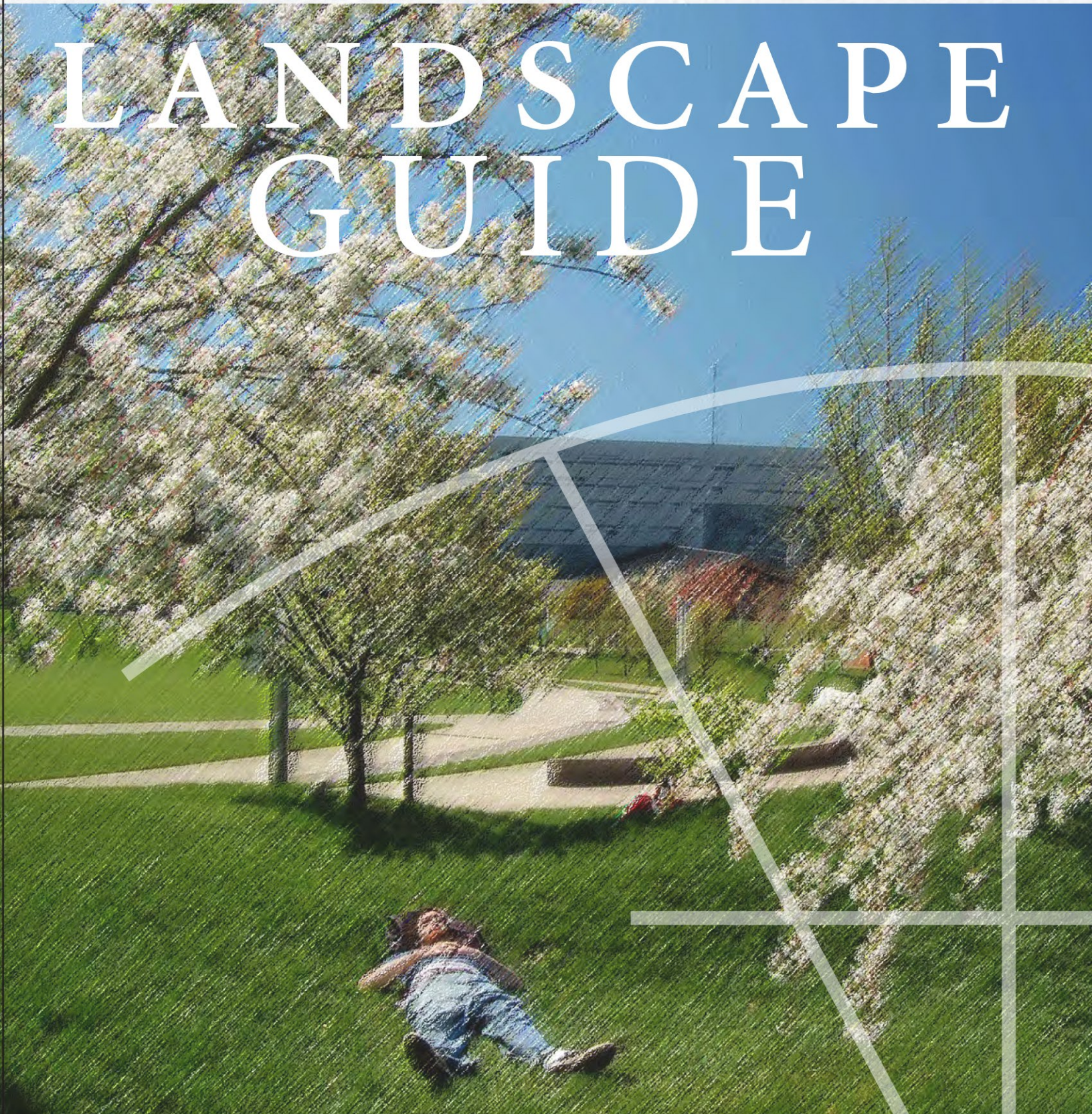


UNIVERSITY OF CINCINNATI

LANDSCAPE GUIDE



OVERLAY 2014

The Sustainable Landscape

Sustainable landscape design begins with an understanding of the intended use of the site and includes function, maintenance, environmental compatibility, cost effectiveness, accessibility and aesthetics.

As a continuum that is both active and passive, the sustainable design reinforces the interconnection of natural and human resources through its commitment to energy and water conservation, plant, pavement, and light fixture selection, chemical utilization, waste prevention, pollution, and facility maintenance and operation.

The following is a list of sustainable landscape recommendations and strategies that introduce concepts related to the aforementioned design criteria. The content is regionally relevant, compatible with the United States Green Building Council standards, and, in many cases, applicable and achievable (with perhaps some modification) on the campus landscape:

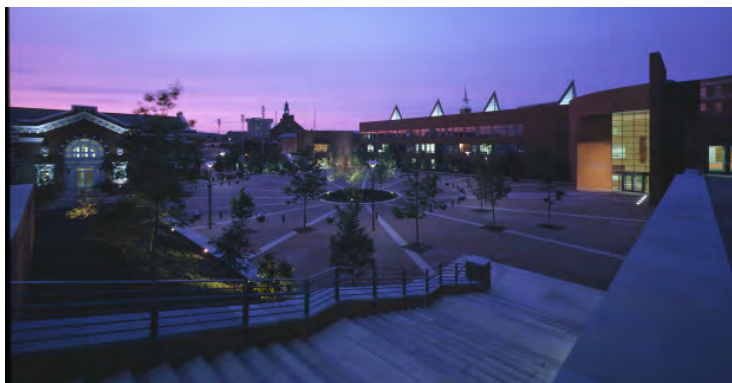
- How we plan, design and manage the landscape has significant consequence on biodiversity. Biodiversity generally refers to the variety of life in all its forms and combinations, including the diversity found among eco-systems, species, and the genetic make-up of all living things. The best way to conserve biodiversity is to save habitats and ecosystems. The demands on the natural resources from increasing activity (i.e. construction) places great pressure on biodiversity... habitat modification, introduction of non-native species, and pollution from a variety of sources all contribute to its loss



- Encourage conservation of the ecosystem through:
 - use of regionally specific community models
 - increased (though not exclusive) use of native plants which are adapted to the climatological conditions of our region
 - sound management of aggressive exotic invasive plants
 - during new construction, minimal site disturbance and preferential re-use (if possible) of existing plant materials
 - careful selection, siting, and proper installation of new plant material, including proper after care, to reduce such problems as transplant shock, long term plant stress, on-going maintenance, and mortality



- Cultivate a minimum of high maintenance lawn areas...therefore lower maintenance requirements, including reduced mowing, raking, fertilizing, irrigating, aerating, soil amending, and pesticide applications. Reduction in total lawn area will also reduce maintenance costs
- Reliance on integrated pest management (I.P.M.) to maintain undesirable pest species below action thresholds with minimal pesticide use
- Low use of toxic and/or hazardous materials, and lower use of chemicals, petroleum products, and fuels in general; reduction in use of rock salt and related deleterious chemicals for snow and ice removal operations
- Conservation of water by reducing surface and subsurface run-off through preservation and use of vegetation, and through water detention and retention areas; reduction of storm drains and diverting of water off-site; reduction of impervious paving surfaces, and increase in porous surfaces
- Conservation of soil through erosion control, retaining organic matter on site (i.e. grass clippings and shredded leaves), and reducing soil pollutants (salt, petroleum products, toxic chemicals)
- Preferential use of local materials (pavers, concrete, wood, mulch, plant materials, etc). Encourage utilization of renewable and recyclable materials
- Education and interpretation of the sustainable landscape throughout the curriculum, from classroom to outdoor lab, to informal walks across campus...identification of the importance of sustainability in the living process, and its contribution to the creation of “the sense of place”



Sustainability and Construction

Since construction practices can adversely effect the environment, restrictions related to future construction should be mandated/encouraged. Recommended practices to retaining the health of a site and the post-construction healing of the site should include:

- Locate the existing features within the construction zone and protect the inherent resources
- Remove invasive plants
- Keep utilities accessible
- Clearly designate perimeter, and fence to protect resources within and outside the construction site
- Limit the use of adjacent green and hardscape for parking
- Preserve healthy topsoil... attempt to avoid compaction and leave native soils unamended
- Protect existing trees...avoid intrusion within drip line and do not modify the grade under the trees canopy
- Use lightest equipment necessary to accomplish site work
- Thoughtfully restore the site after construction
 - grade to follow prevailing topography
 - grade subsoil, not topsoil
 - amend soil with restraint and use green waste/compost to improve organic quality of soil
 - utilize the right plant in the right place
 - remove excessive, unnecessary pavement
 - if practical, employ practices of phyto and bioremediation (using plants and /or micro-organisms) to decontaminate soil, water, and air



Plant Selection

By carefully selecting the “right plant for the right place”, and matching the plant characteristics to the site and soil conditions, the “resourcefully” designed sustainable landscape can anticipate reductions in water, pesticide and fertilizer usage, reductions in maintenance costs, and increased erosion control.



Sustainability does not necessarily mean the elimination of maintenance or economic input (i.e. chemicals, labor, capital) but rather, the sustainable landscape “encourages” the creation of outdoor spaces that require fewer inputs, are self-perpetuating, and establish a harmonious relationship between the natural and the man-made environments.

One key to achieving the sustainable landscape is to select plants that are either native to the area, or have demonstrated an adaptability to perform well in our area.

This can be accomplished by following the below practices and recommendations:

- Factors such as hardiness, water, light, and soil requirements need to be considered
- Choose plants that require minimal care
 - compact varieties require less pruning
 - insect and disease resistant varieties require less spraying
 - drought tolerant require less water (xeriscapes)
 - use native and/or adapted plant materials
 - use annuals only in small areas...trees, shrubs, and
 - perennials reduce yearly planting costs and maintenance
- Restrict/eliminate the use of invasive plants that might displace native plants, and disrupt the natural ecosystem
- Use groundcovers, and/or mulches to control weed and conserve soil moisture

Chemicals and the Sustainable Environment

Integrated Pest Management (I.P.M.)

The improper use of pesticides and fertilizers contributes to both the pollution of surface and groundwater, as well as the possible contamination of the soil. Using effective landscape

management practices and appropriate applications of pesticides and fertilizers, a reduction and/or elimination to the impact on water quality can be expected.

The recommended approach of managing pests in the sustainable landscape is through the practice of an Integrated Pest Management (I.P.M.) program. I.P.M. is a decision-making process which considers culture, mechanical, biological, and chemical control of pests.



This pest management system centers on preventing and managing pests with the minimal impact on human health, the environment, and non-target populations. Selecting plants that are climatologically tolerant (drought/cold) and disease and insect resistant are the best prerequisites in sustaining a healthy pesticide-free environment.

Where chemical control is used, specific pest populations are targeted when they are most vulnerable, rather than the indiscriminant applications of these chemicals.



Ice and Snow Control

“According to the Natural Oceanic and Atmospheric Administration, each year in the United States adverse winter weather contributes to an average of 1.4 million car accidents, resulting in 7,000 deaths, more than 600,000 injuries and an estimated \$42 billion in economic loss.” (Campus Facility Magazine Nov. 2006).

For the college environment, the efficient removal of snow and ice is essential in promoting a safe pedestrian and vehicular campus experience. However, as the public becomes more aware of the harmful effects of ice-melt products, alternative, environmentally-friendly products are being introduced.

Rock salt (sodium chloride) has been The University standard, and as an ice and snow control agent, dates back to the 1930's.... over application of sodium and calcium chloride, while

performing at colder temperatures (-20 degrees Fahrenheit) can, however, have significant influence in shortening the life of concrete surfaces, corroding metal railings, polluting water through run-off, damaging soil and killing plants.

Interestingly, some governments, including Canada, have recognized the harm and have considered adding rock salt to their toxic substance list, in order to control its use.

For this reason, several other products should be considered as alternatives to conventional rock salt and calcium chloride. Calcium magnesium acetate (CMA) is considered the most viable alternative because of its low environmental impact and low potential for corrosion. It is, however, less effective at colder temperatures, and significantly more expensive than rock salt, but CMA is biodegradable and actually improves the water and air permeability of the soil...perhaps its use in selected sidewalk applications, building entrances, and hardscapes where plantings are either contained or immediately adjacent, would be the most appropriate use for this de-icing agent.



Water Use and Management

Water conservation is essential to the sustainable landscape. The key to its management is to apply only the amount needed, using the best strategies, fixtures, and equipment to maximize the potential for water collection (where applicable), and minimize water loss and run-off.

The evolution of The University campus through Master Plan construction has included the installation of irrigation systems as an open space standard. With our measurable annual rainfall, and the relative inexpense associated with water usage, The University's typical design and maintenance approach to the water requirements of the campus landscape has been one principally of indulgence, rather than conservation.

Recent projects, including Varsity Village and Main Street's east phase, have incorporated non-potable retention systems as part of their infrastructure. These systems were designed to hold the necessary amount of water to adequately irrigate the green spaces within, and adjacent to these two projects. While the concept is meritorious and its design is endorsed by the USGBC, the system remains untested, and both require additional pipe and pump inspection and repair before the efficiency or deficiency of its performance can be determined. Similarly, the open space (Eden Quad: 5 acres +/-) associated with the new MSB/CARE project will be irrigated by roof collected rain water. While this method of water harvesting conforms to USGBC/ LEED Standards, other hydrologic and water collection/containment/ distribution systems and design methodologies remain "untapped."

Some of these other less conventional water retaining systems might include:

- Harvesting of gray water (all non-toilet wastewater)...This was once considered for irrigation on the Zimmer roof garden
- Drywells and dry streambeds to allow rainwater to percolate slowly into the soil
- Add rain gardens to low-lying areas...These gardens are achieved by grading and planting to allow storm water to daylight into a low-lying area and slowly infiltrate into the surrounding landscape and groundwater system. As an option to traditional storm drains, that carry water directly to local streams and rivers, rain gardens filter and re-use this water, reducing storm water run off and pollution. These gardens, once established, require little maintenance and are ideal wildlife habitats
- Install swales and berms to hold and direct storm water... one of the inherent benefits of our existing landform architecture



- Irrigate efficiently... There are many ways to increase the efficiency of our irrigation systems. Match the method (drip: in-line or sub-surface, pop-up (our typical system), or soaker hose) to the situation, the soil, and the plants. Most importantly, do not water paved areas... adjust the spray patterns. Finally, avoid evaporation, reduce fungal growth, and avoid leaf scorching by using spray irrigation in the early morning hours between 4:00-8:00 AM
- Reduce lawn areas... consider converting areas around campus to natural looking, mulched, tree and shrub borders that will conserve water and reduce maintenance
- Utilize xeriphytic plants... landscape to minimize water consumption requires the selection of drought resistant plant varieties. Many varieties of native and non-invasive ornamental plants are adaptable to “dry landscapes.”

Pavement

In the natural environment rainfall penetrates into the soil, is filtered, and ultimately

migrates to waterways and aquifers. The built environment, by contrast, contains countless miles of impervious surfaces (driveways, roads, walks, patios, etc) that potentially seal the surface preventing water penetration, and increased erosion, allowing containments to run-off.

The goal, then, is to construct surfaces that are porous, allowing water to infiltrate, restore the hydrology of the site, improve water quality, and potentially eliminate the need for detention systems.



There are many recommendations for improving the impervious condition of hardscapes... some of these include:

- Utilizing planting swales around parking lots instead of berms...swales gather and direct water allowing it to be absorbed, berms simply let water run off onto the pavement, and/or into the storm drain
- Narrow the width of roads, driveways, and sidewalks
- Replace impenetrable driveway surface with porous alternatives... pervious concrete and asphalt as options to conventional concrete and asphalt, contain aggregates that are interconnected, yet highly permeable. Other options would include pavers, brick, and turf stone, all of which have interstitial space to allow water to penetrate
- Design green spaces between hard surfaces
- Use dry laid patios and walkways instead of pavers set in concrete
- Recycled rubber sidewalks as an alternative to concrete

Landscape Lighting



“Qualitative lighting design meets the quantitative needs of the visual environment with the least impact on the physical environment.”

The University’s landscape lighting is, at best, contradictory. While we continue to search for better, more energy efficient lights to provide predetermined (recommended foot candle) levels for ambiance, function, and safety, we similarly select and perpetuate fixture types that are sustainably unacceptable. Our current composition of ball and basket, historic, sodium vapor, disc, half-sphere, gooseneck, uplights, fiber optic, LED, architectural luminaries and bollards represent an ensemble in need of modification and continuity.



The lighting Master Plan designed by LAM Partners in concert with Hargraves’ campus Master Plan, consists principally of two light fixtures (disk and ball and basket) that were assigned to primary and secondary pedestrian connections. Unfortunately, the ubiquitous ball and basket fixture does not conform to the USGBC’s and the International Dark Sky Association’s light pollution standards of acceptability, and, at some point, and with great expense, should be re-evaluated based on its non-sustainable design (in both material content, durability, and inefficiency), and replaced with a fixture that is downward directed and more energy efficient.



Since lighting consumes so much of the country’s energy output, recommendations, in appropriateness of selection of fixture type and lamp, are necessary. In order to effectively achieve security, function, and aesthetic standards, the following criteria should become prerequisite for fixture lamp selection:

- The light source should produce adequate light efficiently , maximizing illumination and minimizing energy consumption
- The light produced should be focused and aimed where needed
- A light source should function only at the time needed... the installation of timers and sensors can help coordinate this requirement

As more lighting manufacturers join the USGBC, more lighting options will be introduced that will comply with recommended photometric levels, reduced energy utilization, and conformity with dark sky requirements.



Landscaping can provide a means of suppressing noise from a specific source. To reduce external noise such as that associated with roadways, the construction of acoustic barriers (i.e. earth berms vegetative walls or screens, etc) can prove effective.

Other measures can be incorporated into the landscape design to improve the sound/soundless quality of the space... by combating sound with sound, like that associated with Campus Green and University Commons’ fountains; the drone from the adjacent roadway traffic is “masked” by the sound of running water.

With the constant sensory over-stimulation of dissonant sound intersecting and interrupting our outdoor experience, the need for establishing a “peaceful sustainable harmony” between man and his environment becomes increasingly more important... whether it is a gentle stroll across campus, an outdoor dining experience, or just pensively pausing for momentary engagement or disengagement.

While the total elimination of noise is unachievable in our urban environment, the possibility of sound reduction, through effective landscape placement, is realistic

Energy

Fuel

In the University environment, energy conservation applies to both the buildings and the open space... in the landscape, energy savings can be realized through proper infrastructure selection and management, labor efficiency and equipment selection and utilization.

Undertaking the amount of energy (fossil fuel) being used, and constantly seeking viable alternatives to minimize their consumption is the first step in reducing maintenance costs.

By utilizing smaller power tools or hand tools, fuel efficient vehicles, and more effectively consolidating campus service activities, measurable reductions in fuel utilization can be realized.

In today's world of climbing fuel prices, approaching the peak oil supply limit, and discussions of global warming, alternative energy is gaining more attention and receiving more support.



The use of biomass, a material derived from plants rather than petroleum, has significant relevance. This material can be used to create fuels, such as ethanol and biodiesel, which are essentially carbon neutral. Unlike the burning of fossil fuels, which utilize carbon, biofuels utilize plants that take up carbon dioxide. Biomass fuels reduce greenhouse gas emissions and reduce dependence on imported oil while supporting agricultural economies.

Where applicable, fleet vehicles and the equipment required for grounds and facility maintenance should be converted to non-fossil fuel sources.

Landscape



While principles of "residential" landscape design probably cannot be fully employed in our institutional setting, it is worth noting that the thoughtfully designed landscape can produce the following energy saving benefits; and may have relevance in the institutional setting.

■ Trees clean the air by absorbing carbon dioxide and releasing oxygen

■ Interestingly, the National Academy of Sciences (NAS) estimates that urban America has over 100 million potential “tree spaces” (i.e. spaces where trees could be planted). NAS further estimates that filling these spaces with trees would result in annual energy savings of 50 billion kilowatt hours... 25% of the 200 billion kilowatt hours consumed by air conditioners in the United States. This would reduce electric power plant emissions of carbon dioxide by 35 million tons annually and save users of utility supplied electricity \$3.5 billion each year (* assuming an average of \$0.07/kilowatt hour).



■ Carefully placed trees can save up to *25% (*based on a residential survey) of energy consumption for heating and cooling... shade in summer, solar penetration and/or windbreak in winter

■ Shading and evapotranspiration (the process by which a plant actively releases water vapor) from trees can reduce surrounding air temperatures as much as 9 degrees Fahrenheit. Because cool air settles near the ground, air temperatures directly under trees can be as much as 25 degrees Fahrenheit cooler than air temperatures on blacktop with no tree canopy... similarly, daytime air temperatures are found to be 3-6 degrees Fahrenheit cooler in tree-shaded areas, as treeless areas

■ In winter, if the outside temperature is 10 degrees Fahrenheit and the wind speed is 20 miles/hr, the wind chill is -24 degrees Fahrenheit. A residential study found that windbreaks on the north, west, and east (south left open for passive solar collection) cut fuel consumption by as much as 40%... houses with windbreaks on the windward side only averaged 25% less fuel consumption

■ Certain grasses, such as buffalo grass and fescue only grow to a certain height (roughly 6”), and are water thrifty. By using these species, measurable reductions in fuel, water, and time required for mowing, watering, and string trimming should be expected. Furthermore, pollution caused by the equipment needed for high maintenance could be substantially reduced as well.

Sustainable Products

The products of the sustainable landscape are abundant, and include pavement, lighting, irrigation systems, site furnishings, metal for drainage, grates, and railing, signage, plants, soil and soil amendments, pesticides and fertilizers (organic), stone, wood, and equipment.

Many of our suppliers have adopted policies and manufacturing methodologies that employ environmentally sustainable practices, including the production of goods that are comprised of recycled materials and are, in themselves, designed for energy efficiency.