

Managing Pest Invasions with Integrated Pest Management

Clifford Sadof
Department of Entomology
Purdue University

Movement of Pests

- Natural – Unassisted by humans
 - Self propelled -Flying, Walking, Swimming
 - Event propelled – Wind, rain, flood
- Artificial – Human assisted movements
 - Trade – solid wood packing material, bilge water
 - Hitch-hiking on nursery crops, sod and other plant material

Scales of Invasion (large to small)

- Continent
- Country
- Region
- Landscape
- Plant

Pest Invasiveness (plant scale)

- Immigration
 - Ability to find plant
- Colonization
 - Ability to feed and reproduce on plant
- Rate of Spread
 - Ability to move between plants

Pest Invasiveness (landscape scale)

How easily do pests move between host plants?

- Pest attributes

- How many kinds of plants does it feed on
- Does it fly, walk, or is it blown to new plants
- How many generations a season

- Landscape attributes

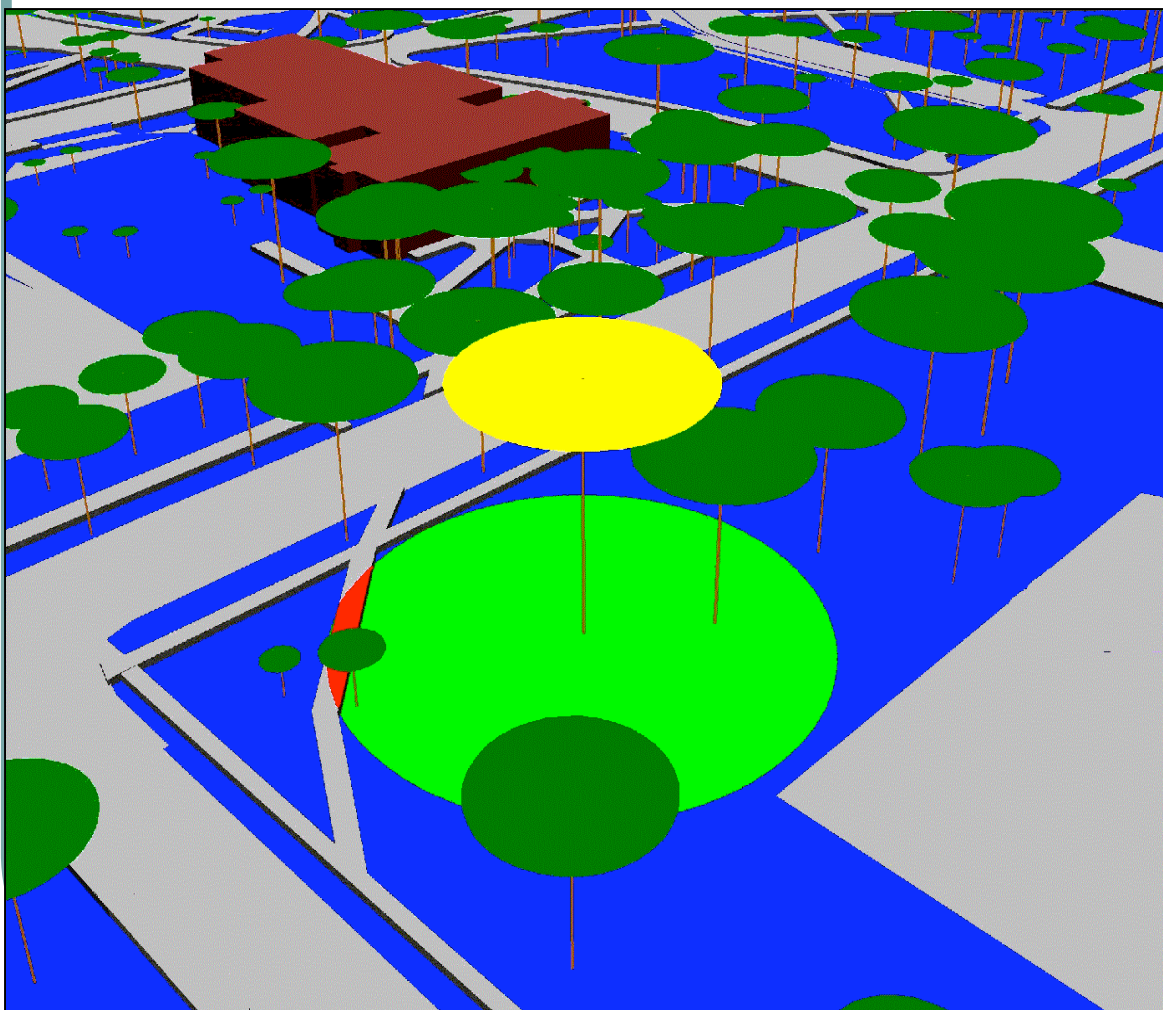
- How many host plants
- What separates host plants- are they connected in a corridor?
- How often are new plants brought into the landscape? (Artificial spread)

Landscape Attributes and Invasiveness

- Host abundance, and host connectivity
 - Can plants support a pest population and can pests move readily between acceptable food plants?
- Barriers
 - Are these plants separated by buildings that impede pest movement?
- Matrix
 - Does the landscape background help or hinder pest movement?

Turf and Tree Landscape

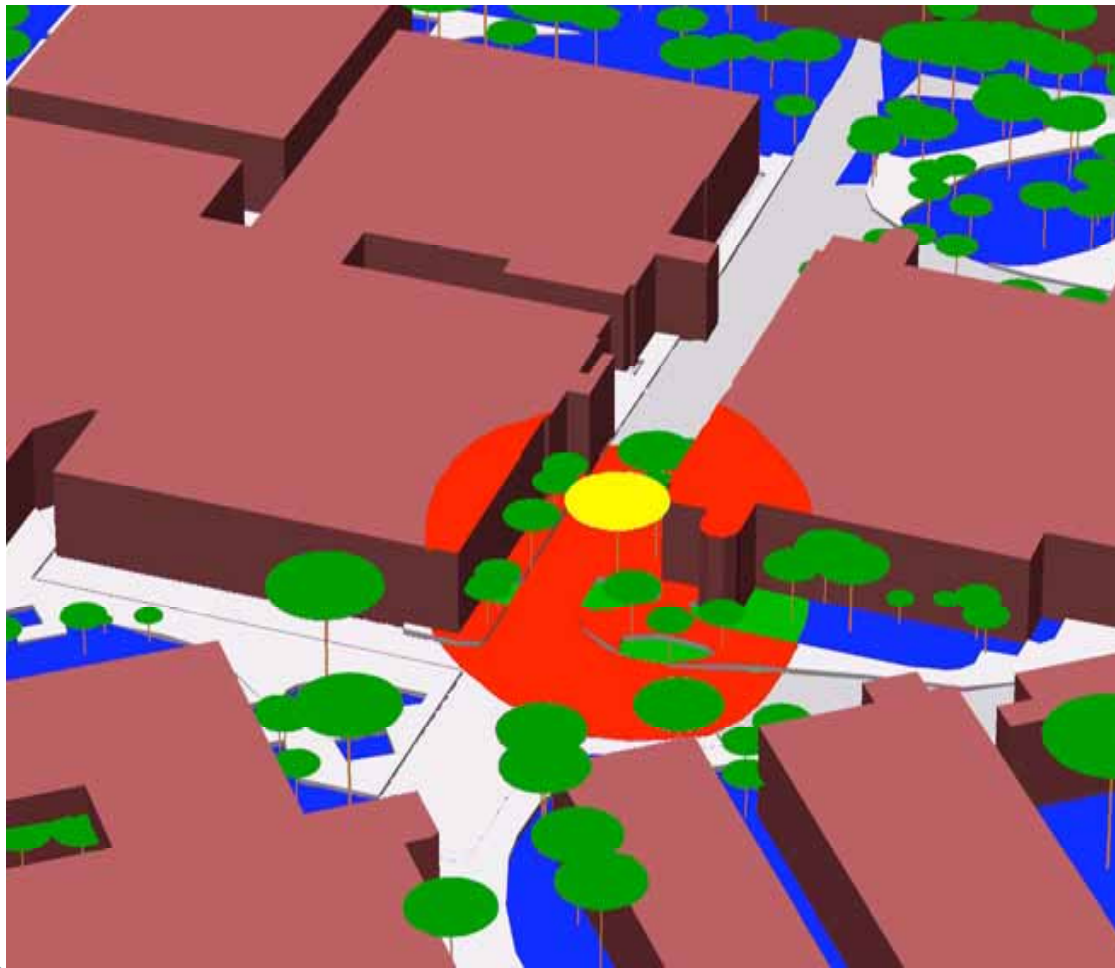
Trees in a matrix of turf and pavement



- building
- turf
- pavement
- tree canopy

Building and Tree Landscape

Trees in a matrix of buildings and pavement



- building
- turf
- pavement
- tree canopy

In which landscape is a tree more easily invaded by pests?

Tree in turf matrix?

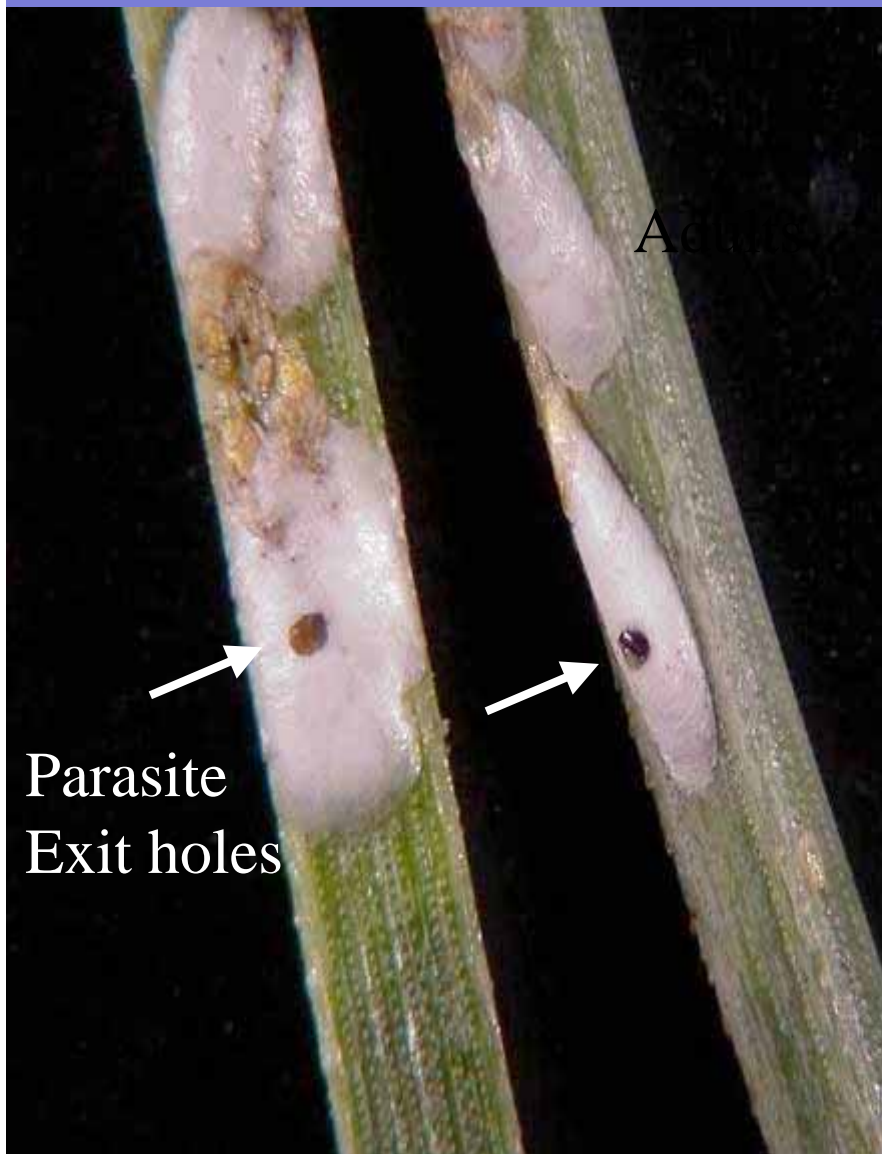
Turf in building matrix?

- Answer depends on the mobility of the pest and the spatial arrangement of the landscape.

Three different pests

- Pine needle scale
- Honeylocust spider mite
- Japanese beetle

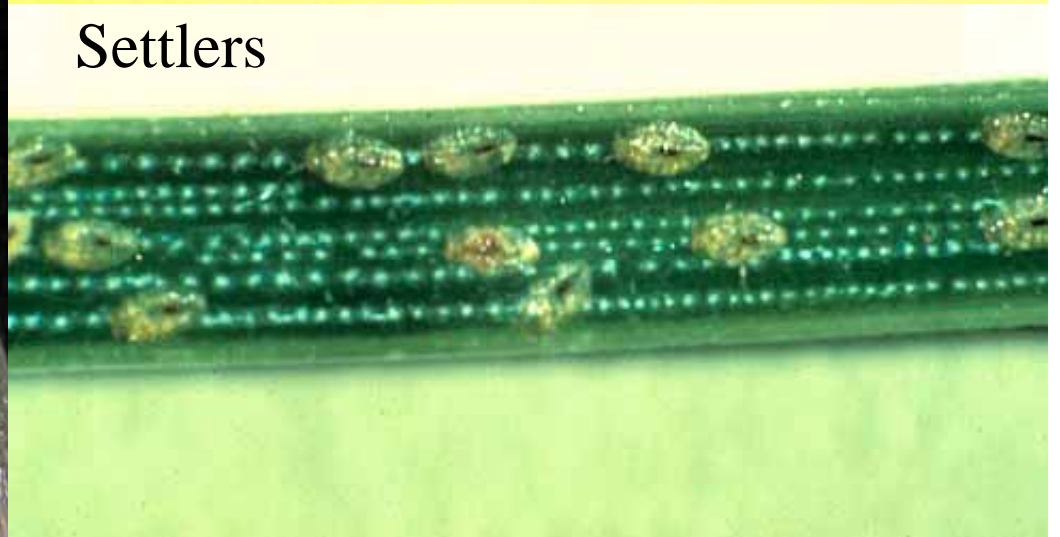
Pine needle scale



Crawlers



Settlers



Pine needle scale

- How many kinds of plants does it feed on?
 - Pines
- Does it fly, walk, or is it blown to new plants?
 - Blown during crawling stage (two week periods)
- How many generations a season?
 - Two

Honeylocust spider mite



Honeylocust spider mite

- How many kinds of plants does it feed on?
 - Honeylocust
- Does it fly, walk, or is it blown to new plants?
 - Blown during mobile stages (all but a week)
- How many generations a season?
 - Up to 10

Japanese beetle



Japanese beetle

- How many kinds of plants does it feed on?
 - 300 species of trees; and turf
- Does it fly, walk, or is it blown to new plants?
 - Flies (miles) to hosts for 6 weeks
- How many generations a season?
 - One

Relative invasiveness of PNS, HLSM, and Jb

	Number of hosts	Mobility	Gens./YR
PNS	1 (pine)	low (crawlers)	2-3 wk pds
HLSM	1 (honeylocust)	mod (all stages)	up to 6
JB	>300	High as adult	1

Mitigating Landscape Factors:

Number of hosts

Relative location, are they close, are there barriers between them

Relation between presence of buildings and plants

Management Implications

- Streets lined with one species of tree are easy for a pest to invade.
- Diverse plantings can be more difficult for pest to move through, and could reduce pest problems.
- Highly mobile pests that feed on wide range of plants may be less impacted by diversity.

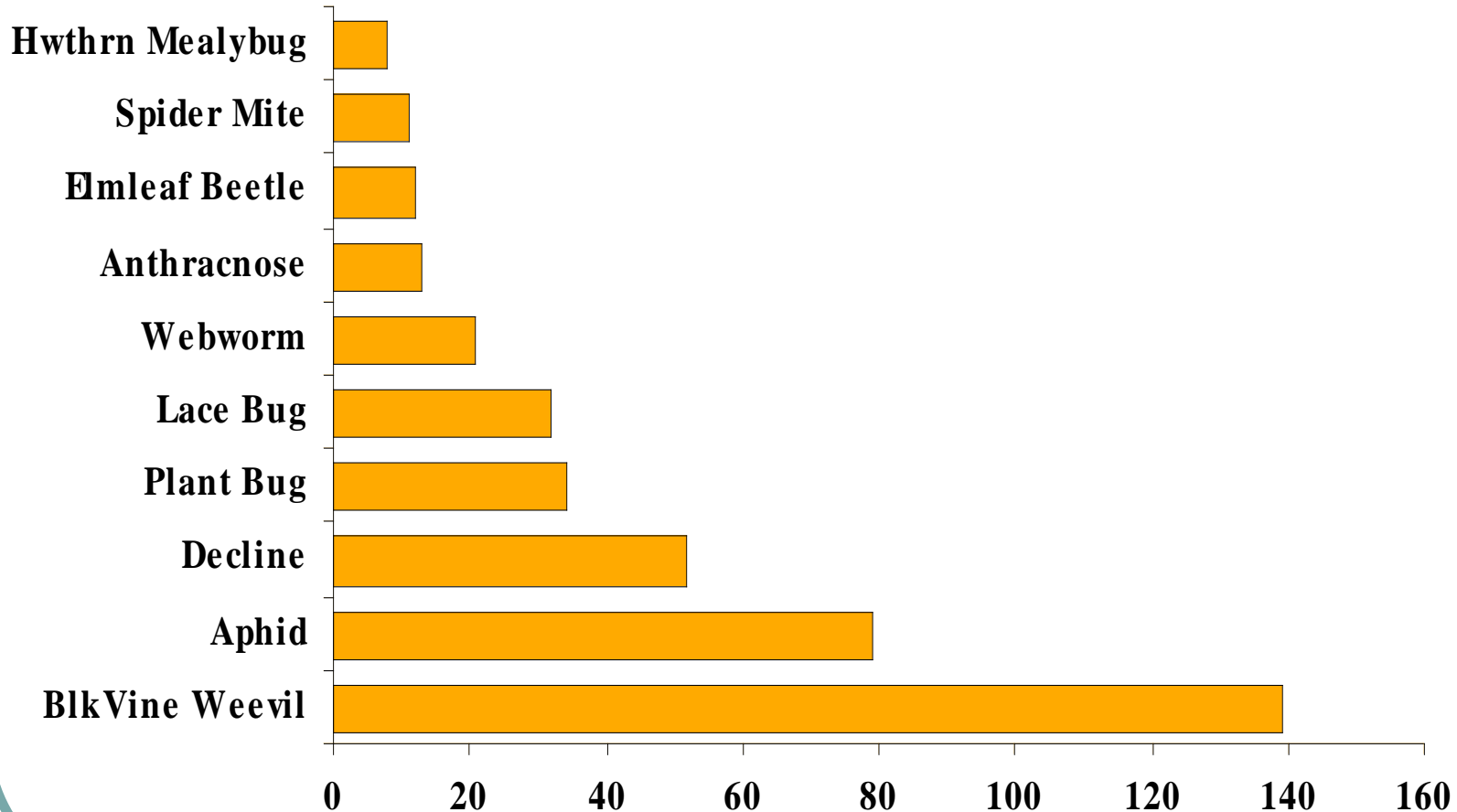
Use IPM (PHC) to track invasion

- Scouting
- Record Keeping
- Decision Making – Thresholds
- Tactic Selection
- Evaluation (during next visit)

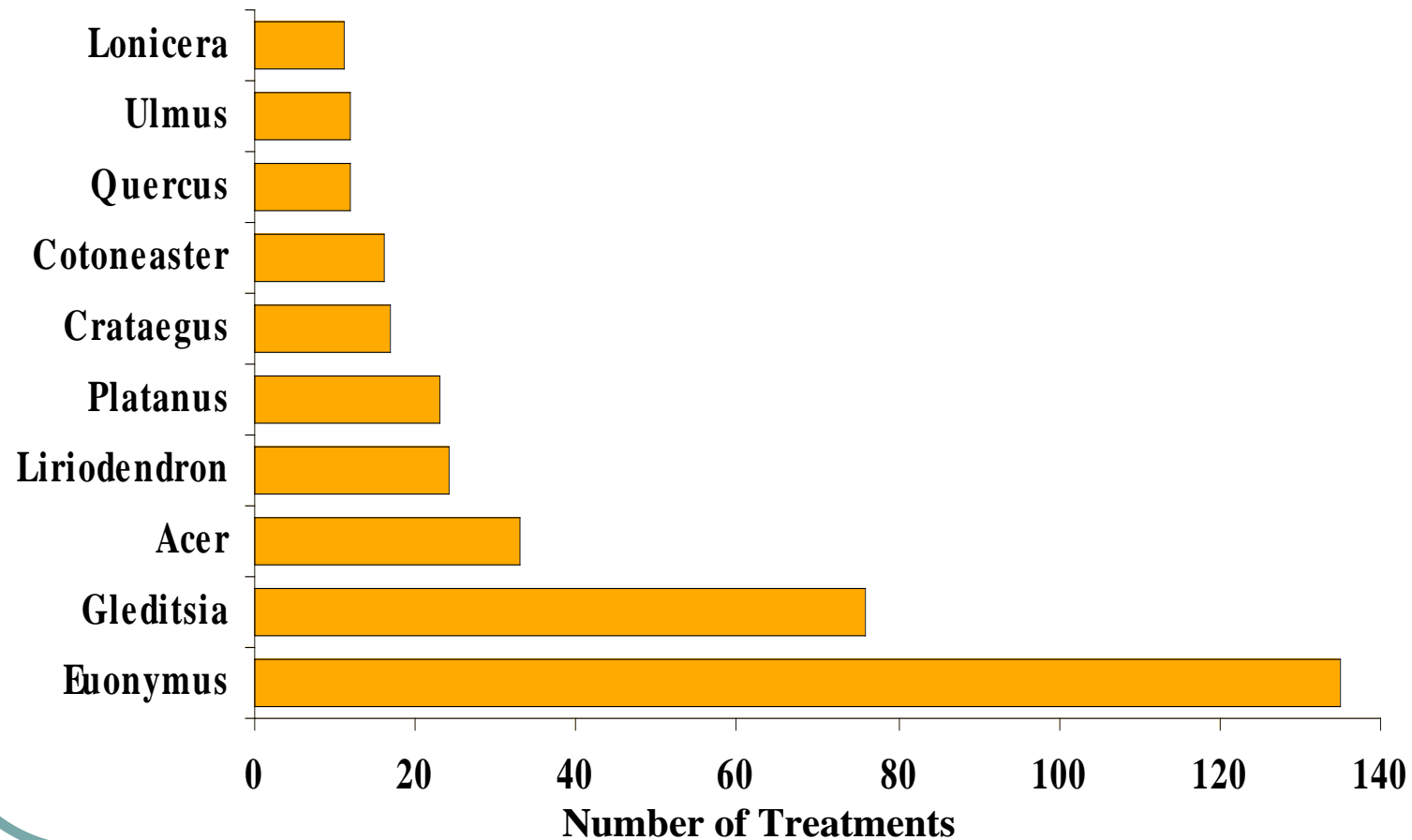
How to Summarize Records?

- Key pests - 10 most frequently observed
- Key plants - 10 most commonly with problems
- Key areas - Those with the most problems
- Seasonality - Frequency of key pests @ 2 week
 - Frequency of key plants @ 2 week

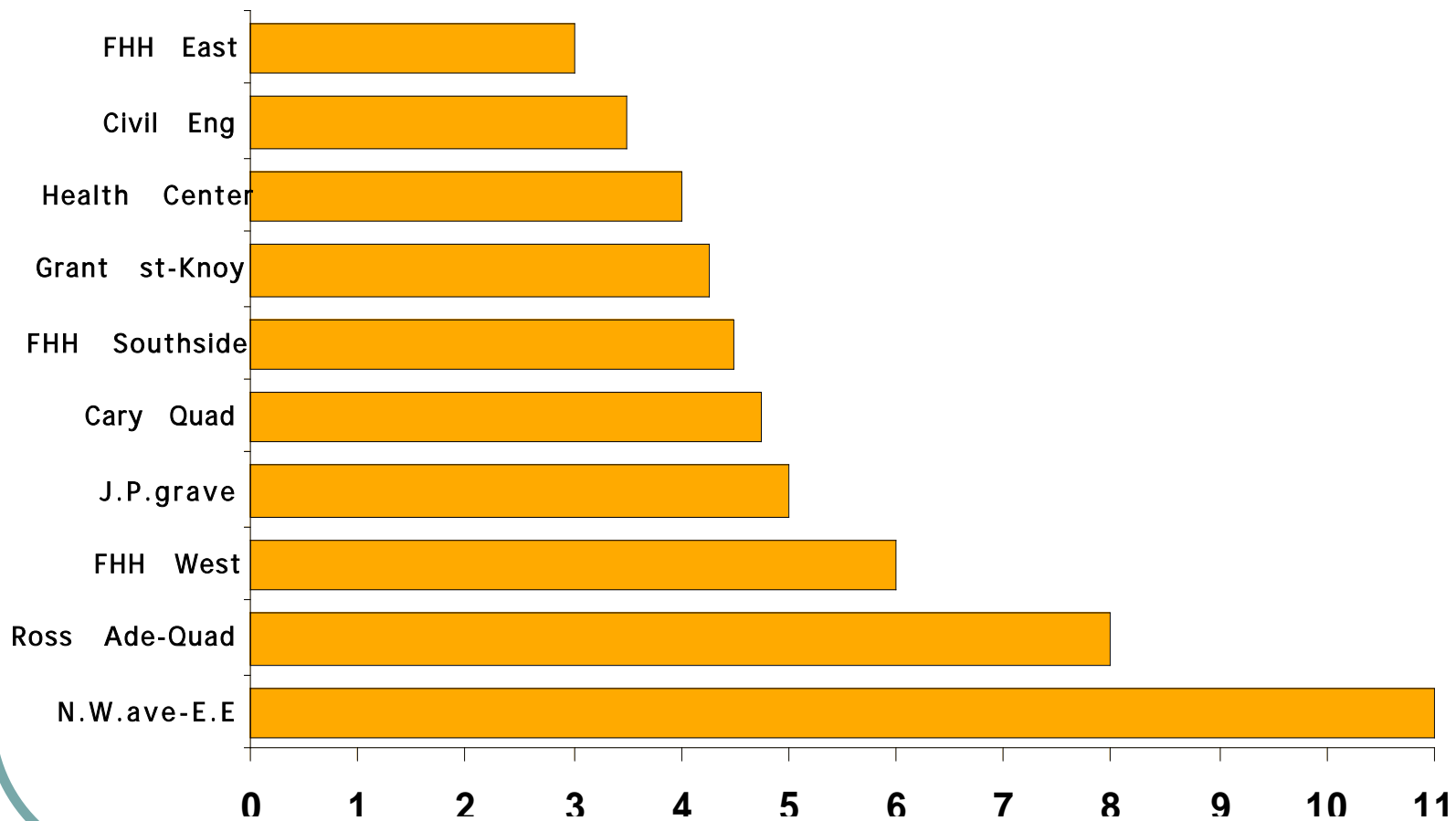
Use IPM to Identify Problem Pests



Use IPM to Identify Problematic Plants

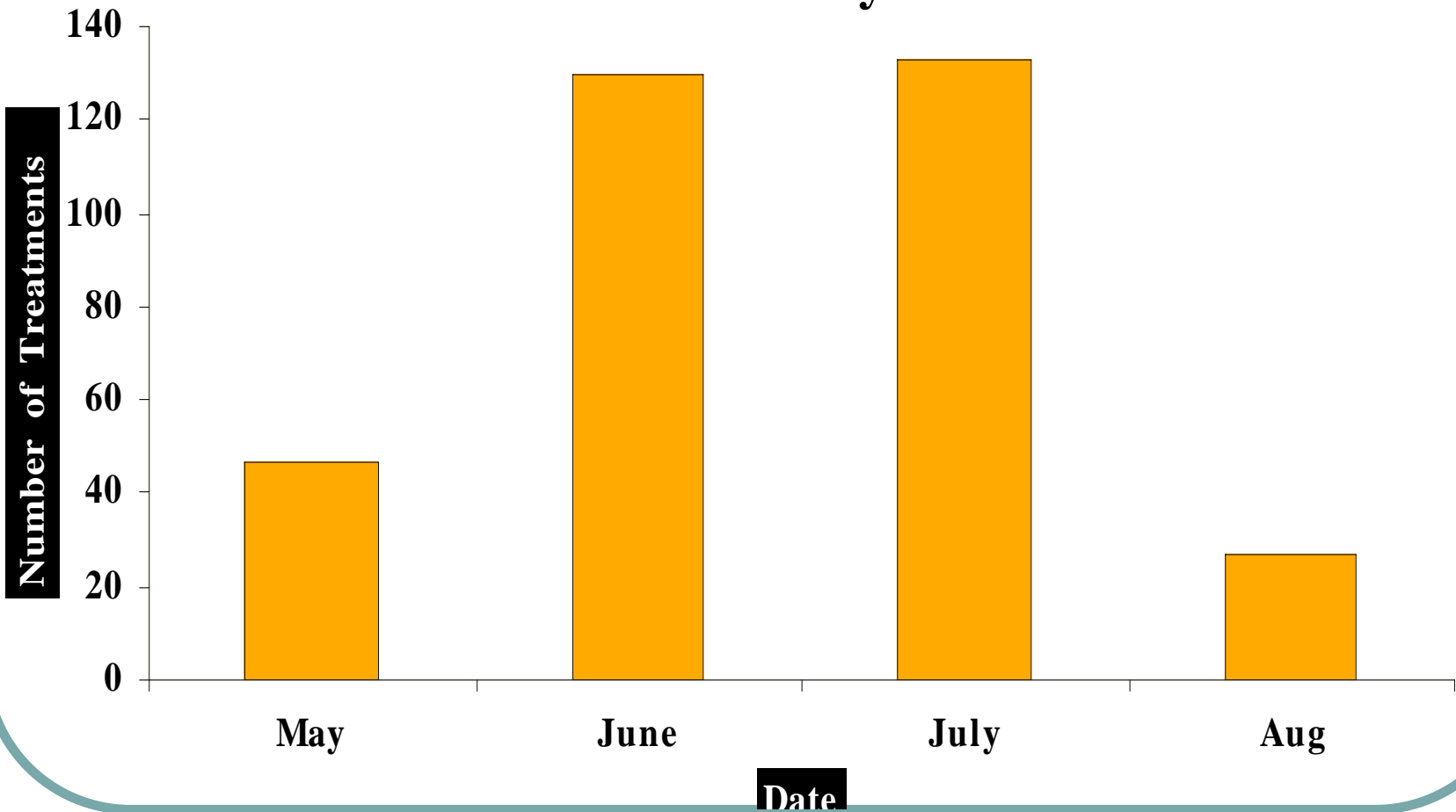


Use IPM to ID Properties or Locations with Most Problems

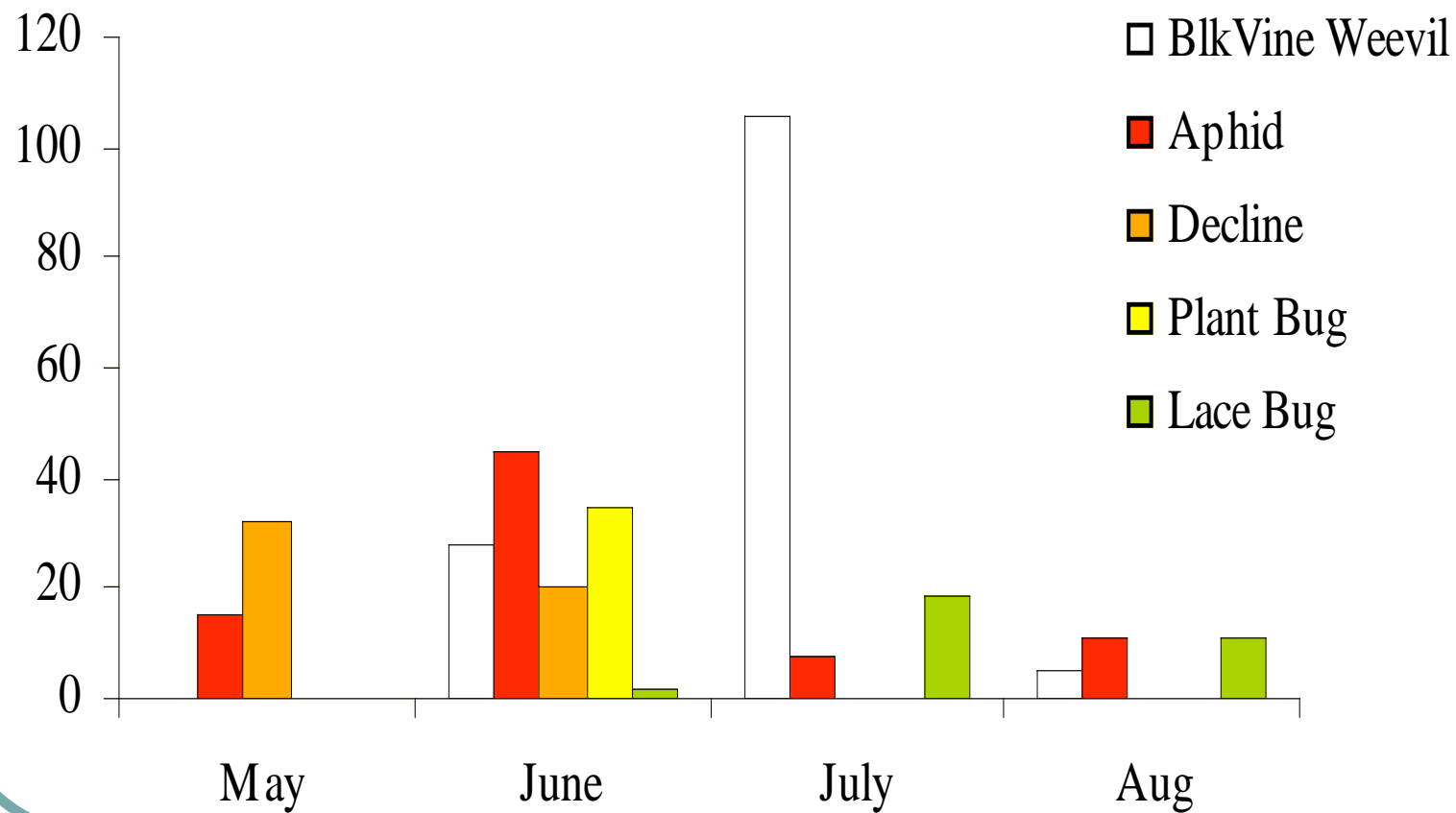


Use IPM to Identify Busy Times:

Seasonal Activity - 1992



Use IPM to find out when specific pests are problems



Other ways to predict insect activity

- Historical calendar dates
- Temperature based systems (Degree days)

Degree day with a 50 F base

$$DD50 = \frac{(\text{Max } T - \text{Min } T) - 50}{2}$$

- Plant phenology indicators

<http://www.entomology.umn.edu/cues/Web/049DegreeDays.pdf>

Pest Invasions and IPM

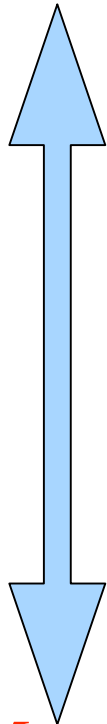
- Immigration
 - Know when pests are active
- Colonization
 - Determine where and which plants
- Rate of Spread
 - Knowing how fast and far pests move help you appropriate scale of control

IPM provides a framework for using practices compatible with NE's

- Cultural Control
 - mulching, proper fertilization and watering
- Mechanical Control
 - hand removal of pests, pruning
- Short Residual, Selective Pesticides and Repellants
 - oil, soap, neem, BT, spinosad, IGR's
- Biological Controls
 - conservation
 - augmentation
 - (predators, parasites, diseases)

Range of pest management programs and compatibility with biological control

Least Compatible with BC



Cover Sprays (convenience driven)

Calendar Sprays (= semi-biology based)

See – and – Do (pest problem driven)

See, Do and Record (record treated problems)

Monitor, See, Do, and Record (=IPM or PHC)

Most Compatible with BC