ded to patent the material to ensure its quality control. As we were developing CU-Structural Soil, we often spoke about it at conferences so that several people decided to try it for themselves. Often during these attempts the user would change the proportions of soil to stone by adding more soil that we specified. In doing this, stone did not touch another stone, it being pushed apart by too much soil. When that mixture was compacted, the stone lattice would not occur and the end result was compacted stony soil. These mixes were also called 'structural soil' yet had nothing to do with the carefully researched proportions we had developed. Therefore we decided to patent our structural soil as CU-Structural Soil® in 1998 (U.S. Patent # 5,849,069). Cornell University owns the patent and Amereq, Inc (www.amereq.com) is the licensee who sublicenses it all over the country and Canada. There are other structural soils, however, only CU-Structural Soil has over a decade of research and hundreds of installations.

There are now 71 licensed producers of CU-Structural Soil in the US and Canada and over 500 installations from Quebec to Puerto Rico to California. CU-Structural Soil has been used in many different climates and is compatible with irrigation when that is necessary. As with any new technology, we are learning more about it as we continue to do research on its uses.

Agro Sur 35 (2):4-9 2007

HOW DO YOU SELECT THE RIGHT TREE OR SHRUB FOR YOUR LANDSCAPE?*

¿COMO SELECCIONAR EL ARBOL O ARBUSTO ADECUADO A SU PAISAJE?

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There are four questions that come to mind when thinking about plant selection:
What is the plant's function on the site?
How well the plant adapted to the site?
What are the management issues related to the use of a particular plant?
What are the plant's aesthetic attributes?

What functions do plants play in the urban environment?
People who regard the use of plants in the urban environment as an aesthetic nicety are not seeing the whole picture. It will be increasingly incumbent on professionals to recognize and quantify the many functions that plants play in order to justify the need for continued funding of the green urban environment in times of restricted budgets.
Where summer temperatures are very high, plants, especially trees provide shade and reduced air temperatures. Tree planting to reduce wind speeds has long been practiced around the world. Research shows that semi porous windscreens that may include trees and shrubs can have a profound wind reducing effect. A barrier of approximately 35% transparent material can create a long calm zone that can improve human comfort levels.
A few plants alone do a poor job of reducing noise. However, dense planting especially combined with solid barriers or landforms can reduce noise significantly.

Plants may play a role in reducing air pollution, both particulate and gaseous. More research needs to occur related to the effectiveness of certain species in the reduction of air borne pollutants in our urban areas.
Plants may be used to create physical barriers, directing foot traffic or screening unsightly views. Private spaces or places that mitigate a wide array of urban conditions can be created with the use of vegetation. Such places are increasingly prized in dense urban areas. Plants can change the sense of scale to a more human dimension. Notable features and architectural lines can be enhanced with appropriate planting. Historic neighborhoods often have culturally appropriate landscapes that are intrinsic to the historical experience and sense of place.
Plants play a crucial role in reducing soil erosion as well as trapping and slowing storm water run-off. Incorporating plants that can significantly reduce our reliance on storm water abatement systems, improve natural water infiltration and reduce the velocity of water moving over a landscape is important in contemporary design. Urban green spaces provide necessary animal habitat and are the places where most of the human population connects with the natural world as well as actively pursuing recreation. Cities with well cared for parks are always listed as more desirable places to live. Property values are significantly higher near well cared for green spaces as well as for properties that are considered well landscaped.

What about aesthetic appeal?
An appreciation of the vast aesthetic possibilities that plants offer can be overwhelming Yet, by embracing this diversity of seasonal interest, form, color and texture we can create wonderfully inventive landscapes. The realization of a design vision for a site and the ultimate success as a built landscape require more than creative elements of space, line and form. It requires a thorough understanding of how people will use the site and how the site may or may not support the long-term biological needs of plants growing there.

How well is the plant adapted to the site?
All plants have a genetic potential to grow to a certain size and shape at a given rate under optimal conditions. Knowing the plant's potential and matching its needs to the site's ability to meet those needs is the key to achieving the realization of a design vision. Rarely do site conditions enable a plant to grow to its full genetic potential. However, if enough of a plant's needs are met such as appropriate levels of the basic six factors: light, water, nutrients, temperatures, oxygen and carbon dioxide, we can have confidence that the proposed planting will develop into what was originally envisioned.

With all the potential choices in plant materials, the knowledge of plant adaptability to site conditions can seem overwhelming. Moreover, it is important to know under what conditions plants will grow satisfactorily, if not optimally. There are many references that can help people learn about appropriate planting conditions.

How do we begin matching the plant to the site?

The first most limiting factor for successful tree growth is how that plant can fit into its envisioned space. Given the vast number of plant choices, coming up with the desired spatial envelope for plant growth on the site is a good place to make the first cut.
In the urban environment, clear site lines for visual access can be key for pedestrian and vehicular safety. A question needs to be asked whether the tree you choose can be branched up to provide these conditions. Will the natural form of the tree be so altered to fit into a particular space that its aesthetic appeal is lost?

Hardiness
Plant adaptability to extremes of heat and cold would be the next most important limitation on plant choices. Knowing the heat and cold hardiness zone of your site is essential. It is also important to know about any microclimatic factors such as re-radiated heat, wind, rain shadows caused by buildings and frost pockets. Often in the urban environment there are sheltered areas that enable a wider range of plants to be grown than would be possible in surrounding rural areas. This is because of temperature, light

and wind altering effects of buildings and built surfaces. Localized microclimates regularly occur in cities. This might occur because of building-created wind tunnels, channeling the wind. However, the use of raised planters can cause a relatively small amount of soil to change temperature similar to air temperatures. In addition, references sometimes does not agree on the hardiness parameters of plants. A good idea would be to consult several references as well as local experienced professionals. When there is a discrepancy, choose conservatively. Cultivars may also have different hardiness ratings compared to the species.

Sun / Shade

Most trees require full sun to grow well (4-6 hours daily) into their envisioned size and form. Occasionally a few smaller trees may tolerate partial shade. This can be a significant issue in many landscapes. When it comes to shrubs or perennials however, there are many more choices for plants that prefer partial or heavy shade.

Soil moisture

In the natural environment, plants are often grouped by their ability to tolerate similar soil conditions such as soil moisture and pH. These are important parameters that should be used to choose plants. Some plants have the ability to tolerate a wide range of soil moisture conditions from flooding on the one extreme to drought on the other. Where soil volumes are limited, it is common for plants to experience alternating periods of too wet and too dry soil conditions. This may be due to the shallow nature of the soil. When it rains, water does not drain away and the roots experience oxygen deprivation. When the soil eventually dries out, the roots are in such a small area that there is too little water to support plant growth.

Where soil volumes are large and drainage is good, it is possible to grow a large number of plants including those that cannot adapt to alternating soil moisture extremes.

Knowing the conditions that determine moisture and oxygen availability in the soil are the keys to good design and successful plant establishment. Soil texture, depth, volume, density, drainage and the presence of irrigation will determine how water and air are available in the soil.

Soils that are seasonably wet, but otherwise well drained will accommodate a larger number of plants than those that are continually wet during the growing season or those that alternate between very wet and very dry. Sites that are dry most of the growing season will also pose challenges in plant selection. It might be necessary to modify these soil conditions to provide a better balance between too wet and too dry conditions in order to grow plants successfully on the site. If little soil modification is possible to overcome these limitations, the number of plant choices for the site will be severely limited

Soil pH

Testing soil pH is a simple, inexpensive technique that provides vital information about nutrient availability. Although most plants grow best at a slightly acid pH, there are many plants that will grow well in pHs as high as 8.2. Fewer plants will grow well in extremely acid soils of pH 3.5-4.5, but there are some selections for this range too. It is important that plants be chosen that will do well in the existing soil pH. It is much more difficult to change soil pH especially when making a permanent change. Regular monitoring of a site under consideration and frequent soil additions are often called for. If that is impractical, it is better to choose plants that tolerate the existing soils. Our research shows there is generally a wider range of acceptable pH tolerance in many plants that will have acceptable growth.

Salts

Consider plants that tolerate de-icing salts or more general saline conditions such as seashore sites when developing a planting plan. There are places where salts may drift aerially to a site such as along the seashore, highway roadsides during winter in northern climates, or soil related conditions as in arid areas, and saltwater intrusions into soils from seawater. There are few woody plants that will not be killed by some level of salts, but there are many that have some tolerance. Other site factors can exacerbate salt contamination, notably poor soil draina-

ge. Most salts are quite water-soluble and will wash through the root zone after a good rain if soils are well drained.

Beyond environmental factors, there are other management concerns that are important in plant selection, including plant susceptibility to pests and pathogens, their ability to be transplanted, availability in the trade, maintenance requirements as well as many other considerations.

What are the management issues associated with the plant?

Pests and diseases

Susceptibility of plants to insect and disease attack is a significant factor in plant selection. Plants that do not require pesticides to enable them to grow well should always be a first choice. It is worthwhile checking with local growers to find out about locally troublesome pests for a particular plant. Most plants have some pest problems. However, there are those that attract fewer pests. There is excellent information on both species and cultivars that are resistant to particular pests and diseases. Also, by planting in sites well adapted for a particular plant, the species will generally suffer fewer pest problems or will be able to recover from an attack more rapidly. Woody plants that suffer from a lack of water are more susceptible to boring insects that can do tremendous damage. Many times there may be reasonable substitutions for plants that may be particularly troubled by a certain disease or insect.

Transplanting

Several trees and shrubs are notably difficult to transplant. There are practices that help insure greater success in transplanting, yet some remain difficult even when appropriate transplanting measures are taken. It would be reasonable not to choose too many of the troublesome plants in any one particular installation

Cost and availability

Many desirable plants are not available in appropriate sizes or are too costly to be specified for a landscape planting. Increasingly, plants can be found to meet what is specified due to a diversified nursery industry. Timing is always important when transplanting. The designer may want to consider availability of plants and inform the contractor to be sure that species and sizes specified can be located. Alternatively, horticultural brokers may be hired to find plants that otherwise would be difficult to obtain. Having gone through the process of site assessment and making the best selections, it is worth trying to find the best plant before contractor substitutions are accepted.

Maintenance issues

Some plants produce an unacceptable amount of fruit or leaf litter under certain circumstances or require regular pruning for appropriate appearance. There may be small fruited or fruitless alternatives that have less of a litter problem. If there is no regular maintenance, shrubs and trees that need less pruning should be selected.

Thorns on plants may also be an issue in settings where people are likely to be in direct contact with the plants, such as a playground or a narrow street or alley planting.

'Weak-woodedness' is a term that refers to the propensity of trees to break up or drop limbs in high winds or during snow and ice storms. Often, fast growing trees are the most frequent offenders. Placement of such weak-wooded trees away from areas where people frequent or property that may be damaged is warranted. Plants that may be perfectly acceptable in a natural area may not be suited to certain urban conditions.

Native or non-native plants

The most important factor for the success of a plant in the landscape is its adaptability to the site and not its original geographic origin. Most urban sites are altered so as to make its original native site conditions, prior to centuries of development, irrelevant. If a tree was native to parts of New York City in the 16th century, it may not be the right tree for a particular site in New York City today. Non-native introductions represent a very small proportion of weedy plants that become a nuisance in nearby natural areas. Clearly, these invasive plants should be avoided. It is important to remember that a tendency of a plant to become invasive is a function of a particular plant and its location. Local authori-

ties will know which plants are problematic in a particular area.

Diversity vs. uniformity

The selection and placement of trees in the urban environment is a complex task requiring the consideration of many factors. Issues such as visual access, spatial constraints, disease and insect resistance can sometimes conflict with design objectives. Perhaps the most troubling conflict arises between the preference for visual uniformity and the practical need for biological and species diversity. Until recently a typical street tree planting consisted of uniform rows of a single species, generally selected for its attractive appearance and high tolerance to urban stresses. However, as over planting has brought about the decline of a number of such favorite species such as the American elm it is clear that design objectives must be balanced against the practical need for species diversity in street tree plantings.

REFERENCES

Information on many recommended trees can be found at:
http://www.hort.cornell.edu/uhi/outreach/recurbtree/index.html
A woody plant database can be accessed at:
http://hosts.cce.cornell.edu/woody_plants/

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CONTROL DE FLORACIÓN EN ESPECIES ORNAMENTALES: *Leucocoryne, Zephira* y *Helianthus*

FLOWERING CONTROL IN ORNAMENTAL SPECIES; *Leucoryne, Zephira* and *Helianthus*

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El control de la floración puede ser definido como un conjunto de técnicas de producción y prácticas de manejo dirigidas a manipular la floración de las plantas sobre la base de una acabada comprensión del crecimiento y desarrollo vegetal. El fotoperíodo, la intensidad de la luz y la temperatura son los principales factores involucrados en los mecanismos de control ambiental de la floración en cultivos florícolas de uso comercial. En la floricultura moderna el control de la floración es una herramienta muy importante para resolver diversos problemas relacionados al proceso de floración con el objetivo final de responder a las exigencias del mercado. El presente trabajo de investigación fue desarrollado en el curso de varias temporadas a fin de determinar el efecto del peso del cormo y diversas temperaturas de almacenaje sobre la dormancia de la geófita chilena *Zephyra elegans*, una potencial flor de corte, el efecto del almacenaje a largo plazo de bulbos de especies del género chileno *Leucocoryne* sobre su floración y determinar la temperatura más apropiada para estos fines, y por último el efecto del fotoperiodo sobre la respuesta de floración de diferentes cultivares ornamentales de *Helianthus annus*, todo esto dirigido a establecer prácticas de control de floración aplicables al cultivo comercial de estas especies con propósitos ornamentales.

Z.elegans está provista de un cormo que es reemplazado anualmente y presenta un habito de crecimiento deciduo y sinanto. Los cormos dormantes de esta especie fueron almacenados a