

Landscape Design With Plants as Architectural, Engineering and Aesthetic Tools

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ABSTRACT

Garden has been considered as an important element of a joyous and integral section of life for a long time and more succinctly from the beginning of creation. Sequel to this, landscape designer has held outstanding position in many cultures all over the globe. Prominent designers have evolved a lot of design methods through artistic talents, exposures, understanding as well as through strong influence by the client, site conditions, materials applied and plants used. Landscape design is common with average client. However, moving high garden type art to the backyard context is difficult. When applying plants in landscape design, the outcome is in most cases overemphasized and consequently misinterpreted. The situation is unfortunate since this aspect of planting design can bring about a long lasting overall expression within the outdoor design. The study adopted the secondary source of data collection by exploring previous works on the subject matter using the internet, books, conference papers, and journals. The paper emphasizes complementing and reinforcing the existing architectural design, the creation of 3-dimensional outdoor spaces, modifying the environment and improving the aesthetic of the surrounding using plants. At the end of the research, plants in landscaping are able to achieve architectural, engineering as well as aesthetic requirements.

Keywords: 3-dimentionl space, artistic talents, plants in landscape, modifying the environment, tools.

INTRODUCTION

Modern landscaping is a process that makes changes to an area of land in one or all of these three categories,

Plants: The addition of ornament, edible, native or other types of landscaping plants with a goal of creating a beautiful environment.

Terrain: changing the shape of the land, through grading, backfilling, terracing, elevations or borders of water.

Structures: Constructing patio covers, fences, walks, decks, raised planter or built features (landscaping network 2016)

People of various race have practiced landscaping for centuries. The addition of plants changes to the existing terrain and the construction of structures are all part of landscaping. When it comes to landscaping, the options abound. Some people want a perfectly balanced combination of hardscape (patios) and softscape (plants). Others prefer a sustainable landscape design that saves water and creates a natural habitat. While others go for recreating a certain garden style they find appealing, such as modern or tropical. Still others want a space complete with an outdoor kitchen, fire pit and swimming pool where they can entertain friends and family.

An environment without an effective landscape is as good as a circle without a circumference, an arch without a keystone, an ocean without water (Richard P, Dober 1992). Landscapes are also the media of cultural experiences; they are altered by the societies in many ways. Landscaping also refers to the interaction between man as an individual and as a part of human society on one hand and non-living nature as a set of processes and store house and materials on the other hand (Fadamiro, 1998). Also, Fatunsin (2011) defined it as the work of planning, designing, and supervising of beautification works in the area usually containing a building. He opined that landscaping spaces are organized through the use of the basic principles of unity, balance, accents, focalization, scale, proportion, harmony and rhythm, variety, sequence and emphasis and also classified the elements of landscape design under structural and plant materials. The structural materials include sculptures, rock outcrops, bricks and tiles, concrete, water fountains,

walls and fences. On the other hand, the plant materials can be classified under the major groups of trees, shrubs, ground covers, palms, grasses, vines and hedges. Singh (2009) in his own view define landscape as a large area that includes one or more ecosystems. From this point of view, he perceived the environment (and invariably the ecosystem) as something that should be taken care of and protected. Man's interaction with environment is a two-way dimensional phenomenon. Man modifies alters, and reshapes his environment to suit his needs, desires, values and aspirations (Fadamiro 1998). He is in turn affected biologically, socially and psychologically by the environment. Influence can be intelligent that is, by design, or it can be unintended. In either case, land is influenced by human activities and vice-versa symbiotically ever since man assumed his first place of abode in paradise (the Garden of Eden).

According to Michael, B. et al (1998), design in architectural term refers to the arrangement and planning of houses, roads, streets and paths in a way that allows them to be meaningfully structured; function properly and also make them admirable to behold. The landscapes of care are spatial manifestations of the interplay between socio structural processes and structures that shape experiences and practice of care (Ibimilua, 2014). By caring for the environment with respect to plants used as architectural, engineering and aesthetic progress is achieved in three fold.

Landscape Architecture: The practical art and science of adapting land for human use and enjoyment, based on the premises that land use and beauty are compatible and that neither is complete without the other. Includes the planned combination of living plants, such as flowers, grass, ground cover, shrubs, trees, and vines as well as natural features such as rocks and stones; and may also include reflecting pools, fountains, outdoor artwork, gazebos, screen walls, benches or fences. (Dictionary of Architecture and Construction 2006).

The objectives of the study are:

- i. To use plants as tools in landscaping design to achieve architectural needs.
- ii. To use plants as tools in landscaping design to achieve engineering needs.
- iii. To use plants as tools in landscaping design to achieve aesthetic needs.

METHOD OF STUDY

The study adopted the secondary source of data collection by exploring previous works on the subject matter using the internet, books, conference papers, and journals.

DESIGN TOOL, DESIGN TECHNIQUE AND DESIGN METHOD

The basic distinction among these three which are used interchangeably need to be clarified. According to Zeisel (1981), design tool means a physical or conceptual instrument that is used in designing. Design technique connotes the way in which a design objective is accomplished. Thus, techniques are ways of using design tools. Whereas the techniques used are the result of decision model in this concern, Ackooff (1962) argues that methods are rules of choices and techniques are the choices themselves. Design decision model can therefore be defined as a set of rules that governs the procedure of the design process. Architectural landscaping creates a proper environment for human habitation according to their nature and lifestyles as a group and as individuals. While in Engineering profession the design and planting of plants is to modify our environment to make it safer, healthier and more comfortable. According to Abdulkarim(2005) **Design descriptions** does not only refer to the outcome of design ,but to its ingredients as well. These ingredients represent the processes, techniques and tools that enable the designer to achieve the goal in designing.

CLIMATIC VARIABLES THAT CAN BE CONTROLLED THROUGH LANDSCAPING

Adedeji, Aluko and Ogunsoye (2010) described aspects of the microclimate that can be regulated through landscaping: soil-air temperature, air temperature, humidity, air velocity and wind speed, wind direction, surface absorptivity and reflectance (albedo); seasonal shading, pollution, glare, air freshness and fragrance.

Soil-Air Temperature Control: Ventilated shading provided by trees, shrubs and climbers can be used for the control of radiant temperature, and reduction of air, ground and surface temperature. Ventilated shading reduces the amount of solar radiation reaching ground and wall surfaces, thereby reducing the sol-air temperature, which is an indication of the globe temperature.

Air Temperature Control: Air temperature control is achieved by reduction in sol-air temperatures through ventilated shading. Ventilating shading is accompanied by evapotranspiration, a process whereby plants take water from the soil and lose the water by evaporation through the leaves. This causes cooling just like sweating causes cooling in humans, with the latent heat of evaporation taken from the surrounding air.

Humidity Control: Plants in general increase the humidity of the area and can therefore increase the human thermal comfort during hot, dry seasons.

Control of Air Velocity and Wind Speed: Plants are used to reduce wind speed and to increase the velocity of stagnant and slow-moving air. Windbreakers in the form of rows of trees are a very effective way of reducing wind speed and filtering dust.

Control of Wind Direction: Landscaping can be used to direct wind away from buildings, or towards buildings. Fences, walls, hedges and trees can be combined to form an obstruction that will deflect the wind above buildings. On larger plots, groups of trees can be used to channel the wind in a particular direction.

Control of Surface Absorptivity and Reflectance: Landscaping can be used to control the rate at which surfaces absorb and reflect solar radiation. The use of lawns, plants, color and careful selection of pavement materials can control the proportion of solar radiation absorbed to that reflected.

Seasonal Shading: Pollution Control

Plants are very effective in controlling levels of pollution. They absorb dangerous gases like carbon dioxide that are associated with urban heat islands. They also reduce the levels of other pollutants, especially from automobiles. Buffer zones planted with trees are used for separating industrial areas from residential areas.

Glare Control: Direct glare can be prevented by using trees to block off the relevant portions of the sky while indirect glare can be prevented by planting flowers, shrubs and grass on surfaces that would normally reflect light into the building.

Fresh Air and Fragrance: Plants produce oxygen and fragrances, which create the refreshing atmosphere of gardens. While the freshness of the air and fragrance may not be measurable by climatic variables, the improvement in the microclimate is unquestionable.

LANDSCAPE ELEMENTS

Soft Landscaping Elements

Trees and shrubs: Trees and shrubs are the most significant in the provision of shade and the control of relative humidity and air movement. Air crossing hard, reflective or absorptive surfaces like parking lots and sidewalks is warmed, but air passing through trees and plants will be cooled.

Lawns and Flowerbeds: Lawns and flowerbeds are used to reduce ground temperature and to prevent glare. Vegetation generally improves air freshness and fragrance.

Pools and Ponds: These water bodies are used for humidification and evaporative cooling.

Mulches: Mulch is a protective covering over the roots of trees and shrubs to retain moisture and kill weeds. Mulches include straw, fallen leaves or plastic sheeting. Others are gravel, wood chipping, rotting leaves and grass. Mulches can be used to reduce surface and air temperatures by reducing the heat absorbed by the ground.

Trellises and Climbers: A trellis is a light framework of crossing strips of wood, plastic, et cetera, used to support climbing plants and it is often fastened to a wall. This can be used to provide shade on western walls, or used as free standing elements to block out the Western sun.

Hard Landscaping Elements:

Walls and Fences: Walls are used to deflect the wind, and they can also be used to channel the wind. Walls are usually solid, while fences are made from stakes, rails, wire, netting, et cetera. Fences thus allow some wind to flow through them, even when they have climbers.

Steps and Paving: The choice of the surface finishing, material and construction of steps and paving can play a significant role in the reduction of ground temperature. The use of asphalt in parking lots without any form of shade is a primary source of discomfort.

Slopes and Barriers: The use of slopes and barriers to direct airflow can be very effective on sites with significant variations in the topography.

Stones and Boulders: Stones and boulders can be use as aesthetic elements in an environment.

DISADVANTAGES OF LANDSCAPE

- Damage to foundation if close to building.
- Bring pest, rodent, unwanted insects and snakes.

- Some hard landscape allow grass to grow.

PLANTS AS ARCHITECTURAL TOOLS.

Plants with respect to architecture can perform two basic roles

- (1) They can complement and reinforce the existing architecture of a building.
- (2) They can create outdoor rooms.

Complement and reinforce the existing architecture of a building

Desirable architectural lines and masses of buildings can be emphasized by the use of trees, shrubs and ground covers as evidenced in figure 1.



Figure 1: plants soften and filter light as well as blend with natural material.

Architectural angles, masses and materials can be softened and balanced by the use of plants. See figure 2



Figure 2: plants and house form in harmony.

Plants can also be applied to frame desirable views of buildings. See figure 3.



Figure 3: plants used to beautify the façade of buildings

The horizontal lines are emphasized and apparent length can be increased by placing plants in increasing heights away from the buildings corner. See figure 4.



Figure 4: Graduating plants sizes away from a house, makes the apparent size of building increased.

An uninviting, inhibiting and disastrous appearance results when plants are placed on either sides. The vertical lines are emphasized, making the house appear taller and narrower. See figure 5.



Figure 5: plants creating an uninviting, inhibiting look to the entrance.

The growth habits and requirements of plants must be considered in selecting plants. These selection will be best done by consulting other professional specialist on plants growth. Considerations must be given plants heights and widths at maturity, other considerations

includes:checking any special cultural and maintenance requirements of the plants such as soil type,moisture,sun exposure and pesticides.Otherwise, an overgrown and crowded appearance that dwarfs and hide the building results.See figure 6.



Figure 6: Tree planted too close to building, evolves to overcrowding and dwarfing of building.

Creating Outdoor Rooms

The extension of low planting beds to taller trees and shrubs masses and hedges can create very effective walls with which to enclose an outdoor room and direct traffic to it. Choosing the type of plant to use as a wall is akin to choosing a wallpaper for its texture, color and ease of maintenance. The leaf, flower and winter pattern of individual plants provide the same visual qualities as wallpaper. Height and thickness or density of the wall are determined by inward or outward orientation of the space and required degree of enclosure. Low to small shrubs,600mm to 15000mm can be used to suggest partial enclosure but still allow views out of the space. Taller dense evergreen shrubs,1500mm in combination with smaller shrubs and trees provide the strongest enclosure. Tall and medium trees,7500mm or taller provide overhead enclosure but also allow views from underneath the canopy. Plants with more open growth habits can provide a partial screen to filter views. See figure 7.



Figure 7: Various plant types, heights, and combinations create walls, partial screens, and overhead canopies.

Source: Janice A.C(2017).

Outdoor walls also can be used effectively to screen negative views, sounds, and smells near a space. The size and the intensity of these negative elements will determine the size, spacing, and density of the screen. Poor views will generally require dense evergreen plantings or constructed screens for year-round effectiveness. Unpleasant smells require a combination of aromatic ground covers, annuals, perennials shrubs and trees to be placed downward between the source and the house owner. Annoying sounds are especially difficult to screen with plants on small

sites and require a combination of constructed walls fences, and landforms. See figure 8.



figure 8: A sculptured hedge creates a partial screen between parking area and entrance courtyard.

Source: Janice A.C(2017).

Plants combinations can act as floors. Walls can frame the views in both inwardly and outwardly oriented space. Low shrubs and ground covers are used as foundation to offset a central focal point such as a sculpture piece or patio in an inwardly oriented space. See figure 9.



Figure 9: Low planting beds and overhead canopy enclose and complete this outdoor sitting area.

Source: Janice A.C(2017).

Taller shrubs and trees enclose a space and lead the eye to a central focal point. Framing an outward view involves the same concept but uses trees. Ground covers, or planting beds to draw the eye out of the space. See figure 10. Outdoor ceilings are the most important part of the room, and you can create them with tall shrubs, 3000mm or taller and small, medium, and large trees, 4500mm or taller. The orientation and scale or size of the room will determine the type of ceiling. Inwardly oriented space should have a wide variety of ceiling heights, density, and texture. Let desire intimacy or the scale determine the ceiling height. Rooms intending a grandiose effect such as a dining room or ballroom require high ceilings. The density of the tree canopy and the overlap will determine the amount of light in the room. The darker the room, the heavier and smaller it may appear. It may also render a cooler, more mysterious effect on the viewer. A brighter room is generally perceived as lighter, airier enclosure. Tall, dense evergreen shrubs and trees are needed for darker wall and enclosure. Careful planning of the interplay between sun and shrubs at different times of the day can bring about dramatic effects of light and dark.



Figure 10: An overhead tree canopy helps to frame the outward view from this wood deck.

Source: Janice A.C(2017).

PLANTS AS ENGINEERING TOOLS.

The engineering profession is primarily concerned with modifying our environment to make it safer, healthier and more comfortable. Landscape designer use plants to achieve these same objectives through erosion control, pollution control and glare reduction.

Erosion control

The continual development of land brings certain undesirable side effects. one of these is erosion, which is the wearing away of the top soil layers through the forces of water and wind. Damage from impact and runoff of water can take the form of small troughs, then larger gullies, and end with more massive slips. Plants can be placed on steep, exposed slopes to prevent the formation of troughs and gullies. Leaves and branches the impact of raindrops and slow down water runoff while shallow, fibrous roots root systems hold soil in place The organic matter added to soil by plants acts as a sponge to soak up and retain water. In addition, plants add to the aesthetic appearances of the slope in comparison to constructed erosion-preventative materials. Plants with shallow, fibrous roots systems are the most effective controllers of erosion Evergreen plants are more effective for year- round control.

Pollution control

Plants can also control pollution in congested urban areas. They can purify the air by removing carbon dioxide and limited quantities of sulfur dioxide and replacing them with oxygen (Carpenter c. et al 1975). The fresh air produced by plants along freeways or in heavily travelled streets mixes with and dilutes heavily particulate air. Plants can also cleanse the atmosphere by removing dust, ash and smoke particles form air. The particles settle on the leaves and branches and are eventually washed by rain to the ground. Roadways planted with trees contained one-quarter of the total number of dust particles per liter than those without trees in the same area of the city (Aloys,B et al 1966).Plants have been shown to be most effective at screening the higher, more annoying frequencies of unwanted sound(Robinette,G 1972).Deciduous plants with thick, fleshy leaves and thin petioles have shown to be the most effective in absorbing, deflecting and reflecting noise. Evergreen trees, shrubs, and ground covers can be mixed with deciduous plants

to create a solid year round buffer. Wide bands of such massing, not often practical on medium to small-sized lots, are required for reducing sound. Even then total control cannot be guaranteed. Plants reduce noise by seven decibels per 34meters wide plantings. This is seemingly negligible when one considers that a general traffic and play area generates 90 decibels (Embleton, T.F. W 1963). The most effective sound control can be achieved by combining plants with embankments and berms along with structural elements such as walls.

Glare reduction.

Cities are full of bright lights and reflective surfaces that cause glare. The cause of glare can be either a direct light source such as sun, bright signs, auto headlight, or a reflection from a surface such as metal, glass, light colored concrete walls, streets, walks, and water surfaces. To filter or completely block glare, plants can be placed in key locations between the light source and the viewer Care must be taken to choose plants with appropriate size, shape, and density of foliage.

PLANTS AS AESTHETIC TOOLS.

Landscaping as stated by WiseGEEK (2012) help to create functional and beautiful spaces and these are created in order to improve the visual perceptions, aesthetics and health of the individual (Ayeni, 2012)

Aesthetics is the normal subject of poets, philosophers, painters, sculptors and scientists from the genesis of times. People of all races, religions, and nationalities devote countless hours and resources to the care of landscape plants. Plants appeals are not only to our intellects but also to our physical sense and emotions. The most obvious appreciation of plants is through the physical senses of sight, smell, and touch. Individual parts of plants-blooms, leaves, fruits, and branches-are valued for their shape, color, texture, and aroma. Plants can also be appreciated for the sculptural quality of overall size, form, and color. Unusual or prominent plants can be used as focal points to contract their surroundings. They can also be used as a backdrop or setting for focal points. Just as with the display of art in a gallery, much thought should be given to the display of plants. Whether you want the focal point to be viewed from one or several vantage points, the subject must appear dominant within its context but never overpowering. The plant should appear contained within the setting but never engulfed by it. The setting should be simple and continuous, yet harmonious and complementary. A massing of one or two species of

noticeably shorter or taller growing plants can be used to either back drop, frame or pedestal the focal point and is an appropriate planting scheme (See figure 11). The composition of views to particular focal points or open vistas can also be done with plants, keeping in mind the general rules of composition within painting. Landscape painting can utilize a foreground, middle ground, and background to present its subject (See figure 12).

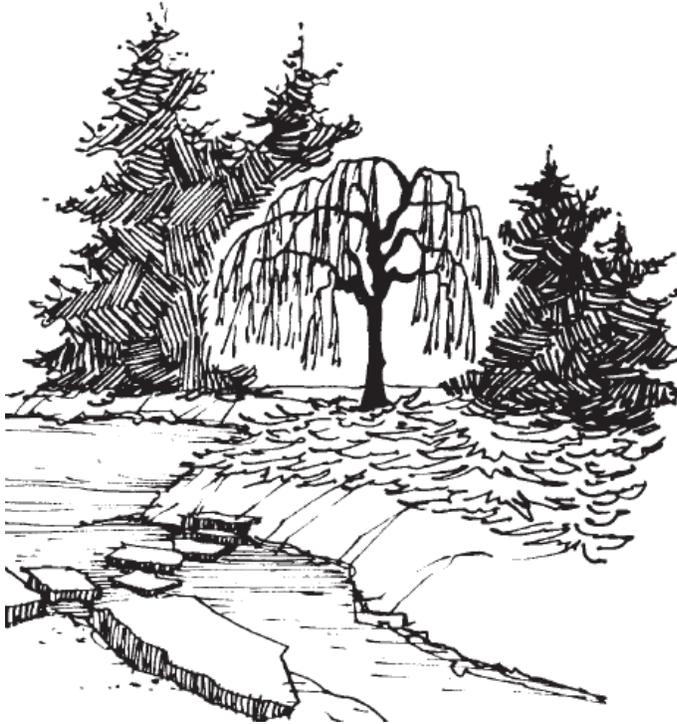


figure 11: A specimen plant is set off as a focal point.

Source: Janice A.C(2017).

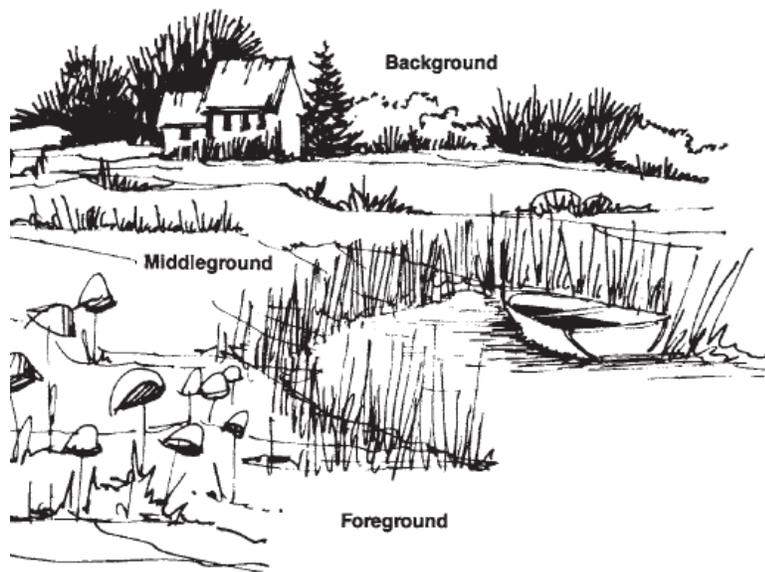


figure 12: A typical landscape composition with background, middle ground and foreground.

Source: Janice A.C(2017).

CONCLUSION

Plants are of paramount importance in many spheres of human life. Landscaping with plants is an aspect that is highly valuable to humans. Among the numerous values of plants in landscaping are the applications of plants for landscaping to assist in the creation of outdoor spaces for human entertainments and relaxation as well as complementing and reinforcing the existing architecture of buildings. Plants in landscaping can also contribute in achieving the major aim of engineering work; which is to modify the environment in favor of humans with regards to safer, comfortable and healthier environment. Plants in landscaping can also be useful in making the surroundings beautiful, appealing, cool and presentable to individual, community and tourist. The paper emphasizes complementing and reinforcing the existing architectural design, the creation of 3-dimensional outdoor spaces, modifying the environment and improving the aesthetic of the surrounding using plants. At the end of the research, plants in landscaping are able to achieve architectural, engineering as well as aesthetic requirements.

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