

Mosquito IPM in a Zoo Environment: Collaborating for Success

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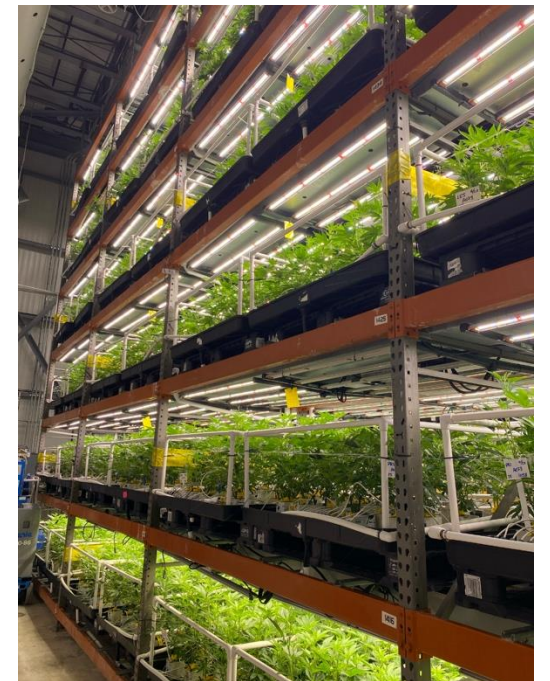
Role of Technical Services

Optimize Your Pest Management Plan



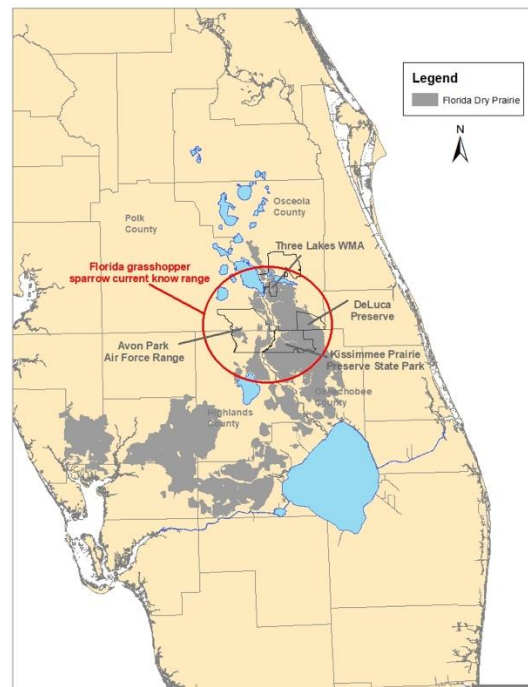


Lumber transfer crane



Samer standing at the log decks.

Decks stacked over 40 feet high.



IPM Recognition

Southern
IPM
Center

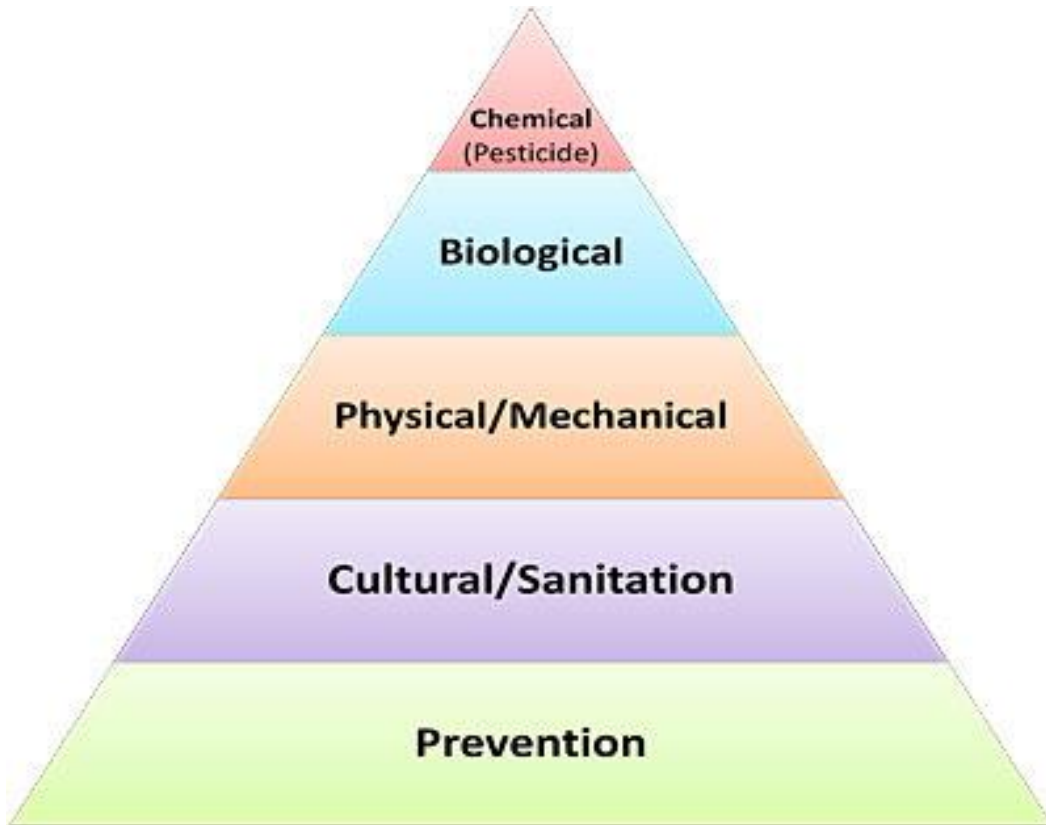


WHAT IS IPM?

- Integrated Pest Management (IPM) is a science-based, sustainable decision-making process that uses information on pest biology, environmental data, and technology to manage pest damage in a way that minimizes both economic costs and risks to people, property, and the environment.
- Designed to promote mindfulness of impacts for each input into a system, based on a set of values, and informed through systematic feedback.

Southern
IPM
Center

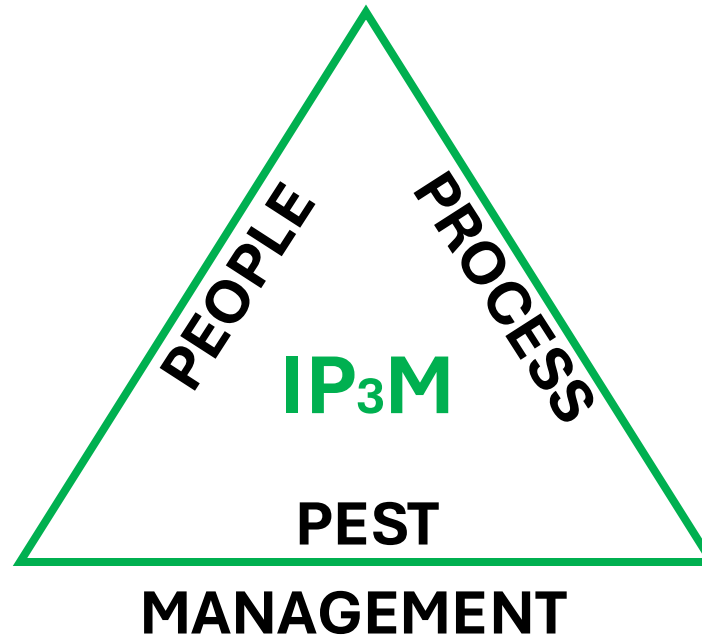
IPM BASICS



- 1- Identify the pest to species
- 2- Determine level of pest activity
- 3- Develop management plan
 - *Explore treatment options
- 4- Timely treatment
- 5- Monitor and adjust plan as needed

IP₃M

INTEGRATED



People

Experience
Training
Communication
Attitude

Processes

Inspection
Identification
Planning
Communication
Products
Contract
Timing

IP₃M

INTEGRATED

PEOPLE

PROCESS

IP₃M

PEST

MANAGEMENT

People

Experience
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Understanding the human element and ecological systems within an area of concern is essential to recognizing reasons behind pest issues and the solutions for controlling them

Sensitive Sites Defined

- Any environment can be a sensitive site
- “Sensitivity” may be based on values
- Margin of error often defines a sensitive account
- Any account or location where standard types of suitable pest control tactics may be greatly restricted for social, human health, or environmental safety reasons



The Zoo Challenge

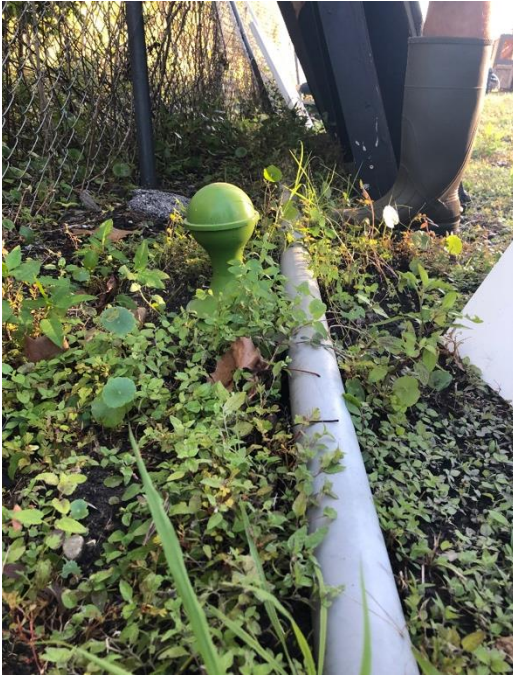


- Recent increase in the presence of mosquito-transmitted diseases in the JZG Managed Animal Population (MAP)
- Collaborative mosquito control plan was developed
- Goal is to improve mosquito monitoring and control through:
 - mosquito surveillance
 - mosquito development site elimination (source reduction)
 - selective barrier treatments where applicable
 - workforce engagement



Deja Zoo

- 2019 asked to assist with Crazy ant challenge in the avian and reptile nutrition house (APEC)
- Provided bait stations and bait
- Localized success limited to highly monitored areas



Unwanted Guest

- The Twany crazy ant is an emerging pest ant in the SE US
- Resident at JZG since 2010
- Extensive efforts to eradicate have failed
- *Nylanderia fulva* nests occur in leaf litter, soil, rotten logs, under potted plants, and along underground electrical conduits
- Multiple queens and nest sites
- Often occur in huge numbers and display super colony characteristics



Sensitive Site IPM

- Zoos host diverse wildlife in highly sensitive environments
- Pest management must protect animal health while preserving exhibits
- Conventional pesticide approaches can pose risk to:
 - Non target species
 - Aquatic and avian habitats
 - Keeper and visitor safety



An IPM approach creates a mindset of risk reduction

The Browse Hurdle

Acacia - *Acacia* spp.

Anise - *Illicium floridanum*

Bamboo

Banana leaf - *Musa acuminata*

Beautyberry - *Callicarpa americana*

Bottlebrush - *Callistemon* spp.

Cape Honeysuckle - *Tecomaria capensis*

Creeping Cucumber - *Melothria pendula*

Creeping Fig - *Ficus pumila*

Crepe Myrtle - *Lagerstoemia* spp.

Dotted Horsemint - *Monarda punctata*

Elm - *Ulmus* spp.

Fakahatchee Grass - *Tripsacum dactyloides*

Firebush - *Hamelia patens*

Grapevine - *Vitis* spp.

Hibiscus - *Hibiscus* spp.

Hickory - *Carya* spp. (including pecan)

Honeysuckle - *Lonicera japonica*

Japanese Blueberry - *Elaeocarpus decipiens*

Magnolia - *Magnolia grandiflora*

Mimosa - *Albizia julibrissin*

Mulberry - *Morus alba* or *Morus rubra*

Palms

Plumbago - *Plumbago auriculata*

Prickly Pear Cactus - *Optunia* spp.

Rose - *Rosa* spp.

Spanish Needle - *Bidens alba*

Spiderwort - *Tradescantia ohiensis*

Sugarberry - *Celtis laevigata*

Sugarcane - *Saccharum* spp.

Sunflower - *Helianthus* spp.

Winged Sumac - *Rhus copallinum*

Sweetgum - *Liquidambar styraciflua*

Sycamore - *Platanus occidentalis*

Tulip Poplar - *Liriodendron tulipifera*

Wax Myrtle - *Myrica cerifera*

Willow - *Salix* spp.

Sensitive Site Challenges of a Zoo

- **Reptile House**- humidity and temperature promote pest activity
- **Aviary**- seed spillage promotes stored product pests and rodents
- **Aquarium**- pyrethroid use restricted near aquatic systems
- **Mammals exhibits**- animal bedding harbors fleas, mites, and flies
- **Horticulture**- zoo staff in contact with vegetation



Pest Challenges

Pest Type	Example	Concern
Flies	House flies, stable flies	Animal stress, disease vectors
Ants	Crazy, Argentine, OHA	Biting nuisance, feed contamination
Rodents	Roof rats, Norway rats	Gnawing damage, zoonotic risk
Mosquitoes	<i>Culex</i> , <i>Aedes</i> spp.	Zoonotic risk (WNV), annoyance

Good IPM Practitioners

- JZG IPM implemented in 2018 with internal staff and external consultants
- Shifted from reactive spraying to preventative monitoring
- Key results:
 - 45% reduction in rodent sightings
 - Mosquito management integrated with local MCD
 - Reduced pesticide applications by 60%
 - Staff training emphasized
 - *communication
 - *recordkeeping

Information provided from:
Jacksonville Zoo & Gardens 2023 Annual Report



Non-Chemical Strategies

Sanitation- strict waste handling and feeding protocols

Exclusion- sealing gaps, drain covers, screen maintenance

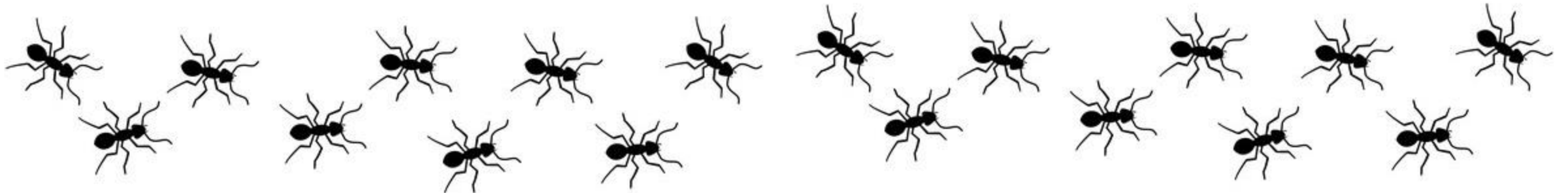
Mechanical control- source reduction, traps, barriers

Cultural practices- timed feeding, enclosure design



Lessons Learned

- Limitations of pesticide use near open enclosures
- Importance of sanitation and keeper engagement
- Weather variability impacting mosquito pressure
- Continuous staff education leads to sustained success



Ant Patrol

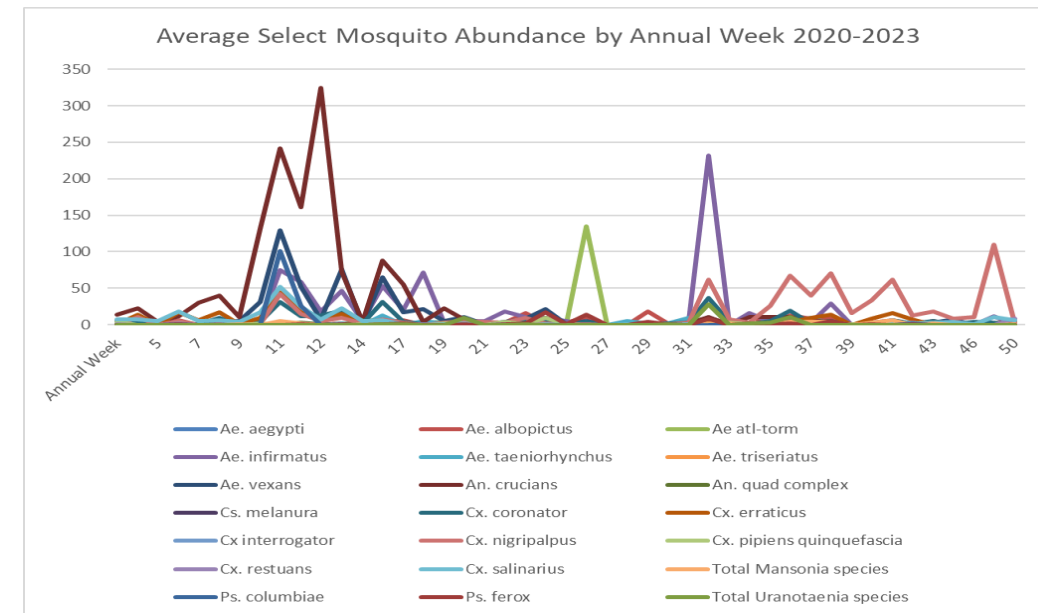


Historical Mosquito Data

Species	Average Annual Total	Preferred Habitat	Preferred Hosts/ Behavior
<i>Anopheles crucians</i>	1330.83	Woodland pools, ponds, swamps, marshes, puddles, and seepage wetlands	Mammals (including humans)
<i>Aedes infirmatus</i>	730	Woodland edges with standing water	Mammals (humans), persistent daytime biters
<i>Culex nigripalpus</i>	678.92	Water filled ditches, grassy pools, marshes, and artificial containers	Birds, mammals, reptiles, and amphibians
<i>Aedes vexans</i>	497.5	Permanent/temporary water bodies (ephemeral floodwater pools and ditches)	Opportunistic, annoying human day/twilight biter
<i>Culex coronator</i>	249.25	Rain-filled depressions and artificial containers	Deer and domestic animals, opportunistic bird feeder
<i>Culex erraticus</i>	226.75	Permanent and semi-permanent ponds and marshes	Opportunistic, many species of mammals, birds, reptiles, and amphibians. Most common hosts are deer and large wading birds (herons and egrets)
<i>Culex salinarius</i>	221.58	Densely vegetated freshwater impoundments and coastal marshes	Mammals and birds
<i>Aedes atl-torm</i>	157.5	Temporary pools in woodlands, and fields	Mammals, birds, reptiles, amphibians
<i>Aedes albopictus</i>	151.75	Artificial containers, bromeliads, tree-holes, bamboo cavities	Mammals (preferential to humans) Very pestiferous daytime biter. Will bite in open sunlight and enter structures when host seeking
<i>Psorophora columbiae</i>	129.75	Sunlit water-filled pools, tire ruts, ditches, pasture depressions, and other sunny sites	Mammals (deer, livestock, rabbits, armadillos, and humans. Very aggressive daytime biter.

Table 1. Mosquito bionomic information for select mosquito species caught in COJ trap at old EDU campus

Mosquito abundance by annual week 2020-2023
caught in COJ trap at old EDU campus



Mosquito Surveillance



Proposed trap locations:

Trap 1	Greenhouses
Trap 2	Komodo Dragon Nighouse
Trap 3	RES 1 Nighouse
Trap 4	Lion Nighouse
Trap 5	River Valley Aviary
Trap 6	Rhino Nighouse



Feedback

- Zoos staff and visitors are at risk for mosquito interactions
- System for tracking mosquito and other biting fly issues is needed
- Real time data is best
- Track complaints for seasonal preparedness



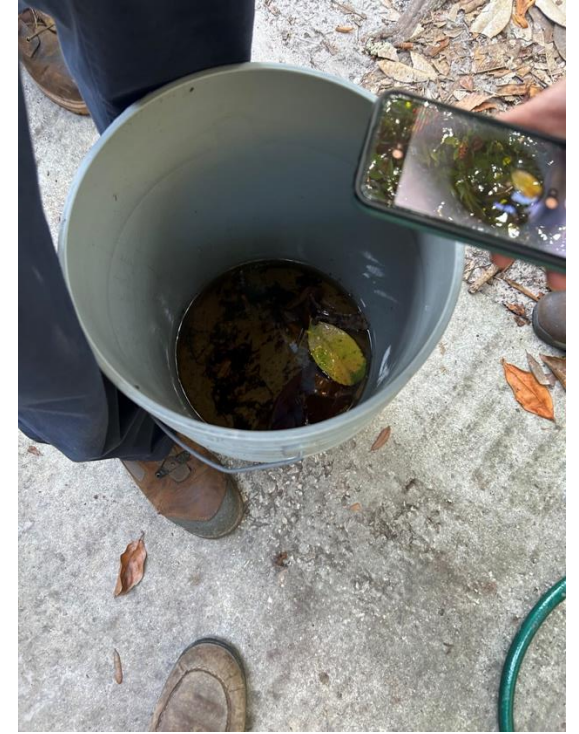
MOSQUITO REPORTING



**HELP TRACK MOSQUITO ACTIVITY!
PLEASE FILL OUT THE FORM WEEKLY**

CONTACT: KAPLANJ@JACKSONVILLEZOO.ORG

Training How to Inspect and Report



Informing and Planning

- Where possible, eliminating these water sources is the best line of defense to reduce mosquito populations
- An extensive map of the JZG stormwater system has been developed to help locate potential water pooling areas.
- Continuous monitoring of these areas and other potential development sites will be undertaken by the JZG IPM Coordinator and LPS personnel.



In2Care



Chemical Strategies

- Lead with a plan and not a product
- Pesticide selection guided by EPA registered, low toxicity products
- Spot or crack and crevice applications preferred
- Avoid broad area sprays near:
 - Aquatic systems
 - Sensitive mammals and birds
- Coordination with pest management professionals and veterinary staff is essential for success

Fielding Questions for Planning

3. How long after spraying can browse plants (plants that are harvested and fed to our animals) be collected from the treated areas? Do the treatment areas need to be off limits for browsing permanently?

In an abundance of caution, it would be best to avoid feeding treated materials to the animals. Thank you for the questions. I'm happy to answer any follow up concerns anyone may have.

Glad to hear the plan was approved by the vets and department leadership. Thank you for coordinating all the many pieces.

Chemical Applications



Summary

- Zoo IPM protects wildlife, staff, and the environment
- Focus on prevention, monitoring, and data-driven action
- Cross-disciplinary coordination is key
- Communication is a continuous process
- Doing the work at the start means less work later



Thank You!

Q&A

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