



RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

Plant Health Care

Dr. Allyson Salisbury



1

What decreases plant health and how can we help?



2

Trees provide places for many organisms to live

- Insects
- Nematodes
- Birds
- Bacteria
- Viruses
- Fungi
- Lichen
- Mammals
- Amphibians
- Reptiles



3



Food Web

- Some insects that feed on trees become food for bigger creatures
- A healthy food web keeps populations of creatures that damage trees in check



4

What makes something a plant disease?

- Persistent disturbance in the function of a plant
- Usually caused by microorganisms
- Symptom = the sign of that disturbance

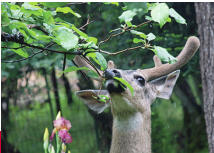





5

What makes something a pest?

- A thing that threatens the health or aesthetic value of a plant
- Usually associated with bigger organisms




6

Healthy trees better resist pests and disease

- Trees have chemical and physical defenses to resist pests and diseases
- If a tree is stressed, it may not have enough resources to produce those defenses

Nicotine in tobacco is a chemical defense. >

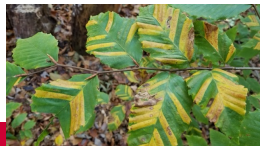


< Rubber is a physical defense.

7

Non-native pests and disease usually have more severe impacts on trees

- Co-evolution: when two species have lived in the same place for thousands of years, they usually have limited impact on each other
- Example: beech leaf disease
 - Nematode is from Japan, does not kill Japanese beech
 - Does kill American beech – naïve to the nematode



Microscopic worm

8

Dead and dying trees are an important part of forest ecosystems

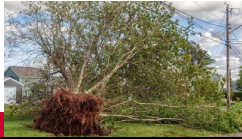
- Recycling nutrients back into the soil
- Food for fungi and insects
- Living space for animals
- Snag = standing dead trees



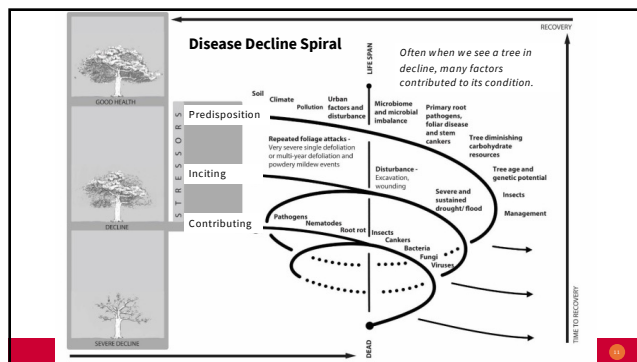
9

How do trees die?

- Severe physical damage
- Stressors prevent the tree from making enough energy
 - Includes not having enough water
 - No water = no photosynthesis = no energy



10



11

Disease Diagnostic Process

1. Accurately identify the plant

- Some insects and diseases are host specific.
- Some tree species are prone to abiotic disorders.

Non-living

Sugar maple >



12

Disease Diagnostic Process

2. Look for patterns of abnormality

- What is normal for a plant (e.g., yellowing needles every few years on pines)?
- How does the tree compare to other trees on site or nearby?
- Is damage localized within the plant or uniformly all over the plant?



13

13

Disease Diagnostic Process

3. Carefully examine the site

- Consider light levels, soil, water availability, prevailing winds and proximity to structures.
- Is this new or old development?
- Are there other plants that could be causing crowding/competition?



14

14

Disease Diagnostic Process

4. Note the color, size, and thickness of foliage

- Remember that abnormalities in foliage may be symptomatic of problems elsewhere in the tree
- Multiple problems can manifest similar leaf symptoms



15

15

Disease Diagnostic Process

5. Check the trunk and branches

- Check for loose bark, wounds, discoloration, drying, oozing, holes indicating the presence of borers, profuse water sprouts
- Check twigs for growth rates using bud scars



16

16

Disease Diagnostic Process

6. Examine the roots and root collar

Check soil condition, look for evidence of decay, wounding



17

17

Disease Diagnostic Process

- Search for "Acer saccharum" canker
- *Phytophthora cactorum* (water mold), most likely.
- Would need to send a sample to a diagnostic lab to confirm
- Treatment options include fungicides, avoid cross-contamination with tools



18

18

Rutgers Plant Diagnostic Lab

- <https://extension.rutgers.edu/plant-diagnostic-lab>
- Fees start ~\$50 for in-state samples
- Can mail or drop off samples



19

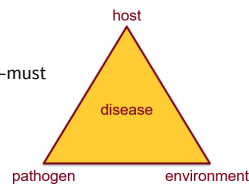
How do we manage diseases?

20

The Disease Triangle

Three factors are needed for a disease to occur.

- Host (the tree) – must be susceptible
- Environment – must favor pathogen
- Pathogen (thing that causes the disease) – must be present

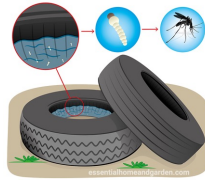


21

Removing one leg of the disease triangle prevents or eliminates the disease

Example: Mosquitoes & associated pathogens

Removing shallow pools of stagnant water decreases their breeding habitat, creating an unfavorable environment.



22

Removing one leg of the disease triangle prevents or eliminates the disease

Example: Dogwood varieties

Dogwoods are susceptible to many diseases.

Some species and varieties are more resistant to diseases.



23

How do we know a plant is healthy?

24

How do we know a plant is healthy?

- Vitality – able to deal with stress and thrive
- Rapid growth? Not necessarily. Rapid growth can detract from other resources uses
- Is the plant able to allocate resources to maintenance, growth, reproduction, defense, storage in a way consistent or “normal” for its species?
- Does it meet the expectations of you or the client?

25

Plant Health Care (PHC) The Appropriate Response Process

- 1) Gather information
- 2) Assess severity & implications of problem
- 3) Determine client expectations
- 4) Decide on a course of action



26

PHC Goals

Prevention

Stop pest or disease from occurring in the first place

Eradication

Total elimination of pest from an area.

Very hard to achieve.

Usually saved for extremely noxious, harmful, introduced pests

Suppression

Reducing pest population and associated plant injury to a tolerable level.

27



Thresholds

When a pest population level requires intervention

Varies based on client expectations.

28

What do we monitor for?

- 1) Site conditions
- 2) Plant conditions
- 3) Disorder characteristics – What is it? How much and how severe? What life stage?

29

Health Management Strategies



Pest prevention

- 1) Minimizes plant stress
- 2) Minimizes pest activity by discouraging favorable conditions

30

Cultural Control

Landscape management practices that promote plant health or deter pest development

- Plant selection
- Promoting soil health (compost, proper mulching)
- Pruning
- Sanitation

31

Health Management Strategies

Sanitation

Removing infected materials (fallen twigs, leaves, fruit)

Sterilizing pruning tools

Cedar apple rust (*Gymnosporangium juniper-virginianae*) common problem on crabapples, infecting leaves and causing premature leaf senescence. Removing leaves as they fall in summer can help lessen disease pressure.



32

Health Management Strategies



Timing

- Some disease take advantage of pruning wounds during certain times of the year (Oak wilt)
- Unnecessary irrigation can facilitate root diseases (*Phytophthora*)
- Pesticides applied at appropriate life stage, weather, season

Oak wilt (*Bretziella fagacearum*) is a fungal infection that affects the vascular system of oaks. One way it spreads is by a beetle that feeds on oak sap from exposed wounds. So avoid pruning oaks between April and October. Not in NJ yet, looks a lot like BLS.

33

Health Management Strategies

Plant selection

- Pest-resistant cultivars
- Right species for site
- High quality nursery stock



Dogwoods are susceptible to several pests and pathogens. *Cornus kousa* and some hybrids tend to have greater resistance.

Image credit: University of Maryland System, Department of Entomology and Plant Pathology

34

34

Health Management Strategies

Avoiding Monocultures

Extensive planting of the same species increases vulnerability to pests



Image credit: University of Maryland System, Department of Entomology and Plant Pathology

35

35

Mechanical Control

Physical removal of pests

Often easier in morning – cooler temps, pests move slower



Bagworms are caterpillars that hatch out of eggs laid in "bags" of needles on arborvitae, junipers, and other evergreens. Can just pull the bags off, or some pesticides can be used when bags and larvae are small.

36

36

Biological Control

7 BENEFICIAL INSECTS FOR GARDEN PEST CONTROL		
INSECTS	FEEDS ON	ATTRACTED BY
LADYBUGS	• APFIDS • WHITE FLIES • COLORADO POTATO BEETLES	• RED • REDDISH-ORANGE • REDDISH-YELLOW • REDDISH-BROWN
GROUND BEETLES	• SLUGS • CATERpillARS • COLORADO POTATO BEETLES • CABBAGE	• DARK, MOIST PLACES • DARK, MOIST PLACES • DARK, MOIST PLACES
MINUTE PRINCE BEETLES	• SPIDER WEBS • APFIDS • THrips • CATERpillARS	• DARK, MOIST PLACES • DARK, MOIST PLACES • DARK, MOIST PLACES
GREEN LACEWINGS	• APFIDS • WHITE FLIES • LEAFHOPPERS • BEETLES	• DARK, MOIST PLACES • DARK, MOIST PLACES • DARK, MOIST PLACES
APHID BEETLES	• APFIDS	• DARK, MOIST PLACES • DARK, MOIST PLACES • DARK, MOIST PLACES
CABBAGE BEETLES	• CATERpillARS • SPIN • APFIDS • CABBAGE WORMS	• DARK, MOIST PLACES • DARK, MOIST PLACES • DARK, MOIST PLACES
SPRINGTAIL BEETLES	• CATERpillARS • APFIDS	• DARK, MOIST PLACES • DARK, MOIST PLACES • DARK, MOIST PLACES

40

Biological Control

Augmentation = rearing and releasing beneficial organisms to supplement existing populations.

Not well studied.

Product quality may be highly variable



41

Chemical Control

Usage of pesticides to manage pests. Includes:

- Insecticides
- Miticides
- Fungicides
- Bactericides
- Repellents
- Herbicides

Can be specific or broad-spectrum.

42

Chemical Control

Contact pesticides

Suppress or kill pests through direct physical contact

- Fast, but only kills surface pests.
- Timing and coverage impact effectiveness
- Possible non-target effects

Systemic pesticides

Absorbed by plants then harms pest as it feeds on plant

- Reaches pests not readily accessible by spraying.
- Takes longer to work, possible non-target effects
- Risks of decay in stem with injections, groundwater contamination for soil applications

43

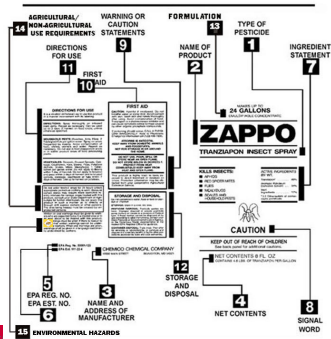
Chemical Control Decision Process

- 1) identify pest/disorder
- 2) identify potential severity of problem
- 3) choose an appropriate pesticide targeting pest
- 4) correct dosage
- 5) correct application technique
- 6) apply at appropriate time and frequency
- 7) adhere to label instructions

44

Labels

The label is the law

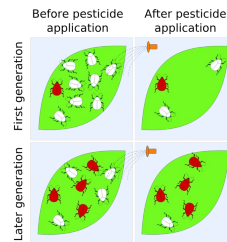


45

Pesticide Resistance

Pesticide selectively kills members of a pest population that are susceptible, while individuals with resistance survive and pass on resistance genes to future generations.

Reduce this scenario by rotating through several pesticides with different active ingredients or modes of action.



46

Biorational Control Products

Product or pesticide formulated from naturally occurring plant extracts, microbes, or microbial byproducts that poses low risk to nontarget organisms and limited environmental persistence.

- Insecticidal soaps
- Horticultural oils
- Botanical pesticides
- Microbial pesticides



47

Summary

- Trees interact with many types of organisms – most interactions don't significantly harm trees
- Pests and disease severely compromise the function of a plant
- Often multiple stressors lead to the decline and death of trees
- Plant health care takes a holistic approach to helping trees recover

48

Bonus Content

49

Integrated Pest Management (IPM)

A methodology for managing plant pests using a variety of control tactics.

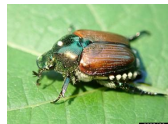
Arborists consider it a component of PHC



50

IPM Example – Japanese Beetles

- **Identifying** adults and grubs (several look alike grubs)
- **Check** for grubs in turf with large dead patches (animal consumption also a clue)
- **Timing** for pesticide treatment of grubs: May to mid-June or mid-July to early September (multiple pesticide options) - need to take care to not harm pollinators as well
- **Biological control** options: parasitic nematodes, *Bacillus thuringiensis galleriae*, microsporidian fungal pathogen *Ovavesicula popilliae*



51

IPM Example – Japanese Beetles

- Traps debatably not useful
- Mechanical removal of adults from plants
- While generalists, adults prefer some woody plants over others

a) Plants that attract beetles				b) Plants seldom damaged							
American chestnut	apple	grapes	plum	American elder	euonymus	holly	red oak	spruce			
American elm	birch	hollyhock	roses	artemisia	fir	juniper	rhododendron	white ash			
American linden	black cherry	horse chestnut	walnut	black oak	green ash	ginkgo	scarlet oak	white oak			
American mountain ash	flowering crabapple	Norway Maple		boxelder	hemlock	red maple	silver maple	white poplar			

52
