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Water-Conserving Landscapes: An Evaluation of Homeowner Preference

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Abstract: Landscape preferences were assessed for three identically designed Xeriscapes™, differing only in the plant material, under both well-watered and drought conditions. The classes of plant material included traditional (high water use), intermediate (moderate water use), and native/adapted plant species of the Intermountain West (low water use). Landscapes were subjected to a 5-week dry-down period. Under drought conditions, respondents preferred drought/adapted and intermediate landscapes to traditional landscapes. A focus on Xeriscape™ education, practices, and visual exposure may result in greater adoption of Xeriscape™ practices by homeowners and may also result in significant residential water savings.

Introduction

Drought and the increase in population throughout the Intermountain West area of the United States have created severe water shortages in the region. The population in the Intermountain West continues to grow faster than anywhere else in the United States, and homeowners there use approximately 60% of potable water to irrigate landscapes (Utah Division of Water Resources, 2003). Because water is a limited resource, the need for conservation of landscape irrigation water has become increasingly important.

Although water is used in high amounts for other purposes as well, "a landscape may serve as a visual indicator of water use to the general public due to its visual exposure" (Thayer, 1976). As homeowners become more aware of landscape water conservation alternatives, attitudes toward drought-tolerant landscapes may change throughout the United States. In 1979, Hancock suggested that residential landscape water conservation is "essential to establishing a successful water policy aimed at curbing use in all sectors of water conservation" (Hancock, 1979).

Since landscape water use represents a major portion of the water used in urban areas in the Intermountain West, there is considerable potential for providing water savings through landscape water conservation. Xeriscaping™ has been emphasized as one potential technique for conserving water in residential landscapes. The seven principles of Xeriscaping™ are:

1. Plan and design the landscape comprehensively from the beginning;

2. Create practical, usable turfgrass areas;

3. Appropriately use perennials, trees, and shrubs and zone them together according to the water needs of the plants;

4. Improve the soil where needed;

5. Use mulches;

6. Irrigate efficiently, and;

7. Maintain the landscape appropriately (Spranger, 1993).

Xeriscape™ practices have long been advocated by landscape architects, landscape designers, and horticulturists with little adoption (Thayer, 1982). This may be, in part, because homeowners are unaware of landscape water requirements and the potential for Xeriscapes™ to provide colorful, attractive landscapes.

Little research has been conducted on homeowner preferences for Xeriscapes™. A great deal of research, however, has been conducted on what a preference is and what psychological elements influence preferences for landscapes. Preference is an extremely useful measurement in landscape assessment research, and most differences in preference are probably influenced in one way or another by familiarity and knowledge (Kaplan & Kaplan, 1989).

Thayer (1982) used a preference survey to determine what public responses were to xeric landscapes. Identical plants were used in each of eight small landscapes,

differing only in groundcover. Thayer's research, although provocative, focused mainly on the ground cover and the preferences that homeowners had for the landscapes under well-watered and dry conditions. Research has not been conducted to compare preferences for integrated ornamental and turfgrass landscapes under well-watered and drought conditions.

Objectives

The research reported here implemented design elements and survey instrumentation to evaluate the hypothesis that lower water use, xeric landscapes can be equally or more aesthetically acceptable than higher water use, traditional landscapes.

The specific objectives of this research were:

1. To compare homeowner perceptions of three landscapes differing only in plant material, and

2. To assess homeowner knowledge of Xeriscaping™ and how that knowledge might or might not influence attitudes toward different landscape plant materials.

Materials and Methods

Three different landscapes were designed and constructed at the Utah Botanical Center Research Station located in Kaysville, Utah (41°1'59" North, 111°56'10" West). The test site has a high mountain desert climate, with temperature extremes ranging from -30 C in January to 41 C in July. Average daily temperatures range from -4 C in January to 24 C in July. Soil at the test site is a Kidman fine sandy loam (coarse-loamy, mixed, mesic Calcic Haploxeroll) (United States Department of Agriculture, 1968).

Experimental Design

Landscape plant materials included (traditional [high water use], intermediate [moderate water use], and native/adapted plant species of the Intermountain West [low water use]). Planting plans for the landscapes were spatially identical (Figure 1), and landscapes differed only in plant material. For example, each landscape contained one evergreen tree [traditional-Pinus heldreichii (Antoine) Markgr. ex Fitschen, intermediate-Pinus aristata Elgelm., and native/adapted - Pinus edulis Engelm.] (Figure 2). Turfgrasses planted in the landscapes were Poa pratensis L. (traditional), Festuca arundinacea Schreb. (intermediate), and Buchloe dactyloides (Nutt.) Engelm. (native/adapted). Landscape material was purchased from local retail nurseries and installed using accepted horticultural practices.

Figure 1.
Conceptual Landscape Design

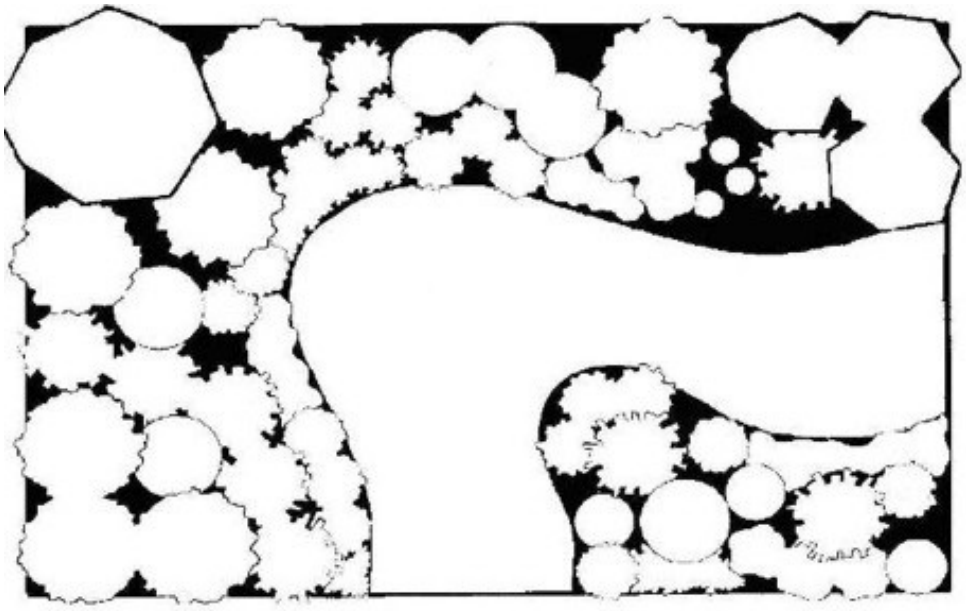


Figure 2.
Examples of Different Plant Materials in the Landscapes

	Native/Adapted	Intermediate	Traditional
Tree	Pinyon Pine	Bristlecone Pine	Bosnian Redcone Pine
Shrub	Fernbush	Korean Spice Viburnum	Redtwig Dogwood
Turf	Buffalograss	Tall Fescue	Kentucky Bluegrass

Figure 3.
Installation of Ornamental Plants and Drip Irrigation System

Once the landscapes were installed, a 1-year long establishment period began in which the plants were irrigated to prevent any moisture stress. The public preference survey was conducted the following summer both before and after a 5-week-long dry-down period in which the landscapes were not irrigated.

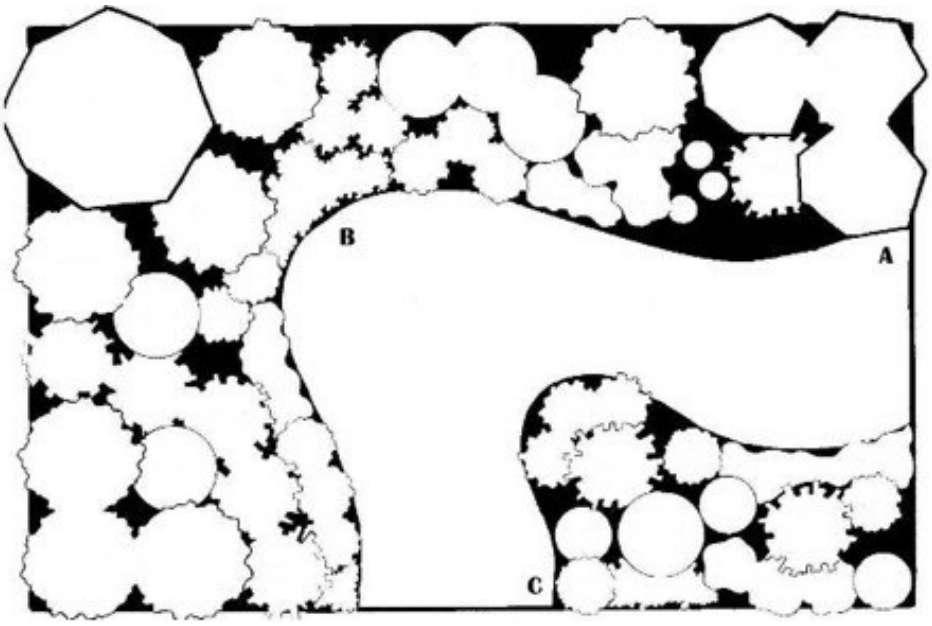
Survey

Part 1 of the survey instrument included seven-point, bipolar adjective scale (like - dislike) questions (Thayer, 1976). A seven-point Likert scale was used, with "1" meaning "strongly dislike," "4" meaning "neutral," and "7" meaning "strongly like." Part 2 of the survey instrument included semantic, differential scale questions. Part 3 of the survey instrument included demographic questions (Thayer, 1982).

In June of 2005, the study population, adults over the age of 18 who owned homes within a 10-mile vicinity of the test site, was invited to participate in the survey. Follow-up reminders were sent to the study population with a map and directions to the landscapes. Three different days were offered for participation, and subjects were also offered a five-dollar gasoline gift card for participating.

As the study participants arrived at the experiment site, written and verbal instructions were given out along with the survey instrument. Each survey instrument contained detailed questions concerning the three landscapes, and participants viewed each type of landscape from three different positions (Figure 4) and answered questions that assessed their reaction to the overall color schemes and appearances of the landscapes. Similarly, the participants were asked for their overall opinion of the grass texture in each landscape and an overall opinion of each landscape. As they completed the survey for each type of landscape, the participants moved on to the next type of landscape and answered the same set of questions until all three landscape types had been viewed and evaluated.

Figure 4.
Location of Survey Positions Within the Landscape.



The first survey was conducted in June 2005 (days 167-169) before the dry-down began. A follow-up survey was conducted the following week to increase the number of participants. A second survey was conducted in August 2005 (days 216-218) at the end of the dry-down period.

Results and Discussion

In June of 2005, a total of 66 subjects responded over six scheduled survey days. June respondents were similar in certain respects to the Davis County census record (United States Census Bureau, 2000). Some notable differences for June include the percentage of female respondents (63% in survey compared with 50%), age (60 years for the sample versus 27 years in Davis County), income (76% compared with 55% having household incomes above $50,000), and educational levels.

In August of 2005, a total of 132 subjects responded over three scheduled survey days. The characteristics of the sample population from August were similar in many respects. Differences existed with respect to 60% percent female, a median age of 58, over half having attained a four-year college degree, and 64% reporting household income above $50,000. These differences can, in some respects, be explained by our strategy of sampling homeowners, with the possible exception of the proportion of female respondents.

The highest opinion ratings and preferences of the respondents in June were for the traditional landscape (Table 1). However, they favored the appearance of the turfgrass in the intermediate landscape (*Festuca arundinacea* Schreb.) over any of

the other turfgrasses in the study (Table 1). In the native/adapted landscape, 69% of respondents somewhat to strongly liked the color scheme of the landscape. And statistical tests of differences in the survey items show considerably more similarities than differences in preferences (the latter of which were linked with turf perceptions).

Respondents' perceptions of the landscapes in August were different than those from June during the well-watered conditions. For example, though not statistically different, the preference of the August respondents was for the intermediate landscape overall, whereas June respondents preferred the traditional landscape (Table 1). Thirty-eight percent of August respondents disliked or strongly disliked the turfgrass in the traditional landscape after the dry-down, whereas 39% liked or strongly liked the turfgrass in the intermediate landscape (Table 1).

The native/adapted landscape, which bloomed profusely in June, was flowerless during the August survey, and the preference for this landscape dropped slightly in August (Table 1). However, the 0.5-point drop in mean preference for the native/adapted landscape was less than the 1 to 1.5-point drop in mean preference for the traditional landscape. And mean difference tests point to more differences than similarities (the latter of which were linked with turf between water-wise and native landscapes). Thus, the physical changes in the landscapes as a result of the dry-down are to some extent reflected in perceptions, given how the different landscape types fared over the course of the summer.

Table 1.
Descriptive Statistics for Landscape Preference Types for June and August Surveys (Likert Scale Where 1=Strongly Dislike and 7=Strongly Like with Standard Deviations in Parentheses)

	June Survey (N=66)			
	Traditional	**Intermediate**	**Native/Adapted**	**T**
Overall Color Scheme from Position B	5.35 (1.09)	5.03 (1.30)	4.94 (1.26)	4
Overall Appearance from Position B	5.27 (1.12)	4.92 (1.23)	4.74 (1.32)	4
Grass Texture	5.14 (1.07)	4.79 (1.17)	3.11 (1.37)	3
Appearance of the Grass	4.98 (1.14)	5.15 (1.08)	3.02 (1.32)	3
Overall Opinion of the Landscape	5.41 (1.10)	5.05 (1.01)	4.55 (1.18)	4

Respondents from both survey periods understood the concept of Xeriscaping™ and had a basic knowledge of the seven principles of Xeriscaping™. For example, three-fourths of respondents in both surveys agreed or strongly agreed that Xeriscape™ designs can result in visually pleasing residential landscapes (Table 2). It is thus possible that individuals with some knowledge of Xeriscaping™ may have different preferences for landscapes under drought stress.

Table 2.
Xeriscape™ Knowledge of Respondents (June and August 2005)

JuneStrong Disagree/DisagreeNeutralStrongy Agree/Agree
Xeriscape™ designs can result in a visually pleasing residential landscape1.322.576.0
Residential Xeriscape™ designs include some areas of turf or grass lawns1.527.671.1
AugustStrong Disagree/DisagreeNeutralStrongly Agree/Agree

Xeriscape™ designs can result in a visually pleasing residential landscape3.921.123.7
Residential Xeriscape™ designs include some areas of turf or grass lawns.1.323.775.0

When participants were asked what percent of drinking water supplied to cities in the Rocky Mountain region was used for landscape irrigation, 64% of respondents in June and 63% of respondents in August answered either 60% or 75% (Table 3). This finding further indicates participants' familiarity with water issues in the region.

Table 3.
Water Use Knowledge of Respondents (June and August 2005)

June	**15%**	**30%**	**45%**	**60%**	**75%**	**90%**	**100%**
What percent of the drinking water supplied to cities in the Rocky Mountain region is being used for landscape irrigation?	8.0%	6.7%	17.3%	26.7%	37.3%	4.0%	0.0%
August	**15%**	**30%**	**45%**	**60%**	**75%**	**90%**	**100%**
What percent of the drinking water supplied to cities in the Rocky Mountain region is being used for landscape irrigation?	2.7%	12.1%	17.5%	30.2%	32.9%	4.7%	0.0%

Many of the respondents in June were familiar with Xeriscapes™, having seen them before in person (87%), whereas only 14% had never seen a Xeriscape™ (Table 4). Respondents in August were as familiar with Xeriscaping™ as June respondents, with 74% of respondents having viewed Xeriscapes™ in person. All of the August respondents reported having seen a Xeriscape™ design previously on at least one occasion (Table 4).

Table 4.
Familiarity with Xeriscapes™

Familiarity with Residential Xeriscape™ Designs		
Other than the landscapes surveyed today, have you ever seen a residential Xeriscape™ landscape? If so, in what way?		
	Percentage of Respondents	
In person	87.0%	74.6%
On television, video	18.0%	33.3%
In magazines or books	27.0%	37.3%
Lecture or public presentations	5.0%	6.4%
No	13.7%	13.7%

How many times have you seen a residential Xeriscape™ design?		
Once	11.7%	8.8%
Two or three times	46.7%	36.0%
More than three times	41.7%	55.3%
During what season(s) have you seen residential Xeriscape™ designs?		
Spring	73.1%	73.9%
Summer	25.0%	24.3%
Fall	0.0%	1.8%
Winter	1.9%	0.0%

Summary and Conclusions

The results of the study reported here indicate that survey respondents from Davis County, Utah are familiar with Xeriscape™ principles and believe that Xeriscaping™ can result in aesthetically pleasing landscapes with the potential to conserve water. Under well-watered conditions, however, respondents still expressed higher opinions and preference for traditional landscape plant materials over the lower water-use intermediate and native/adapted landscape plant materials. Under drought conditions, respondents expressed higher opinions and preference for the intermediate landscape. Under drought conditions, respondents preferred the appearance of the grass in the intermediate landscape over the traditional landscape. The preference levels for the native/adapted landscape plant materials were similar under both well-watered and drought conditions and were neither negative nor positive.

As water resources become more scarce across the US and landscape irrigation is more scrutinized, an understanding of public landscape preferences will help to shape and target water conservation programs. Landscape water conservation programs often encourage the use of lower water use plant materials in landscapes to help decrease outdoor irrigation amounts, and the study reported here provides one example of how public preference information may be obtained and utilized.

Future survey research related to Xeriscaping™ should focus on different socio-economic classes, ethnic groups, or non-residents, because their knowledge of Xeriscaping™ and general landscape preferences could differ significantly from the participants in this study. This research could also be duplicated in other parts of the United States to develop an understanding of landscape preferences on a regional basis.

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