Master Gardener Training

Module 1: The Fundamentals

Office Hours Summary

Welcome to Module 1! This week covers the foundational plant and soil science that underpins successful gardening. Understanding these fundamentals will help you make informed decisions about plant selection, site assessment, and garden management.

Section 1.1: Plant Biology for Gardeners

Learning Objectives

- Recognize plant parts and their functions
- Learn how plants are classified into family groups
- Understand the value of using scientific nomenclature
- Become familiar with environmental factors affecting plant growth
- Examine the three basic processes: photosynthesis, respiration, and transpiration
- Learn to use dichotomous keys for plant identification

Key Concepts

Scientific Nomenclature

Using scientific (botanical) names is more straightforward than common names because it ensures everyone understands exactly which plant is being discussed. Common names can vary by region and may refer to multiple different plants, while scientific names are universal and specific.

Essential Plant Parts and Functions

Plant Part	Description & Function
Blade	Flattened part of the leaf where photosynthesis occurs
Petiole	Stalk supporting the blade
Bud	Contains the beginnings of future growth; size, color, shape and markings help with identification
Leaf Scar	Heart-shaped scar remaining on stem where petiole was attached
Node	Area on stem from which one or more leaves develop

Leaf Arrangements on Plant Stems

- **Alternate:** 1 leaf per node
- **Opposite:** 2 leaves per node
- **Whorled:** More than 2 leaves per node

- **Rosette:** Radiating cluster at base

Duration of Vegetative Parts (Life Cycles)
- **Annual:** Completes life cycle in one year
- **Biennial:** Completes life cycle in two years
- **Perennial:** Life cycle extends three or more years
- **Deciduous:** Plants that shed their leaves at the end of the season and become dormant
- **Evergreen:** Plants that are never without leaves attached

Plant Appearance or Habit
- **Herbs (Herbaceous plant):** Plants with non-woody stems
- **Shrub:** Woody perennial with more than one main stem
- **Tree:** Woody perennial with a single main stem
- **Vine:** Herbaceous plants with elongate, flexible, non-self-supporting stems
- **Liana:** A woody vine

Three Basic Processes of Plant Growth
Photosynthesis: The creation of sugars using sunlight, carbon dioxide, and water. Plants use this process to convert light energy into chemical energy, producing oxygen as a byproduct.
Respiration: The burning (breakdown) of sugars to release energy for growth and other life processes. This releases carbon dioxide and water. Both photosynthesis and respiration occur in plants, but photosynthesis only happens in green parts exposed to light.
Transpiration: The translocation (movement) of water and nutrients from the roots up to shoots, buds, and leaves. This creates the pull that moves water through the plant.

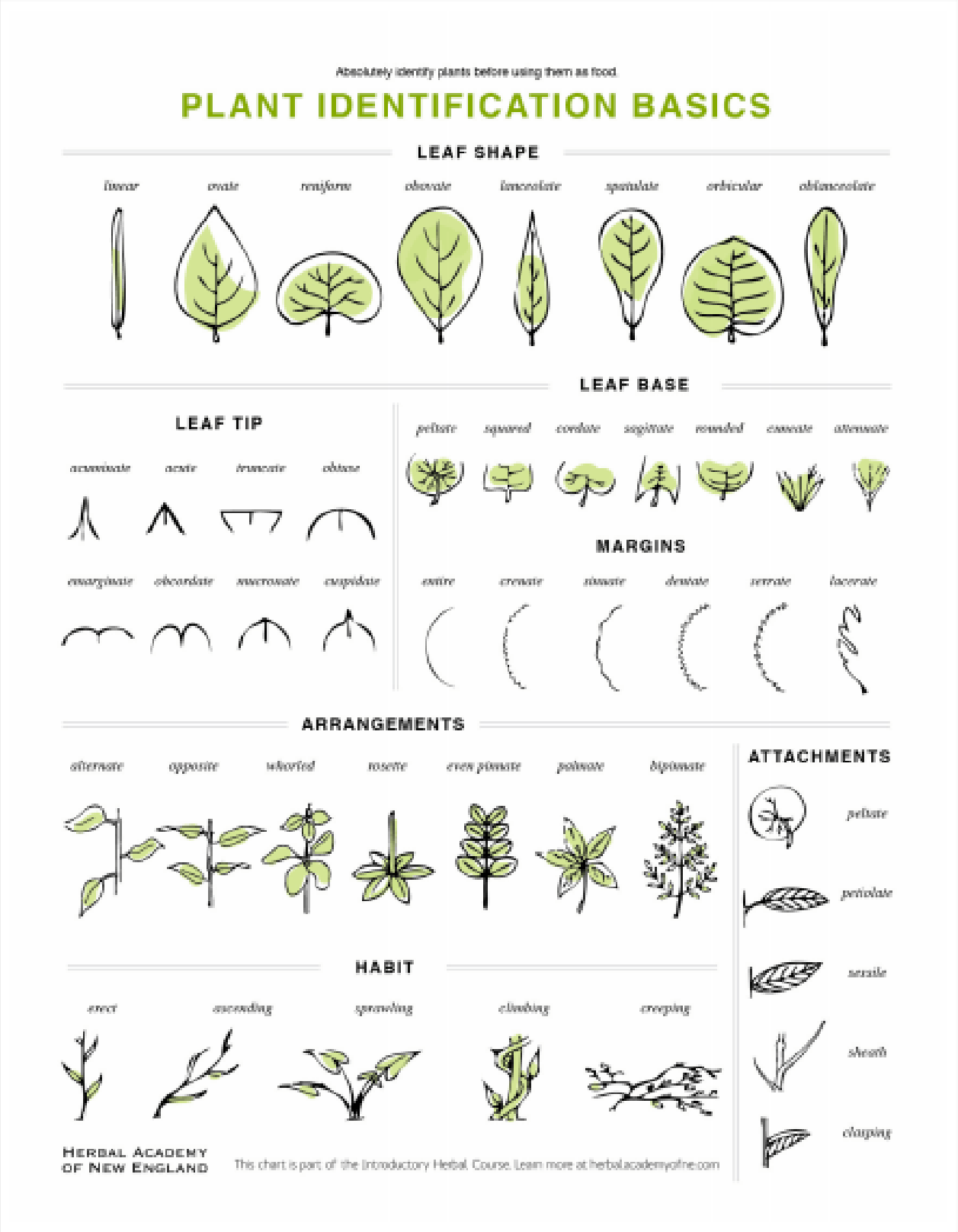
Understanding Monocots and Dicots
Plants are classified into two main groups based on how many seed leaves (cotyledons) they have. These groups function very differently, which affects how we care for them:

- **Monocots** (1 seed leaf): Grasses, lilies, orchids, palms. Parallel leaf veins, flower parts in 3s
- **Dicots** (2 seed leaves): Most flowering plants, trees, shrubs. Netted leaf veins, flower parts in 4s or 5s

Plant Phenology
Phenology refers to when plants do the things they do—when they flower, when they fruit, when they go dormant. Understanding phenology helps you know what to expect throughout the growing season and can help with plant identification.

The best way to learn about plants is by touching them, observing them, and living with them. These activities are designed to help you get up close and personal with plant parts.

Plant Identification Key



Section 1.2: Right Plant, Right Place

Learning Objectives

- Describe the basic relationship of soil and environmental factors to plant growth
- Understand soil characteristics: texture, pH, and organic matter
- Recognize there is a right plant for the right soil
- Become familiar with systems thinking
- Learn how to conduct a basic site assessment

The Importance of Soil

Soil is Not Dirt!
Soil is a living, dynamic system—an amazing intersection of mineral particles, organic matter, soil biology (living organisms), and void spaces filled with air or water. **Dirt** is soil material that is taken out of its native location. Let's change our mindset and treat what we garden in as the valuable resource it is: soil.

What is Soil Made Of?
Ideal soil composition (by volume):

Component	Percentage
Mineral particles	45%
Organic matter	5%
Water	25%
Air	25%

Soil Texture
Soil texture refers to the proportion of sand, silt, and clay particles. These particles range in size:

- **Sand:** Largest particles (0.05-2.0 mm). Large pore spaces, rapid drainage, low water storage, excellent aeration
- **Silt:** Medium particles (0.002-0.05 mm). Moderate drainage and water-holding capacity
- **Clay:** Smallest particles (<0.002 mm). Tiny pore spaces, slow drainage, high water storage, can impede root growth and aeration

Soil texture is *inherent* (difficult to change) but affects how you manage your garden. You can learn your soil texture using the **jar test** or **feel test**.

Pore Spaces: Why Size Matters
Pore spaces between soil particles are essential for air and water movement. **Sandy soils** have large pores (rapid drainage, less water storage). **Clay soils** have tiny pores (slow drainage, more water storage but less aeration).

Plants and soil organisms need *both* water and air to survive. Poorly drained soils limit respiration because air cannot move through waterlogged soil, and excess carbon dioxide can build up.

Soil pH and Nutrient Availability
Soil pH measures acidity or alkalinity on a scale from 0-14 (7 is neutral). Most plants prefer pH 6.0-7.0. pH **dramatically affects nutrient availability**—nutrients can be present in the soil but unavailable to plants if the pH is wrong.

Example: Blueberries need acidic soil (pH 4.5-5.5). If planted in neutral or alkaline soil, they won't thrive even with fertilizer because they can't access the nutrients they need.

Organic Matter
Organic matter includes both living and non-living components—plant residues, decomposing materials, soil organisms (bacteria, fungi, earthworms, insects). Organic matter:

- Improves soil structure
- Increases water-holding capacity
- Provides nutrients as it decomposes
- Supports beneficial soil life

Note: *Cultivating or tilling aerates soil but increases the rate that organic matter decomposes, so excessive tilling can deplete organic matter over time.*

Soil Profile (Horizons)
Most soils have distinct layers called horizons:

- **O Horizon:** Organic layer on the surface
- **A Horizon (Topsoil):** Contains most organic matter and plant roots, highest biological activity
- **B Horizon (Subsoil):** Accumulation zone for minerals leached from above
- **C Horizon (Substratum):** Weathered parent material

The Right Plant, Right Place Philosophy
This is the KEY to successful gardening. There is a right plant for the soil you have, and if you want a specific plant, you need to either find the right location or modify the soil to match.

Example: Don't plant yews (Taxus) in poorly drained soil—they don't like *"wet feet"* and will fail. Similarly, don't plant moisture-loving plants in dry, sandy soil.

The more you can tailor your plant choices to what your soil provides, the healthier your plants will be and the better they'll resist pests and diseases. It's far easier to select plants suited to your site than to constantly battle against site conditions!

Conducting a Site Assessment
A comprehensive site assessment looks at multiple factors beyond just soil:

- **Soil:** Texture, drainage, compaction, pH
- **Light:** Full sun = 6+ hours of afternoon sun (not morning sun!)

- **Water:** Where does water collect? Where does it drain? (Best observed during heavy rain)
- **Topography:** South-facing slopes are sunnier than north-facing
- **Wind:** Prevailing wind direction and exposure
- **Hardiness Zone:** What temperatures can plants withstand?
- **Wildlife:** Deer pressure? (This dramatically limits plant choices!)
- **Existing features:** Trees providing shade, rooting space limitations, walnut trees (juglone toxicity)
- **Human traffic:** Where do people walk? Where does snow get plowed?
- **Existing vegetation:** What's already growing well? What's struggling? Are there invasive weeds?

Systems Thinking in Gardening
Systems thinking means understanding how different parts of your garden ecosystem connect and influence each other. Instead of seeing plants, soil, water, and wildlife as separate elements, recognize that changes to one part affect the whole system.

Example: Adding mulch affects soil temperature, moisture retention, weed growth, and soil organisms. Planting native flowers supports pollinators, which increases fruit production in your vegetable garden. A healthy soil ecosystem with diverse organisms helps suppress diseases naturally.

Discussion Questions

- Why is using scientific plant names important for Master Gardeners?
- How do the three plant processes (photosynthesis, respiration, transpiration) work together to support plant life?
- Reflect on the quote: *"A nation that destroys its soils destroys itself."* What does this mean for your gardening practices?
- Can you think of a plant in your garden that's struggling? How might site conditions be contributing to its poor performance?
- What's one change you could make to better match your plant selections to your site conditions?

Key Takeaways

- **Learning plant parts and terminology** enables accurate plant identification and better understanding of plant function
- **Observing plants closely** (touching, examining) deepens your appreciation and knowledge more than lecture alone
- **Soil is a living resource,** not dirt—treat it with respect and it will support healthy plants
- **Soil texture is inherent** but understanding it helps you make informed management decisions
- **pH affects nutrient availability** as much as nutrient presence—test your soil!
- **Right Plant, Right Place** is the foundation of sustainable gardening—match plants to site conditions rather than fighting against them

- **Site assessment** goes beyond soil to include light, water, wind, wildlife, and human use patterns
- **Healthy plants in the right location** are naturally more resistant to pests and diseases

Additional Resources

- *Manual of Woody Landscape Plants* by Michael Dirr (especially pages 1-30 on plant botany)
- *The Botany Coloring Book* (relaxing way to learn botany)
- USA National Phenology Network Botany Primer (available in project materials)
- Landscape for Life: landscape4life.org (excellent online manual for site assessment and sustainable landscaping)
- Cornell Plant Clinic: plantclinic.cornell.edu/mastergardner.html

Remember: *Master Gardener training is not about memorizing everything—it's about learning how to ask the right questions, use appropriate resources, practice critical thinking, and provide helpful information to the public. Some concepts will stick immediately; others will make sense after the third or fourth exposure. That's completely normal!*

Questions? Bring them to office hours or post in the discussion forum!

How soil pH affects availability of plant nutrients