Advances in Scientific Research: Engineering and Architecture

Editors

Ilia CHRISTOV
Viliyan KRYSTEV
Recep EFE
Abd Alla GAD

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Landscape in LEED-Certified Buildings: What Matters Most, Aesthetic Concerns or Sustainability?

Alev P. GÜRBEY

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INTRODUCTION

After the time first cases of COVID-19 emerged in late 2019 in Wuhan, China, no one could have imagined that it would soon become a pandemic recognised by the World Health Organization (WHO). Today the virus has spread around the world and this invisible –organism at the edge of life- has forced people to stay in quarantine and social isolation globally. These sorts of pandemics are often perceived by many as a -war of nature against humanity -(Rybicki 1990). However, while sociopolitical dogma gets played out amongst nations, many problems caused by our intense human activities such as climatic change, over-extraction of natural resources have slowed due to the virus, and nature has been allowed a respite.

This situation presented by the current pandemic is an exciting snapshot into testing and reconfiguring our concepts of sustainability. Originally brought to the fore 33 years ago with the Brundtland Report, the concept of sustainability has been underlined by different branches of science for years, becoming even more relevant today.

"Balancing environmental protection and social responsibility with a healthy economy over time" is the main concept of most sustainability definitions to date (URL 1). The idea of sustainability is highly contingent upon cultural and natural characteristics. Therefore, even though the term has universal use, an agreement on the application of the definition amongst numerous disciplines is much more difficult. Within the mutually-agreed confines of a sufficiently inclusive conceptual framework, multiple meanings and site-specific definitions are possible. (Seghezzo 2009). To be defined as sustainable, it is purported that a steady continuity of use within specified

goals and aspirations until the end of a planned lifecycle is all that is required, even though the parameters may change (Sutton 2004). Indeed, in this way, sustainability is more a relative concept; a goal to strive for rather than a well-defined endpoint (Cook and Van Der Zanden 2011) and thus can be difficult to initiate in a world of heavily interlinked and fluctuant economic and social systems.

The concept of sustainability has arisen out of the growth of human-dominated ecological systems (URL 2). While indigenous people have lived in more harmonious connectivity with nature since before the beginning of the colonial system, the majority of today's industrialized countries supported ever-increasing populations through the extraction of resources to produce food and other staples often without keen regard for environmental consequences. What these efforts were doing to the earth or how they might affect its capacity to provide for future generations did not factor into the equation in many cases. As stated by Mittman (2006) and Newton (2007) the devastating human consequences of environmental events like hurricanes, earthquakes, droughts, floods, and tsunamis were among the only checkpoints to remind us how difficult it is to continue to separate economic and social parameters of society from environmental consequences. Today, in light of the current disruptions caused by COVID-19, a similar test is being put to our separation of these parameters, and indeed, therefore, toward our ability to embrace sustainability.

So how do we embrace sustainability? Goodland (1995) puts forth a slightly simpler definition of sustainability as "the maintenance of natural capital". Therefore, this definition of sustainability uses more so the basis of maintaining long-term harmonious use and interaction with the environment as the foundation, atop which both social and economic requirements must retrofit (Morelli 2011). In other words, sustainability is the ability to maintain the qualities that are valued in the physical environment balancing the interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate these services nor by our actions diminishing biological diversity (Sutton 2004, Morelli 2011).

With globalization and the global human population fast-growing, it is necessary to pay increased attention to the implications of our continued failure to embrace sustainability properly (Jha & Murthy 2006). Environmental sustainability programs are developing and include actions to reduce the use of new physical resources, the adoption of a 'reduce, reuse,

recycle' approach, the use of renewable rather than depletable energy sources, the redesign of production processes and products to eliminate toxic and unnecessary materials and the protection and restoration of natural habitats and biological diversity (Sutton, 2004). These essential activities to ensure such sustainability need to take place at a more holistic scale and between nations and disciplines, rapidly. One way this can be done is through the field of architecture and sustainable buildings.

SUSTAINABLE DESIGN

In the 1970s, the concept of sustainable design emerged when some designers started to criticize modern and unsustainable product development and suggested alternatives. This included ideologies such as 'design for the environment' predominantly focused on scientific and technological fixes for problems of sustainability. At the beginning of the 21st century, sustainable design principles (the Hannover principles) were crafted by William McDonough, who espouses a message that we can design materials, systems, companies, products, buildings, and communities that can continuously improve over time (PennState 2020)

Nowadays, sustainable design is characterized by the designers' growing concern for environmental and socio-cultural sustainability, life quality and user innovation. It can also be defined as a design philosophy that seeks to maximize the quality of the built environment while minimizing or eliminating negative impact to the natural environment (Keitsch 2012, McLennan 2004). The concept of integrative and sustainable design recognizes that human civilization is an integral part of the natural world. That nature must be preserved and perpetuated if the social community itself is to survive. Sustainable design articulates this idea through approaches that exemplify the principles of conservation and encourage the application of those principles in our daily lives (Milosevic 2004). The concept of good architecture has headed to encompass the notion of a building that is sensitive to its environment. That is why many approaches to sustainability in architecture and design focus primarily on environmental issues, ignoring contextual aspects surrounding sustainable design (Williamson et al. 2003).

The objective of sustainable (green) design, is to create and sustain a high quality of community values and environmental responsibility in the design and construction of buildings, infrastructure, transport, and landscape. Sustainable design goals are to reduce consumption of non-renewable resources, minimize waste, and create healthy, productive environments;

hence it applies the principles and practices of resource conservation and renewable energy design (URL 1, URL 3).

GREEN BUILDINGS AND CERTIFICATION SYSTEMS

Green buildings generally have construction and lifetime of operation that assure the healthiest possible environment while representing the most efficient and least disruptive use of land, water, energy and resources. This has come out as a product of sustainable design processes (GGGG, 2014).

Buildings have substantial direct and indirect impacts on the environment. During their construction, occupancy, renovation, repurposing, and demolition, buildings use energy, water, and raw materials, generate waste, and emit potentially harmful atmospheric emissions. These facts have prompted the creation of green building standards, certifications, and rating systems aimed at mitigating the impact of buildings on the natural environment through sustainable design (Vierra 2019)

Certification systems for measuring the environmental performance of buildings have been around for 30 years. They have been instrumental in driving innovation regarding sustainability issues within the construction industry (Inbuilt 2010). These new technologies such as Building Research Establishment Environmental Assessment Method (BREEAM), Leadership in Energy and Environmental Design (LEED), German Sustainable Building Council's DGNB etc., are continually being developed and updated to complement current practices in creating sustainable structures. The common objective is that buildings are designed to reduce the overall impact of the built environment on human health and the natural environment. (Akadiri et al. 2012)

Nowadays, nearly 600 certification systems are used either on a global or a national scale (Vierra 2019). These certificates can only be given after an assessment mainly based on energy and environmental evaluation by using a single "rating". All these certification systems encompass issues as a whole which might otherwise be individually dropped or missed. BREEAM (UK) and LEED (USA) are the two most widely recognized environmental assessment methodologies used globally in the construction industry today. In Turkey, for example, only 3 of them are currently used. These are LEED (USA), BREEAM (United Kingdom) and DGNB (Germany). LEED is the most widely used system in Turkey. There is a total of 882 projects that have applied for the LEED-Certificate and approximately 405 different types of projects that are LEED-certified (Table 1).

Table 1. LEED-Certified project types and certification levels in Turkey

RATING SYSTEM	CERTIFICATION LEVEL			
	Platinum	Gold	Silver	Certified
LEED BD+C: New Construction	17	132	41	11
LEED BD+C: Core and Shell	6	69	4	1
LEED BD+C: Schools	1	4	-	2
LEED BD+C: Retail	-	1	-	-
LEED BD+C: Healthcare	1	6	1	-
LEED BD+C: Data Centers	-	1	-	-
LEED BD+C: Warehouses and Distribution Centers	-	-	1	1
LEED BD+C: Homes	18	14	-	1
LEED O+M: Existing Buildings	4	23	5	-
LEED ID+C: Commercial Interiors	4	23	5	-
LEED ID+C: Retail	-	-	3	4
LEED-ND: Plan	-	1	-	-
TOTAL	51	274	60	20

In 1998, the United States Green Building Council (USGBC) released the first version of LEED Green Building Rating System to create a system that the construction industry could use to achieve sustainable design goals (Fowler and Rauch 2006).

During the next ten years, some of the energy and water-related credits were changed, and the version "LEED 2009" was devised. While certification levels remained the same, certification is based on a 100-point credit scale, and the number of points required to achieve each level has changed; however, the primary construct and per cent each area contribute in total points remain unchanged (Nyikos et al. 2012). On 2 April 2019, USGBC announced the most comprehensive, collaborative, accessible and effective LEED system to date called LEEDv4.1 (Stanley 2019). Today ratings are made under eight different project types and rating systems with varying weights of scoring. There are the leading eight categories for building design and construction. The categories can be changed according to the project types.

Every green building project is required to take at least 40-49 points out of 110 from the specified titles of "New Building Design and Construction

Project Checklist" to receive a LEED certificate. Any points above 49 count toward higher certification levels, including Silver (50-59 points), Gold (60-79 points) and Platinum (80 or more).

LANDSCAPE-BASED DECISIONS ON LEEDv4.1 CATEGORIES

As research in landscape ecology and associated disciplines evolves, the design and building industry will need to respond, and LEED provides an excellent forum for doing so. By addressing the underlying biophysical relationships and context of a site from the earliest phase, building projects can improve environmental performance and achieve LEED accreditation while also integrating intelligently with the surrounding land and natural systems – a goal worthy of any sustainable design initiative. Landscape architects (LAs) are uniquely equipped to facilitate this process of integration and should be incorporated from the beginning of a project aiming for LEED certification (Almiñana and Eisenman 2003).

LAs are trained to think about landscapes as systems. Much of their work centres on the best practices driven by ecologically sound principles for vegetation, stormwater, material use, and microclimate effects (Cowie 2020). LAs can contribute to the following landscape-related LEED credits fall under the categories of Location & Transportation, Sustainable Sites, Water Efficiency, and Materials & Resources.

Location & Transportation (18 Points)

This new category includes some credits that were evaluated in the sustainable sites category in LEED 2009.

LEED for Neighborhood Development Location & Sensitive Land Protection & Surrounding Density and Diverse Uses: LAs need to be in the decision-making process to avoid the development of inappropriate sites and to protect soils designated as prime farmland, floodplains, endangered species habitat, wetlands and public parklands in land-use plans. Because their training in natural and cultural systems gives them the knowledge to select sites, or areas within locations, which minimize impact to soils, hydrology, vegetation, and wildlife habitat (Carmichael 2014).

High Priority Site: LAs create solutions for remediation studies of the sites such classified as a Brownfield. In the landscape recovery process, biological rehabilitation and planting have an essential place. Depending on the conditions of the construction area, it is possible to reclaim the space through reconstructing ecological, economic and aesthetic values by

landscaping with the correct plant types and effective planting techniques. These works require time, labour, financial resources, and expertise to be successful and must start with construction activities and carry out with a holistic approach (Akpınar 2005).

Bicycle Facilities & Reduced Parking Footprint: LAs have a substantial contribution to alternative transportation, by bicycle/pedestrian ways and parking lots. By providing bicycle ways&parking, also changing rooms, pedestrian ways, minimizing parking lot size and offering preferred parking for carpools will make projects more advantageous. These regulations will encourage building users and employees to drive fewer autos and accordingly have positive effects on air quality and human health.

Sustainable Sites (10 Points)

Sustainable sites are the category which has the most resemblance to landscape architecture. This category has the most significant effect on how the building is built and connects with surrounding areas (Morris 2009).

Construction Activity Pollution Prevention: LAs can take place in the preparation of soil erosion and sedimentation control plans before starting construction work. Las can help the design process which fits the site's topographic, soil, vegetation, and drainage context to minimize erosion and also can limit removal of vegetative cover and employ vegetative buffer strips to control erosion. For controlling sedimentation; stabilization by seeding and mulching are also among the works of LAs (Hopper 2007).

Site Assessment: LAs can complete and document an extensive site survey/assessment that includes natural and cultural data of the sites such as topography, hydrology, climate, vegetation, soils and human use.

Site Development: Intention of this credit is to conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity (URL 4). LAs can guide strategic decisions within sites to achieve development in harmony with natural systems. Also work at the site scale to minimize site disturbance, preserving and enhancing the highest quality resources while developing upon the least sensitive (Carmichael 2014). They can help getting points by documenting existing native or adaptive green areas, replacing hardscapes with appropriate green spaces, converting sod/non-natives to an approved green zone, or create an off-site green space.

Open Space: The projects need to provide outdoor space greater than or equal to 30% of the total site area (including building footprint). A minimum of 25% of that outdoor space must be vegetated (except turf grass) or have overhead

vegetated canopy (URL 5). It is the LAs duty to design and create spaces for active & passive recreation, interaction with nature and social interaction.

Rainwater Management: LAs are uniquely positioned to assist in rainwater management facilities. Solutions such as green roofs, cisterns, rain gardens, bioswales, wet ponds and permeable pavements help to collect and keep stormwater at the source and also have the benefit of creating wildlife habitat with a beautifully landscaped setting.

Heat Island Reduction: For reducing heat island effect (non-roof and roof), LAs use planting for shading (native vegetation, drought-tolerant plants and trees), green roofs and pavements that are light in colour and porous.

Light Pollution Reduction: LAs can also ensure low outdoor lighting and reduce light pollution at the site by installing more efficient and better performing luminaires to avoid wasteful diffusion and reduce long-term maintenance requirements. The LAs can choose motion sensors and precision lighting in the appropriate sites (Almiñana and Eisenman, 2003).

Water Efficiency (11 Points)

Points can be achieved by reducing the amount of water used, including up to 30% of the overall water use and up to 100% of the landscaping irrigation. The main idea of this step is "no potable water is used". LAs can minimize the use of potable water by choosing the right plant to the right place using the right planting philosophy such as "Xeriscaping" and also by using soil binders, nitrogen fixers, green manure and pest repelling plants.

LAs are also increasingly engaged in the design and development of systems that biologically treat wastewater. As creative, on-site wastewater technologies become more common, LAs play an essential role in their design, siting, and integration with the site (Almiñana and Eisenman, 2003).

Materials & Resources (13 Points)

Building Product Disclosure and Optimization - Sourcing of Raw Materials

Points can be earned for encouraging sustainable forestry practices by using certified wood products, where wood is used. Decking and exterior canopy structures are opportunities to incorporate the use of certified timber in landscape and site-related improvements (Almiñana and Eisenman, 2003).

Especially in redevelopment projects, LAs can reuse materials such as concrete slabs from the existing construction area in a variety of applications.

For example; large intact pieces are used for dry-laid stone walls and stormwater check dams. Small sections of broken concrete are crushed, then reused as pavement sub-base for new roads (Almiñana and Eisenman, 2003).

Recycled materials such as glass, plastic, aggregates, wood, fly ash, blast furnace ash, garden waste, tyres and rubber, tar and bitumen products, paper, polystyrene and soil can be considered in the landscape as a means to reduce the waste stream. Plastics, polythene or polystyrene, are commonly used for boardwalks, decks, marinas, furniture, gates, fencing, geotextiles and paving. Playground safety surface made from recycled rubber tires is available in a variety of colours and forms. Processed sand is made from 100% recycled glass. This can be used as a top dressing or in cement or planting pits. Also, decorative pavers incorporating recycled glass chips as an aggregate provides different colour solutions. Recycled aggregates from inert construction waste (concrete, blocks, bricks, etc.). can be used in the formation of paths and roads or as a drainage layer. Wood can be used as woodchip or play bark in play areas, rural or domestic path surfaces, as a mulch or in decking and railings. Fly ash and blast furnace slag can be used in the formation of paths and roads, blocks or bricks or concrete. Garden waste can be turned into compost for soil improvement, turf establishment top dressing, planting or topsoil manufacture. Bitumen products are used as part of a bound path surface. Paper can be used as mulch (Carmichael 2014; Vernon, Tennant and Garmory 2009).

For credit achievement calculation, one of the most efficient ways to reduce the environmental impact of construction materials is to obtain them locally, due to the significant embodied energy expended during transportation (Thompson and Sorvig 2008). Even though what materials are used depends on the architect and contractor, this category also has the possibility for high LA involvement.

Construction and Demolition Waste Management: Landscape works mostly are the last part of a construction project. Still, the LAs can play an essential role from the startup by identifying and salvaging usable materials and designing them into the landscape plan. Materials resulting from the construction site such as heavy timbers, granite setts and other traditional paving materials have often been salvaged and reused. Still, it is possible to use many different materials. Proper storage of soil and the use of constructed lands from site waste can make a significant contribution to the volume of site material that is reused. The salvaging and processing of waste timber for composts and mulch can also be very beneficial for new planting.

Inorganic waste and excavated material are expensive to transport off-site and considerable cost savings can be made if the content can be used for ground modelling as part of the creative landscape design (Barnes 2012).

Energy-Efficient Landscaping

Out of the credits mentioned so far, there is one more LEED subcategory named as "Optimize Energy Performance" that applies primarily to the building structure. However, there are significant energy savings obtained through the intervention of landscape architects. Energy and Atmosphere category has the highest points (33 Points) in LEEDv4.1 checklist and Optimize Energy Performance subcategory has a range of 1-19 points for credits.

Energy and landscape are critical constituents in the physical development of the built environment. Energy conservation and landscape quality have been widely acknowledged as essential parameters in the design of building, surroundings and built-up areas. In the design process, the landscape is one of the vital parameters of functional, aesthetical and environmental considerations. It is essential to understand its contribution towards energy and environment to enable the designer to utilize its potential effects in an integrated design approach and thought process with due consideration to climate change. It has a potentiality to dilute the greenhouse effect, absorb dust particulates, and noise pollution and to benefit local on microclimate and sol-air temperature (Ramesh 2016).

Planting

Landscaping may be the best long-term investment for reducing heating and cooling costs. Strategically-selected and placed vegetation can reduce an unshaded building summer air-conditioning costs by 15% to 50%. The well-planned landscape also saves up to average 25% fuel consumption in winter just by using trees, fences, or geographical features as windbreaks to shield the building from the wind. (DOE 1995). Shade or windbreak plantings, green walls and also plantings that create air pockets that insulate the premises can help to reduce the overall solar gain and heat radiation of built structures. Designing a planting plan by using different forms of deciduous and evergreen trees, shrubs and groundcover plants in the right place can affect the microclimate of the building surroundings.

Besides plantings, landscapes can help reduce heat island effect through the use of pavements that are light in colour and porous. Light-coloured

sidewalks, patios, and parking lots reflect rather than absorb heat, providing a measurable reduction in heat gain. Porous pavings allow for infiltration of water, which also serve to cool a given field of paving (Carmichael 2014).

Green Roofs or Walls

The major benefit of a living green roof or wall is that it slows and can detain stormwater runoff, by providing a porous, vegetated surface—thus preserving water resources rather than increasing the monetarily and environmentally costly stormwater management systems. Green roofs and walls are more effective in reducing heat gain in the spring/summer than heat loss in the fall/winter. This is because the green roof or wall can reduce heat gain through shading, insulation, evapotranspiration and thermal mass, thereby lowering consumption and cost of energy use. Liu and Minor (2005) demonstrated that the heat flow through a roof could be reduced by 70–90% in summer and 10–30% in winter, with the use of green roofs. Also, the transpiration of the vegetation on green roofs provides an evaporative cooling effect that can lower the air temperature locally to below ambient temperatures, helping to reduce the urban heat island effect globally. (Hopper 2007, Liu and Baskaran 2003, Feng and Hewage 2014)

Landscape Lighting

Landscape lighting has three basic objectives: providing safety, security, and aesthetics (Hopper 2007). Besides, energy efficiency is among these objectives when it comes to sustainability. Motion-triggered lights, photovoltaic lighting can be used in energy-efficient landscape lighting by limiting the amount of time lighting is on. Low-voltage lights, fibre optics and LEDs powered by solar, wind, or tiny batteries are also the means lowering energy use.

MATERIALS AND METHODS – CASE STUDY FROM TURKEY

As Turkey's first LEED Gold-certified project, Siemens Gebze Campus is selected as a research area (Figure 1). Applied landscape strategies and planting of the area were examined, and assessments were made.

This project has an area of 150000 m^2, and is located in Istanbul-Gebze Industrial Zone. Upon the completion of the facilities intended to be done in two phases, this campus has an 85000 m^2 covered area. Approximately 54000 m^2 of open spaces of the campus are reserved as green spaces.

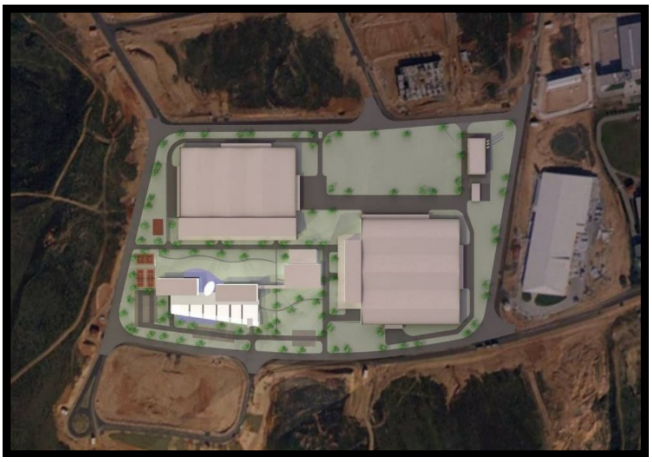

Figure 1. Siemens Gebze Campus (URL-6)

Applied Landscape Strategies in the context of LEED 2009

Sustainable Sites

As one of the critical steps of effective landscape design, topography needs to be left as unaltered as possible, and by using the existing slopes, the terrain can be transformed into an advantage. Bicycle parking lots and changing rooms were provided for staff living nearby, to reduce motor vehicle usage.

Throughout the project, open spaces were left above the standards, both for reduction of the heat island effect and conservation of public spaces. Most of the open spaces and half of the hard landscape areas (roads, sidewalks, etc.) was shaded by the use of native plants to reduce the negative heat island effect.

Turf stones were used in parking lots to transmit rainwater through and be absorbed by the soil and this helps to protect the quality of groundwater resources. Rainwater on the hard landscapes (especially asphalt-paved roads) was also routed to the ground instead of drainage channels, and filtering was provided there.

Landscape lighting was designed according to the ASHRAE (American Society of Heating Refrigerating and Air Conditioning Engineers) standards within specified limits.

Water Efficiency

The campus has approximately 29.300 m^2 of soft landscape area. Besides this, 24.300 m^2 of the campus area was covered with meadow grass. All plants were carefully selected and planted for their indigenous character and

optimum water usage.

Native plants and meadow grass were used for landscaping to minimize the need to irrigate the plant site, which is both an energy and water use saving. Instead of using potable water, water supplied from rooftop rainwater harvesting and treatment systems was used for landscape irrigation. By the implementation of these strategies

50% of water was saved in landscape irrigation. Also, the drip irrigation system was preferred for not allowing evaporation of wasted water.

For landscape planting, eight species of conifers, nine species of broadleaved trees, 19 species of shrubs and one species of groundcover were installed. Thirty-two (32%) of the 37 plant species that were used in the planting design have been identified as native plants in the Turkish Plant Data Service (Tubives). The non-native species (68%) on the list are well-adapted plants to Istanbul's climate. The plant characteristics, which are essential for LEED Water Efficiency such as drought tolerance, moisture use, and whether they are native, are stated in Table 2. Fourteen (14%) of the plants have high, 22% have medium and 19% have low drought tolerance. Drought tolerance of 46% of plants could not be determined. Eleven (11%) of the plants have high, 3% have medium/high, 49% have medium, 22% have low/medium, and 8% have low moisture use.

Table 2. List of the plants that were determined in the area.

Plant Name	Native	Non-Native	Drought Tolerance	Moisture Use
CONIFEROUS TREES				
Abies nordmanniana	X	-	-	Low/Medium
Cedrus atlantica 'Glauca'	-	X	High	Low
Cedrus deodora 'Pendula'	-	X	-	Medium
Cupressocyparis leylandii	-	X	-	Low/Medium
Cupressus sempervirens	X	-	-	Low/Medium
Pinus pinea	X	-	Medium	Medium
Thuja orientalis 'Aurea nana'	-	X	Medium	Medium
Thuja orientalis'Pyramidalis aurea'	-	X	-	Low/Medium
BROADLEAVED/DECIDUOUS TREES				
Acer platanoides	X	-	Low	Medium
Cercis siliquastrum	X	-	-	Low/Medium
Magnolia grandiflora	-	X	Low	High
Morus alba 'Pendula'	X	-	Medium	Low

Cont. of Table 2. List of the plants that were determined in the area.

Plant Name	Native	Non-Native	Drought Tolerance	Moisture Use
BROADLEAVED/DECIDUOUS TREES				
Prunus ceracifera 'Pisardii Nigra'	-	X	-	Medium
Prunus serrulata "Kanzan"	-	X	-	Medium
Robinia pseudoacacia 'Umbraculifera'	X	-	High	Medium
Salix babylonica	X	-	Medium	High
Tilia tomentosa	-	X	-	Low/Medium
SHRUBS				
Abelia floribunda	-	X	Medium	Medium
Aucuba japonica	-	X	Medium	Medium
Bambusa metake	-	X	-	Medium/High
Berberis thunbergii 'Atropurpureum'	-	X	Low	Medium
Chanomeles japonica	-	X	High	Medium
Cornus alba	-	X	Low	Medium
Cotoneaster dammeri	-	X	-	-
Cotoneaster horizontalis	-	X	Medium	Medium
Elaeagnus pungens	-	X	-	Low/ Medium
Euonymus fortunei	-	X	Low	Medium
Fatsia japonica	-	X	-	-
Forsythia intermedia	-	X	Medium	High
Hibiscus syriacus	-	X	-	Medium
Juniperus horizontalis	-	X	Low	High
Laurus nobilis	X	-	-	Low/Medium
Nerium oleander	X	-	High	Low
Photinia serrulata' Red Robin'	-	X	-	-
Pittosporum tobira 'Nana'	-	X	High	Medium
Pyracantha coccinea	X	-	Low	Medium
GROUNDCOVERS				
Cerastium tomentosum	X	-	-	Medium

For getting points from water-efficient landscaping, selecting plant species is important. The projects applied for LEED can get two points by reducing potable water consumption for irrigation by 50%. Reductions can be attributed to any combination of plant species, density and microclimate factor, irrigation efficiency, use of captured rainwater, use of recycled wastewater and use of water treated and conveyed by a public agency specifically for nonpotable uses. Using only captured rainwater, recycled wastewater, recycled greywater or installing a landscape that does not require permanent irrigation systems can help projects for getting four points from this credit. Temporary irrigation systems used for plant establishment are allowed if removed within a period not to exceed 18 months of

installation. Selecting plants with high or medium drought tolerance and also with low and medium moisture use helps to get points without the need for a permanent irrigation system (URL-7).

CONCLUSIONS

The world is in a current state of flux due to COVID-19. From the adversity brought with this global pandemic comes an opportunity to address the way we embrace sustainability and utilise nature. One such way to do so rapidly is to improve our understanding and usage of sustainable building and design. Through the adoption of rating systems such as LEED, projects can begin to intrinsically examine the use and impacts of resources combined for building construction. In this chapter, we discussed how these rating systems, such as LEED can still be built upon. There is currently little recognition of the benefits of sustainable landscapes and site design (sustainable sites) in LEED certification. It has been identified that getting points from structural credits was preferred over landscaping credits. The reason being that the scores gained by landscape planning studies are not high enough. It is remarkable that landscape architects who work on the ecologically-balanced design, planning, management and conservation projects as a profession, are inclined not to include such consideration from the outset of such green building projects. As Thompson and Sorvig (2008) mention, if landscape professionals give input at the right time, sustainable practices will be more effective. Such "winning influence" over land-use planning is critically important to sustainability.

For projects aimed at receiving LEED certification in the future, landscape architects and urban planners must participate from the first stages of decision-making and throughout the design process. Using the landscape only as "makeup" is mostly due to the aesthetic concerns of contractors, architects and clients/users. However, natural solutions emerging with landscape architecture studies will provide long-term economic benefits to these projects.

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