

Movement of insect pests in landscapes

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

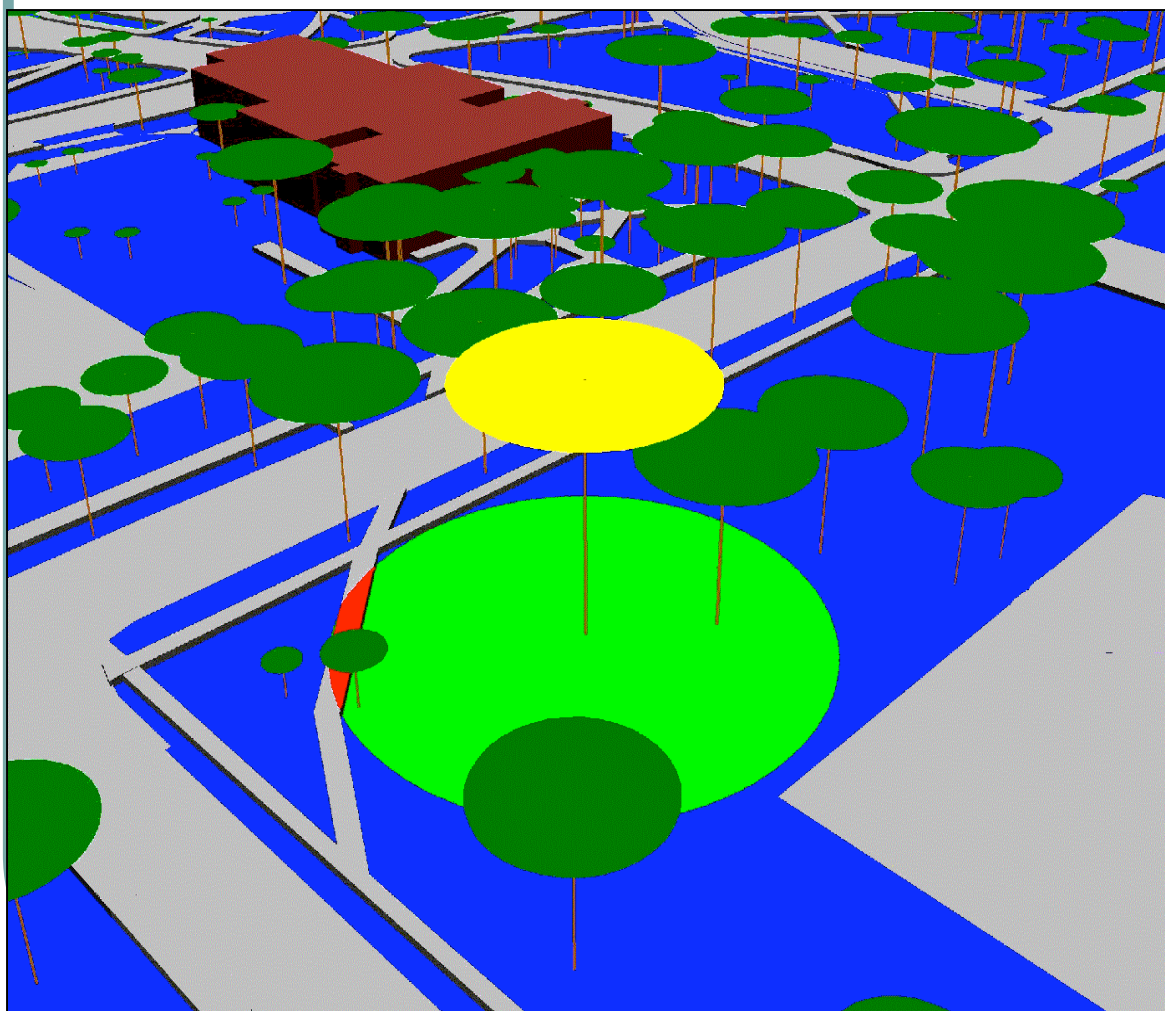
- How many host plants
- What separates host plants- are they connected in a corridor?
- How often are new plants brought into the landscape? (Artificial spread)

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?

Landscape 1: Turf and Tree Landscape

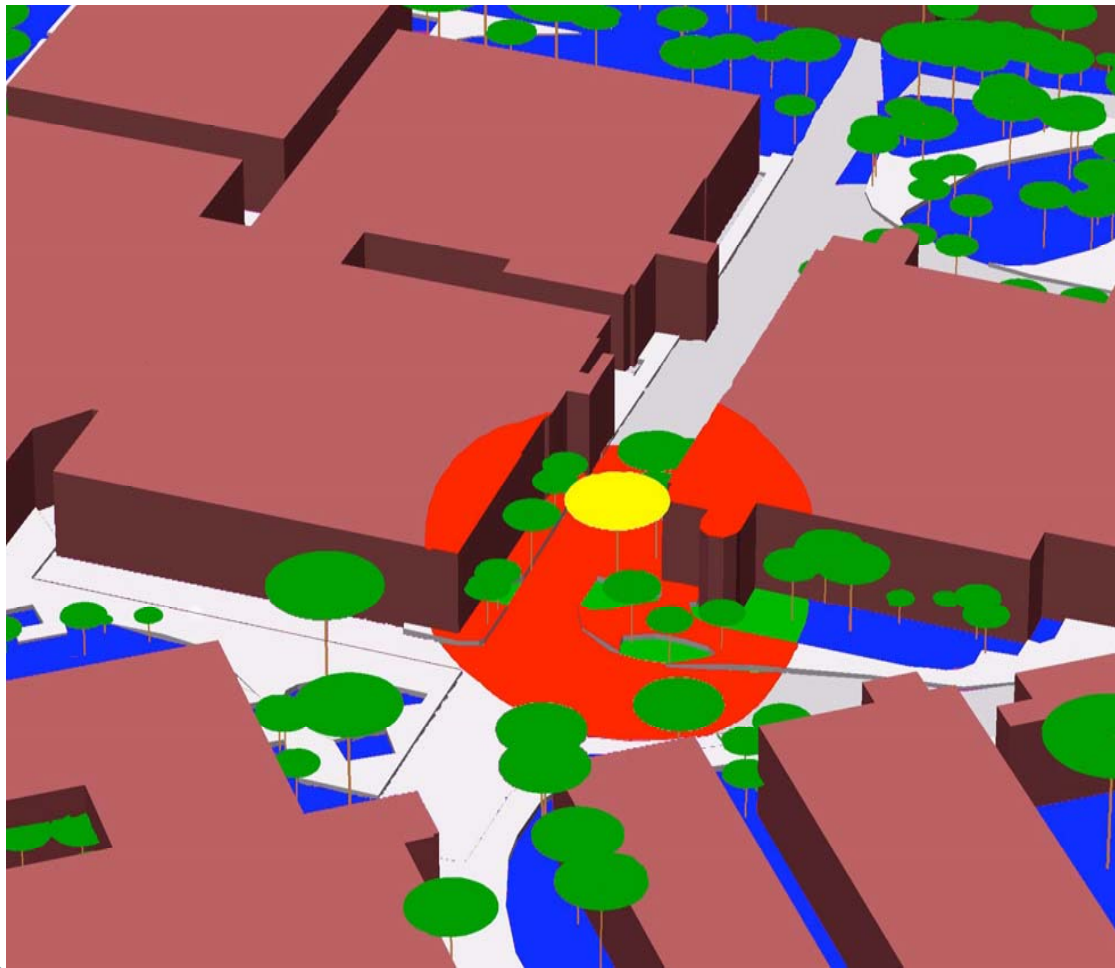
Trees in a matrix of turf and pavement



- building
- turf
- pavement
- tree canopy

Landscape 2: Building and Tree Landscape

Trees in a matrix of buildings and pavement



- building
- turf
- pavement
- tree canopy

In which of the two landscapes is a tree more easily invaded by pests?

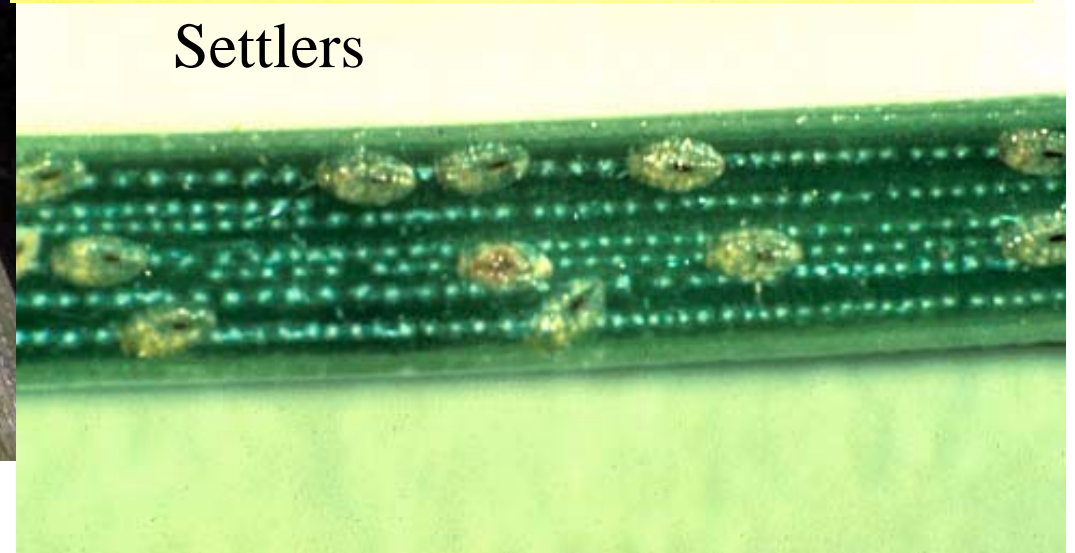
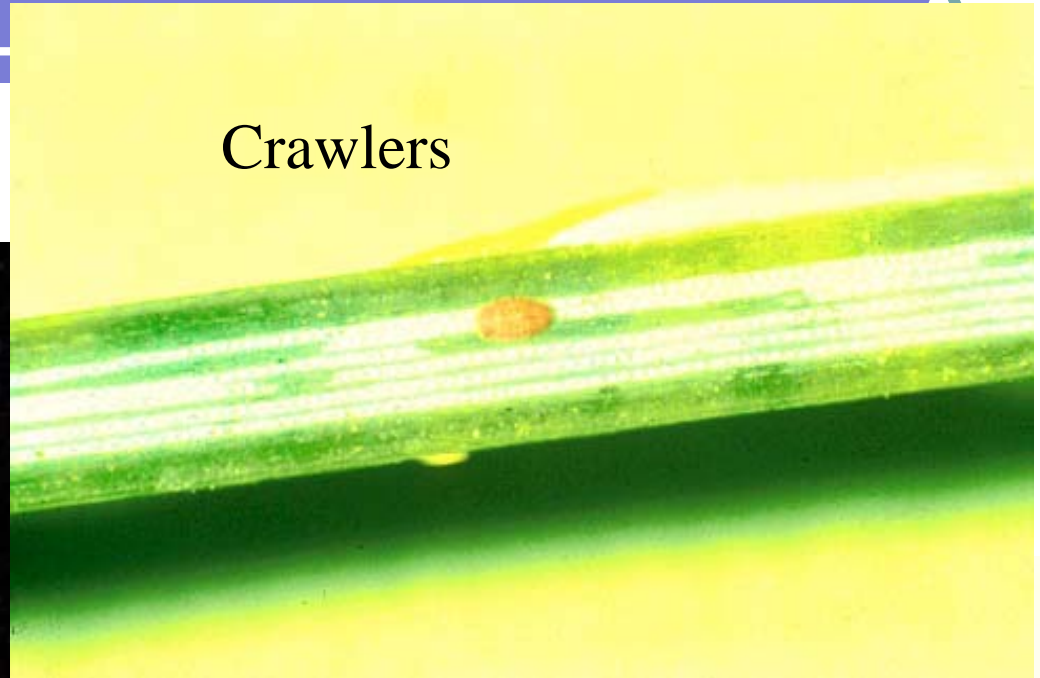
- Tree in turf matrix?
- Turf in building matrix?

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

Three pests with different mobilities

- Pine needle scale
- Honeylocust spider mite
- Japanese beetle

Pine needle scale



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 Japanese beetle

	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.