

# URBAN/ORNAMENTAL ARTHROPOD MANAGEMENT

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# A LITTLE ABOUT ME...

**Hometown:** Boise, ID

**High School:** Capital High School (Go Eagles)

**College:** University of Idaho (Go Vandals!)

**B.S. Plant Science (Minor: Crop Science)**

**M.S. Entomology – Aphids/EIL/ET/Viruses**

**Excelled in Insect ID/Taxonomy**



# OUTLINE

Arthropods

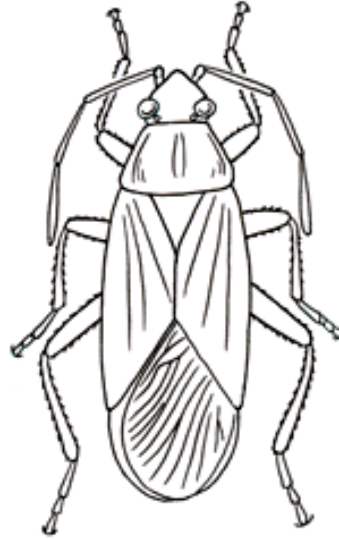
Urban (ornamental) vs. Rural

IPM Concepts

IPM/IRM in the Urban Landscape

Putting it All Together

Take Homes



# ARTHROPOD

Invertebrate animals – no backbone

Segmented body

Paired jointed appendages

Includes Insecta (insects), Arachnida (spiders/mites), Myriapoda (centipedes/millipedes) and Crustaceans (crabs, pillbugs/sowbugs)

Must molt in order to advance to the next life stage... EXOSKELETON



# ARTHROPOD



# IDENTIFYING ARTHROPODS

## USE THE EXPERTS!!!

Send clear photos to arthropod experts or detailed descriptions

**“I have a big black insect/spider in or around my house – what is it?”**

**- anonymous**



# IDENTIFYING ARTHROPODS

All smart phones have the capability to take clear photos... be still when photographing – send questions anytime

Luc LeBlanc (UI), Paul Castovillo (ISDA)

Brad Stokes (UI), [bstokes@uidaho.edu](mailto:bstokes@uidaho.edu)

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# URBAN VS. "RURAL"

**Urban** – population at or above 1,000 individuals/square mile

**Rural** – all population, housing and territory not included within an urban area, whatever is not urban is considered rural

**Rural = AGRICULTURE/RANGELAND/FORESTS ETC.** in the case of this presentation.... Larger more homogeneous systems – same types of plants/ecosystems over larger areas

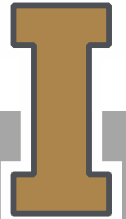




# RURAL (AGRICULTURAL SYSTEM)



# URBAN



# URBAN SYSTEMS

Currently **more than 50%** of the human population lives in urban settings

Estimate that by **2050 6.3 billion** humans will live in/around urban settings

## U.S. PESTICIDE USE

~300 MILLION pounds/year (2006 estimate; EPA) rural + urban

**URBAN = ~70 million pounds/year in the U.S.**



**Insecticide Resistance in Urban Systems???**

# URBAN SYSTEMS

Considered a “disturbed ecosystem”

Plants/niches separated by inhospitable areas (concrete/buildings)

Habitat fragmentation/degradation/loss

Island ecology – is the urban environment comparable to islands?

Decreased arthropod biodiversity (reduced beneficial insects?)...

Introduction of exotic flora.... Invasive plant/insect species – new niches?





# URBAN SYSTEMS



# INSECTICIDE RESISTANCE

Depends on numerous known factors:

## **Very dynamic and complex process**

Depends directly on the “pests” genetic, physiological, behavioral and ecological factors

Depends indirectly on anthropogenic (human-caused) operational factors: identification of pest, application timing, rate, coverage, selection of chemical and application method



**Table 1**

Top 20 resistant arthropods in agricultural and urban ecosystems [7] (permitted kindly by Drs. Mark Whalon and David Mota-Sanchez).

Rank	Common Name	Scientific Name	Number *	Ecosystem
1	Two-spotted spider mite	<i>Tetranychus urticae</i>	94	Agricultural
2	Diamondback moth	<i>Plutella xylostella</i>	92	Agricultural
3	Green peach aphid	<i>Myzus persicae</i>	76	Agricultural
4	House fly	<i>Musca domestica</i>	62	Urban
5	Colorado potato beetle	<i>Leptinotarsa decemlineata</i>	55	Agricultural
5	Sweetpotato whitefly	<i>Bemisia tabaci</i>	55	Agricultural
7	Southern cattle tick	<i>Rhipicephalus microplus</i>	50	Agricultural
8	Cotton aphid	<i>Aphis gossypii</i>	49	Agricultural
9	Corn bollworm	<i>Helicoverpa armigera</i>	48	Agricultural
9	European red mite	<i>Panonychus ulmi</i>	48	Agricultural
11	German cockroach	<i>Blattella germanica</i>	42	Urban
12	Southern house mosquito	<i>Culex quinquefasciatus</i>	40	Urban
13	Beet armyworm	<i>Spodoptera exigua</i>	38	Agricultural
13	Oriental leafworm moth	<i>Spodoptera litura</i>	38	Agricultural
15	House mosquito	<i>Culex pipiens pipiens</i>	36	Urban
16	Yellow fever mosquito	<i>Aedes aegypti</i>	35	Urban
16	Tobacco budworm	<i>Heliothis virescens</i>	35	Agricultural
18	Hop aphid	<i>Phorodon humuli</i>	34	Agricultural
19	Red flour beetle	<i>Tribolium castaneum</i>	33	Urban
20	African cotton leafworm	<i>Spodoptera littoralis</i>	30	Agricultural

\* Number of active ingredients to which the pest has exhibited documented resistance.

## Resistance in urban arthropod pests

Two-spotted spider mite (*Tetranychus urticae*)

House fly (*Musca domestica*)

German cockroach (*Blattella germanica*)

Southern house mosquito (*Culex quinquefasciatus*)

House mosquito (*Culex pipiens*)

Yellow fever mosquito (*Aedes aegypti*)

Red flour beetle (*Tribolium castaneum*)

Others.... **ABSOLUTELY**



# URBAN SYSTEMS

## Factors:

**Heterogeneity** – a mosaic of numerous different plants with numerous different arthropod pests planted closely together in alternating patches

**Customer Perception** – individual mindset, WHAT IS A PEST? Each customer's preconception on pests and pesticide use widely vary

**Socioeconomic** – some customers may not have the means for proper pest control in urban systems (even if the infestation is serious)





# URBAN SYSTEMS & PESTICIDES

## Other factors:

People applying pesticides...

Pest control professionals (**YOU**), golf course managers and homeowners/renters/maintenance crews for city/county/state... others?

**WHO'S THE URBAN EXPERT?**

**YOU ARE!!!**



# IPM/IRM IN URBAN SYSTEMS

**IPM** – integrated pest management

combination of **SEVERAL** non-chemical pest management methods in combination with the judicious use of insecticides

**IRM** – insecticide resistance management

understanding the status and mechanisms of resistance, delaying resistance to existing chemical compounds and preventing the development of resistance to new insecticides by **reducing the insecticide selection pressure**



# MECHANISMS OF RESISTANCE

**Metabolic** – most common, detoxify or metabolize the a.i.

**Target-Site** – genetic alteration of the a.i. binding site (P450, *Ace*, *Kdr*-mediated, DLD etc...)

**Penetration** – thicker cuticle (cuticular wax) inhibits the a.i. from normal penetration

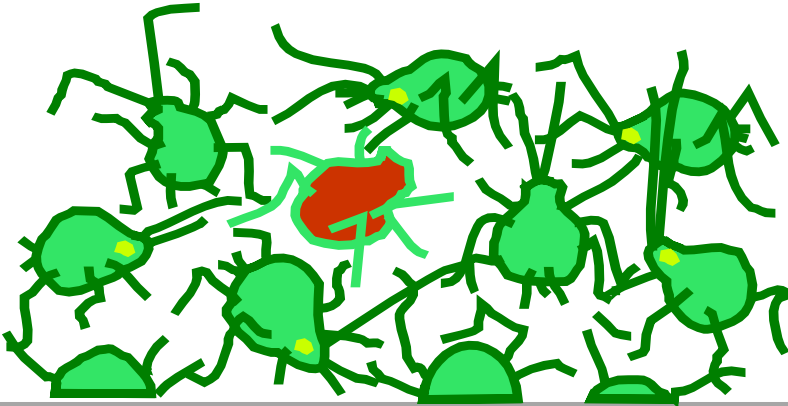
**Behavioral** – movement or behavior mediated, well documented in several pest insects (mosquitoes etc...)



# HOW DOES RESISTANCE HAPPEN?



Same chemical... or  
insecticidal mode of action



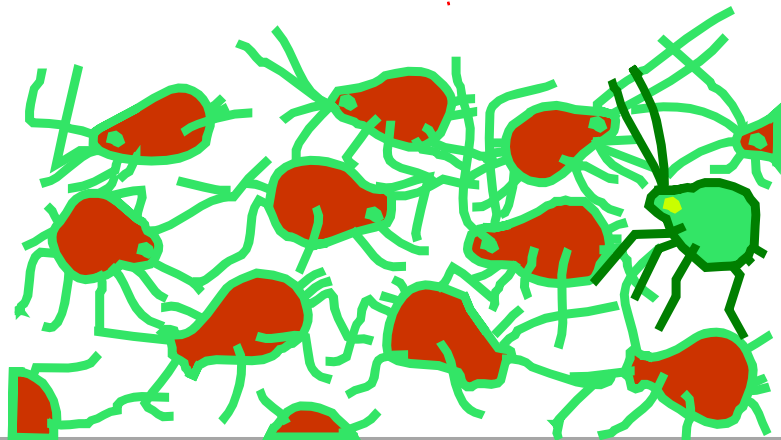
**REPEAT, REPEAT,  
REPEAT... over  
seasons/years/population  
level**



# HOW DOES RESISTANCE HAPPEN?

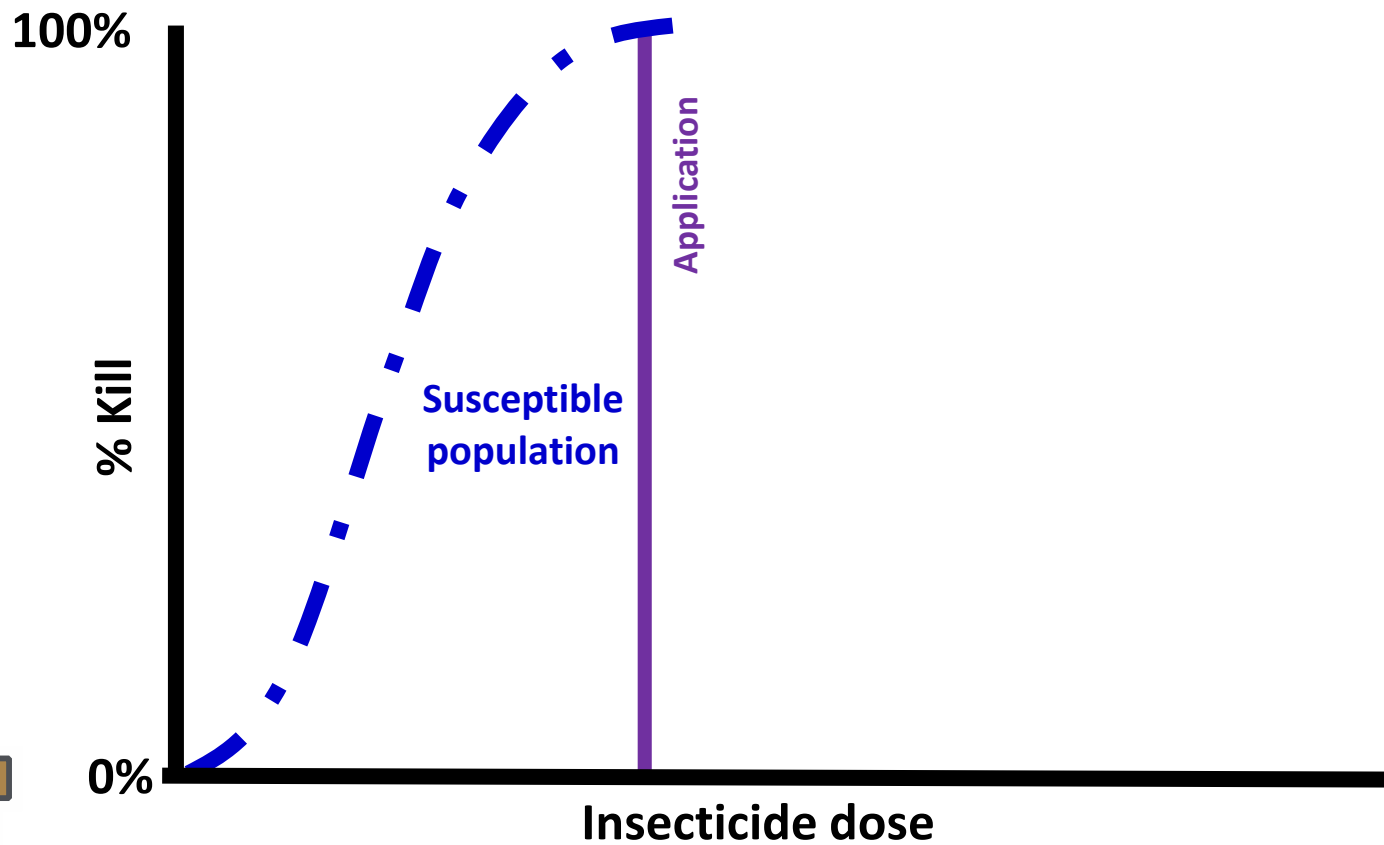


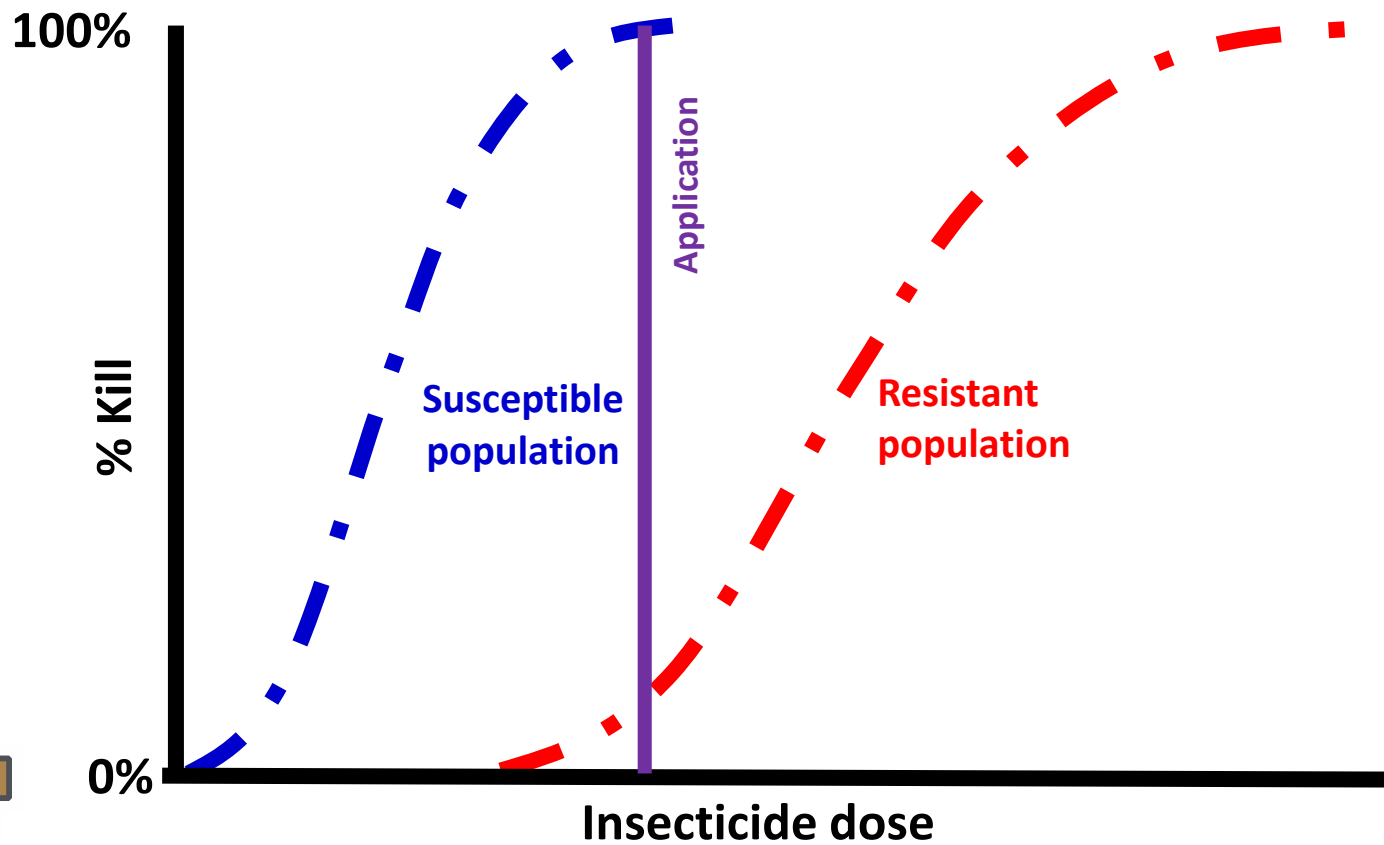
Same chemical... or  
insecticidal mode of action



**We are selecting for those  
resistant individuals who  
reproduce... increasing  
the resistant population**







# HOW DOES RESISTANCE HAPPEN?

It's at the **POPULATION LEVEL**

**ANTHROPOCENTRICALLY DRIVEN (human-caused) AND SELECTED FOR BY US (me included), using chemical approaches**

We are selecting the small percentage (often  $< 1\%$  or  $0.1\%$ ) of the pest population that has these (often unfavorable) genetic mutations by using insecticides





# MANAGEMENT OF RESISTANCE

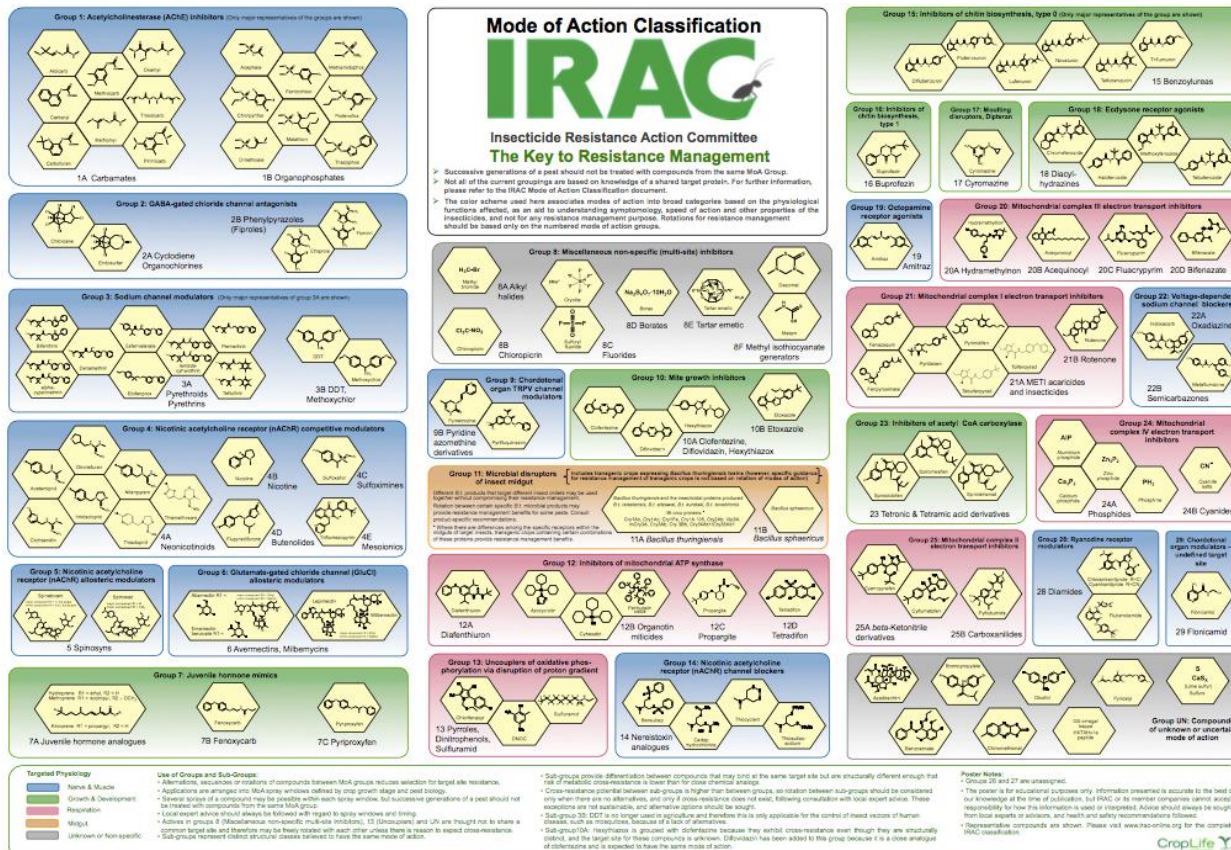
Most IPM/IRM management strategies have been developed and somewhat successfully implemented in rural systems (agriculture, rangeland, forests etc.) instead of urban systems

Mechanical control (tillage etc.), cultural control (varietal selection), preservation and understanding of beneficial insects, application timing, coverage and rate... recommendations by Extension professionals and field men/women



Some of these strategies may not be applicable to urban setting...

# IRAC



# MODES OF ACTION

For most insecticides scientist have discovered their mode of action

**SWITCH** often and throughout the season... especially if applying insecticides to the same area for the same pest problem or perimeter treatment... **SOMETIMES** MoA is listed on insecticide label

**MoA1 → MoA2 → MoA3 or even MoA4...** will help **prevent resistance**

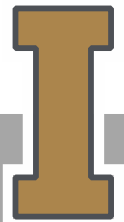
**IMPORTANT NOTE: DIFFERENT CHEMICALS MAY HAVE THE SAME INSECTICIDAL  
MODE OF ACTION... BE SURE TO MAKE SURE THEY ARE DIFFERENT MoA's**



# IRAC


"There's an app for that!"

I'd recommend any urban/rural applicator to download and USE this reference for MoA/chemicals/a.i.'s



DOWNLOAD OUR FREE MoA APP

Reference modes of action on your mobile device - filter by chemical class and active or simply browse the full list.



The image shows a smartphone displaying the IRAC app. The app has a green header with the text 'IRAC'. Below the header is a list of categories: 1. Acetylcholinesterase inhibitors, 2. GABA-gated chloride channel antagonists, 3. Sodium channel modulators, and 4. Pyrethroids. The 'Pyrethroids' category is selected and highlighted in green. Below this, a list of pyrethroid chemicals is shown: Aurothrin, Allethrin, D-allyl-chloro Allethrin, D-trans Allethrin, Difenethrin, and Resmethrin.

APPLE STORE

GOOGLE PLAY

# IPM/IRM TACTICS IN URBAN SYSTEMS

## ASK CUSTOMER QUESTIONS!!!

Evaluate the situation – is this “pest” really a pest? Sometimes doing nothing is the BEST solution

Scouting/monitoring – customer saw one, two, several hundred, how long has the infestation been going on?

Economic thresholds/injury levels – vary by pest (boxelder bug vs. termite)

Other methods of control available?



**HAS THE CUSTOMER APPLIED ANYTHING THIS YEAR?**

# IPM/IRM TACTICS IN URBAN SYSTEMS

Customer often has preconceived notions of what constitutes a pest...

A single individual pest **DOES NOT** constitute an infestation that warrants an insecticide application (or repeated applications)... **UNLESS** that pest has an extremely low threshold/injury level

Examples of pests with low threshold/injury level: flea/bed bug/lice/infected mosquito/cockroach/fly....



May also depend on customer – are they allergic (bee/wasp/asthma from cockroaches) or concerned about health?



# EXAMPLE SCENARIO

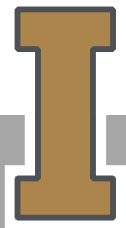
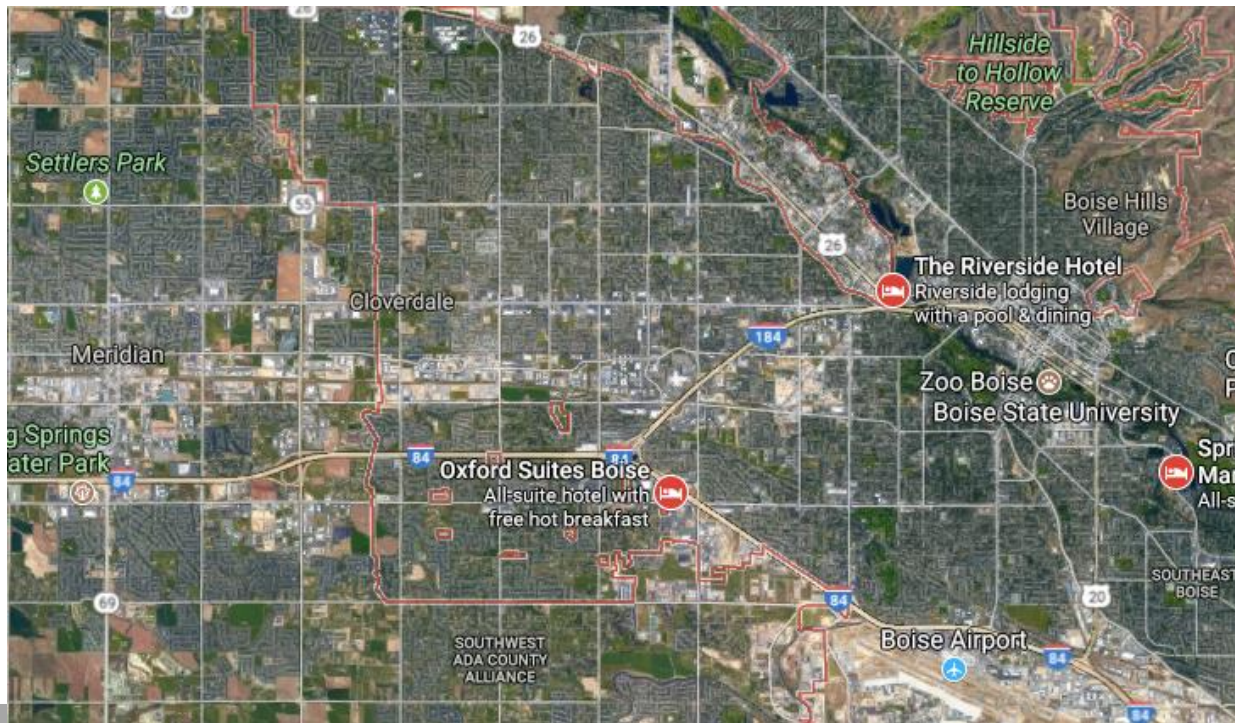
**Pesticide Applicators (estimated):**

~100,000 Homeowners = \*

~100 City/County Managers = \*

~50 Golf Course Managers = \*

~500 Pest Control = \*



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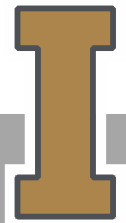
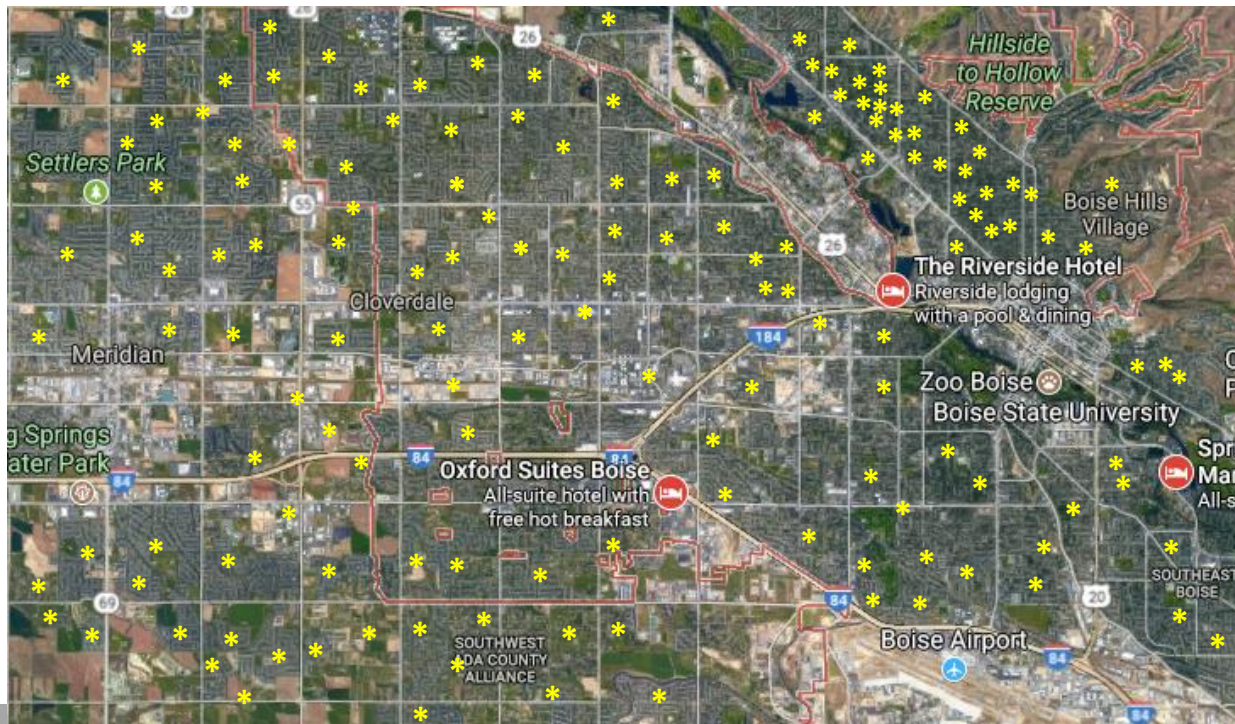
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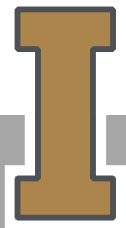
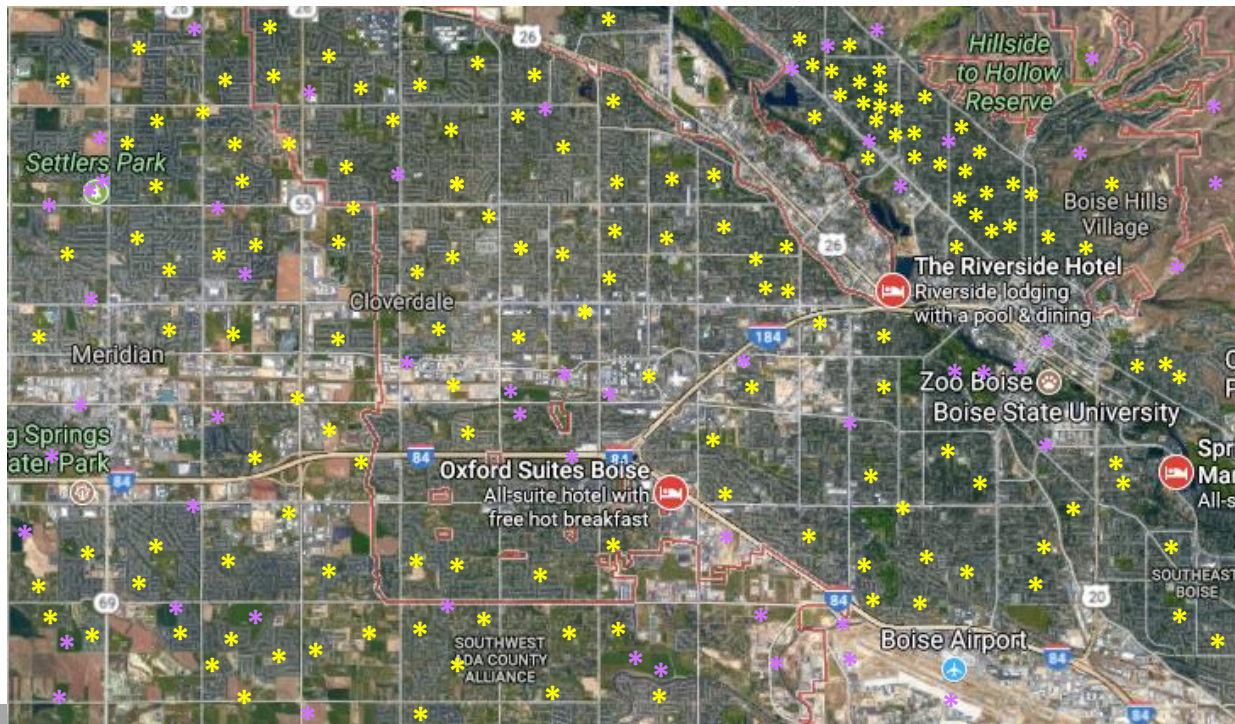
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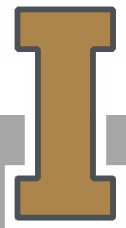
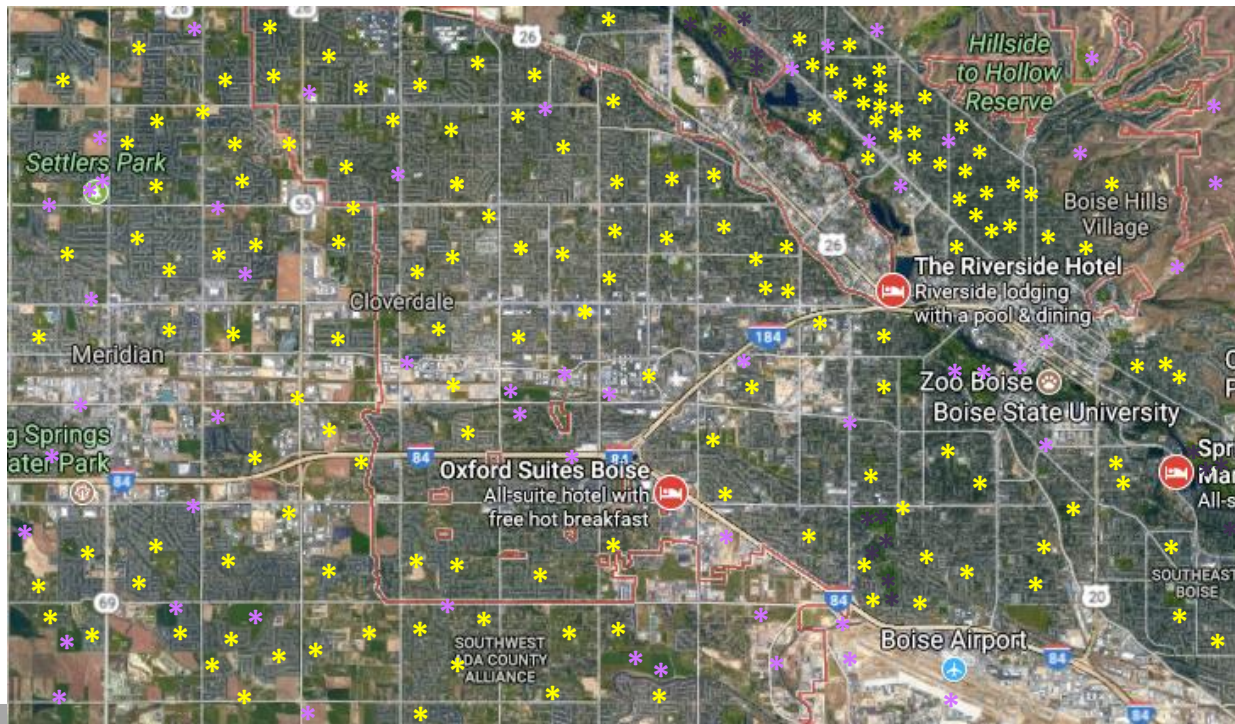
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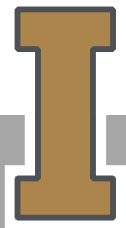
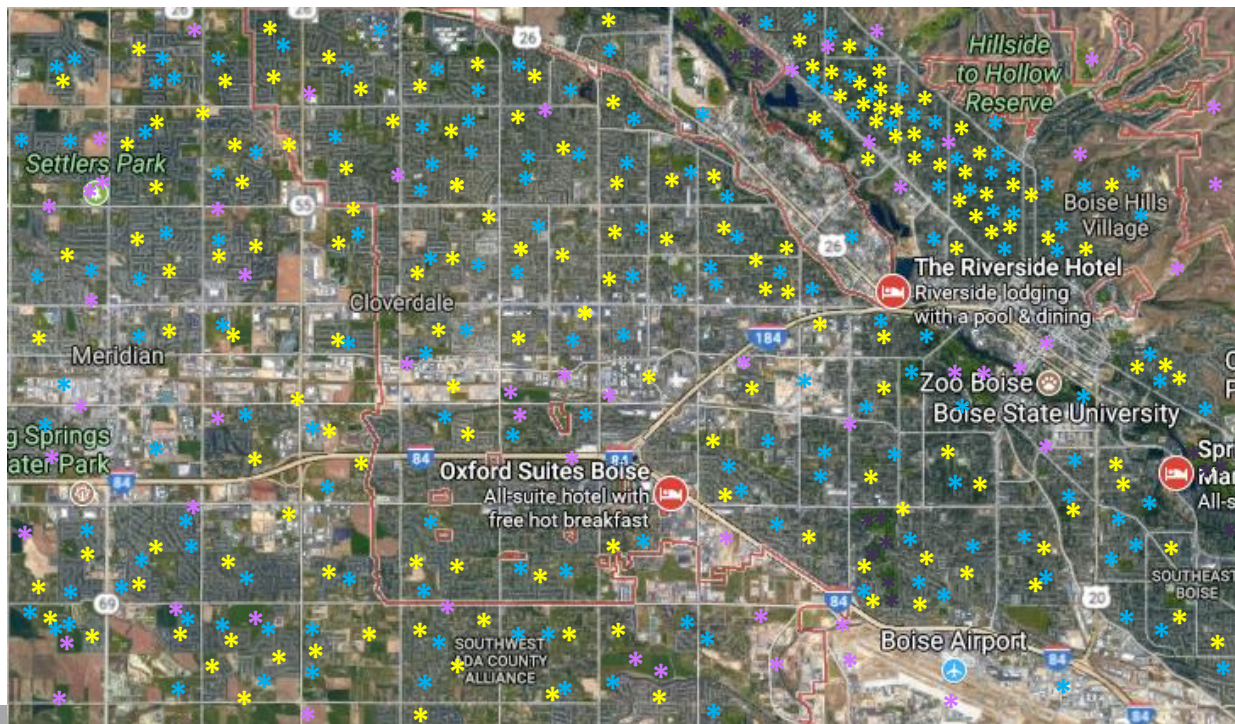
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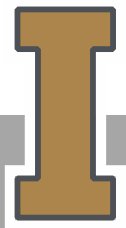
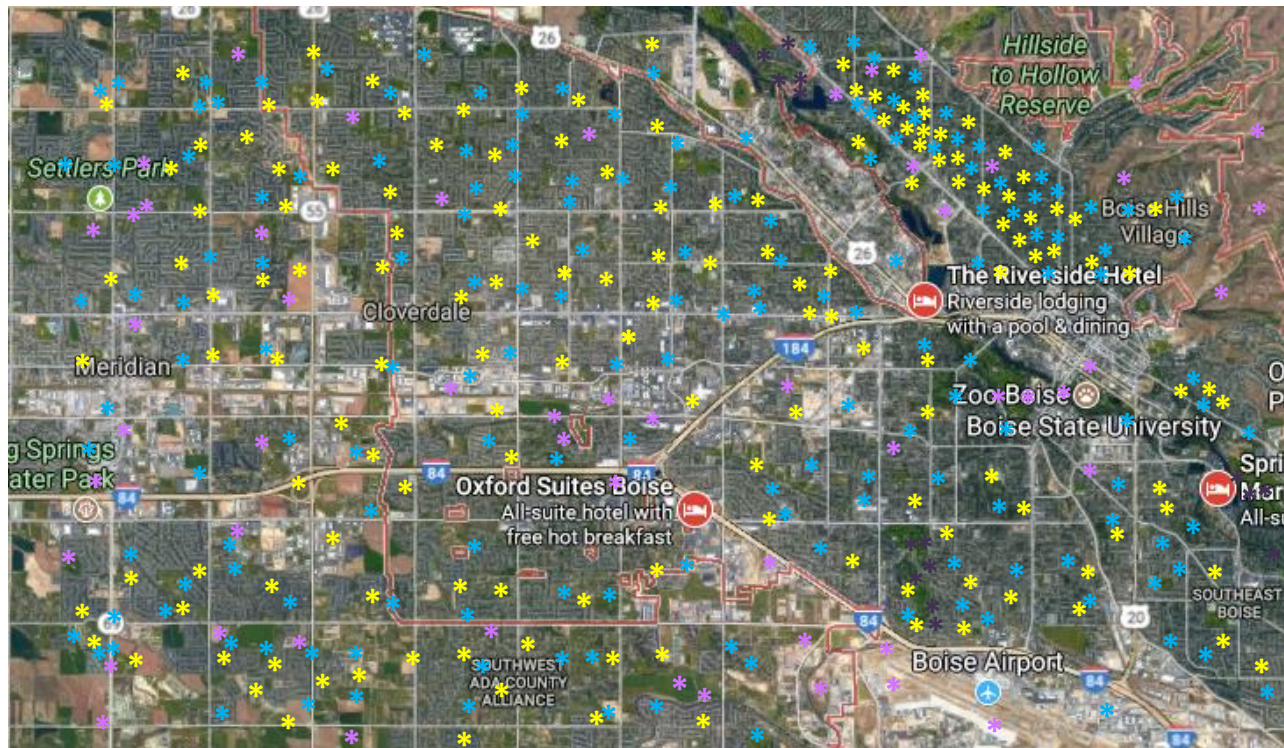
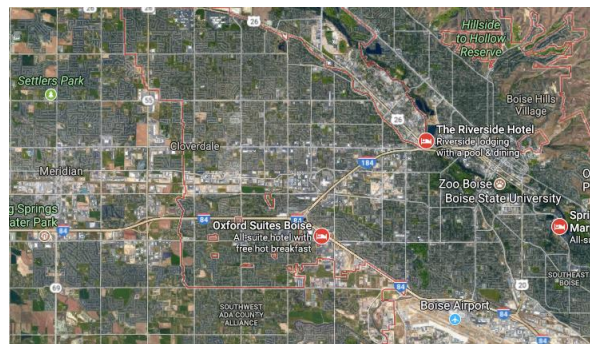
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# URBAN PROBLEMS

It's **IMPOSSIBLE** to know every and all applications and what was targeted... homeowners may also be inadvertently making incorrect applications (timing/rate)

**OVERLAP/UNDERLAP** of applications within the urban setting... between applicators/homes/neighborhoods etc...

MoA/Resistance problems within this setting.... Who's targeting and applying what insecticides/MoA's?

Are we all contributing to or preventing resistance...?

**WE ARE ALL IN THIS TOGETHER**





# ADDITIONAL URBAN FACTORS

Proximity of pest host plants...

You may treat an infestation or pest problem, **but** the pest population may continue due to the close proximity of host plants (next door or around the block)

Socioeconomic issues....

Particular areas/subdivisions/homeowner associations may

Pre-scheduled quarterly treatments... goes against **EVERY IPM/IRM** principle... ☹️

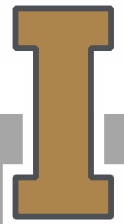
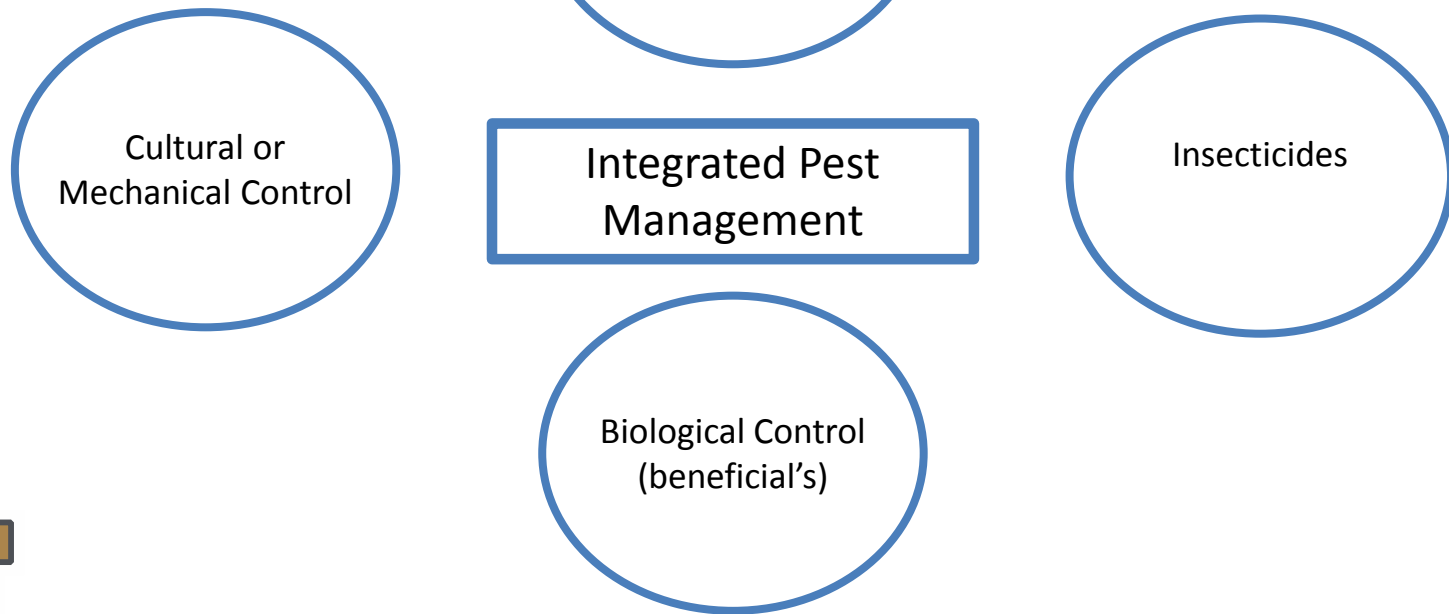


# STEWARDSHIP

... the careful and responsible  
management of something  
entrusted to one's care.



# IPM





# TAKE HOMES...

**USE** your resources... ISDA/UI Extension/EPA etc. – we (me included) are here to help provide expert advice and answer questions

**COMMUNICATION** – between applicators, across companies and within the same industry; if we want to continue using insecticides we must work together

**THINK** – is there really a “pest” problem here? Other control options available?

**EDUCATE YOUR CUSTOMERS** – talk about insecticides/pesticides/MoA's, what is your goal as an urban applicator? Resistance management... etc.



# TAKE HOMES...

**CONSIDER THE BENEFICIALS...** when you kill the predators/parasitoids we inherit their work

**APPLICATION TIMING AND RATE...** use the most appropriate rate, is this a heavy or light infestation - does the label differentiate?

**PEST BIOLOGY...** which life stage is most susceptible – is right now the proper life stage for control – **SCOUTING!!!**

**AS ALWAYS READ AND FOLLOW INSECTICIDE LABEL!!!**



THANKS!!!

Questions or comments?

