



Integrated Pest Management

APPA Institute
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Course Description

Is your campus dealing with challenging pests like bed bugs or pigeons? Is your campus interested in reducing pesticide use due to health and safety concerns? Are you looking for safe, cost-effective, and long-term solutions to perennial issues? Join us for an in depth yet fun look into the evolving world of Integrated Pest and Wildlife Management. This session will explore the role of your departments' maintenance staff, the use of thermal remediation for structural pests, wildlife management, and IPM in Grounds. The program will also cover emerging topics such as pollinator protection and environmentally sensitive mosquito control programs. Join this engaging class and learn how to "treat the source, not the symptom."



Learning Objectives

1. Identify and explore the principles and benefits of environmentally friendly pest control, or Integrated Pest Management (IPM).
2. Review the hazards and consequences of (improper) pesticide use.
3. Explore the role of Facilities Maintenance in campus pest control.
4. Learn the current trends and initiatives in integrated mosquito control, IPM in landscaping, wildlife management, and pollinator protection
5. Share practical examples from around the country.

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Personal Introduction

- Dept. of Facilities Management
 - Division of Infrastructure & Sustainability
- Sustainability Program Manager
- Formerly the Assistant Director for Environmental Operations
 - Campus Pest Control Coordinator & Wildlife Manager
- 18 years experience



Initiatives & Programs

- Greenhouse bio controls
- Bed bug eradication
- Integrated Turf Management Plan
- Wildlife protection, relocation, and lethal control
- Parasitic wasp releases in steam tunnels (roaches)
- Mosquito control
- Noxious weed mngmt.- 1000+ Cashmere goats, over seeding
- Pollinator protection
- Integrated Turf Management Plan

Course Overview

- Introduction to IPM
- UCB Program Summary
- Role of trades / maintenance staff
- Thermal Remediation
- Mosquito Control
- IPM in Outdoor Services (Grounds)
- Wildlife Management
- Bird Control
- Pollinator Protection



Pesticides 101

- The term "Pesticide" includes:
 - Insecticide
 - Herbicide
 - Fungicide
 - Larvacide
 - Biocide, etc.
- -cide
 - *combining form*
 - suffix: **-cide**
 1. denoting a person or substance that kills.
"insecticide"
 2. denoting an act of killing.
"homicide"
- Pesticides are designed to kill, repel, disrupt.
- Anything used by a licensed pest control professional can be considered a pesticide, including soapy water.

Pesticides: Why should we be Concerned?

- Pesticides are generally over used
- Pesticides move - N.C State study
- Pesticides should not be considered "safe"
- Pesticide registration process flawed...burden of proof on public
- "Inert" ingredients not biologically inert
- Greater effects on children
- MCS (Multiple Chemical Sensitivity)



Common Effects of Pesticides on Humans

Acute:

- Eye, skin, lung irritant / damage

Chronic:

- Reproductive hazards
- Organ damage
- Carcinogen
- Neurotoxicity
- Mutagen (DNA)
- Endocrine disruptors (hormones)

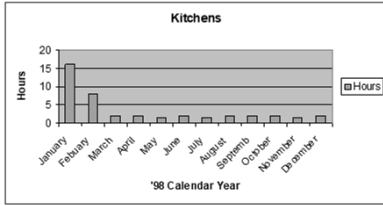
Integrated Pest Management

- Focuses on long term prevention of pests.
- Minimizing the impact on human health and the environment.
 - Utilizing extensive knowledge about the pests.
 - Monitoring through regular and careful inspections.
 - Use of least toxic controls: Biological, Mechanical, Cultural, and Chemical.
 - Record keeping to track and evaluate pest management.
- Most cost effective.

Beyond “Extermination”

- Pest control industry business model dependent on ‘call-backs’
 - Move past ‘spray & pray’ mentality
- Environmental protection
 - Including non-target and beneficial organisms
- Safety – of applicators, campus community, public
 - IAQ / IEQ
 - Acute exposure
 - Chronic exposure

IPM is Front -Loaded



- Began w/ 4 hrs per WEEK for 6 weeks.
- Reduced to maintenance level of 2.5 hrs per MONTH.
- Control is better than ever.

History at CU Boulder

- Pre 1998:
 - No campus pest control staff, program or policy
 - Pest control conducted by (zone) maintenance staff
 - Departments called private pest control providers
 - 1000's of gallons of liquid pesticides used (indoors) in certain years
 - Little to no IPM
- Since 1998: *Beyond Compliance*
 - In-house structural IPM and wildlife management team
 - Campus wide policy (IPM coordinator)
 - All pesticide applications reviewed in advance
 - All applicators licensed by State

Policy Overview

- Policy is campus-wide (3/12/02)
- "Threshold Action Levels" determined
- Based on Threshold Action Levels, select a treatment that is:
 - Least hazardous to human health
 - Least damaging to the environment
 - Effective in controlling the pest
 - Has minimal negative impacts to non-target organisms
 - Within available resources
- All proposed pesticide applications reviewed by coordinator.
- Only "Qualified Supervisors" have authority to purchase pesticides.

How CU Internalized Program

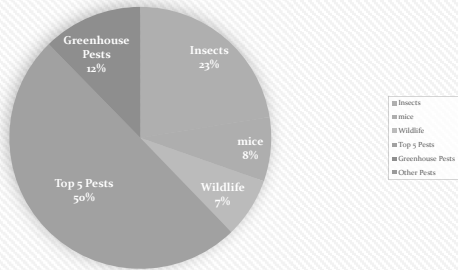
- Primarily a financial argument
 - Decentralized service using private vendors
 - Compared vendors costs vs. in-house rates
 - Calculated amount of recharge
- Fortunate to have a private technician working on campus and looking to work for campus

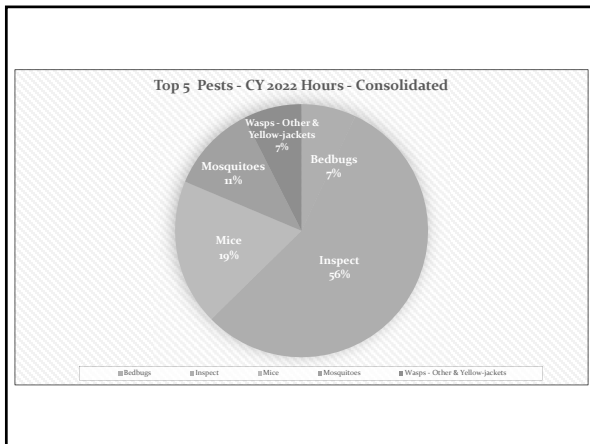


Services provided

- All structural/indoor pests controlled including:
 - Research & Animal Labs
 - Food Service areas
 - Greenhouses
 - Recreational facilities
 - Museums / Collections / Archives
 - Bed and Bat bugs
 - Residential areas
 - Child Care centers
- Outdoor pests:
 - Mosquito control program
 - Yellow Jacket traps (~300 traps every 3 months)
 - Rodent bait stations (~700 stations/month)
- Wildlife management:
 - Bird control
 - Marmots, coyotes, foxes, p-dogs, deer, bears, mtn. lions, sasquatch

CY 2022 Total Labor Breakdown by Hours





Non-Chemical Controls at CU

- Parasitic wasps released in steam tunnels to combat cockroaches.
- Use of bio-controls in greenhouses.
- Vacuum, hair dryer, CO₂, hand tools.
- Thermal remediation for the control of structural pests



Current Resources

- Campus IPM Coordinator (.17 FTE)
- IPM Manager (1.0 FTE)
- IPM Technicians (3.0 FTE)
- 2-3 students (.68 FTE)
 - Depends on season
- IPM Structural Trades Apprentice (1.0 FTE)
 - Currently on hold

Responsible for more than 13 million sq. ft. throughout roughly 370 structures across >1000 acres

Rely on most trades to assist IPM in excluding pests and eliminating attractions

Defensible Space

- Exclusion is key to controlling the indoor environment
 - Door sweeps
 - Screens
 - Caulking & sealing
 - Bldg. envelope
 - Old / broken windows
 - Roof / sophet
- Pest control maintenance often overlaps w/ Energy Conservation initiatives

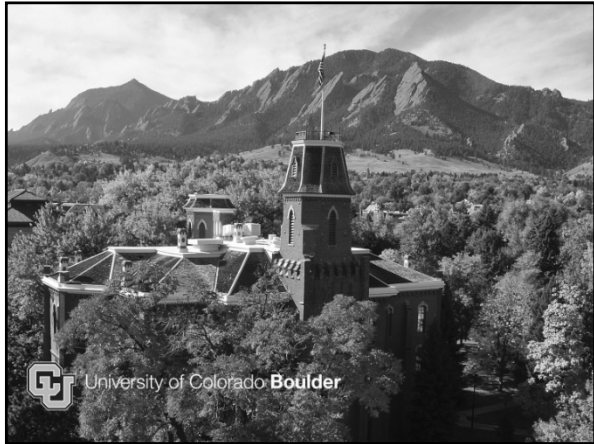


Recent Collaborations

Trades

- | | |
|---------------|--|
| • Carpenters | Bats & Bees - caulking, sophet repairs |
| • Fabricators | Bird exclusion - sheet metal work |
| • HVAC | Henderson Museum - moisture issues |
| • Elevators | elevator shaft maintenance & drainage |
| • Structural | bldg. envelope, windows, screens |
| • Roofers | gutters, roof tiles, Cupalo exclusion |

Access to restricted spaces such as mechanical rooms, roofs, and elevator shafts is invaluable



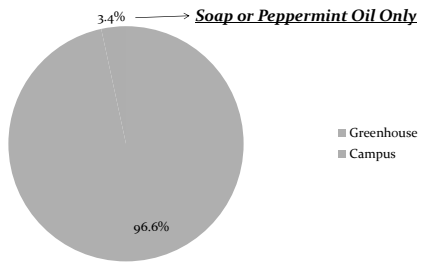


Indoor* Chemical Use
CY 2005-2006
 *(not including greenhouses)

<p style="text-align: center;"><u>CY2005</u></p> <ul style="list-style-type: none"> • Total of 3898 grams of solids. <ul style="list-style-type: none"> • 8.54 lbs. of solid pesticides used in roughly 8 million square feet. • 519 ounces of liquid/aerosol spray applied. 	<p style="text-align: center;"><u>CY2006</u></p> <ul style="list-style-type: none"> • Total of 2725 grams of solids. <ul style="list-style-type: none"> • 5.96 lbs. of solid pesticides used in roughly 8 million square feet. • 699 ounces of liquid/aerosols spray applied
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Exposure to Sprays Minimized

CY19 Greenhouse vs Campus



Thermal Remediation



CONTROL METHOD SUMMARY

Control Method	Description	Control Method Benefits					
		Controls adults	Controls nymphs	Controls eggs	Area-wide Treatment	Local Treatment	Treats inaccessible areas
Vacuum Cleaner	Use conventional vacuum cleaner to remove bed bugs	x	x			x	
Steam Cleaner	Use steam cleaner to heat and kill bed bugs	x	x	x		x	
Chemical Pesticide - Aerosol	Mixed liquid pesticide applied to kill bed bugs	x	x			x	
Chemical Pesticide - Dust	Powdered pesticide applied to kill bed bugs	x	x			x	x
Thermal Pest Remediation	Area-wide treatment to heat and kill bed bugs	x	x	x	x	x	x

Benefits of Thermal Remediation

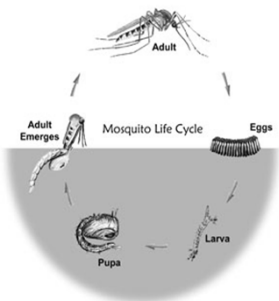
- Kills all life cycles, including eggs
- Scalable
- Far reaching
- Less disruptive
- No toxic residues
- Safest approach
- One time treatment (most cases)
 - Certain structures tricky (i.e., cinder block)
 - Re-treatments due to unseen cracks, crevices, voids
 - Heat doesn't penetrate down into deep cracks well
 - Tenant compliance becoming more complicated

Mosquito Monitoring & Control

- FTE & student crews trap adults and control larvae
- Season is roughly 4 months long (June to Oct.)
- Set 33 15 traps per week for 4 months – report #'s to County
- Check roughly 300 potential breeding sites per week – treat w/ larvicide as needed
 - Occasional release of minnows
- No adulticides/fogging needed in 20 yrs of control



Treat The Source



Mosquitoes Grow Quickly

- 11-14 days at 70 degrees
- 7-10 days at 80 degrees
- As few as 4 or 5 days above 90 degrees*

Mosquito Control

Integrated Program

Preventive

- Emphasis on reproductive cycle:
- Adult trapping (weekly+)
- Larval inspections (weekly+)
- Larvacides - no need to 'fog'
- Bio-controls (minnows)



Zika Response

Reactive

- Use of adulticides as primary control
- Especially ineffective in urban setting
- Must make direct contact w/ mosquitoes
- Health impacts of insecticide
- Extensive non-target impacts...Bees!
 - I.e, Florida

IPM in Outdoor Services



Developing a Professional Team

- Certified Turfgrass Manager hired - Jan. '02
- Certified Arborist hired - 2002
- Assistant Turfgrass Manager - Sep. '03
- Licensed spray technician(s) - Apr. '05
 - Evolved into plant scientist / horticulturalist as of '23
- Full time mowing crew - May '06
- In the field turf technician - Nov. '06
- Lead irrigation technician - Nov. '06
- Grounds reorganized into Outdoor Services - 2009
- Additional turf & tree FTE - 2012
 - All arborists ISA certified w/in 3 yrs.

Turf, Trees, Noxious Weeds

- Specialized staff hired and certified / licensed
 - Investment in robust irrigation system
 - Steady reduction in herbicide use since 2002
 - Specialized fertilization program
 - Specialized equipment for cultural turf program
 - Scheduled tree spraying (w/o inspection) eliminated
 - 1st Integrated Turf Plan - May '02
 - Revised Integrated Turf Plan - June '08
 - Compost tea system established - 2011
-
- No Pesticides on campus turf areas since 2012

Compost Tea



Meets longstanding desire to use compost on campus grounds... that was seen as time & cost prohibitive.



Now covers all areas serviced by ditch water, including Folsom Field.



Non-Chemical Controls at CU

- Cashmere goats used to graze noxious weeds.
- Use of seed- and root-feeding weevils for knapweed control.
- Investigating mites for bindweed
- Cultural Care: Sanitation pruning, mulching, winter watering
- Non-stinging parasitic wasps for control of Emerald Ash Borer (EAB).
- Soil drench w/ *Ooovesicula popillae*-infected Japanese beetles (2020)
- Winsome Fly (*Istocheta aldrichi*) release for Japanese Beetle (22/23)
- Steam machine for beds, cracks, crevices



Collaboration over the years...

- 'Beaver Deceivers'
- Herbicide reduction initiatives (turf)
- Reduction in mosquito breeding habitats
- Honey bee relocations
- Tree maintenance program
 - Broadcast sprays predominantly oils
 - Use of soil & trunk injections
 - Use of biocontrols

Trunk Injections



Wildlife Management

Research ponds example

- Beavers damming up pond connectors
- Flooding adjacent areas
- Mature trees lost
- Repeated relocations
- Costly



Solution / Results

- 'Beaver Deceivers' installed
- Water level stabilized
- Mature trees wrapped and protected
- Relocation unnecessary
- Resource limits regulate population









BIO-CONTROLS

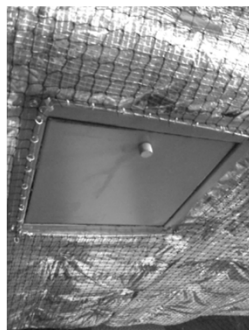


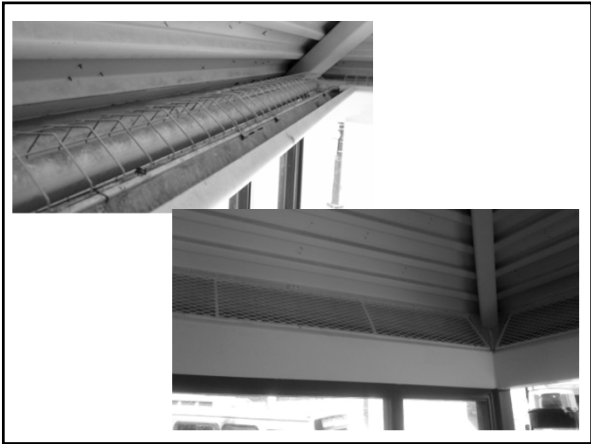
Bird Control

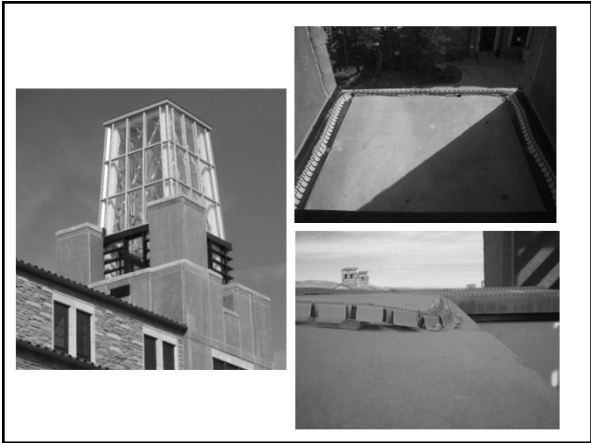
City of Boulder considered a bird sanctuary

- Netting
- Fabrication (metal)
 - Cupolas
 - Score boards
- Shock track
- Bird slide™
- Spikes rarely used

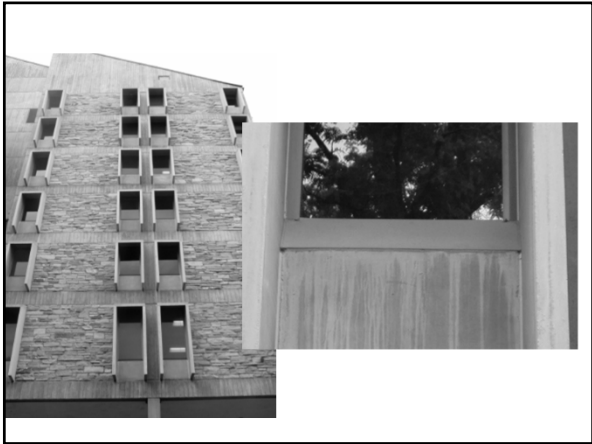
















Structural removal

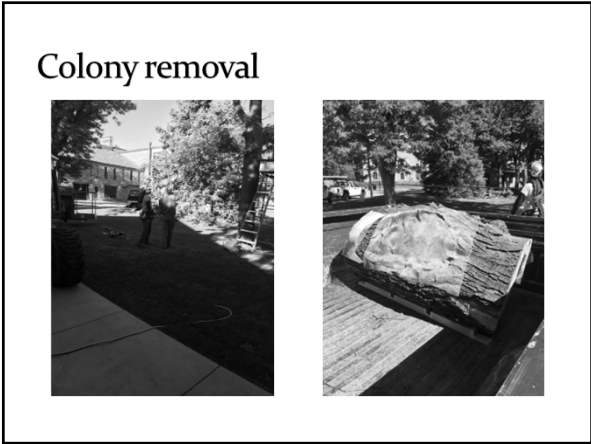








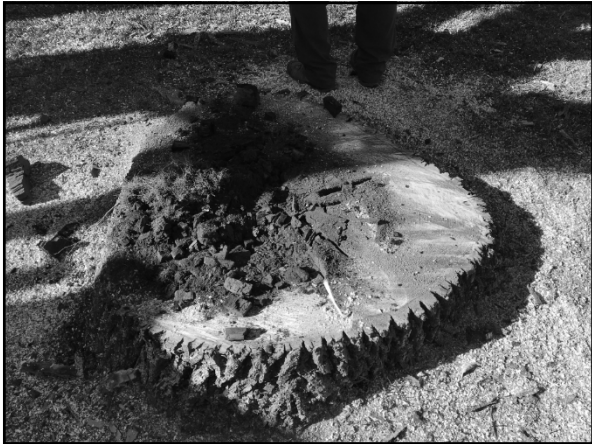








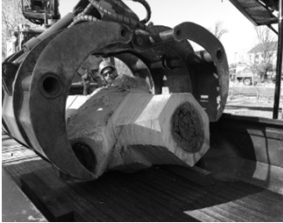






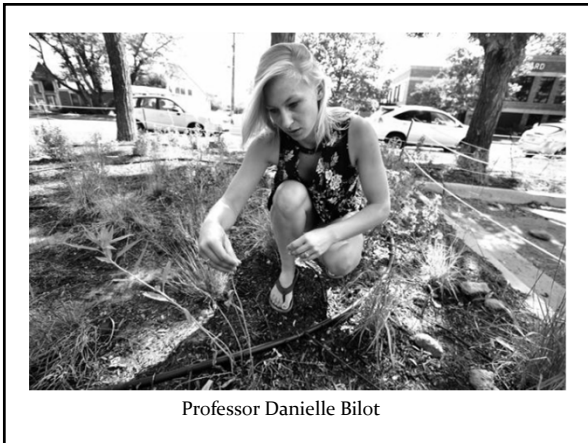
Keys to Success

- Patience
- Extensive research
 - Colony size / health
 - Pesticide impacts to bees
 - Tree health
 - Cavity size
 - Level of infestation
- Coordination w/ contractor
 - Upfront language?



Pollinator Takeaways

- Proper identification
- Not all bees are the same
 - Many different varieties
 - Most natives do not produce honey
 - Natives have different habitat requirements
- Leads to different approaches in different landscapes
- Use pollinator protection to help guide pesticide reduction strategies



Professor Danielle Bilot



Final Takeaways

- Preventive vs. Reactive
- Problem solving
 - I.D. the pest
 - Think like the pest ☺
- Exclusion – defensible space
- Baits & sticky traps
- Bio-controls
- “Treat the source, not the symptom”



Thank you!

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