PRINCIPLES OF INTEGRATED PEST MANAGEMENT

What is I.P.M.?

Why is less reliance on pesticides so important?

Toxicity to the applicator, to non-target organisms and to the environment.

Insect resistance and subsequent resurgence.

Secondary pest outbreaks

Pesticide residues on food

Identify the pest organism
  - Living: insect, disease, weed, etc. that is causing the problem
  - Non-living: drought stress, rain soaked, frost, freeze or man-made

Monitor plants
  - Look for damage on a regular basis
  - Keep a record of observations

Establish an acceptable injury level
  - Varies from person to person
  - Varies between plants and life stages of an individual plant

Manage using all available strategies
  - Cultural
  - Physical
  - Biological
  - Chemical

USE THE LEAST DISRUPTIVE AND LEAST TOXIC CONTROLS FIRST

Evaluate
### TABLE III: EXAMPLES OF USEFUL WEB SITES

Land Grant Institutions, USDA/ARS Research Centers and other agencies have World Wide Web sites that can be accessed over the internet. Web site addresses may change so use a search engine to peruse institutions in your area and look for topics related to IPM or entomology.

**IPM AND RELATED SUBJECTS:**

- **http://www.ippc.ornst.edu**  Integrated Plant Protection Center at Oregon State University. This site includes other links to homepages containing general IPM information. This site also contains near realtime weather information from 45 weather stations in Oregon, Washington and Idaho. Along with the weather information, this site also includes a degree-day calculator and other valuable information for insect pest management on tree fruit and small fruit. Links to other useful sites include: DIR (a Database of IPM Resources), EXTOXNET (the Extension Toxicology Network), and a Compendium of IPM Definitions.

- **http://www.ipmnet.org**  This is an excellent national IPM site with information on all aspects of integrated pest management. This site includes links to the IPM Textbook, IPM publications, IPM Experts, and Bulletin Boards and Databases. This site is in cooperation with the Consortium for Integrated Crop Protection - CICP.

- **http://www.ipm.ucdavis.edu**  This site covers comprehensive IPM programs in California and includes good information on biology and management of many important pests in California. This site contains pest management identification including pest management guidelines and insect, mite and plant phenology models. This site also contains information on weather and degree-day calculations for many areas in California.

- **http://coopext.cahe.wsu.edu/~ipm**  This is the Washington State University IPM site that has information on IPM programs in Washington with links to other sites in the West.

- **http://osu.orst.edu/dept/entomology**  This is the Oregon State University entomology homepage that has information related to entomology with links to IPM related information.

- **http://www.uidaho.edu/pes**  This is the University of Idaho entomology homepage that has information related to entomology with links to Idaho Research Centers and IPM related information.

- **http://www.colostate.edu/depts/IPM/**  This site is connected to the national IPM network and offers many links to other useful sites dealing with IPM. This site contains information on IPM in the Western Region and has links to other regions in the U.S. This site also contains a complete list of regional publications dealing with pest management in the West.

- **http://ipm.ww.ncsu.edu/biocontrol/biocontrol.html**  This is a biological control virtual information center covering all aspects of biological control. This site includes information on how to use biological control agents and has links to other sites dealing with biological control.

- **http://www.nysaes.cornell.edu/ent/biocontrol/**  This covers biological control with guidelines on the use of biological control agents in pest management in North America. Information on the use of parasitoids, predators, pathogens and biological control of weeds is included. Links are provided to suppliers of beneficial organisms in North America.

- **http://ianw.ww.unt.edu/ianw/plntpath/nematode/wormhome.htm**  This is an excellent site that has very comprehensive information on the use of entomopathogenic nematodes for biological control of insects. This site also has excellent information on plant parasitic nematodes.
WHO is the GUILTY PARTY?
Possible Causes of Injury DAMAGE to Plants

Sometimes the problem and answer is obvious, but frequently one must search for specific and subtle symptoms... so before you attempt to diagnose the ills of a plant, take in consideration all the factors that may cause similar plant symptoms such as hail, too much sun, or excessive rain or wind; weed competition, disease, fertilizer, deer, rabbits etc.

- Tattered or Chewed plant parts-tissue loss.
  Examples of chewing insects: cabbageworms, grasshoppers, flea beetles, root weevils, the pear slug, leafcutter bees (use plants for nests), armyworms, cutworms, centipedes, millipedes, sowbugs, and slugs (!)... cucumber beetle... rodent, birds, hail damage

- Discoloration-bleached, bronzed, yellowish or stippled plant parts.
  Examples of insects with piercing-sucking mouthparts that suck out the sap from the plant cells: mites, thrips, whiteflies, stink bugs, scales, aphids.
  ... dry soil, root rot, nutrient deficiency, insufficient light, viral disease

- Distortion- curling of leaves or general wilting, deforming of the fruit, growth or enlargement on plant
  Examples: Aphids, scale, leafhoppers, gall-makers, thrips, leafrollers,
  ... herbicide injury, viral disease

- Dieback-plant part (leaves, stem, buds, roots) dies from internal feeders.
  Examples: Wireworms, root maggots, carrot rust fly, gall wasps or flies, leafminers, borers in wood or pith, apple maggot in fruit, Juniper twig girdler, flat-headed borers, Cypress tip moth, scales... fertilizer burn, potassium deficiency, cold injury

- Products left behind as insects feed, reproduce, or make a home.
  Examples: Carpenter ants, spittlebugs, thrips, aphids, scales, mites, mealybugs, tentmaking caterpillars, codling moth larvae
  ... mildew, rust disease
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Commonly INTEGRATED PEST MANAGEMENT employs a variety of management options such as chemical, biological, cultural, physical and mechanical means to maintain pest populations or damage below an unacceptable "injury" level. Regular monitor and regular evaluations of control measures are also part of good integrated pest management programs

PLANT HEALTH CARE - focuses on managing the health, appearance and structural stability of landscape plants

Health of landscape plants:
1. reasonable growth
2. appearance
3. pest resistance
4. resilience to stress
5. ability to adapt to changing conditions

Need to take into account things like
a) inherent characteristics of the plant
b) environmental factors
c) climatic events
d) insects and disease
e) mechanical injury
f) site disturbances
g) age of plants
h) horticultural practices used

GOAL OF PLANT HEALTH CARE IS TO DEVELOP A LONG TERM MANAGEMENT STRATEGY TO IMPROVE AND MAINTAIN PLANT HEALTH THROUGH APPROPRIATE TREE CARE PRACTICES. THIS STRATEGY RELIES HEAVILY ON ESTABLISHING, RESTORING, OR MAINTAINING FAVORABLE AND STABLE GROWING CONDITIONS THROUGHOUT THE LIFE OF THE PLANT.
Concepts of Plant Health Care
1. Consider the whole landscape as a dynamic living system that is constantly changing – owners change, landscape practices change, weather conditions change, plants grow, plants die and open up areas, damage can occur from cars/people/string trimmers/poor pruning/good pruning

Trees and Pests
1. Key insect/ mite pest for plants to keep in mind
2. Monitoring – where, when, how
3. Action numbers? (10 mites per leaf or terminal, aphids? Root weevil notches?

Pest Resistance
a) Misconception that “healthy trees” are more pest resistant than stressed trees; likely true for secondary pests like bark borers
b) Growth rate: not always a good indicator of tree health if sole reliance on it. For example nitrogen fertilizer stimulating new shoot growth that higher availability of amino acid rich phloem (may result from excessive fertilization) beneficial to aphids, psyllids therefore higher population of pest may result

Factors Increasing Susceptibility to Pests
Environmental Factors:
1. drought
2. poor soil aeration
3. shade
4. temperature extremes
5. competition
6. root loss
7. defoliation

Single most important stress causing agent in landscape
Plants is water availability – too little/too much
DEVELOPING A PLANT HEALTH CARE MANAGEMENT PLAN

You are trying to create or restore and maintain stable growing conditions throughout the plant's life by

1. Identifying and mitigating stress-causing factors;
2. Monitoring for signs and symptoms of pests or poor plant performance;
3. Creating more favorable growing conditions to reduce competition and water according to the species’ need;
4. Altering or adjusting existing irrigation systems to increase or decrease irrigation, or improve drainage as needed, keeping water from wetting the trunk and root flare; and irrigating to reduce stress from drought or root loss.
5. Soil analysis to determine fertilization needs;
6. Mulching to conserve soil moisture, reduce soil surface temperatures, supplement nutrient levels, discourage weed growth, and long term work to reduce soil compaction.
7. Evaluate structural stability of trees and prune accordingly or modify other horticultural practices as necessary
8. Management objectives for Plant Health Care Program change with age of the landscape plants

References:


http://insects.ippc.orst.edu/pnw/insects
Pacific Northwest Insect Management Handbook

http://oregonstate.edu/Dept/nurspest/index.htm
Oregon State University Pacific Northwest Nursery IPM Home Page

http://www.ipm.ucdavis.edu
Statewide IPM Project – University of California
Creating and Caring for Landscapes that Really Work

Think:
Before reaching for a tool, a pesticide, or your checkbook, consider other options (including "no action") before proceeding. Ideally, the path you select should eliminate, not perpetuate, the landscape problem you have.

Eliminate weed-friendly areas:
Every square foot of a site should be covered with wanted plants or with dead leaves (which effectively deter weeds). Areas of open soil and those covered with fine-textured mulches such as bark mulch are just asking for trouble (i.e., weeds). Minimize soil disturbance, as it, too, just creates a weed-friendly environment.

Use ecological succession to your advantage:
A healthy landscape is constantly changing. West of the Cascades, most areas, if left undisturbed, will over time become forested. So start by planting trees. Introduce shrubs and herbaceous plants later, once the tree canopy has begun to develop. Some plants will, of course, arrive on their own, by wind and by bird, from nearby natural areas (if there are any). Use a light hand to help orchestrate these changes, rather than a heavy hand to try to prevent them from happening altogether. If you do, in fact, wish to keep the site from becoming forested, recognize that such an approach will require constant human intervention through the years.

Plant both conifers and broadleaf trees (and put away those rakes):
Besides providing a host of wonderful benefits for humans and many other creatures, trees shade out many undesirable plants. And fallen leaves recycle nutrients right on-site and help restore soil health.

Introduce site-appropriate, regionally native plants:
Examine nearby natural areas to determine what plants might do best on your site (considering soil type, hydrology, and amount of sun/shade). Although some existing plants may need to be removed initially, there are usually plenty of available sites where new plants can be introduced, even in established landscapes. Over time, then, older plants that were less site-appropriate can be removed without creating large gaps.

Plant a variety of plants and plant them in an irregular pattern:
Even under the best of circumstances, it is only natural that some plants will fail to thrive, or just die. By avoiding straight lines and masses of identical plants, you ensure that any individual that languishes or dies will be less noticeable. And should disease or insects strike, you ensure that your entire planting will not be lost.

Fill in the gaps with annuals or low-growing legumes:
Self-reseeding annuals such as California poppy and crimson clover can protect open areas of a recently landscaped site until newly planted woody vegetation begins to produce shade. These annuals prevent weeds from moving in and, as the site becomes more shaded, will

- over -
eventually disappear. You can also seed new landscapes with low-growing, perennial legumes such as birdsfoot trefoil and white clover that, over time, will also disappear.

Rethink lawn-covered areas:
Lawns can range from extremely high maintenance (grass species only, irrigated, and manicured) to relatively low-maintenance (multiple species of grasses and other plants such as lawn-daisies and clover; no irrigation; infrequent mowing). The more plant species in a lawn, the healthier the little ecosystem that develops there. Consider converting some lawn areas to “meadows” that are mowed just once a year, thus providing wonderful habitat for all kinds of beneficial insects, birds, and other creatures. Where large areas that include fencelines and trees must be mowed, leave broad swaths of unmowed grass along the fencelines and around the trees so these areas look purposefully unmowed rather than just missed by careless mower operators.

Approach weed removal and pruning in a light-handed way:
Try to disturb the soil as little as possible. Leave pulled and cut weeds lie where they are on the site (unless they’ve reached the seed-producing stage); this eliminates the cost of off-site composting. Time your work to catch weeds at their most vulnerable moment (e.g., cut back new blackberry growth in early summer). Select woody plants and space them so they can develop without constant need for pruning. When you do need to prune, leave the prunings on-site (under shrubs and snipped into smaller pieces, if necessary).

Monitor your landscape at regular intervals:
See what is working in your landscape, and what is not, and make adjustments accordingly. Keep a journal of what you do and when you do it, to learn what approaches are most effective in your area.

Be creative and have fun:
Your time on the planet is short, so try not to waste it on repetitive tasks and ineffective or futile approaches that make your life dull and unsatisfying. If your supervisor asks you to prune the same shrubs year after year, just because they “need to be pruned,” ask yourself and your supervisor if there is not a better use of your skills and your time.

Recognize that the landscapes we build and care for around us are a reflection of ourselves:
Are they barren and relatively lifeless expanses of grass and asphalt that require constant attention, or are they attractive, productive plant and animal communities that mostly take care of themselves?

Understand that healthy landscapes take time to develop:
Our tendency these days toward “instant landscapes” (e.g., three rhododendrons, a couple bags of bark-mulch, and an hour’s work) ignores the fact that landscapes that really work take time to develop. So relax, and enjoy watching your new trees grow!

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