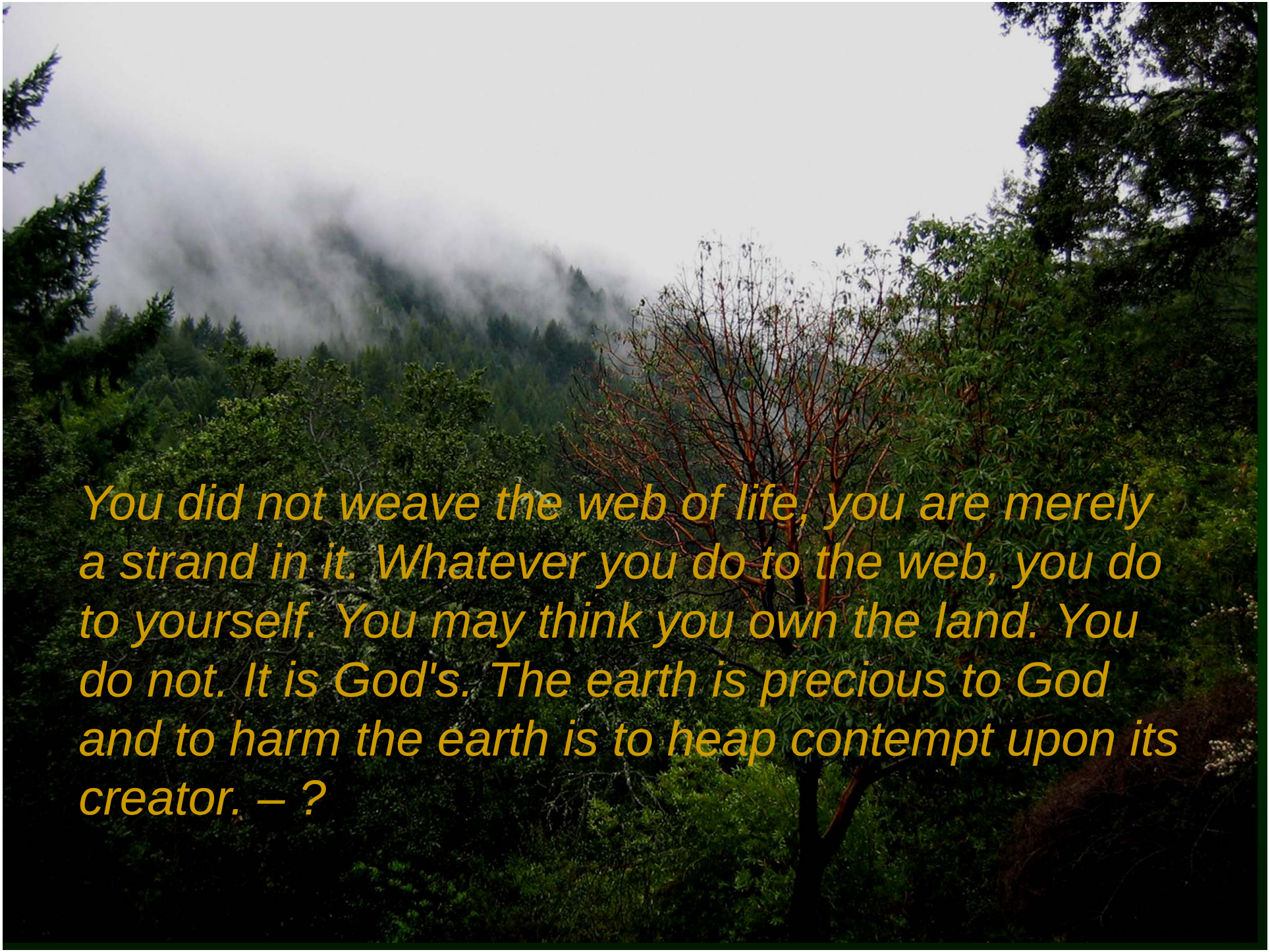
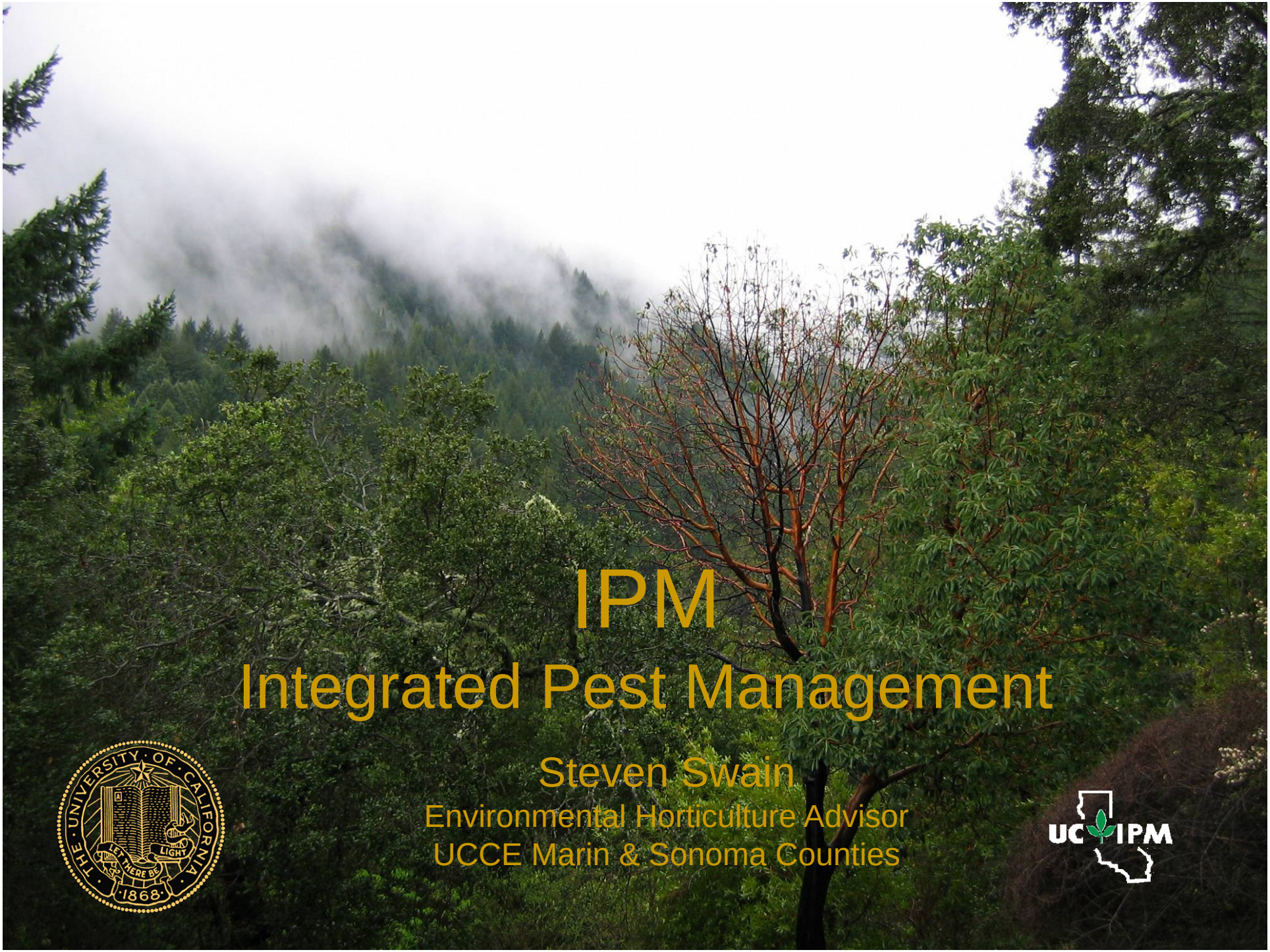

You did not weave the web of life, you are merely a strand in it. Whatever you do to the web, you do to yourself. You may think you own the land. You do not. It is God's. The earth is precious to God and to harm the earth is to heap contempt upon its creator. – ?



IPM
Integrated Pest Management

Steven Swain
Environmental Horticulture Advisor
UCCE Marin & Sonoma Counties

Chief Sealth (Seattle)

~ 1786 – 1866

Spoke in Lushootseed language, translated into Chinook Indian Trade language and then into English

Pled for Native American and Environmental rights

…but nothing written down.

Quote: Ted Perry (1971) Hollywood

as: Chief Seattle (1854) Washington

IPM has a long history

- Two of the four horsemen:
  - Pestilence
    - Ignis sacer (St. Anthony's fire)
      - Gangrenous ergotism
      - *Claviceps purpurea*
      - Hallucinations: LSD
  - Famine
    - Irish potato famine
      - *Phytophthora infestans*
    - Prehistoric famines recorded in bones

Cottony cushion scale on citrus

- Biological control vs. IPM
- Problem emerged in California in 1880's
  - *Icerya purchasi*
    - (Not native)
  - Desperate growers cutting and burning trees
  - Orchard land values plummet
- Vedalia beetle introduced winter of 1888-89 (514)
  - *Rodolia cardinalis*
  - Australian
  - Amazingly fast recovery
    - Defoliated orchards on brink of bankruptcy in March had full harvest in August
  - Redistributed ~11,000 beetles by June 12, 1889

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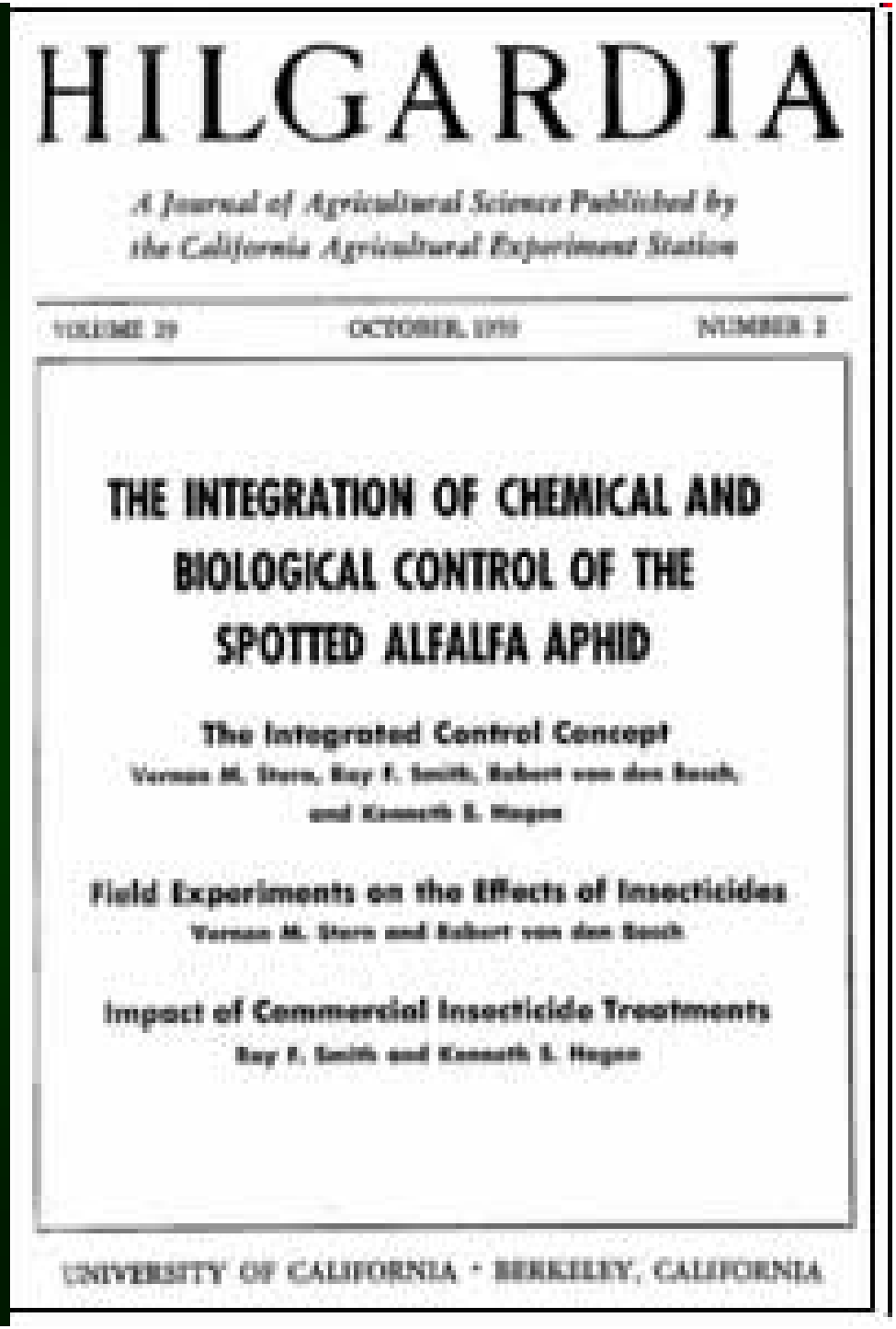
Pesticide Impact

- DDT use functionally eliminated vedalia from central valley (1950's)
  - 3 years for re-establishment
  - $1/beetle
- IGR's used on California red scale (molt inhibitor)
  - *Aonidiella aurantii*
  - IGR kills cushion scale slowly, at applied concentration
  - IGR kills vedalia quickly at much lower concentration
  - CCS outbreaks severe on neighboring orchards in 1999
  - Malathion for control
  - > 9 month recovery

Most important paper of 20th century (?)

- Hilgardia 1959 (29) 81:101
  - Stern, Smith, van den Bosch, Hagen
- Founding of “IPM”
- Rachel Carson
  - Silent Spring 1962



HILGARDIA

A Journal of Agricultural Science Published by the California Agricultural Experiment Station

VOLUME 29 OCTOBER, 1959 NUMBER 1

THE INTEGRATION OF CHEMICAL AND BIOLOGICAL CONTROL OF THE SPOTTED ALFALFA APHID

The Integrated Control Concept

Vernon M. Stern, Ray F. Smith, Robert van den Bosch, and Kenneth S. Hagen

Field Experiments on the Effects of Insecticides

Vernon M. Stern and Robert van den Bosch

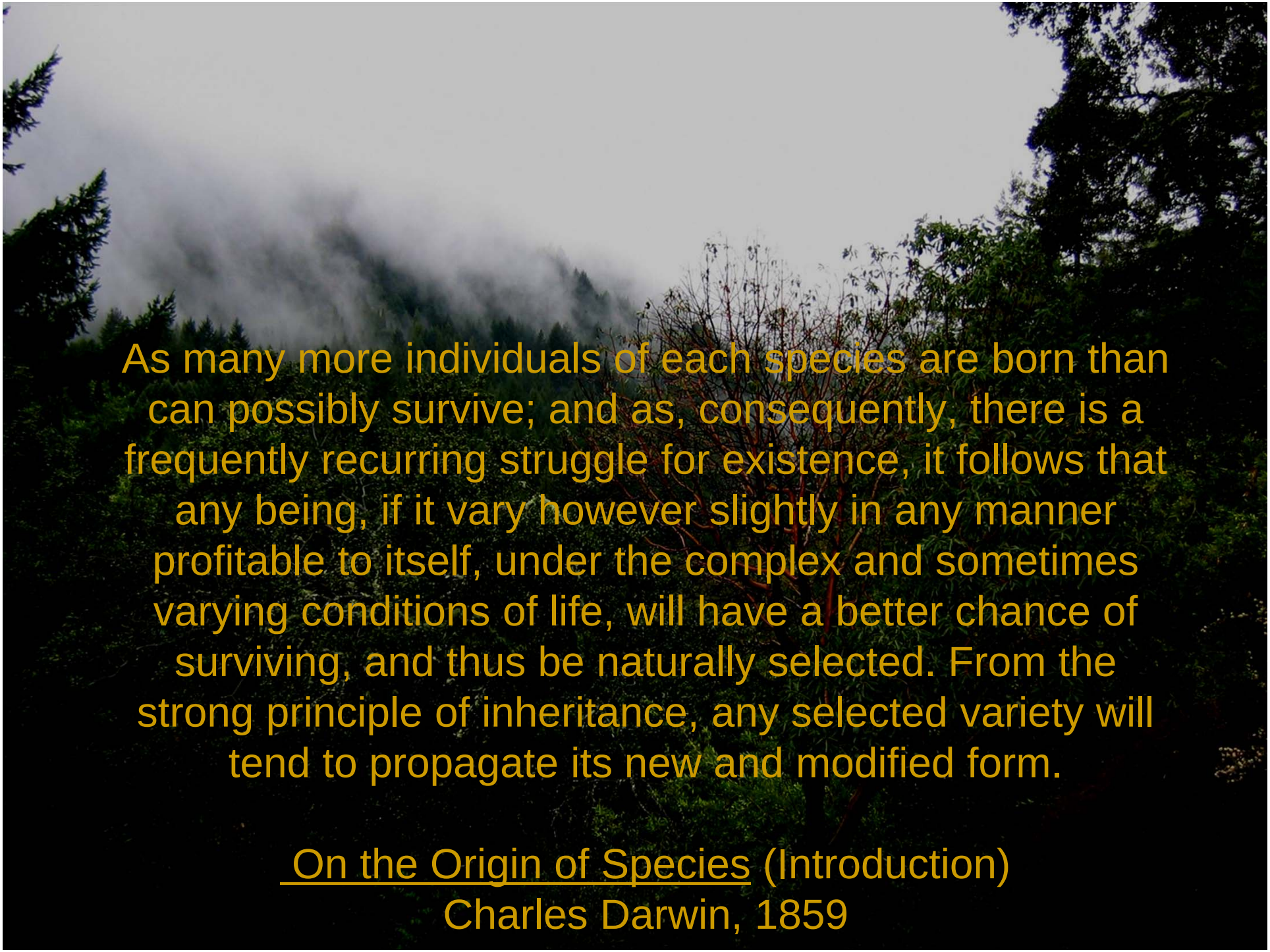
Impact of Commercial Insecticide Treatments

Ray F. Smith and Kenneth S. Hagen

UNIVERSITY OF CALIFORNIA · BERKELEY, CALIFORNIA

Original goal: resistance management

EIT: Economic Injury Threshold
AIT: Aesthetic Injury Threshold

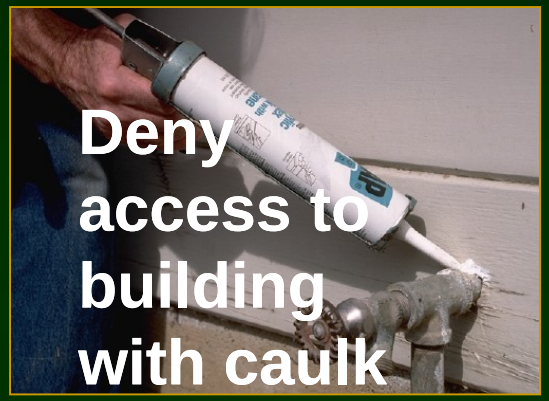

As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form.
On the Origin of Species (Introduction)
Charles Darwin, 1859

Original goal: resistance management

EIT: Economic Injury Threshold
AIT: Aesthetic Injury Threshold

IPM tools and techniques

- Synergy



Prevention

- **Physical/ mechanical**

Cultural practices

Biological control

Pesticides, only if needed

- **Monitor to detect and assess problems**
- **Use least-toxic materials**

What is a pest?

- Insect pests
- Diseases
- Vertebrate pests
- Weeds

How do we manage them?

- Detection
  - Monitoring
    - Traps
    - Surveys
  - Prediction
- Identification
  - Life cycle
  - Interaction with host
  - Natural enemies
  - Competitors

- Threshold
  - Requires both previous steps
  - Known for:
    - Crops
    - Turf
  - Landscape relevance?
    - How many aphids?
    - How much barnyard grass?
    - By the time they noticed …

How do we manage them?

- Prevention
  - Cultural practices
    - Clean planting stock
    - Sanitation
    - Irrigation timing & type
    - Crop rotation
  - Resistance
  - Habitat modification
    - Ivy removal
    - Alternate host removal
  - Physical barriers
    - Tanglefoot
- Treatment
  - Mechanical control
    - Traps
    - Picking
      - Leafminers
  - Natural enemies
    - Nursery plants
      - Food
      - Shelter
  - Biologicals
  - Botanicals & soaps
  - Chemical

Why have IPM?

- We need IPM because we are
  - forcing plants into unnatural lines of development
  - and into unnatural locations of growth,
  - and under unnatural conditions.
  - Law of unintended consequences

Law of Unintended Consequences

- Not a scientific law
- … a warning against the hubristic belief that humans can fully control the world around us.

What exactly is a Pesticide?

EPA: A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.

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When are pesticides needed?

When pests are causing intolerable damage

Non-chemical methods aren't effective

How to know?

Identify your pest

Assess the problem

Research and consider alternatives

Does IPM = organic?

- IPM
  - "Least toxic" approach
  - Based on knowledge of
    - pest
    - biology
    - habitat
  - Right plant, right place
  - Emphasis on prevention
  - Pesticides limited
    - Synthetics allowed
      - Low toxicity
      - Degrade slower
        - » Bio
        - » Photo
        - » Thermo
  - A technique
- Organic (pest mgmt.)
  - "Natural" approach
  - Based on knowledge of
    - pest
    - biology
    - habitat
  - Right plant, right place
  - Emphasis on prevention
  - Pesticides limited
    - No synthetics
      - Natural = rapidly biodegradable
      - Highly toxic?
  - A legal classification

IPM/Organic overlap

IPM, non-organic:
Effective control achieved using synthetic (and potentially non-sustainable) inputs

Overlap: effective control using organically approved methods

Organic, non-IPM:
Ineffective control
or
Control at high environmental or safety costs (non-sustainable)

Sustainability: The 3 E's

- Ecological
  - Does it cause lasting damage to the biological systems on which it's based?
- Economic
  - Can it be done profitably?
- Equitable
  - Is the system unjust to others?

2009 east coast tomato and potato failure

- Late blight
  - *Phytophthora infestans*
  - Afflicts
    - Tomatoes
    - Potatoes
    - Others in Solanaceae
- In a well-managed farm:
  - Typically shows up late in the season
  - More of an annoyance than a problem
  - Organics: manageable

When it's not so well managed …

- Poor quality control at one (?) big nursery
  - Thousands of infected tomato starts
  - Small gardens > farms
    - 36 million gardens 2008
    - >43 million as of Aug 2009
    - Not a lot of education
    - Pathogen can travel 40 mi
  - Early start to late blight
  - Impact on tomato and potato crops:
    - Conventional: barely manageable
    - Organic: crop loss

Remember these points:

1. Do some homework ahead of time
2. Monitor regularly
3. Correctly ID pests & beneficials
4. Determine if management is needed
5. Change conditions so they don’t favor pest population development
6. Consider nonchemical controls first

Thanks!

- UC IPM: http://www.ipm.ucdavis.edu/
- Presentation on-line at:
  - http://ucanr.edu/MarinIPM
- Steven Swain: svswain@ucanr.edu
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