

# The Hidden Value of Landscapes: Implications for Drought Planning



A study of the contribution of landscaping to the environment, quality of life and property values in Colorado, which should be taken into account when planning for drought.

**Zachary S. Johnson, PLA, CLT, CLP**

Associate Professor  
Horticulture and Landscape Architecture  
Colorado State University, Fort Collins, CO

**Tony Koski, Ph.D**

Extension Specialist and Professor  
Horticulture and Landscape Architecture  
Colorado State University, Fort Collins, CO

**Alison Stoven O'Connor, Ph.D**

Extension Agent  
Colorado State University,  
Fort Collins, CO



# Contents

Drought is inevitable 4

Landscape water consumption 5

Environmental benefits 6

Air quality

Cooling effects

Stormwater management

Wildlife habitat

Real estate value 8

Community and health 9

How landscapes improve our lives

Crime and community

Child development

Stress relief

Fitness and health

Unintended consequences 11

Why we can't let landscapes die

Planning for drought 13

Recommendations for elected officials,  
water providers and landscape managers

Guidelines for property owners

Conclusion 15

Resources and citations 16

# Landscapes only use **3%** of **Colorado Water**

Here's what **3%** of our water does for us:



**25%** fewer crimes occur in public housing with landscapes



**7%** higher rents are paid on commercial sites with attractive landscapes



Every **\$1** invested in a home landscape yields a \$1.35 return



**Children** who spend time outdoors are better learners



**45°** cooler temps when cars are shaded by trees



**48 lbs** of carbon dioxide are absorbed by 1 tree each year



**55 sq ft** of lawn provide enough oxygen for 1 person for 1 day

There's a big **ROI** on that **3%**.

That's why we need to **preserve landscapes** while we **conserve water**.

3%

## Drought is inevitable

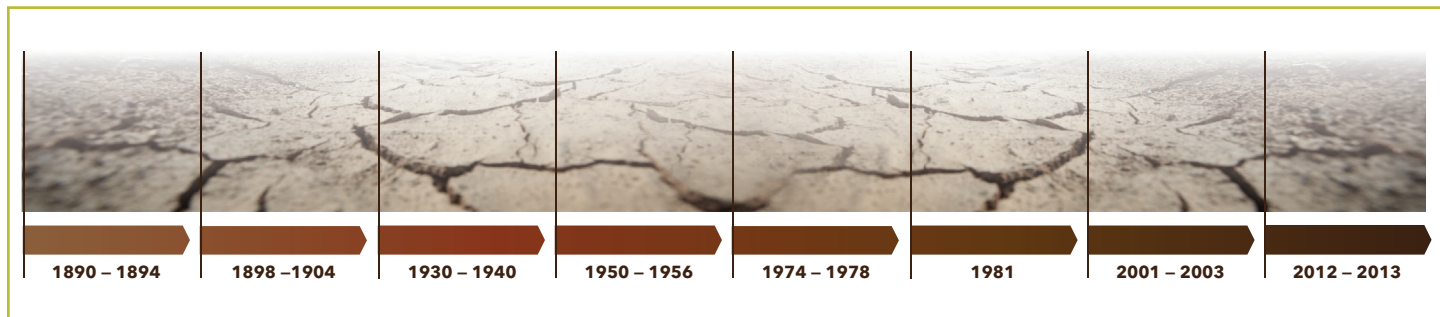
*As Colorado's population continues to grow, demand on all water resources will increase, especially during periods of drought.*

Colorado has long experienced periods of drought. Our most recent severe drought occurred in 2002, which was preceded by a series of dry winters and springs and summers of limited precipitation during the late 1990s and early 2000s. Then-Colorado Governor Bill Owens, stated in his 2003 State of the State address, "... this is perhaps the worst drought in 350 years." This drought followed others in the 1950s and 1980s, each creating countless challenges for our state and its citizens. Periods of drought often follow years of above normal precipitation, making them difficult or impossible to predict.

As Colorado's population continues to grow, demand on all water resources will increase, especially during periods of drought. According to the Colorado Water Plan, by 2050 Colorado's population could be nine million, nearly doubling our current population. Some communities may grow moderately, while others are expected to triple in size.

In the past decade, Colorado water users have reduced per capita water consumption by slightly under 20%.<sup>1</sup> Some of these savings have come from improved technologies, tiered rate structures, the use of plants with low water requirements and increasing general awareness among users that they should conserve. As citizens and industry work together to meet the Colorado Water Plan's water conservation goals, the steps we take now will better prepare us for future natural stressors, such as drought, flood, fire and temperature extremes, which will impact the benefits that our landscapes provide to society.

### Colorado droughts over the last 125 years



## How much water do Colorado landscapes really use?

While Colorado has numerous river systems including the headwaters of the Colorado River, more water leaves the state than remains within it. More than 60% of naturally flowing water leaves the state and is consumed by downstream users. Of the approximately 40% of water which remains, our landscapes only use approximately 3% of all water consumed in Colorado.<sup>1</sup> This 3% includes water used for residential and commercial landscapes as well as parks, sports complexes, golf courses, etc.

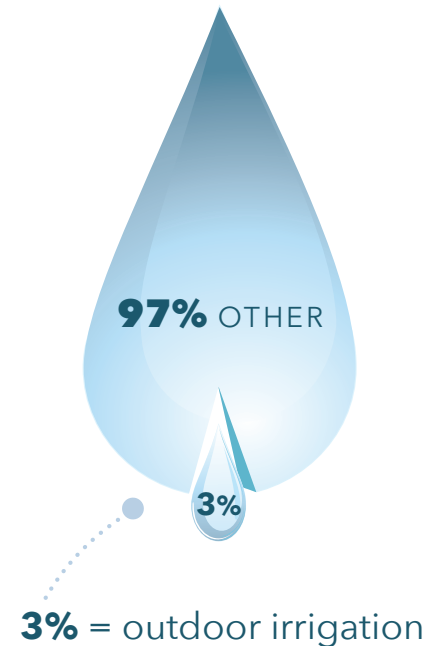
## Return on investment from that 3%

The water investment of that 3% of total water in landscapes, however, offers a tremendous return. Aesthetic value is only a small piece of the overall importance of landscapes.

Significant health benefits, both physical and psychological, are realized by everyday interactions with urban landscapes.<sup>2</sup> Landscapes improve property values, reduce heating and cooling requirements, improve air quality, provide wildlife habitat and sequester carbon. Some of our most prominent landscapes such as parks and cemeteries also offer significant cultural and historical value.

Colorado's citizens enjoy a tremendous return from water used for landscapes. Responsible water management demands that in advance of drought we must be prepared with a drought plan that saves water, but does not threaten the ongoing viability of our cherished landscaped areas. In the following pages, we document the many ways landscaped outdoor areas contribute to the quality of life and property values in Colorado. With this knowledge in mind, preserving landscapes should be equally important as conserving water when we prepare for future droughts.

## Colorado's total water use



*More than 60% of naturally flowing water leaves the state and is consumed by downstream users. Of the approximately 40% of water which remains, our landscapes use only 3%.*

## Environmental benefits

Landscapes provide a multitude of environmental and ecological benefits, which contribute to urban air quality, stormwater management and wildlife habitats. Landscapes also shade and cool urban areas.

### Air quality

#### Carbon sequestration

Landscapes in urban areas play a significant role in removing carbon from the atmosphere.<sup>3</sup>

- One tree can absorb as much as 48 pounds of carbon dioxide each year and provides enough oxygen to support two human beings.<sup>4</sup>
- Each year, one acre of trees absorbs enough carbon dioxide from the atmosphere to equal the amount produced by driving a car 26,000 miles.<sup>5</sup>
- Urban tree carbon storage is equivalent to 5% of all human-caused carbon emissions.<sup>6</sup>
- Lawns also have the ability to sequester carbon for 25 to 30 years, when using best management practices.<sup>7</sup>
- Landscapes further improve air quality by reducing the need to provide cooling and heating, thus reducing pollutants created by generating power to heat and cool.<sup>8</sup>

#### Reducing airborne pollution

Trees reduce air pollution.

- Trees remove air pollution primarily via uptake through the leaves.
- Translated into the economic value, the local tree canopy provides air quality benefits in excess \$500,000 in Denver and \$1.7 million to the entire metro area.<sup>9</sup>

**48 lbs** of carbon dioxide are absorbed by 1 tree each year



#### Oxygen creation

All living plants create oxygen.

- 55 square feet of turfgrass provide enough oxygen for one person for one day.<sup>10</sup>
- As noted above, one tree provides enough oxygen to support two human beings.

# Environmental benefits

3%

## Cooling effects

When there is limited vegetation in a community, buildings and paved surfaces absorb energy from the sun and cause the surface temperature of urban structures to be 18 to 38°F higher than the ambient air temperatures.<sup>11</sup> Higher air temperatures lead to increased need for cooling systems, straining natural resources required to cool our homes and businesses.

Unlike paved areas which absorb solar radiation, vegetation cools the air when moisture evaporates from soil and plants. Landscaping, specifically trees, can also reduce home energy costs for heating and cooling. Three trees properly placed around the home can save \$100 to \$250 annually in energy costs.<sup>12</sup>

Additionally, shade from trees significantly mitigates the urban heat island effect.<sup>13</sup> Tree canopies provide surface temperature reductions on wall and roof surfaces of buildings ranging from 20 to 45° F and temperatures inside parked cars can be reduced by 45°F.<sup>14</sup>



**45°**

**lower temps**  
are in parked cars  
shaded by trees

## Stormwater management

Landscapes also play a substantial role in stormwater management and water quality. Pervious surfaces, such as lawns, planting beds and even patios using permeable building materials, help to treat stormwater runoff close to the source. When stormwater is slowed by moving through landscaped areas, the amount of runoff into storm drains is reduced along with sedimentation of streams, rivers and lakes.<sup>15</sup> This filtering process also cleans water of pollutants.

## Wildlife habitat

Between 2001 and 2011, Colorado lost 525 square miles of open spaces to development, the equivalent of a football field of natural areas every two and half minutes.<sup>16</sup> This loss of open space means significant loss of wildlife habitat. As the Colorado population continues to grow, the ability for urban areas to bridge the gap in providing wildlife habitat will become increasingly important. Landscapes can and do provide habitats and refuge for species impacted by urbanization. Many animals and insects, including pollinators, find homes in urban landscapes.



3%

## Real estate value



Every **\$1** invested in a home landscape yields a \$1.35 return

A well-landscaped property has curb appeal that speeds up real estate sales, improves occupancy rates and adds to property value. The value of landscaping can also be quantified in the amount that quality landscaping brings to residential and commercial properties:

- Every dollar invested in a residential landscape can yield a \$1.35 return (135%). Further, a “high” to “excellent” quality landscape is estimated to increase property values as much as 10% and bring as much as a 17% increase in overall curb appeal.<sup>17</sup>
- Research has shown 7% higher rental rates for commercial offices having high-quality landscapes.<sup>18</sup>
- Large street trees add a 3% to 15% value to a home, and continue to appreciate in value over time.<sup>19</sup>
- An additional street tree increased monthly rent in a single-family home in Portland, Oregon by \$21.<sup>20</sup>
- Homes immediately adjacent to parks and open spaces are valued 8 to 20% higher than comparable properties one-half mile away.<sup>21</sup>





## How landscapes improve our lives

While beautification of our neighborhoods is one of the most appealing facets of green spaces, landscapes also provide physical and psychological benefits that contribute to our quality of life and sense of well-being. Through landscapes, we connect with nature, even in the most urban settings. Green spaces and vegetation facilitate personal relaxation and rejuvenation and also socialization by pulling people outdoors to engage within their community. Landscapes can also serve as informal meeting places for group and individual activity—a single tree can be the landmark where groups will get together.<sup>22</sup> These benefits span both genders and all ages and cultures. Listed below are several documented ways in which landscapes improve our quality of life.

## Crime and community

The importance of green spaces in urban areas and the role they play in reducing crime and aggressive behavior has been recognized by sociologists. Research shows that the greener a building's surroundings are, the fewer total crimes. This is true for both property crimes and violent crimes. Landscape vegetation around buildings can mitigate irritability, inattentiveness, and decreased control over impulses—all of which are well-established psychological precursors to violence.<sup>23</sup>

Two benefits of landscaping are found within densely populated urban areas where vegetation tends to be scarce.

- Residents in public housing reported 25% fewer domestic crimes when landscapes and trees were planted near their homes.<sup>24</sup>
- A study of individuals living in 28 identical high-rise apartment units found residents who live near green spaces had a stronger sense of community, coped better with stress and hardship, were less aggressive and violent and managed problems more effectively than those living away from green space.<sup>25</sup>

## Child development

Besides offering children a place to play, natural settings contribute to child development in at least four critical areas. Children who spend time in green settings have improved:

- Creativity
- Imagination and
- Cognitive function
- Intellect<sup>26, 27, 28</sup>

Children with ADD experienced reduced symptoms when exposed to green environments, even if they only view through a window.<sup>29</sup>

*Through landscapes, we connect with nature, even in the most urban settings.*

**Children**  
who spend time  
outdoors are  
better learners



3%

*95% of people feel calmer and have a positive change in mood after spending time in a landscape.*

---

## Community and health

### Stress relief

Studies show 66% of people prefer to retreat to a natural setting when stressed. Many health care facilities are now implementing landscaped areas known as healing gardens to provide green spaces for patient well-being. Further, studies done on people who were feeling stressed, anxious or depressed found 95% of people felt calmer and had a positive change in mood after spending a short time in a landscape.<sup>30</sup>

### Fitness and health

Gardening and working in our yards accomplishes more than ongoing landscape maintenance. Many routine landscape tasks such as weeding and picking fruit from trees are forms of exercise. Yard work provides sufficient exercise to meet the Center for Disease Control's guidelines for physical activity. Walking and pushing a lawnmower, for example, can burn up to 370 calories per hour. Gardening also helps with grip force and hand strength as people age.<sup>31</sup>

Participating in community gardens provides similar activity that helps people remain healthy. People who joined a community garden had a lower body mass index (BMI) than their neighbors who were not in the community garden program; the same study revealed community gardeners had a lower chance of being overweight or obese compared to their non-gardening neighbors.<sup>32</sup>

Green space promotes physical healing following surgery. One study involved 120 patients who had their gall bladder removed. Patients who could see trees from their hospital window slept better, reported less stress, had improved pain tolerance and were, on average, discharged one day sooner than patients who could not see trees.<sup>33</sup>



**66%** of people prefer to retreat to a natural setting when stressed

---

# Unintended consequences

3%

## Why we can't let landscapes die

When water supplies diminish, it is easy to argue that irrigating landscapes is not the highest and best use of water when compared to other uses such as agricultural/food production, household use and outdoor recreational activities. Implementing water restrictions that reduce or eliminate irrigation of lawns and parks is a typical first response during periods of water shortages. To deal with prolonged drought, more drastic measures have emerged such as the "cash for grass" buyouts in Nevada and California. Through these programs, homeowners receive cash in exchange for removing their lawns.

On the surface, these measures to cut landscape water use appear pragmatic. Yet, the unintended consequences of cash for grass and severe watering restrictions are now being recognized. When former lawn areas are no longer watered, trees and other plants that once received water along with the lawns become drought stressed. These plants become prone to diseases and are a falling hazard when deprived of regular irrigation. When trees in these landscapes die due to lack of water and related stressors, the shading and cooling benefits they provided are lost forever and air temperatures rise significantly.

It is impossible to replace a 30-year-old shade tree immediately with an equivalent tree. The property owner must start over with a much younger and smaller tree that will require years to grow to the size of the one lost. There are no quick fixes when mature, long-lived plants that offer shade, property value and curb appeal are lost to inadequate watering during drought.

Likewise, the aesthetics of neighborhoods change when lawns are replaced with poorly designed landscapes. Converted lawn areas where children and pets played become less conducive for play activities, and these marginal landscapes also become hotter during the day.<sup>34</sup>

Some property owners have converted living lawns to synthetic turf thereby losing the environmental benefits of the lawns. Because synthetic turf provides no cooling effect, the ambient air temperature around homes and other buildings has been shown to increase dramatically. In addition, natural turf's ability to store carbon is lost, leading to increased pollution. Collectively, lack of adequate irrigation leads to higher temps, more pollution of air and water, loss of habitat for pollinators and other wildlife as well as compromised property values through declining plants and curb appeal.

*The use of 3% of Colorado's total water to maintain green landscapes is a legitimate allocation of water resources.*



3%

## Unintended consequences

*In our predominantly urban world, the only connection to nature and “agriculture” most people now have is through their home landscapes and shared recreational areas.*

Eliminating landscape water is a short-term fix that creates complex, long-term problems. While maintaining healthy landscapes comes at some cost, the unintended consequences and cost associated with sacrificing landscapes during drought are substantial.

Preserving urban green spaces is equally as important as conserving water. As we have indicated, landscapes provide a number of benefits including the following:

- Conserving biodiversity within the environment
- Protecting soil and water resources
- Sequestering carbon
- Cleaning the air and creating oxygen
- Mitigating storm water runoff
- Connecting people with nature
- Improving personal fitness, healing and learning
- Encouraging outdoor recreation
- Discouraging violence and crime
- Preserving historic outdoor spaces
- Supplying local fresh food and
- Alleviating the urban heat island effect.

In our predominantly urban world, the only connection to nature and “agriculture” most people now have is through their home landscapes and shared recreational areas. Ecologists tell us that separating people from agricultural and natural areas will place greater pressure on urban green spaces to meet our innate need to connect with the outdoors that was available from rural areas in the past.<sup>35</sup> To sacrifice urban landscapes would deprive people of their critical connection to the natural world.

When we consider the range of ecological, economic and sociological benefits provided by our landscaped areas, we can easily defend allocating the mere 3% of Colorado’s water required to preserve them. Without doubt, this is a legitimate apportionment of Colorado’s precious water resources.



## Drought policy recommendations

Policy makers, corporate and municipal landscape managers, green industry companies and individual homeowners should have plans in place for managing landscapes during periods of drought and watering restrictions. Effective planning and the use of Best Management Practices will help all parts of the landscape survive extended drought episodes and the different levels of water restrictions that might be imposed. The 3% of the state's water used by landscapes could be further reduced through more effective water management.

*The 3% of the state's water used by landscapes could be further reduced through more effective water management.*

### Recommendations for elected officials, water providers and landscape managers:

- **Put clear drought policies and plans in place well before a drought occurs.** This will help property owners be prepared and know what to expect if and when water restrictions are enacted. Informative advanced policy will also help property owners make better water-conscious decisions about the design and management of their landscapes which will result in lower water demands.
- **Base drought policies on science and research-based horticultural Best Management Practices** that have been codified in various state and local statutes since 2003.<sup>36</sup> Depending on the projected severity and duration of drought, determine which areas of landscapes should be irrigated and those areas that can be allowed to enter dormancy.
- **Prioritize watering of trees and large shrubs** as they can't quickly or inexpensively be replaced.
- **Prioritize watering of sports and recreational fields** for the physical and psychological benefits of children and adults.
- **Provide financial incentives** for water consumers to implement water-saving technology prior to droughts, such as smart controllers, rain sensors and dedicated meters for tracking landscape water.
- **Establish budgets** to repair broken heads, leaks, inoperable valves and rain sensors, malfunctioning drip system components, and sprinkler heads hitting sidewalks, driveways and other hardscapes. Making repairs will ensure that irrigation systems are operating at optimal efficiency when used.



3%

*Eliminate over-irrigation because it is a significant source of water savings.*

## Planning for drought

- **Eliminate over-irrigation** because it is a significant source of water savings. Help consumers understand basic steps to conserve water. Ensure they understand when and how much to irrigate, how to conduct simple inspections of their irrigation system and how to identify over-watering.
- **Educate consumers** about water-saving technologies, appropriate plant material and services offered by local water utilities and the green industry. Help consumers realize they might already possess water-saving technologies, such as controllers with seasonal adjustment options and water restriction settings.

### Guidelines for property owners

The following recommendations will help residential and commercial property owners conserve water:

- **Select plants** that have low water requirements once established.
- **Develop plans** based on projected severity and duration of the drought and how water use is limited. Prioritize areas of landscapes that should receive water and identify areas that can go dormant without irrigation or can be more easily and less expensively replaced when restrictions are lifted.
- **Prioritize watering of large shrubs and trees** because they can't be quickly or inexpensively replaced when compared to other plants in the landscape.
- **When possible, delay installation of new plant material** which generally requires frequent, and more irrigation than existing plants to aid in establishment.
- **Become familiar with pertinent drought triggers** and enforced watering guidelines and/or restrictions.
- **Program sprinkler clocks to irrigate conservatively**, while adhering to restrictions. Monitor irrigation system for leaks and damaged components which can lead to water waste. Understand the water-saving technologies your system may already have in place and utilize them.
- **Repair** broken heads, leaks, inoperable valves and rain sensors, malfunctioning drip system components, and sprinkler heads hitting sidewalks, driveways and other hardscapes to ensure that irrigation systems are operating at optimal efficiency when used.
- **Check drip irrigation** hidden under mulch and landscape fabric for leaks and broken components, and to ensure it is operating appropriately for soil conditions and the age and type of plant material.
- **Add or refresh mulch** in landscape beds and tree rings to reduce evaporative water loss from bare soil.



# Planning for drought

3%

- **Never irrigate during the heat of the day**, in windy conditions or during rain storms. Don't over water and allow water to run off landscapes. Over watering is a significant water savings opportunity.
- **If lawn irrigation is prohibited** – but tree watering is allowed – use drip irrigation to supply trees with water. Young/recently planted trees should be watered closer to the trunk where the majority of the root system is located. Older, mature trees should have water applied in the zone between the trunk and out to the drip line (the outer edge of the tree's canopy).
- **Follow all label instructions** when applying pesticides and fertilizers to drought-stressed lawns and other landscape plants, to avoid plant injury. Understand that some applications may not be necessary or effective when sufficient water is unavailable.

## Conclusion

Coloradans benefit tremendously from the 3% of all of the state's water used for landscapes. The return on investment from that 3% pays tangible benefits in terms of property value, quality of life within our communities related to environmental issues as well as to personal safety, health and well-being. That said, there is more opportunity to conserve and reduce the 3% consumption of outdoor water without jeopardizing the long-term benefits associated with landscaped areas.

We can and should preserve landscapes in the process of conserving water. Working together, Coloradans can partner to preserve our green spaces and ensure future generations enjoy the many benefits community parks and recreation fields as well as our own backyards provide.



## Resources

**Colorado Foundation for Water Education**  
**Colorado State University Extension**  
**Colorado Water Institute**  
**Colorado Water Plan**  
**Colorado Water Wise**  
**Green Industries of Colorado, Best Management Practices for the Conservation and Protection of Water Resources in Colorado**  
**Wright Water Engineers, Quantifying Expected Benefits of Landscape Water Conservation Best Management Practices**

## Citations

1. Colorado Water Plan. [www.colorado.gov/cowaterplan](http://www.colorado.gov/cowaterplan). Accessed 14 September 2016.
2. Maller, C, M. Townsend, A. Pryor, P. Brown and L. St. Leger (2005). Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations. *Health Promotion International*. December 2005. Vol. 21(1):45-54.
3. Moulton, R., and Richards, K. 1990. "Costs of Sequestering Carbon through Tree Planting and Forest Management in the United States". General Technical Report WO-58, U.S. Department of Agriculture. Washington, D.C.
4. McAloney, M. 1993. Arguments for Land Conservation: Documentation and Information Sources for Land Resources Protection. Sacramento, CA: Trust for Public Land.
5. Nowak, D.J. and D.E. Crane. 2002. Carbon storage and sequestration by urban trees in the USA. *Environ. Pollution*. 116:381-389.
6. Timilsina, N., Staudhammer, C., Escobedo, F.J., Lawrence, A. 2014. Tree biomass, wood waste yield, and carbon storage changes in an urban forest. *Landscape and Urban Planning*, 127:18-27.
7. Qian, Y.L., and R.F. Follett. 2002. Assessing soil carbon sequestration in turfgrass systems using long-term soil testing data. *Agron. J.* 94:930-935.
8. Nowak, D.J. and G.M. Heisler. 2010. Air quality effects of urban trees and parks. National Recreation and Park Association. [http://www.nrpa.org/uploadedFiles/nrpa.org/Publications\\_and\\_Research/Research/Papers/Nowak-Heisler-Summary.pdf](http://www.nrpa.org/uploadedFiles/nrpa.org/Publications_and_Research/Research/Papers/Nowak-Heisler-Summary.pdf). Accessed 14 September 2016.
9. McPherson, G.E., Q. Xiao, C. Wu and J. Bartens. 2012. Metro Denver Urban Forest Assessment. [https://www.denvergov.org/Portals/747/documents/forestry/Denver\\_FinalReport.pdf](https://www.denvergov.org/Portals/747/documents/forestry/Denver_FinalReport.pdf). Accessed 14 September 2016.
10. The Lawn Institute. <http://www.thelawninstitute.org/pages/education/lawn-facts-and-stats/lawn-and-turfgrass-facts-and-stats/>. Accessed 14 September 2016.
11. Taha, H., D. Sailor, and H. Akbari. 1992. High-albedo Materials for Reducing Building Cooling Energy Use. Lawrence Berkeley National Laboratory Report No. 31721 UC-350: 71.
12. United States Department of Energy. 2003. Energy savers: Tips on saving money and energy at home. Energy Efficiency and Renewable Energy Clearinghouse.
13. Environmental Protection Agency. 2016. Climate Change and Heat Islands. <https://www.epa.gov/heat-islands/climate-change-and-heat-islands>. Accessed 14 September 2016.
14. Akbari, H., D. Kurn, S. Bretz, and J. Hanford. 1997. Peak power and cooling energy savings of shade trees. *Energy and Buildings*. 25:139-148.
15. Jarrett, A.R., D.P. Shelton, K.A. Feehan. 2010. Stormwater management on residential lots. The Pennsylvania State University. F264.
16. Hood, G. 2016. Development gobbled more than 500 sq. miles of Colorado in a decade, study says. Colorado Public Radio News.
17. Stigarll, A. and E. Elam. 2009. Impact of Improved Landscape Quality and Tree Cover on the Price of Single-family Homes. *Journal of Environmental Horticulture* 27:24-30.
18. Laverne, R.J. and K. Winson-Geideman. 2003. The influence of trees and landscaping on rental rates at office buildings. *J. Arboriculture*. 29(5): 281-290.
19. Wolf, K.L. 2007 (August). City Trees and Property Values. *Arborist News* 16(4):34-36.
20. Donovan, G.H. and D.T. Butry. 2011. The effect of urban trees on the rental price of single-family homes in Portland, Oregon. *Urban Forestry & Urban Greening*. 10:163-168.
21. Tyrväinen, L., and A. Miettinen. 2000. Property Prices and Urban Forest Amenities. *Journal of Environmental Economics and Management* 39:205-223.
22. Health Council of the Netherlands. 2004. Nature and Health: The Influence of Nature on Social, Psychological and Physical Well-Being. Health Council of the Netherlands and RMNO, The Hague.
23. Kuo, F.E. and Sullivan, W.C. 2001. Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environment and Behavior*. 33:343-367.
24. Wolf, K.L. 2010. Crime and Fear—A Literature Review. In: *Green Cities: Good Health*. College of the Environment, University of Washington.
25. Kuo, F.E. and W.C. Sullivan. 2001. Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environ. and Behavior*. 33(3):343-367.
26. Heerwagen, J.H., and G.H. Orians. 2002. The ecological world of children. In: Kahn, P.H.J., and S.R. Kellert (eds.), *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*. MIT Press, Cambridge MA, pp. 29-64.
27. Kahn Jr., P.H., and S.R. Kellert. 2002. *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*. MIT Press, Cambridge MA.
28. Kirkby, M. 1989. Nature as refuge in children's environments. *Children's Environments Quarterly* 6:7-12.
29. Kuo, F.E., Sullivan, W.C., Coley, R.L., & Brunson, L. (1998). Fertile ground for community: Inner-city neighborhood common spaces. *American Journal of Community Psychology*, 26(6): 823-851.
30. Cooper-Marcus, C. and M. Barnes (1995). *Gardens in Healthcare Facilities: Uses, Therapeutic Benefits, and Design Recommendations*. Martinez, CA: The Center for Health Design.
31. Park, S., C. Shoemaker and M. Haub. 2009. Physical and Psychological Health Conditions of Older Adults Classified as Gardeners or Nongardeners. *HortScience*. 44: 206-210.
32. Cathleen D. Zick, Ken R. Smith, Lori Kowaleski-Jones, Claire Uno, and Brittany J. Merrill. Harvesting More Than Vegetables: The Potential Weight Control Benefits of Community Gardening. *American Journal of Public Health*: June 2013, Vol. 103, No. 6, pp. 1110-1115.
33. Ulrich, R.S. 1984. View through a window may influence recovery from surgery. *Science*. 224(4647):420-1.
34. Jenerette, G. D., Harlan, S. L., Stefanov, W. L. and Martin, C. A. 2011. Ecosystem services and urban heat riskscape moderation: water, green spaces, and social inequality in Phoenix, USA. *Ecological Applications*. 21:2637-2651.
35. Lovell, S. T. and Taylor, J.R. 2013. Supplying urban ecosystem services through multifunctional green infrastructure in the United States. *Landscape Ecol.* 28:1447-1463.
36. Green Industry Best Management Practices (BMPs) for the Conservation and Protection of Water Resources in Colorado: Moving Towards Sustainability. [www.greenco.com/current-bmps.html](http://www.greenco.com/current-bmps.html). Accessed 14 September 2016.