

SYNTHETIC SUBSTITUTES
FOR LIVE PLANT MATERIALS:
AN INTRODUCTORY STUDY

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ABSTRACT

SYNTHETIC SUBSTITUTES FOR LIVE PLANT MATERIALS: AN INTRODUCTORY STUDY

By

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Various design problems necessitate that the landscape architect specify a substitute for live plant materials, for example, substitution of some type of paving material for grass. To help insure that the particular substitute chosen will be highly functional, the designer must continuously make himself aware of what is available and what possible technological breakthroughs are at hand which may prove beneficial for particular design situations.

Recently there has been an influx of artificial plant materials being used in several areas where natural plant materials are capable of being grown. Due to the nature of the material (artificial plants) and where they are being used (in various areas of the landscape), the fact that the landscape architect should concern himself with this situation should be self-evident. In this

regard, it should be the responsibility of the landscape architect and other closely allied practitioners, to investigate this practice and assess its possible implications.

Initial research revealed that very little information of any value had been published dealing with the use of artificial plant materials and their relevance for the landscape architect. A series of questionnaires were sent out to various manufacturers and users of artificial plant materials, and to landscape architects and others in associated professions in order to obtain current information on this subject. It was found that it was possible to assemble a substantial amount of factual data and to unearth some interesting trends. Such information is judged helpful in producing a useful basis for comprehending this situation, as well as providing some clear implications for the future.

It is the contention of this thesis that the present use of artificial plant materials should be of concern to the landscape architect, and that there is a definite need for his involvement in continuing research oriented around this basic subject of substituting for nature.

The object of this study has been to explore the following:

1. How and why man has grown to accept substitutes for nature.

2. Does the ability to perform functions normally associated with live plant materials have an effect on this situation?
3. What are some of the determining factors that must be evaluated before specifying live plant materials or substitutes?
4. Are there instances where the use of artificial plant materials can be justified?
5. What are the ethics and responsibilities of the landscape architect with respect to substituting synthetic materials for nature?

This study has resulted in the following general conclusions:

1. The use of substitutes for natural materials has been practiced for centuries.
2. The acceptance and use of artificial plant materials will continue.
3. There is sufficient justification for the landscape architect to consider specifying synthetic substitutes for live plant materials under certain circumstances.
4. There are some very promising potentials for further development of useful synthetic substitutes.
5. Artificial turf presents the most promise for adaptable use in the future.
6. Since very little is presently known on this whole issue, extensive research and experimentation is needed in several areas, in order to provide the landscape architect with the necessary knowledge to effectively resolve various design and functional circumstances.

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"Begger that I am, I am
even poor in thanks."

(Hamlet: Act II, Scene 2,
Shakespeare.)

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INTRODUCTION

In this rapidly changing age of technology and diverse ideas and needs, many advances have been made that have, are and will significantly enhance mankind's existence. With a world population of some four billion people, it is no wonder that a growing need for goods and services has fostered the production of substitute materials for a wide variety of traditional ones. If wood were the only material utilized for furniture or building construction, it is conceivable that the climax forests of today would not have been allowed to evolve.

Considering this need for diversity and the opportunity to make a profit, private enterprise, with the aid of new scientific skills, has synthesized an ever-growing number of products.

- + Gas-flame fireplaces are in increased usage.
- + The artificial hair industry has gained a profitable acceptance in society.
- + Synthetic Christmas trees are being used almost as often as the traditional live varieties.
- + Plastic silverware and dishes are commonplace items in many homes.
- + Artificial turf is being installed in an ever-growing number of major athletic stadiums.

- + Milk made from soybeans is gaining acceptance as a dairy product substitute.
- + Many people are continuing a near-normal existence with artificial body parts.
- + Plastic flowers can be found in many fine restaurants as table centerpieces.

The list of examples is growing every year. Many of these products have been designed and produced for very functional and humane reasons; a prime example being that of the artificial body parts.

The versatile female welcomes the convenience of false hair pieces and wigs which aid her in changing from the role of housewife to that of a business woman and then to socialite, all in a day's time; providing a freedom that would be difficult to obtain without the use of time-saving artifacts and materials.

A strong demand for a less expensive wood paneling has fostered the production of imitation wood veneers which are available in a wide range of textures and colors. In most cases, this substitute material costs substantially less than the authentic product, and the quality of reproduction that has been achieved makes this type of paneling highly competitive.

Although the initial cost of aluminum siding is higher than it is for wood siding, maintenance costs and fire hazards are substantially reduced, thus offering a substitute product with several beneficial qualities.

For a variety of reasons, it is quite evident that the range and volume of substitute materials will continue to increase and gain acceptance for a wide variety of products. The challenge for any professional is to make himself continuously aware of any trends, new products, etc., that may affect his particular expertise. This awareness is particularly important for the landscape architect since he has the potential of utilizing and integrating adaptable materials into his design concepts.

Recently there has been an increase in the use of synthetic substitutes for traditional organic plant materials. Artificial turf (or plastic¹ grass as it is sometimes referred to) has been installed in many athletic stadiums. Several commercial establishments have artificial plants (plastic trees, shrubs, and flowers) adorning the exterior of their buildings. Since much of this substituting is being done in areas that will support the growth of live plant materials, it is worthwhile for the landscape architect to take note of this situation and assess what impact, if any, this may have on the field of landscape architecture.

¹The term "plastic," as it will be used throughout this thesis, is a general descriptive term for the material used to manufacture the product; i.e., plastic spoons, a sheet of plastic, etc. This is to distinguish it from the term "plastic," meaning any substance capable of being molded.

One of the principal materials that the landscape architect uses is, of course, live plants. To specify the use of artificial plants would seem to defile this traditional practice, thereby posing a possible "moral" or "ethical" conflict that must be resolved. In this regard, it must be realized that substituting for nature is not new. For many decades designers have specified various types of paving materials to replace natural grass for a wide variety of reasons without a loss of moral conviction. Fencing and walls have been substituted for the traditional hedge, as a barrier or space definer, without the designer consciously feeling remorse. Awnings and overhead trellises have assumed the role of shade producing elements in many designs in place of shade trees. Currently, an assortment of artificial plant materials is available which are being advertised by their promoters as excellent products offering a wide variety of attributes.² These materials should be evaluated for their relevance as a possible substitute material, with or without modification, in landscape architectural design.

The primary purpose of this study is to examine generally the nature of these substitute materials, to clarify understanding of their potential design value and to formulate some possible guidelines to aid decision-making

²A partial list of manufacturers is included in Appendix B.

and proper utilization. It is not the intent of this study to answer all of the questions relevant to artificial plant materials, nor will irrefutable guidelines be presented for their use. It is hoped, rather, that through this research endeavor, some of the conflicting arguments and data now prevailing can be placed in their proper context and that new areas of research will be opened up which should be undertaken so that the landscape architect may be able to keep pace with technology.

Selected highlights of historical significance will be presented from both architectural and landscape architectural developments, which will help illustrate the repeated experience of man's acceptance of substitutes, as well as his changing attitudes toward nature. This brief background should aid the reader in comprehending why artificial plant materials have seemingly come of age.

A comparative analysis of the functional uses of live plant materials with other possible design solutions will be presented and evaluated. Although the results of this comparison are not to be considered absolute, they will provide the designer with a basis for determining functional solutions to various design problems, as well as increasing his awareness of other areas where substitutes for live plant materials may gain additional acceptance.

Socio-psychological implications will be discussed as well as an evaluation of economic considerations. A case study of artificial turf will detail problem areas and several advantages in its use. Questions of aesthetics, maintenance, physical make-up and environmental implications of artificial plant materials will be dealt with in this study also.

Preliminary investigation revealed that very little research on this topic had been conducted, geared specifically for the needs of the landscape architect. Because of this apparent lack of information, it has become necessary to establish a basic platform from which additional research can hopefully be generated. Since design philosophy is subject to individual interpretation, it is hoped that others will be stimulated by the facts presented and the conclusions drawn to conduct supplemental investigations on this basic topic of substituting for nature.

CHAPTER I

BACKGROUND

Today we live in a society that very willingly accepts substitutes for many things as a way of life, and for some urbanized citizens, the supermarket provides their main contact with the essence of nature. The use of synthetic substitutes for live plant materials is expanding and it appears that this trend is likely to continue.

Substituting for nature is not a new phenomenon, nor is it very startling to find that many people do not share the same attitudes toward the natural as the environmentally oriented professionals do. In order to understand why artificial plant materials are gaining increased use and acceptance today, it is useful to look back at selected highlights of architectural and landscape architectural history. By doing so, the development of man's willingness to accept substitutes, and how his attitudes have changed with regard to nature, can be more easily understood.

Architecture and the Use of Materials

From the earliest reliable recordings of history, art and architecture were basically separate creative processes. Function and tradition governed architecture, whereas art and sculpture did not always follow strict rules in expression or form. Initially architecture was conditioned by function in the role that it played; i.e., palace, church, temple, etc. Limits were imposed on form due primarily to the limited range of accepted construction materials. The architect was dependent upon natural materials such as wood, stone, clay and tile. Line and form were angular and solemn. Tradition seemed to be so ingrained in the attitudes of the day that the use of new materials was often influenced by old ideas. Honesty in design, as it is referred to today, was virtually an unknown phrase.³

The early Egyptians (around 4000 B.C.) constructed their buildings with columns made from bundles of papyrus. When wood was introduced as a substitute material, it was hewn to take on the appearance of the original papyrus column. During the Third Dynasty (2780-2680 B.C.) when limestone was used, it was still worked with a decoration

³The terms "honest (y)" and "dishonest (y)" as used in this thesis are not to be considered literally. They are relative in nature and subject to wide interpretation. For the purposes of this study, they are a convenient means to express a generalization.

reflecting the texture of papyrus.⁴

Prior to 600 B.C., the Greeks used wooden columns and, when stone began to be substituted, the principles of carpentry were applied.⁵ The columns were given a wood-like texture and were seated on a stone plate.⁶ History further records that the early Greek temples (around 600-500 B.C.) were prime examples of attempts to hide or cover up the construction material. Many of these structures were built from quarried stone which was covered with plaster. The roofs were made of sun-dried clay tiles which also were plastered.

The Persians built their columns out of wood or stone and, as in the case of the Palace of Persepolis, completed in 460 B.C., they covered the material up with a thick layer of plaster to which was added paint.⁷ Early Christian and Byzantine architecture was strongly influenced by the Romans who followed many of the traditions established by the Greeks. Building materials were disguised to look like something they were not naturally.

⁴Sources of Art Nouveau, S. Tschudi Madsen, 1956.

⁵Ibid.

⁶With wooden columns it was necessary to place them on a stone pad to keep them from rotting. Although no longer functionally needed with respect to stone, this practice continued, based on the traditional way a column should be placed.

⁷Sources of Art Nouveau, Op.Cit.

Most sources refer to such things as the leaf decorated capital of a column as art instilled in architecture. Tradition seems to have evolved into what may best be described as decoration. As has been shown up to this point, in many cases the roots of decorative practices go back to the original construction material. Many other practices which are more loosely referred to as ornamentation, decoration, or style, have been strongly influenced by tradition. Eventually many of the traditional materials such as wood, stone, brick and clay tile were appreciated for their inherent beauty. However, the practice of disguising materials was pretty much followed until well into the 18th century.

Carlo Lodoli (1690-1761), a Franciscan monk from Venice, was one of the first theoreticians to express a need for change in architectural practices.⁸ He felt that the chief requirements of architecture were that it should be functional and should do justice to its materials. Prior to this time, little or no concern was given to honesty and truth in design as a guiding force. Many old traditions, it seems, were beginning to lose ground.

Augustus Pugin noted in 1841 that

There should be no features about a building which are not necessary for convenience, construction, or propriety The smallest

⁸Elementi di Architettura (Principles of Lodolian Architecture), Andrea Memmo, 1786.

detail should . . . serve a purpose, and construction itself should vary with the material employed.⁹

Eugene Viollet-le-Due (1814-1879), a French architect, demanded truth in the use of materials. He felt that "stone should appear as stone, iron as iron, and wood as wood."¹⁰

In 1859 architect Philip Webb designed a home that was "daring in many ways, in exposing its red brick without a coat of stucco, in planning from the inside out, that is, with secondary considerations of facades, and in frankly showing the construction inside."¹¹ This new kind of thinking set the stage for a strong change in ideals and attitudes for the future.

The Art Nouveau era (from 1893 to the early 1900's) was in many respects a radical departure from old traditions. To some degree, it opened the door for further progress and imaginative creativity. In other respects it perpetuated the dishonest use of materials. Art Nouveau is best typified as an era of decoration. The designers of that age borrowed the lines, forms and feelings invoked by nature and applied them to architecture, furniture, ceramics, jewelry, tapestry and other such items of design.

⁹The True Principles of Pointed or Christian Architecture, 1841, page 1.

¹⁰Entretiens, Volumn I, Eugene Viollet-le-Due, 1863, page 472.

¹¹The Sources of Modern Architecture and Design, Nicolous Pevsner, 1968, page 21.

Emile Galle (1846-1904), a French craftsman and designer expressed one of the attitudes of the time. He felt that, "Our roots are in the depths of the woods, beside the springs, upon the mosses."¹² He also wrote than, "The forms furnished by plants adapt themselves quite naturally to line-work."¹³

The quest for naturalism was paramount at this time and a strong revival of traditional decoration was practiced. The foliage on the capitals of columns was made to appear even more life-like. Wood was forced into unnatural shapes (for the material itself) in an attempt to adapt every material possible into lines depicted in nature. Furniture in the Art Nouveau style seems very awkward and lumpy; a clash between form and function is apparent. Wood was made to perform curves that could be better achieved by materials such as clay, metal or plastic (although plastic was not known at that time).

Iron was a favorite material of the Art Nouveau era. The ease with which it could be molded and shaped revealed a new form of decoration. Antoni Gaudi was perhaps the most influential in adapting iron to architectural ornamentation. In keeping with the fad of the time, Gaudi designed wrought-iron grille work which mirrored nature. A prime example is the grille work at Casa Vicens in

¹²An inscription above the door to his studio.

¹³Sources of Art Nouveau, Op. Cit., page 178.

Barcelona, built in 1880, where lavish palm fronds were depicted in great detail.¹⁴

Another architect, Louis Sullivan, utilized cast-iron ornamentation on the Guaranty Building in Chicago in 1895. The effect was one of minute detail; a creation of delicate leaves preserved in iron duplication.¹⁵

Gaudi further expressed this image of natural things by designing supports in the Crypt of Santa Coloma de Cervello (begun in 1898), by quite precisely representing dead trees with concrete and brick.¹⁶ His use of stone, concrete and iron to represent plant materials is again seen in Guell Park where leafless concrete trees are placed, and in Casa Mila and Casa Battlo (begun in 1905), where stone columns appear as tree trunks and balconies dribble over with cast-iron seaweed.¹⁷

Were it not for an anti-Art Nouveau movement at this same time and the fact that plastics were unknown, it is conceivable that plastic plants would have evolved much sooner.

Charles Voysey (1858-1941), an English architect, was one of the leaders of this anti-Art Nouveau movement.

¹⁴The Sources of Modern Architecture and Design,
Op.cit., page 64.

¹⁵Ibid., page 40.

¹⁶Ibid., page 108.

¹⁷Ibid., page 104.

He felt that returning to nature was one thing, but these natural forms must be reduced to symbol. Abstractions were in order, not exact duplication of nature.¹⁸

Eugene Gaillard (1862-1933), a French furniture designer, felt that furniture should express its function and be in harmony with the materials; curves and forms should be used decoratively only.¹⁹

Prior to this time, iron was used as a structural material but it was always encased in concrete, plaster, or some comparable material. With this new movement, iron began to be used in decoration as well. The traditional restraints imposed on iron (and eventually steel) were finally broken. Iron and glass became suitable external construction materials for factories, warehouses and office buildings. Perhaps the most daring use of iron and glass at this time was the Crystal Palace in London, England (completed in 1851) which was completely constructed from these materials.²⁰ Apparently these materials had finally gained acceptance as being aesthetically pleasing in their own right.

It should be quite evident by now that throughout history there has been a reluctance to allow various materials to exhibit their inherent aesthetic qualities.

¹⁸Ibid., page 74.

¹⁹Ibid., page 83.

²⁰Ibid., page 11.

It seems that new materials have always had to be covered up or disguised for varying amounts of time before they were allowed to come of age.

The Changing of Attitudes Toward Nature

Man's attitudes toward plant materials have also evolved and changed. As in the use of construction materials, history records several transitions that are worthy of note.

The nature of man's first relationships with plant materials continues today--that relationship being to provide food and shade. At some point in time man discovered that shelters could be constructed from plant materials; a practice which advanced to the building of cities. Control was imposed on nature to provide human shelter.

The Egyptians were perhaps the first to record their physical surroundings.²¹ Paintings found in tombs reveal life along the Nile some 5,000 years ago as being one of great admiration for the land and for vegetation. Great gardens were created, avenues of trees were planted and private gardens were in abundance. The typical plant materials used in these gardens were fruit-bearing trees, herbs, vegetables, grape vines and assorted flowers for

²¹Gardens, Plants and Man, Carlton B. Lees, 1970.

aesthetics only.

Gardens continued to exhibit a very practical use (for cooking or medicinal herbs, dyestuff, oil, spices, fruit, aromatic or cosmetic materials, etc.) until the Early Christian era. The Romans are credited with being the first civilization to cultivate plants for beauty alone.²² Their love ranged from the very natural to the sheared topiary garden.

Pliny the Younger (A.D. 62-113), a first-century Roman statesman, offers a good example of what was typical of the times. Letters he wrote to friends provide vivid descriptions of his love for an abundance of plants and flowers. His Tuscan Villa was geometrically laid out with box trees cut into a multitude of shapes, evergreen shrubs closely cropped to form pyramids or letters and, of all things, a topiary zoo depicting an assortment of animals.

As was typical for architecture, geometry played a major role in influencing man's relationship with plant materials. Order and control were the rules of the day. The Roman influence dominated design for centuries and even during the Dark Ages, herb gardens were geometrically arranged.

A strong revitalization of traditional design was enacted during the Italian and French Renaissance period.

²²Ibid.

Such estates as Villa Lante, completed in the late 15th century, are referred to as an experience in perfection. Man, with the use of pruning shears, was controlling natural tendencies. Nature as a source of life took second place; instead, nature was considered as a source of beauty to be toyed and played with.

By the end of the 17th century many English intellectuals were beginning to take offense at the symmetry that was being applied to nature. Alexander Pope related satirically, "Adam and Eve in yew . . . St. George in box, his arm scarce long enough but will be in condition to stick the dragon by next April."²³

Horace Walpole wrote in retrospect in the mid-18th century, that

To crown these impotent displays of false tastes, the sheers were applied to the lovely wildness of form with which nature has distinguished each various species of tree and shrub. The venerable oak, the romantic beech, the useful elm, even the aspiring circuit of the lime, the regular round of the chestnut, and the almost moulded orange-tree, were corrected by such fantastic admirers of symmetry. The compass and square were of more use in plantations than the nurseryman Trees were headed, and their sides pared away; many French groves seem green chests set upon poles. . . .²⁴

William Kent (1685-1748), an English architect, was more noted for his landscape designing than for his

²³Ibid., page 110.

²⁴Ibid.

architecture. He rejected the geometric discipline and introduced the idea of the natural park which evolved into what is now termed the "English Garden."²⁵ This was a new relationship between architecture and its surroundings. Nature was not subservient to architecture, the two were equals. Kent's ruling principle was that "Nature abhors a strait line."

Lancelot "Capability" Brown carried this concept to perfection, eliminating the idea of the formal garden and introduced the idealized landscape which should encroach upon the walls of structures.²⁶ He interpreted beauty as gentleness, smoothness and grandeur.

At this same time, blind passion and an overly zealous attitude pushed garden design into an artificial state.²⁷ Brown's critics wanted the picturesque and a more rugged beauty. They hastily eliminated any object that might not be part of the natural landscape. What was introduced can best be described as an obvious attempt to deceive. Many designers would haul in rotting logs or "plant" dead trees. False ruins were "constructed" and crumbling bridges were "built." Some enthusiastic individuals would even go so far as to hire a hermit to live

²⁵Ibid.

²⁶Ibid., page 111.

²⁷Ibid., page 117.

in the area. The stylized, geometric use of plant materials was transposed into a stylized, natural form. As most historians will agree, there was still an element of formality quite similar to that of the Japanese garden in that materials were exactingly placed for a specific purpose.²⁸ Formality in these gardens was not geometric however, but it was in a sense artificial.

Humphry Repton completed the transition between the artificial building and the natural landscape.²⁹ He introduced some of the artificiality of the house into the park. His most useful tool was to use a terrace or deck, surround it with geometric planting arrangements and then create a blend into the natural park.

Since America lacked a tradition of centuries of evolution in one place, the transplanting of design ideas from various parts of Europe was quite common. Many Americans adopted the traditional Medieval herb garden along with a prototype of the English geometric pleasure garden.³⁰ With the advent of the Industrial Revolution, many of the new landed gentry continued to copy traditional forms of European architecture and design until well into the 20th century.³¹

²⁸Ibid., page 111.

²⁹Ibid., page 117.

³⁰Ibid., page 130.

³¹Ibid., page 111.

A notable characteristic of the 20th century in the United States was the rapid development of substantial economic well-being coupled with increased individual freedom. Unfortunately, with this wealth, prosperity and freedom, came a lessening of respect for the natural systems that support life, as illustrated by the degree of environmental decay that has been allowed to evolve. The evidence existing today indicates that man has generally lost touch with the spirit of nature and that, for many, nature is just another object to control and exploit.

The flashy lights, shiny cars and polished imitation wood desk tops seem to have turned man into what might be described as a modern day Judas. He seems to have lost sight of the realities of his sources of life. The supermarket is his garden, his apple pie is made up of emulsifiers, his oranges have artificial coloring added, he continues to befoul the air he breathes and he has virtually killed Lake Erie.

It should be quite evident, not only based on the evidence presented, but also on a myriad of other examples that can be easily perceived, that an apathetic attitude toward nature is a commonplace thing. In his quest for progress, man has exchanged harmony and coexistence with nature, for the achievement of exploitation of nature and economic purchasing power.

Based upon man's past actions and his present attitudes, a few interesting generalizations can be observed:

1. Nature is subservient to man.
2. Substitutes are a common part of life.
3. Many new materials must be disguised for varying periods of time before they may be used honestly.

With respect to the context of this thesis, plastic plants may have evolved for several reasons. The present state of values of the urban citizen has left the door slightly ajar for a "madison avenue" style of approach to offer substitutes for a wide range of items. Many people are not very concerned about the realities of nature. Further, there can be seen an increased use and acceptance of substitutes for nature. Plastic, by virtue of its inherent chemical make-up, is well suited to being shaped into virtually any form. Technology has advanced the field of petrochemicals to the point of being able to reproduce the physical properties of almost any material.

When plastic was first introduced, the quality of products manufactured did not hold up under abusive wear and tear. Its structural characteristics were not competitive with other traditional materials and an aura of cheapness enveloped anything plastic. This general attitude may have been a chief factor in disguising the material to look like something more traditionally accepted. Chrome plated metal bumpers on cars have been traditional; yet,

as early as the 1969 Toronado, automobiles have had plastic bumpers disguised to look like chrome.

In 1969 it was reported that the previous year "may be remembered as the one when the substitution of plastic for wood in furniture became an accepted trend."³² In 1970 some analysts predicted that the trend toward plastics may eventually spell the end of wood being used as a major furniture material.

Not only have substitute materials (principally plastic) gained a strong inroad in the manufacturing trades, but it seems that man has grown to accept them even for natural plant materials. Many gasoline stations feature plastic plants in planter beds, a large number of athletic fields are sporting a new coat of synthetic grass, and several hotels in Florida have fifty foot tall plastic palm trees decorating their facade.

Economics, of course, play an important role. If a product can be manufactured out of plastic for less money and with the same or better life span than a more traditional material, then an obvious advantage is gained (in economic terms).

Based upon the information presented up to this point, the general climate appears to be ripe for a continuing use and acceptance of artificial plant materials.

³²Modern Plastics, Volume 46, Number 1, January 1969, page 18.

Several other observations and facts will be discussed later which should help to clarify some of the pros and cons of this situation.

It should be noted that there are, in fact, many areas where synthetic substitutes may be just as suitable, or more so, than organic plant material for performing a particular function. It is worthwhile for the landscape architect to review the functional uses of plant materials and ascertain the realities of the present in the hope of shedding some light on the future. It is also the obligation of the designer to insure that his chosen problem solution functions well. Whether a substitute material is used or not should be based on a firm knowledge of all the possibilities. Questions of morality and honesty in design will be expanded upon later. At this point, an objective understanding of the comparative ability to perform functions normally associated with traditional organic plant material is useful.

CHAPTER II

A COMPARATIVE ANALYSIS OF LIVE PLANT MATERIALS WITH OTHER POSSIBLE DESIGN SOLUTIONS

Functional Capabilities

The following chart is a comparative listing of the functional uses of (1) traditional organic plant materials, (2) synthetic exact look-alikes, and (3) sculptured functional replacements. The listing of the functional uses of plant materials used in this comparison is not to be assumed complete, but represents the major functions as determined through conferences with professionals in Landscape Architecture and Ornamental Horticulture.³³

The functional uses are broken down into four basic headings: Architectural, Aesthetics, Climate Control and Engineering. Each of these general functions is further

³³Professors Stephen F. Bochkor, Carl S. Gerlach, and Christopher Macey, Division of Landscape Architecture, Michigan State University, East Lansing, Michigan.

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Mr. Gary O. Robinette, Executive Director, The American Society of Landscape Architects Foundation, Washington, D.C.

reduced to major explanatory components as necessary. The terminology used has been kept to a minimum and is representative of terms generally accepted by the profession.

The first comparative column represents traditional organic plant materials. Subheadings are broken down into (1) trees, (2) shrubs, (3) vines,³⁴ and (4) groundcover.³⁵ No attempt has been made to distinguish between deciduous and evergreen varieties.

The second comparative column represents synthetic exact look-alikes made of plastic.³⁶ The subheadings are again broken down into (1) trees, (2) shrubs, (3) vines, and (4) groundcover, with the same restrictions applying as those set forth for organic plant materials. An intent to deceive is paramount in this definition.

³⁴Vines in this study are limited to those that either prefer vertical growth or may be trained in that fashion (Espalliers included).

³⁵Groundcover is limited to grass in this study for simplification of variables only. Parallels may be drawn for other forms of groundcover but these will not be presented here.

³⁶Plastic in this study is a general descriptive term for the material used to manufacture the product: This is to distinguish it from "plastic" meaning any substance capable of being molded. Although limited to representation in plastic, parallels may be drawn for other materials such as rubber, metal, glass, paper, etc., as applicable. The term exact look-alikes assumes a highly sophisticated product that would for all practical purposes defy detection by sight or touch. It is conceivable that this degree of quality could be produced if warranted and in some instances is already in existence.

The third comparative column represents sculptured functional replacements.³⁷ The subheadings are listed as (1) trees, (2) shrubs, (3) vines, and (4) groundcover for lack of better terminology and to facilitate cross-referencing. The restrictions applied in this instance are that the sculpture assumes the line, form (as applied to structure), texture, movement and perhaps the color of the plant material it is functionally replacing. Any combination of the above listed criteria (plus any relevant items that have not been enumerated) may be used. No attempt is made to deceive in this instance; the product is a functional replacement incorporating aesthetic appeal.

Ratings on the ability to perform the indicated function are based on the following arbitrary scale:

- 1 = very suitable
- 2 = suitable, but with some limitations³⁸

³⁷The term sculpture is used in an artistic sense. The form of the sculpture may range from a look-alike that is quite obviously man-made, to a more sophisticated art form that projects the concept of the represented plant material. Some examples might be

- (1) a blue concrete tree made from an exacting mold,
- (2) a free form sheet of plexiglass atop a vertical member made of spun aluminum, and
- (3) a "wrought-iron tree" erected to convey the form and texture of its living model.

Inclusive would be such items as green colored asphalt or concrete, edgings of crushed brick, sand, interesting aggregate, etc., cobblestone mounds, aesthetically interesting fences or exposed aggregate paving, for example. The materials used are assumed to be limited only by the imagination and ability of the designer.

³⁸Perhaps in comparison to one or both of the other possible solutions indicated, or doubtful enough that a clean bill of health cannot be given.

3 = suitable, but very limited
4 = not suitable

It should be borne in mind that these ratings are arbitrary and that the values assessed in the comparative chart which follows are based upon the appraisal of the author. Although individual interpretation may vary somewhat, the rating system used and the values given do provide a useful means for comparative evaluation. A general discussion of the results will be presented later.

Analysis

As can be readily seen under the circumstances incorporated in the chart below, there are many parallels that can be made for the ability of varying possible solutions to perform a given function. One major point that can easily be noticed in an analysis of this nature is that traditional organic plant materials generally provide a very practical solution to functional problems. By comparison, it is also evident that under some circumstances, exact look-alikes and sculptured functional replacements may also solve the individual problem as well.

What is valuable at this point is to review the results indicated in the charts to clarify their interpretation. To discuss each item separately, support each value given and compare it with the other possible solutions would merely add bulk of questionable value to this

CLIMATE CONTROL

WIND

Obstruction	1	1	2	4	1	1	2	4	1	1	1	4
Filtration	1	1	2	4	1	1	2	4	1	1	1	4
Deflection	1	1	2	4	1	1	2	4	1	1	1	4
Guidance	1	1	2	4	1	1	2	4	1	1	1	4

SUN

Filtration	1	1	1	4	1	1	1	4	1	1	2	4
Obstruction	1	1	1	4	1	1	1	4	1	1	1	4
Radiation	1	1	1	2	2	2	2	3	2	2	2	3

PRECIPITATION AND HUMIDITY

Snow	1	1	3	4	1	1	3	4	1	1	2	4
Evapotranspiration	1	1	1	1	4	4	4	4	4	4	4	4
Frost and Dew	1	1	1	3	2	2	2	4	3	3	3	4
Rain, Sleet and Hail	1	1	2	3	1	1	2	2	1	1	2	2

TEMPERATURE

Air	1	1	1	1	1	1	1	1	1	1	1	1
Ground	1	1	1	1	1	1	1	1	1	1	1	1

DUST

Filtration	1	1	1	1	2	2	2	3	2	2	2	3
------------	---	---	---	---	---	---	---	---	---	---	---	---

ENGINEERING

Acoustical Control	3	3	3	3	3	3	3	3	1	1	1	1
Erosion Control	1	1	1	1	3	3	3	1	3	3	3	1
Reducing Glare and Reflection	1	1	1	1	1	1	1	1	1	1	1	1
Traffic Control	1	1	1	1	1	1	1	1	1	1	1	1
Air Conditioning	1	1	1	1	4	4	4	4	4	4	4	4
Barrier	1	1	1	4	1	1	1	4	1	1	1	4

1 = very suitable
3 = suitable, but very limited

2 = suitable, but with some limitations
4 = not suitable

analysis. It is worthwhile, on the other hand, to discuss the results in general terms and cite a few clarifying examples where necessary. One major point that can easily be noticed in an analysis of this nature is that traditional organic plant materials generally provide a very practical solution to functional problems. By comparison, it is also evident that under some circumstances, exact look-alikes and sculptured functional replacements may also solve the individual problems as well.

Architectural

As space articulators, all three solutions will provide a very suitable means of defining space. A sculptural replacement for vines has a slight edge in privacy control and screening objectional views, since an opaque material, containing a representative form or texture, could be substituted.

Directing views with groundcover could be better achieved by introducing some form of super graphics in the groundcovering material; i.e., an exposed aggregate arrow placed in concrete.

The ability to provide a smooth visual flow from one point to another is inherent in all three solutions.

Aesthetics

It is debatable whether sculpture can be considered to provide for the softening of architecture in the same context that plant materials can, primarily due to the architectural characteristics of the materials normally used in sculpture.

Background in a macro-situation necessitates a large vertical and horizontal emphasis that organic and plastic trees and shrubs can provide. In this instance, sculptured trees and shrubs may be impractical.

It seems quite doubtful that groundcovers will provide much vertical enframement and therefore should not be considered. The remainder of the categories will function quite well.

Normal organic turf or plastic grass may be used sculpturally, but this quality will be quite limited in comparison to a sculptured functional replacement.

Plastic trees, shrubs and vines may be used as a natural barrier only because they possess deceiving qualities; sculpture, of course, does not.

The qualities of being able to produce shadow patterns and compliment or enhance architecture, are inherent in all three categories as indicated.

So far as attracting birds and animals is concerned, exact look-alikes and sculpture may provide a suitable resting place, but their ability to provide the

natural attraction properties that organic plant materials have is questionable.

All three comparative categories can provide for tying various elements together, and without question exhibit a wide range of textural properties that are aesthetically pleasing.

Climate Control

Groundcovers, under the definition used here, will have virtually no effect at all on controlling wind. Vines may be used to perform the functions indicated, but sculpture would be a better choice. For obstruction, filtration, deflection and guidance, the replacement could be a narrow (in thickness, not length) vertical element that was designed specifically to perform those functions

Due to the natural overlapping growth habit of the leaves of vines, it was felt that the ability to filter the sun's rays would be greater for organic and look-alike vines, than it would be for a sculptured replacement (although this may very well be debated).

Obstructing the sun's rays is a function that all three categories of trees, shrubs and vines can perform quite well.

Organic plant materials possess the ability to absorb tremendous amounts of energy, and when coupled with their reflective qualities, are able to greatly reduce the

effects of radiation in the 0-10 foot zone above the ground surface. Depending on the material used, exact look-alikes and sculpture will be able to do likewise but, generally speaking, not as well as organic plant materials.

In controlling snow, whether it is moving vertically or horizontally, large dense forms will exert a tremendous influence. If the replacement for vines was an impervious vertical element, a significant amount of control could be achieved and perhaps would rate a higher value.

Live plant materials are the only category listed that can perform the natural function of evapotranspiration,³⁹ and subsequently are placed in a league all their own. Water as sculpture would, through evaporation, cool the air, but in this comparative listing, water features were not considered.

Frost and dew control is one area where more comparative study is needed. It is generally felt that organic trees, shrubs, and vines will provide a substantial amount of control whereas exact look-alikes may not. Sculpture, on the other hand, will be lower in value yet, since the materials used tend to be stronger retainers of cold. The opposite argument can be given for sculpture,

³⁹"Evapotranspiration" is a term used to convey the combination of evaporation and transpiration functions that organic plant materials perform.

that perhaps the material is one that absorbs large amounts of heat, and subsequently will afford the protection and control desired by slowly releasing this heat in the evening. For the values given, the assumption was that the materials used would not be as advantageous as traditional organic plant material.

Control of rain, sleet and hail can be accomplished by all three categories of trees and shrubs. Minor limitations are incurred with vines. Substitutes for normal grass are more favorable due to the firm nature of the material that would be employed.

Temperature control can be provided for by all the materials presented. Some will tend to heat up the air and ground, while others will tend to offer a cooling effect. This will also vary according to the season of the year, but in general terms they all will affect variations in temperature.

Traditional organic plant materials generally will provide the best dust control due to the tiny hairs that leaves contain and the omnipresence of moisture on the leaf surface. Depending on the materials used, exact look-alikes and sculpture could provide for this function, but it is doubtful that the quality of performance will match organic plant materials.

Engineering

Acoustical control may best be provided for by sculpture, providing the material used has high sound absorbing qualities.

Plant materials provide the best erosion control overall, due to the effect the root systems have on soil stabilization. Look-alikes and sculpture will slow down the impact force that rain drops have, but they lack the soil stabilizing quality of live plant material, except in the case of groundcovers which would seal or cover the ground surface.

Reducing glare and reflection and controlling traffic can essentially be accomplished by all three categories of trees, shrubs and vines equally as well.

The inherent ability to evapotranspire and thus cool the air, places plant materials in a unique position as being nature's very effective air conditioner.

All three solutions for trees, shrubs, and vines will function quite well as barriers due to the vertical qualities they possess.

General Summary

As was mentioned earlier, traditional organic plant materials rank very high in performing the functions indicated in the comparative chart. It is advisable, of course, to specify plant materials wherever feasible, but

there also appears to be many functions that could be solved quite adequately by exact look-alikes and sculpture. Although this alone is informative, the number of areas in which this can be achieved is most impressive and merits further investigation.

Translated into percentages on the ability to perform the indicated functions with a rating of (1) very suitable, the following chart may also be useful.

	T r e e s	S h r u b s	V i n e s	G r o o u n d r
Traditional Organic Plant Material	97%	97%	72%	44%
Plastic Exact Look-Alikes	75%	75%	47%	31%
Sculptured Functional Replacements	69%	69%	61%	36%

Based on percentages, plant materials are higher in total percentage ability to very suitably perform the indicated functions, but in relative terms the edge is really not so great.

Another aspect of the charts that needs to be examined is the number of areas where exact look-alikes and sculpture have received a (2) value (suitable, but with some limitations). It is conceivable that technology could eventually discover an economical way to improve some of

these ratings to a (1) level, or for that matter, elevate some of the (3) values. This, of course, would have a drastic effect on the percentages by increasing the possible alternatives.

There are only two areas where plant materials appear to be in a league all their own, and two areas where sculpture is eliminated but exact look-alikes are not.

Air conditioning and evapotranspiration are two closely linked functions that plant materials possess naturally. However, if a proper combination of shade producing sculpture or exact look-alikes and water features (fountains, sprays, etc.) were worked out, this area may be undermined to some extent.

If man ever becomes so insensitive toward nature that concept is all he psychologically requires, then "natural barriers" and "natural elements in an urban setting" will also be pressured with higher values for plastic exact look-alikes and sculptured functional replacements.

It is important to realize that if function is the main criterion, the landscape architect should consider the results indicated in the comparative charts in order to insure that the problem requirements are being met with the appropriate general category of material.

Considering function alone, if the design problem were to provide for erosion control, space articulation,

enhancing architecture and the reduction of glare and reflection as major requirements, the normal solution would be for the designer to specify traditional organic plant materials. This decision would probably be quite reasonable since the ability to perform these functions can be rated very high. However, if the area in question were located in a high density urban situation where air pollution was extensive, maintenance and labor costs were very high and the environs were subject to heavy human pressures, then perhaps the designer would be best advised to re-evaluate his choice. For performing these indicated functions, plastic exact look-alikes and sculptured functional replacements also may be rated with a (1) very suitable. Since many live plant materials are intolerant of certain man-made conditions, it is areas such as this that will warrant the consideration of plastic plants or a sculptured replacement to be used.

Other Considerations

There are, of course, several other factors that must exhibit influence on the designer's decision. The ability to perform any one function cannot be weighed in such arbitrary terms. The socio-psychological realities must be inserted as well as the economic aspects. The fourth dimension of time and space is a valuable and necessary consideration. All live plant materials grow and

some have flowers or fruits and possess seasonal variations in color and texture. Live plant materials provide mankind with part of the oxygen he needs to survive (the usual figure given is around 30%). All of this information must be heavily weighed by the designer if a truly functional solution is to be found.

Fifty years ago the various options for problem solving could very well have been considered in a relatively short period of time. External influences were not as profound and varied as they are today. Technology has introduced many factors that have significantly altered the number of considerations which need evaluation. Various pollution problems, population pressure, innovative new materials and increased construction costs demand a greater knowledge of possible solutions if the designer intends to effectively design for the environment.

CHAPTER III

DETERMINING FACTORS

Socio-Psychological Implications

In attempting to discuss the social-psychological aspects of using substitute materials, the difficulty comes in separating what the individual says he wants from what he actually needs. In this respect the landscape architect is placed in a rather unique position of having the responsibility of assessing that need. The art of being a "pace-setter" or "taste-maker" embodies the necessity for a greater understanding of man himself in order to manipulate a higher set of values into the final solution.

In any society there is a vast range of opinion on what is considered good. In a recent research paper published by the Regional Science Research Institute, some interesting observations were made with respect to preference of landscape characteristics.⁴⁰ It was found that the judges (those being tested) generally preferred

⁴⁰Analysis of Landscape Characteristics Relevant to Preference, Rabinowitz and Coughlin, RSRI Discussion Paper Series No. 38, Regional Science Research Institute, March 1970.

landscapes that possessed a strong tendency toward being "parklike" or obviously man-influenced.

Mowed grass and scattered large shade trees seem to be the determining factors. Judges may say, 'This is nice because it looks natural, away from civilization.' However, the scenes to which they are referring are not in a wild or natural state but clearly 'landscaped.'⁴¹

Another observation that was made is that

extreme seclusion in a landscape will tend to be disliked or ignored by a majority of observers, but will inspire extremely strong favorable reactions in a few.⁴²

In addition to his comments on topiary (Ibid., page 17) Alexander Pope presents an interesting concept dealing with attitudes when he states that

We seem to make it our study to recede from Nature, not only in the various tonsures of greens into the most regular and formal shapes, but even in monstrous attempts beyond the reach of art itself; we run into sculpture, and are yet better pleased to have our trees in the most awkward figures of men and animals, than in the most regular of their own. . . . I believe it is no wrong observation, that persons of genius, and those who are most capable of art, are always most fond of nature; as such are chiefly sensible, that all art consists in the imitation and study of nature: On the contrary, people of the common level of understanding are principally delighted with the little niceties and fantastical operations of art, and constantly think that finest which is least natural.⁴³

Frederick Law Olmstead, in his Walks and Talks of an American Farmer in England, related that

⁴¹Ibid., page 7.

⁴²Ibid., page 40.

⁴³Gardens, Plants and Man, Op. Cit.

The architect and the gardener do not understand each other, and commonly the owner or resident is totally at variances in his tastes and intentions from both; or the man whose ideas the plan is made to serve, or who pays for it, has no true independent taste, but fancies to be accommodated, which only follows confusedly after custom or fashion.⁴⁴

There would appear to exist, then, a vast middle ground area of people who must be dealt with in a persevering manner, in order to impose a truer feeling for what is natural versus what is not.

Although it is normally assumed, and quite rightly so, that live landscape materials are what people want, there remains a strong tendency among many to introduce elements that cheapen natural concepts: ceramic reproductions of various animals and "woodnymphs," stuffed birds in trees and other assorted "brick-a-brack" that detract from the sublime natural beauty of plant materials and perpetuate the lowering of individual standards.

Recently, a landscape architect in Michigan specified artificial turf as part of his design solution for some garden apartments soon to be constructed.⁴⁵ When queried on this matter, the designer indicated that the client was maintenance conscious and requested that artificial turf be used. When asked why some other form of

⁴⁴Ibid.

⁴⁵At his request, the individual in question will remain anonymous.

groundcover wasn't suggested, it was revealed that the client simply wanted the appearance of grass without the problems associated with natural turf.

Aside from the observations of Alexander Pope dealing with the acceptance of the least natural, the major determining factor for substituting non-real for real plant materials is economics.

Economic Considerations

For reasons of labor and maintenance, many individuals in decision making positions have been specifying artificial substitutes for plant materials. As Margret Herbst, the Director of Information for the Merion Bluegrass Association recently pointed out, "artificial turf is here to stay."⁴⁶ Mrs. Herbst does not endorse artificial turf but does recognize that tremendous inroads have been made, largely for reasons of maintenance. A large number of the major football stadiums across the country have switched to artificial turf in order to reduce maintenance costs. In 1970, even Albi Stadium in Spokane, Washington, went to artificial turf although Spokane is located right in the heart of the major grass seed producing area.

⁴⁶In a speech entitled "Advantages and Disadvantages of Artificial Grass, Trees and Shrubs," delivered at the Michigan Association of Nurserymen Convention held in Grand Rapids, Michigan, February 10, 1971.

Ironically, the interior plantings at the Apopka Airport in Florida have been changed to artificial ones and located close by are signs advertising the area as the "Foliage Plant Capital of the World."⁴⁷ Many hotels and restaurants in Florida have major exterior planting beds adorned with such items as 40 foot tall plastic palm trees. Mrs. Herbst also noted that during a recent visit to Hawaii she was amazed to see the number of hotels that had converted to artificial plant materials.⁴⁸ The chief reason given was the shortage of labor.

Another area where the lack of maintenance incentive has helped foster the use of artificial plants is the exterior plantings around gasoline stations. One major oil company puts out an impressive guide to landscaping service stations in which the "how to do it" also specifies artificial planting arrangements.⁴⁹

An Illinois landscape architectural firm felt that

there is a slight trend toward the use of artificial turf in golf course design. However, this use is not the result of wide acceptance through tested applications but rather an attempt at solving or at best finding a solution for turf problems experienced on golf courses. Municipal golf

⁴⁷ Ibid.

⁴⁸ Ibid.

⁴⁹ It seems unfair to indicate which oil company does this since they were the only company that openly responded to inquiries and to single them out would be an unjust stereotyping.

courses have found it necessary to use some sort of artificial material on their tees since they receive tremendous amounts of wear. At this time artificial turf offers an immediate solution to their problem, so it is used even though there are no conclusive reports on its durability.⁵⁰

Whether it should be considered a valid reason or not, there are areas where the use of artificial plant materials may be economically justified. These areas may be where proper watering is difficult, where lighting is poor, where maintenance is excessive or where temperatures are too low or too high to sustain normal growth of live plant material.

The Pros and Cons of Artificial Turf

In order for the designer to better understand the pros and cons of artificial plant materials versus natural plant materials, and to establish whether economic considerations are realistic, a discussion of artificial turf as a case in point should provide useful insights.

As has been mentioned, an upsurge in the use of artificial turf for athletic areas can be seen throughout the country. Since 1966 when the Astrodome in Houston was first covered with plastic grass, the novelty now, with respect to football and baseball stadiums, seems to be

⁵⁰William J. Spear and Associates, St. Charles, Illinois, in response to a questionnaire.

to still have natural turf. This trend is beginning to invade such areas as horse racing, tennis, golf, inner-city playgrounds, highway median strips in sun-parched western cities, roof top gardens, commercial developments and even some residential lawn areas.⁵¹ The standard explanation given by those who have made the decision to use plastic grass involves maintenance, durability under heavy human pressures and all-weather use (depending on the area of the country).

The major advantages listed by the promoters are the following:

1. Reduced maintenance costs.
2. Will withstand excessive continual use.
3. Is a more suitable and useable surface immediately after bad weather conditions.

The major disadvantages seem to be these:

1. High initial cost.
2. Increases surface temperature greatly.
3. Repairs are expensive when necessary.

Relative Costs

Precise cost comparisons are unavailable at this time due to the difficulty in obtaining reliable figures. For the purpose of this discussion, general figures will be used as indicators of relative expenses.

⁵¹Based on the information received from questionnaires sent to various manufacturers and suppliers of artificial turf.

The average cost for artificial turf usually given is around \$2.50 per square foot plus installation and base preparation.⁵² Good quality sod will range from \$.12 to \$.18 per square foot plus installation and base preparation. Using some form of grass seed, the cost is around \$.04 to \$.07 per square foot plus base preparation.

The literature indicates two methods of installation of artificial turf; secured to any hard surface by means of some type of epoxy or asphalt base sealant, or anchored to prepared soil. The former method increases the overall cost if the "hard" surface is not already in place.⁵³ The base preparations in all cases (whether artificial or natural surfacing is used) are similar, in that they require essentially the same specifications for gravel, tile drainage and other engineering considerations. Artificial turf does require specially designed installation equipment, particularly in the case of attaching it to a "hard" surface, but this cost is computed in the overall cost figures given.

According to Mr. John Laetz, Business Manager for Intercollegiate Athletics at Michigan State University, the \$2.50 figure is a high estimate. He indicated that

⁵²Based on the best available figures provided at this time. Climatic, geographic, and geologic variations will influence their figures so they are not to be considered as absolute.

⁵³A hard surface in this case is virtually any of the normal surfacing materials such as brick, concrete, asphalt, cobblestone, etc.

the total cost for switching the Spartan Stadium (an area of around 84,000 square feet) over to artificial turf was \$250,000. This figure includes the cost of new goal posts, the asphalt base needed and the turf. Deducting the cost for asphalt (approximately \$36,000) and the goal posts (approximately \$2,600), results in the artificial turf expenditure being reduced to about \$1.32 per square foot. Although this still represents a high initial cost when compared to natural turf, Mr. Laetz feels that in the long run a substantial savings will be shown.

Maintenance expenditures have dropped drastically, and with the rising costs of labor, savings are greater now than anticipated. Mr. Laetz further went on to point out that concern over problems that might occur to the surface before or during a game which may alter or reduce the quality of play have virtually disappeared.

Generally, for high intensive use areas, there do appear to be a few benefits gained by using an artificial turfed surface. It would be reasonable to assume that if the area were used quite regularly, the cost-benefit ratio would be even more in favor of such a decision.

Temperature Problems

Many critics of artificial turf recite the dramatic increase in surface temperatures as another negative aspect of artificial turf. The problem of increased temperatures

is substantiated by a report recently released through the Department of Horticulture at Michigan State University.⁵⁴

It was found that

the highest surface temperature recorded with an infrared thermometer during this study on artificial turf was 163° F on August 5, 1970, while grass outside the M.S.U. Stadium was 88° F. Data from White Sox Park in Chicago, Illinois, clearly illustrates that the temperature differences are not the result of the stadium and stands keeping the artificial turf warm. Surface temperatures of artificial turf on the infield of White Sox Park was 163° F as compared to 86° for natural grass in the outfield less than 10 yards away [See Figure 1, Appendix A].⁵⁵

It was further reported that

unlike concrete, stone or asphalt, the surfaces of artificial turf both in the M.S.U. Stadium and White Sox Park quickly cool off at sundown. In both cases the temperatures of artificial turf were identical to natural grass by 8:00 p.m.⁵⁶

Air temperature variation is not so drastic. For example, air temperatures three inches above the artificial turf in White Sox Park were 96° F compared to 87° F for natural grass.⁵⁷

Figure 2 in Appendix A substantiates the effect evaporative water cooling has on various surfaces. Based on this information, an experiment was performed to test

⁵⁴"The Temperature of Artificial Turf as Compared to Living Grass," Dr. Roy A. Mecklenburg, Associate Professor of Horticulture, Michigan State University, August, 1970.

⁵⁵Ibid., page 2.

⁵⁶Ibid., pages 2 and 3.

⁵⁷Ibid., page 2.

the possible application of water to cool the surface resulting in a suggestion that .20 to .25 of an inch of water applied in the morning will significantly cool the surface for one day (see Figure 3, Appendix A).⁵⁸ It was also revealed that this uniform application will not splash up, run off or significantly alter the appearance of the artificial turf.⁵⁹

Another interesting fact revealed is that shade may also help to reduce the temperatures of hard surfacing materials or possibly artificial turf (see Figures 2 and 4⁶⁰ in Appendix A). The higher temperatures during the day above grass rather than the woods or asphalt (Figure 4) may result from shading in the case of the oak woods and greater absorption of heat by the asphalt in the case of the parking lot.⁶¹ Figure 2 reveals that shaded asphalt is much cooler than unshaded asphalt. The implication is that if artificial turf were combined with shade producing elements, the extreme temperature problem may be substantially alleviated.

⁵⁸Ibid., page 4.

⁵⁹Ibid.

⁶⁰"A Preliminary Report on the Effect of Plants on the Urban Environment," Roy A. Mecklenburg, William Rintelmann, and Ceel VanDenBrink, Department of Horticulture, Michigan State University, August, 1970.

⁶¹Ibid., page 4.

Other Problem Areas⁶²

When considering maintenance problems, artificial turf requires special care. Chewing gum and cigarettes create major problems. If the surface needs to be cleaned, special cleaning equipment is required. Ridges can develop due to heat stresses or improper installation. The sealant materials used in the hard surface installation sometimes bleed up through the turf. Reports of color fading and the present inability to re-dye the surface seem to be negative aspects. If minor patching is necessary, there is a tendency for the overall strength of the surface to lessen, and if the surface has faded at all, it is likely that the patch will not match in color.

Proper drainage is another major consideration. With respect to natural turf, major problems arise due to inadequate soil conditions. The natural turf area must be adequately drained as well as provided with sufficient moisture to sustain a pleasing growth. Various chemicals and soil enhancers are necessary and disease problems are bothersome. The surface is not satisfactory for excessive continuous use nor is it convenient to use immediately

⁶²Based on a questionnaire response submitted by the landscape architectural office of William J. Spear and Association, St. Charles, Illinois, and an information pamphlet entitled "Artificial or Natural Grass? Advantages and Disadvantages," Meriod Bluegrass Associates, 1970.

after bad weather conditions. Proper maintenance also includes a frequent mowing schedule.

Natural turf is, however, relatively easy and inexpensive to repair and does provide a cool surface naturally. Debris must be removed from artificial turf, while natural turf biologically decomposes most materials that are discarded on it.

There still remains the problem of deciding what type of surfacing material to specify in areas where live grass is hard-pressed to sustain acceptable growth. By deciding on a material that would be classified as a sculptured functional replacement (such as colored asphalt or concrete, cobblestone, brick or exposed aggregate paving) low maintenance, durability and longevity would of course be benefits gained. However, the advocates of artificial turf feel quite strongly that their product will competitively offer these same benefits, plus the added safety of a more non-skid surface when wet and the comfort of a more springy grass-like walking surface.

Before specifying artificial turf could be considered a wise choice, technology will have to solve a few major problems:

1. A practical means of reducing the high surface temperatures (a possible solution has already been tentatively suggested).
2. Greater resistance from burns caused by the careless smoker.

3. Less costly repair problems.

It must be remembered that if the major problem areas are solved and the economics involved are brought more closely in line with other surfacing materials, the concerned designer is going to be hard pressed to convince many people that using artificial turf is not a reasonable idea.

An experiment has been conducted at Wayne State University in Detroit that may offer a tough, traffic-resistant turf on walks, paths and other heavily used areas.⁶³ In these tests a seed mix of 20% Kentucky Bluegrass, 20% Perennial Rye, 45% Kentucky 31 Fescue and 15% Creeping Red Fescue was sown, fertilized and watered as would normally be the practice. The interesting aspect of this test is that over this newly seeded area an artificial turf was laid.⁶⁴ In approximately two weeks time the grass had grown up through the artificial covering, and a month later the artificial turf was no longer visible. The new lawn area can be mowed and maintained as would normally be the case and when excessive traffic wears down the real grass, the plastic turf absorbs this impact and

⁶³Information supplied by Mr. A. F. Collins, Landscape Architect for Wayne State University who conducted the experiment.

⁶⁴The artificial turf in this instance was one that contained a series of holes, approximately 1/8" in diameter, evenly spaced and sufficiently separated so as to still maintain a desirable mat.

helps to protect the roots from compaction and dislodging until the real grass can recover. The researchers caution that a project like this should be started only during cool weather since the heat build-up under the artificial turf can "cook" the seed.

Other than taking that precaution, no real problems have been noticed at this point. Although there is an additional expense necessary in procuring the synthetic grass, it was felt that the benefits gained by using a method such as this in areas where natural grass could not be adequately maintained might prove to be a beneficial use of technological innovation.

Further experimentation will be necessary before suggested guidelines can be introduced that will help solve the other problems related to artificial turf, even in a combined situation such as the Wayne State University experiment.

The Pros and Cons of Other Exact Look-Alikes

In depth information is not yet available on the use of plastic trees, shrubs and vines, but trends are apparent and some pros and cons may be found.

One interesting aspect of the influx of artificial exact look-alikes was noted by Margret Herbst when she related that "Many of our own florists [meaning U.S. florists) went over to Hong Kong and were doing the designs

for artificial flowers that absolutely hurt the florist industry here."⁶⁵ She further stated that she felt sure that with respect to artificial trees and shrubs, "There might have even been some nurserymen involved in advising them [meaning the artificial plant material industry] on how to make something that may look real."⁶⁶

One major nurseryman related in an interview that he is now promoting plastic rocks for garden designs and is mass-producing them at his business location in Southwestern Michigan.⁶⁷ As in the case of the plastic trees and shrubs around gasoline service stations, economics is the standard reasoning offered for their use; little or no maintenance is necessary and in the case of large rocks, the plastic reproductions may be more easily handled.

Due to the decided lack of reliable information on exact look-alike trees, shrubs and vines, information such as that presented for artificial turf is not possible. There are, however, a few interesting areas that can be documented which will provide the landscape architect with valuable insight.

⁶⁵Based on an interview with Mrs. Herbst at the Michigan Association of Nurserymen Convention held in Grand Rapids, Michigan, February 10, 1971.

⁶⁶Ibid.

⁶⁷For reasons of unfair publicity, his name will remain anonymous.

The Christmas tree industry is presently noticing the effect of artificial substitutes to a greater degree than most other natural plant material industries. In an article released by United Press International, it was related that "Pennsylvania's Christmas tree growers have fallen victim to modern technology, the affluent society and the American drive for perfection."⁶⁸ "One reason is the artificial Christmas tree, which many are buying for their long-lasting value and their sustaining good appearance and as a result of the merchandizing techniques used to sell them."⁶⁹

Mr. Woodrow W. Dambach, Executive Secretary of the Pennsylvania Christmas Tree Growers Association, feels that

while the artificial tree was at one time a status symbol, the situation could be reversed and the live tree, costing so much that only the affluent can afford it, will become a status symbol.⁷⁰

One marketing report reveals that the "Market for trees [meaning plastic evergreen trees] that look just like the real thing is growing at a healthy rate of

⁶⁸"Fake Trees Hit 'Live' Business," The Michigan State News, East Lansing, Michigan, Friday, December 4, 1970, Supplement Section, page 8.

⁶⁹Ibid.

⁷⁰Ibid.

25% per year."⁷¹ Figures on the number of artificial trees expected to be sold indicate about 12 million plastic trees to 50 million natural trees for the Christmas season, 1969.⁷²

Lester E. Bell, a Michigan State University extension forester indicated that "Buyers wanting to avoid the upkeep problems of natural trees turned to artificial types."⁷³ He further related that "about 30% of all Michigan Christmas Trees sold in 1970 were artificial."

For the naturalist the tragedy of this situation is that perhaps it is an indication of things to come. For reasons of economics and maintenance, a deeply entrenched tradition that has always been fostered by the nostalgic emotion of all the Christmas entails, has been invaded by "madison avenue" style technological advancement. If artificial trees can continue to make heavy advancements in such a sacred area as Christmas, then it begins to seem probably that other areas of the natural will become vulnerable in the near future. Although this situation alone does not necessarily indicate a large scale acceptance of artificial trees, it does seem to substantiate that many inroads have been made, and that in all likelihood this trend will continue.

⁷¹"PVC Christmas Trees Ring up Record Season," Modern Plastics, December 1969, page 67.

⁷²Ibid.

⁷³"Michigan Tree Sales Fall by Half Million," The Michigan State News, February 11, 1970, page 4.

In order to further understand this situation, excerpts from typical brochures advertising plastic plants will exhibit the appeal that may foster their perpetuation in the eyes of many individuals.⁷⁴

One company advertized that ". . . . foliage is fade and sun proof, urine and salt proof, ideally suited to withstand years of weathering in any climate. A built-in bonus: a minimum of maintenance."⁷⁵ Natural attributes are promised such as "Uncommon realism with durable everlasting beauty. . . . A full range of true colors adds to the botanical correctness of each plant specimen. Each leaf is produced with natural variations in color, veining and shape."⁷⁶ One advertisement states that ". . . . foliage is rugged, yet light weight allows these plants to be moved easily for special functions."⁷⁷ Another major selling point is that

Architectural plans incorporating . . . foliage provide instant landscaping. Forty foot palm trees, 18 foot Smilax, giant Rhododendran shrubs, massive hanging baskets, pearl white plants, plants colored with varying subtle shades of brown, and a host of unique special arrangements are all in a day's work for . . ."⁷⁸

⁷⁴For reasons of unfair publicity, the brand names will be left out and the corporation names will also remain anonymous.

⁷⁵Ibid.

⁷⁶Ibid.

⁷⁷Ibid.

⁷⁸Ibid.

There are even subtle appeals to human vanity with statements such as "Designers, architects seeking the 'just right' effect, and discriminating clients searching the 'impossible' turn to" ⁷⁹

The barrage of reasonable and worthwhile sounding statements and promises are indeed impressive. In reality, of course, the materials advertized are not at the stage of sophistication that was defined for the "comparative charts" already presented. The important thing to consider at this point is what will happen when that level of authentic reproduction is reached? Will the designer be able to produce enough real, tangible arguments against the installation of artificial plants?

As has been pointed out, many inroads have been made, and apparently there exists a vast number of people who are not as concerned about the realities of the natural, but are satisfied with the concept of nature instead. More research is necessary in this area before strategy can be developed that will keep the artificial in its proper place. The educated tastes of the landscape architect may provide him with the ability to deal with this encroachment, but at any rate, he certainly cannot afford to turn his back on this problem area and hope that it will simply go away.

⁷⁹ Ibid.

The data presented in the "comparative charts" has indicated that from the standpoint of function, incorporating other than live plant material in a solution is feasible. With the continued existence of troublesome micro-climatic situations, severe pollution problems, increasing maintenance costs, plus a series of other variables that may be included, there does appear to be sufficient reason for the landscape architect to at least consider specifying a substitute material for living vegetation under certain conditions.

CHAPTER IV

POSSIBLE USES OF ARTIFICIAL PLANT MATERIALS

High density urban areas are prime targets (or will be in the future) for the "madison avenue" approach to gain increased momentum in substituting for nature. Economics, which encompasses durability, longevity and little or no maintenance, provides the incentive to substitute for nature. The urban environment appears to be the area where the decision of whether to use exact look-alikes or sculptured functional replacements, will be made in the near future.

The urban area as it is known today is used to accommodate high density populations. Every square foot is worth much more than it is in less dense areas; consequently, the city is designed to avoid waste. Virtually everything must be man-made or man-planned. All materials must be strong and durable in order to withstand the unique and various pressures applied. Where it is found desirable to keep natural elements, it has usually been necessary to create a stylized and protected landscape that is adapted to the harsh environmental conditions of urban life.

It is extremely difficult to economically maintain natural grass on a playground or small park that receives intensive and extensive use. Many tree varieties either die or are severely stunted by the high levels of air pollution now occurring in most cities. In northern areas where snow removal is assisted by the use of chlorides, shrubbery, particularly evergreen varieties, are normally eliminated as a street border due to the severe effect these salts have on their growth. Increased temperatures and poor maintenance schedules result in parched turf areas and the generally stunted growth of most plant materials.

As in most cities when maintenance becomes difficult and costs begin to rise, the usual solution is to eliminate the natural and substitute hard paving materials for grass and install chain link fences for shrub barriers. Trees are either removed and possibly replaced with a small sapling or are simply allowed to struggle along in a less than desirable growing condition.

The decision as to what type of substitute to install (when one is justified) should be based on a firm understanding of the function(s) needed to be satisfied and substantial aesthetic values. The tendency in the past has been to stick with the traditional choice of asphalt or concrete for surfacing materials. Nothing much has been done to substitute for shrubs, unless a

raised seat wall or railroad tie wall can be considered as a replacement. The basic provision for shade along store front sidewalks has been the awning, or, more typically, nothing is done.

When a substitute must be used, it would be advisable to specify a true sculptured functional replacement. But unlike what is normally being done, aesthetics should play a more important part in the problem solution. The designer should strive to recommend materials that add color and texture to the area rather than take the easy road out and specify a more traditional material that usually winds up lacking in aesthetic and enlivening qualities.

Based upon the research done to date, unless more emphasis is placed on imaginative solutions to substituting materials, there is a strong possibility that "conceptual nature" (synthetic exact look-alikes) will soon fill the void. There are some areas where a combination of exact look-alikes and live plant materials may be well suited. There are also a few possibilities where exact look-alikes may function alone.

Surfacing

Artificial turf may well satisfy the problem of providing a surface similar in quality to real grass, but

affording greater resistance to wear and tear and subsequently a reduction in maintenance obligations.

Some possibilities might be:

1. Heavily used playgrounds where a cushioning quality is desired for the reduction of possible injuries due to falling on the surface.
2. Used in conjunction with natural plantings that require little maintenance and are situated in a location where the primary use is viewing into the area rather than physically using it.
3. As a practice putting surface where it would be impractical to install one in the traditional manner.
4. A roof-top garden area where due to structural problems, the large amounts of soil and special drainage facilities necessary for real plant material would be prohibitive.
5. Around the edge of swimming pools where real turf would not survive due to the chlorinated water, but the other attributes of natural turf are desired.
6. As a bank stabilizer along city freeways for example, where the abuses to live plant materials are a problem.
7. In arid or semi-arid regions where the lack of water prohibits the establishment of real grass, but again the other aesthetic characteristics are desired.⁸⁰

⁸⁰ It should be noted here that one of the most critical problems facing many communities today is the shortage of potable water. An added benefit that may be gained if large areas were covered with artificial turf, or for that matter any other hard surfacing material, might be the aiding in collecting rainfall which may help supply the growing need for water. Areas like the Isle of Gibraltar and many south-sea islands now use large sheets of concrete or polyethylene for that purpose, but perhaps for other areas, artificial turf may be aesthetically desired.

8. In very sheltered or indoor areas where proper natural lighting is not feasible.

There are areas where a combination of real and artificial may be useful.

1. In a playground area for example, where live trees and artificial turf are used together. The plastic grass being a convenient surfacing material for reasons previously stated and the live trees providing the necessary shade and evapotranspiration to effectively reduce the temperature problems; or
2. a combination of real grass with an artificial turf covering, similar to the Wayne State University experiment, where the live grass becomes the dominant visual element while being afforded the extra protection indicated earlier.

In the situations stated above, the principal consideration was that real turf could not be economically maintained and therefore a substitute material was required. There may be several other situations that would lend themselves to being considered in this listing but the important thing to consider is that they do exist.

A major question deserving recognition is: Why does the artificial turf have to look like real grass? There really are not any practical reasons why it must be green or have the exact blade-like characteristics of real grass unless promotional value or the fact that green artificial turf looks better on a television screen can be considered practical from a design standpoint. Artificial turf could well be classified as a sculptured functional replacement, particularly if it were available in a wide

choice of colors. Many critics of this material would probably be somewhat pacified if that were the case since the intent to deceive would not be present. A possible result might be, for example, that football stadiums which are outfitted with artificial turf could be color coordinated, which might be a more artistic approach to using a functional surfacing material.

Aside from the fact that the initial cost is high, there do exist possible beneficial uses of artificial turf as a surfacing material and perhaps it should be more seriously considered as a design solution.

Shrubs and Vines

The only practical applications of exact look-alike shrubs and vines might be:

1. Used in conjunction with other exact look-alikes or perhaps live plant materials, in a location where the primary use is viewing into the area rather than physically using it; little or no maintenance being a chief criterion.
2. In a roof top garden area where due to structural problems, the large amounts of soil and special drainage facilities necessary for real plant materials would be prohibitive.
3. Around or near the edge of a swimming pool where the chlorinated water would severely retard the normal plant growth.
4. In very sheltered or indoor areas where proper natural lighting is not feasible.

Again, the basic consideration in the above listings was that live shrubs and vines could not be economically maintained and the alternative would be to use nothing at all or specify some type of replacement.

For shrubs and vines, some form of sculptured functional replacement might be a better solution since the vertical nature of the materials desired, are conducive to imaginative artistic treatment. Aesthetically interesting fences, panels, sculpture, wall graphics and other assorted possibilities might provide a more generally appealing substitute for shrubs and vines in situations where a replacement is warranted.

Trees

From an economic standpoint, it becomes extremely difficult to suggest areas where artificial trees could be effectively used. In situations like Disneyland where people do not mind being fooled, beneficial uses can be derived. For example, it would be impractical to build a tree house in a live specimen and expect it to survive large numbers of tourists climbing into and around it for the thrill of that type of experience.

There are only a few families of trees that would lend themselves to being artificially reproduced; some of the palm varieties in particular. By virtue of their lack of lower branches, they might be capable of being

duplicated economically. Some evergreens might be easily and realistically reproduced due to the uniform texture of the needles and branching habits.

Very limited use might be found in:

1. Interior areas where proper natural lighting is not feasible, or
2. in some special interest area such as Disneyland.

For the provision of shade or large vertical accentuation, some form of sculptured functional replacement would be more practical and desirable. A well designed awning or overhead structure, such as a large sheet of plexiglass atop a pleasing vertical column, might be more economical.⁸¹

Other General Areas

Natural looking path systems in arboretums, forests, and horticultural gardens that receive extensive use are normally constructed with tanbark, woodchips or aggregate in order to blend in with the surrounding area. It may be beneficial to construct these path systems with either artificial turf alone or a combination of real grass with an artificial turf cover.

⁸¹Expo 70 held in Japan experimented with one possible solution that is similar to this one. The problem was that the plexiglass was not opaque enough and therefore did not screen out all of the sun's rays.

With the upsurge in "fun vehicles" such as snow-mobiles and all-terrain vehicles, a possible warm weather surface might be artificial turf. If installed in special use areas designed specifically for those vehicles, a strong, durable surface that will provide good traction and lessen the damage to the area might prove worthwhile.

Due to the increased demand for potable water in many sections of the country, foresters are considering the possibility of defoliating large sections of forested lands located over good aquifer recharge areas.⁸² It is their premise that this action will allow more rainfall to seep into these aquifers, subsequently bringing the supply and demand factor into better balance.⁸³ A more reasonable solution might be to pave large areas and channel the rainfall collected into city water systems thereby supplementing the supply. As was mentioned earlier, for aesthetic reasons, it might prove useful to consider using artificial turf in situations such as this.

⁸²Dr. C. R. Humphrys, Department of Resource Development, Michigan State University, East Lansing, Michigan.

⁸³Recently water researchers have indicated that the demand for potable water is greater than the amount that is naturally recharging most underground aquifers. If the demand continues to accelerate and the pollution of other fresh water sources continues, increased costs for water will result, due to the amount of treatment that will become necessary for other water sources.

The Space Age has caused some psychologists to become concerned about the problem of encasing the human spirit in space without the benefit of their normal Earth environment. Professor Patrick Horsbrugh, Chairman of the Graduate Program in Environic Studies at the University of Notre Dame, echoed this concern and indicated that these space pioneers might need to have such things as plant materials to help soften the impact of living in space or on another planet for extended periods of time.⁸⁴

In an interior situation, it would of course, be advisable to use live plant materials for the mutual exchange of life supporting functions that could be derived therefrom. It might also be desirable to establish an earth-like environment on the moon for instance, outside the confines of their dwellings, that can be observed and thereby reduce the feeling of total isolation. Whether this is warranted or not will have to be determined by much scientific investigation, but artificial plant materials might be beneficial under these circumstances.

⁸⁴In a speech given before the Michigan Chapter of the American Society of Landscape Architects annual meeting held in Lansing, Michigan in November, 1969.

CHAPTER V

CONCLUSIONS

The Role of the Landscape Architect

It can be argued, and quite rightly so, that many of these possible uses of artificial plant materials are incongruous with the ethics of the profession and do not necessarily reflect the type of thinking that the landscape architect should practice. Yet as C. A. Doxiadis, President of Doxiadis Associates and Chairman of the Board of Trustees of Athens Technological Institute in Greece points out, ". . . our human settlements have nothing to do with the settlements of the past."⁸⁵ He feels that "Unless the problems our settlements create are faced in an imaginative and courageous way, we cannot hope to save them." This style of thinking does not perpetuate a blanket approval for using such items as artificial plant materials, but what it does infer, is a need to consider all of the possibilities, not just the traditional ones.

⁸⁵In a speech given before the Air Pollution Control Association meeting in San Francisco in June of 1966.

As members of a profession dedicated to designing with nature and with natural elements for the betterment of man's environment, it is hoped that the landscape architect can adapt man to the landscape rather than change the landscape to accommodate the fantasies of man. Wherever possible, the designer should strive to suggest live plant materials that will function under the most difficult of conditions that prevail. This requirement will necessitate a much greater, indepth understanding of horticultural information than is presently the case.

The landscape architect must maintain high standards in the quality of plant material specified, to include insisting that the nurseryman do his part in perpetuating the best possible specimens that can be grown. It must be borne in mind that if the quality of the design declines and the client is left with a bad experience in the form of high maintenance costs, plant materials that do not live up to the intended expectations or any number of other negative results, he may well turn to some form of substitute material to solve his design problems. A good example may be found in the interior gardens at the Upjohn Chemical Company office in Kalamazoo, Michigan, where artificial plant materials have been substituted for much of the live varieties. High maintenance costs resulting from plant materials that were not suited to the hostile

micro-climate they were being subjected to necessitated such a decision.

Numerous other examples of designs that could not be maintained doubtlessly prevail in both large and small scale situations. The landscape architect must practice the science, as well as the art of his profession, and learn from results such as the above so that similar situations can be avoided.

Whether to specify a synthetic exact look-alike or a sculptured functional replacement will remain a decision the designer must rationalize for himself. Honesty in design and honesty in the use of materials should play an important part in his decision making. Function should also be a prime consideration and must be based on both short and long term goals.

Being a "taste-maker" embodies more than just perpetuating live plant materials. It encompasses a responsibility to understand the capabilities and limitations of all the materials that technology can provide, in order to achieve a viable environment for humans. To achieve this goal, the designer must recognize new materials and study their virtues, their limitations and their possible adaptations, in order to effectively control and direct their use. Experimentation with various new materials and products should be conducted, and the results should be evaluated in terms that are beneficial to their improvement

for future uses by the landscape architect. Any tests that are conducted should be appropriately documented and made available to the profession as a whole. It is important to realize that not only is there a need for experimentation in the various aspects of landscape architecture, but it is essential that the landscape architect take a very active part in conducting and evaluating such tests. He should, by virtue of his professional and moral convictions, assert his influence and viewpoint on any area that may affect the quality of the environment or offer a possible solution for its improvement.

It has not been the contention of this thesis to advocate that substitutes should replace living plant material in areas where adequate and economic maintenance is possible. For as the architect Eero Saarinen once remarked, "There exist enough fake things in this world, without creating more in trying to mimic nature which embodies all that which is pure and beautiful."⁸⁶ But in areas where this is not practical, innovative possibilities should be tried, tested and analyzed for their possible adaptation.

Historically man has built up a willingness to accept substitutes for a wide variety of things. Attitudes

⁸⁶Quotation obtained from Margaret Herbert at the M.A.N. Convention, February 10, 1971.

toward the environment have, for many people, evolved into a passive, almost apathetic state; as witnessed by the degree of despoilment of the environment that has been allowed to evolve. Genuine concern of the type that will stop the trend of substituting for nature is not widespread. Whether or not the present environmental movement can kindle the proper attitudes remains to be seen; presently it does not appear to have done so.

As was indicated in the "comparative charts," there are many areas where plastic exact look-alikes and sculptured functional replacements may be able to perform various functions equally as well as live plant materials. Considering human nature, economics and the environmental problems that prevail in many urban areas, the use of synthetic substitutes for traditional organic plant material will in all likelihood continue.

Many of the possibilities suggested, hinge on the acceptance of the concept of nature rather than the real thing itself. Whether mankind ever reaches this stage of mental tolerance, only time will tell. One thing is certain at this point: strong inroads have been made and the quality of adaptation will depend upon the creative abilities of the designer.

It must be remembered that the artificial plant materials discussed are still in a state of comparative infancy. The present low degree of quality will undoubtedly

improve and the high initial cost can be expected to lower in the future. Once these factors are achieved, economics will most certainly play an important part in the decision making of many individuals.

Of all the artificial plant materials discussed, artificial turf seems to possess beneficial qualities that exhibit the most promise for the future. With the elimination of such technical problems as the low melting point, high heat radiation, non-permanent coloration, and high initial cost, a prime surfacing material for heavily used areas may evolve. By incorporating some of the suggestions presented, such as using artificial turf and real grass together, or a combination of live trees and shrubs with artificial turf, a positive meeting of technology and the natural may become a mutually beneficial result. More testing and experimentation will be necessary before positive guidelines can be suggested, but for the present, there does appear to be enough potential to warrant further research and investigation.

With respect to artificial trees, shrubs and vines, it is doubtful that they should be enthusiastically pursued as a substitute for the real. Although many circumstances do exist where live varieties are difficult to maintain, they are not subject to the same intensive pressures that natural grass is. A more prudent decision may well be to take a more artistic approach and design sculptured functional replacements instead.

In any event, artificial plant materials are gaining increased usage and acceptance. It is the duty and the responsibility of the landscape designer to find the right forms and the right applications of the new materials that modern technology provides. For as Christopher Tunnard once wrote,

We can depend upon the fact that new materials . . . will find their way into the landscape whether we wish them or not; science and economic necessity are forces too strong to be denied. It is the duty of the Landscape Architect, as well as the Architect to adapt and use these materials in harmonious compositions.⁸⁷

⁸⁷Christopher Tunnard, Gardens in the Modern Landscape, second (revised) edition, 1948, p. 129.

CHAPTER VI

RECOMMENDATIONS

There appears to be several areas in which research should be conducted in order to build upon some of the information and tentative conclusions presented in this thesis. The recommendations listed, provide an opportunity for the landscape architect to become actively involved in research which should enhance, and be of benefit to, the total profession.

The recommendations which follow are not placed in any priority order, nor do they represent all of the potential research that could be conducted. Included are some recommendations which are not necessarily considered as research, but are directly related to increasing the capabilities of the landscape architect.

1. The investigation of the possible use of artificial turf and live plant materials (trees, shrubs and vines) together, in an effort to reduce the temperature problem and provide a tough, traffic resistant, all weather surface, as an alternative to concrete, asphalt or other similar replacements for natural grass.

2. A continuation and expansion of the research started by Mr. Collins on the use of real grass and artificial turf combined.
3. Extensive investigation and experimentation on sculptured functional replacement design, directed at providing highly functional and aesthetically pleasing substitutes for live plant materials, when alternate items are necessary.
4. Horticultural research on micro-climatic variables which will produce a listing, readily available to the landscape architect, of various plant materials which are tolerant of these conditions.
5. An increased emphasis on micro-climatic variables and their solutions, in landscape architectural instruction.
6. A continued, or possibly increased effort to insure that the landscape architectural student has a firm understanding of the capabilities and limitations of various plant materials.
7. Horticultural research geared toward establishing maintenance schedules which will decrease the amount of time and money necessary to provide adequate care of live plant materials.
8. The landscape architect, in conjunction with other specialists such as architects, horticulturists, environmental psychologists, etc., should strive

to monitor and review design solutions in the field, to ascertain the effectiveness obtained and document positive guidelines for similar situations.

BIBLIOGRAPHY

BIBLIOGRAPHY

Articles and Periodicals

"Fake Trees Hit 'Live' Business Market," The Michigan State News. December 4, 1970, Supplement Section, page 8.

"Michigan Tree Sales Fall by Half Million," The Michigan State News. February 11, 1971, page 4.

"PVC Christmas Trees Ring up Record Season," Modern Plastics. Vol. 45, No. 12, (December 1969), page 67.

Modern Plastics. Vol. 46, No. 1, (January 1969), page 18.

Books and Reports

Artificial or Natural Grass? Advantages and Disadvantages: A Few Facts for Consideration. New York: The Merion Blue Grass Association, 1970.

Lees, Carlton B. Gardens, Plants and Man. New York: Prentice-Hall, Inc., 1970.

Madsen, S. Tschudi. Sources of Art Nouveau. London: Thames and Hudson, 1956.

Memmo, Andrea. Elementi di Architettura. (Principles of Lodolian Architecture), 1786.

Pevsner, Nicholas. The Sources of Modern Architecture and Design. London: Thames and Hudson, 1956.

Pugin, Augustus. The True Principles of Pointed or Christian Architecture. 1841.

Rabinowitz, Carla B., Coughlin, Robert E. Analysis of Landscape Characteristics Relevant to Preference. RSRI Discussion Paper No. 38, Regional Science Research Institute, 1970.

Viollet-le-Due, Eugene. Entretiens. Vol. I, 1863.

Unpublished Material

Mecklenburg, Dr. Roy A. "The Temperature of Artificial Turf as Compared to Living Grass," Department of Horticulture, Michigan State University, August 1970. (Mimeographed).

Mecklenburg, Dr. Roy A., Rintelmann, William, and VanDen-Brink, Ceel. "A Preliminary Report on the Effect of Plants on the Urban Environment," Department of Horticulture, Michigan State University, August 1970. (Mimeographed).

GENERAL REFERENCES

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Articles and Periodicals

"'Fake' Foods Invade Stores," The Michigan State News.
November 4, 1970, page 6.

Books and Reports

Blake, Peter. God's Own Junkyard. New York: Holt, Rinehart and Winston, 1964.

Calder, Nigel. The World in 1984. Vol I,II. Penguin Books, Ltd., 1965.

Coughlin, Robert E., and Goldstein, Karen A. The Extent of Agreement among Observers on Environmental Attractiveness. RSRI Discussion Paper No. 37, Regional Science Research Institute, 1970.

Gideon, Sigfried. Space, Time and Architecture. Cambridge: The Harvard University Press, 1946.

Marine, Gene. America the Raped: The Engineering Mentality and the Devastation of a Continent. New York: Simon and Schuster, 1969.

Miles, D.C., and Briston, J. H. Polymer Technology. New York: Chemical Publishing Company, 1965.

Proshansky, Ittleson, Rivlin. Environmental Psychology: Man and His Physical Setting. New York: Holt, Rinehart and Winston, 1970.

Rose, James. Creative Gardens. New York: Reinhold Publishing Corp., 1958.

Shepard, Paul. Man in the Landscape. New York: Alfred A. Knapp, 1967.

Simonds, Herbert R., and Church, James M. A Concise Guide to Plastics. New York: Reinhold Publishing Corp., 1964.

Tunnard, Christopher, and Reed, Henry Hope. American Skyline. New York: The New American Library, 1956.

Unpublished Material

Beery, William Eugene. Esthetic Considerations in the Effective Use of Plant Materials. Department of Landscape Architecture, Michigan State University. A Thesis, 1962.

Haskell, Theodore J. "The Importance of Landscape Plants in the Human Environment," Department of Parks and Recreation, Lansing, Michigan. November, 1970. (Mimeographed).

Rasmussen, Steen Eiler. "Urban Esthetics, A Summary." Department of City and Regional Planning. University of California. Fall, 1970. (Mimeographed).

APPENDIX A

FIGURES

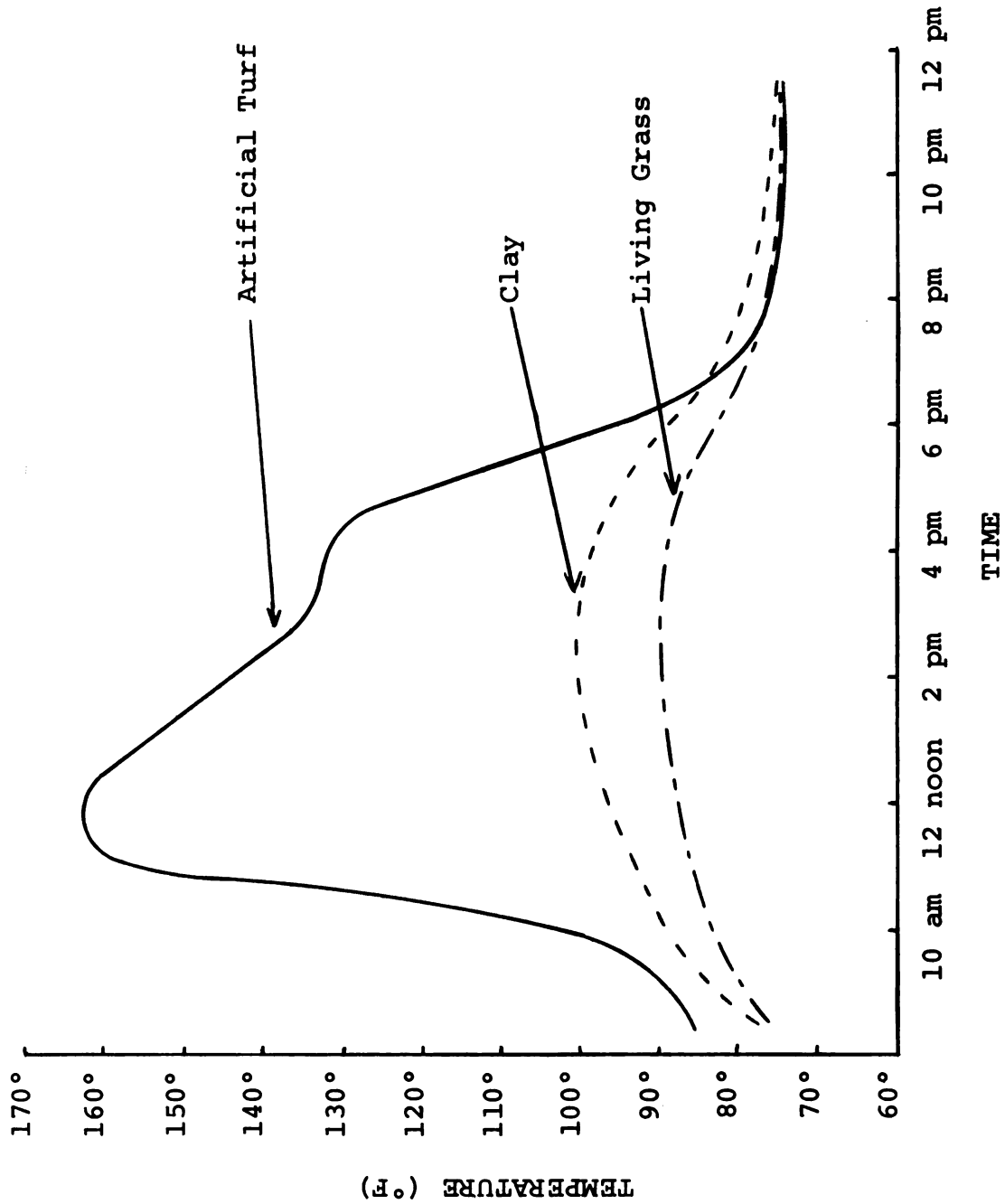


Figure 1. Surface temperatures of artificial turf and living grass at White Sox Park, Chicago, Illinois.

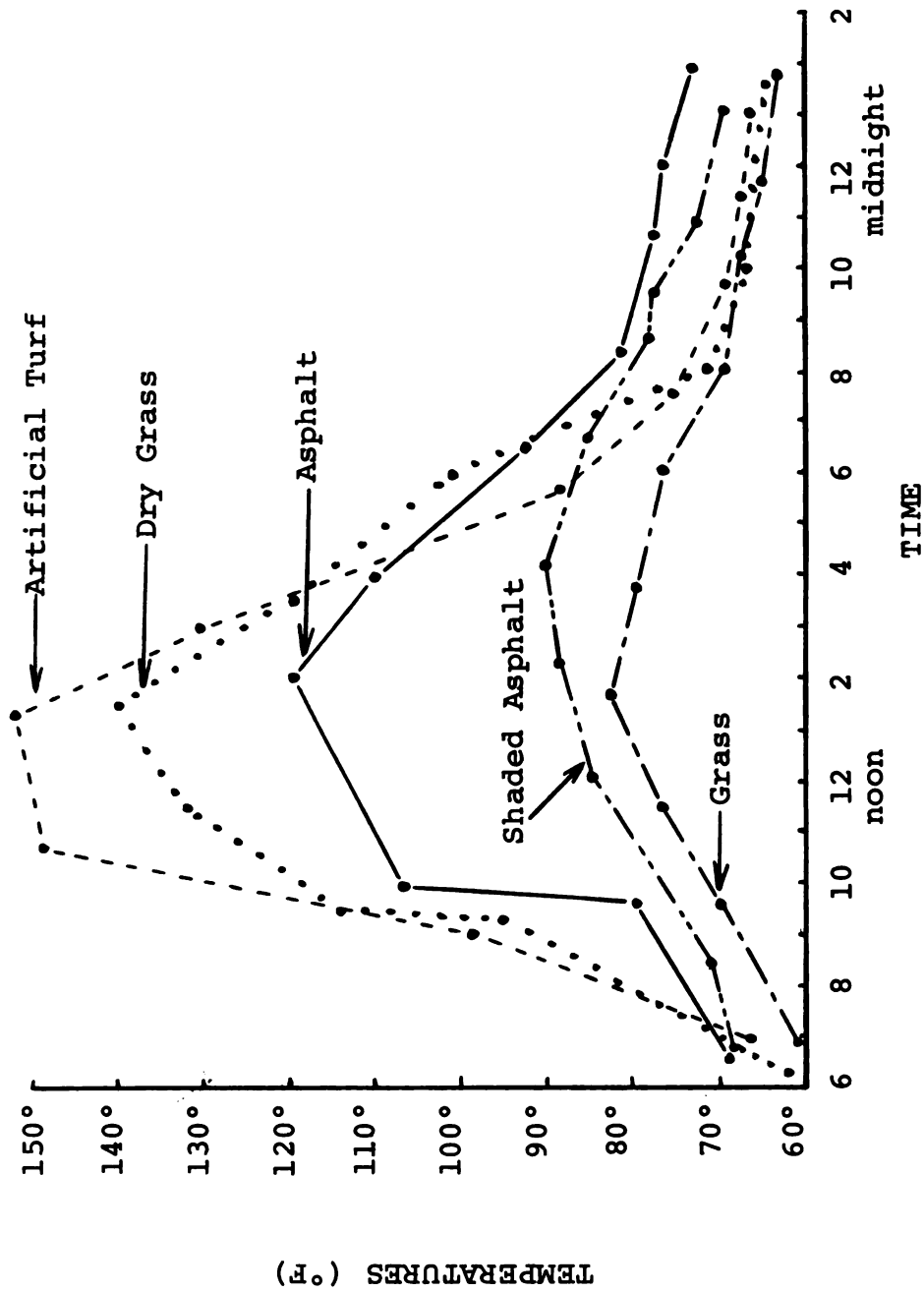


Figure 2. Surface temperature comparisons at Michigan State University, East Lansing, Michigan.

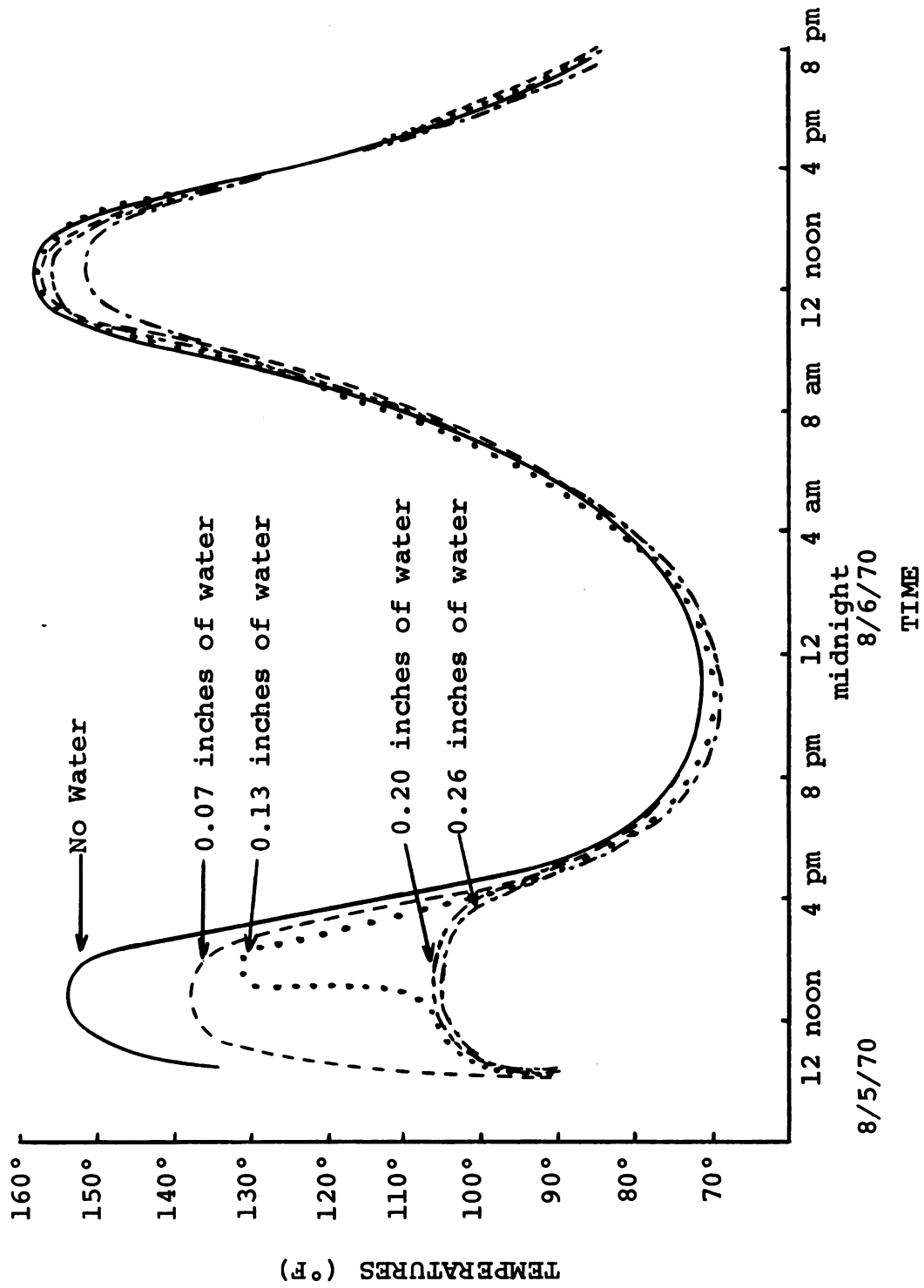


Figure 3. Evaporative cooling effect of artificial turf.

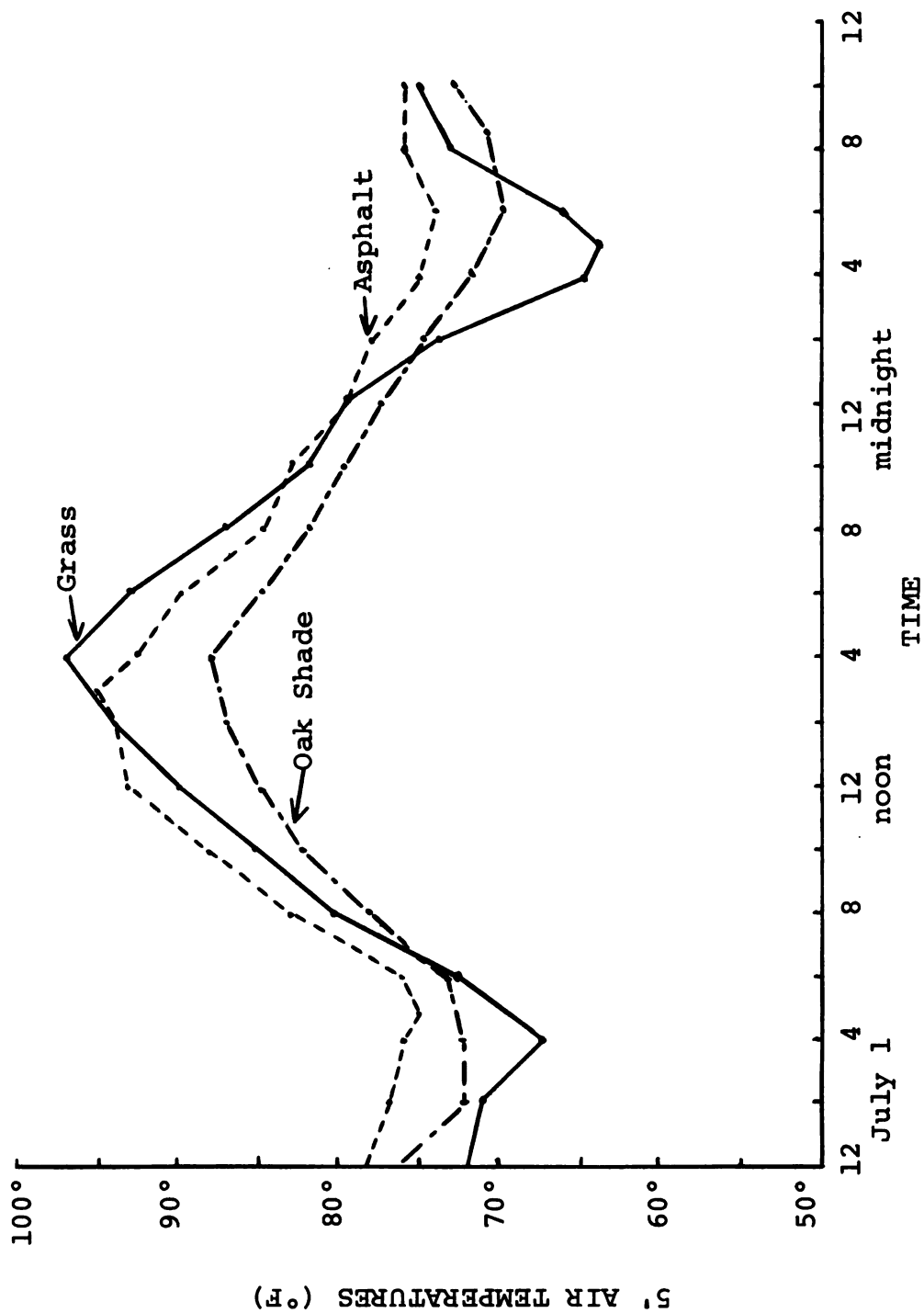


Figure 4. Five foot air temperature comparisons.

APPENDIX B

**A PARTIAL LISTING OF MANUFACTURERS
AND DISTRIBUTERS OF ARTIFICIAL PLANT MATERIALS**

A PARTIAL LISTING OF MANUFACTURERS
AND DISTRIBUTERS OF ARTIFICIAL PLANT MATERIALS

Amoco Chemicals Corporation
Department 10175
130 E. Randolph
Chicago, Illinois 60601

Barrier Corporation
Mineral Wells, Texas 76067

Eaton Brothers Corporation
25 Lake
Hamburg, New York 14075

Edon Corporation
102-T Benson Manor
Jenkintown, Pennsylvania 19046

Gifford's, Inc.
Hanes at Philip Street
Hartford, Michigan 49057

J. Hofert Company
5955 S. Western Avenue
Los Angeles, California 90047

Joseph M. Stern Company
1968 E. 66th
Cleveland, Ohio 44103

Minnesota Mining and Manufacturing Company
3 M Center
St. Paul, Minnesota 55101

Monsanto Company
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166

Niedermeyer-Martin Company
1727 N.E. 11th Avenue
Portland, Oregon 97212

Neva-Mow Grass, Inc.
North Bergen, New Jersey

Paragon Plastics, Inc.
100 Adams
Leominster, Massachusetts 01453

Paxcon Manufacturing Company
State Road at Mill Road
Andolusia, Pennsylvania 19020

Peter Potter Permanent Plants
1 E. 21st Street
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