Step-by-Step Site Analysis Procedures for Developing a Native Landscape Plan

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Introduction

Prior to planting native trees, shrubs, ferns, or perennial flowers and grasses, it is essential to perform a thorough evaluation of the site conditions. Soils, drainage, slopes, and sunlight conditions all have a strong influence on which plants will thrive on a given site. Once the growing conditions have been assessed and evaluated, the appropriate plants can be selected to match the unique site conditions.

In order to be successful in creating low maintenance landscapes, it is very important to plant those species that are adapted to the site conditions. Without irrigation, fertilizers, pesticides and regular maintenance, the plants are on their own. Gardeners sometimes hope they can "will a plant to grow" on a site where it does not belong. This usually results in wasted effort and ultimately, disappointment when the plant does not thrive.

Primary Factors Affecting Plant Success

THE THREE MOST IMPORTANT FACTORS THAT DETERMINE WHICH PLANTS WILL GROW WELL ON A SITE ARE:

1. Soil Conditions
2. Sunlight
3. Slope Aspect and Sides of Buildings

1. Soil Conditions

Soil growing conditions are determined by four main factors: Soil Texture and Drainage, Soil Structure, Soil pH, and Soil Nutrient Levels

Soil Texture and Drainage

SAND:
These are typically poor, dry soils, often extremely well-drained and low in nutrients and water-holding capacity. Only drought-tolerant plant species will thrive under such conditions. Most of the prairie plants that do well on dry sandy or gravelly soils tend to be short, from a few inches tall to three or four feet tall. A few tall grasses and flowers can tolerate these soils, but they are the exception. Some plants are adapted to grow only on well-drained sandy soils, and will do poorly when planted in richer soils such as loam or clay.

LOAM:
These are typically rich soils that combine good water holding capacity with good drainage. Most plants grow best on these soils, except for those that require either very dry or very wet soils. Loam soils support a variety of trees, shrubs, and native flowers and grasses.

CLAY:
These are heavy soils that tend to have poor internal drainage and are easily compacted. Their small silt and clay soil particles hold moisture well, and are usually quite fertile. Air and water movement within the soil is often restricted, so that only plants that can tolerate such conditions will survive. However, some plants prefer heavy clay soils and do best in them.

ORGANIC (MUCK OR PEAT):
Organic soils contain a high proportion of muck or peat. These soils naturally occur in swamps, bogs, and marshes, and are usually wet. Organic soils are often drained and converted to agriculture, due to their ability to hold large amounts of water and nutrients. When drained they can still hold water like a sponge, but when they dry out, they can be difficult to “re-wet.” Never burn a prairie on an organic soil unless the soil itself is damp. Burning when the soil is dry can lead to a peat fire that burns down into the soil, destroying the organic matter in the soil and killing the plant roots.

Some plants have narrow ranges of adaptability, and will only grow in a certain soil type. Others are more adaptable, and can thrive in a wide variety of soils. When selecting plants for a site, the chances of success are greater with plants that have a broad range of adaptability. Of course, the plants must be suited to the conditions the site. Plants that grow only in very specific soil types are referred to as "specialists." These are typically difficult to grow, unless the exact conditions they require are present.

Soil Structure

Soil structure refers to the way a soil is "put together." This has a strong influence on soil behavior in the plant rooting zone, which in turn determines what species can grow successfully.

Soils can have *blocky, platy, columnar, granular,* or *crumb* structure. This refers to the way the soil particles are arranged with regard to one another. Clay soils often have large pieces of *blocky* or *columnar* soil particles. These soils will break up into large chunks or clods when dry. Loamy and organic soils typically have *crumb* structure, in which the soil is loose, and breaks up readily into small pieces. Sandy soils often have no discernable structure, since the sandy soil particles do not stick together to form any type of cohesive structures.

The most important element of soil structure is soil porosity, or the soil's *breathability.* Porosity determines the rate at which water and air can move through the soil. This has a strong influence on plant growth.

For instance, a heavy clay soil with minimal organic matter has a low porosity. The small clay particles bind tightly together, and do not allow air and water to move readily between them. Only certain plants can grow successfully on these soils. A rich loamy soil with good organic matter has a more "open" structure and better porosity, allowing water and air to move more freely throughout the soil. Many plants thrive on loamy soils, as they can gain access to air and water in the rooting zone. The loose nature of sandy soils allows easy movement of air and water into, and through them.

Soil structure becomes a critical consideration when dealing with poor clay soils that contain little organic matter. Organic matter helps to "open up" the soil by breaking up the clay particles and allowing air and water to move through them. It is important to select only those plants that can tolerate poor air and water movement in the soil when planting on heavy clay soils.

Plant roots need air to breathe. Heavy clay soils do not allow ready transfer of oxygen into the soil to the roots. The tight nature of clay soils also prevents infiltration of rainfall, so that rain often runs off without entering the soil. This can make clay soils drier than a soil that has good soil structure and higher porosity. Prairie Nursery has done extensive research on the native prairie flowers and grasses that will grow on these problem clay soils, called "Clay Busters."

Soil pH (Acidity and Alkalinity)

The term pH refers to soil acidity or alkalinity. This can strongly determine the nutrient availability in the soil, and has a strong influence on what plants will do well on a given site.

Most soils typically range in pH from 5.0 to 8.0. A soil pH of 7.0 is considered “neutral” or intermediate between acid and alkaline. Acid soils have a pH below 6.5, and alkaline soils have a pH above 7.5. As the pH decreases the soil becomes increasingly acidic: as it increases, it becomes increasingly alkaline. A pH below 5.0 is considered strongly acidic and a pH above 8.5 is strongly alkaline. Most plants do will not grow in soils with a pH below 5.0 or above 8.5, although there are a number of “specialist” plants that are adapted to growing in extremely acid or highly alkaline soils.

The optimal availability of plant nutrients in the soil occurs at a pH of 6.5. As a result, this is generally considered to be the optimal pH for garden soil. However, certain plants prefer acid or alkaline soils. For instance, blueberries require a strongly acid soil in order to thrive, usually between 4.5 and 5.5. Hackberry trees do best in an alkaline soil with pH levels up to 8.5, and can literally grow right out of limestone rock. Some plants can grow in a wide range of pH’s, such as the prairie grass big bluestem, which grows happily in a pH of between 5.0 and 8.5. It pays to test the pH of your soil, and to select those plants that are known to grow best under those conditions.

Soil Nutrient Levels

The three primary soil nutrients, or “macronutrients,” are Nitrogen (N), Phosphorus (P) and Potassium (K). These are referred to as “Essential Elements,” without which plant growth cannot occur. Nitrogen is seldom limiting for most native plants, as it is supplied by rainfall, especially in thunderstorms. Phosphorus and Potassium, if present in sufficiently low amounts, may cause plant growth to be retarded. Testing for these two nutrients can identify if a problem exists, so that it can be corrected by addition of the appropriate amount of fertilizer.

Sulfur (S), Calcium (Ca), and Magnesium (Mg) are other important nutrients that are required in moderate quantities. Sulfur is seldom in short supply in most soils, thanks to acid rain. Sandy soils are often low in Calcium and Magnesium, and may require the addition of lime, or dolomitic lime if the soil is low in Magnesium. Since sandy soils are often acidic, the addition of lime serves to add these nutrients and increase the pH to a more favorable level between 6.0 and 7.0. This has the added benefit of making other nutrients, especially Phosphorus, more readily available in the soil.

Certain “micronutrients” are required in very small amounts by plants. These include Manganese (Mn), Boron (B), Zinc (Zn), Iron (Fe), Copper (Cu), Molybdenum (Mo), and Chlorine (Cl). These elements usually occur in sufficient amounts in the soil, but can occasionally be deficient, requiring the addition of small amounts of micronutrients.

Sandy soils are more prone to lacking certain micronutrients, particularly Iron, Boron and Zinc. Soils with a high pH also are more likely to have micronutrient deficiencies, in particular Iron, Manganese, Zinc, and Copper. Muck soils may sometimes exhibit low levels of Copper.

Nutrients can be added to soils using either organic or inorganic fertilizers. Lime is a cheap, organic soil amendment that can help make micronutrients and Phosphorus more readily available by adjusting the acidity of the soil. If the soil is deficient in Magnesium, Dolomitic Lime should be applied, as it contains both Calcium and Magnesium.

Phosphorus fertilizer can be purchased in various organic and inorganic forms. Superphosphate (0-21-0) and Triple Superphosphate (0-46-0) are the most commonly available form of phosphorus fertilizers. The Phosphorus in these fertilizers occurs in the chemical forms that are readily available for plants to take up from the soil (orthophosphate and polyphosphate).

Phosphorus is available in organic form as bone meal (1-11-0) and chicken manure or chicken litter (chicken manure mixed with sawdust). Bone meal has the added advantage of being high in calcium (24%), while chicken manure and chicken litter also contain lots of nitrogen.

Bone meal is a slow-release form of Phosphorus, as it must be broken down in the soil to release the mineral itself, as opposed to superphosphate, which contains Phosphorus in a form that is readily available to plants. However, bone meal provides a long-term source of Phosphorus in the soil due to its slow release characteristics. The high calcium content of bone meal makes it a poor choice for fertilizing acid-loving plants, as it will tend to make the soil more alkaline. Bone meal will not release its Phosphorus in a plant available form when applied to alkaline soils, as the nutrient tends to be locked up by other soil minerals in soils with high pH (alkaline) levels.

Potassium, or Potash, is commercially available as Muriate of Potash, or Potassium Chloride (0-0-60), Potassium Sulfate (0-0-50), and Potassium Nitrate (13-0-45). Care must be taken when using these fertilizers, as the high Chlorine content of Muriate of Potash can burn plants if applied in excess. Potassium Sulfate tends to acidify the soil due to its Sulfur content.

Two organic sources of Potassium are wood ashes (0--6) and greensand (0-0-3). Wood ashes are highly alkaline, so they should not be applied to excess, or to acid-loving plants. Greensand is an olive-colored sandstone that was deposited in the ancient ocean sediments during the Jurassic and Cretaceous Periods. It is released slowly from the rock structure and provides a good long-term source of Potassium.

Cottonseed meal (6-2-2) and soybean meal (6-1-1) are good sources of nitrogen, along with modest amounts of Phosphorus and Potassium. Cottonseed meal is not generally considered to be an organic fertilizer due to the large amounts of pesticides that cotton plants receive. Studies have shown that very little of the pesticides are present in the cottonseed meal after processing.

Other organic fertilizers include composted leaves and grass clippings, horse manure, cow manure, sheep manure, llama manure etc. Leaves and animal waste provide nutrients in a less concentrated form than commercial fertilizers and chicken manure, but provide the added benefit of increasing the soil's organic matter content, and thus its nutrient and water holding capacity.

2. Sunlight

Sunlight intensity is a critical factor to consider when selecting plants. Some species require full sun or nearly full sun in order to do well. On the other hand, many woodland plants do best with the protection of a woodland tree canopy. Some plants have the ability to grow in a wide variety of light conditions. Just as certain plants may be adapted to a wide variety of different soil conditions, some can grow in a broad range of sunlight levels.

Sunlight conditions can be divided into four basic levels:

FULL SUN:
Direct sun all day to at least one half day of full sun

PARTIAL SUN:
Direct sun for no more than one half day, shaded for at least one half day.

PARTIAL SHADE:
Little or no direct sun, with diffuse light from the edges or through a light canopy of tree leaves. The "dappled shade" of oaks, hickories, and walnut trees creates partial shade conditions.

FULL SHADE:
No direct or diffuse light reaches the ground. A dense canopy of trees completely shades the forest floor. The forest also minimizes wind speeds, protecting woodland plants from excessive drying or physical damage from high winds. The shade of sugar maples, beech, basswood, and dense conifers typify full shade conditions.

Plants that grow in full sun are adapted to high light intensities, heat, wind, and even hail. Most prairie plants are highly tolerant of hail, and are not damaged even by quarter size hailstones. Plants that grow in full shade must be able to grow under low light intensities, but are protected from rapid temperature changes, high winds, and hail by the trees above.

Plants that grow naturally in the intermediate conditions between full sun and full shade can often be grown in full sun in a garden situation. However, sun-loving plants do not generally do well when planted in shady conditions, as they cannot thrive without sufficient sunlight. Similarly, plants that grow only in deep shade usually cannot tolerate full sun. Their leaves often turn yellow in an attempt to adapt to higher light intensities, and generally fare poorly or die.

3. Slope Aspect and Sides of Buildings

Slopes on hillsides and sides of buildings facing different directions of the compass experience widely varying growing conditions, or "microclimates." Each slope or wall has its own climatic conditions that are determined by the intensity of the sun and the exposure to prevailing winds. The direction that each slope or wall faces has a powerful effect on which plants will grow best there.

South-facing slopes and walls are the hottest and driest, as they receive direct sun from spring through fall. West-facing slopes and walls are the second hottest and driest, receiving the hot afternoon sun, as well as the drying prevailing winds during the growing season.

North-facing aspects are the coolest, as they receive direct sun for only a short period of time in mid-summer when the sun is at its highest point in the sky. North slopes tend to stay cool in spring and fall, and support plants that are adapted to shaded, cooler conditions. East-facing slopes and wall are the most moderate, as they receive direct morning sun during the coolest part of the day and are shielded from the hot afternoon sun and drying winds.

Summary

The three main factors that determine the growing conditions for a plant are Soil, Sun, and Slope Aspect. The combination of all three factors will determine what plants will thrive in a certain location. It is essential that all three of these factors be evaluated and considered when selecting plants. Once the growing conditions are known, the best plants can be selected to match the site, with the knowledge that they will have a high probability of success.