

We analyzed comments for questions that showed a significant difference in level of agreement among groups (9 questions, Figs. 3–5; Online Resource, 4) or that generated a large amount of feedback (specifically questions 5 and 30). Ultimately, we derived 51 comment theme groupings (Online Resource 2) from a total of 306 comments associated with these 11 questions. Comments for all questions can be found in Online Resource 3. We further consolidated this list to 12 common themes (Table 2). The predominant issues as identified by total number of comments regarded the relevance of the question to the respondent's agency, the definition of open space, accessibility of open space and increasing human use of open space (Table 2).

1) Agency Role:

Respondents showed a high level of agreements with questions in this section (Table 1; Online Resource 1) reflecting a largely positive view of agency role in the management and preservation of open space. We found significant effects for two of four questions (questions 2 and 3) in this section.

Question 2. Respondents from USDA and DOI were 2.7 and 2.6 times, respectively, as likely to agree as respondents from DoD that providing and managing open space was a major focus area of their agency (Fig. 4). Agencies which do not manage land

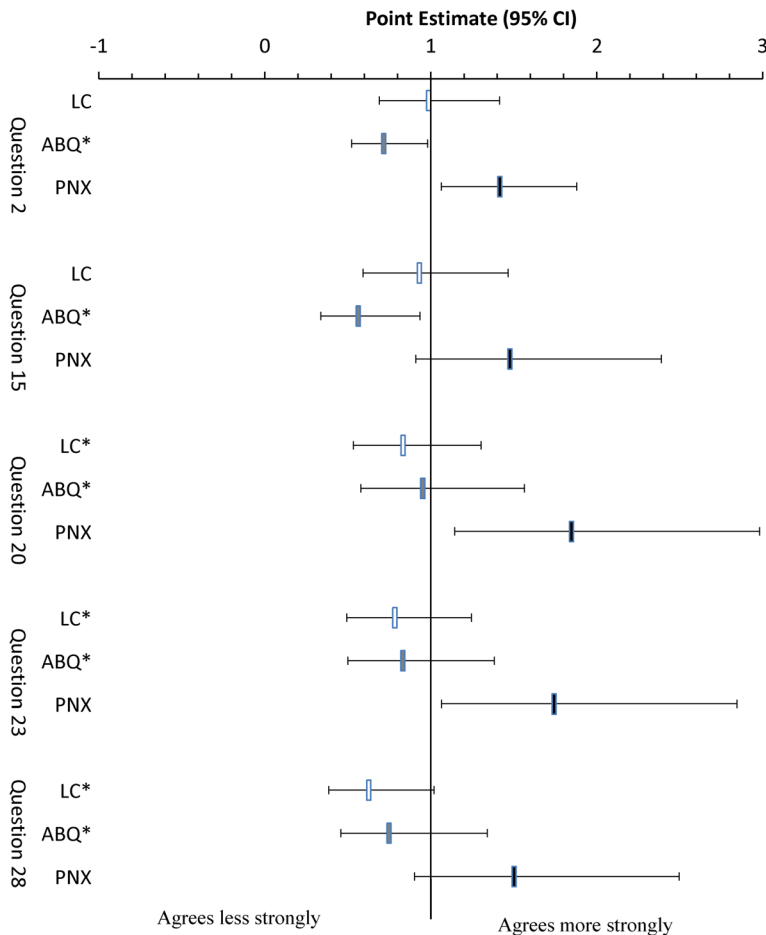


Fig. 3 Odds ratios from a logistic regression to assess federal attitudes regarding open space in a tri-city analysis. Tick marks indicate degree to which respondents from a particular city agree with the question-statement. Asterisks indicate the trend of agreement was significantly different from Phoenix

for natural resources or recreation (e.g. DoD and NRCS) comprised the majority of the 36 % that gave N, D, or SD responses (Table 1). Respondents from ABQ also agreed significantly less with Question 2 than those from PHX. There were 25 comments for this question (Online Resource 3). BLM responders from LC felt recreation is a large part of their open space management and stated “there are four BLM recreation sites and numerous trails on public land within 30 miles of LC.” BLM comments from both ABQ and LC mentioned their concerns over land disposal, “We need to quit selling (land) to cities and counties that simply want more land to build residential and commercial structures.” An FS comment (ABQ) noted that providing open space is a major focus area of the agency but “neither Congress nor the public trusts the agency land managers to have the skill set to care for the federal land.” There was the feeling among respondents that top managers have not conveyed the importance of funding the agency for management of public lands with the goals of preservation and maintenance (Table 2; Online Resource 2,

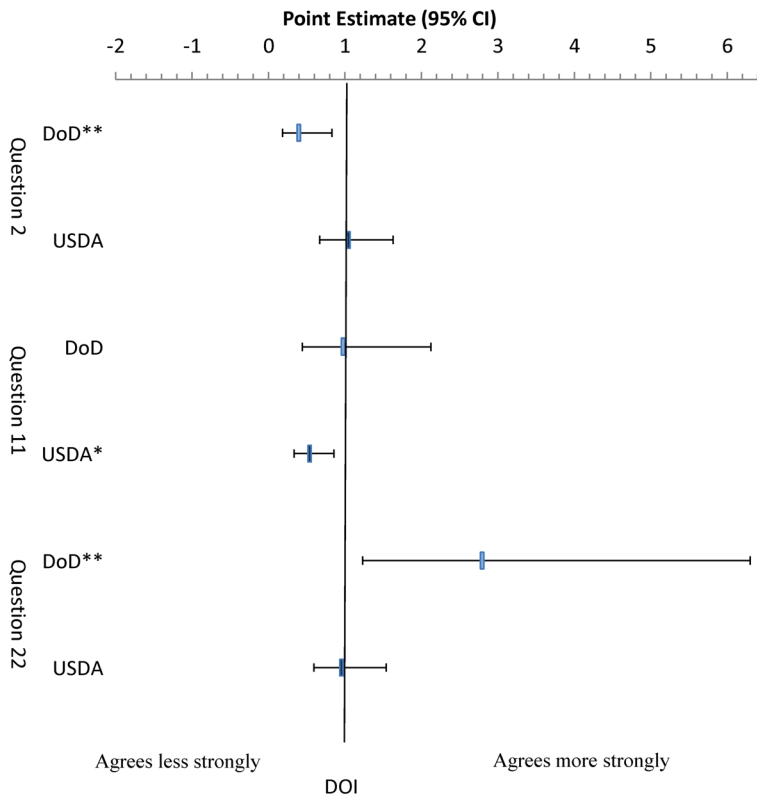


Fig. 4 Odds ratios from a logistic regression to assess federal attitudes regarding open space in a tri-city analysis. Tick marks indicate degree to which respondents from federal departments agree with the question-statement. DOI was the comparison group in the analysis and is represented by the line. Departures in degree of agreement for USDA and DoD are shown relative to this standard. Single asterisk indicates significant difference in agreement from DOI. Double asterisk indicates DoD was significantly different from both DOI and USDA

3). Also in ABQ, open areas of multiple use are the focus of considerable concern because of the incompatibility of some uses such as OHV riding and hiking. A tendency towards more negative views by New Mexico commenters regarding the provision of land to cities for development may explain why ABQ and LC showed significantly less agreement on question 2 as compared to those from PNx. In general, the land and resource managers viewed their agencies as having a focus on providing open space for various reasons but worry about sale of lands, conflicting uses, and adequate funding for the work they wish to accomplish.

Question 3. GS14 and GS11–13 employees were 4.6 and 2.11 times, respectively, as likely to agree as GS9 employees with the statement that agency mission influences work-related decisions regarding open space (Fig. 5). Ten comments were made for Question 3 (Online Resource 3). An ABQ BLM comment emphasized that multiple use is the focus of the BLM mission not just open space. Comments stressing the importance of multiple uses in agency management occurred with relative frequency (Table 2, c4). From LC, a BLM employee felt that “development and land exchanges are driving forces versus consideration for the good of the public”. An NPS responder felt that the Park Service is suffering from “Mission Drift” emphasizing recreation

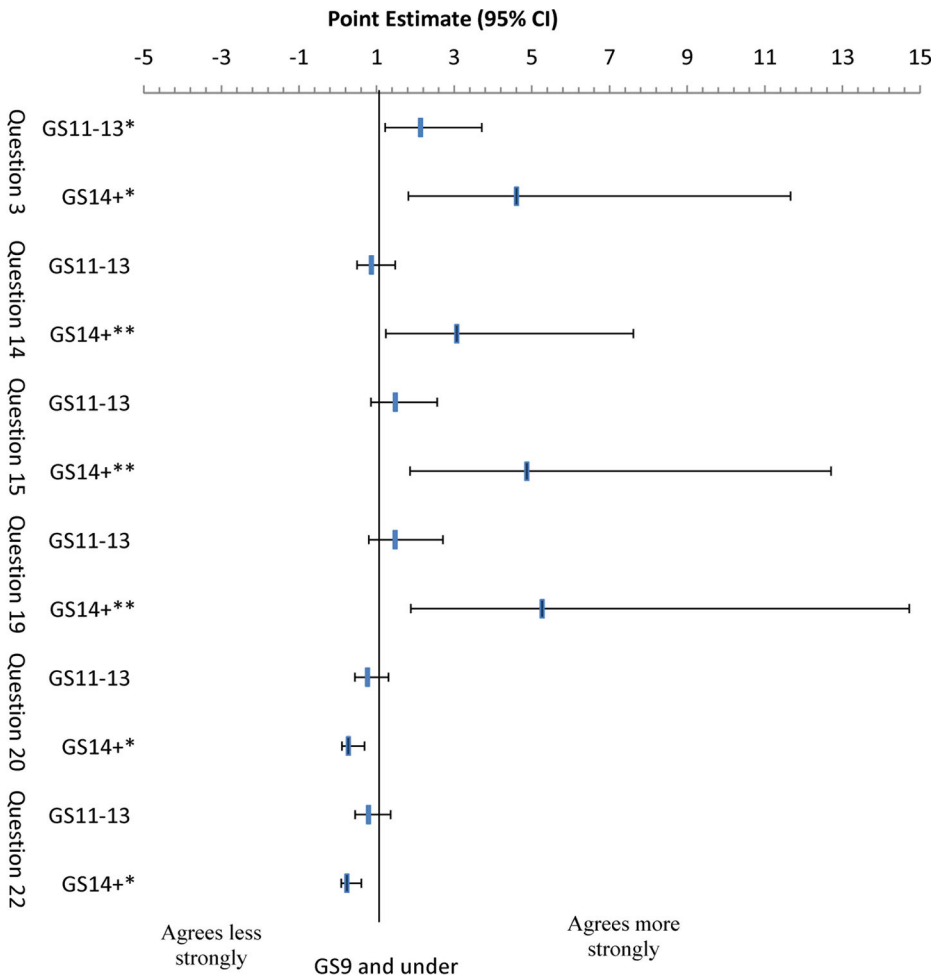


Fig. 5 Odds ratios from a logistic regression to assess federal attitudes regarding open space in a tri-city analysis. Tick marks indicate degree to which respondents from different pay grades agree with the question-statement. GS9 and under was the comparison group in the analysis and is represented by the line. Departures in degree of agreement for GS11-13 and GS14 and above are shown relative to this standard. Single asterisk indicates significant difference in agreement from GS9. Double asterisk indicates significant difference in agreement with both lower paygrade-levels

over natural and cultural resource protection and that this shift is influencing management decisions to the detriment of the resource. Many comments expressed concerns for the resources and their management and comments reflected statistical trends that showed higher-graded employees were more likely to agree that their decisions are influenced by their agency's mission.

2) Homeowners/Stakeholder values:

There was generally less agreement with the three questions in this section (Table 1). Though not significant, respondents agreed strongly (85 % SA and A combined response) with the idea that homeowners may feel that they benefit from nearby open space

Table 2 Recurring comment theme groupings

Theme	Number
C1. This question is not applicable to me or my agency for various reasons.	24
C2. Open space provision and management are not major emphasis areas of the agency, although some open space is managed .	12
C3. Public land can be considered open space; private land cannot be regulated and cannot be considered open space (Example: farm land is considered private and is not considered to be open space).	36
C4. Multiple use mandate, support sustainable multiple uses on public lands.	5
C5. Homeowners see value in living near public lands.	8
C6. Closing open space to the public is a bad idea. Conservation is important but is not the only component of open space management. Open space should be for the enjoyment and education of all.	28
C7. Conservation and preservation are important—come before irresponsible use.	8
C8. Open space depends on use and accessibility by the public—also on compatible use and management of the land such as for wildlife viewing (in discussion of farmlands as open space).	29
C9. There is no discussion of this in my agency. My agency is not doing anything/enough to address projected shifts in demographics related to age and ethnicity.	8
C10. Increasing human use from growing populations presents challenges that need to be addressed in planning. A concern—not a threat.	13
C11. Increasing human use could be a threat if not managed properly. Depends on the use and the amount of increase.	39
C12. Agree with the statement that increasing human use from growing populations is a threat to lands, resources, water, and/or open space. Already see the effects.	9

List of 12 common themes from the 51 comment theme groupings derived from a survey of open space management by federal managers. Common themes were defined as those where at least 5 individuals gave similar comments. See Online Resource 2 for a complete list of comment theme groupings and Online Resource 3 for a complete list of all comments

(question 5), and made over 34 comments (Table 2; Online Resource 3). A FS commenter from ABQ believed some homeowners may see too much benefit in living adjacent to open space, “When everyone sees how beautiful the forest is, they want to move there and encroach on the forest boundary.” Other FS in ABQ felt that fire is a danger that is underestimated by landowners who then want the FS to treat the land, and there is not enough funding. Another comment from ABQ BLM stated “proximity to public land drives up real estate value and at times makes the bordering residents troublesome to other recreationists.” “(Some) think it is their private paradise and all the other land users better keep off.” Most respondents were of the opinion that those living near public lands view the location as a benefit (Table 2, c5). Many who commented stressed the problems agencies have with these neighbors and their failed expectations.

3) Open space utilization:

We found a high level of agreement for all but 2 questions (questions 12 and 14, Table 1) in this section. Only 37 % of respondents felt that open space should be used primarily for recreation (question 12) and 36 % of respondents agreed that farmlands should be considered open space (question 14). Results generally showed strong support for the importance and use of open space but less agreement when defining what type of lands constituted open space. We found significant differences for three (questions 11, 14, and 15) of the eight questions.

Question 11. Respondents from the DOI were 1.86 times as likely to agree as respondents from USDA with the statement that open space should be used primarily for conservation or preservation of ecosystems and their components (Fig. 4). Forty-four individuals commented (Online Resource 3). Interestingly, many comments expressed areas of disagreement, reservations or clarifications. A series of BLM comments from all three metro areas provided the following views. From ABQ: “While the best method of conservation/preservation may be to keep people out, open space should be for the enjoyment of the public....closing an area is not management, it is a lazy way to not manage.” However, from LC: “There should be a balance between conservation and public use. Conservation and preservation are very important; however, people should be able to explore this area so the ecosystems can be appreciated first hand”. From PNX: “Open space should be used for the enjoyment of all species, including humans. Access to these areas for walking, hiking, family outings, enjoying nature, is the reason for such places.” This theme of public access for education and enjoyment was common across agencies, and garnered 28 comments (Table 2, c6). Another frequent theme focused on the importance of responsible use, which received eight comments (Table 2, c7). The FS in ABQ and PNX stressed a balanced approach between conservation and public access. Education was emphasized on the topic of ecosystem conservation and preservation. In PNX multiple use was mentioned—with conservation, preservation and recreation all seen as important components. Comments from the other agencies and departments such as FWS, NPS, and DoD also focused on the combined roles of conservation and education. From the NPS in LC: “Added to conservation and preservation should be appropriate recreation opportunities to build stewardship and to educate people”. Comments highlighted the role of multiple use and the restorative aspects of open space for the well-being of people.

Question 14. Individuals from the highest pay-grade category GS14+ were 3.5 and 3 times as likely to agree as GS11–13 and GS9, respectively, that farmlands should be considered open space (Fig. 5). Forty three individuals commented (Online Resource 3). A common theme among all respondents was that farmlands are private and cannot be considered open space if the government does not have control. Open space implies access and recreational use to these commenters, even though the survey definition of open space included agricultural land and lands with varying levels of public access (29 comments, Table 2, c8). Some said farmlands could be perceived as open space as they contribute to an open feeling. The FWS from PNX stated “Active farmlands can function in some capacities as open space, but typically there is little opportunity for recreation on these areas and depending upon the farming operation, it may be difficult to manage for multiple species and water quality.” Another who agreed with the statement remarked “I think that the small orchards and farmlands near the ABQ Bosque fit the criteria for urban open space and make the city much more livable than it would be without them.” Though some viewed a more limited, visual role as open space for farmlands, most did not view farmlands as open space owing to their private ownership and usual lack of public access.

Question 15. Employees in the highest pay-grade, GS14+, were 3.2 times and 4.8 times as likely to agree as GS11–13 and GS9 employees, respectively, that rangelands should be considered open space. We also found differences among metro area where respondents from ABQ agreed less than individuals from PHX. Forty one individuals commented (Online Resource 3). Comments showed stronger agreement with this question versus question 14 relating to the existence of publicly owned rangelands,

whereas most farmlands are not publicly owned. Responders felt rangelands could be considered open space, especially if there is also public access for recreation. Like farmlands, private ranchlands were not considered open space. A LC BLM comment stated “Rangeland can be open space, but the users need to be respectful of the livestock and improvements.” Phoenix comments were in a similar vein and said rangeland could be considered open space if it were public land that allowed public recreation. Other agencies (FS, FWS, and NPS) commented that properly managed public rangelands could be considered open space but not private rangelands. Actual use, access, and public ownership were the key factors among those who expressed an opinion, not the visual aspect of the land.

There was a high level of agreement across all respondents that presence, accessibility, and provision of open space now and in the future are important: question 8 had 99 % agreement, 9 had 95 %, and question 10 had 98 % agreement (Table 2). The majority (83 %) also agree that open space should be managed for multiple uses where possible (question 13), again stressing the importance that certain agencies such as the BLM and FS place on multiple use management.

4) Open Space planning:

In contrast to the other sections of this survey, we received very few SA and a relatively high proportion of N responses for statements in this section (Table 1) indicating less agreement with ideas that agencies are planning for future population growth and urbanization. One of 4 questions had a significant effect: Employees in the highest pay-grade category (GS14+) were 3.5 and 5.25 times as likely to agree as GS11-13 and GS9, respectively, that their agency is addressing projected shifts in demographics related to age and ethnicity in land use and land management planning (question 19). Of the 22 comments received for this question, eight indicated that not enough is being done (Table 2, c9; Online Resource 3). However, a planner from ABQ and LC replied “I can attest that we consider social and economic trends in our land management planning.” FWS responded that they are trying to encourage youth toward more outdoor wildlife oriented appreciation and activity (from ABQ, LC, and PNX). Some other comments indicated that ethnicity of the public should not be a consideration for land use planning (BLM). Another commenter felt that the population is aging and putting more land into wilderness is restricting access to that demographic (BLM, LC). An LC NPS responder, on the other hand, felt that the Park Service is moving toward universal access in too many areas. “At a certain point some wilderness areas and activities just may not be possible for everyone depending on their physical limitations.”

5) Land Use conflicts:

There was a high level of agreement with the statements in this section (Table 2), indicating personal beliefs that land use conflicts relating to population growth, urbanization and competing needs are and will continue to be a problem. We found significant effects for three of 11 questions (questions 20, 22, and 28) and a notable number of comments for question 30.

Question 20. We found both Pay grade and cities differed in their level of agreement that increasing human use from growing populations constituted a threat to lands, resources, water and/or open space: GS11-13 and GS9 employees were 2.8 and 3.7 times more likely, respectively, to agree than GS14+: and individuals from PHX agreed more strongly than individuals from ALB or LC. Question 20 had 39 comments

(Online Resource 3). As one upper level manager commented, “the answer needs several caveats. WISE use and management that actually protects the areas will make their value much more apparent to future generations than they are to the current one.” From ABQ: “It’s a concern, not a threat, a consideration that needs to be addressed in planning. It requires active management (BLM)”. From LC (BLM): “Humans are not a threat. Some (very few) human destructive actions are a threat, but we have ways to deal with those with LEOs (Law Enforcement Officers), rangers, etc.” Another BLM comment from PNX: “Not as long as we have the personnel and funding to do our jobs, which is manage the land appropriately. If the land is managed properly, protections are taken in sensitive areas, the population is educated, then growing populations may not be a threat to lands, waters, and open spaces.” An FS comment from ABQ stressed the importance of public education on responsible open space use. “Human use can be detrimental, but it is the agency’s responsibility to determine what types of activities are appropriate, then plan for, design and manage them.”

Question 22. We found differences in level of agreement among Pay grade and Departments that increasing urbanization, both within and on the edges of the metropolitan area(s), is a threat to lands, resources, water and/or open space: GS14 + employees were 3.35 and 4.3 times as likely to agree as GS11-13 and GS9, respectively and DoD employees were 2.9 and 2.8 times as likely to agree as USDA and DOI, respectively. Statistical trends were supported by 27 comments left for this question. One manager from PNX notes “people have the right to enjoy the land but without damaging it...will require more aggressive education.” Another, “Agencies must be leaders in helping people understand and value their natural resources.” An FWS comment from ABQ/LC noted that “proper planning could address some of the stresses that urbanization is causing on quality wildlife habitat areas...” Good urban planning and management action was suggested as an antidote to the impact of increasing urbanization.

Question 23. Individuals from PHX agreed more than those from ALB or LC that increasing urbanization, both within and on the edges of the metropolitan area(s), impacts their ability to manage lands, resources, water and/or open space. Among the 21 comments, many respondents felt that management under these circumstances can be a problem—especially those individuals from PNX. In PNX, it was felt that increasing population leads to more diverse opinions and competing “wants” from the public. An FS responder from PNX noted that law enforcement is the major problem with typically urban issues such as murder and violence on public lands adjacent to the metro area. An Albuquerque BLM comment said “land adjacent to metro areas is almost unmanageable due to public protests and appeals.” From ABQ and LC, an FWS respondent discussed how floodplain encroachment, fragmentation along river corridors, changes in land use practices, and separating water rights from agricultural lands impacts their agency’s ability to retain connected wildlife corridors. Another FWS commenter repeated the statement that people management is more difficult than land management.

Question 30. Though not statistically significant there were 18 comments regarding the personal belief that a respondent’s agency has adjusted how it manages and provides open space in response to increasing city size. A BLM comment from LC stated “I used to feel that we were managing/allowing for open space, but currently I think management has lost sight of this important aspect we used to provide.” An FS employee in ABQ responded that an “increasing population has created a need for open space but the agency has not been able to respond to those needs due to

limitations in staff and a decreasing budget.” A staffer from PNX remarked that the agency “has adjusted but is not keeping up”. The FWS from ABQ and LC stated the agency “is under pressure to provide for urban refuge experiences, which can be a part of the solution to improving planning decisions in the long run, but with very limited resources.” They also said the agency has adjusted but added that the change was not always to the benefit of wildlife. Agency views on adjustment were mixed, highlighting problems such as inadequate staffing and funding for the task at hand.

Discussion

The results of the survey showed strong personal support for the preservation of open space and a high level of agreement regarding the importance of open space. Indeed, significant differences among respondents were typically driven by the proportion of strongly agree versus agree responses (Table 1). The majority of respondents did not agree, however, with statements that said homeowners were negatively impacted by open space or that farmlands should be considered open space. This latter result is interesting because though the survey supplied a definition of open space that included public lands, private lands, wilderness, and agricultural lands, responders generally felt public land could be open space, while private land was not (36 comments, Table 2, c3). Within the respondent population, open space was interpreted mainly as a source of recreation. As has been found with other studies, accessibility appears to be an important characteristic of open space (Brander and Koetse 2011; Jim and Shan 2012) (29 comments, Table 2, c8).

This survey of federal employees was conducted across three different metropolitan areas to better describe the relationship between city size and attitudes regarding land management decision making processes (Boone et al. 2012). We found clear and consistent differences among the metro areas surveyed. Respondents from Phoenix tended to agree more strongly with survey questions than individuals from Albuquerque and Las Cruces. Most commonly, differences existed between Las Cruces and Phoenix (Fig. 2). To determine whether differences were driven by regionally specific attitudes, we repeated our analysis with respondents grouped by state instead of metro (analysis not presented). We found identical patterns to those obtained from metro level analyses: for each question respondents from Arizona agreed more with the statements than New Mexico, which may indicate differences are driven by other factors in addition to city size. However, as was the case for most of the questions, significant trends were driven by differing levels of agreement rather than disagreement. A recent regional comparison found variations in preference that likely relate to differences in supply and quality of open space, historical land-use practices, and cultural context (Brander and Koetse 2011). Our results may reflect the unique characteristics among the study states. Arizona has a greater population, a larger main city and urbanized area, and substantially less private land than neighboring New Mexico. New Mexico also has a larger Hispanic population.

Differences in level of agreement regarding future threats and management difficulties may also vary among our study cities due to a natural evolution of open space management as cities grow (Brander and Koetse 2011). Each of the cities studied here lies along a unique part of the development spectrum. The results of our analysis support the contention that open space is valued more highly in areas where development has encroached on open lands because open space becomes more scarce (Kline 2006). Further, there tends to be a greater interest in preserving agricultural lands where population densities are rapidly increasing (Kline 2006). Phoenix has seen a 32 % decline in agricultural land and a corresponding 168 % increase in

urban land use between 1975 and 1995 (Knowles-Yáñez et al. 1999). Preliminary land-use land-cover change data from Las Cruces shows a decline in farmland from 89 % of the city to 23 % since 1955 and rural residential and urban land uses rose from 0.5 % in 1955 to 25 % (from a representative 21,000 ha sample taken in 2007 of Dona Ana County north of Las Cruces, Wright 2014). Despite this growth, Las Cruces maintains a greater amount of agricultural land and a more rural character than Phoenix, which may relate to the attitudes described from the current survey. In the relatively more rural area of Las Cruces, the marginal value of open space is low because there is significantly more open space available, specifically agricultural lands. Though not specifically addressed in our survey, population density rather than city size or growth rate, may also have a strong influence on perceptions of open space (Kline 2006; Brander and Koetse 2011; Boone et al. 2012).

We found personal beliefs and attitudes about open space management differed among respondents from different departments (Fig. 4). We do not know whether attitudes derive from the institutions themselves or are inherent to the personality of individuals who become employed at each institution. It may be that employment within the agency leads to a more positive attitude about open space or, alternatively, those who value open space are more likely to seek employment with land management agencies. We also do not know how well the target population reflects attitudes of the larger metropolitan base or state and regional groups. Within the departments, differences in open space views and attitudes expressed by personnel from the various federal agencies appear to relate to whether their particular agency is involved in natural resource/land management or had a more regulatory or defense-related mission. Many within the latter group explained that open space provision and management is not a mission of their agencies (24 comments, Table 2, c2). Agencies involved in land and resource management include the following: FS, NPS, BLM, and, to some extent, FWS, although their role is largely regulatory. BLM, FS, and NPS have more contact with the public and more open space concerns (Table 2, Online Resources 2 and 3). Other agencies work less with land management and appeared less concerned about open space. As examples, NRCS works with private land owners and does not administer land. The BIA states that the Tribes manage the land not the agency; the Tribes are considered first. The mission of the BOR is water management not land management. The DoD is not primarily concerned with open space except as a buffer from the public and for military use although they do recognize the importance of open space and resource conservation. Perhaps as a result, we found the largest number of differences for comparisons between DoD and the USDA, which was comprised largely of FS agency personnel.

Comments reflected differences among individual agencies in each department with respect to institutional role or mission in open space management (Online Resource 3). Though these comments only represent the views of those who responded and not the agencies as a whole, they may lend insight into the overarching culture of each agency. Agency culture, often defined at the inception of an organization, describes the common set of beliefs and practices that guides interpersonal interactions and the development and implementation of mission actions (Apple 2000). Culture has been seen as a source of resistance for change within organizations and is thought to have a large influence on individual interpretation of conditions and response to learning (Apple 2000; Kurtz 2003). Some NPS comments expressed concerns over a balance in accessibility and open space and over perceived “mission drift” from conservation to recreation. FS responses stressed risk reduction by closing open space areas to risks such as wildfire. Various BLM responders saw problems with land sale (disposal) for development. They also stressed their multiple use mandates. Personnel from the FWS expressed concerns with open space for wildlife and indicated that open space is not just a benefit for humans—there must be access for wildlife.

It should be noted that not all response to the survey was positive. One participant from BLM in Phoenix wrote “I believe this survey is designed to support a preconceived conclusion. Open space management is complicated. Development of open spaces within and at the edge of metropolitan areas is often necessary to protect more important areas further removed from the urban areas. The questions in this survey tend to lead to ‘all development of open space is bad. Therefore, all open space should be protected. This is short sighted.’”

Federal employees generally agreed that population growth was an issue (61 comments, Table 2, c10–12). Supporting continued growth under increasingly scarce water resources leads to considerable conflict in the policy making arena in the Southwest (Harper and Crow 2006; Harlan et al. 2009). However, agreement was less strong among lower Pay-grades when asked whether agencies were prepared for and dealing with population change and growth (Fig. 5). Higher-level employees had more confidence in their agency’s capacity to deal with future open space management issues and were more likely to agree that farmlands and rangelands constituted open space. Presumably higher-level pay-grade employees are more involved in higher-level decision making and implementation of the mission than lower graded workers who may be doing more supervised, on-the-ground tasks. Comments also seem to indicate that higher pay-grade employees considered many issues from a solution based perspective, while lower-graded, on-the-ground employees may not see the proposed solutions being implemented as rapidly as they would like. Specific agency activities and culture could also influence opinions regarding conflict between open space and population growth. For example, those working in forested landscapes often consider increasing population densities an issue for production forestry and managing wildfires in forest-urban settings (Alig and Plantinga 2004; Kline 2006). Interestingly, population growth can be the impetus leading to greater protection of open space where development is expected to cause significant reductions in available open space (Kline 2006). The threat of loss can increase the marginal value of open space, leading to increased public demand and political support for its preservation.

Conclusion

Preservation of open space and population growth are often considered incompatible (York et al. 2011). In the Southwest, there is a trend of low-density development on the urban fringe where parcels are in the midst of natural amenities. Social and external costs of fringe development patterns include greater amount of polluting emissions from traffic and other sources and loss of open space. These development trends may be facilitated by permissiveness in attitudes by decision makers who are strongly influenced by homebuyers and developer’s preferences (Ewing 1997; Logan and Molotch 1987). However, in this study we note strong support for the preservation of open space. Further, many agencies are aware of and actively dealing with challenges relating to population growth and development. The last two decades have seen the emergence of a richer, more diverse set of policies to manage growth and many cities have adopted innovative growth management plans (Pallagst 2007; Weissman et al. 2013 for review). Ongoing work in Phoenix demonstrates that policy makers recognize that population growth and unrestricted geographic expansion under conditions of water scarcity create issues that require policy innovations (Wutich et al. 2010).

We know from the results of this survey that, at the federal level, open space is perceived as a valuable resource. Recent efforts to involve multiple local, regional and federal partners and integrate economic and social values into land-use decision making processes in light of climate change and population growth demonstrate the potential for coordination of efforts across political and jurisdictional boundaries (Harper and Crow 2006; Weissman et al. 2013).

Collaborative approaches have been the focus of Forest Service efforts to develop plans to designate and preserve open space (Forest Service Open Space Conservation Strategy; http://www.fs.fed.us/openspace/OS_Strategy_final_web.pdf; Harper and Crow 2006) and the U.S. Department of Transportation recently designated central New Mexico for one of two Interagency transportation, land use, and climate change pilot projects (Volpe Center, www.volpe.dot.gov). The latter effort uses scenario planning to find a shared vision among diverse groups to identify appropriate planning and conservation actions under growth and climate change. Another example is seen in the recent establishment, through the efforts of multiple organizations, of Valle del Oro, a National Urban Wildlife Refuge in Albuquerque that aims to provide wildlife habitat, flood control relief, and reconnect urban residents to the natural world (http://www.fws.gov/refuge/valle_de_oro/). Calls continue for greater integration of scientific knowledge of valuation and revealed preferences of ecosystem services into the decision making processes (Gober 2006; Roach et al. 2008). Here we add to this call recognition that successful management of open space will require continued coordination among local, state and federal management agencies and sustained efforts to engage stakeholder participation and education.

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References

- Alig RJ, Plantinga A (2004) Future forestland area: impacts from population growth and other factors that affect land values. *J For* 102:19–24
- Alig R, Kline J, Lichtenstein M (2004) Urbanization on the U.S. landscape: looking ahead in the 21st century. *Landsc Urban Plan* 69:219–234
- Allaire Y, Firsirotu ME (1984) Theories of organizational culture. *Org Studies* 5:193–226
- Apple DD (2000) Evolution of the Forest Service toward a learning organization. http://www.fs.fed.us/publications/policy-analysis/fs_learning.html. Accessed 11 March 2014
- Trayhmann D, Elfrink J, Vazzana G (1999) E-mail and snail mail face off in rematch. *Mark Res* 1:11–15
- Benedict MA, McMahon ET (2002) Green infrastructure: Smart conservation for the 21st century. *Ren Res J* 20: 12–17
- Bengston D, Fletcher J, Nelson K (2004) Public policies for managing urban growth and protecting open space: policy instruments and lessons learned in the United States. *Landsc Urban Plan* 69:271–286
- Boone C, Cook E, Hall S, Nation M, Grimm N, Raish C, Finch D, York M (2012) A comparative gradient approach as a tool for understanding and managing urban ecosystems. *Urban Ecosyst* 15: 795–807. doi:10.1007/s11252-012-0240-9
- Bowling A (2005) Mode of questionnaire administration can have serious effects on data quality. *J Public Health* 27:281–291. doi:10.1093/pubmed/
- Brander LM, Koetse MJ (2011) The value of urban open space: Meta-analyses of contingent valuation and hedonic pricing results. *J Engground and exploring Manag* 92:2763–2773. doi:10.1016/j.jenvman.2011.06.019
- Ernstson H. (2008) In Rhizomia: Actors, Networks and Resilience in Urban Networks. Dissertation, Stockholm University

- Esbah H, Cook EA, Ewan J (2009) Effects of increasing urbanization on the ecological integrity of open space preserves. *Environ manag* 43:846–862
- Ewing R (1997) Is Los Angeles-Style Sprawl likeable? *J Am Plan Assoc* 63:107–126
- Giddings B, Hopwood B, O'Brien G (2002) Environment, economy and society: Fitting them together into sustainable development. *Sustain Dev* 10(4):187–96
- Gober P (2006) *Metropolitan Phoenix: Place Making and Community Building in the Desert*. University of Pennsylvania Press, Philadelphia
- Grimm N, Foster D, Groffman P, Grove JM, Hopkinson CS, Nadelhoffer KJ, Pataki DE, Peters D (2008) The changing landscape: ecosystem responses to urbanization and pollution across climate and societal gradients. *Front Ecol Environ* 6:264–272. doi:10.1890/070147
- Groves RM, Dillman DA, Eltinge JL, Littleland RJA (eds) (2002) *Survey Nonresponse*. Wiley, New York
- Harlan SL, Tabiku ST, Larsen L, Brazel AJ (2009) Household water consumption in an arid city: affluence, affordance and attitudes. *Soc Nat Resour: Int J* 22:691–709
- Harper C, Crow T (2006) Cooperating across boundaries: Partnerships to conserve open space in rural America. U.S. Department of Agriculture, Forest Service General Technical Report FS-861. 49p.
- HEIM C (2001) leapfrogging, Urban Sprawl, and Growth Management: Phoenix, 1950-2000. *Eco Soc Am J* 60(1): 245–283
- Hermansen LA (2003) Wildland-urban interface issues and approaches. In: Kollin C (ed) *Engineering green*. American Forests, Washington, DC p 249–250
- Jim CY, Shan X (2012) Socioeconomic effect on perception of urban green spaces in Guangzhou, China. *Cities* 31:123–131
- Kem K, Alber G (2008) Governing Climate change in cities: modes of urban climate governance in multi-level systems. Proceeding of The Organization for Economic Co-operation (OECD) International Conference, Competitive Cities and Climate change, October 9–10, 2008, Milan, Italy
- Kline JD (2006) Public demand for Preserving Local Open Space. *Soc Nat Resour* 19: 645–659
- Knowles-Yáñez K, Moritz C, Fry J, Redman CL, Bucchin M, McCartney PH (1999) *Historic Land Use: Phase I Report on Generalized Land Use*. Central Arizona - Phoenix Long-Term Ecological Research Contribution No. 1, Global Institute of Sustainability, Arizona State University, Tempe
- Kurtz RS (2003) The Park Service and the Exxon Valdez. *Public Integr* 5:305–317
- Logan JR, Molotch HL (1987) *Urban Fortunes: The Political Economy of Place*. University of California Press, Berkeley
- Lubowski RN, Plantinga AJ, Stavins RN (2008) What drives land use change in the United States? A national analysis of landowner decisions. *Land Econ* 84:529–550
- Luckingham B (1984) The American Southwest: An urban view. *West Hist Q* 15(3):261–280
- Macie EA, Hermansen LA (2002) *Human Influences on Forest Ecosystems: The Southern Wildland-Urban Interface Assessment*. SRS-55. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 160 p.
- Pallagst KM (2007) Patterns of shrinking cities in the USA. The future of shrinking cities: Problems, patterns, & strategies of urban transformation in a global context. Center for Global Metropolitan Studies, Institute of Urban and Regional Development, and the Shrinking Cities International Research Network Monograph Series, Berkeley
- Pauleit S, Duhme F (2000) Assessing the Environmental Performance of Land Cover Types for Urban Planning. *J Landsc Urb Plan* 52:1–20
- Rasker RB, Alexander J, van den Noort, and Carter R (2004) *Public Lands Conservation and Economic Well-being*. The Sonoran Institute, Tucson, AZ. Available at: <http://www.sonoran.org/programs/prosperity.html>.
- Redman C, Foster DR (2008) *Agrarian Landscapes in Transition: Comparisons of Long-Terms Ecological and Cultural Change*. Oxford University Press, New York
- Roach J, Heffernan JB, Grimm NB, Arrowsmith JR, Eisinger C, Rychener T (2008) Unintended consequences of urbanization for aquatic ecosystems: A case study from the Arizona desert. *Bioscience* 58:715–727
- Sanchez-Rodriguez R (2008) Urban sustainability and global environmental change: reflections for an urban agenda. In: Martine G (ed) *The New Global Frontier: Urbanization, Poverty and Environment in the 21st Century*. Earthscan, London and Sterling, pp 149–164
- Schneider A, Logan KE, Kucharik CJ (2012) Impacts of urbanization on ecosystem goods and services in the U.S. corn belt. *Ecosyst* 15:519–541
- Thompson CW (2002) Urban open space in the 21st century. *Landsc Urban Plan* 60:59–72
- U.S. Census (2013) Available at: US Census Bureau, <http://quickfacts.census.gov/qfd/states/04000.html>
- U.S. Department of Agriculture, Forest Service (2007) *Forest Service Open Space Conservation Strategy*. http://www.fs.fed.us/openspace/national_strategy.html
- U.S. Department of Agriculture, Forest Service (2012) *Future of America's Forest and Rangelands: Forest Service 2010 Resources Planning Act Assessment*. Gen. Tech. Rep. WO-87, Washington, p 198

- United Nations, Department of Economic and Social Affairs, Population Division. (2012) World Urbanization Prospects, the 2011 Revision: Highlights. New York www.unpopulation.org
- Weissman S, Varghese S, Wood Z (2013) Effective governance for multi-jurisdictional, multi-sector climate adaptation. Berkeley Center for Law, Energy and the Environment. <http://www.abag.ca.gov/jointpolicy/pdfs/Task%207c4%20Decision%20Making.pdf>. Accessed August 18, 2014.
- Wright JO (2014) Southwest transformation: Eras of growth and land-use land-cover change in Las Cruces, New Mexico. *Southwest Geogr*
- Wu J, Plantinga AJ (2003) The influence of public open space on urban spatial structure. *J Environ Eco Manag* 46:288–309. doi:[10.1016/S0095-0696\(03\)00023-8](https://doi.org/10.1016/S0095-0696(03)00023-8)
- Wutich A, Lant T, White D, Larson K, Gartin M (2010) Comparing Focus group and individual responses on sensitive topics: A study of water decision-makers in a desert city. *Field Methods* 22:88–110. doi:[10.1177/1525822X09349918](https://doi.org/10.1177/1525822X09349918)
- York AM, Shrestha M, Boone CG, Zhang S (2011) Land fragmentation under rapid urbanization: a cross-site analysis of southwestern cities. *Urban Ecosyst* 14:429–455. doi:[10.1007/s11252-011-0157-8](https://doi.org/10.1007/s11252-011-0157-8)