

Excerpt from

Up By Roots: Healthy Soils and Trees in the Built Environment
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UP BY ROOTS—DESIGN PRINCIPLES

Once the designer understands the environment of the site and the requirements of the trees, this information can inform and inspire a suitable design approach. Trees need more space at the soil line and below the ground than is allotted in most contemporary urban design. There is fierce competition for this space, and for the budget needed to prepare this space for trees.

To ensure that each tree gets its needed share of space and budget, the designer must defend tree requirements from the beginning of design through the end of construction. Designing space for trees cannot be left to the construction document phase. Successful tree design cannot be an afterthought once the design direction is set.

The following ten principles can guide the process of building landscapes from initial concept sketches through construction and the start of maintenance cycles. The principles are organized into soil-based strategies, tree-based strategies, and management-based strategies.

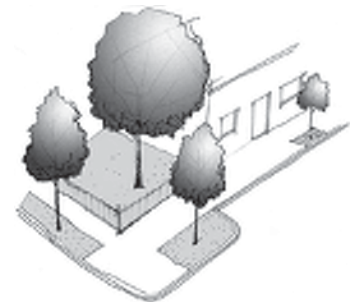
Soil-Based Strategies

Soil-based strategies work with existing soil resources, protect and improve those resources, and recognize when to abandon the existing soil in favor of replacements.

Principle 1. Plant the Easy Places First

It sounds simple, doesn't it? Assign large trees to areas where you have the largest or the best soil resources.

In the urban environment, there are always easier and more difficult places to grow trees. Big differences in growth possibilities may be only a few yards apart, a result of slight variations in a design decision or changes in soil or drainage patterns. These sometimes subtle differences may be identified in the site assessment or perceived by an experienced designer who understands trees and their needs. Starting the design with the easier locations yields a greater chance of successful trees at a lower price. This may mean other goals have to be compromised, but all designs involve balance among conflicting goals.



Working with existing resources is also fundamental to the principles of environmentally sustainable design. One of the best examples of this principle is the decision to place street trees between the sidewalk and the curb, as opposed to placing them between the sidewalk and the building. The soil between the walk and the building is often more suitable to grow a healthy large tree, but it is rare for this location to be selected. Conversely, the space between the curb and the walk is usually too small and the soil too compacted for a large tree. The curbside location may be preferred for aesthetic and urban design reasons. Yet unless the project has the resources to overcome the technical problems of putting trees in very confined space, these advantages may be beside the point. There is no aesthetic value to a dead tree or an empty planting hole.



Principle 2. Make Larger Planting Spaces

Another simple way to improve the health of trees in urban areas is to reduce the areas of paving and increase the areas open for soil. Of all the principles, this is the most important and the easiest to undertake. Competition for space in the city is severe, but rarely does anyone ask, “Could the paving be reduced even slightly to improve tree growth?” This is because designers who are not interested in the health of trees often make paving decisions.

Architects, civil engineers, and many landscape architects see paving as the primary element in the design. They either do not know how their decisions affect tree health or may shrug these concerns off in the belief that trees can be replaced when they die. Paving is considered easy to maintain and is necessary for pedestrian and vehicle traffic. The size of a paved area may also be part of an aesthetic plan. Yet it is possible to ask how wide roads and sidewalks have to be, and how much paving is really needed for a plaza.

Fewer larger spaces for clustered trees are better than many smaller isolated tree plantings. Often a small change in the widths of drives, walks, and spaces between obstructions can result in enormous benefits to the amount of soil available to the tree, increasing tree longevity.

Formulas for determining the amount of soil needed to support a large tree are provided in this book. Use them to gain support for larger soil areas.



Principle 3. Preserve and Reuse Existing Soil Resources

Despite dire predictions of destroyed soils and poor growing conditions, there are often usable soils at urban sites. If these soils can be identified, incorporated into the design and protected during the construction, a small piece of the environment has been preserved. It is hard to make good soil, so anytime reasonable soil exists, reuse is the best option.

Removing and replacing soil is a very environmentally destructive act. Existing soil must be moved at great expense and use of fuel, and often ends up as fill dirt or, worse, in a landfill. The harvesting of topsoil and other materials to make replacement soil results in large areas of degraded land, silting of waterways, and again considerable use of fuel. If promoters and stakeholders wish to represent a project as sustainable, then preserving, protecting, and reusing existing soil must be a priority. Even without this concern, a simple budget calculation can make a strong case for reuse.

Soil reuse, protection, and preservation are not easy tasks in a complex construction process. They demand the same level of effort as tree preservation, and many of the principles are the same. Think of soil preservation as growing space for future trees. Reusing soil—moving it around the site and restoring it in a new location—is the second-best option, but comes with its own requirements and an acceptance of a significant level of soil degradation no matter how carefully it is handled.

Principle 4. Improve Soil and Drainage

Once the design has established the limit of available soil area, make this soil “right for the tree.” Sometimes simple deep tilling of compacted soil is sufficient, while in other places complete soil replacement is required. Knowledge of soils, drainage, and the requirements of the trees to be planted is necessary to make the right decisions. In some cases, a little soil amendment can actually create more problems by forming “bathtubs” that hold water. Improper soil amendments are one of the most common mistakes in working with soil, and much of this book is devoted to this subject.

Too much water creates more problems in the urban landscape than too little. Plants can adapt to dry conditions, and a little supplemental water at establishment or during a drought can make all the difference. In contrast, drainage problems can be difficult to fix, especially if not discovered until after the project is finished. Poor drainage will undo all the other principles.



Tree-Based Strategies

Tree-based strategies discuss the needs of the tree and instruct the designer on how they are accommodated into the design.

Principle 5. Respect the Base of the Tree

Do not pave within the area of the tree’s future trunk flare. The mature trunk flare is the pronounced swelling at the base of the tree just before the trunk disappears underground. It is usually more than twice the diameter of the trunk at 4 feet above the ground. This area must be treated with great care and respect. The trunk will expand to dimensions dictated by the tree, not the designer. The tree will either push aside any constrictions or suffer damage from them.

Just beyond the trunk flare, the first set of large roots extends out underground and rapidly tapers away from the trunk over the next 6 to 8 feet. These are the roots that cause the most conflict with paving and curbs. Obstructions within this area are always at risk unless measures are taken to prevent root intrusion or develop conditions that allow roots to grow deeper within the soil.



Principle 6. Make Space for Roots

Design spaces for roots under the pavement and adopt different approaches to root space design as conditions change.

At some point in the design process, it may simply be impossible to provide sufficient soil for the tree in an area separate from the paved areas. At that point the designer must begin to anticipate roots growing under the pavement. This may limit the type of paving that can be used and may increase the cost of the project. Yet it is possible to encourage root growth under pavement in ways that do not impact the stability of the pavement.

In urban areas, when the rooting space is smaller than required by the tree, uniform design and detailing of the tree rooting space often does not result in uniform tree growth. Trees will adapt to subtle differences in the area around the prepared rooting space. Designers must consider each tree as a unique organism in a unique environment and develop solutions that reflect these differences in conditions. This book offers many approaches to solve soil and drainage problems. Use as many of them as are appropriate to optimize the budget with a goal of growing large, healthy trees.





Principle 7. Select the Right Tree

Put the right tree in the right place and make the place right for the tree.

Only after all the above principles have been followed can the design consider tree selection. Selecting the right tree assumes that one has made every effort to make the place right for the tree. This order of priority gives the designer a much wider range of available trees from which to choose. Select trees primarily for their ability to perform the desired functions and aesthetic contributions to the design. Even pines can be used as street trees, if their use would meet the goals of the project.

Selecting the right tree also assumes a high level of professional knowledge about the requirements of each tree. Designers must still take on the responsibility of learning the nuances of horticulture. This is more than a quick look at a textbook resource or the use of a digital plant selection program. Those resources are great beginning points, but are no substitute for personal experience. Local climate, maintenance, nursery availability, regional soil differences, and other variables must become part of the designer's thought process.

Once the tree is chosen, go back through the design process and make sure the site has been made right for that tree. Be prepared to change elements if a tree selection changes.

Management-Based Strategies

Management-based strategies provide tools to fund and implement the first two sets of strategies.



Principle 8. Establish Reasonable Tree and Soil Budgets

Balance the design quality of all elements in the landscape.

Trees are just one element in the urban fabric needed to support design goals of bringing people together in dense yet attractive spaces for economic and social interaction. Other elements, such as paving, furnishings, and lighting, are also important. It is necessary to keep the resources devoted to each element balanced within the available budget.

Growing and maintaining a large, healthy tree in urban soils requires about the same resources per unit as installing and maintaining a good-quality street light. Trees and lights offer different benefits to the community, but these benefits are reasonably similar in value. Too many landscapes are built with high-quality light fixtures, paving, and furniture placed among dead or stressed trees because the designer did not understand the need to balance project resources.

As budgets run up against limits, adjust the quality or quantity of everything a little bit. Planting fewer trees, but providing each with healthy soil, will be a better investment and produce a better landscape over the long term.

Principle 9. Create Detailed Tree and Soil Construction Documents

Once the concept design has been developed with the basic systems needed to support trees, the construction document process must continue with the same high level of care and commitment to the principles of soil science and tree biology. As in any construction system, there is a big leap from the planting concept plan to the finished product.

Make detailed drawings of the soil design. A separate soil and drainage installation plan should be a requirement. Draw the trees in sections to scale, accurately depicting the root ball size. Make sure that each tree fits in the allotted space at

