IPM 1: Sampling

1 Integrated Pest Management and Sampling
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2 Integrated Pest Management
   - "A decision support system for the selection and use of pest control tactics singly or harmoniously coordinated into a management strategy, based on cost-benefit analyses that take into account the interests and impacts on producers, society, and environment."
   - Based on Integrated Pest Control in 1959.
   - Became national priority under Nixon. Was again named a national priority under Carter and Clinton.

3 Key Elements of Integrated Pest Management
   - Systems Approach
   - Sampling and Monitoring: Population Ecology
   - Application of Thresholds: Economic Models
   - Multiple Strategies: Integration
     - Cultural/Physical
     - Biological
     - Chemical

4 IPM terminology
   - IPM Program: Overall pest management plan
   - IPM Strategy: A group of related Tactics
   - IPM Tactic: A particular pest management approach

5 Prokopy's Four Phases of IPM
   - Starts with a single pest and moves on to all of society
   - What is a possible flaw with this model of thought?

6 The IPM Pyramid
   - Begins with Bottom up: Host plant resistance, agroecosystem design
   - Has a Sampling and decision model layer
   - Ends with Responsive Pest management.
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- 7 IPM decision Staircase
  - Identification
  - Population Monitoring
  - Damage and economic loss
  - Available controls
  - Interactions
  - Environmental and Legal Restraints
  - Decision

- 8 Identification
  - Next two lectures focus on the middle tier of the IPM triangle
  - Is this a problem?
  - What kind of problem?
  - E.g. Striped Cucumber Beetle vs. Corn Root Worm
  - Once we've ID'd the pest we need to decide if it is a potential problem

- 9 Pest Severity
  - Recall pest severity this has a basal impact on defining a pest problem
  - High value crops with direct feeding pests or pests that contaminate harvest require more carefull attention than low value crops with pests that cause minor yield losses or are just and annoyance.
  - Once we think we might have a problem we need to decide how big a problem it may be: This is where surveillance and sampling comes in.

- 10 Surveillance vs. Sampling
  - Surveillance is done when a pest is expected to appear in a broad area = qualitative
    - Invasive species
    - Zebra mussels
    - Garlic Mustard
    - Medfly in CA
    - Migrating pests
      - Soybean Aphid
  - Sampling is done when pests are known to be present and used to guide a pest management decision = quantitative
    - i.e. Codling moth, PC in apples
    - Striped Cucumber beetles
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- Lambsquarters, Pigweed, common weeds

**11 Sampling**
- Provides spatial data
- Provides data for temporal predictions
- Two types of Samples: Absolute and Relative
- Many Sampling Tools Available

**12 Absolute vs. Relative Samples**
- Absolute: pests per spatial area
  - Direct observation/count of pests: easier with static organisms
  - Total census of pests within a given area
- Relative: pests per sampling effort
  - i.e. Sweeps with a sweep net
  - Insects/Spores per passive or active trap
  - Partial census: sampling method is not 100% foolproof
  - Relative measures can be transformed into absolute measures
  - This is often the basis for pest management thresholds.

**13 Sampling and Spatial pattern**
- Random, Clumped, Uniform distributions
- Pest most typically exhibit Clumped distributions
- Direct measurements provide more useful spatial data

**14 Sampling Methods**
- Direct Observation/Counting
- Quadrats
- Knockdown/beat sheets
- Soil Samples

**15 Damage Evaluation**
- Symptoms of pathogens
- Plating/DNA extraction can help identify pathogens
- Animal Damage
- % Crop with specific damage

**16 Trapping**
- Pheromone traps
- Intercept visual traps
- Spore traps
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- Suction traps

**17 Sequential Sampling**

- A method for maximizing sample information while minimizing cost
- Stop or continue sampling based on previous samples
- Within a field
- Over a season

**18 What do we do with samples??**

**19 Phenological Models**

- Based on Degree Days or other environmental data
- Degree Days = Average Temperature - Lower Developmental Threshold
- Also an Upper threshold
- Sampling sets the "biofix" or starting point for subsequent steps
  - Benefits of Phenological Modeling
    - Predicts:
      - When pest populations will be a problem
      - Times when pests are most vulnerable
      - May be combined with other pest models

**20 Codling Moth**

- Phenology

**21 Codling Moth Lifecycle**

**22 Pest management decision thresholds**

- Apply responsive, topdown pest management in response to a **threshold** pest density