

OLDMAN WATERSHED COUNCIL-URBAN TEAM

# Grass to Xeriscape Cost Benefit Analysis and Qualitative Study

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## **Executive Summary**

The objectives of this study are to conduct a cost to benefit analysis and strength of opinions in regards to questions asked in a residential survey of residents with Xeriscaped gardens within the City of Lethbridge, Alberta. Permission given by participants, will allow for water meter history's to be compiled and compared to create before and after comparison of switching to Xeriscape. Specific questions on the survey will also provide the Oldman Watershed Council with data regarding routine maintenance, herbicide and fertilizer usage, as well as overall satisfaction using a five-point scale. A total of 16 surveys were collected. For several areas of analysis, including cost, year of conversion and size, if both back and front yards had been converted, information was recorded separately, giving unique values for both front and back yards, and increasing sample size to 21. Landscaper converted landscapes and participant only converted landscapes had the same frequency of conversion, with 7/16 participants for each, while the remaining used both methods of conversion. Average cost of conversion was calculated to be \$7.73/ft<sup>2</sup> for a landscaper, \$8.49/ft<sup>2</sup> for an individual, and \$7.72/ft<sup>2</sup> for both. Year of construction ranged across the city, with some gardens converted in 1992, to several conversions in 2010. Maintenance time and costs were reported to have significantly declined after the conversion to Xeriscape, as well as a decline in herbicide and fertilizer usage. Water consumption shows a decrease between comparisons of Xeriscape to random neighborhood values, equalling an average of \$15.34 savings per year. Calculated from yearly savings, and total installation cost, return on investment (ROI) indicates that 7594m<sup>3</sup> of water, equivalent to 3 Olympic sized swimming pools, will be saved in the 544 summers it would take to turn a profit on the initial investment.

Results gathered in this experiment can be used by the Oldman Watershed Council and the City of Lethbridge to better facilitate education programs surrounding city water consumption, in addition to promoting Xeriscape landscapes within the city limits.

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## **Introduction**

Xeriscape is a method of landscaping, originally developed for drought affected areas, where water conservation and unique aesthetics are a major influence to promote its installation. There are 7 main principles behind the motivation and proper installation of a true Xeriscape landscape; 1) Water conservation 2) Soil improvement 3) Limited turf areas 4) Appropriate plants 5) Mulch 6) Irrigation and 7) Maintenance. Each of the 7 principles helps to create a low impact, environmentally friendly landscape.

Water conservation is of growing importance in areas like Lethbridge, where in years like 2011 and 2012, low snowpack and runoff springs in addition with low precipitation summer months creates water stresses and limitations throughout the year. Maintaining the environmental integrity of the watershed is the main concern of the Oldman Watershed Council (OWC).

The objectives of this study are to develop a cost benefit analysis of converting from traditional lawn, to a Xeriscape landscape for City of Lethbridge residents in Lethbridge Alberta. A survey was conducted among selected residents with visible Xeriscape aspects to their gardens. Participants were chosen from a list of residents previously involved with the Prairie Urban Garden Tour, where a series of questions asked will give insight to the cost and maintenance as well as overall feeling about their Xeriscaped garden. Water meter history was obtained from City of Lethbridge archives from subjects willing to provide permission; with this information we are able to use water meter data prior to the conversion to conduct a cost analysis and comparison to after the conversion.

This report is divided into seven sections, the first being Research Protocol, followed by a Results section, a Discussion of results, Conclusions, Further recommendations, Bibliography and an Appendix.

A guidebook to ethical human research is outlined by the Tri-Council Policy Statement, where the three governing principles are (Canadian Institutes of Health Research; Natural Sciences and Engineering Research Council of Canada; Social Sciences and Humanities Research Council of Canada, 2010):

- Respect for Persons
- Concern for Welfare
- Justice

## Research Protocol

Xeriscape study participants were selected from a previously generated list from the Oldman Watershed Council and the participants from the Prairie Urban Garden Tour. The participants were largely located on the south side of the city, with several on the west side of Lethbridge.



Figure 1: City of Lethbridge. Red box designates participant survey area. Arrow in top right indicates North. Image provided by Google Maps. (Google, 2011)

The participants involved in the study that were selected from a list generated from the OWC, indicates that they had met Xeriscaping criteria and were familiar in participating in Xeriscape promoting events. Several other participants whom also met Xeriscaping criteria (as determined by visual analysis) were selected via mailed invitations (see appendix) and door-to-door recruitment by the primary researcher.

A prepared set of questions (see appendix) was created by the primary researcher to ensure ethical collection of information from participants as outlined by the University of Lethbridge Application for Ethical Review of Human Subject Research and the Tri-Council

Policy Statement. Criteria for appropriate subjects were outlined in Section B of the Application for Ethical Review of Human Subject Research; some features included any person with a Xeriscaped landscape of 18 years or older (age of consent in Alberta), either gender, knowledgeable and understand English.

Survey dates ranged between March 1, 2012 and March 31, 2012. Time of day in which the survey was conducted was left to the discretion of the participants, but most commonly consisted of 9am to 7pm, as an objective to not disturb participants, but interview as many as possible. The primary researcher travelled to the participants' home to allow for residents to show their yards and ensure a comfortable interview for those being surveyed.

A letter initiating contact was mailed out to selected residents from the Prairie Urban Garden Tour. A follow up phone call to potential participants was made to determine if residents were interested in participating in the study and to organize an appropriate time for the survey. The primary researcher then travelled to the participants' home to conduct the survey; one survey was completed per household (i.e. Xeriscape garden), with the individual having communicated to the researcher in the initiating phone call.

The structure of the questionnaire began with historical questions; having subjects identify who did the design and landscaping of their garden (given a choice of themselves, or a landscaper) followed by an estimate for total cost of converting the landscape to its current state. Participants were asked to estimate the size of space, and the length of time it took to complete the transformation. Next, questions regarding current day aspects of the garden, including maintenance time and/or cost, as well as a measure of herbicide and fertilizer usage (increased, decreased or stayed the same) were asked. The strength of opinion question regarding overall satisfaction of the finished product was responded to using a five-point scale, one symbolizing very dissatisfied, and five symbolizing very satisfied. Testimonials were voluntarily given in response to the answer provided in the question regarding overall satisfaction of the garden. Demographical information was asked regarding education and occupation of participants.

For several participants, we were able to determine water usage before and after the switch to Xeriscape, however for most subjects, as Xeriscape was installed prior to 2008, we used randomly selected comparables from the same block and street to compare to the Xeriscape garden. Xeriscape gardens built after 2008 were chosen for before and after comparisons so that sufficient data was available for before the conversion (2008) and after (to 2011).

## Results

A total of 16 individual cases were surveyed for the study. From the survey questions asked we were able to determine by what method traditional lawns were converted to Xeriscape gardens. Total cost, size of area, time required and maintenance time was also recorded during the interview. The following results are inclusive of the 16 individual participants; for where participants had converted both front and back yards, separate cost, size and years were recorded increasing sample size to 21.

### Design and Construction

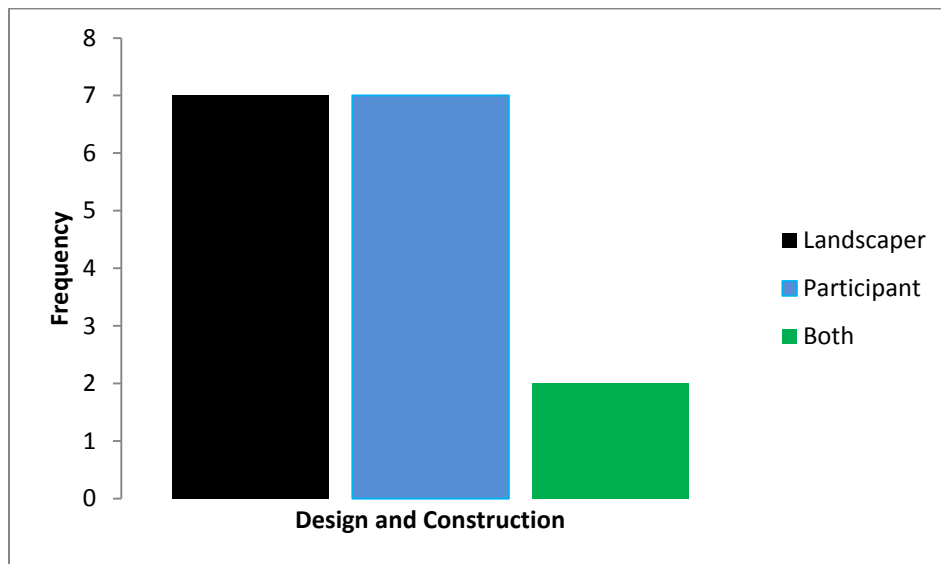


Figure 2: Method of design and construction by participants

Participants reported if they, a landscaper or a combination of both completed the design and landscaping of their Xeriscape gardens (refer to figure 2). 7/16 reported they hired a landscaper, 7/16 reported completing the transformation themselves, and 2/16 stated having used both themselves and a landscaper to complete the design/construction.



## Cost Compared to Size and Construction Type

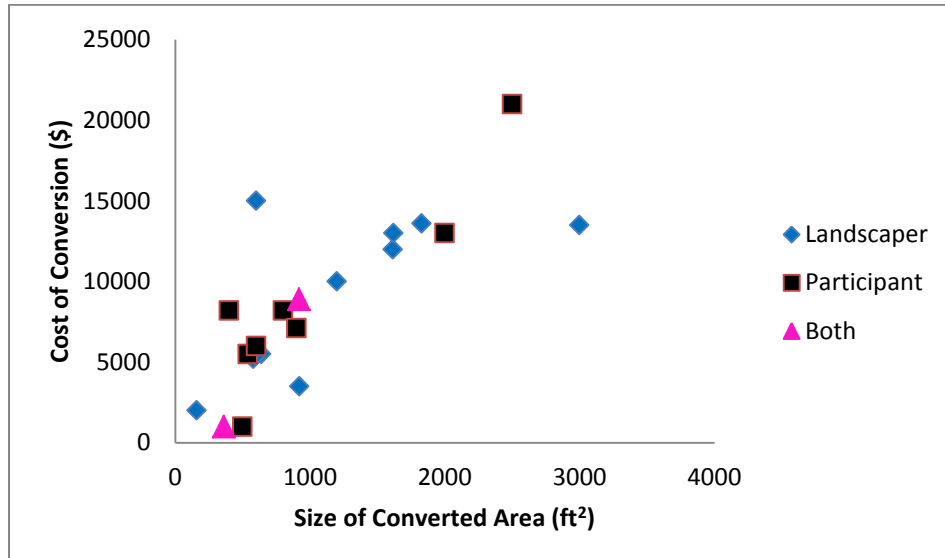


Figure 3: Approximate cost of converting Xeriscaped area by size and construction type

Data was analysed by comparing cost of conversion to the size of space (in square footage) and by the method of conversion (landscaper, participant or both). Figure 3 illustrates that the landscaper contracted gardens contains a majority of the most expensive converted gardens, and individual participants who completed their garden had some of the lowest costs associated. One outlier represents an individually converted garden, where an area of 2500ft<sup>2</sup> cost approximately \$21,000. The average cost per square foot to transform from grass to Xeriscape is \$7.73 for a landscaper, \$8.49 for an individual to complete and \$7.73 for both a landscaper and an individual. Total cost for participants ranged from \$1000, to \$21,000; both values inclusive of a participant conducting the transformation by themselves.

## Year of Construction

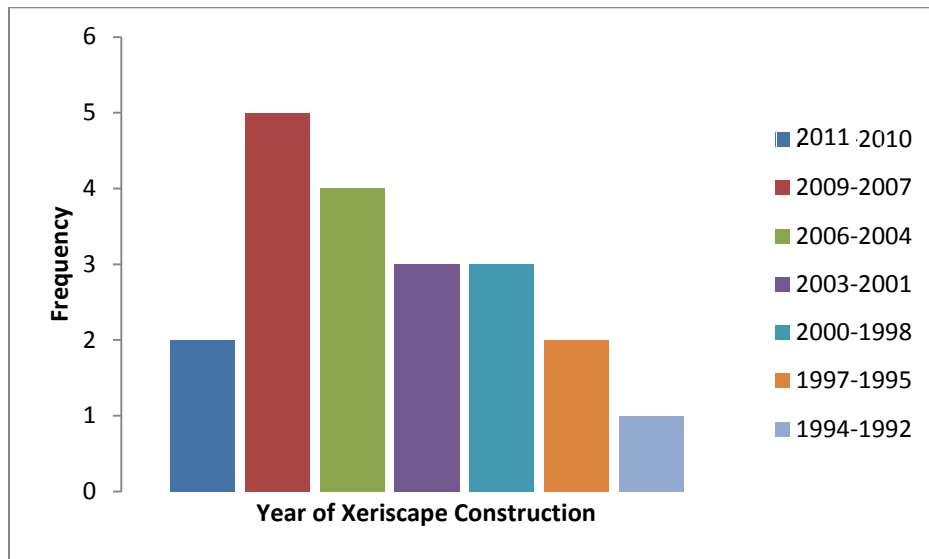


Figure 4: Number of Xeriscape gardens by year of construction for front and back yards

The years Xeriscape gardens were converted within the city varied greatly (refer to figure 4). The four west side homes were constructed after the year 2000, where two were new constructions and the other two converted in 2004 and 2007. The remaining 12 participants were located on the south side and had varied conversion dates, from 1992 to 2011. The highest proportion of conversion years is between 2007-2009, with 5/21 converted spaces. The three oldest gardens, converted between 1992 and 1997 are located in older residential areas of the south side.

## Maintenance

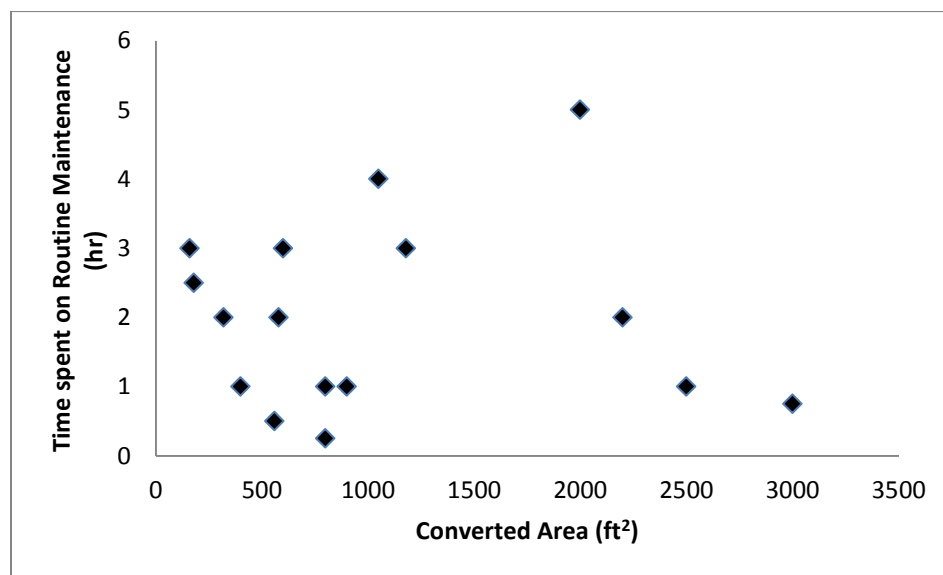


Figure 5: Time spent maintaining Xeriscaped gardens measured by area

Weekly maintenance routines were recorded for the 16 study participants. The average time conducting routine maintenance reported by individuals was 2 hours, with the most popular response being 1 hour, or less. The largest area of 3000ft<sup>2</sup>, located in south Lethbridge, was reported to have very low maintenance time of 1 hour per week, where another south Lethbridge home with 2000ft<sup>2</sup> had the highest maintenance time of 5 hours per week. All participants stated that they completed their own weekly maintenance without the work of a contractor.

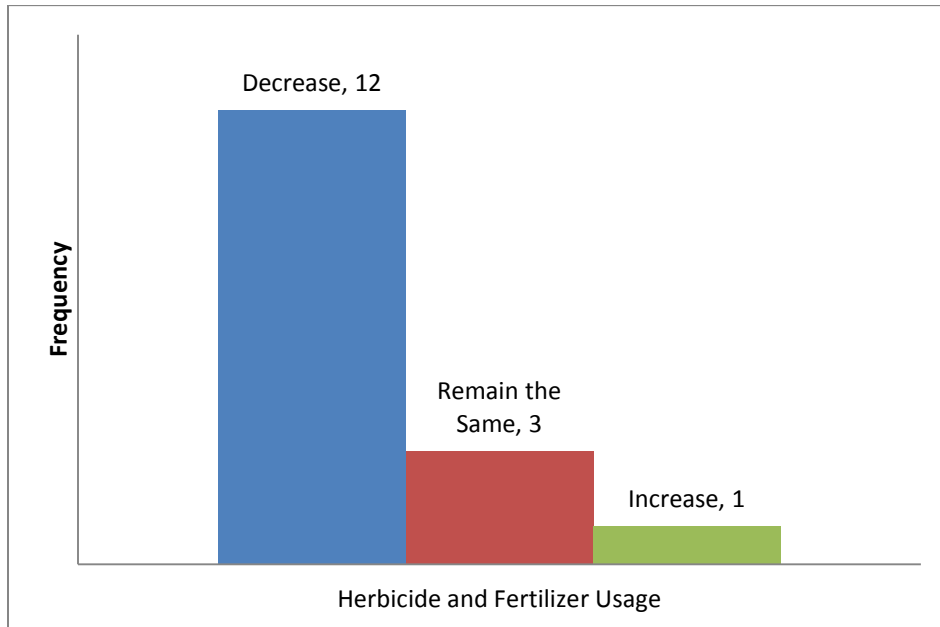


Figure 6: Herbicide and Fertilizer Usage As Compared to Prior To Switching to Xeriscape

12/16 participants reported a decrease in herbicide and fertilizer usage since the conversion, where the remaining 3 reported that their usage has remained the same, and 1 reported an increase, but a switch to natural fertilizers.

## Water Consumption

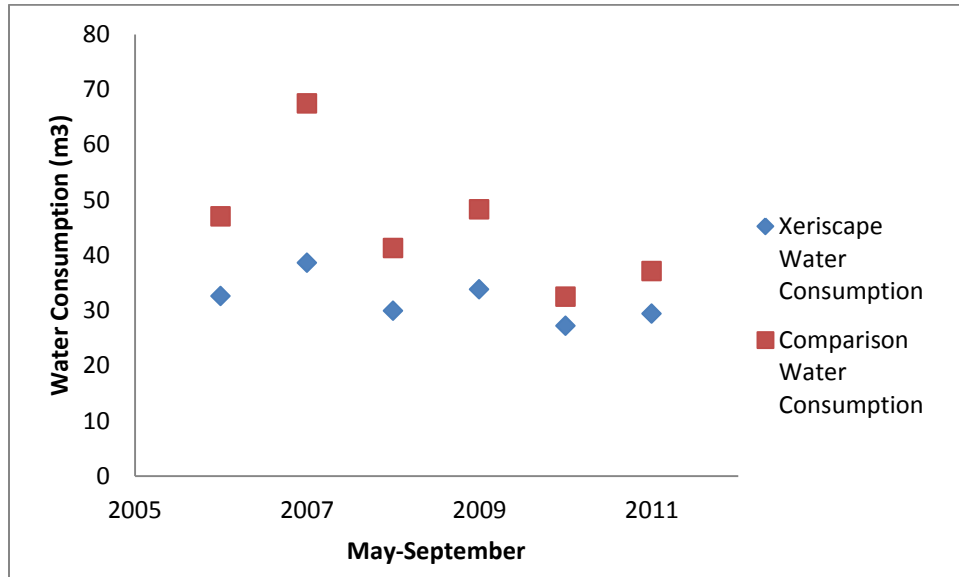


Figure 7: Water consumption difference between Xeriscape gardens and neighborhood comparables

For gardens converted before 2005, where water data was not available, we used randomly selected neighborhood water consumption data to compare Xeriscaped gardens to traditional lawns. Figure 7 illustrates the difference between Xeriscape water consumption and neighborhood comparables. In 2006, Xeriscape had a 14.4m<sup>3</sup> decrease in water usage, in 2007 a 28.9m<sup>3</sup> decrease, 2008 a 11.4m<sup>3</sup>, 2009 a 14.5m<sup>3</sup>, 2010 5.3m<sup>3</sup> and in 2011 a 7.7m<sup>3</sup> decrease. If converted into dollar amounts, at \$1.12/m<sup>3</sup> of water, savings for each year would be \$16.12 in 2006, \$32.37, \$12.77, \$16.24, \$5.93, and \$8.62 in 2011; translating into an average of \$15.34 savings each May-September.

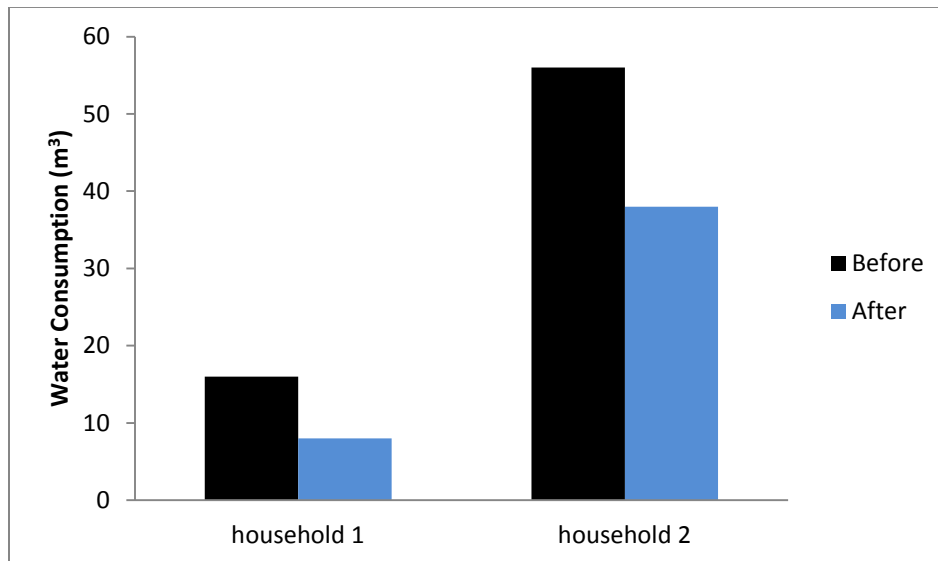


Figure 8: Individual household water consumption comparison before and after the conversion to Xeriscape

Figure 8 illustrates two gardens converted after 2009, where water meter data was available to use as an individual household comparison, there was a 50% decrease, or \$8.96 in savings, in household one water consumption, and a \$20.16 savings, or 32% decrease in consumption in household two.

<b>Year</b>	<b>Water Saved (m<sup>3</sup>)</b>	<b>Money Saved (\$)</b>
2006	14.4	16.13
2007	28.9	32.37
2008	11.4	12.77
2009	14.5	16.24
2010	5.3	5.94
2011	7.7	8.62
<b>Average/Yr</b>	<b>13.7m<sup>3</sup></b>	<b>\$15.34</b>
<b>Total</b>	<b>82.2m<sup>3</sup></b>	<b>\$92.06</b>

Table 1: Total water and money saved per year of Xeriscape conversion,

Total savings, between 2006 and 2011, for the months of May to September, was calculated to be 82.2m<sup>3</sup> of water, or \$92 (refer to table 1). Average total conversion cost of Xeriscape by construction type was calculated to be \$8972.72 for landscaping, \$8750.00 for participants and \$4950.00 for a combination. With an average total conversion cost of \$8504.76, and \$15.34 savings per year, by the time the conversion has a positive return on investment participants will have saved approximately 7594m<sup>3</sup> of water, equivalent to 3 Olympic sized swimming pools!

### Strength of Opinion Survey Responses

Subjects were asked about overall satisfaction of the garden. 14/16 participants reported being 'Very Satisfied' with the finished product, and the remaining 2/16 participants reported being 'Satisfied.' Aesthetics were of the largest reasons for converting and reporting being 'very satisfied.' Some testimonial statements provided include, but are not limited to:

"....aesthetically rewarding and a pleasant place to be... it's an ethical reward"

"We are doing the right thing for the Oldman Watershed"

"To maintain my traditional lawn was a never ending task to keep it green; No longer am I up at 1:30 in the morning to water my garden. It looks good and adds a lot of variety"

"We are able to sit and enjoy it, like we are totally away from everything..... It's sanctuary like"

“...very pleasing, even in the winter. It brings in all types of wildlife and birds year round”

“We can be away for long periods and not worry about maintenance as there is less water requirements” .... “It is not manicured, and still looks nice...wild”

“The Prairie Urban Garden tour should come at 3 different times over the summer... the look of the landscape is always changing throughout summer with the different perennials and annuals”

### Participant Demographics

Participant minimum requirements to participate in the study indicated that they must be at least 18 years of age, of either gender, knowledgeable and understand English. For the 16 participants interviewed for the study, all were working professionals of at least 30 years of age. 10/16 participants involved in the conversion to Xeriscape reported having post secondary education (Bachelors, Masters, and PhD's). 6/16 participants were currently employed as faculty at the University of Lethbridge or Lethbridge College.

### **Discussion**

This descriptive study yielded both qualitative and quantitative results for the study of the conversion of traditional lawn to Xeriscape. Of the 16 individual surveys, 44% of participants reported having used a landscaper to complete the design and construction of the conversion, 44% reported having completed the conversion themselves, and the remaining 12% using only partial services of a landscaper. The use of a landscaper in the conversion of the study may be a factor of time; conversions completed by a participant alone most commonly took two years (8 summer months), where a landscaper installed garden ranged from three days to six months. Although these time values are representative of the time of construction, they are not indicative of the time it takes for a mature Xeriscape garden to establish.

The costs associated with the conversion to Xeriscape per square foot were calculated to be \$7.73 for a landscaper, \$8.49 for an individual to complete and \$7.73 for a combination of a landscaper and an individual. For this study, the difference in price per square foot can be explained by the average size of converted area. Landscaped areas were commonly larger in size, approximately 1160ft<sup>2</sup>, and self converted gardens were 1030ft<sup>2</sup>, thus illustrating a smaller cost per square foot for a landscaper converted garden.

Maintenance times for participants averaged around two hours, where some reported maintenance times as high as five hours, most indicated time spent conducting routine weeding, and trimming to be less than one hour. The individual with a high maintenance time featured a pond in the back yard, around which was Xeriscaped. In this participants account for maintenance time, pond upkeep was the bulk of time spent in the yard. All participants stated that they complete their own maintenance, without hiring out work to contractors or neighborhood residents. With traditional lawns, it is more common to hire out yard maintenance each week, however, all participants with Xeriscape landscapes complete their own maintenance, which can be likely explained by the low maintenance times and reduced effort. Herbicide and fertilizer usage also declined with the majority of participants who switched to Xeriscape; 12/16 reported a decline, and 3/16 reported that usage had remained the same. Participants indicating a constant use of chemicals before and after the conversion can be attributed to residents with insect problems, (in particular, ants) which they claim to have worsened since the switch. Participants with younger gardens stated that they used more herbicides and fertilizers to reduce the invasion of weeds and undesired vegetation while the garden was beginning to establish and mature.

The years in which gardens were constructed varied greatly across the city. Older gardens, constructed prior to the year 2000, were located on the south side of the city, where the newer gardens were located in both the south and west sides. The older Xeriscape constructions being on the south side can be attributed to that being the older area of the city. The newer developments on the west side are beginning to show elements of Xeriscape, but not enough in most cases, to be considered true Xeriscape. Xeriscape conversions have been increasing since 1997, with the highest majority of conversions between 2007 and 2009.

Since no data was available prior to 2005, for most gardens there was insufficient data to use a direct before and after comparison. For most participants, water savings were calculated for each year, from a comparison of randomly selected houses on the same street and block as the Xeriscaped garden. By using neighborhood comparisons we hope to best represent weather conditions and watering habits uniformly, to give an accurate average water consumption and comparison from the Xeriscape home. The greatest water savings year was 2007, where Xeriscape gardens saved on average 28.9 m<sup>3</sup> of water, between the months of May to September. There has been a decline in water savings up to 2011, where water saved was calculated to be 7.7 m<sup>3</sup>. The decline may be a result of the recent years of heavy rainfall summers, which made traditional lawn comparisons to average less water consumption, and Xeriscape to remain relatively constant. By using a standard water cost for the city of Lethbridge, at \$1.12/m<sup>3</sup>, we were able to calculate a dollar savings for each year as well. For 2007, participants will have saved \$32.37, and in 2011, will have saved \$8.62. The small margin of savings calculated here can be attributed

to the combined outdoor/indoor water meter data. Had water meters been installed to monitor outdoor water usage separately, results would have showcased a much larger savings. The difficulty with this data was the comparison of households; for instance, since entire households were compared, families of 4 or 5 may have been compared with families of 1 or 2. If the Xeriscape home contained a full sized family, we expect to see water usage to be significantly more than a household of 1 or 2 that may have a traditional lawn. The unknown variables behind this data do not provide an accurate savings calculation of switching to Xeriscape. The best results were shown with participants with young enough gardens to conduct a before and after comparison; the two gardens converted after 2009 showed a 32% and 50% decrease in water consumption. This type of analysis yields more accurate results than the neighborhood comparisons; however is still subject to uncertainty around household water consumption. We would expect that the conversion to Xeriscape would yield a better analysis of savings if outdoor water meters were installed, so no influence of household use was a factor, as well as having enough water meter data to conduct a before and after comparison, not neighborhood comparisons.

With total average conversion cost of switching to Xeriscape calculated to be \$8504.76, and total average water savings per summer calculated to be \$15.34, we can approximate that it would take 554 summers to achieve a return on investment of the Xeriscape garden. During this time, participants would save 7594 m<sup>3</sup> of water. The total amount of water saved during this time would be enough to fill 3.03 Olympic sized swimming pools, at a volume of 2500 m<sup>3</sup>. This data is subject to the problems mentioned above; having taken into account entire household data, true water savings of converting to Xeriscape is not shown here. We would not expect the conversion to take 554 summers (181.3 years) for a return on investment, and therefore can conclude that the small difference in savings as determined from the above calculations contributes to the lengthy return on investment.

## **Conclusion**

Promoting Xeriscape landscapes in Lethbridge is a method of employing water saving techniques that can be exercised at an individual, residential level. The objectives of this descriptive study were to evaluate the total cost and water savings for Xeriscape landscapes within the city, from the switch from traditional lawns.

From the 16 participants' surveyed in this study, we were able to determine that by switching to Xeriscape, residents decrease the amount of water applied to their gardens during the months of May to September, decreased the amount of maintenance time/money applied, as well as a reported decline in herbicide and fertilizer usage.



Historical research of studies regarding the switch from traditional lawn to Xeriscape was mostly found to be conducted in highly drought affected areas, such as Nevada and Arizona. These types of studies yielded similar but more noticeable results from the comparison of the switch to Xeriscape. In Nevada, by switching to Xeriscape, total yearly savings neither decreased or increased over the years, but on average after the switch, consumption drops dramatically and immediately stabilizes (Sovocool, Xeriscape Conversion Study Final Report, 2005). A decline in maintenance time and cost was also observed in additional studies, similar to results found in our study. For homes that converted 60% or more of their landscape compared with homes with 60% or greater traditional turf, Xeriscape homeowners reported a monthly reduction of 2.2 hours in maintenance and an additional \$206 per year savings on herbicide and fertilizer. This decline represents a savings of about one third in total landscape labor and maintenance as compared to traditional lawn homeowners (Sovocool, Xeriscape Conversion Study Final Report, 2005). It was measured that annual water bill savings determined by landscape conversion projects can be much larger than what was calculated for Lethbridge; the annual savings in Nevada was calculated to be \$239.92, representing a savings of 54% of total yearly charges for water consumption (Sovocool, Morgan, & Bennett, An in-depth investigation of Xeriscape as a water conservation measure, 2006).

Below is a chart representation of results found from *An in-depth investigation of Xeriscape as a water conservation measure*.

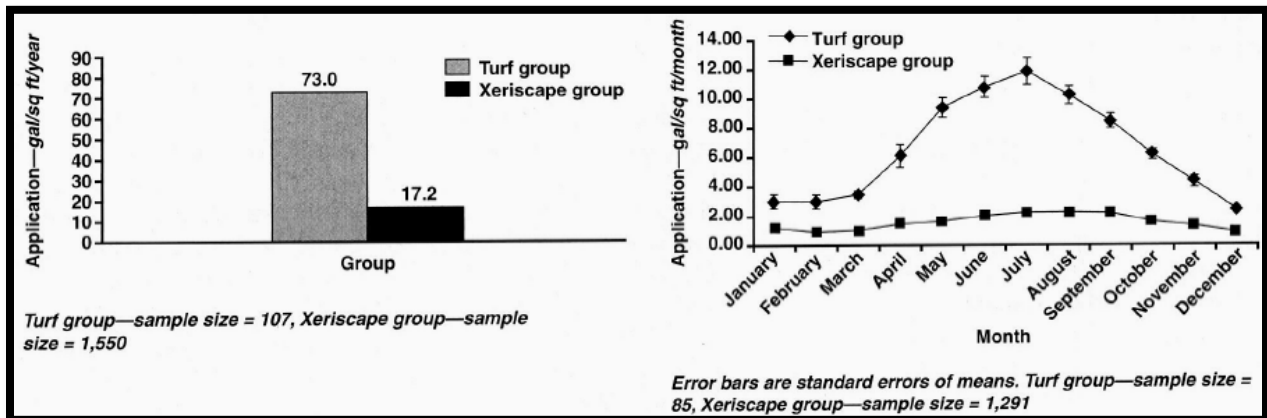


Figure 8: (left) Annual application per unit area for Traditional and Xeriscape groups (right) Monthly water application for Traditional and Xeriscape groups (Sovocool, Morgan, & Bennett, An in-depth investigation of Xeriscape as a water conservation measure, 2006)

We can see from the graphs in figure 8, a clear delineation of water consumption between traditional lawns and Xeriscape converted areas. We would expect that Lethbridge would

yield similar results given a longer study time, larger sample size, and sub-metered houses (subjects with a meter measuring outside water use only).

Some of the biggest differences between *Grass to Xeriscape Cost Benefit Analysis and Qualitative Study* and historical studies lie with research protocol. Historical studies were conducted over several years and with sample sizes for Xeriscape participants and a comparison group of 321 and 298. In areas of these historical studies, incentive programs are in place to promote the conversion to Xeriscape, which influences the total time to receive a positive return on investment. Historical studies also featured having sub-metered participants in the study, which is essential in eliminating bias in data representation and ensuring a direct comparison between grass and Xeriscape, not the behaviors and water consumption of individual households.

Due to the small sample size, and household bias imposed on our data, we must consider that average return on investment and water savings are not a true representation of a population.

The City of Lethbridge should continue to promote Xeriscaping by residents, and maybe consider introducing bylaws that will be a requirement in new subdivision clauses in the Lethbridge area. Ensuring people know the difference between Xeriscape and 'Zero-scape,' I think Lethbridge will experience an increase in residents with Xeriscape gardens. When done properly, Xeriscape is a unique and functional outdoor living space for people and families... not the sterile rock garden that some people have perceived Xeriscape to be.

## Further Recommendations

If further study is taken place a few recommendations should be made to better influence the results, and research design.

- Sub-metering Xeriscape participant and comparison group homes is essential to accurate data representation. Elimination of household water consumption must be a factor in further research.
- Increasing time allotted for participant recruitment and interviewing is essential in increasing sample size numbers. As common in Lethbridge, many retirees and senior residents (which composed the bulk of potential participants) winter away from Lethbridge. Consider summer months to recruit and interview potential participants.
- Incentive programs for potential residents to convert traditional lawns to Xeriscape; this process may not only help increase the number of residents in the city who have converted, but also will be a better method to track and recruit potential participants in further study
- Adding a question in the survey, or changing the “Please elaborate/Provide a Testimonial” to something similar to a rank question.  
“Please rank the following options by importance for your reasons for switching to a Xeriscape landscape...  
\_\_\_\_\_ Water Savings \_\_\_\_\_ Aesthetics \_\_\_\_\_ Low Maintenance  
\_\_\_\_\_ Intrinsic value (Being environmentally friendly) etc ”  
may give a better representation of why residents are switching to Xeriscape

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Supervising Professor- *Tom Johnston*, Department of Geography; University of Lethbridge

Applied Studies Coordinator- *Jasmin Berteotti*, Program Coordinator; University of Lethbridge

## **Appendices Attached**

# Grass To Xeriscape Participant Questionnaire

1) Who did the design and landscaping of your Xeriscape garden?

Yourself \_\_\_\_\_ Landscaper \_\_\_\_\_

2) What would you estimate the cost of converting your garden to Xeriscape was?

\$ \_\_\_\_\_

3) How large of a space was converted to Xeriscape landscape?

M<sup>2</sup> \_\_\_\_\_ Ft<sup>2</sup> \_\_\_\_\_

4) How long did it take to complete the transformation to the finished product?

Months \_\_\_\_\_ Years \_\_\_\_\_

5) Who does the maintenance in your garden?

Yourself \_\_\_\_\_ Contractor \_\_\_\_\_

6) If yourself: Estimate the time spent each week conducting routine maintenance

Hours \_\_\_\_\_

If contracted: What is the approximate cost per week charged to you for landscape maintenance?

\$ \_\_\_\_\_

7) How would you estimate your fertilizer and herbicide usage/application since the switch to xeriscape?

1) Decrease \_\_\_\_\_ 2) Increase \_\_\_\_\_ 3) Remain the same \_\_\_\_\_

8) On a scale of 1-5, how happy are you with the finished product?

Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
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9) Would you elaborate on your answer to question 6? Provide a testimonial.

10) Would you provide the following information?

Education: \_\_\_\_\_ Occupation: \_\_\_\_\_