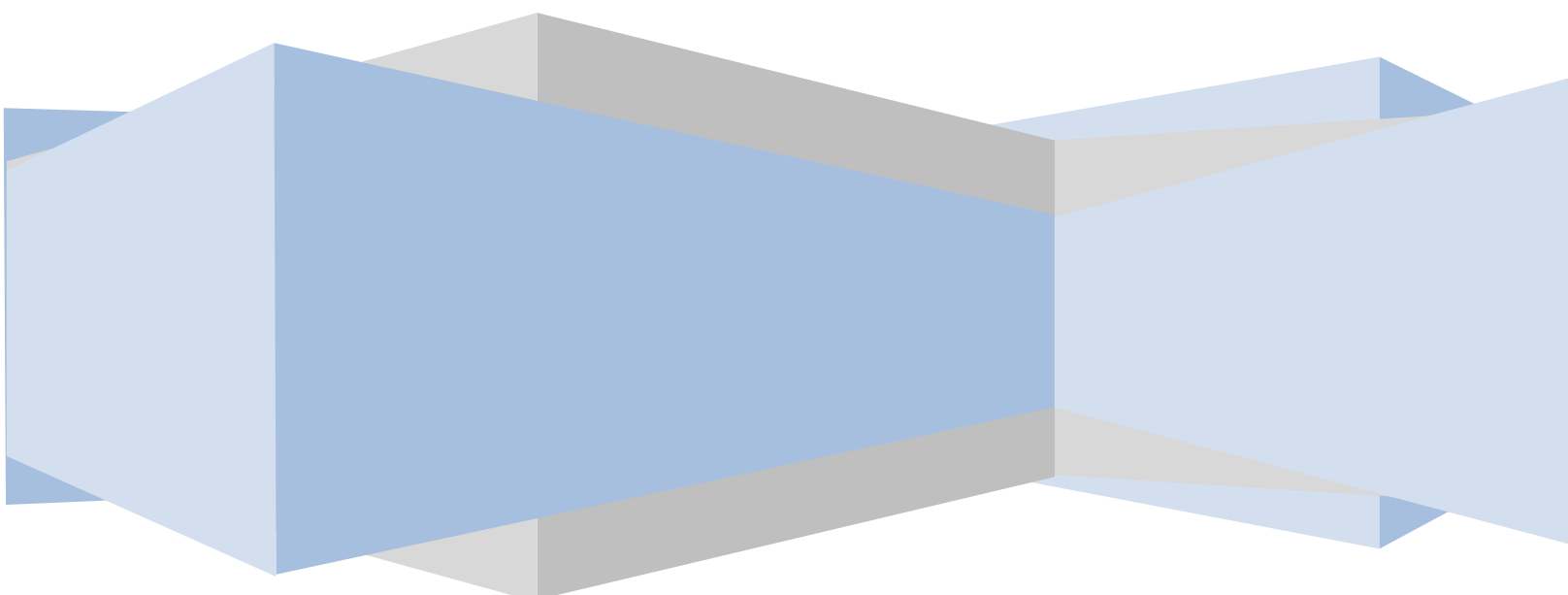


Landscape Studies and Planning (EMT 314)

Lecture Notes



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August. 2011

UNITS: 3

SEMESTER: HARMATTAN

Course Synopsis

Concepts in Landscape Planning and Design

Basic Elements of Landscape

Landscape Design Goals, Processes and Analytical Methods

Climate and other Environmental factors in Landscape Design

Landscape Evaluation Techniques

Site Selection and Site Planning

Principles and factors for Site Selection

The Site Plan: scale, circulation, building lines, plot coverage and drainage.

Landscape Construction Materials and Elements

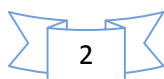
Typology of humanized landscape (housing)

Landscape design Techniques

Management of Landscape and their Environmental Impacts

This material is intended for educational purpose and not commercial. The information contain therein are from several sources such as journal articles, online internet materials, textbooks, magazine etc.

The author acknowledged all these sources.



Concepts in Landscape Planning and Design

Landscape

Landscape has various definitions by different scholars:

- Landscape is an attractive, important and ambiguous term. Meinig 1979, p.1
- Landscape is a term which both invites and defies definition... it is the very fullness and ambiguity of the concept of landscape that makes it so useful and helps span the gaps that might otherwise exist between a number of disciplines. Gosden and Head 1994, p. 113
- Landscapes are formed by natural systems and shaped by history and culture. Conservation Study Institute website – visit www.nps.gov/archive/csi/about/about.htm. Accessed March 2008.
- ... there is no unanimously recognised method for studying, identifying and describing landscapes; or even a system of studying landscape components... Our period of history is probably only seeing the beginning of a process of redefining conceptual tools and meanings related to landscape. Scazzosi 2003, pp 57, 59
- "The outdoor environment, natural or built, which can be directly perceived by a person visiting and using that environment. A scene is the subset of a landscape which is viewed from one location (vantage point) looking in one direction ..." Hull and Revell (1989)

A **natural landscape** is a landscape that is unaffected by human activity. A natural landscape is intact when all living and nonliving elements are free to move and change. The nonliving elements distinguish a natural landscape from a wilderness. A wilderness includes areas within which natural processes operate without human interference, but a wilderness must contain life. As implied, a natural landscape may contain either the living or nonliving or both. In his extensive travels in South America, Alexander von Humboldt became the first to conceptualize a natural landscape. Some have described a transition of a pristine landscape state to a humanized landscape state—which includes the human-modified landscape, the primeval landscape, the ancient landscape, the undisturbed wilderness and the managed landscape. The natural landscape is a place under the current control of natural forces and free of the control of people for an extended period of time.

Cultural landscapes are places or artefacts currently maintained by people whether directly or indirectly. Examples of cultural disruptions are: fences, roads, trails, species under human management, invasive species introduced by people, extraction or removal of species and objects, vegetation alteration, alterations of animal populations, natural landscaping, buildings,

agricultural areas, pollution, paved areas. Areas that may be confused with natural landscape include parks for people, agricultural areas, orchards, maintained views (use of aesthetic judgments), artificial lakes, managed forests, golf courses, nature center trails, back yards, and flower beds.

It can also be defined various:

- Cultural Landscape: A concrete and characteristic product of the interplay between a given human community, embodying certain cultural preferences and potentials, and a particular set of natural circumstances. It is a heritage of many eras of natural evolution and of many generations of human effort.
Wagner and Mikesell 1962
- The cultural landscape is a tangible manifestation of human actions and beliefs set against and within the natural landscape.
Melnick 1984
- [Cultural landscapes] are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment, and of successive social, economic and cultural forces, both external and internal. Fowler 2003, p. 22. (Part of definition prepared by international expert delegates at the October 1992 meeting in Alsace for consideration by the World Heritage Committee).
- Cultural landscapes are at the interface between nature and culture. They represent the permanent interaction between humans and their environment, shaping the surface of the earth. von Droste, Plachter and Rossler 1995
- Cultural landscapes... present a cumulative record of human activity and land use in the landscape, and as such can offer insights into the values, ideals and philosophies of the communities forming them, and of their relationship to the place.
Pearson and Sullivan 1995,
- A cultural landscape is a physical area with natural features and elements modified by human activity resulting in patterns of evidence layered in the landscape, which give a place its particular character, reflecting human relationships with and attachment to that landscape. Historical significance exists in a [cultural] landscape where the landscape or its components have strong links to or associations with important historic themes, and where the evidence assists in understanding the past. Lennon and Mathews 1996.

Landscape classification

Landscape classification involves using a conceptual model to characterize a landscape, grouping landscape elements into categories and/or allocating entire landscapes into classes based on the amount and distribution of landscape attributes. This allows generalizations to be bounded (i.e. generalization X occurs within landscape type Y). Landscapes can be classified using: structural attributes, such as the amount and configuration of vegetation (e.g. Forman 1995); habitat for a particular species (e.g. Fischer et al. 2004) and functional attributes or landscape processes (e.g. Ludwig et al. 1997).

Complexity, issues and interrelationships

Landscape classification is challenging because:

1. Landscapes are dynamic and characterized by compositional (structural) attributes and process (functional) attributes, such as flows of energy, water and nutrients.
2. Maps are the usual translation of a landscape into a classification and while they capture compositional attributes reasonably well, they have rarely been used to represent processes or flow paths, particularly those that are continuous entities or gradients.
3. There are many ways of perceiving the same landscape. Organisms perceive landscapes differently (Manning et al. 2004) as do humans, including (lumpers) who favour generality and *_splitters_* who focus on complexity.
4. Different problems and objectives may require different classifications, even in the same landscape. A classification to guide an organism-specific research programme may differ from one needed by a landscape manager

Landscape Planning

Landscape Planning is the development and application of large scale strategies, policies and plans to create successful environments, in both urban and rural settings, for the benefit of current and future generations. Landscape architects working in landscape planning operate at all contexts and scales, from the international to the local, and on all types of development, advising on or managing proposals for change which may affect the landscape. They assess and resolve environmental, economic and social opportunities and constraints relevant to areas of landscape interest and take these into account in addressing a landscape's potential and capacity to accommodate change.

Typical activities include:

- Preparing and advising on policy and strategy within legal frameworks
- Preparing Green Infrastructure plans and implementation strategies

- Project management, coordination of and contributions to detailed assessments and studies including:
 - Environmental Impact Assessment and environmental statements
 - Landscape and Visual Impact Assessment
 - Landscape character surveys, assessment and reports
- Master planning for development and regeneration schemes
- Consultation and community/ stakeholder engagement
- Contributing to planning appeals and public enquiries and acting as an expert witness
- Advising on compliance with relevant policy, legislation, good practice and relevant standards
- Managing projects
- Providing advice on policy and strategy
- Contributing to public inquiries and acting as an expert witness

Needs and Goals of Landscape planning

Proper landscape planning is a basis for human survival in any part of the world. Human activities on the earth have lots of deleterious (harmful) effects the natural system (e.g. pollution). The destruction of the environment can be arrested and the ill-effects reversed by sound land use and landscape planning principle and techniques. Conflicts normally arise in land uses and in land use planning these conflict must be resolved if a coherent and workable plan is to emerge. All these conflicts can only be resolved through effective landscape and land use planning. Below is the summary of some of the reasons why there is the need for landscape planning.

- **Land and urbanization:** The earth and many of its resources is finite and only a small percentage of its surface is capable of habitation and sufficiently fertile for the production of food. The conservation through proper landscape planning is therefore one of the most fundamental principles in sound land use planning to cope with the trend.
- **Erosion and salination:** Overgrazing of land by animals, intensive cultivation of marginal lands, deforestation and forest degradation initiate the erosion of soil. Vast plantations of timber have been removed for more agricultural lands and fuelwood. This has resulted in the erosion and turning of hundreds of thousands of hectares of fertile lands into arid landscapes. Intense evaporation in the dry periods drew the salts from the soil to the surface thus sterilizing the soil.
- **Husbandry and conservation:** To promote good husbandry **and** the establishment of a conservation ethics which seeks to preserve the countryside, the widest variety of land uses and landscape, the greatest number of wildlife habitats and the keeping open of all possible options for future action.
- **Comprehensive planning goals:** These goals are likely to be otherwise achieved without planning especially to prevent the harmful results of sporadic and uncontrolled developments.
- **The balance land uses:** To balance the priorities given to the different uses of countryside such as urban development, forestry, mining, recreation, transportation, oil installations, industry and utility services with amenity consideration.
- **Corporate planning:** To encourage a comprehensive multi-disciplinary and corporate approaches to rural and urban planning.

Basic Elements of Landscape Design

Simplicity

Simplicity is the essence of design. This is an objective that I have always tried to achieve in all of my previous residential, commercial, institutional and recreational projects. How a designer creatively combines plant material and other design components into a simple, unified scheme is always an exciting challenge.

In the landscape palette, the designer is dealing with living plants that are subject to a myriad of weather conditions, different soil types, insect and disease problems, and a host of other environmental and physical circumstances. The landscape artist must deal with plants that celebrate the seasons with the unfurling of leaves in spring, the aroma and visual delight of ephemeral flowers, and the bareness of branches in winter. Change in the landscape is never constant as the seasons come and go. How the designer successfully combines plants and other material components in the Landscape Planting Plan involves paying careful attention to detail, a thorough knowledge of practical horticulture, and a good understanding of the basic principles and elements of design. The designer faces the challenge of creating a plan that is pleasing to the senses and that visually, functionally and aesthetically improves the appearance of the landscape at an affordable cost.

Line

In curvilinear design, lines should be dramatic, done with a sense of flamboyancy and be very expressive in their shape. Curvilinear lines that have weak, scallopy edges will not be visually interesting or pleasing to the eye. Curvilinear, meandering lines suggest a naturalistic look that invites the user to casually stroll through and experience the landscape. On the other hand, linear lines such as those found in a straight hedge or the edges of paving materials suggest quick, direct movement. Angled lines can create opportunities for creating the "bones or the framework of the landscape". Lines that interconnect at right angles create an opportunity for reflection, stopping or sitting. Through skillful use of lines in the landscape, the designer is able to direct the attention of the viewer to a focal point.

Focal point or Emphasis

Through the use of emphasis, eye movement is directed towards a center of interest that takes a position of prominence in the landscape. This could be a single tree, a beautifully designed water feature, a piece of sculpture, or a collection of ericaceous plants that automatically draw the eye to this point of interest. Open lawn areas, paths and strategically placed plants can lead the eye to the principal feature without distraction. Plantings should be placed to easily lead the eye to this center of heightened interest. Secondary features of landscape interest can also be created. In this case, while these components are beneficial in contributing to the unity of the site and tying the total composition of the site together, they have considerably less overall impact than the focal point.

Form

Form relates to the natural shape of the plant. For example, a plant that is very fastigiated or upright in its habit of growth is said to have a vertical or aspiring form. Ginkgo biloba "Princeton Sentry"- Princeton Sentry Ginkgo- is a good example of this form. Other plants that are spreading in their habit of growth are said to have a horizontal or spreading form. A shrub example of this form is Taxus x media "Hillii"-Hill's Yew- and a tree example is Quercus palustris- Pin Oak. The Hill's Yew could be effectively used as a hedge to provide special definition between two properties. When horizontal forms are placed together as is the case in the hedge, the individual vertical forms take on a horizontal profile.

Weeping, drooping or pendulous forms can also be used to create softer lines or as interesting accents in the garden. Fagus sylvatica "Purple Fountain" – Purple fountain Beech- is an excellent example of this form. There are also rounded or globular forms that are useful in creating large masses. The majority of shrubs fall into this category.

Texture

Texture relates to the coarseness or fineness of a leaf, roughness or smoothness of the bark, heaviness or lightness of the foliage or other components used in the landscape plan. In terms of plants, the large, glossy leaves of Bergenia cordifolia "Bressingham Ruby"- Bressingham Ruby Bergenia- make it a coarse textured plant when compared to the medium textured plant Pachysandra terminalis- Japanese Spurge- used adjacent to fine textured grass.

When using ornamental grasses for example, a gradation of textures from fine to medium to coarse could be as follows:

1. *Festuca glauca* "Elijah Blue"- Blue Festuca Grass
2. *Deschampsia caespitosa*- Tufted Hair Grass
3. *Calamagrostis x acutiflora* "Karl Forester"- Feather Reed Grass

Texture in the landscape depends upon the distance from which the plant is viewed by the observer. In distant views, the overall mass of the plant is the dominating feature and the fineness or softness of a leaf or branching pattern is lost.

In terms of the overall planting plan, texture must balance in relationship to the axis. Weight on one side should equal the mass on the other side of the axis. For example, much fine texture- as the case would be in using Buxus- is required to balance relatively little coarse texture, as the case would be in the use of Viburnum rhytidophyllum, the Leatherleaf Viburnum. Intermediate plants are recommended to provide the necessary transition from one textural extreme to the other.

Colour

Color can be one of the most **powerful** attributes when considering the elements of landscape design. Color brings variety, as well as personality, to your landscape design, but selecting the

right year round **colour scheme** for your outdoor plan can be a difficult task. While selecting your plants and materials, consider the seasonal changes of the blooms and leaves and factor those changes into your colour scheme.

You can use colour in a number of ways, including:

- **Attracting** attention to prominent areas of your area
- **Affecting** the perception of distance. Colours that blend into the landscape, deep hues like black, green, and cool shades of blue, can make a home appear further away, while bright, warm colours make objects appear to be closer.
- **Creating** mood and atmosphere throughout your outdoor space. Vibrant reds, oranges, and yellows convey excitement and are most appropriate in active areas of your landscape design. Cool shades, like blues and greens, are tranquil colours that work well in areas designed for relaxation.

Colour theory is a very complex and very personal matter that expresses individual taste and feelings. Warm colours such as reds, oranges and yellows tend to advance towards to viewer while blues, violets and greens tend to recede into the landscape. Warm colours read well and affect the eye more quickly than do cool colours. When using warm colours, they should be used in sequence which must be smooth and gradual. For example, red to scarlet to orange scarlet to orange to bronze to orange yellow to yellow to pale yellow to cream to white.

Consideration of the use of colour in plantings requires a thorough, practical understanding of the personality of the plants. To vigorously use colour and effective colour combinations requires a thorough knowledge of plants, their colours and seasonal changes with detail of twig, leaf, flower and fruit as well as principles of colour.

Balance

Balance is either formal (symmetrical) or informal (asymmetrical) in nature. In formal balance, the mass or weight or numbers of objects on either side of a central axis should be exactly the same. Plants are frequently clipped, lines tend to be straight, and edges are clearly defined. For asymmetrical balance, plants should be irregularly placed on either side of an imaginary axis so that the mass or weight on either side of the axis appears to be balanced. Curved lines, obscure and merging edges and natural contours identify asymmetry in the garden.

Repetition

By repetitiously using identical or similar components elsewhere in the landscape, the designer is able to achieve a unified planting scheme. However, it is important not to excessively use any materials too frequently as this could lead to monotony. A delicate balance is necessary to achieve a design that is visually, functionally and aesthetically attractive.

Variety

It has oftentimes been said that "variety is the spice of life". In terms of landscape, it is often important to remember that a variety of lines, forms, textures and colours is required in order to achieve an interesting landscape. Without variety in both the use of 'hard' and 'soft' landscape materials, this can lead to unfavourable results.

Grouping

Much greater appeal is achieved when odd numbers of plants are used in the landscape. Groupings of three, five, seven, nine plants etc. will create a strong feeling of mass and a bold landscape statement. Plants should be irregularly spaced and every effort should be made to avoid placement of plants in an equilateral triangle. When grouping, a designer usually starts with a specimen that establishes the scale of the landscape. Around it are grouped slightly less important plants which complement the specimen in colour, texture and habit of growth. Planting one of this and one of that will create a spotty disjointed feeling.

Mass

Made up of plants that cannot be seen in their entirety from any one vantage point. Seasonal stability and variety in plant mass is accomplished through a mix of evergreens and deciduous plants. Only rarely should a design consist exclusively of evergreens or deciduous material instead of a mixture of both. To create a harmonious effect in any group, a designer should strive to properly fit together plant forms, textures and colours into a harmonious whole or mass. Size of any mass or composition depends upon its location in relationship to other factors such as the need for screening, proximity to other groups, etc. Mass can be any size, but smaller masses or clumps are not normally as effective as larger, bolder mass plantings.

Scale and Proportion

Good proportion and scale have no hard and fast rules. Generally speaking, it is a matter of "does it look right?" Scale usually bears reference to the size of a thing or object that appears to have a pleasing relationship to other things or to the design as a whole. It essentially relates to some finite measure of universal application or a standard of known dimension.

Proportion is the relationship of the width to the length of an area or the relationship to parts of an organization.

Rhythm

Rhythm is expressed through the placement of plants, park furniture, etc., either individually or as group. For example, several benches could be placed at regular indentations along a shrub border. If every other bench was replaced with an attractive piece of sculpture, rhythm would be created that would relieve any monotony from the overuse of one landscape component.

Sequence

The effective use of sequence is oftentimes employed to create visual movement in the landscape. It is an important consideration to take into account in the development of the overall planting pattern. For example, sequence could be an orderly natural combination of plant material. In this case, low objects would appear in the foreground, intermediate objects in the middle ground, and tall objects in the background. Triggered by the term "experience", how effectively the designer addresses people's needs and the functional requirements of the site,

considers ongoing maintenance requirements and the selection of appropriate plants, efficiency and economics will all combine to measure the aesthetic success of the project. All of the above must be carefully woven together to create an outdoor room that is truly pleasurable and enjoyable on a year round basis. Celebrate the seasons in style. Start the most fascinating of the fine arts by developing a garden that takes into account the above principles and elements of design.

Landscape Design goals, processes and analytical methods

Landscape Design

Landscape Design is the art of arranging these elements to make good outdoor space. It implies putting forward proposals for future developments of the landscape. This is done on the basis of understanding, but also of views, ideas and notions that are derived from all sorts of paradigm in this case a design theory. Design activities are concerned with the projection of images of things into the future. Landscape design is primarily a fine art whose important function is to create and preserve beauty in the surrounding of human habitation and in the broader natural scenery. Like architecture, it is also concerned with promoting comfort, convenience and health of the population.

Landscape design is likened to environmental design because it embraces a wide field of activities within the ambit of the outdoor scene embodying those concept not only with the visual impact of man's immediate physical surrounding and the pattern with which they fit within the broad discussion of the landscape but also their psychological effects. It is an expressive or communicative activity and for it to be acceptable, it must conform to functional, structural and aesthetic satisfaction. Its success is measured by the number or importance of the people who responded to its message and by the continuity of this response overtime.

Generally the art of design is a mental plan. It could be a scheme of attack, something to be achieved or adaptation of means to an end, a preliminary sketch, and delineation of pattern, artistic or literary groundwork or a general idea. In a very much professional approach, landscape design involves the designing, construction and management of space.

Design begins when an individual or team first think about the project. It includes many intangible elements such as institution, imagination and creativity of all of which are essential to research as well. Excellent design is created through the articulation of these elements. Landscape Designers influence Natural Processes, Social Processes and Aesthetic Processes. Their aims and objectives can also be placed in these three groups. Outdoor space which is 'good' from one point of view (e.g. social) may be bad from another point of view (e.g. aesthetic

or natural process). A space can also be good for humans but bad for other species (e.g. a swimming pool with treated water).

Planning design creatively mixes together ideas, drawing information and a good many other ingredients to create something where nothing was before. Design can also be seen as an ordered process in which specific activities are loosely organized to make decisions about changing the physical world to achieve identifiable goals.

Design includes several analytical distinct elementary activities such as imaging, presenting and testing. Imaging is the ability to go beyond the information given which is often called real creativity. It involves forming a mental picture. Images are often visual, they provide designers a larger framework within which to fit specific pieces of a problem as they are resolved. Comparing a design against a mental image makes visible where the design can be improved and perhaps where the image itself might be modified.

Presenting involves the designers sketch, drawing of plans, building of models and taking photographs. It takes skill not only to present an idea well but to choose the mode of presentation best suited to a particular time in the design process. Designers present ideas to make them visible so that they themselves or others can use and develop them. Presenting includes both the very important characteristic that for each design, one must choose and organize only some elements from a larger number.

Testing involves the process of appraisal, criticisms, judgments, comparison, reflections, review and confrontations. It means comparing tentative presentations against an array of information like the designer's and client's implicit images, explicit information about constraints or objectives, degree of internal design consistency and performance criteria: economic, cultural, technical and sociological. Testing is a feedback and feed-forward process, adjusting the relation between design products as it develops and the many criteria and qualities the product is intended to meet.

Basic considerations in landscape design

In an attempt to enhance the quality of the environment through design, certain important considerations are to be given special attention. Such considerations are taken care of by the

designer irrespective of the size, location or the owner of the design. The most fundamental among other are the user's requirements, aesthetics, climate and environmental factors and construction and management cost.

User's requirements

Essentially, all design problems start off with client who has developmental programmes to be resolved through design. In landscape design, the requirements of the client should always be the uppermost in the mind of the designer. It is on this requirement(s) his design should be based and evolved. The client may either be single or group (comprising families, organization etc.), or private type who will use development themselves or public type representing a community or political sub-division of the community. There may however be a need for a compromise between the client requirements and professional ethics of the designer. According to Fairbrother (1974), the role of the designer is to evolve out of all conflicting claims, a landscape that will be pleasant for all users.

Aesthetic consideration

The concept of aestheticity is landscape design consideration has a lot of relationship with design, implementation and maintenance of the landscape. It is very important to evolve a rhythmic balance and unity in every design. The principle is to bring out the aesthetic value of the landscape in any design work. To maintain the aesthetic value of the landscape, well structured maintenance schedule is important.

Climatic and environmental considerations

The impact of climate and other environmental factors such as the vegetation, water, topography, relief, drainage pattern, soil etc. are important in landscape design. They are the forces and processes of the world within which we live and work. While the user's requirements is the starting point of any landscape design, the physical arrangement of the landscape materials should be undertaken as a creative exercise evolving in the first place from the consideration of the interacting complex of climate, geology, vegetation, wildlife and all other elements in the natural scene.

Construction and management costs

This is a function of the first three considerations and it depends much on them. It relates to the total financial involvement of the client in installing, fixing the design on the ground and the cost of the maintenance of the final design. Consideration of construction and management costs is essential, though expensive and increasingly hard to get your hands on. In any landscape scheme, the nature of maintenance in terms of cost and skills should be given top priority because it is a decisive factor in design.

Design Objectives

The objective of landscape design varies with the type of landscape and the purpose it is intended to serve. Below, the goal of a roadway landscape design is described. The goal of roadway landscape design is to integrate the road into the landscape context. This goal is guided by three objectives:

1. protection of natural and cultural resources,
2. restoration and rehabilitation of landscapes damaged or compromised by transportation improvements, and
3. enhancement of the corridor such that it becomes not merely a functional facility, but a community asset.

Achieving these objectives involves evaluating the features of the corridor, and the corridor as a whole, to determine project impacts and how to best integrate the facility into the larger community and environmental context.

Protection and Preservation

Some features, such as wetlands, waterways, historic landmarks and districts, and parks, are protected by regulation. Yet there may be locally significant elements – pathways, architectural details, monuments, groves of trees – that may not meet regulatory thresholds, but may support adjacent ecosystems, or define the atmosphere of a village or town. Plants, especially trees, provide climatic benefits, air filtration, erosion control and slope stability, storm water retention, and natural habitat. They also enhance the visual quality of the roadway corridor. Project planning and design should seek to preserve and protect existing plants, important cultural features, and ecosystems that make up the corridor.

Restoration and Rehabilitation

When impacts to the landscape are unavoidable, project design should, to the extent feasible, seek to restore or repair landscapes damaged by construction. For natural systems, the intent of such restoration is not merely to replace lost elements, but to replace specific lost functions. This may mean restoring habitat, water buffers, edge systems, hydrologic connections and soil functions. Streetscape restoration, like ecological restoration, involves more than simply replacing individual elements that have been lost. Therefore, the overall character of the street context must be evaluated in project planning and restored to the extent feasible.

Enhancement

Often landscaping is part of a civic improvement or a beautification initiative that has been incorporated into a transportation project. The local community is typically involved in design decisions for these projects and is committed to the future care of the streetscape elements. Project enhancements may include sidewalk improvements, furnishings, lighting, and street trees. New elements should be properly integrated with and linked to existing streetscape elements and should contribute to creating a sense of place and town identity. Landscaping used in these instances should be designed to avoid weed growth or the need for chemical controls.

Corridor Considerations

There are many requirements and considerations involved in safely accommodating the multiple uses of roadway corridors while respecting environmental conditions and meeting public expectations.

Public Expectations

The roadway landscape is the interface between the functional area of a road and the community through which it passes. Project planning and design must address a broad constituency with sometimes competing interests. For example, vehicles, including bicycles, require certain minimum widths for travel; neighbourhood residents may desire street trees; and pedestrian accommodation requires minimum vertical as well as horizontal clearances. All of these factors will influence the streetscape opportunities for a roadway.

- **Safety** The over-riding spatial design considerations for roadway landscaping are those that address the safety of the corridor. The principle considerations are:
 - a) ***Sight Lines*** must be maintained near intersections and driveways. No obstructions, such as plant material, signs, lights, signals, and other furnishings should block sight lines. Chapter 3 provides guidance as to the necessary sight distances.
 - b) ***Clear Zones*** provide a recovery area adjacent to the roadway. Trees that will attain trunk diameters of 4 inches (measured 2 feet above ground) or more at maturity should not be located within the clear zone

- c) **Buffers** provide separation between higher speed vehicular traffic and pedestrian traffic. They serve to increase the comfort and safety of pedestrians walking on sidewalks. Measures, including landscape, to provide buffers and improve walkability also important.

Environment

The environmental conditions of a site determine which plants will survive and thrive. Roadside conditions are typically harsh, limiting the palette of plants for landscape restoration and streetscapes. The following conditions should be analyzed to guide location and selection of species

- a. Climate and microclimate of the roadside vary from site to site and within sites. Slope angle and orientation will dramatically affect ground temperatures and water demands of plant material. Desiccating winds increase with closer proximity to the roadway.
- b. Soil quality of existing soils and proposed fills must be assessed as to drainage characteristics, compaction potential, organic content and fertility, as well as potential exposure to salt run-off and other soil contaminants.
- c. Existing hydrology will determine erosion considerations and species choices.
- d. Existing vegetation should be characterized with regard to plant communities, invasive species, native species, and the function that that vegetation serves (wetland buffer, screening, habitat area, erosion control, etc.). Indirect construction impacts on existing vegetation, such as changes in light or exposure, should also be addressed.
- e. Existing habitat should be assessed prior to choosing species for restoration.
- f. Care should be taken to avoid landscaping that would provide an unnecessary food source, such as heavily fruited plants, which may attract wildlife to highway corridors.

Utilities

Roadsides often serve as utility corridors. Underground and overhead wires and conduits are among the most common features. However, electric boxes, manholes, fire hydrants, lighting, and other fixtures must also be evaluated for clearance and access requirements. Underground utilities may require setbacks for the purpose of access and maintenance, although excavation of underground service is typically infrequent. With the exception of the occasional high voltage

utility corridor, overhead clearances are primarily a concern in urban and other developed areas. Utility poles, wires, and streetlights present special challenges for landscape design.

Roadway Maintenance

Landscape design must anticipate the type of maintenance that will be required. Responsibility for maintenance varies depending on roadway jurisdiction. Maintenance for streetscape areas is typically the responsibility of local municipalities.

Design guides

A design guide provides detailed guidance on how specific types of development can be carried out in accordance with a plan's design policies. A guide:

- elucidates and exemplifies a set of design principles relating to that topic;
- identifies common design failings and helps to avoid them;
- provides a basis for consistency in the local authority's dealings with planning applicants and a basis for negotiation;
- enables a local authority to communicate its commitment to design both internally and to everyone involved in the development process;
- some design guides, on satellite dishes for example, may relate to a single policy. Others, on complex subjects such as mixed-use development, will relate to a number of policies

What a design guide does

Design guides are among the most comm. on mechanisms used by local authorities (and others) to influence the design of development. The most successful guides have the committed support of all the relevant council officers and planning committee members, and are clearly understood by local developers, architects and other users. Design guides can inspire innovative design appropriate to its context; raise standards of a particular type of development where problems have been identified; and provide answers to questions frequently asked by applicants. Design guides enable local authorities to guide development in relation to particular design issues and type of development, elucidating the design policies in the development plan. Producing a design guide can be an effective use of a council's design skills, in cases where officers find themselves repeatedly giving the same advice.

What a design guide contains

A well-prepared design guide will usually include:

- the purpose of the guide;
- information on how to use the guide and who produced it;
- an account of consultation on the guide and the authority's response;
- current status (draft for consultation, for example) and eventual status (SPG, for example);
- an explanation of the policy context, how the guide relates to plan policies, national guidance,
- other design guides, development briefs, and relevant initiatives such as any relating to town centre management, security or conservation;

- an explanation of what context appraisals the guide is based on, and a summary of what they showed;
- design guidance, illustrating the design policies in the development plan through a set of design
- principles relating to the specific topic and the local context;
- illustrations, photographs and plans (with captions, except where the illustration is included purely to make the document attractive);
- information on when planning permission is required and submission requirements;
- a glossary (unless all specialised terms are explained where they appear in the text);
- references to further information;
- grants available (if relevant);
- contacts in the local authority and other organisations;
- details of specialist manufacturers, contractors and advisors (on crime prevention, for example)
- where appropriate.

Landscape Design Guidance

Design decisions are ultimately based on specific site conditions and may, in certain instances, require different solutions than those recommended.

Streetscapes

Many of the roadway projects in Massachusetts pass through densely settled areas, and thus involve the design of “streetscapes,” which encompasses the road and its surrounding built environment as a whole. This section focuses on the pedestrian landscape bound by the limits of right-of-way, and comprised of sidewalks and crosswalks. It may include decorative pavement, street trees, decorative lighting, and, where appropriate, other furnishings such as bicycle racks, benches, and trash receptacles.

Sidewalks

Occupying the border between the vehicular travel ways and private property, the sidewalk is a zone of many uses. In addition to pedestrian use, it usually carries underground and/or overhead utilities, streetlights and signs, as well as other sidewalk furnishings, including mailboxes, utility cabinets, and hydrants. Sidewalk design must be attentive to the need for equitable access for a broad range of physical abilities.

- a. **Clearances.** Sidewalks must provide a clear path, a minimum of 5 feet wide. Short portions of this path may be narrowed to 3 feet to avoid fixed objects. Accommodating these clearances typically requires consolidation of street furnishings, including utility poles, lighting, and street trees to one side or the other of the walking path, which limits the possible location of plants.
- b. **Gradient.** Sidewalks are allowed to follow the prevailing grade of the roadway. When other walkways are proposed, the constructed profile of walkway without a railing must not exceed 5 percent. Cross slopes should be designed to 1.5 percent, so as not to exceed the regulatory maximum of 2 percent. These cross section constraints restrict the type of materials and surfaces to those that can maintain these grades.
- c. **Surfaces.** Accessible surfaces should be slip resistant, with vertical deviations (such as at joints) not exceeding 1/8 inch. As with gradient thresholds, these constraints restrict the location and types of decorative pavement used.
- d. **Ramps at crossings.** Individual wheelchair ramps must be provided at both ends of all street crossings. They must be traversable from all approaches, and must provide level landings at top and bottom (See Chapter 6 for additional details). Landscape design must integrate other features—such as street trees, lighting, and decorative pavement—to ensure that these transition areas function properly.

Aesthetic Pavement Surfaces

Pavements for sidewalks are typically concrete or hot mix asphalt. Occasionally, decorative pavements are desired to reflect architectural materials and details in historically significant areas, to beautify otherwise significant downtown locations, or to highlight pedestrian zones. In general, the designer should:

- a. Limit irregular or rustic surfaces to non-traversable areas, such as the buffer zone, or “furniture zone” between the pathway portion of sidewalk and the street, or for non-traversed portions of medians; and
- b. Where highlighted or decorative walks are desired, consider textured pavement and color admixtures. Where unit pavers are used for pathways, the designer should:

- c. Provide a concrete or otherwise rigid base to ensure a smooth surface, and provide an adequate bituminous setting bed (minimum 3/4 inch) to ensure a durable bond.
- d. Avoid irregular or rustic materials such as cobble or rustic moulded bricks. Use only highly durable modular units that fit together evenly and without gaps. Chamfer of pavers should be no greater than 1/8 inch.
- e. Apply unit pavement only where pavement line is continuous, with minimal breaks requiring cutting and hand fitting of units.
- f. Anticipate utility fixtures and develop templates to fit whole units around fixtures without gaps.
- g. Wheelchair ramps should be constructed out of non-slip cement concrete. Integrate modular pavement with ramp conditions without transitional breaks and gaps. Decorative pavement can be expensive to construct and presents challenges to maintain. Its application should be limited to projects that have explicitly identified the enhanced treatment as a priority and where there is local municipal commitment to maintenance, including proper repairs when pavements are disturbed or damaged.

Street Trees

Compared with other investments in civic improvements, street trees are relatively inexpensive and yield substantial community and environmental benefits. The desire for and feasibility of planting trees as part of a transportation project should be identified in the early stages of project development. Street tree plantings are frequently provided as part of state highway projects, but maintenance becomes the responsibility of local municipalities. For this reason, street tree planting design must consider not only conventional traffic issues of sight lines and clear zones, but also the horticultural requirements of plant material. An assessment of the planting area must take into account soil area, volume and type; availability of water; tree species; and microclimate. Historically, trees have often been planted in strips too narrow and pits too small to adequately support long-term growth. Do not replant in these existing sites without carefully considering whether the soil volume, soil quality, microclimate, moisture levels and other site considerations are appropriate for the species selected.

Back-of-Curb Planting

Locating trees along the traffic side of sidewalks provides a buffer between the sidewalk and the street and may provide a visual traffic-calming cue to drivers. The planning and development of streetscapes should aim to provide sufficient area for tree planting, while accommodating pedestrian and utility demands. Considerations for back-of-curb planting for include:

- a. Due to the many demands that may need to be met within the limited corridor space available – additional travel lanes, more parking area, space for utility structures, and bicycle and pedestrian accommodation – there is often insufficient area left for tree planting in back of the curb. Existing or proposed overhead and underground utility lines place further constraints on planting behind the curb.
- b. Typical urban forestry practices recommend at least 6 feet, preferably more, for the width of a street tree lawn. However, this amount of available area is rarely found, especially in dense urban corridors. □□If the width of the planting strip is less than 6 feet, or where the planting surface area is less than 60 square feet per tree, planting design should include documentation as to how species selection, soil modifications, irrigation or other designed modifications will support planting design.
- c. Tree strips as narrow as 3.5 feet may be viable. However, with smaller planting areas, municipalities should expect diminished tree growth and health, shorter plant life spans, and increased maintenance.
- d. Different species have different soil volume and moisture requirements. Choose species most likely to survive in the microclimate, site and soil conditions of plant area.
- e. Shared root space provides a benefit to trees. Link tree pits or tree lawns to create spaces with greater soil area and volume.
- f. Municipalities may need to provide irrigation where there is insufficient soil volume to provide the moisture that the trees will require.
- g. In general, planting strips less than 3.5 feet wide are too narrow for trees. These strips do not contain sufficient soil volume for most species, do not provide sufficient area to protect tree trunks and roots from pedestrians, bicycles and parked cars, and, due to roots seeking soil outside the planting area, do not provide optimum long term conditions for sidewalks.

Back-of-Sidewalk Planting

Where sidewalk conditions (including accessible pathway) limit the feasibility of back-of-curb planting, and where abutting land use allows, current urban forestry practices recommend back-of-sidewalk planting. Under these circumstances, the design process should include agreements with adjacent owners, especially where installation will encroach on private property.

Where right-of-way limits fall close to or on the back of the sidewalk, a portion of the sidewalk and sub-grade may be cut out to accommodate the root ball, provided there is adequate passage between the back of the curb and the back of the sidewalk. While planting in back of the sidewalk does not provide a physical buffer between the sidewalk and the street and may appear to compromise the conventional image of the tree-lined street, there are several significant benefits:

- a. Trees planted in areas with larger volumes of soil are more likely to survive and grow faster than trees in individual tree pits or strips because the roots have greater access to moisture and nutrients.
- b. Trees on back of sidewalk are much less likely to lift sidewalk pavement
- c. Conflicts with overhead utilities along the sidewalk are avoided.
- d. Trees are less likely to be injured by vehicles and car doors.
- e. Trees will be less likely to obscure traffic signs and lights
- f. Setback plantings are out of the way of future street repair such as curbing resetting or installation.

General Location and Design Guidelines

- i. The outside face of the tree trunk at its estimated mature size should be at least 1.5 feet behind face of curb.
- ii. Locate trees and select species such that the canopy will not block signs, signals, or street lights
- iii. Locate trees so that trunks do not obscure sight lines at intersections and curb cuts.
- iv. Where there are on-street parking, coordinate tree locations with parking stalls to minimize conflicts with car and truck doors.
- v. In commercial areas, allocate space for bicycle parking to deter people from locking bikes to trees.

- vi. Avoid planting under utility wires. Otherwise, choose appropriate species/cultivars: low growing, columnar, or finely branched trees that can be pruned without causing major damage to the tree.
- vii. Locate trees away from hydrants, electric boxes, lights, and other utility structures that may need to be accessed.

Urban Design

Urban design is the process of shaping the physical setting for life in cities, towns and villages. It involves both the art of ‘place making’ and the science of creating urban form which is fit for purpose. Landscape architects working in urban design apply their expertise to producing design solutions that meet the needs and aspirations of people living in urban environments. They will conduct consultations, carry out urban design studies, appraisals and reviews, develop master plans and design statements, and provide expert advice relating to the planning process. Successful urban design requires a consultative and inclusive approach along with close collaboration with other professionals.

Typical activities include:

- a) Managing the Urban Design process, including facilitating public and stakeholder engagement, setting briefs for consultants, negotiating and collaborating with other professionals and organising urban design competitions.
- b) Conducting Urban Design studies and appraisals such as morphology studies, policy reviews, urban/townscape character assessments, public space appraisals, sustainability studies and connectivity studies.
- c) Preparing Urban Design policy and guidance such as vision statements, Urban Design codes and guides, development briefs, public realm strategies, local or village design statements.
- d) Master planning, including designing the overarching movement/development framework for sites or areas, site specific development layouts, preparation of Design and Access Statements, and preparing delivery documents.
- e) Providing Urban Design advice such as advising on prospective planning applications, advising on the design aspects of development control and strategic planning, and providing expert witness services at Planning Appeals and Development Plan Inquiries.
- f) Managing projects
- g) Providing advice on policy and strategy
- h) Acting as an advocate for urban design and place making
- i) Contributing to public inquiries and acting as an expert witness

Good urban design is essential if we are to produce attractive, high-quality, sustainable places in which people will want to live, work and relax. It is fundamental to our objective of an urban renaissance. We do not have to put up with shoddy, unimaginative and second-rate buildings and urban areas. There is a clamour for better designed places which inspire and can be cherished, places where vibrant communities can grow and prosper. To achieve this we need to effect a culture change, and this guide is designed to help this process. Urban design is the art of making places for people. It includes the way places work and matters such as community safety, as well as how they look. It concerns the connections between people and places, movement and urban

form, nature and the built fabric, and the processes for ensuring successful villages, towns and cities.

Urban design is a key to creating sustainable developments and the conditions for a flourishing economic life, for the prudent use of natural resources and for social progress. Good design can help create lively places with distinctive character; streets and public spaces that are safe, accessible, pleasant to use and human in scale; and places that inspire because of the imagination and sensitivity of their designers. There are many benefits to be gained from thinking coherently about the way places are designed. Some are the traditional concerns of good planning, others are relatively new.

Successful urban design requires a full understanding of the conditions under which decisions are made and development is delivered. Many factors determine or influence the outcome of the design process and the sort of places we make. Success, nowadays, rarely happens by chance. It depends on:

- a clear framework provided by development plans and supplementary guidance delivered consistently, including through development control;
- a sensitive response to the local context;
- judgements of what is feasible in terms of economic and market conditions;
- an imaginative and appropriate design approach by those who design development and the people who manage the planning process.

It is vital to bring these factors together. If policy is not set out clearly for applicants, a proposed development may conflict unwittingly with a local authority's aspirations for good design. If too little weight is given to feasibility, the development may fail commercially. If too little weight is given to local context, the proposal may be opposed locally. If the design approach is wrong, the site's opportunities will be missed and poor or mediocre development will result.

The role of the planning system

The planning system provides the means to encourage good design, not just in conservation areas and other attractive places, but everywhere. Securing good design is central to good planning. The appearance of proposed development and its relationship to its surroundings are relevant to the consideration of a planning application makes it clear that local planning authorities should reject poor designs.

Objectives of urban design

Successful streets, spaces, villages, towns and cities tend to have characteristics in common. These factors have been analysed to produce principles or objectives of good urban design. They help to remind us what should be sought to create a successful place. There is considerable overlap between the objectives and they are mutually reinforcing. by design urban design in the planning system: towards better practice.

OBJECTIVES OF URBAN DESIGN

CHARACTER

A place with its own identity

To promote character in townscape and landscape by responding to and reinforcing locally distinctive patterns of development, landscape and culture.

CONTINUITY AND ENCLOSURE

A place where public and private spaces are clearly distinguished

To promote the continuity of street frontages and the enclosure of space by development which clearly defines private and public areas.

QUALITY OF THE PUBLIC REALM

A place with attractive and successful outdoor areas

To promote public spaces and routes that are attractive, safe, uncluttered and work effectively for all in society, including disabled and elderly people.

EASE OF MOVEMENT

A place that is easy to get to and move through

To promote accessibility and local permeability by making places that connect with each other and are easy to move through, putting people before traffic and integrating land uses and transport.

LEGIBILITY

A place that has a clear image and is easy to understand

To promote legibility through development that provides recognisable routes, intersections and landmarks to help people find their way around.

ADAPTABILITY

A place that can change easily

To promote adaptability through development that can respond to changing social, technological and economic conditions.

DIVERSITY

A place with variety and choice

To promote diversity and choice through a mix of compatible developments and uses that work together to create viable places that respond to local needs.

ASPECTS OF DEVELOPMENT FORM

<p>LAYOUT: URBAN STRUCTURE <i>The framework of routes and spaces that connect locally and more widely, and the way developments, routes and open spaces relate to one other.</i></p>	<p>The layout provides the basic plan on which all other aspects of the form and uses of a development depend.</p>
<p>LAYOUT: URBAN GRAIN <i>The pattern of the arrangement of street blocks, plots and their buildings in a settlement.</i></p>	<p>The degree to which an area's pattern of blocks and plot subdivisions is respectively small and frequent (fine grain), or large and infrequent (coarse grain).</p>
<p>LANDSCAPE <i>The character and appearance of land, including its shape, form, ecology, natural features, colours and elements, and the way these components combine.</i></p>	<p>This includes all open space, including its planting, boundaries and treatment.</p>
<p>DENSITY AND MIX <i>The amount of development on a given piece of land and the range of uses. Density influences the intensity of development, and in combination with the mix of uses can affect a place's vitality and viability.</i></p>	<p>The density of a development can be expressed in a number of ways. This could be in terms of plot ratio (particularly for commercial developments), number of dwellings, or the number of habitable rooms (for residential developments).</p>
<p>SCALE: HEIGHT <i>Scale is the size of a building in relation to its surroundings, or the size of parts of a building or its details, particularly in relation to the size of a person. Height determines the impact of development on views, vistas and skylines.</i></p>	<p>Height can be expressed in terms of the number of floors; height of parapet or ridge; overall height; any of these in combination; a ratio of building height to street or space width; height relative to particular landmarks or background buildings; or strategic views.</p>
<p>SCALE: MASSING <i>The combined effect of the arrangement, volume and shape of a building or group of buildings in relation to other buildings and spaces.</i></p>	<p>Massing is the three-dimensional expression of the amount of development on a given piece of land.</p>
<p>APPEARANCE: DETAILS <i>The craftsmanship, building techniques, decoration, styles and lighting of a building or structure.</i></p>	<p>This includes all building elements such as openings and bays; entrances and colonnades; balconies and roofscape; and the rhythm of the facade.</p>
<p>APPEARANCE: MATERIALS <i>The texture, colour, pattern and durability of materials, and how they are used.</i></p>	<p>The richness of a building lies in its use of materials which contribute to the attractiveness of its appearance and the character of an area.</p>

Aspects of development form

Urban design objectives are, by themselves, abstract. They have an impact on people's lives only by being translated into development. The form of buildings, structures and spaces is the physical expression of urban design. It is what influences the pattern of uses, activity and movement in a place,

and the experiences of those who visit, live or work there. It sets out the most important characteristics of the physical form of development by articulating eight aspects. Together, these define the overall layout of the place (in terms of its routes and building blocks); its scale (in terms of building height and massing); its appearance (as expressed in details and use of materials); and its landscape (including all the public realm, built and green spaces).

Objectives and development form brought together

Effective design policy and design guidance is likely to focus on how, in a particular context, development form can achieve the urban design objectives. These questions should draw together urban design objectives and aspects of development form. For example, what form of layout would help to achieve a particular objective in this context? What scale? And so on, depending on what is considered relevant. Guidance based on such systematic thinking will help developers and designers by moving beyond simple exhortations that, for example, new development should be 'in character'. Ultimately, the development form which emerges as a result of such a process is more likely to result in better designed places.

The list of urban design objectives is used as the basis of the prompts which follow.

Character *(A place with its own identity)*

The positive features of a place and its people contribute to its special character and sense of identity. They include landscape, building traditions and materials, patterns of local life, and other factors that make one place different from another. The best places are memorable, with a character which people can appreciate easily. Many of the places which we now think of as being pleasantly distinctive grew naturally in response to local circumstances. Where such distinctiveness is ignored, new development may reflect only the marketing policies or corporate identities of national and international companies, the standard practices and products of the building industry, or the latest fashions among design professionals. Development that responds sensitively to the site and its setting, by contrast, is likely to create a place that is valued and pleasing to the eye.

Designing for local distinctiveness involves the creative reconciliation of local practices, on the one hand, with the latest technologies, building types and needs, on the other. Where there are no significant local traditions, the challenge to create a distinctive place will be all the greater. There is no reason why character and innovation should not go together. New and old buildings can coexist happily without disguising one as the other, if the design of the new is a response to urban design objectives.

Consider the site's land form and character when laying out new development.

- The three-dimensional shape of the landscape is the basis for a development's form (expressed in its layout and massing). Natural features can help give shape to a development and integrate it into the wider area, contributing to a sense of place.

- Conserving a site’s natural features provides for a better relationship between new development and its environment. Natural features include rivers and streams, wetlands, ponds and lakes, hills, trees, wildlife habitats and rock outcrops.
- The local ecology can help to determine the character and identity of both a development and the place of which it is a part.

Integrating new development into its landscape setting reduces its impact on nature and reinforces local distinctiveness.

- The layout, massing and landscape design of development can be integrated successfully into the wider landscape through using structure planting, shelter belts, green wedges, and (along natural features, roads, rivers and canals) green corridors.
- Reflecting plant species that are common locally will help planting in new development to reinforce the distinct natural qualities of a place.
- Integrating new and existing development at their boundaries maintains the continuity of urban form and landscape.

Responding to the existing layout of buildings, streets and spaces ensures that adjacent buildings relate to one another, streets are connected and spaces complement one another.

- The existing layout of an area reflects its history, functions and connections with adjoining areas. These can contribute to the interest and richness of new development, and to its potential to accommodate further change in future.
- Integrating existing buildings and structures into new development can maintain the continuity of the built fabric as well as retaining buildings of local distinctiveness, historic or townscape merit.
- Narrow plot widths promote more active frontages, increase the sense of enclosure and allow higher densities. They are particularly appropriate where they reflect existing settlement patterns.

Responding to local building forms and patterns of development in the detailed layout and design of development helps to reinforce a sense of place.

- Local building forms and details contribute to the distinctive qualities of a place. These can be successfully interpreted in new development without necessarily restricting the scope of the designer. Standard solutions are rarely acceptable, as they are unlikely to create a distinctive identity or make good use of a particular site.
- Local building forms sometimes include distinct housing types, boundary treatments, building lines, roof slopes, window types and gardens.
- Responding to such forms and practices should only be at the appropriate scale. The common practice of inflating traditional domestic forms to larger scales is generally to be avoided.

The use of local materials, building methods and details is a major factor in enhancing local distinctiveness.

- The scale, texture and colour of building materials reflects an area’s special function and character.
- Every element of the street scene contributes to the identity of the place, including sculpture, lighting, railings, litter bins, paving, fountains and street furniture.
- Development can be enhanced by reflecting local art and craft traditions. These might relate to elements such as ironwork, stained glass, thatching, brickwork, masonry, walling and paving. They should not be add-ons or afterthoughts, but part of the design from the start.

The scale, massing and height of proposed development should be considered in relation to that of adjoining buildings; the topography; the general pattern of heights in the area; and views, vistas and landmarks.

- Relating new development to the general pattern of building heights should not preclude a degree of variety to reflect particular circumstances. The character of townscape depends on how individual buildings contribute to a harmonious whole, through relating to the scale of their neighbours and creating a continuous urban form.
- On a sloping site, buildings that sit on the real ground and step up the hill are more likely to contribute to local character and avoid blank walls at ground level than large monolithic slabs that ignore the topography.
- The massing of development contributes to creating distinctive skylines in cities, towns and villages, or to respecting existing skylines. The character of a skyline is composed of the massing of blocks and the shape of roofs, as well as by the height of buildings. A building should only stand out from the background of buildings if it contributes positively to views and vistas as a landmark. Buildings which have functions of civic importance are one example.

Climate and other Environmental factors in Landscape Design

Climate and other Environmental Factors in Landscape Design

Landscapes are open, complex systems in which ecological, economic, social and cultural processes interact. The values of landscapes are correspondingly manifold. The natural or intrinsic values of landscapes are mainly related to the biological diversity, whereas the social values are connected to human habitation, recreational use as well as its cultural and artistic information.

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) concludes that the ‘warming of the climate system is unequivocal’ and that ‘Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely [assessed likelihood over 90%] due to the observed increase in anthropogenic greenhouse gas concentrations’.

Adapting to climate change is increasingly being recognized as equally important as reducing the anthropogenic causes of climate change. And adapting to climate change is at its core a call for planning. As such, it provides the planning profession with opportunities to provide leadership in responding to this great global challenge.

The increasing evidence for climate change, and the lack of adequate action on mitigation, has brought renewed emphasis on adaptation policies. The IPCC Fourth Assessment of mitigation efforts ‘shows that current commitments would not lead to a stabilization of atmospheric greenhouse-gas concentrations,’ and that, due to lag times in the climate system, ‘no mitigation efforts, no matter how rigorous and relentless, will prevent climate change from happening in the next few decades’. During this century, regardless of mitigation efforts, we will either suffer the adverse impacts of, or successfully adapt to, climate change.

Planners have roles to play in mitigating greenhouse gas emissions, through land use policies that reduce vehicle travel, building standards that reduce the need for cooling and heating, encouraging the use of alternative energy sources, and other related policies. And, cities in the US have increasingly taken leadership in reducing greenhouse gases.

Climate change and cities

The impact of climate change takes place in cities, towns and villages. They in turn have the greatest impact on climate change. As our climate changes things are getting worse, threatening more extreme weather. If sea levels rise by just one metre, many major coastal cities will be under threat: Buenos Aires, Rio de Janeiro, Los Angeles, New York, Lagos, and Cairo Karachi, Mumbai, Kolkata, Dhaka, Shanghai, Osaka-Kobe, and Tokyo. To cite just some, those are mega cities with populations of more than 10 million. Never mind the many smaller cities and island nations.

UN figures show that this year alone, 117 million people around the world have suffered from some 300 natural disasters, including devastating droughts in China and Africa, and massive flooding in Asia and Africa, costing nearly \$15 billion in damages. One example – New Orleans after Hurricane Katrina.

Everywhere the urban poor live in places no-one else would dare set foot – along beaches vulnerable to flooding, by railway, on slopes prone to landslides, near polluted grounds. They scratch out a living in shaky structures that would be flattened the instant a hurricane hit causing untold loss in lives and destruction.

In this new urban age, the mega-cities therefore loom as giant potential flood and disaster traps. In sub-Saharan Africa, slum dwellers constitute over 70 percent of the urban populations. In other parts of the developing world that figure is a shocking 50 percent.

Our partners, including Mayors and Local Authority organizations, are deeply concerned that the developing world is extremely vulnerable to the impacts of climate change. They have sought direct access to global climate funds. The developing world needs local funding and local solutions to this global crisis.

Reduce urban poverty and we will directly offset the horrors of disasters brought on by climate change. The United Nations has calculated that one dollar invested in disaster reduction and

adaptation to climate change today, can save up to seven dollars tomorrow in relief and rehabilitation costs.

In the climate change literature, adaptation is defined in the context of vulnerability, sensitivity and adaptive capacity. Vulnerability is often defined as the propensity of human and ecological systems to suffer harm, and adaptive capacity as their ability to respond to stresses as a result of climate change effects. Sensitivity refers to the degree to which a system is affected by climate change impacts. Adaptive capacity is seen as a function of behaviour, resources and technologies. Vulnerability is seen to be influenced by development path, physical exposure, distribution of resources, prior stresses and social and government institutions.

The concept of resilience is seen as the ‘flip side of vulnerability—a resilient systems or population is not sensitive to climate variability and change and has the capacity to adapt.

Landscape Evaluation Techniques

Definition of Evaluation

Evaluation is the **assessment of value** or the act of considering or examining something in order to judge its value, quality, importance, extent, or condition. The term evaluation is often used loosely in planning and physical planning. It is often referred to as the description of planning proposals and statements of their merits. It is used more to formally denote the process of analysing a number of plans or projects with the view to searching out their comparative advantages and disadvantages and the act of setting down the findings of such analysis in a logical framework.

Evaluation is concerned with the assessment of the consequences of planning proposals for the individuals of group of individuals who comprise a community. This assessment should relate to concepts of their comparative well-being as between the alternative situations.

Evaluation in physical planning

Plan evaluation is a crucial stage of the planning process in which the planner put together facts and values in an attempt to compare alternatives. Based on the result of evaluation the decision makers are able to make their choice out of the available defined alternative courses of action, representing the most reasonable means of achieving the goals originally specified. Once the broad goals and the objectives for a particular planning problem have been established and the alternative course of action has been prepared, the next step is to evaluate these alternatives strategies comparing their respective advantages and disadvantages. This testing process is described as evaluation and is intended to assist the decision maker in selecting his final choice. As evaluation entails more than just a description of alternatives, the various constituent elements of the plan must be identified and subsequently measured. During evaluation, a plan or proposal may be described without reference to other plans or proposals. A plan may be evaluated only by considering its advantages and disadvantages in relation to the characteristics of one or more other possible course of action.

Evaluation should be directed towards the assessment of the comparative performance of plans in terms of the achieved levels of sectoral objectives.

Types of Evaluation

Comprehensive evaluation implies that the evaluation considers and records as far as practicable some measures of the variation in the well-being of all individuals and groups who are affected by the planning decision or proposal in question. A comprehensive evaluation will normally be defined widely in two directions. First it will encompass all groups affected by the proposal at any point in time in the future. Secondly, it will encompass the effects on these groups through time, which can include unborn generations.

A partial evaluation will have considered a subsection only of the community or subsection only of all the full range of plan consequences.

Role of Evaluation in Planning

Evaluation provides information about the effects of the proposal on all members of a community with two different users of this information being formal decision takers and the general public who may participate at any stage during the overall process of arriving at a decision. The other group are the decision makers who require information about the social welfare consequences of proposal to help them form a soundly based choice.

Evaluation also generates evidence for policy makers to use in defending their decisions as well as in the process of arriving at them.

Most important about evaluation is the need for the findings of an evaluation, to be made available to the general public, to whom elected representatives are normally accountable since urban and regional planning decisions should be seen as part of the overall responsibilities of elected representatives and should therefore conform with democratic process if members of the public are potentially affected by a proposal, either beneficially or adversely, they should be aware of the reasons.

Factors to be considered in Evaluation

Lichfield (1975) suggests a set of ten criteria which an appropriate evaluation technique should satisfy. They are outlined as follows:

- Have regard to the stated or implied objective of the decision maker which may be or not be the objective of those for whom they are planning
- Cover all systems of urban and regional facilities which are encompassed in the plan
- Cover all sectors of the community which are affected , that is those which should be included within the decision makers' concern
- Subdivide the sector into producers/operators of the plan output and its consumers so that all the transactions implicit in the plan are considered
- Take into account all the benefits to sectors, including externalities

- Take into account all the cost to all sectors , including externalities
- Measure of all the costs and benefits in monetary terms
- Facilitate the adaption of a satisfactory criterion for choice
- Show the incidents of the cost and benefits of all sectors of the community
- Be usable as an optimising tool with a view to ensuring the best solution

Landscape Evaluation

The Landscape is regarded and recognised as a resource and is therefore a variable to be considered in land use decisions. When evaluating landscapes one should use an interdisciplinary approach, communicate with other evaluators and, importantly, recognise the academic respectability of the elementary. A structured method of landscape assessment, linking description, classification, analysis and evaluation, will provide an integrated framework within which decisions on land use management and advice can be debated (Cooper and Murray, 1992). One of the biggest problems in developing quantitative assessment methods for scenic impacts is that of measuring the contributions of specific landscape elements to overall preference.

There is an emphasis in landscape assessment to produce 'objective' and quantitative methods of attaching a numerical value for the 'subjective' responses to aesthetic or scenic quality. These methods were developed to act as evaluative tools to enable an evaluation to be repeated by different observers, or carried out in different areas and still produce comparable results that is they were expected to give reliable and consistent information about the observers' responses to landscape quality.

Unwin (1975) describes three phases of landscape evaluation.

- Landscape measurement: an inventory of what actually exists in the landscape;
- Landscape value: an investigation and measurement of value judgements or preferences in the visual landscape;
- Landscape evaluation: an assessment of the quality of the objective visual landscape in terms of individual or societal preferences for different landscape types.

Definitions in landscape evaluation

Before the subject of landscape evaluation can be reviewed, it is necessary to define several key words. In the course of this report the term "total landscape" refers to the less tangible properties of the landscape as well as the more obvious visual properties and should not be confused with "landscape" which refers to the visual properties only.

Landscape

The term landscape clearly focuses upon the visual properties or characteristics of the environment, these include natural and man-made elements and physical and biological

resources which could be identified visually; thus non-visual biological functions, cultural/historical values, wildlife and endangered species, wilderness value, opportunities for recreation activities and a large array of tastes, smells and feelings are not .

Landscape quality

Often landscape quality is defined as including a wide range of environmental/ecological, socio-cultural and psychological factors. According to Jacques (1980) the distinction between 'value' and 'quality' is meaningless, since both terms refer to the comparison of the landscape in front of your eyes to an idealised landscape in one's mind.

Visual impact

Visual impact on landscape quality is concerned with physical changes introduced to a site by a new development activity (Amir and Gidalizon, 1990).

Objective definitions

Visual quality - a phrase synonymous with beauty, but intended to convey an impression of objectivity; landscape evaluation - ascertaining of a single, often numerical, measure of visual quality, more appropriately would be " landscape quality survey"; judgement - the presumed ability by the design professions to evaluate 'visual quality', as distinct from value (Jacques, 1980).

Subjective definitions

Landscape value - a personal and subjective assessment of aesthetic satisfaction derived from a landscape type; landscape appraisal - the study of the effect of landscape changes upon landscape value; preference - the liking of one landscape type better than another (Jacques, 1980).

Subjectivity versus objectivity

There is a fundamental, theoretical, divergence of opinion over the question of whether landscapes have an intrinsic or objective beauty which may in some way be measurable or comparable, or whether scenic beauty is a value that can only be subjectively attributed to an area or specific landscape (Shuttleworth, 1980b). While physical geographers have devised ways of measuring landscape parameters to reflect visual quality; human geographers have probed individual and societal attitudes toward landscape (Dearden, 1985).

Orland *et al.* (1995) have described qualitative approaches as those which focus upon the evaluation the complexity of landscape using the judgements of panels of human subjects, and quantitative approaches as those which measure physical characteristics of the visual field directly.

On the physical/objective side, Buhyoff and Riesenmann (1979) have presented evidence that certain landscape dimensions can be used successfully to prepare an evaluation, and that aesthetic impact can be measured from specific landscape dimensions.

There is an increasing interest in the use of mapped data and geographic information systems (GISs) to assess visual landscape variables using reproducible methods over a wide area (Bishop and Hulse, 1994). Recent research efforts have shown that the public's scenic preferences can be assessed objectively and quantitatively (Dearden, 1980). This research has also demonstrated that public perceptions can be related to and, in fact, predicted from environmental attributes of a more tangible nature (Buhyoff *et al.*, 1994).

The assessment and/or quantification of scenic quality are mandatory for proper consideration of the aesthetic consequence of management actions (Buhyoff *et al.*, 1994). The Belgian experience with landscape evaluation, especially in rural re-allotment projects, indicates, and international literature from a great number of disciplines or research field confirms, the necessity to speak of scenic or visual resource management (Tips, 1984).

Evaluation techniques

Numerous techniques of landscape evaluation have been devised in recent years (Crofts and Cooke, 1974). They form a spectrum in which the extremes are represented on the one hand by techniques based unequivocally on the subjective assessments of landscape quality by individuals or groups (e.g. Shafer *et al.*, 1969) and on the other by techniques using physical attributes of landscape as surrogates for personal perception (e.g. Linton, 1968; Land Use Consultants, 1971).

The various models can be subdivided several ways. Arthur *et al.* (1977) splits them into descriptive inventories and public preference models, both categories being further split into non-quantitative and quantitative methods. Briggs and France (1980) use direct and indirect methods to subdivide the models; Crofts (1975) describe two sorts of techniques - preference and surrogate component techniques; Daniel and Vining (1983) split the methods into ecological, formal aesthetic, psychophysical, psychological and phenomenological models. For purpose of this course the methods will be split into *descriptive inventories*, *public preference methods* (after Arthur *et al.*, 1977) and a third category of *quantitative holistic techniques*.

- Descriptive inventories include ecological and formal aesthetic models, methods which are mostly applied by experts in an objective manner.
- Public preference models, such as psychological and phenomenological, are often undertaken using questionnaires, and are unavoidably linked to the problems of consensus among the public.
- Quantitative holistic techniques use a mixture of subjective and objective methods and include psychophysical and surrogate component models.

It is important to examine the reliability and validity of landscape evaluation models and to identify any assumptions central to the models. Internal and external validity are of concern in the development of any landscape visual assessment system. External validity reflects, in part,

how well the system-generated assessments correspond to other, known measures of visual quality. Internal validity reflects how well the system's internal logic withstands testing and violation of assumptions (Buhyoff *et al.*, 1995).

Descriptive inventories

Descriptive inventories comprise the largest category of techniques for assessing scenic resources; they include both quantitative and qualitative methods of evaluating landscapes by analysing and describing their components (Arthur *et al.*, 1977). Classification methods are those which first attempt to classify the survey units on the basis of their overall similarity, and then to grade or evaluate the resulting clusters - formal aesthetic models are an example of this method. Non-classificatory methods, such as ecological models, attempt to identify the relationships between selected landscape components and environmental quality, and then use these relationships to predict landscape quality (Briggs and France, 1980).

Descriptive inventory methods rely on combinatorial functions (such as addition, subtraction and multiplication) to value, compare and aggregate landscape components which have been identified and measured by an individual expert or team of experts. The components in the inventory may consist of physical landscape elements (Tandy, 1971) or design elements (Bureau of Land Management (BLM), 1980). Implicit in the quantitative design inventories approach to landscape evaluation is the assumption that scenic quality of the whole landscape can be explained in terms of aggregation of the values of the landscape components.

Although these surrogate methods of landscape evaluation can provide general assessments of landscape quality and a landscape inventory based on subjectively-selected but objectively-applied criteria, the objectivity of their application and their precise, often quantitative, results disguise their underlying subjectivity (Crofts and Cooke, 1974).

The descriptive inventory approach contains several assumptions. One is that the value of a landscape can be explained in terms of the values of its components. Another is that scenic beauty is embedded in the landscape components that it is a physical attribute of the landscape; however, scenic beauty depends on the observer as well as that which is being observed (Arthur *et al.*, 1977). Descriptive inventories methods have been criticised for the way landscape components are arbitrarily identified then subjectively scored by the design professionals, and the lack of empirical research to justify the inclusion of these components as determinants of scenic quality (Robinson *et al.*, 1976, Arthur *et al.*, 1977).

Formal aesthetic models

The basic theory of the formal aesthetic model is that aesthetic values are inherent in the formal properties of the landscape. These properties are defined as basic forms, lines, colours and textures and their interrelationships. The relationships between these elements are then inspected to classify each area in terms of variety, unity, integrity or other complex formal characteristics. Due to the formal training required for this, the method is almost always applied by an expert, usually a landscape architect (Daniel and Vining, 1983).

Because the landscape-quality assessment results in ordered categories, and not in cardinal or interval measures, it is difficult to relate these assessments to economic or trade-off types of valuation processes. Thus, valuing landscape quality relative to other social values is rather restricted. The models have been found to be seriously deficient with regard to the fundamental criteria of sensitivity and reliability (Daniel and Vining, 1983).

Ecological models

Within the ecological model, the environmental features that are relevant to landscape quality are primarily biological or ecological. The landscape is characterised in terms of species of plants and animals present, ecological zones, successional stage or other indicators of ecological processes. In the context of such modelling humans are characterised as users of the landscape (Daniel and Vining, 1983).

Ecological models tend to be designed for specific areas and are therefore difficult to apply to landscapes in general; they are also more sensitive in distinguishing between natural and human-influenced environments than in making distinctions within either of those classes. If the alternatives for land management are to manipulate or not manipulate the environment, the ecological models will almost invariably indicate against any manipulation (Daniel and Vining, 1983).

A major underlying assumption of the ecological model is that landscape quality is directly related to naturalness, or ecosystem integrity. The validity of this model depends upon the assumption that "natural" areas undisturbed by humans are highest in landscape quality. Reliability depends on the consistency and accuracy of the individual applying the method as the assessments are usually carried out by an "ecological expert" (Daniel and Vining, 1983).

Examples

An example of a formal aesthetic model is the Visual Management System (VMS) developed by the USDA Forest Service. It has the purpose of evaluating scenic resources within a land-management framework and assumes that scenic quality is directly related to landscape diversity or variety (Daniel and Vining, 1983). VMS uses character classification (such as gorges, mountains, foothills and plateaus), variety classification (form, line, colour and texture) and sensitivity level (referring to the relative importance of the landscape as a visual or recreational resource). In some cases VMSs are more quantitative holistic techniques than descriptive inventories.

Leopold's "uniqueness ratio" illustrates a landscape assessment methodology based primarily on ecological measures of the landscape. The uniqueness of a given landscape is defined by multiple physical, biological, and human-use dimensions that reflect the implicit assumption that aesthetic value is primarily a function of ecological criteria (Daniel and Vining, 1983).

Cooper and Murray (1992) used local patterns of land class distribution and land class clusters to divide a region into geographically distinct landscape units. High-elevation and upland areas were differentiated from lowlands and unit boundaries were then drawn in relation to selected

physiographic and landform features such as watershed boundaries and specified juxtapositions of land classes.

In the BLM's (1980) scoring scheme for scenic quality, landscape features were valued using different criterion. The first was in terms of the four basic design elements, namely: form, line colour and texture (R. Kaplan, 1985). High valuations are given to the five natural landscape components (landform, vegetation, water, colour and adjacent scenery), whilst cultural modification is assumed to have negative effects. It is the only component that can receive a negative score. The other criterion is to value landscape in terms of variety, scarcity, vividness and distinctiveness. Landscapes with the greatest variety in landform, vegetation, and colour patterns are given the highest scores.

Brabyn (1996) describes an automated classification process which uses a GIS to determine uniqueness and variety. The landscape character classification process used national digital databases to classify vegetation, naturalness, water and landforms in an objective manner. The resultant hierarchical classification, which is based on different levels of generalisation, enables the classification to cope with the different levels of perception that people experience. Brabyn (1996) also notes that a landscape character classification does not identify quality and points out that such a classification needs to evolve as the understanding of the nature of landscapes becomes more sophisticated.

Public preference models

The recent upsurge in public interest in preserving the beauty of public lands has resulted in the development of scenic assessment based on public input (Arthur *et al.*, 1977), indeed, it can be argued logically that the best source of data upon such a subjective issue as landscape quality is the general public. Although planners may claim that it is their duty to guide public taste in these matters, the visual attractiveness of the landscape is ultimately a product of the aggregated opinions of all the individuals concerned with that landscape (Briggs and France, 1980).

The visual quality (or value) of a landscape is rated on the basis of an observer's individual preference of the whole landscape. Those techniques that are based on subjective assessments of scenery and attempt to encompass the diverse and changing perceptions of individuals are likely to be most successful. The essence of the preference approach is the judgement of the landscape in totality, as opposed to the measurement techniques, which rely on the definition of factors to explain variation in landscape quality (Dunn, 1976).

Questionnaires or verbal surveys are the most commonly used non-quantitative method for sampling scenic preference of various groups. They are a valuable source of quick information but accuracy can be sacrificed for speed. They are useful for determining preferences for extremely divergent categories of landscape (Arthur *et al.*, 1977). Alternative to questionnaires, one can provide visual stimuli for evaluation, such as photographs (e.g. Shuttleworth, 1980a; Wade, 1982) or one can use other stimuli, such as sound (Anderson *et al.*, 1983). Although perceptions still vary, the variation is less than with verbal descriptions.

There are various difficulties when carrying out such evaluations. Past studies show that the personality of the observer, and their location affect what they observe, as does the duration of observation, the socio-economic profile of the observers, the type of physical characteristics of the landscape, the dynamics of its components and its complexity (Amir and Gidalizon, 1990). Two concerns are noted by Hull and Stewart (1992) - regarding the ecological validity of photo-based assessments caused by differences between on-site and photo-based contexts and that the individual, rather than the group average, is the more appropriate unit of analysis for tests of validity of photo-based assessments. The techniques have other problems - their psychological basis is at best uncertain; the validity of their quantitative or semi-quantitative results is invariably questionable; and in order to be representative of society's views, they require extensive, time-consuming surveys (Crofts and Cooke, 1974).

Psychological models

The psychological approach has been used in many studies where dimensional analyses of people's preferences for different landscapes are performed. These studies have demonstrated that various psychological constructs such as complexity, mystery, legibility and coherence are important predictors of human landscape preferences (Buhyoff *et al.*, 1994). The psychological model refers to the feelings and perceptions of people who inhabit, visit, or view the landscape. A high-quality landscape evokes positive feelings, such as security, relaxation, warmth, cheerfulness or happiness; a low-quality landscape is associated with stress, fear, insecurity, constraint, gloom, or other negative feelings (Daniel and Vining, 1983).

Because psychological methods use multiple observers and yield one or more quantitative scale values for each assessed landscape, their reliability and sensitivity can be precisely determined. This is an important advantage, since users of these assessments can know the degree of precision and to prove confidence in the landscape values produced. The methods base landscape assessments on the reactions and judgements of the people who experience and/or use the landscapes. In this regard there is an important element of validity inherent in the method (Daniel and Vining, 1983).

Without clear relationships to objectively determine environmental features, the psychological methods leave landscape assessment in a correlational feedback loop; psychological reactions to the landscape are explained only in terms of other psychological reactions:-

"From a practical perspective, this leaves the landscape manager with both feet firmly planted in midair" (Daniel and Vining, 1983).

Phenomenological models

The phenomenological model places even greater emphasis on individual subjective feelings, expectations, and interpretations. Landscape perception is conceptualised as an intimate encounter between a person and the environment (Daniel and Vining, 1983). The principal method of assessment is the detailed personal interview or verbal questionnaire. Phenomenological models tend not to be used to rank landscapes in terms of scenic beauty.

Phenomenological approaches have largely sacrificed reliability in favour of achieving high levels of sensitivity; by emphasising very particular personal, experiential and emotional factors, the visual properties of the landscape become only very tenuously associated with landscape experience. This model represents the extreme of subjective determination of relevant landscape features. It fails to establish systematic relationships between psychological responses and landscape features. However, by emphasising the unique role of individual experiences, intentions, and expectations, the phenomenological model serves to point out the importance of the human context in which landscapes are encountered (Daniel and Vining, 1983).

Consensus

Most landscape techniques proceed on the assumption that there is a broad consensus within our society upon what is considered to be of high landscape value. This assumption is linked to another: that "visual quality" is an intrinsic property of landscape and can be stated objectively (Jacques, 1980). The issue of observer consensus is a major topic in landscape perception and preference.

Landscape preference studies should not rely exclusively on general rankings of preference, but should also consider other trends of variation and eventually compare individual patterns of selection. If only consensus aspects are examined (e.g. group preference rank), idiosyncratic features remain ignored. The subjects' variance in the relative evaluation of appraisal characteristics may have very different origins. It may be related to sociocultural or psychological factors that affect landscape preference as described by a number of authors (Abello et al, 1986).

Reasons for the real variation in consensus levels remain elusive. Evidence suggests little overall correlation between perceived attractiveness and consensus levels, although the more 'extreme' evaluations rarely attract majority support. Consensus does not increase with greater familiarity. Indeed those admitting less knowledge of local landscapes show greater consensus in their generally cautious and conservative evaluations. Those with the greatest landscape knowledge are more critical of its various qualities so that their responses show greater variance. The degree of consensus on evaluation, therefore, generally declines with increasing landscape familiarity, although not always sufficiently to be statistically significant given the available sample sizes (Penning-Rowsell, 1982).

Examples

A series of studies by Kaplan and Kaplan illustrated the psychological model of landscape assessment. A basic method in these studies is to identify relevant psychological variables on photographs of landscapes. Preference ratings and ratings on the landscape dimensions are then obtained from naive observers (Daniel and Vining, 1983).

The essence of Fines' technique is the classification by field observers of subjective responses to the attractiveness of views according to a single, comprehensive and predetermined scale (Crofts and Cooke, 1974). Most literature on phenomenological methods is devoted to studies of

developed landscapes or to perception of environmental hazards. There are only a few specific studies seeking to assess natural landscapes (Daniel and Vining, 1983).

Quantitative holistic methods

Quantitative holistic methodologies combine two approaches: quantitative public preference surveys and landscape features inventories. Measures of landscape quality should be systematically related to physical / biological and social features of the environment so that accurate predictions of the implications of environmental change can be made (Arthur *et al.*, 1977). Models, such as that of Shafer *et al.* (1969) represent a compromise between techniques which assess the effects of landscape elements on overall preference by summing evaluations of individual dimensions (descriptive methods) and techniques which emphasise the interactions of landscape elements by evaluating the scenic quality of the entire image (preference models); this compromise creates the quantitative holistic models such as the psychophysical and surrogate component models (Buhyoff and Riesenmann, 1979; Arthur *et al.*, 1977).

A prominent feature of this method is the use of a statistical technique known as multiple regression analysis to establish a mathematical relationship, between components of the landscape and the scenic preferences of observers. Weights for landscape components are estimated from preference ratings collected from the public. The weights, multiplied with a set of measurements of landscape components, produce an overall scenic quality score for the other similar landscapes. These predictive models have tended to be more a tool for research than for impact assessment. Their orientation is to predict scenic quality based on the presence of quantifiable landscape attributes (Palmer, 1983). Psychophysical modelling uses measurements of physical landscape features to predict people's preferences for the overall visual quality of the landscapes (Daniel and Vining, 1983).

Implicit in the psychophysical approach is the principle that a model of an observer's perceptive processes need not be complete in all possible respects in order to obtain meaningful results. Although this assumption is at variance with the Gestalt school of thought (regarding the sum of parts to make the whole), it has nevertheless been largely upheld by modern empirical psychophysical work (McAulay, 1988). Traditional psychophysical models, while not "classifying" landscapes, are developed to make predictions of scenic preference or visual quality from variables which are often selected for their predictive, rather than "genuine" explanatory ability (Buhyoff *et al.*, 1994). Surrogate component techniques are based on the identification of physical landscape components which can be compared with preference ratings. Visual management systems aim to be able to both predict and explain scenic preference; their essential purpose is the prediction and assessment of impacts resulting from potential management alternatives (Bishop and Hulse, 1994).

Psychophysical models

Psychophysical methods of landscape assessment seek to determine mathematical relationships between the physical characteristics of the landscape and the perceptual judgements of human observers (Daniel and Vining, 1983). The relationships of interest are those between physical features of the environment (e.g. topography, vegetation, water, etc.) and psychological

responses (typically judgements of preference, aesthetic value or scenic beauty). Landscape features such as land cover; land use, forest stand structure, and arrangement are measured and then statistically related to scenic quality judgements. Models such as paired comparisons, Likert scales, and sorting and ranking scales are a means to evaluate scenes quantitatively (Arthur *et al.*, 1977); multiple linear regressions has recently been the most commonly used techniques to determine these relationships (Buhyoff *et al.*, 1994).

Of all landscape assessments, these methods have been subjected to the most rigorous and extensive evaluation. They have been shown to be very sensitive to subtle landscape variations and psychophysical functions have proven very robust to changes in landscapes and in observers (Daniel and Vining, 1983). Relying on ordinal or interval scales of measurement, psychophysical methods have consistently been able to provide different landscape-quality assessments for landscapes that vary only subtly. However, they require the full range of scenes to be selected to represent all of the physical characteristics used as predictors of scenic beauty (Hull and Revell, 1989). They also provide good assessments of public perceptions of the relative scenic quality differences between landscapes (Buhyoff *et al.*, 1994) based on the assumption that the aesthetic judgements of public panels provide an appropriate measure of landscape quality (Daniel and Vining, 1983).

However, the models can be expensive and time consuming to develop and are restricted to a particular landscape type and to a specified viewer population and perspective; in the short term they are not highly efficient (Daniel and Vining, 1983). The very structure of these models is often a limiting factor in their explanatory value and wide generalisation (Buhyoff *et al.*, 1994).

Psychophysical assessments are useful in many management contexts - features such as quantitative precision, objectivity, and a basis in public perception and judgement are important. The assessments are not based on one expert's opinion, but reflect a measured consensus among observers representative of the public that views landscapes and is affected by management actions (Daniel and Vining, 1983).

Surrogate component models

The basis of component techniques is the identification and measurement of those physical components of the landscape which are regarded as surrogates of scenic quality. The individual components are isolated, their identification and measurement discussed and their combined utility within existing techniques evaluated. Because component ratings are compared to overall preference ratings in these models, the contribution of particular components to scenic beauty can be measured in terms of explained variance (Arthur *et al.*, 1977).

These components can be assigned to three groups in relation to their assumed importance in determining scenic quality. The major components comprise the landscape skeleton as expressed by macro relief (measured by terrain types), relative relief and water presence (measured by drainage density). To these can be added the minor but permanent components which are the variations of the macro forms at smaller scales. They are the overall variations such as surface texture and ruggedness, particular features such as the irregularity of two-dimensional outlines and three-dimensional forms, and the singularities such as isolated features. Finally, there are the

transitory components with regard to the characteristics of water bodies and surface textures (Crofts, 1975).

Visual Management Systems

Another approach to the evaluation/assessment of visual resources is the design-based classification/assessment. Visual management systems (VMS) are straightforward systems that use intuitive constructs and easily observable physical landscape attributes to arrive at landscape classification decisions. Because expert, or knowledge-based, computer systems are capable of carrying out reasoning and analysis functions in narrowly defined subject areas at proficiency levels approaching that of humane experts, they have characteristics that can be used to develop not just a method of predicting visual landscape quality but also a system that explains why certain levels of quality exist. In fact, the specification of knowledge may well be the most important contribution of a scenic quality assessment or prediction system (Buhyoff *et al.*, 1994).

Examples

The prolific work of Shafer and colleagues (Arthur *et al.*, 1977) is an example of quantitative holistic methodologies. They have measured areas, perimeters, and tones of the differentiated landscape zones of photographs and related them to preference rankings using factor analysis and multiple regression techniques (e.g. Shafer *et al.*, 1969; Shafer and Tooby, 1973; Brush and Shafer, 1975). Shafer's studies illustrate a sound and systematic approach to relating components to preferences (Arthur *et al.*, 1977). The Scenic Beauty Estimation (SBE) method requires that landscapes be observed and judged by panels of persons representative of targeted populations. To develop models using this system, a number of different landscapes must be assessed and their physical characteristics evaluated (Daniel and Vining, 1983). This can be done using colour photographs or slides (Arthur, 1977) or on-site at the landscapes (Schroeder and Daniel, 1981).

Psychophysical models have been developed for landscape vistas by relating measured characteristics of the vistas to scaled landscape preference (Daniel and Vining, 1983). These have often used colour slides of forest or panoramic views and gained preference ratings using paired-comparison formats (Buhyoff and Wellman, 1980; Buhyoff and Riesenmann, 1979). In Eleftheriadis and Tsalikidis's (1990) model, coastal landscape quality was expressed in terms of scenic beauty preferences of the resource users, and these preferences were related to quantitative measures of land use designations, and of forest stand and site characteristics. Carls (1974) used the landscape zones of Shafer *et al.* (1969) together with a people zone, and low and high development zones to look at the effects of people and man-induced conditions of preferences for outdoor recreation landscapes.

Economics of landscape evaluation

How do preference values determined from models relate to economic values of the same landscapes? Results of an exploratory study (Brush and Shafer, 1975) suggest that a consumer's evaluation of real estate that overlooks a given natural scene correlates highly with the scene's predicted preference scores. It should be possible to develop an equation that ties scenic preference values to economic land values. The results of such research should be useful in

benefit-cost and environmental impact analyses of the effect of proposed man-made changes in natural environments.

Traditional economic analyses have generally failed to account for unmarketed (nonpecuniary) resources, such as aesthetics. The effect of excluding nonpecuniaries from trade-off (economic) decisions is that they have entered the system as if they were free. Recognition of this problem has, in part, motivated attempts to evaluate scenic resources. If applied to aesthetic resources, redefinition would require putting a price on scenic beauty or charging for its "use". However, putting a price on aesthetic resources is probably not feasible for several reasons. First, aesthetic experiences are difficult to define; second, there is the problem of placing charges on aesthetic experiences (Arthur *et al.*, 1977).

Methods of scenic resource financial valuation

Several methods have been used to obtain values for scenic resources. "Willingness-to-pay" values (how much will a commuter pay to preserve the trees), revealed demand (does he take a different highway?) and opinion tallies (does he complain to his MP?) are only a few of the methods used (Arthur *et al.*, 1977). Opinion tallies often result in undervaluation. Revealed demand is complicated by the necessity of identifying all of the variables acting on the situation.

The hedonic price method (HPM) is a less subjective way of scoring landscape components; components of landscape are valued against people's willingness to pay to live in particular types of landscape, defined as comprising of different bundles of components (Willis and Garrod, 1993). HPM is a process of constrained maximisation in which systems of equations involving both prices and quantities for the composite commodity and its attributes are constructed and then solved (Price, 1994).

The travel cost method (TCM) uses a sample of visitors to a site which embodies desired environmental attributes and asks them factual questions about the origin of their journey to the site, their mode of transport and perhaps about other costs incurred and their own socio-demographic characteristics (Bergin and Price, 1994).

Contingent Valuation Technique and Willingness-to-Pay

Contingent valuation techniques (CVT) in landscape evaluation are seen as a natural evolution from landscape evaluation methods based on the scoring of landscape components and other public preference techniques such as landscape ranking. By valuing landscape as an entity, CVT avoids many of the problems, such as those of separability and collinearity, often associated with travel cost and hedonic price methods of landscape valuation (Willis and Garrod, 1993).

Willingness-to-pay (WTP) studies can assist in valuing today's landscape; they also attempt to value the benefits which residents and visitors might derive from alternative landscapes which could arise at some time in the future (Willis and Garrod, 1993). WTP's linearity means that it is a linear or other predetermined function of the quantity of the feature in the landscape. However, evidence suggests that the impact of a landscape feature does not increase in proportion to its size (Willis and Garrod, 1993). Unfortunately, WTP values are often too high (Arthur *et al.*,

1977) and WTP to gain a commodity is generally less than willingness to accept compensation for losing it (Price, 1994).

Limitation of Evaluation

There has often been lacking of clear notion of the nature of evaluation and the purpose it is intended to serve, hence the quality of evaluation processes and their effectiveness as an aid to decision making are often restricted. A number of factors limit the quality of contemporary practices:

- Evaluation and Data Collection
- Evaluation and Design
- Evaluation and Equity Consideration
- Evaluation and Testing of Alternatives
- Evaluation and Decision Taking

Site Selection and Site Planning

Defining a Site

A site may be defined in one of two ways:

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- as a parent site, i.e. encompassing the entire area of land proposed for development;
- as a dwelling site, i.e. the area of land set aside for the exclusive use of a dwelling.

Where a distinction is not made between the two, then the criteria should be regarded as applying to both.

Site planning

Site Planning Objectives

To achieve a coherent site layout that provides a pleasant, attractive, manageable, resource-efficient and sustainable living environment. Successful site planning stems from thorough analysis of the site and its development context. Design skills are then required to balance factors affecting site layout. To achieve a pleasant and attractive living environment for residents and their neighbours, site planning should ensure that a development:

- is compatible with the desired character of the locality, and considers the amenity of neighbours;
- takes advantage of the site's best attributes;
- satisfies reasonable privacy, security and other user needs;
- makes good use of outdoor space;
- is environmentally sensitive;
- is attractive and functions effectively.

Site planning in landscape architecture and architecture refers to the organizational stage of the landscape design process. It involves the organization of land use zoning, access, circulation, privacy, security, shelter, land drainage, and other factors. This is done by arranging the compositional elements of landform, planting, water, buildings and paving and building.

Site planning generally begins by assessing a potential site for development through site analysis. Information about slope, soils, hydrology, vegetation, parcel ownership, orientation, etc. are assessed and mapped. By determining areas that are poor for development (such as floodplain or steep slopes) and better for development, the planner or architect can assess optimal location and design a structure that works within this space.

Site planning is a process that involves developing and implementing a specific organizational plan for an interior or exterior space. Landscape architects develop site plans for the grounds surrounding a home or place of business. Commercial architects perform a similar function when designing the interior placement of key elements of the building construction, such as the placement of artificial and natural lighting, entry and exit options, and any other amenities that are intended to provide function as well as form.

However, site planning is not just about coming up with a workable layout for the space. It also involves making sure the area is designed so that the space will comply with local laws that relate to zoning, construction, and any other regulations that govern what can and cannot be included. From this perspective, the architect must be very familiar with all laws that apply to the project and make sure everything meets with the local codes. Failure to do so can result in the loss of a great deal of time and money, as well as the possibility of fines or other actions on the part of local authorities.

The process of site planning also involves taking into consideration any physical attributes of the area that is to be developed in some manner. This can involve such important details as the type of soil and vegetation that is native to the area, whether or not the property is located in a floodplain, and what elements would have to be acquired to modify the terrain successfully. In the case of green landscape design, the challenge is not so much how to modify the land to fit the design, but how to create a design that is in harmony with the land itself.

Professionals who make use of landscape architecture know that site planning is not a process that is accomplished in a couple of hours. More commonly, site planners will spend weeks or even months to create the ideal exterior plan for the site. The same is true for architects as they design the layout of interior spaces. At all times, practical aspects such as safety must be

accounted for, while also seeking to create the most visually appealing and practical design possible.

While site planning is more often thought to apply to new construction, the same basic principles can also be applied to the renovation of existing interior and exterior spaces. For example, a commercial site planner may help a retail chain to come up with a plan to modify existing retail space so that it mirrors the design that is common to all the chain's retail stores. The site planner may also help to redesign the configuration of outdoor eating around a restaurant, landscaping the parking area with foliage to soften the harsh lines of asphalt, or to modify the exterior and grounds to better reflect the atmosphere that the establishment wishes to cultivate.

Site Planning and Design

The landscape is in a constant state of flux (change). The patterns and rates of growth of land development often seem to have a life of their own. As growth occurs in an area, physical land development frequently seems to spring up overnight. Each project or facility is constructed in accordance with applicable local regulations. Since this new development probably occurs in a piecemeal fashion, often on relatively small areas, it is usually considered to be of little significance in and of itself. However, the composite impact of several of these facilities upon the surrounding environment may be quite significant.

The development of land for any use involves a range of issues from environmental concerns, to the compatibility of uses, to infrastructure coordination, to detailed consideration for size, character and materials for construction of facilities. It is safe to say that sensible future growth and development mandates that we approach site planning and design of the land for that growth with an eye on all of these issues. Land use planners often look at general land use issues with discussions centred on two questions: a) how do we tend to organize different human activities? ; and then b) How do we regulate or control these activities from the standpoint of physical planning and design concerns? This second question will be answered by means of an overview of traditional legal mechanisms and procedures.

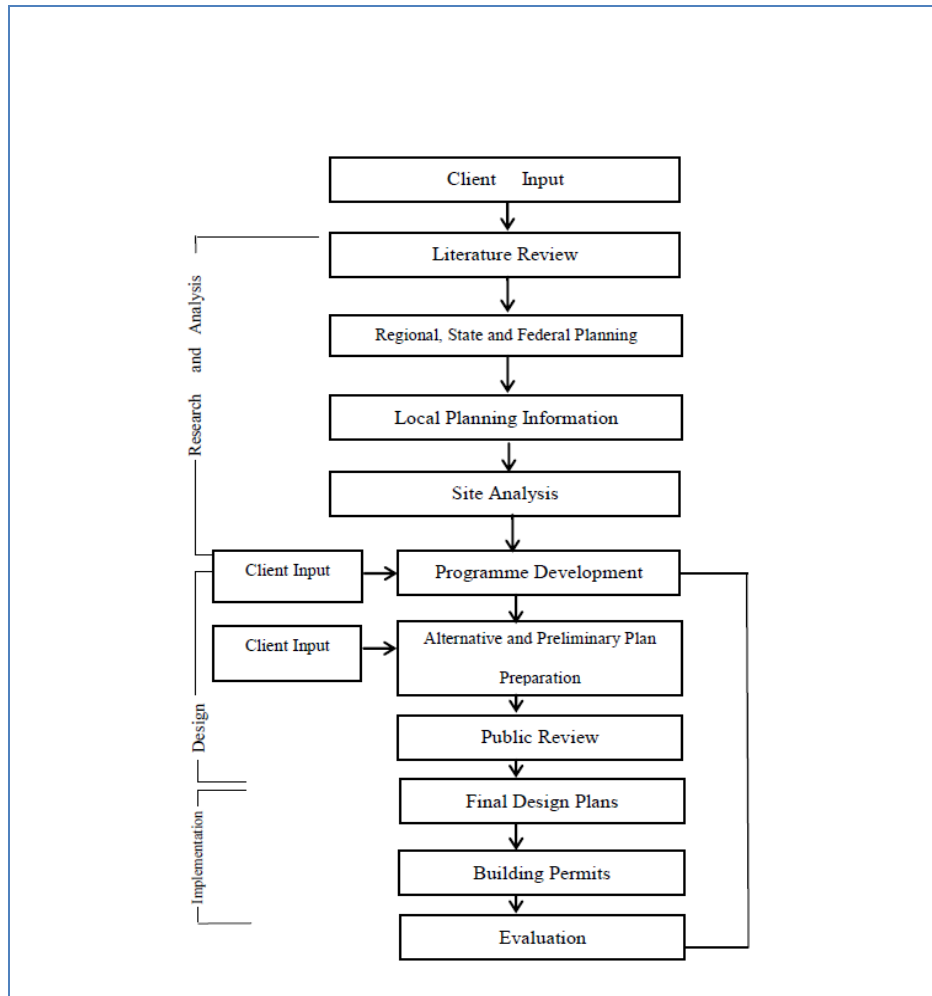
The major thrust of site planning and design refers to specific site- or project-level issues. These must be put into a larger regional context to make more specific decisions. We will examine the

traditional planning and design process, including research and analysis, design development, and implementation. The presentation of this process will be supplemented with illustrations to clearly demonstrate the considerations and interrelationships that are required to bring a physical land use development from concept to reality.

Landscape and Site Planning Process

Planning and design occur as a process, by which we mean that they follow a logical sequence of actions or events that must be carried out to arrive at a viable solution. It is a multi-disciplinary problem-solving operation often involving architects, landscape architects and engineers, and frequently may require input from physical scientists as well to address environmental issues. It requires a logical objectivity for some steps, but also allows room for subjective design interpretation at others.

The process of landscape design and site planning normally begins with the conception of an idea by the client to envelop a site for specific purpose economic, social, technological or cultural in nature. It begins with broad information gathering and ends with specific detailed design drawings. The process involves three basic stages, namely: analysis, design and implementation. The chart below indicates a planning process specific of the site such as physical site characteristics, location, and community criteria- may modify the process.



Landscape Design Process: Concept

Client Input:

The first step is the contact between the client and the planner. Although the land planner should be involved as early as possible in the making process, the client may already have some broad objectives based on financial capabilities and market feasibilities. It is advisable that the client retain the same site planner for assistance in selecting site that meets the client's basic aims. The planner should also obtain the entire client's data relative to the site planning for the site.

Literature Review:

A review of relevant literature on the subject may be in order if the site planner has not had exposure to all aspect of site planning. It is advisable for the planner to do specific and extensive research especially in new areas of design.

Regional, State and Federal Planning:

The site planning process usually starts at the regional level. In many parts of the country, Regional and Country Planning agencies were established for the purpose of research and planning regional issues such as water management, transportation, population studies, pollution control, and other regional environmental concerns. Many communities have adopted plans that establish regional guidelines relative to land use planning. The site planner should find out those regional issues that are pertinent to the design of the site.

Some projects may be under state and or national criteria, although this is not a common occurrence. Adopted state plans may address broad issues applicable to large sites or impose constraints on sites involving issues of state-wide concern.

Local Planning Information:

This is the stage where the site planner becomes more involved in collecting local planning information that will influence decisions made in the site planning process. Personal contact with local planning and zoning agencies is important in order to clearly comprehend local criteria. The following is the list of information that should be reviewed:

- a. Planning Documents:** Many communities have adopted comprehensive planning that will indicate in general terms, and in some instances specific terms, the particular land use and intensity of the site. Valuable information on the availability and /or phasing of public services and utilities, environmental criteria, traffic planning information and population trends can be found in most comprehensive plans. In addition to the comprehensive plan, some communities adopt neighbourhood or area studies that refine the comprehensive plan as it relates to subareas.
- b. Zoning:** The zoning on a tract of land determines specifically the intensity and types of land use that can occur. If the existing zoning does not permit the type of land use and intensity planned for the project, a zoning change will be required.
- c. Public Services and Utilities:** In most cases these information may be found in the comprehensive plan or neighbourhood study, the critical nature of the availability of these public facilities may require additional research, specifically in terms of the following:
 1. *Availability of public sewer services, access to trunk lines, capacity of trunk lines, and availability of increase in flow.*
 2. *Availability of public water, with the same basic research approach as indicated for the sewer services determination.*
 3. *Local and state regulations on freshwater wells and septic tanks*
 4. *Access to public roads, existing and projected carrying capacity, and levels of services of the roads.*
 5. *Availability and capacity of schools and other public facilities such as parks and libraries.*

Land Uses

Human development impacts upon all facets of the environment. While most apparent in urbanized areas, there is literally no place on the globe that does not bear some evidence of the impact of humankind. Consequently, all new development and redevelopment must be undertaken with consideration of its resultant effect on the environment as well as on adjacent existing development. The reality of this fact underscores the importance for planning and design principles and controls to insure compatibility and to minimize negative impacts as this development occurs. While this may seem to be an obvious understatement it is not the mentality with which most growth has occurred in most parts of the world including Nigeria. In addition, there is a steadily growing change in philosophy apparent in modern society that reflects a heightened awareness and concern for the environment.

It may be useful to begin by looking at the primary land use categories. These encompass such basic functions as residential, commercial, industrial, recreational, institutional, and agricultural uses. There are some general characteristics of each of these uses that define their environmental impacts as well as potential compatibility issues. We can discuss about the places or land where we live, where we spend, where we work, and where we relax. This is a good way to characterize development, in terms of the major activities that occupy our day-to-day existence, and to which different parcels of land are devoted. There are some commonalities of physical elements or facilities and the environmental impacts of the different land uses that manifest themselves in the resultant physical site planning and design development requirements within each use category. We will also see that the tendency to separate each use within distinct areas or zones sometimes creates unnecessary duplication as well as some functional and environmental conflicts. This speaks to the importance of comprehensive planning to ensure that individual decisions are made within the context of the “big picture.”

Land Use Relationships

General Environmental Considerations and Compatibility Issues

Any physical development is going to have some environmental impact. The degree or extent of that impact is dependent upon such factors as the category of use, the intensity of the development, and the physical characteristics of the site. For example, the construction of

infrastructures or facilities (structures, pavement, etc.) on a site affects the surface permeability and hence increases the amount of surface run-off. This can have an impact upon the water table and on adjacent and/or down-stream sites.

Site preparation may require removal of existing vegetation and always requires the re-grading of the ground surface, sometimes dramatically, to accommodate the development. This, in turn, may increase soil erosion, stream sedimentation, and disrupt the natural character of a site and its surroundings. Removal of vegetation may also expose a site and its surroundings to wind and sun from which they were previously protected. Disruption of natural site patterns may also have an impact upon wildlife habitats. The kinds of physical changes mentioned above may also result in significant visual impacts upon a site and its surroundings. The aesthetic response to these visual impacts may be very instrumental in the acceptance of or resistance to new development within its surrounding context.

The range of land uses is as extensive as human experience, covering residential, industrial, commercial, and recreational activities. The nature of particular land uses suggests a greater environmental impact for some than for others, at least in respect to certain criteria. For example, industrial site facilities can usually be expected to require more extensive site development than many forms of residential development. On the other hand, different uses, such as certain types of recreational facilities, may be assumed to be low-impact. This may be somewhat misleading however. In some cases a park development may impose a greater impact upon the environment than a residential or a commercial facility by virtue of its demand, from sewage treatment, to traffic generation, to its impact on air and water quality.

Most land use controls consider compatibility in establishing land use districts. However, the focus frequently is on suitability of adjacent uses to each other, rather than on the environmental compatibility of the given land use. There are some ordinances that do delineate environmentally sensitive areas such as steep slopes, flood plains, coastal zones, ridgelines, woodlands, or conservation districts. Development options are based upon the limitations imposed by the particular physical properties or conditions.

Legal Mechanisms

Comprehensive Plan

A comprehensive or master plan is a written and graphic document that serves as a guide for community growth. It provides the basis for policies and regulations affecting growth and establishes a framework for long-range planning. Although specific requirements vary from one state to another, since it frequently serves as the legal basis for land use controls, the comprehensive plan must include certain components. A comprehensive plan include a statement of goals and objectives, land use and housing plans, a circulation plan, a community facilities plan, a statement of the interrelationships between the various plan elements and with surrounding communities, and a discussion of implementation strategies.

This language reflects the key elements that, among others, identify as essential for the comprehensive plan to be effective:

- It must consider the broad social, economic, political and environmental issues.
- It should address issues of policies and strategies by which they might be implemented. It must also provide a graphic indication of the proposed spatial organization of that implementation.

The end result of the process of developing a comprehensive plan is “a *blueprint for the future.*” Through its implementation, the jurisdiction will be able to meet the goals and objectives outlined in accordance with the specified plan and strategies. An important cautionary reminder however, is that it is not a static document. Since conditions and issues are constantly changing, the plan must be reviewed and updated frequently to reflect the current needs and situation.

Land Use Controls

The term land use controls refers to restrictions on the use of land by the property owner for the common good. Traditionally, such restrictions may be imposed through either common or statutory law actions. The former is essentially a reactive, case by case response driven by very specific circumstances. For example, the common law concept of nuisance is defined as “*an unreasonable interference by one party with another’s enjoyment of his or her land.*”

The operation of a company may result in air or noise pollution, diminishing the value of a neighbouring parcel. If the neighbour takes the offending company to court, the result might be an injunction of the offending activity or monetary compensation to the neighbouring property owner. This is a response to a specific set of circumstances. Legislation and regulation on the other hand provide a more formal, encompassing approach. In this particular instance, zoning

would likely separate the incompatible land uses, precluding the offending impact from arising in the first place.

Land use planning

Land use planning implies an orderly process by which the use of land within a municipality, a county, or some other jurisdiction is regulated. To be effective, land use planning should be based upon a comprehensive plan, which we have defined as long-term studies of the jurisdiction, considering broad social, economic, environmental, and political issues. The land use controls (e.g., zoning, subdivision regulations, etc.) are the legal mechanisms by which the patterns of human growth and activities are directed.

a). Zoning – Zoning is a form of police power which is delegated by the states to local governments through enabling legislation to ensure the welfare of the community by regulating the most appropriate use of the land. In many states a comprehensive plan is a legal prerequisite for a zoning ordinance. Accordingly, the comprehensive plan will delineate where different land uses or activities are currently located within the community and where they are projected to be located in the future. The zoning ordinance is the mechanism by which new development is controlled as growth occurs. As such, zoning is a classification of land uses that limits what activities can or cannot take place on a parcel by establishing a range of development options.

The traditional concept behind zoning is to separate potential conflicts among incompatible land uses. There may be a variable number of zones designated as part of the zoning ordinance, depending upon the size and complexity of a given city or jurisdiction. Typically, the zoning ordinance will include the following categories of use: residential, commercial, industrial, office, public/institutional, and agricultural. There may be several subcategories as well such as detached or attached residential zones of various size or density or heavy or light industrial uses. Each zone is regulated by a number of conditions in addition to use including density, or physical restrictions such as height, area coverage, parking requirements, screening, etc. In addition, as indicated above, there may be zones based upon environmental conditions such as open space, flood plains, and steep slopes.

Zoning can be a valuable tool for directing and controlling growth within a community. However, for it to be effective there needs to be an element of stability or consistency. Some criticisms have been directed to the political vulnerability of zoning and the ease with which variances or spot zoning may diminish its potential impact. A variance is permitted when an “unnecessary hardship” would result to the property owner unless a land use is allowed that varies from those permitted under the zoning regulation.

Spot zoning refers to the situation arising when an amendment is proposed to a zoning ordinance, modifying its application to a particular property. The court’s rather strong support in linking zoning to a comprehensive plan has diminished some of this concern over stability since it validates the importance of the larger context and how community objectives have a greater impact than those addressing individual parcels of land. When utilized as a tool for achieving planning goals rather than serving as the plan itself, zoning has proven to have positive merit.

We should also make some reference to the growing use of restrictive covenants . These, also known as deed restrictions, refer to private land use control mechanisms that supplement or even replace zoning regulations. They are often employed in new housing developments as a means of providing property value protection for adjacent landowners by placing restrictions on the use of property. When a person purchases a piece of property, he or she agrees to certain restrictions in terms of what can be done with that property. The restrictive covenants may provide more stringent requirements above those imposed by the zoning restrictions. For example, covenants might place limitations on the density (e.g., only single family detached units in a zone allowing attached housing) or they might increase the building set back lines beyond the zoning limits.

Covenants may also be included as a means to enhance property value protection requirements. e.g., they may specify minimum building square footage requirements, limitations in terms of acceptable construction materials, or specifications on architectural styles. They may also be used to address environmental protection issues, relating to amounts of grading allowed, acceptable fertilizers, well and septic requirements, vehicle storage, etc. Legally, they must be diligently overseen to be effectively enforceable. In essence, restrictive covenants require “self-policing” by the members of the community to whom the deed restrictions apply.

Just as there is a legal requirement for a comprehensive plan as the basis for land use controls, so there is a theoretical requirement for comprehensive planning as the basis for sound site design. By virtue of its name, comprehensive land use planning suggests a broad approach to the process of new development or expansion of existing development within the environment on the basis of a range of considerations including economic, social and physical factors among others. It certainly implies planning within a larger context beyond the individual site.

In fact, comprehensive land use planning is a complementary process. “An understanding of landscape at the regional scale is an essential prerequisite to smaller scale site planning and detailed landscape design. Conversely many of the criteria for land use in regional land use planning should be based on an understanding of construction and grading techniques used in site planning”. The essence of this discussion is the importance of planning and designs within a context rather than in a vacuum.

Site Survey

Site survey is the collection of detailed primary and secondary information not only in respect of the physical characteristics of the site but also of all other relevant information and data on the factors and influences affecting the site and its development by on-site survey through visits. It involves collation of data on the measurable quantities and qualities of the site. The nature of information collected depends on the scale of the projects and for what purpose the site is required. Information required can be classified into the following:

- i) Geographical elements such as information on location, landform, and physiology of the site and environmental hazard;
- ii) Information on infrastructural facilities including road networks and access, telephone, gas pipelines, oil pipelines, and solid waste disposal;
- iii) Situation on adjoining properties, artefacts and historical objects, land ownership and tenure system, cultural and sociological context of the environment and users requirements
- iv) The visual qualities of the site should be analyzed in terms possible visual links, interacting factors such as slope and drainage relationship, vegetation and climate, soil and vegetation.

Types of Survey

Site survey involves two stages namely the preliminary survey and the detailed survey.

Preliminary Survey:

Preliminary (reconnaissance) survey is to identify the setting, location and general character of site. It saves time during the final survey. It involves personal inspection of the site by the landscape designer. The Ordinance survey contoured map of the site is usually helpful and should be taken to the site. This will show the basic feature of the existing buildings, boundaries, access etc. A camera and sketch book is useful tools for recording purposeful image and data on the site. The preliminary survey is useful in the identification of the topography, soil, vegetation, drainage, building and roads and a visual appraisal of the view into and out of the site.

Detailed Survey:

This involves the collection of more detailed information than in the preliminary survey. The information collected is recorded cartographically, diagrammatically or pictorially. The information required may be obtained from published maps and data. Maps of different scales (small and large scales: 1: 1250, 1: 25000, 1:50,000) are useful at this stage. The architect's and engineer's drawings may also provide useful information. Meteorological constraints may also provide specialist information on weather and climate. Small scale maps of 1:1,000,000, 1:250,000 and 1:100,000 are produced on a given broad basis of agricultural qualities, climate, vegetation, hydrology, topography, soil, rainfall etc.

Photographic surveys are also made to provide additional information on different sites. Photographic maps could be one or a combination of the following types:

Terrestrial photographs usually taken from the ground with camera axis horizontal,

Aerial oblique photographs taken from aircraft with the axis of the camera inclined to the vertical given a bird eye view of the site,

Vertical photograph taken from aircraft in level flight as a mosaic and printed to a scale which will coincide with the maps being used on a project.

Other details should include topography, slopes, climate, ownership, geology, soil, vegetation, services, and aesthetics amongst others.

Topography

The topographical map is the basic base map required for any meaningful landscape site analysis. It shows the contour structure, shape of the land, other physical details and ground forms. It is analyzed to obtain the site scenery, contour patterns, slopes access and communication. The contour pattern will give us information on the relief and height of the land, the shape and form of hills and valleys, angles and directions of slopes.

Slope Analysis

From the contour a slope analysis diagram may be produced showing the various textural traits and slopes of varying degrees. This will enable us to see and appreciate easily the nature of slopes on the site. The slope analysis will allow the designer clearly areas within acceptable limits for development without regarding.

Site Boundaries and Ownership

There is the need to mark out and have perimeter investigation of the site boundaries and land ownership. This will include the precise details about site deeds, leasing contracts, easements, public right of way and tenural system. The client's solicitors and the land registry should be consulted.

Site Analysis (Site Inventory)

Site analysis is an inventory completed as a preparatory step to site planning, a form of urban planning which involves research, analysis, and synthesis. It primarily deals with basic data as it relates to a specific site. The purpose of the site analysis is to record and evaluate information on the site and its surroundings, and to use this evaluation in the design response. Site analysis is more than just collecting information about the site. The site analysis should identify issues that will influence the design of a development in order to make a considered response to both site opportunities and constraints, to provide a good quality living environment, and respect, acknowledge and improve the character of the area. The site analysis results in a site context plan, which is then used as a prompt in developing the design for the site. The site analysis should provide the basis for the design response. A site analysis is not a justification for a preconceived design. A good site analysis will be a combination of facts and influences for development of an appropriate design response.

Site Analysis is an element in site planning and design. The first step in working out a good working landscape design is preparing a Plot Plan. The site analysis establishes the development context, identifying and explaining graphically:

- the key influences on the design;
- how the proposed dwellings will relate to each other and to the immediate surroundings.

It shows the uses of neighbouring sites, and potential constraints relating to overlooking, overshadowing, view retention, building bulk, landscaping and screening between the development and adjoining sites.

Site analysis is one of the site planner's major responsibilities. All of the on and off-site environmental design determinants must be evaluated and synthesized during site analysis process. The site analysis processes follow the pattern below:

- a. Programme Development:** At this stage, the background research and site analysis are combined with client input and synthesized into a set of site development concepts and strategies. Elements that form the basis for programme development

include market and financial criteria, federal, state, regional and local planning information, development costs, and the client's basic objectives, combined with site opportunities and constraints as developed in the synthesis of environmental site determines. Trade-offs and a balancing of the various determinants may need to be made in order to develop an appropriate approach to site development.

Considerations of dwelling unit types, density, marketing, phasing, and other similar criteria, as well as graphic studies of the site constitute the programme. Graphic representations depicting the design concepts should be clearly developed and presented to the client who may have inputs to the process. A close working relationship between the architect and the site planner is important at the design phase of site development process to develop architectural solutions that respond to the site characteristics.

- b. Alternative and Preliminary Plan Preparation:** Once the programme is established and accepted by the client, alternative design solutions that meet the programme objectives, including basic zoning criteria are developed. The accepted alternative is further developed into the preliminary plan and this plan should be a relatively detailed plan showing all spatial relationships, landscaping and similar information.
- c. Public Review:** If a zone change is required to implement the plan, some form of public review. Some communities will require substantial data such as impact statements and other graphic exhibits, while others may require only an application for zone change.
- d. Final Design Plan:** At this stage, the preliminary plan is further refined to include any information that may be agreed upon at a public hearing. Final design plans including landscape plans and all requires dimensioning must be provided in the final design. Furthermore, all drawings that are usually prepared by the surveyor or engineer, such as plans, utilities, street, and drainage plans must be prepared. Upon approval, final design is recorded in public records in form of plans.

- e. **Building Permits:** Building permits may be issued when all final documents are recorded and architectural drawings have been reviewed and approved in accordance with local building codes. Depending on the agreements between the client and the site planner, the site planner may continue his or her services into the supervision of the site development.

- f. **Evaluation:** This stage may come years later after the community has become a reality. The purpose is to review the process and the resulting programme and assess it in the context of the community as it exists. It provides the site planner with valuable data for future planning programmes.

An analysis of the street character may also be necessary. It can provide clues for successful integration, and may influence site layout, landscape, alignment of buildings and the design of the proposed development in relation to the streetscape. A separate Site Analysis Plan is recommended as part of the approval process for larger developments. For smaller projects, the site analysis information can form part of the Site Development Plan. It is worth noting that a Site Analysis Plan is not a document where unimportant detail should override its purpose, that is, to explain the relationship of proposed dwellings with each other and with the environment.

A site analysis must be to scale and should identify development opportunities and constraints. It should influence the design to minimize negative impacts on the amenity of adjoining developments and to complement neighbourhood character.

A Site Analysis is just taking a little time to study your landscape site or property and analyze the basic features found there. It is a brief description of your property, listing its assets and liabilities by area, as well as environmental factors that may affect a final design (i.e. sun angle, wind direction, pleasant views, and unpleasant views).

A Site Analysis helps understand unique problems associated with the property and how they can be best used to create a functional and enjoyable outdoor living space. The Site Analysis is like a road map of your property as it relates to the seasons. When done, the Site Analysis will show the direction and angle of the sun throughout the year, interesting views of the house's exterior,

as well as views from inside the house. It also considers views you have of your neighbours as well as what your neighbours can or can't see of you.

The Site Analysis includes prevailing wind directions across the property, and notes if those winds are sufficiently strong enough that they may need to be diverted in some way to add comfort to your outdoor living areas. In other words, a Site Analysis should include important items that should be addressed in creating an overall landscape design. For example, if you don't want nosy neighbours looking at you when you sunbathe in the backyard, then maybe privacy plantings may be in order. If there's an unpleasant view of a parking lot to one side, then ways of hiding that should be considered. Likewise, if you have a view of the lake but can only see it in the winter when the leaves have dropped off, you probably wouldn't want to include tall evergreens that would block the view permanently in a few years. Of course, with every landscape and design being unique, there may be other considerations not mentioned here.

- ❖ **Existing plants and trees** and their relation to the landscaping and your new design should be noted. Do some trees need to be removed or changed? Will shade from existing trees affect plant selection, structure placement, pond placement, or activity areas? Are there areas where you'll want more shade?
- ❖ **Observe views** from the outside of the house looking in and (most folks forget this one) from the inside looking out. Your view from inside the house can be just as pleasing as being outside in the garden. If you want to see it, consider placement of large structures and plantings. Cute little plants grow up to be big plants. Can existing or newly planted shrubs, plants, or trees be used to either enhance or block out certain views? Or noise? Do you need more protection or privacy in the front or back yard?
- ❖ **Consider the wind current and strength** in your landscaping. Do you need plants or other elements such as walls or fences to be used as wind screens?
- ❖ **Do slopes or land elevations** need to be changed to accommodate for water drainage? Will steps or terracing need to be installed for slope or elevation changes?

- ❖ **Locate all utilities** and mark them on your plot map. Always, always, always call before you dig.
- ❖ **What are your needs as a person or family?** Functional and practical landscaping should be considered an outdoor extension of your home. There should be activity areas outside just as there are inside your home. These areas might include a living area, play area for the kids, work area, public or entertaining area, entrances, and flower or vegetable garden areas. The outdoor areas should be natural extensions of your indoor areas. For instance, the work area should extend off of the garage or utility room and the entertainment area should extend off of the kitchen or family living room.
- ❖ **Vehicle access** to the back parts of the yard should be considered. Should a large gate be installed in the back fence?
- ❖ **Maintenance?** Do you want low, medium, or high maintenance landscaping? Do you want shrubs you'll have to trim, plants to prune, leaves to clean up, a lawn to mow and water, a pool or pond to clean, a sprinkler system, etc.?
- ❖ **Do you need more lawn area?** Less lawn? How much? For what?
- ❖ **Storage space** for gardening equipment, trash, patio furniture, toys and play equipment?
- ❖ Fountains, waterfalls, pools or ponds? Consider the spaces needed for these and design around them or include them in the plan now.

Site analysis and design response

At its most exhaustive, a site analysis should document the site in terms of the matters raised under the issues list in the table below.

ISSUE	POINTS TO CONSIDER
In relation to the site: <ul style="list-style-type: none">Orientation, direction and angle of slope	How does the sun move across the site? How / where might buildings be sited to allow sunlight into living areas and private open spaces? Do neighbouring buildings overshadow the site? Does the site slope represent any design challenges? E.g. structurally and/or maintenance of views from adjoining buildings. At what points on the mountain will there be long range views to your building?
<ul style="list-style-type: none">Trees and other significant vegetation	Is the light on your site affected by any significant tree or topographical feature on you site or abutting sites? Are there any trees or other significant vegetation on site (including shrubs, grasses etc). Are there any opportunities to include these assets as features of the development?
<ul style="list-style-type: none">Buildings	Indicate existing buildings on your site. Are they worth retaining and incorporating in the development?
<ul style="list-style-type: none">Access points	Where is the potential access to your site? Where do neighbours access their site? What are the street and on-site parking conditions? Are there any skier or pedestrian ways that need to be taken into account?
<ul style="list-style-type: none">Drainage and services	Note the location of services, including street poles, pits, garbage storage sheds and landscaping. Are there any natural springs or watercourses on the site? Is there any opportunity to retain natural drainage within the site?
<ul style="list-style-type: none">Boundaries and easements	Where are the boundaries and easements? Will the development be contained within the lease boundaries with setbacks?
<ul style="list-style-type: none">Any other notable features or characteristics of the site	

ISSUE	POINTS TO CONSIDER
<p>In relation to the surrounding area:</p> <ul style="list-style-type: none"> ▪ The location and use of surrounding buildings 	<p>What height are the buildings?</p> <p>What implications are there for your development, for example in relation to limiting potential overlooking or overshadowing, protection of views or setbacks for landscaping?</p>
<ul style="list-style-type: none"> ▪ The difference in levels between the site and surrounding properties 	<p>Can you use the slope to provide aspect or views for your site, or to assist basement parking?</p> <p>Does the slope mean limiting the height of your development in order to be a 'good neighbour'?</p>
<ul style="list-style-type: none"> ▪ Balconies, decks and habitable room windows for nearby properties 	<p>Where are private areas, for example, habitable room windows and balconies/decks?</p> <p>What implication does their location have for your design?</p>
<ul style="list-style-type: none"> ▪ Solar access enjoyed by surrounding residents 	<p>How can your design respond to maintain solar access?</p>
<ul style="list-style-type: none"> ▪ Major and significant vegetation on surrounding properties 	<p>Are there any significant off site trees/vegetation that could be used to advantage in your design?</p>
<ul style="list-style-type: none"> ▪ The built form, scale and character of surrounding and nearby development 	<p>Is there any obvious character to the streetscape or village in terms of height, bulk, setback, building detailing or vegetation character that can help influence or guide your design response?</p>

The design response

Use your site analysis as a prompt in developing the design for the site. The questions and answers raised in the site analysis will also provide a useful check at the end of the design process. Your design response should explain how the development will relate to other dwellings on the site, and to the existing neighbourhood character.

Key steps in developing your design response

- ✓ Decide what features of the site you are able to take advantage of, which enhances your development.
- ✓ Discuss your proposed building envelope and its implications with the Planning office before you start your detailed design.
- ✓ Develop the detailed plans, taking into account the implications from your site analysis.
- ✓ Test your design response against the site analysis. Have you adequately resolved the key issues?

Environmental features to consider:

Sun and shade during different times and season

The way the sun affects your house and site throughout the seasons will greatly influence the overall design. By knowing the direction of the sun at different times of the year, you can determine where trees will be needed to provide shade in the summer and where you will need open areas to allow the winter sun's rays to heat the house and outdoor living areas. Knowing that the afternoon sun is much hotter than the morning sun is also a factor to consider.

Prevailing wind directions at different times of the day and perhaps different seasons

Prevailing winter winds can help you determine where to locate a windbreak (which can be important if you live in the mountains). You'll also probably not want to block summer breezes from reaching your primary outdoor living spaces in warm climates.

Local sights and sounds

Do a property walk, noting what you see in various directions. Standing on the front step, do you have a pleasant view? What do you see from the backyard deck? Note recurring objectionable noises. Also note the good and bad views and the sources of noise on the Site Analysis. Think about views looking in at your property from outside the property— what your neighbours will be seeing as they look in your direction.

Current soil conditions

Urban soils may include building leftovers such as mortar, bricks, sheet rock, plywood, and pieces of plastic. Many new housing developments had most of the existing top soil removing or buried by excavation materials during construction and levelling. Sod was then laid on top of the compacted sterile soil and makes for a poor growing structure.

Soil content may be clay, which needs both physical and chemical amendments before trees and shrubs can be planted and expected to thrive. Other parts of the country are extremely sandy and will need organic matter added to retain moisture.

Have soil tests made and note the soil type and topsoil depth on your Site Analysis. (County Extension Centres can provide information on soil testing.) It may be necessary to add top soil for new garden beds, both to improve the existing soil and raise the beds.

Note poorly drained areas that may need underground drainage. Does water stand in low areas after a rain? Do these areas remain wet for several days? Is the soil compacted there? Does grass have trouble growing?

If you live in an area that requires frequent supplemental watering, you might want to consider a sprinkler installation. Include on the Site Analysis areas that might cause problems with such an installation such as large tree roots.

In a residential landscape plan, site analysis is a very important part of the process. Site Analysis is compiling and synthesizing information found during the site survey that you will use in the development of your landscape plan. Very often this information is then presented in a visual form, and you can read more about this in the next article.

During this step in the planning process you will be asking yourself some important questions. Some of the questions you want to ask when you perform your site analysis are:

What kind of neighbourhood do you live in?

Urban, rural, suburban landscapes each have a character that should be considered, as well as the challenges each present. We might like to forget the neighbours, but most of us have to consider the consequences of our decisions on the others in our environment.

What style is the house?

Pleasing landscapes are not only a personal preference. Whether it's formal or informal, matching the landscape to the architectural style of your home will make it feel more harmonious.

Are you replacing or newly installing a landscape?

Each is challenging in different ways. Remember to work with the existing environment as much as possible.

What is your landscape budget?

Will you need to stage the project to meet financial constraints? Trying to achieve too much with too little in too short a time frame can lead to making costly mistakes for your bottom line and the environment.

What will the spaces in the landscape be used for?

A busy young family will require a very different landscape than a retired couple. You can decide what and where things might go during the site analysis.

How much lawn is required?

Sustainable landscapes utilize lawns for recreational needs and visual relief. Deciding how much is, but not too much will keep you in the green.

What is the landscape budget?

Estimating costs is the best way to decide what must happen and in what order. Going green will really help save you money in the long run, so don't skimp on the essentials.

Who maintains the landscape?

Knowing who will be doing the required maintenance can help you decide how to plan your landscape and how much landscape to plan.

Layout Issues

The arrangement of buildings and spaces on a site will have an important influence on the quality of the residential environment. Key components to be considered include:

- the building 'footprint' or site development plan;
 - private open space (e.g. rear garden or courtyard);
 - semi-public open space (e.g. front garden or setting for the dwellings);
 - communal open space;
 - setbacks for amenity;
 - street appearance;
 - access and parking;
 - services and facilities.

Issues to be considered in site layout include:

- appropriateness of built form and landscape in relation to the site context, topography and the desired urban character;
- cost-effective utilisation of the available land;
- arrangement of buildings, especially in relation to streets and open spaces;
- the role of streets and accessways/paths in providing connections within and beyond the site;
- location, function and control of open space;
- ongoing site management considerations and the future role of anybody corporate;
- relationship of buildings and open spaces;
- the qualities of spaces;
- personal privacy and security;
- parking arrangements;
- energy efficiency in building design and siting;
- heritage and conservation opportunities and constraints;
- environmental appropriateness.

Principles and factors for Site Selection

Site Location

A site must be placed within its proper geographical, political, and functional context. This fixes the site in relation to adjacent land uses, community transportation patterns, utility and infrastructure availability, employment, commercial, cultural and recreational centres. Each of these has a bearing on the site development potential. For example, the adjacent land use patterns will determine the appropriate land use for a proposed site based upon the comprehensive plan. The availability of roads, and in some cases mass transit may have a significant influence on if, and for what, a site is suitable in terms of access. The presence of water, sewers, and other utilities can also dictate the suitability of a site as a target for expansion. And of course the proximity to work, jobs, and schools are a factor in real estate suitability.

Existing Conditions

Depending upon the size and complexity of the site, this may be one or a series of base plans or maps that delineates and evaluates the physical attributes and constraints for the parcel of land. It will cover such items as:

Topography and Slopes – Treatment of these factors requires base information in the form of contours and elevations to a degree of accuracy appropriate to the proposed development. For general planning, topographic information such as is available from Federal Survey and town planning offices may be suitable. However, more detailed site design requires more specific elevations from aerial or field surveys. Visually, as well as functionally, the form of the landscape, its slopes and patterns are one of the most important categories to consider, no matter what the proposed land use. The topographic map provides a considerable amount of information including drainage patterns and problems, potential on-site and off-site views, erosion and sedimentation potential, as well as potential for development. There are standards that establish categories of slopes related to suitability for different uses and activities. These standards are somewhat regional. For example, in the U.S., the acceptable range of slopes in the

mid-West is apt to be more restricted than that used in western Pennsylvania or West Virginia where steeper natural slopes are more prevalent.

A typical slope breakdown might include:

0-2%	-	Most developable
2-8%	-	Easily accommodates most categories of development
8-16%	-	Some development restrictions; upper limits for roads and walks
16-24%	-	Significant restrictions to most development
24%+	-	Generally restricted for development

The slope categories are also keyed to the proposed land use or types of facilities. Obviously slopes that are suitable for certain activities may be restrictive for others.

Geology and Soils – General information is available from Survey maps and Department of Agriculture soil surveys. More explicit information may be required from core drillings and specific soil testing. The subsurface geology is the basis for the visible landform discussed above. Other implications are the engineering characteristics such as bearing capacity that determine suitable locations for structures and other heavy elements. Conversely, shallow depth to bedrock may restrict certain construction options on the basis of cost and impact of development. Similarly, a high water table may limit or restrict some sanitary sewage options.

Closely related are the soils characteristics which are frequently a direct product of the underlying geology. The soils may be important in terms of stability, suitability for structural foundations, erosion susceptibility, surface drainage, and soil fertility to support plant growth. Again, the suitability of soils is very much dependent upon the proposed uses. A site suitable for intensive structural development may be unsuitable for recreational activities and vice-versa.

Vegetation – The existing vegetation patterns and types can be obtained from aerial photographs and maps. Detailed plant identification and location of specimen plants may require field study and measurement. The significance of vegetative information relates to a range of development issues. The visual character and spatial definition of a site is impacted by the amount and category of vegetation – from ground cover to canopy, from new growth to mature stands of trees, etc. Vegetation can modify the climate by providing shade, protecting potential development from winter winds or by channelling summer breezes. Plant coverage enhances

soil stability, provides an indication of soil conditions (e.g., wetlands) and relates to potential wildlife habitats. Therefore, a site with extensive mature vegetation would be less suitable for high-density development from the standpoint of environmental character. The presence of trees and other plants may on the other hand make a site attractive for certain kinds of housing and/or for recreation facilities.

Hydrology and Drainage – A good base of information for this analysis, supplemented with flood data from the local drainage maps. Surface hydrology is an integral part of the slopes and subsurface drainage systems. The kinds of information normally indicated and analyzed include determination of watersheds (basically a system of ridge lines and valleys or drainage patterns), duration and volume of flow, swales, streams, standing water, and flood plain definition. Susceptibility to erosion and the problem of sedimentation to off-site water flow are also problems to be noted. Generally it is advisable to avoid disturbing natural subsurface drainage patterns such as high water tables which have implications for locations of structures or excavations.

Microclimate – Information on general climatic factors such as seasonal temperature averages, amounts of precipitation, etc. are available locally. Microclimatic factors refer to variations to the general climate such as might be created by topography, plants and vegetation, exposure to winds, elevation above sea level, and relationships to structural elements. These factors are important to design in terms of delineating the “opportunities and constraints” of a particular site for development noted by Laurie (See earlier discussion). Slopes are analyzed in relation to solar orientation to determine “warm” and “cool” slopes, based on sun exposure. Shade and shadow patterns created by existing vegetation and structures are important to design in terms of potential positive or negative impacts for development. Plants may be used to ameliorate undesirable conditions by providing windbreaks, shade, etc.

Views – A visual analysis is the most practical means of determining positive and negative on-site and off-site views. This study is useful in determining the visual character of the site itself as viewed from the outside as well as the visual impact of its surroundings upon potential on-site development. Factors to be examined include mass and space definition from natural and man-

made elements, off-site views to be accentuated or screened, and on-site view opportunities or problems.

Existing Structures / Infrastructure – The availability of essential utilities – water, sanitary sewer, storm sewer, gas, electric, telephone, etc. – is crucial to the potential for site development from both an economic and environmental standpoint. If utilities are available to tap into directly adjacent to a site, the costs of development may be significantly minimized. Environmentally, if storm and sanitary sewers are not available, the options for land development may be severely restricted. Available municipal facilities may be at capacity or receiving streams may be restricted to additional outflow by state and federal environmental regulations. Off-site systems such as transportation networks (vehicular, pedestrian, bicycle) may also be the determining factor in the suitability of a site for a particular land use. This relates to issues of accessibility, ranging from commuting distances to work, to convenience and safety for pedestrians, to enhancement of recreation opportunities.

Legal Constraints – These may include legal property boundaries, easements, rights of way; restrictive covenants, and deed restrictions. Local regulations such as zoning ordinances and subdivision regulations may impose limitations upon what a developer is allowed to do on a given site and provide procedural requirements by which development may move forward.

This information, in a totally objective format, is critical to the designer in terms of becoming familiar with the site. It then serves as the basis for developing a sense of the opportunities and constraints provided by the site for development. Thus, the next step after cataloging or mapping the above information is to analyze its implications for development. This may be done on a separate set of maps (plans) or combined with the inventory information on the same drawing. In either case, the end product of the site analysis phase of the design process is a composite analysis map (sometimes referred to as an opportunities and constraints sheet). This is developed through an overlay process delineating the most suitable and least suitable areas of the site for each analysis factor.

Generally, these areas will reinforce one another. That is, steep slopes, poor soils, areas of vegetation to be protected, etc. will fall in the same general locations, although what is suitable

for one type of land use may be unsuitable for another. This is why it is important to have some idea of the program prior to completing the site analysis. The composite analysis map provides clear justification to the designer for where the most intensive development should occur on a site with the minimum environmental impact. It also highlights particularly positive elements of the site that should be accentuated in the subsequent design development.

Site Development Plan

A site development plan is the primary means of illustrating layout and design. Where there are communal facilities of body corporate responsibilities, the plan should include a statement of management objectives for those items. For example, the statement might indicate the extent to which the body corporate is intended to control, and be responsible for, landscape maintenance, or the extent to which private responsibility for landscape maintenance is proposed. Implementation by the body corporate may be a condition of planning approval.

For large-scale urban housing developments, the site development plan may initially be conceptually defined, with full details being provided in stages. For smaller-scale developments, the level of detail required at the planning approval stage will depend on local implementation requirements.

Site Planning, Orientation and Layout

In temperate, cool–temperate and hot–arid climates in particular, the orientation of spaces within and outside the house relative to the sun’s movement can significantly influence temperatures within a building and thus the ability to use the spaces throughout the year. In these climates designers should attempt to arrange rooms so that the main living areas of a house (i.e. lounge, dining room, family room, kitchen, principal area of private open space) are orientated towards the north for solar penetration during winter.

Ideally, buildings should be positioned with the long axis extending east–west to maximise the length of north-facing walls and windows to living areas. A depth of 10–14 m is ideal to allow natural light and cross-ventilation. In hot–humid climates the desire for solar penetration into north-facing rooms will vary according to the latitude. For instance, in areas such as the south west of Nigeria, allowing for solar penetration into the house during winter will probably increase temperatures to an uncomfortable level.

In hot–humid climates an important design objective is to allow for cross-ventilation. This can be achieved through the orientation of the building to capitalise on cool prevailing breezes. An elongated building design one room in depth and the placement of external openings on opposite walls will facilitate cross-ventilation. In hot–arid climates a landscaped and shaded courtyard can act as a cool air well. The courtyard should be located directly adjacent to a main living area and should preferably be shaded by the house. Narrow, tall and vegetated courtyards are most effective.

In all climates there is a case for designing houses which minimise the external wall and roof area of each room, thereby providing less area through which undesirable heat loss or gain can occur. Landscaping around the house plays an important role in modifying the microclimate of a site and the energy efficiency of a building. In temperate and cool–temperate climates wide canopied

deciduous trees and deciduous vines grown on a pergola at the north of a dwelling will provide shade and reduce glare during warmer months and allow solar penetration during the coolest months. However, as many deciduous species can block sun during early autumn and late spring, the use of eaves to control sun penetration is most important. The landscaping strategy should be considered together with room and private open space layout.

In all climate zones it is preferable to locate evergreen trees to the west and east of a dwelling. The sun is at a low angle in the mornings and afternoons, and shade trees can prevent considerable glare and heat on these sides. The careful design of landscaping around the house can also serve other functions, such as screening winter and summer prevailing winds, deflecting cooling summer breezes into the house, providing cooling air through leaf transpiration, reducing glare and generally modifying ambient temperatures throughout the year. In hot–arid climates, in particular, vines grown on walls and over roofs can effectively insulate against summer heat.

Factors affecting site selection

Factors that may affect the selection of a site for landscaping or any other development depends on the purpose of such developments. For instance, the main planning purposes of a neighbourhood unit are a convenient representation of physical unit suitable for the full development of community life. This is an area within which residents may all share the common services, social activities and facilities required for convenient living. of about 5,000 population is acceptable as standard of definition of a neighbourhood. The implication of a

neighbourhood unit as the basis of planning unit is all that all residential and community facilities and services required for good shelter, health and conveniences are provided. These facilities are grouped as follow:

- Residential Facilities (buildings and lands devoted exclusively to dwelling, spaces for garden, driveways, garages etc.)
- Community Facilities (Educational, social, cultural, recreational and shopping facilities commonly used by members of the community)
- Utilities and services (water supply, electricity, telephone, stormwater and sewage disposal, fire protection, postal and police services. Efficient circulation including roads, pedestrian's walkways, parking spaces, traffic control and lighting).

Residential Site Selection

The purpose of selecting a site for residential development may be summarized as follows:

- To procure or secure a site which is suitable for physical development including the installation of utilities and the provision of dwellings.

Important Physical Characteristics of the Site

The following must be considered in the selection of a site for residential purpose:

- ❖ *Soil and subsoil conditions:* The soil must be suitable for evacuation and site preparation. It must not allow water to gather or too steep because of erosion problems. The subsoil condition should afford suitable bearing capacity for the economical constructions of buildings of the type contemplated.
- ❖ *Groundwater and Drainage:* Water table should be low enough to protect the building against basement flooding and interference with sewage; the absence of swamps and marshes. Sufficient slope to permit surface drainage of normal rainfall and free flow of sanitary sewage. Periodic flooding should discourage a site unless preventive measures are taken.
- ❖ *Freedom from Surface Flood:* The development area should be free from danger of surface flooding by stream, lakes, or tidal waters. Ideally no land should be included in the development areas that has been flooded at intervals of less than 25 years unless flood control measures have been put in place and capable of removing such dangers.
- ❖ *Suitability for Siting of Projected Building:* Land should not be too steep for satisfactory building on it. Building sites should not have elevations above those at which normal water pressure for domestic use and fire fighting can be obtained. Orientation of slope may affect the possibility of good development.

- ❖ *Suitability for access and circulation:* Topography should permit adequate vehicular and pedestrian access and circulation within the development area. It should permit grading so that streets and walkways will conform to standards.
- ❖ *Suitability for the Development of Open Spaces:* Land to be reserved for private gardens, playgrounds, and neighbourhood park should permit grading and development to conform with specification.

Other important factors are:

- Freedom from topographic accidents and hazards (avoid slope edges, open pits, hazardous shoreline)
- Availability of Sanitary and protective services (water supply, sewage disposal)
- Power, Fuel and Communication
- Fire and Police Protection
- Freedom from Local hazards and Nuisance (e.g. poisonous chemical industry or factory nearby)
- Noise and vibration (railroad, airports, heavy factory, street traffic_
- Odours, Smoke and Dust
- Industrial plants, Refuse dumps, Farm animals

The Site Plan: scale, circulation, building lines, plot coverage and drainage.

Site Plan

A site plan is a "set of construction drawings that a builder or contractor uses to make improvements to a property. Regions can use the site plan to verify that development codes are being met and as a historical resource. Site plans are often prepared by a design consultant who must be either a licensed engineer, architect, landscape architect or land surveyor". It is an architectural plan, and a detailed engineering drawing of proposed improvements to a given lot. A site plan "usually shows a building footprint, travel ways, parking, drainage facilities, sanitary sewer lines, water lines, trails, lighting, and landscaping".

Such a plan of a site is a "graphic representation of the arrangement of buildings, parking, drives, landscaping and any other structure that is part of a development project".

Site plan building blocks

A site plan is a top view, bird's eye view of a property that is drawn to scale. A site plan can show:

- ❖ Property lines
- ❖ Outline of existing and proposed buildings and structures
- ❖ Distance between buildings
- ❖ Distance between buildings and property lines (setbacks)
- ❖ Parking lots, indicating parking spaces
- ❖ Driveways
- ❖ Surrounding streets
- ❖ Landscaped areas
- ❖ Easements
- ❖ Ground sign location

Plot Plan

The first step in developing a landscape plan is to sketch out a Plot Plan of the property as it exists now. This should show boundaries and physical features affecting your new landscape plan. It includes items such as property lines and angles; placement of the house on the property; and location of driveways, utilities, easements, and any other existing limitations.

The following features are marked on the Plot Plan and then incorporated with a Site Analysis:

- ❖ Windows, doors, and other openings, including height off the ground for both doors and windows
- ❖ Above and below ground utility lines
- ❖ Outdoor air conditioner coils that may need screening to reduce noise and hide from view
- ❖ Existing trees and shrubs
- ❖ Utility meters, drain pipes, water spigots, outlets, and buried septic tank
- ❖ Features on or near the property line
- ❖ Anything else prominent on the site: easements, set-backs and zoning regulations for clear zones

Other issues to be discussed are:

Plot Ratio:

Plot ratio expresses a relationship between the area of a site and the total gross floor area of the building/s whether existing or intended to be erected on it.

Calculating Plot Ratio

$$\frac{\text{Gross floor area of building/s}}{\text{Site Area}} = \text{Plot Ratio}$$

Gross floor area is the sum of floor space within the external walls of the buildings, excluding plant and tank rooms, covered recycling units and car parking areas. The gross floor area only includes floor space at ground level or above. Site area relates to the area of the development site and in the case of 'greenfield' sites would include access roads, car parking areas and open spaces within the site.

Site coverage

Site coverage is a control for the purpose of preventing the adverse effects of over development, thereby safeguarding sunlight and daylight within or adjoining a proposed layout of buildings. Site coverage is the percentage of the site covered by building structures, excluding the public roads and footpaths. Site coverage is a tool particularly relevant in urban locations where open space and car parking standards may be relaxed. The plan sets out recommended standards for the city centre, and the district centres. These standards are intended to be indicative only. The special considerations, which apply to plot ratio, will also apply to site coverage. Site coverage should reflect traditional patterns of usage within the area of a proposed development. Site coverage is determined by dividing the total area of ground covered by the building/s by the total ground area within the curtilage (enclosed property or an enclosed area occupied by a dwelling,

grounds, and outbuildings) of the building/s excluding any land lying between the building line and the public street. The maximum site coverage is 55%.

Building lines

Building lines in the urban environment are intended to provide protection from the noise and fumes associated with traffic, to allow for the provision of off-street car parking and future road development, and to preserve the existing character of an area. Within residential development, the building line shall not be generally less than 7.5 metres as measured from the inside edge of the footpath. A revised building line will be considered where the layout and overall design concept and its relationship to existing adjacent developments warrant such consideration.

Generally, in determining applications for development works the planning office will seek to ensure that development is not carried out in front of established building lines or in a position where it would be in conflict with the building lines determined by the planning office to be appropriate for that area. Maintenance of the traditional street line is of particular importance in the town centre. However, in specific situations, it may not be in the interests of good planning to enforce a rigid standard for building lines. Consequently, the planning authority, in the interests of maintaining a good townscape, will examine each application on its own merits.

Building Height Control

A high building is a building that is significantly higher than neighbouring or surrounding development. In a number of locations, particularly within the town centre and local neighbourhood centres, the Council will permit developments in which an increase in roof heights is proposed, in accordance with the appropriate plot ratio standards, especially where this provides added definition to the streetscape.

The building height of proposed developments will generally be considered in terms of the extent and location of the site, its relationship to open space and its setting within the town. The Planning Office will not permit proposed development that will have a significant negative effect in terms of the following:

- the degree of overshadowing and consequent loss of light;
- the degree of overlooking (particularly of residential property) and consequent loss of privacy to surrounding premises;
- the disruption to the scale of an existing streetscape;
- a detraction from the structures or spaces of architectural or historic importance, and important landmarks;
- the detrimental effect on any existing building having special visual identity;
- the degree of obtrusion to/from significant vantage points;
- The degree of obtrusion on the skyline;
- The visual relationship as well as the scale of the building in relation to open space, and the effects of the building on the quality of the space;
- the area of the site and whether it is large enough to provide a visual transition from the scale of surrounding development;
- whether the purpose or civic importance of the building would justify its prominence;
- whether the building may be used as the site for any advertising structure and the possible

effect of such a structure on the amenity and environmental quality of the adjoining area. An advertisement will only be permitted on a high building if it is accepted that it forms part of, or is complimentary to the design of the building and is otherwise compatible with the land use zoning objective.

Landscape Construction Materials and Elements

Landscape elements

The landscape elements can be divided into hard and soft materials. The hard landscape materials are the inorganic, inert, probably synthetic elements of the scene in contrast to natural living vegetation or moving water bodies. They include roads, buildings, paths, walls, fences, paved areas etc. The basic function of the hard surfaces is to provide a hard dry non-slip traffic surface for pedestrian and vehicles. They may also include all forms of accessibility, footpaths, parking areas, installations and fittings, and furniture. Among structures constructed with hard landscape materials are walls, steps, ramps, sculptures, outdoor lighting, benches, billboards etc. Bricks, stones, iron and other hard materials are often used for such constructions.

The soft landscape elements include vegetation, water bodies and general planting. It includes all forms of ornamentation with plants.

Planting Design

Plant Material Selection

Selecting the appropriate species is an essential part of creating a successful roadside landscape. Plants should be selected based not only on how they will thrive in that particular site, but also on how they may interact with and impact surrounding ecological systems. Good plant selection will create sustainable plant communities and transition areas, benefiting human and ecological systems. Poor selection can lead to plant failure which can result in soil loss, compromised highway structures, and the encroachment of invasive species, causing long-term negative impacts to surrounding as well as distant ecological systems.

Plant Material Selection Guidelines

- **Hardiness.** Plants should be hardy to the region in which they will be planted. Roadsides have extremes of microclimates: south facing slopes get full sun and heat, north facing slopes is cool and shaded, areas close to the road have high wind conditions and salt spray. In urban environments, asphalt, building masses, automobiles, and reflective surfaces generate radiant heat, creating a microclimate hotter and drier than the general climate.
- **Existing Plant Species and Communities.** Surrounding vegetation should be assessed to determine what species are doing well in the site's general soil and climate conditions. Determine whether there are invasive species in the surrounding area that may out-compete new plantings. Surrounding vegetation can also be used as a clue to pH and moisture levels when selecting new species.

- **Soil Quality.** Soil should be evaluated for texture, pH, and moisture and soil biology. Most soils close to the road are infertile, dry, compacted and contain salt and other pollutants. New soils brought in after construction has better soil quality in terms of texture and density, but they tend to lack necessary soil organisms. The designer should select plant species appropriate to anticipated conditions.
- **Diversity of Species.** A diverse selection of plants, including native species that are already existing in the landscape should be used. Mixing different sizes and types of plants (i.e., shrubs, evergreens, deciduous trees, and groundcovers) helps create an interactive plant community. While the diversity opportunities are much more limited on streetscapes than in naturalized areas, diversity of species remains important. There are many benefits to choosing a variety of species, including pest or disease resistance within the population. Choosing cultivars that are more tolerant of drought and more resistant to pests and diseases than the species is also important.
- **Plant Sizes and Densities.** Plant sizes (in age) should be relatively small, and quantities and spacing (particularly for reforestation type plantings) should be close due to the stresses and mortality during establishment. Varying ages prevents all trees from maturing and having to be replaced at the same time, thus maintaining general canopy cover at all times. Where conditions permit, smaller species can be planted between or in front/back of larger shade trees. The following general species selection considerations apply.
 - ✓ Do not use invasive and potentially invasive species.
 - ✓ Use native species, particularly in ecologically sensitive areas, when possible.
 - ✓ Choose trees that are low maintenance (no spraying, pruning, fruit litter).
 - ✓ Choose trees that are tolerant of specific site conditions (narrow spaces, overhead wires, salt, compacted soil, low soil volume, pollution)

Native Species

Native species are defined as species that occur in a region as result of natural forces rather than as having been brought in by humans, either intentionally or accidentally. A species may be native to a large area, such as North America, or may be native only to a small area, such as Cape Cod. The plant's native range, or region, is typically associated with environmental factors such as climate, soils, and topography. When choosing native species, it is recommended to choose plants as locally "native" as possible.

In addition to environmental benefits, native species reflect the region's ecological characteristics. For instance, sugar maples or New England Asters along a New England roadside give a sense of place and identity to the roadway or streetscape. In general, native species are better adapted to the native climate and soils of a region. However, roadsides and

other developed or exposed areas may not have typically “native” conditions. Therefore, species should be chosen with regard to the specific site conditions. Special attention should be paid to sensitive areas and efforts should be made to plant native species in ecologically sensitive areas along waterways, wetlands, and areas noted for rare and endangered species.

Invasive Non-Native Species

Exotic or non-native species are those that have been introduced into a region by humans. Many early introductions came from European settlers who brought plants with them for human and animal consumption, for medicine, to make products, and for ornamental use. Some non-native species were accidental introductions, arriving with ships, in packaging, or with cattle. Many new weed species continue to enter the United States as seed contaminants.

Potentially Invasive Plants

Plants that have been found to be potentially invasive should be avoided, particularly in sensitive areas such as near waterways. In particular, species that spread by seed should be avoided as highway traffic, wind, and maintenance activities provide means for seeds to travel. Also, many roadways are along rivers and waterways, allowing for further spread of these species.

Plant Selection for Streetscapes

Vegetation and individual street trees play an important role along streetscape corridors. They serve to enhance the ecological environment, which in turn enhances the environment for the community by improving microclimate, air quality and aesthetics. While more sparsely located, street trees and shrubs should also be considered as part of a larger system in that they function as links for animals migrating or seeking food within a larger habitat corridor. Streetscape environments are complicated by having multiple users, utilities, intersections, sidewalk accessibility requirements, and limited planting areas. Microclimate conditions on streetscapes are often harsh due to heat radiation from light reflected from buildings, windy conditions, or heavy shade from buildings. Soil conditions are generally poor. Soil volume in tree pits may be inadequate for healthy growth of most tree species and existing soil compaction or potential soil compaction due to pedestrian traffic are typically problems. Urban activities also create limitations: car doors opening, bus/truck clearance, and sign and safety visibility requirements. Overhead wires, utility poles, hydrants, mailboxes and light fixtures further restrict the types of trees that can be used.

Recommended Species for Urban Conditions

- Use a variety of species, rather than just one or two types or plants.
- Columnar cultivars should be considered for narrow areas.
- Trees that reach mature heights of 25 to 30 feet are better for areas where there are overhead utilities. The small upper branches of these trees may be pruned, but the heavy limbs, capable of breaking wires, remain well below wires.

- Where soil conditions and overhead clearances allow, larger shade trees that can be limbed up, may be preferred over smaller trees.
- Avoid species and cultivars that drop fruit or have excessive leaf litter, species that require frequent pruning or irrigation, and species with thorns.

Suggested Street Trees

Botanical Name	Common Name	Cultivars	Size	Characteristics
Large Trees (mature size more than 40')				
<i>Acer rubrum</i>	Red Maple	'Red Sunset', 'Armstrong', 'Bowhall', 'Columnare'	40-75'	Does not tolerate heavily polluted areas, dry soils. Prefers acid soils.
<i>Celtis occidentalis</i>	Common Hackberry		40-60'	Wind tolerant, salt and drought resistant. Subject to pests and disease.
<i>Fraxinus pennsylvanica</i>	Green Ash	'Marshall's Seedless', 'Summit'	50-60'	Tolerant of heat, cold, wet and dry soils. Subject to borers and scale. Select male cultivars.
<i>Ginkgo biloba</i>	Ginkgo	'Autumn Gold', 'Princeton Sentry'	50-80'	Tolerates extremes of soil, heat and pollution. Choose male clones only.
<i>Gleditsia triacanthos var. inermis</i>	Thornless Honeylocust	'Skyline', 'Shademaster'	30-70'	Very adaptable to soils and tolerant of salt, drought, and soil compaction. Over-used. Subject to pests and disease.
<i>Platanus x acerifolia</i>	London Planetree	'Bloodgood', 'Columbia', 'Liberty', 'Yarwood'	70-100'	Tolerates wide range of soils. Select anthracnose resistant cultivars. Best where has large space.
<i>Quercus palustris</i>	Pin Oak	'Crownright', 'Sovereign'	60-70'	Fairly tolerant of city conditions. Intolerant of high pH soils. May need to be limbed up.
<i>Quercus robur</i>	English Oak	'Fastigata'	40-50'	'Fastigiata' is good for restricted areas, but red and pin oak are better choices where space allows. Mildew can be a problem.
<i>Quercus rubra</i>	Northern Red Oak		60-80'	Tolerates range of soils, withstands pollution. Intolerant of high pH.
<i>Tilia cordata</i>	Littleleaf Linden	'Corinthian', 'Glenleven', 'Greenspire'	60-70'	Tolerates pollution and pruning. Susceptible to salt, as well as aphids and Japanese beetle.
<i>Ulmus americana</i>	American Elm	'Princeton', 'Valley Forge', 'New Harmony'	60-80'	Withstands extremes of soil conditions, salt tolerant. Subject to pests and decay. Select Dutch elm resistant cultivars.
<i>Ulmus parvifolia</i>	Chinese Elm	'Allee', 'Athena', 'Milliken'	40-50'	Adaptable to wide range of soil, tolerant of urban conditions. Resistant to Dutch elm disease, elm leaf beetle and Japanese beetle.
<i>Ulmus sp.</i>	Elm hybrids	'Frontier', 'Regal', 'Homestead'	40-50'	Tolerant of urban conditions. Select resistant cultivars. Susceptible to elm leaf beetle.
<i>Zelkova serrata</i>	Japanese Zelkova	'Green Vase'	50-80'	Tolerant of soils, wind, drought, pollution. Good resistance to Dutch elm disease, elm leaf and Japanese beetle.

Botanical Name	Common Name	Cultivars	Size	Characteristics
Medium Trees (mature size approximately 30-40')				
<i>Acer campestre</i>	Hedge Maple		25-35'	Very adaptable, tolerant of dry soils, soil compaction and air pollution. Withstands severe pruning.
<i>Koelreuteria paniculata</i>	Golden Raintree	'Fastigiata'	30-40'	Tolerant of heat, drought, wind, compacted soils, and air pollution. Possibly weak
<i>Pyrus calleryana</i>	Callery Pear	'Aristocrat', 'Chanticleer'	30-35'	Adaptable to soils, tolerates dryness and pollution. Overplanted. Use only disease/pest resistant cultivars, narrow cultivars for restricted space.
Small Trees (mature size less than 30')				
<i>Acer ginnala</i>	Amur Maple		15-20'	Adaptable to wide range soils, tolerant of wind and drought. Select single stem. May need to be limbed up.
<i>Amelanchier sp.</i>	Serviceberry	'Autumn Sunset', 'Cumulus'	15-25'	Adaptable to soil, not pollution tolerant. Subject to insects and diseases. Select resistant cultivars and single stem.
<i>Malus sp.</i>	Crabapple	'Donald Wyman', 'Cardinal', 'Prairifire', 'Snowdrift', 'Zumi'	15-30'	Tolerant of drought, salt, air pollution. Wide variety of sizes and shapes. Select disease/pest resistant cultivar. Fruit litter. Low branching.
<i>Syringa reticulata</i>	Japanese Tree Lilac	'Ivory Silk', 'Regent', 'Summer Snow'	25-30'	Adaptable to difficult sites. Resistant to mildew, borers and scale.
*List is not a comprehensive urban tree list. Trees in list may not be appropriate for all conditions.				

Source: MassHighway

Typology of humanized landscape (housing)

Cultural landscape

In 1925, Carl Sauer introduced the term ‘cultural landscape’ in his essay on the morphology of landscape (Sauer 1925), believing that a cultural landscape expressed the ways of life in a place. He stated:

The cultural landscape is fashioned from a natural landscape by a culture group. Culture is the agent, the natural area is the medium, the cultural landscape is the result.

Sauer 1925, p. 46

humans, through the medium of culture, were active agents of environmental transformation. This contrasted with the era’s dominant view that humans were entirely the product of their environment [environmental determinism] Harrison 2004, p. 10. Johnston (1998, pp 57–60) criticised Sauer’s claim that ‘the cultural landscape is fashioned out of a natural landscape’ (Sauer 1925, p. 343), saying it exemplifies an ‘explicit’ perspective on landscape, distinguishing between the natural and the human or social dimensions of landscapes.

Meanings

Two terms are frequently mentioned in this review: ‘culture’ and ‘landscape’. These seemingly straightforward terms have complex histories and many meanings, some of which are considered in the quotations below. The term ‘cultural landscape’ is used most in human geography, anthropology and archaeology.

Landscape design Techniques

Landscape Design Process

The Landscape Design Process is more than choice and placement of plants and physical components. It is a series of steps that help landscape gardeners work in an organized manner. It is the foundation of a workable and attractive garden landscape. An effective landscape design allows revising certain steps to change desired results. Checking and revising outcomes also make design a circular process. Avoiding an organized landscape design process may lead to common design problems that are frustrating, irritating and perhaps costly. The resulting landscape garden just does not look or feel "right."

A well thought out plan checks beginning impulse projects like walkways, decks and planters that are never finished or do not accomplish anticipated functions. A plan avoids impulse plant purchases that lead to hit and miss borders and often-poor plant growth.

Landscape Design Process Checklist

1. Useable and well-defined paper plan. This lays the groundwork and should include:

- ❖ Compass directions;
- ❖ Property lines, easements and restrictions;
- ❖ Driveway and bordering streets, sidewalks and paths;
- ❖ House, garage and any outbuilding;
- ❖ Entrance or public areas;
- ❖ Private, garden and recreation areas;
- ❖ Existing plants and garden areas; and
- ❖ Service areas like compost and trash bins, clothes lines and storage structures.

2. Survey of site and environmental conditions. Do not omit this step, as plants will not grow in hostile environments. On the paper plan, include at the minimum:

- ❖ Soil tests done by reputable laboratories;
- ❖ Presence of animals such as deer and rabbits which like to eat plants, and
- ❖ Prominent physical features – like boulders and streams.

3. Survey of existing and proposed plants or plant groupings. This step, when considered in terms of function and done thoughtfully, will take the most amounts of study and time. All considerations need to take into account steps #1 and #2.

4. Time, money, and maintenance. This step demands honesty and costs for time and money of project implementation as well as that of maintenance. This is also a good step to consider availability of large trees and shrubs and hard scape materials like gazebos and boulders, their costs, and suitability to the overall plan and budget.

5. Aesthetics and visual impact. This is an opportunity to determine the landscape's overall function. Is it as lovely from the inside looking out as it appears from the street. There are garden landscapes that are lovely to look at and perhaps dream within, but not the functional ones in which we want to rest or play, and with which we want to surround families and ourselves.

The most difficult of these five categories with which to come to grips is that of learning site and environmental conditions. It is difficult to go slow, arrange for tests, and take time to collect, record and analyze data. Landscape gardeners want action!

The beginning of a new project is, however, the best time to stop everything, including the chain saw and trips to the local plant outlets. Now spend several months, including those during your area's snow or rain season, to watch, record on paper and film, and plan.

Neighbourhood Design

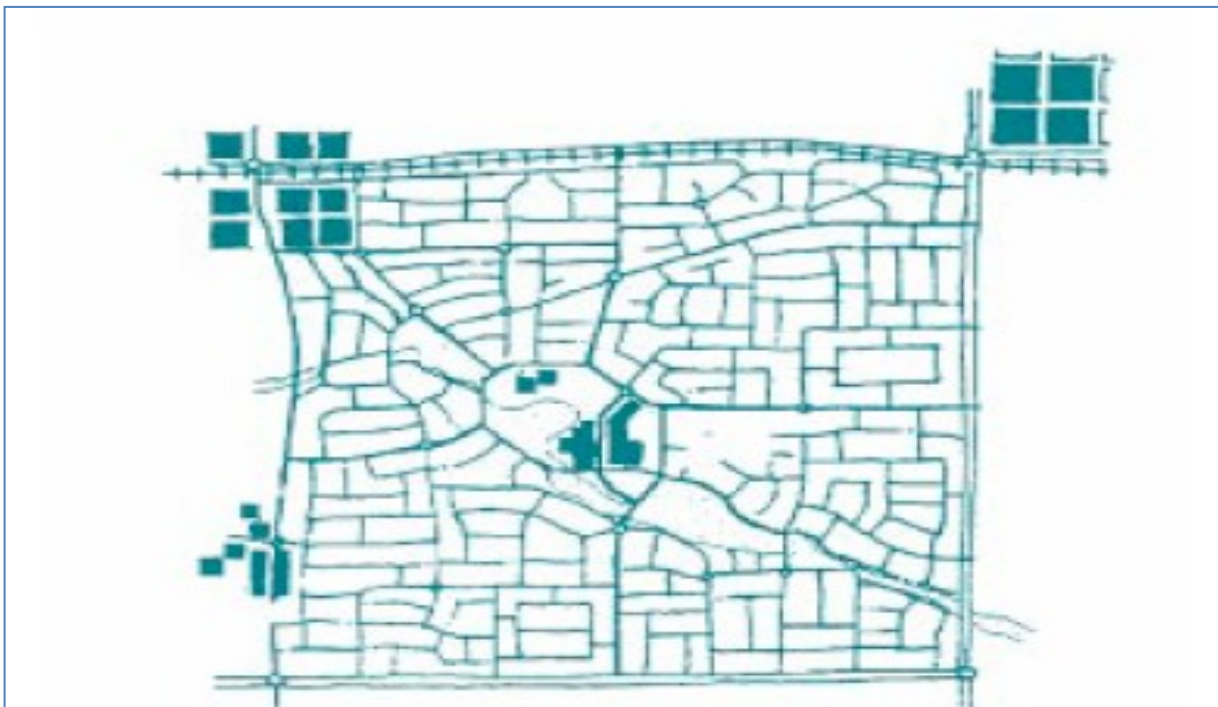
The intent of neighbourhood design is to provide safe, convenient and attractive neighbourhoods that meet the diverse and changing needs of the community. This encompasses offering a wide choice in good quality housing and associated community and commercial facilities, providing for local employment opportunities, encouraging walking and cycling, minimizing energy consumption, and promoting a sense of place through neighbourhood focal points and the creation of a distinctive identity which recognizes and, where relevant, preserves the natural environment

As a focus for social interaction, leisure, personal expression and fulfilment, neighbourhoods can have a major influence on quality of life Successful neighbourhoods require the creation of attractive living environments that promote social interaction, participation and a sense of community identity for all residents. Therefore, in addition to housing, the neighbourhoods

should include a mix of compatible and complementary facilities for living, education, working and recreation. A high level of safety for residents and visitors, which can be partly addressed through the design process, is a critical component. The need to incorporate human services planning within overall planning and design, and the effective programming of physical and social infrastructure, is now widely recognised as important elements. Planning for human services is a dynamic process which must recognize possible future demographic changes, building in flexibility wherever possible. This process allows for the timely and coordinated provision of community facilities and services. It also ensures that other key social issues associated with a particular development, including those relating to cultural development, can be identified and formulated. The community planning process also places emphasis on involving the community.

Neighbourhood or Community Design Approaches

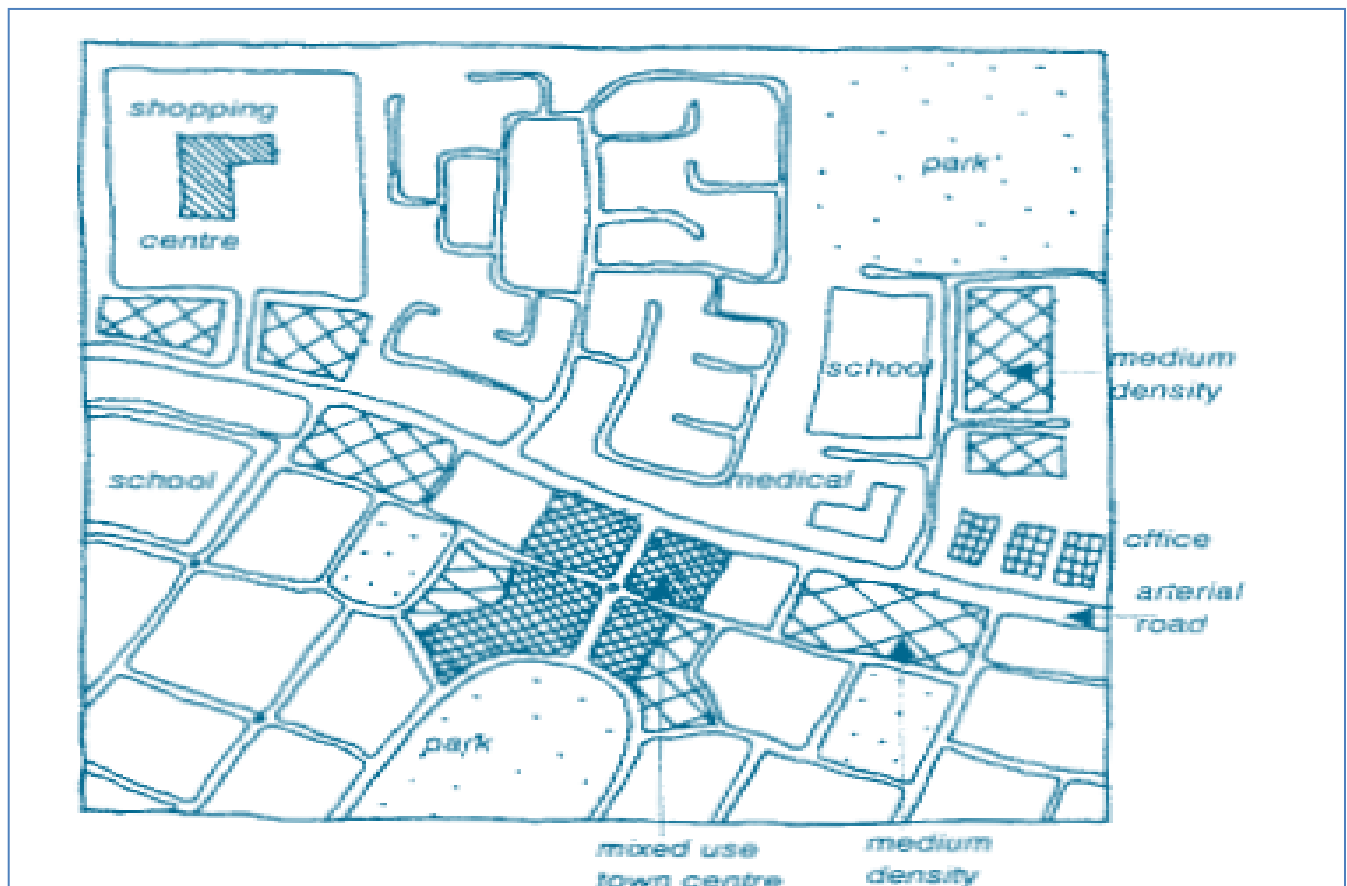
There are many approaches to neighbourhood or community design. Neighbourhoods typically comprised low-density housing on individual, large allotments. A curvilinear street layout with a strong street hierarchy and low levels of connectivity (usually culs-de-sac leading off local collector streets) were common elements along with limited land use mix and employment opportunities. Little regard was given to energy or greenhouse implications or the long-term social implications of these 'dormitory' suburbs.



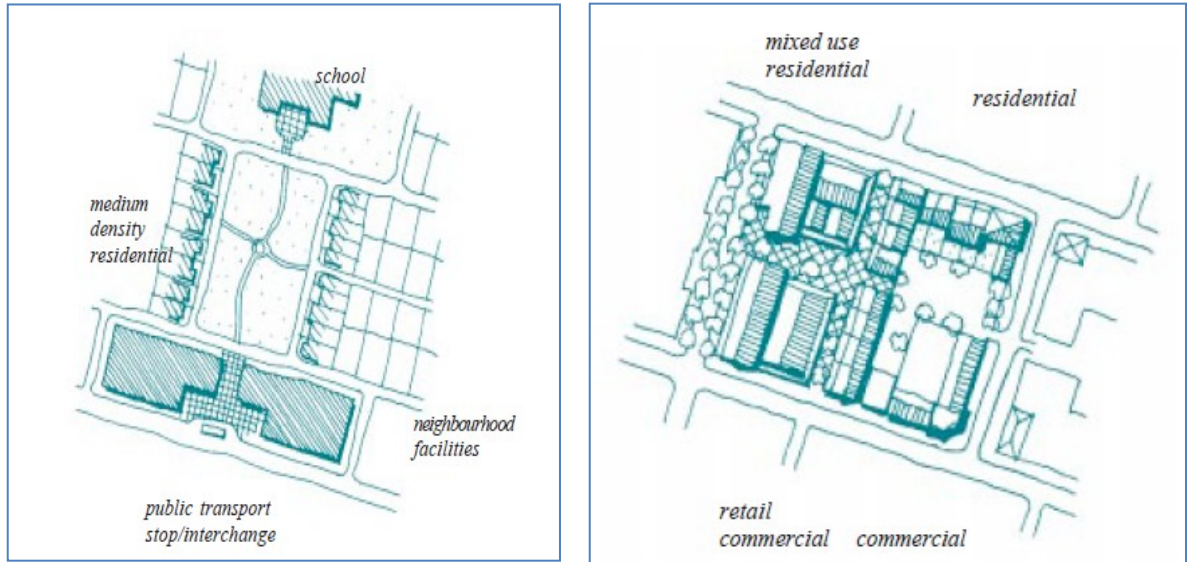
Conventional interconnected neighbourhood land use and street pattern.

The urban village concept can be described as a compact, well-defined community featuring the following main design principles:

- higher residential densities;
- increased local self-containment (e.g. higher levels of local employment and daily activities);
- reduced travel to local employment and activities (e.g. interconnected street networks and local activity centres within walking distance);
- smooth travel speed and flow;
- dwellings designed to minimise energy use;
- accessible public transport;
- higher levels of public safety.



Contrasting forms —conventional suburban development compared to traditional neighbourhood development



Mixed-use centres provide for community focus, variety and identity.

Each principle is predicated on achieving increased housing densities, resulting in a higher population to support a range of activities and public transport services close to housing.

Neighbourhood Design Process

Neighbourhood design is an interactive process involving a range of stakeholders (e.g. developers, /various design professions, government and non-government service providers, local authorities and the community). It is more than a physical planning solution for a particular site and must incorporate a degree of integration with surrounding urban areas while still creating distinctive, identifiable and relatively self-contained neighbourhoods.

Management of Landscape and their Environmental Impacts

Urbanization is perhaps one of the most important human activities, creating enormous impacts on the environment at the local, regional and global scales. Although urbanization in the form of land-cover (either built-up or impervious surfaces) occupies less than 2% of the earth's land.

Surface, there is plentiful evidence that human disturbance due to urbanization has significantly altered the natural landscape (Grubler, 1994). Recent institutional changes, marketization and globalization have combined to bring about new processes of rural–urban interaction, giving rise to new forms of human settlement.

Urban spaces have become more differentiated and contested, in response to technological change, globalisation and social restructuring. Land degradation is believed to be one of the most severe and widespread environmental problems. Years of excessive clearance of natural forests for the expansion of farmland and build-up area, which was driven by a significant population growth in the rural areas. Moreover, many of the remote villages did not participate in a market economy. In such a subsistence system a population increase automatically leads to an increase of the agricultural area resulting in the exploitation of new land units on sloping land.

Landscape change is driven by various actors and forces which trigger a specific rate of change. Today, many landscapes change in a direction and with a rate considered unsustainable. The context, direction, and rate of landscape change have varied over space and time. During the last decades, high rates of change, and related problems, have attracted the attention of policy and planning and raised the need to understand the causes of high rates of landscape changes. Problematic aspects of high rates of landscape change can be the limited potential of species for adaptation (Haines-Young et al., 2003) or the irrecoverable, accelerated loss of cultivated land because of construction (Koeppel et al., 1991).

Based on these considerations, we distinguished between actors and driving forces. Whereas actors, like individuals, agencies, institutions or boards, are the decision-making and mediating agents, the driving forces are the (sometimes materialized) expression of these decisions or acts, like, for example, laws, subsidies or mechanization. Understanding landscape changes, however, requires a sound understanding of the underlying processes. In this context, the concept of driving forces is gaining increasing attention in landscape change research. Driving forces are the forces that cause observed landscape changes, i.e. they influence the trajectories of landscape development (Bürgi et al., 2004). These forces have also been called keystone processes (Marcucci, 2000), drivers (Wood and Handley, 2001) or causal or causative factors (Geist et al., 2006).

The driving forces are classified in five types, i.e., cultural, economic, political, technological and natural/structural driving forces, a classification suggested by Bürgi et al. (2004). The type 'natural/structural' includes natural factors, such as topography, soil characteristics or climate, and the spatial structure, which means that the influence of spatial adjacencies is considered. An example of such structural driving forces is increased accessibility of an area due to proximity to a railway station which can foster construction. Therewith the former landscape state as a prerequisite for the further development is included in the analysis.

Naturally, all five types of driving forces are interlinked. Since economic needs are, for example, often expressed in political programs, laws and policy, the economic and political driving forces are sometimes hard to separate clearly (Bürgi et al., 2004). An encompassing concept of culture comprises economic, political, technological and structural driving forces. For our analysis of driving forces we found Rockwell's (1994) narrow concept of culture more suitable, including attitudes, beliefs, values and traditions.

Changes in the landscape resulting from infrastructure, housing or industrial developments cause impacts on the natural environment with fragmentation and habitat loss being some of the main threats (Fahrig 1997).

The management of landscapes for biological conservation and ecologically sustainable natural resource use are crucial global issues. Landscape ecology, conservation biology and restoration ecology aim to promote better management of natural resources including biodiversity.

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