# Plant Diagnostic Process

John Thompson
Sandoval Extension Master Gardener Project

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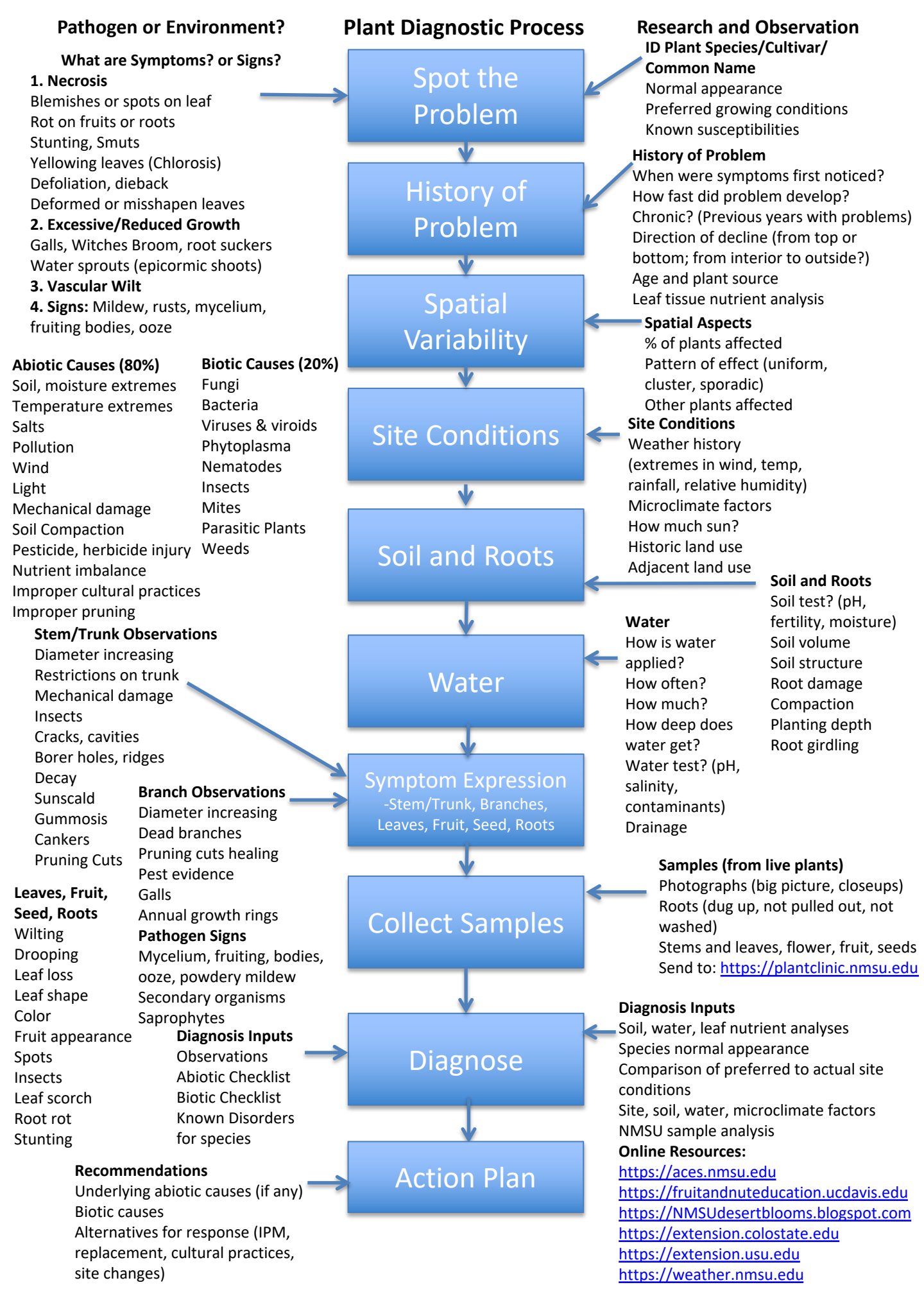

Pathogen or Environment?
Plant Diagnostic Process
Research and Observation
What are Symptoms? or Signs?
1. Necrosis
Blemishes or spots on leaf
Rot on fruits or roots
Stunting, Smuts
Yellowing leaves (Chlorosis)
Defoliation, dieback
Deformed or misshapen leaves
2. Excessive/Reduced Growth
Galls, Witches Broom, root suckers
Water sprouts (epicormic shoots)
3. Vascular Wilt
4. Signs: Mildew, rusts, mycelium, fruiting bodies, ooze
Spot the Problem
ID Plant Species/Cultivar/ Common Name
Normal appearance
Preferred growing conditions
Known susceptibilities
History of Problem
When were symptoms first noticed?
How fast did problem develop?
Chronic? (Previous years with problems)
Direction of decline (from top or bottom; from interior to outside?)
Age and plant source
Leaf tissue nutrient analysis
Spatial Variability
Spatial Aspects
% of plants affected
Pattern of effect (uniform, cluster, sporadic)
Other plants affected
Abiotic Causes (80%)
Soil, moisture extremes
Temperature extremes
Salts
Pollution
Wind
Light
Mechanical damage
Soil Compaction
Pesticide, herbicide injury
Nutrient imbalance
Improper cultural practices
Improper pruning
Biotic Causes (20%)
Fungi
Bacteria
Viruses & viroids
Phytoplasma
Nematodes
Insects
Mites
Parasitic Plants
Weeds
Site Conditions
Site Conditions
Weather history (extremes in wind, temp, rainfall, relative humidity)
Microclimate factors
How much sun?
Historic land use
Adjacent land use
Soil and Roots
Soil and Roots
Soil test? (pH, fertility, moisture)
Soil volume
Soil structure
Root damage
Compaction
Planting depth
Root girdling
Water
Water
How is water applied?
How often?
How much?
How deep does water get?
Water test? (pH, salinity, contaminants)
Drainage
Stem/Trunk Observations
Diameter increasing
Restrictions on trunk
Mechanical damage
Insects
Cracks, cavities
Borer holes, ridges
Decay
Sunscald
Gummosis
Cankers
Pruning Cuts
Branch Observations
Diameter increasing
Dead branches
Pruning cuts healing
Pest evidence
Galls
Annual growth rings
Symptom Expression
-Stem/Trunk, Branches, Leaves, Fruit, Seed, Roots
Leaves, Fruit, Seed, Roots
Wilting
Drooping
Leaf loss
Leaf shape
Color
Fruit appearance
Spots
Insects
Leaf scorch
Root rot
Stunting
Pathogen Signs
Mycelium, fruiting, bodies, ooze, powdery mildew
Secondary organisms
Saprophytes
Collect Samples
Samples (from live plants)
Photographs (big picture, closeups)
Roots (dug up, not pulled out, not washed)
Stems and leaves, flower, fruit, seeds
Send to: https://plantclinic.nmsu.edu
Diagnose
Diagnosis Inputs
Observations
Abiotic Checklist
Biotic Checklist
Known Disorders for species
Diagnosis Inputs
Soil, water, leaf nutrient analyses
Species normal appearance
Comparison of preferred to actual site conditions
Site, soil, water, microclimate factors
NMSU sample analysis
Online Resources:
https://aces.nmsu.edu
https://fruitandnuteducation.ucdavis.edu
https://NMSUdesertblooms.blogspot.com
https://extension.colostate.edu
https://extension.usu.edu
https://weather.nmsu.edu
Action Plan
Recommendations
Underlying abiotic causes (if any)
Biotic causes
Alternatives for response (IPM, replacement, cultural practices, site changes)

# Rules of Thumb

## A. Diagnosing Plant Problems in New Mexico

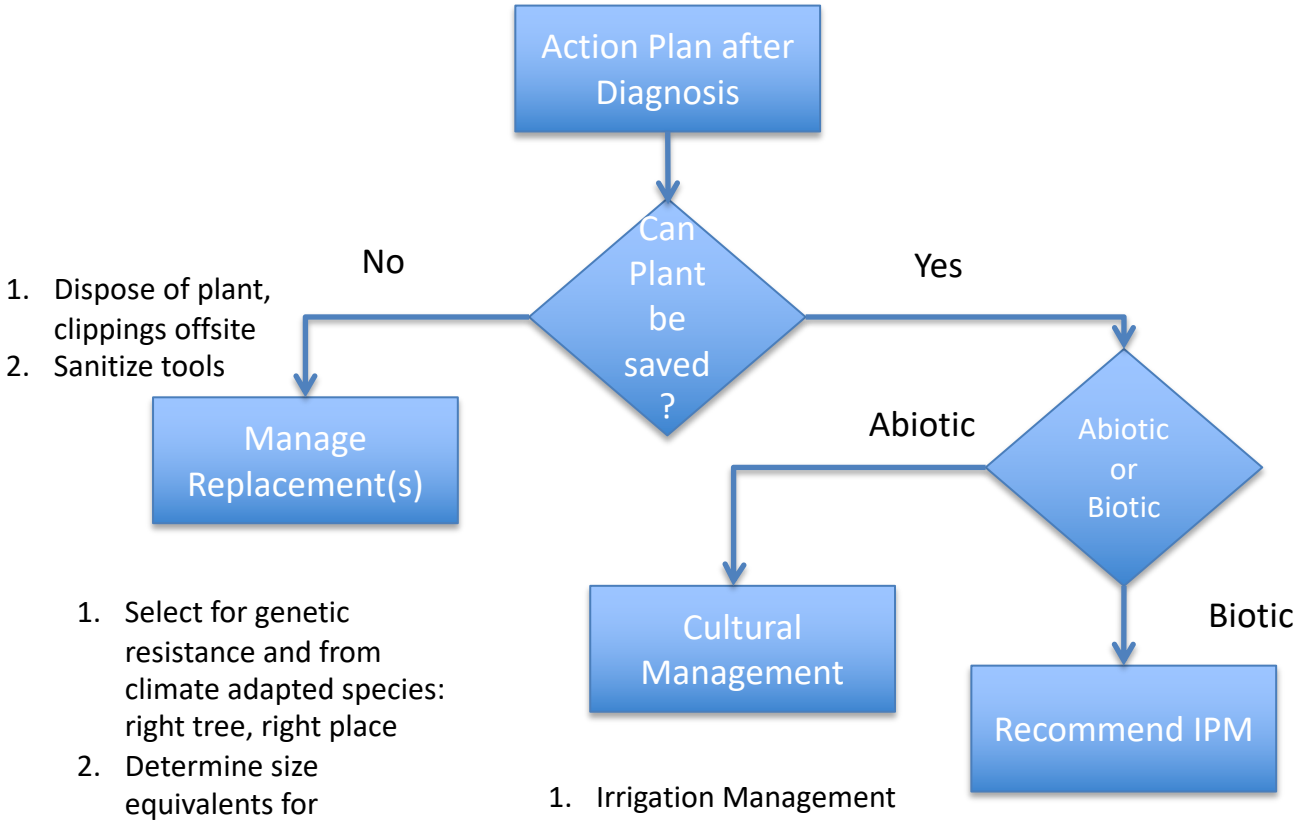
1. 80% of causes are abiotic (environmental) and 20% are biotic.
2. If symptoms are found on multiple genera, it suggests abiotic disorders.
3. If symptoms are uniform around an area, it suggests environmental causes.
4. If symptoms develop slowly, it suggests biotic causes.
5. If symptoms develop rapidly, it suggests environmental causes.
6. If symptoms do not spread, it suggests environmental causes.
7. Insects and diseases tend to be host specific. ID species and research susceptibilities and preferred environment.
8. Fungi are most prevalent pathogen. Symptoms are leaf spots with dry defined borders, visible hyphae, cankers. Examples: Cytospora, Vascular Wilt (Verticillum, Fusarium), Phytophthora Root and Crown Rot, Alternaria Leaf Blight. Signs of fungi are mildew, fruiting bodies, ooze.
9. Bacteria symptoms are leaf spots that have no defined borders, appear wet, slimy, smelly, oozing, galls. Examples: Slime Flux, Fire Blight, Leaf Spot, Leaf Scorch, Xylella.
10. Virus symptoms are leaf streaks that are colored, variegated flowers, distorted tissue. Examples: Beet Curly Top Virus, Alfalfa Mosaic, ToBRFV.
11. Push screwdriver or rebar into ground to check for moisture depth. Most environmental problems are water related.
12. Second most common environmental problem is soil. Has soil test been done?
13. Use soil penetrometer to check soil texture.
14. Plants under stress (drought, non-irrigated site, limited root spreading, or newly planted) are less tolerant of pests and other disorders, and more prone to their damage as well.
15. Sending samples
    - Send all parts of the plant including roots whenever possible
    - Dig plants up–don't pull out
    - Send live plants—dead plants tell no tales

# Rules of Thumb

## B. Diagnosing Problems in Urban Trees in New Mexico

1. 80% of causes are abiotic and 20% are biotic.
2. If symptoms are found on multiple genera, it suggests abiotic disorders.
3. Insects and diseases tend to be host specific.
4. Push screwdriver or rebar into ground to check for moisture depth. Most tree problems are water related.
5. Second most common problem with trees is soil.
6. Decline from top of the canopy down is typical of root problems and/or drought.
7. Use soil penetrometer to check soil texture.
8. Surface roots indicate soil compaction and/or wet soils and/or not watering deeply enough. Roots proliferate where water is applied, so in order to keep roots from peeking up at the top, water to a depth of 2-3 feet and allow soils to dry between irrigations for root access to oxygen.
9. Lack of visible root flare indicates tree planted too deep.
10. Normal vs. abnormal
    a. Needle problems and dieback of new needles at branch tip is abnormal.
    b. Yellowing and dropping of older needles from the inside of a tree are normal.
    c. Stress may cause needles to drop sooner.
11. Normal occurrences confused as abnormal:
    a. Fuzz on underside of leaves
    b. Male pollen cones on pine or spruce mistaken for insects or disease
    c. Less conspicuous fruit, such as juniper berries
    d. June drop of apples and other fruit
12. Trees under stress (drought, non-irrigated site, limited root spreading, or newly planted) are less tolerant of pests and other disorders, and more prone to their damage as well.
13. Healthy trees not under stress can withstand loss of 1/3 of total leaving surface by chewing insects.
14. Lawnmower decline (aka weed whacker wilt) is a common problem with park and residential trees. Take care not to damage bark when working near trees and shrubs.
15. Evidence of decay may be seen in large size pruning cuts. A drum-like hollow sound when the trunk is tapped with a wooden mallet is a symptom of extensive internal decay.
16. Ridges and valleys along the trunk are symptoms of internal problems and decay.
17. Borer exit holes indicate stress issues.
18. Evaluating annual growth rings on trimmed branches can show year-to-year changes in vigor of tree and effects of stress.
19. Mulch, mulch, mulch. The best amendment on top of soil to prevent moisture loss, compaction, trunk damage from mowers. Wood chips are the best.

# Tree/Shrub/Plant Disorder Management Process




1. Dispose of plant, clippings offsite
2. Sanitize tools

1. Select for genetic resistance and from climate adapted species: right tree, right place
2. Determine size equivalents for replacements
3. Site selection and preparation
4. Microclimate (sun, wind, temperature extremes)
5. Soil analysis (texture, compaction, pH, Alkalinity, nutrients)
6. Planting (depth, staking, water, mulch)
7. Irrigation (adjustment by season, tree age)
8. Structural pruning for young trees

1. Irrigation Management
2. Measures to improve soil Conditions (texture, compaction, nutrients, alkalinity, soil volume)
3. Repair or eliminate cause of mechanical damage (girdling, weed whacker, root damage, planting depth, trunk damage)
4. Structural (Wind, Sun, Pruning)
5. Herbicide use

1. Cultural
    a. Sanitation
    b. Pruning infested areas
2. Biological
    a. Beneficial insects (Pocket Guide to Beneficial Insects)
    b. Birds
3. Physical
    a. Physical removal
    b. Traps
    c. High pressure water stream
4. Chemical: Correctly ID pest before selecting a chemical. Always read and follow the label.

# Rules of Thumb for Managing Urban Tree Disorders

1. Right Tree- Right Place- Genetic resistance is first line of defense. Select trees for planting that have genetic resistance to known problems and adapted to climate and local environment.
2. If a tree is not under drought or soil stress, it is more likely to survive biotic pest problems without pesticide use.
3. If a tree is under drought stress:
    a. Correct watering schedule for weather, soil texture
    b. Mulch with wood chips to minimize loss of moisture
4. If disorder is caused by soil conditions:
    a. Compaction can be reduced by eliminating vehicle, foot traffic nearby
    b. Severe compaction corrected with air hammer
5. If soil volume problem:
    a. Remove obstructions to horizontal root growth
    b. Recommended soil volume is 1-2 cubic foot for every 1 square foot of canopy.
6. If mechanical damage:
    a. Recommend assessment, pruning by ISA certified arborist
7. If nutrient problem confirmed by soil analysis:
    a. Suggest nutrients
    b. Suggest extra irrigation to leach out salinity
8. If pesticide problem, revise IPM for site
9. If a tree is in a grassy area where weed whackers and power mowers are used, a layer of mulch around the tree trunk will prevent problems occurring.

**Integrated Pest Management (IPM) Rules of Thumb:**

1. PREVENTION: Avoid insect pests through proper plant selection, planting and maintenance.
2. MONITORING: Regularly inspect trees and shrubs for insect pests and damage.
3. IDENTIFICATION: Be sure to correctly identify tree species and insect pests.
4. MANAGEMENT: Select appropriate IPM strategy for the pest.
5. Minimize tree stress with proper irrigation and mulching.
6. Sanitize area to reduce pest population (weeds, fallen fruit)
7. Correct pruning of trees and shrubs for airflow and to remove infested areas.
8. Avoid mechanical damage to trunk and improper pruning that creates vulnerable locations for pests to attack.
9. Provide habitat for natural predators (insects and birds).
10. Use hand-removal of pests (e.g. eggs and bagworms) when possible.
11. Traps can be used to trap codling moth larva.
12. Monitor pest infestations to determine an “action threshold” requiring use of chemicals.
13. Use insecticides only after correctly identifying the pest, the insect is in the correct stage for treatment, and the product is registered for use in NM.
14. ALWAYS READ THE LABEL BEFORE APPLYING A PESTICIDE.